Vol. 2

Northwest Training and Testing

Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

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Northwest Training and Testing Activities Draft Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement

Volume 2

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Supplemental Environmental Impact Statement/

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Northwest Training and Testing

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3.7 Marine Vegetation

3.7.1 Affected Environment

For purposes of this Supplemental, the region of influence for marine vegetation remains the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS).

3.7.1.1 General Threats

Following a review of recent literature, the existing conditions of marine habitats in the Study Area as listed in the 2015 NWTT Final EIS/OEIS have not appreciably changed. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.7.1.2 Marine Vegetation Groups and Distribution

A literature review found that the information on marine vegetation groups in the Study Area have not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid for the following marine vegetation groups: phylum Dinophyta [dinoflagellates], phylum Cyanobacteria [blue-green algae], phylum Chlorophyta [green algae], phylum Heterokontophyta [brown algae], phylum Rhodophyta [red algae], diatoms, and phylum Spermatophyta [seagrasses and cordgrasses]).

Some of the vegetated habitats, such as eelgrass beds, are Essential Fish Habitat (EFH) and protected under the Magnuson-Stevens Fishery Conservation and Management Act, which was reauthorized and amended by the Sustainable Fisheries Act in 1996.

3.7.2 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of explosive stressors under the two action alternatives. New activities being proposed; high-energy lasers (Energy stressor), as described in Section 3.0.3.3.2.2 (High-Energy Lasers); and biodegradable polymer (Entanglement stressor), as described in Section 3.0.3.5.3 (Biodegradable Polymer) would not impact marine vegetation and therefore do not change the stressors analyzed or the results of the analyses presented in the 2015 NWTT Final EIS/OEIS.

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine vegetation. The stressors applicable to marine vegetation in the Study Area include the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- **Explosive** (in-air explosions, in-water explosions)
- **Physical disturbance and strike** (vessels and in-water devices, military expended materials, seafloor devices)
- **Secondary** (impacts associated with sediments and water quality)

This section evaluates how and to what degree potential impacts on marine vegetation from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Proposed training and testing activities, the number of times each activity would be conducted annually, and the locations within the Study Area where the activity would typically occur under each alternative are presented in Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives). The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The analysis presented in this section also considers standard operating procedures described in Section 2.3.3 (Standard Operating Procedures) and mitigation measures that are described in Chapter 5 (Mitigation) and analyzed in Appendix K (Geographic Mitigation Assessment). These procedures and measures include the use of lookouts or observers to observe for additional biological resources, such as floating vegetation. The term "floating vegetation" refers specifically to floating concentrations of detached kelp paddies and *Sargassum*. The Navy observes for these additional biological resources to protect Endangered Species Act-listed species or to offer an additional layer of protection for marine mammals and sea turtles. The Navy would implement these measures to avoid potential impacts on marine vegetation from stressors associated with the proposed training and testing activities.

3.7.2.1 Explosive Stressors

3.7.2.1.1 Impacts from Explosives

As stated in the 2015 NWTT Final EIS/OEIS, the potential for an explosion to injure or destroy marine vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight. In areas where marine vegetation and locations for explosions overlap, marine vegetation on the surface of the water, in the water column, or rooted in the seafloor may be impacted. Seafloor macroalgae and single-celled algae may overlap with underwater and sea surface explosion locations. If these vegetation types are near an explosion, only a small number of them are likely to be impacted relative to their total population level. Also, some seafloor macroalgae are resilient to high levels of wave action (Mach et al., 2007), which may aid in their ability to withstand underwater explosions that occur near them. Underwater explosions also may temporarily increase the turbidity (sediment suspended in the water) in nearby waters, incrementally reducing the amount of light available to marine vegetation. Reducing light availability decreases, albeit temporarily, the photosynthetic ability of marine vegetation.

3.7.2.1.1.1 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

As shown in Table 3.0-7, the number of explosions would increase for E1, E2, and E5 explosives, but decreases for E12 explosives compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 nautical miles (NM) from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area, and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges).Therefore, the impacts to marine vegetation would be the same. As stated in the 2015 NWTT Final EIS/OEIS, underwater and surface explosions conducted for training activities are not expected to cause population-level impacts on seagrasses because (1) the impact area of underwater explosions is very small (localized) relative to seagrass distribution; (2) the training would occur in previously disturbed areas; (3) the low number of charges reduces the potential for impacts; and (4) disturbance would be temporary and dependent upon the level of sediment redistributed, the amount of time it takes the sediment to settle, and the amount of light that reaches the disturbed area. Based on these factors, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training activities under Alternative 1 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

Impacts from Explosives Under Alternative 1 for Testing Activities

As shown in Table 3.0-7, the number of explosions would increase for E1, E7, and E11 explosives, but decreases for E4 explosives compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately three times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore that other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine vegetation would be the same. As stated in the 2015 NWTT Final EIS/OEIS, underwater and surface explosions conducted for testing activities are not expected to cause population-level impacts on seagrasses because (1) the impact area of underwater explosions is very small (localized) relative to seagrass distribution; (2) the low number of charges reduces the potential for impacts; and (3) disturbance would be temporary and dependent upon the level of sediment redistributed, the amount of time it takes the sediment to settle, and the amount of light that reaches the disturbed area. Based on these factors, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during testing activities under Alternative 1 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

3.7.2.1.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

The quantity of explosives used during training activities under Alternative 2 would increase compared to levels presented above for Alternative 1 (Table 3.0-7) and levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 NM from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area, and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges). Therefore, the impacts to marine vegetation would be the same as described above under Alternative 1 and in the 2015 NWTT Final EIS/OEIS. Impacts of explosions that exceed natural disturbance intensities may uproot plants and damage substrates, which would delay recovery; however, the Navy reduces impacts on overall vegetation communities by using previously disturbed areas for training. Therefore, potential impacts on marine algae and vegetation from underwater and surface explosions are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during training activities under Alternative 2 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

Impacts from Explosives Under Alternative 2 for Testing Activities

The quantity of explosives used during testing activities under Alterative 2 would be the same as Alternative 1 (Table 3.0-7), but would decrease from 148 to 129 activities compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately three times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore that other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine vegetation under Alternative 2 would be the same as those described above under Alternative 1 and in the 2015 NWTT Final EIS/OEIS.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives during testing activities under Alternative 2 may have an adverse effect on EFH by reducing the quality and quantity of marine vegetation that constitutes EFH or HAPC. Impacts on attached macroalgae is determined to be minimal and temporary to long term throughout the Study Area and minimal and long term (stressor duration or recovery in more than 3 years but less than 20 years) on submerged rooted vegetation beds.

3.7.2.1.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Explosive stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from explosive stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts on marine vegetation of the various types of physical disturbance and strike stressors during training and testing activities within the Study Area. Three types of physical disturbance and strike stressors are evaluated for their impacts on marine vegetation, including (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

The evaluation of the impacts of physical disturbance stressors on marine vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), or dropped to the seafloor (e.g., military expended materials), or dropped to the seafloor and recovered (e.g., seafloor devices such as anchors). Not all activities are proposed to occur throughout the entire Study Area. Wherever appropriate, specific geographic areas of potential impact are identified within the Study Area boundaries.

3.7.2.2.1 Impacts from Vessels and In-Water Devices

As described in the 2015 NWTT Final EIS/OEIS, the potential impacts of Navy vessels used during training and testing activities on marine vegetation are based on the vertical distribution of the vegetation, and vessel disturbance of marine vegetation would be limited to floating marine algae. Vessel movements may disperse or injure algal mats. Training and testing activities would be on a small spatial scale, and because algal distribution is patchy, mats may re-form. Navy training and testing activities involving vessel movement would not impact the general health of marine algae; the impact would be minimal relative to their total population level.

3.7.2.2.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously.

There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of approximately 104 in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would remain inconsequential because impacts are expected to be short term and temporary, based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation; and (4) the implementation of Navy protective measures. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increase slightly in the Inland Waters (from 916 to 918) and in the Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles. The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to impact marine vegetation. The proposed net increase of vessel and in-water device activities combined would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would be inconsequential for the same reasons presented above for training activities. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would remain inconsequential because impacts are expected to be short term and temporary based on (1) the quick recovery of most vegetation types; (2) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increases in suspended sediment in shallow areas; (3) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation; and (4) the implementation of Navy protective measures. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the total use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, impacts to marine vegetation during vessel and in-water device activities would be unlikely. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine vegetation would be inconsequential for the same reasons described above for training activities. Based on these factors, potential impacts on marine algae and vegetation from physical disturbance and strike are not expected to result in detectable changes to growth, survival, or propagation that would result in population-level impacts.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2.2 Impacts from Military Expended Materials

Military expended materials that could impact marine vegetation includes non-explosive practice munitions (Table 3.0-14), other military materials (Table 3.0-15), and explosive munitions that may result in fragments (Table 3.0-16).

3.7.2.2.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 is combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be expected to be the same or marginally reduced, as stated in the 2015 NWTT Final EIS/OEIS, and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 is combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. Although there are a few new activities, such as mine countermeasure and neutralization testing and kinetic energy weapon testing, that would generate military expended materials, impacts to marine vegetation would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increase compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine vegetation would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities, such as mine countermeasure and neutralization testing and kinetic energy weapon testing, that would generate military expended materials, impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.2.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are (1) precision anchoring training, where anchors are lowered to the seafloor and recovered; (2) EOD mine countermeasures training exercises, where some mine targets may be moored to the seafloor; (3) crawler UUV tests in which UUVs “crawl” across the seafloor; and (4) various testing activities where small anchors are placed on the seafloor to hold instrumentation in place.

3.7.2.2.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of seafloor devices would increase from 10 to 40 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18) as part of the Precision Anchoring exercise. The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered, and the activity is complete. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential because (1) the anchors will be deployed in previously disturbed areas; (2) most vegetation types will recover quickly; and (3) the implementation of Navy protective measures.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of testing activities that include the use of seafloor devices would increase compared to ongoing activities (from 1,809 to 1,878) (Table 3.0-18). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons given in the 2015 NWTT Final EIS/OEIS, the size of the disturbed area would be small, and the activities would be short term and infrequent.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities under Alternative 1 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as under Alternative 1 (Table 3.0-18) and would increase from 10 to 40 compared to ongoing activities. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting), crushing the vegetation, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons described above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices would increase compared to both Alternative 1 (1,878 to 1,953) and ongoing activities (1,809 to 1,953) (Table 3.0-18). The majority of the activities involve mine shapes. Because of the nature of the activity, marine vegetation on the seafloor may be impacted by seafloor devices by physically removing vegetation (e.g., uprooting); crushing the vegetation; temporarily increasing the turbidity (sediment suspended in the water) of waters nearby; or shading seagrass, which may interfere with photosynthesis. However, the impact of seafloor devices on marine vegetation would be inconsequential for the same reasons described above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities under Alternative 2 would have no impact on attached macroalgae or submerged rooted vegetation that constitutes EFH or HAPC.

3.7.2.2.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential impacts from physical disturbance and strike stressors on marine vegetation, but would not measurably improve growth, survival, or status of marine vegetation populations.

3.7.2.3 Secondary Stressors

As described in the 2015 NWTT Final EIS/OEIS, the Navy determined that neither state or federal standards or guidelines for sediments nor water quality would be violated by proposed training and testing activities. Because of these conditions, population-level impacts on marine vegetation are likely to be inconsequential and undetectable. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on marine vegetation from the training and testing activities proposed by Alternative 1, or Alternative 2, or the No Action Alternative.

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3.8 Marine Invertebrates

3.8.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS), the region of influence for marine invertebrates remains the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS. Following a review of recent literature since 2015, including government technical documents and reports, and online scientific journal databases managed by the Navy (e.g., MARLIN), the existing conditions of marine invertebrates in the Study Area, as listed in the 2015 NWTT Final EIS/OEIS, have not appreciably changed.

3.8.1.1 Taxonomic Groups

As described in the 2015 NWTT Final EIS/OEIS, all marine invertebrate taxonomic groups are represented in the Study Area (see Table 3.8-1), with the major taxonomic groups presented below in Invertebrate Hearing and Vocalization.

Following a review of recent literature, including government technical documents and reports and online scientific journal databases, the information presented on invertebrate hearing and vocalization, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed. New research describes detection of particle motion in mechanical receptors on various invertebrate body parts (Roberts et al., 2016) and how acoustic sensory capabilities, if present, are apparently limited to detecting the local particle motion component of sound (Edmonds et al., 2016). As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding invertebrate hearing and vocalization remains valid.

3.8.1.2 Sound Sensing and Production

Following a review of recent literature, including government technical documents and reports and online scientific journal databases, the information presented on invertebrate sound sensing and production, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed. New information on particle motion detection by Roberts et al. (2016) reinforces the finding that mechanical receptors on some invertebrates are found on various body parts. In addition, these structures are connected to the central nervous system and can detect some movements or vibrations that are transmitted through substrate (Edmonds et al., 2016) (Roberts et al., 2016). As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding invertebrate sound sensing and production remains valid.

3.8.1.3 General Threats

The general threats to marine invertebrates discussed in the 2015 NWTT Final EIS/OEIS included overexploitation and destructive fishing practices; habitat degradation from pollution and coastal development; disease; and invasive species, with compounding factors such as increasing temperature and decreasing pH of the ocean from pollution linked to global climate change. New information is regularly being published on the effects of global climate change and ocean acidification on various aspects of invertebrate life development such as larval development (McLaskey et al., 2016). However, the new research is generally in agreement with the information provided in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS regarding general threats remains valid.

Table 3.8-1: Taxonomic Groups of Marine Invertebrates in the Study Area

Major Invertebrate Groups[1]		Presence in Study Area		
Common Name (Species Group)	**Description**	**Offshore**	**Inland Waters**	**Western Behm Canal, Alaska**
Foraminifera, radiolarians, ciliates (Phylum Foraminifera)	Benthic and pelagic single-celled organisms; shells typically made of calcium carbonate or silica.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Sponges (Phylum Porifera)	Benthic animals; large species have calcium carbonate or silica structures embedded in cells to provide structural support.	Seafloor	Seafloor	Seafloor
Corals, hydroids, jellyfish (Phylum Cnidaria)	Benthic and pelagic animals with stinging cells.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Flatworms (Phylum Platyhelminthes)	Mostly benthic; simplest form of marine worm with a flattened body.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Ribbon worms (Phylum Nemertea)	Benthic marine worms with a long extension from the mouth (proboscis) from the mouth that helps capture food.	Water column, seafloor	Seafloor	Seafloor
Round worms (Phylum Nematoda)	Small benthic marine worms; many live in close association with other animals (typically as parasites).	Water column, seafloor	Water column, seafloor	Water column, seafloor
Segmented worms (Phylum Annelida)	Mostly benthic, highly mobile marine worms; many tube-dwelling species.	Seafloor	Seafloor	Seafloor
Bryozoans (Phylum Bryozoa)	Lace-like animals that exist as filter feeding colonies attached to the seafloor and other substrates.	Seafloor	Seafloor	Seafloor
Cephalopods, bivalves, sea snails, chitons (Phylum Molluska)	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers, and clams are filter feeders.	Water column, seafloor	Water column, seafloor	Water column, seafloor

Table 3.8-1: Taxonomic Groups of Marine Invertebrates in the Study Area (continued)

Major Invertebrate Groups[1]		Presence in Study Area		
Common Name (Species Group)	**Description**	**Offshore**	**Inland Waters**	**Western Behm Canal, Alaska**
Shrimp, crab, barnacles, copepods (Phylum Arthropoda - Crustacea)	Benthic or pelagic; some are immobile with an external skeleton; all feeding modes from predator to filter feeder.	Water column, seafloor	Water column, seafloor	Water column, seafloor
Sea stars, sea urchins, sea cucumbers (Phylum Echinodermata)	Benthic predators and filter feeders with tube feet.	Seafloor	Seafloor	Seafloor

[1] Major species groups (those with more than 1,000 species) are based on the World Register of Marine Species (Appeltans et al., 2010) and Catalogue of Life (Bisby et al., 2010)

Notes: Benthic = a bottom-dwelling organism; Pelagic = relating to, living, or occurring in the waters of the ocean.

3.8.1.4 Endangered Species Act-Listed Species

3.8.1.4.1 Offshore Area

No marine invertebrates listed as threatened or endangered under the Endangered Species Act (ESA) occur in the Offshore Area of the Study Area, as stated in the 2015 NWTT Final EIS/OEIS.

3.8.1.4.2 Inland Waters

As stated in the 2015 NWTT Final EIS/OEIS, no marine invertebrates listed as threatened or endangered under the ESA occur in the Inland Waters; but three species of concern, the Pinto abalone (*Haliotis kamtschatkana*), the Olympia oyster (*Ostreola conchaphila*), and the Newcomb's littorine snail (*Algamorda subrotundata*) do occur in the Inland Waters of the Study Area. Species of concern status does not carry any procedural or substantive protections under the ESA.

3.8.1.4.3 Western Behm Canal, Alaska

As stated in the 2015 NWTT Final EIS/OEIS, no marine invertebrates listed as threatened or endangered under the ESA occur in the Western Behm Canal; but three species of concern, the Pinto abalone (*Haliotis kamtschatkana*), the Olympia oyster (*Ostreola conchaphila*), and the Newcomb's littorine snail (*Algamorda subrotundata*) have potential to occur in the Western Behm Canal. Species of concern status does not carry any procedural or substantive protections under the ESA.

3.8.1.5 Federally Managed Species

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), which was reauthorized and amended by the Sustainable Fisheries Act (1996), requires eight regional fishery management councils to describe and identify Essential Fish Habitat (EFH) in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." This definition also covers federally managed invertebrates such as squid, krill, and scallops, which are described below.

3.8.1.5.1 Offshore Area

Market squid (*Doryteuthis opalescens*) and krill (euphausiids) are the only federally managed coastal pelagic invertebrate species found in the Offshore Area of the Study Area, as described in the 2015 NWTT Final EIS/OEIS. A literature review found that the information on this species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid. The analysis of impacts on commercial and recreational fisheries is provided in Section 3.12 (Socioeconomic Resources).

3.8.1.5.2 Inland Waters

Market squid (*Doryteuthis opalescens*) and krill (euphausiids) are the only federally managed coastal pelagic invertebrate species found in the Inland Waters of the Study Area, as described in the 2015 NWTT Final EIS/OEIS. A literature review found that the information on this species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid. The analysis of impacts on commercial and recreational fisheries is provided in Section 3.12 (Socioeconomic Resources).

3.8.1.5.3 Western Behm Canal, Alaska

As described in the 2015 NWTT Final EIS/OEIS, four species of scallops including *Patinopecten caurinus, Chlamys rubida, Chlamys hastata,* and *Crassadoma gigantean* are federally-managed in the Western Behm Canal portion of the Study Area include. A literature review found that the information on this species in the Study Area has not substantially changed from what is shown in the 2015 NWTT Final EIS/OEIS. Siddon et al. (2017) describes a standardized method for determining the age of *Patinopecten caurinus* in Alaska that helps provide the foundation for sound fisheries management. As such, the information presented in the 2015 NWTT Final EIS/OEIS remains valid. The analysis of impacts on commercial and recreational fisheries is provided in Section 3.12 (Socioeconomic Resources).

3.8.2 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that could potentially affect marine species; high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine invertebrates. The stressors applicable to marine invertebrates in the Study Area for this Supplemental include the two new stressors and the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- **Acoustic** (sonar and other transducers, vessel noise, aircraft noise, weapons noise)
- **Explosives** (in-air explosions, in-water explosions)
- **Energy** (in-water electromagnetic devices, high-energy lasers)
- **Physical disturbance and strike** (vessels and in-water devices, military expended materials, seafloor devices)
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymer)

- **Ingestion** (military expended materials – munitions and military expended materials – other than munitions)
- **Secondary** (impacts on habitat and impacts on prey availability)

This section evaluates how and to what degree potential impacts on marine invertebrates from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal and state regulations and standards relevant to marine invertebrates and reviewed scientific literature published since 2015 for new information on marine invertebrates that could inform the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers standard operating procedures (see Section 2.3.3, Standard Operating Procedures) and mitigation measures that the Navy would implement to avoid or reduce impacts to live hard bottom, artificial reefs, and shipwrecks (see Appendix K, Geographic Mitigation Assessment, for more details). Mitigation for marine invertebrates will be coordinated with the National Marine Fisheries Service through the ESA consultation process.

3.8.2.1 Acoustic Stressors

Little information is available on the potential impacts on marine invertebrates from exposure to sonar and other sound-producing activities. Most studies have focused on a few species (squid or crustaceans) and the consequences of exposures to broadband impulsive air guns typically used for seismic exploration, rather than on sonar or explosions. Because research on the consequences of marine invertebrate exposures to anthropogenic sounds is limited, qualitative analyses were conducted to determine the effects of the following acoustic stressors on marine invertebrates within the Study Area: non-impulsive sources (including sonar, vessel noise, aircraft overflights, and other active acoustic sources) and impulsive acoustic sources (including explosives and weapons firing).

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.1 (Acoustic Stressors) remains applicable. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of acoustic stressors within the Study Area.

As stated in the 2015 analysis, marine invertebrates are generally not sensitive to most sounds that would result from the proposed activities. Given that the activities would also be conducted in the same areas as described in the 2015 analysis, the amount of sound (i.e., the number of activities producing those sounds) would not change the conclusions. The analysis below analyzes the impacts from all acoustic sources such as sonar and other transducers.

3.8.2.1.1 Impacts from Sonar and Other Transducers

3.8.2.1.1.1 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Under Alternative 1, there will be an overall decrease in the number of sonar hours used in the Study Area during training activities and a slight increase in other sources of acoustic stressors (aircraft and weapons noise) (Table 3.0-2) compared to the number analyzed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains valid.

As described in the 2015 NWTT Final EIS/OEIS, invertebrates throughout the Study Area may be exposed to non-impulse sounds generated by low-, mid-, and high-frequency sonar and other acoustic sources, vessel noise, and aircraft noise. Acoustic impacts on marine invertebrates under Alternative 1 would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior and become disoriented due to masking of relevant environmental sounds if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may also contribute to masking of relevant environmental sounds. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses would last only minutes. Furthermore, invertebrate species have their best sensitivity to sound below 1 kilohertz and would not be capable of detecting the majority of sonars and other acoustic sources used in the Study Area.

Non-impulsive sounds associated with training under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or Habitat Areas of Particular Concern (HAPCs) within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

Under Alternative 1, there will be an increase in both the number of sonar hours and other sources of acoustic stressors used in the Study Area during testing (Table 3.0-2) compared to the number analyzed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains valid.

As described above, acoustic impacts on marine invertebrates would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Non-impulsive sounds associated with testing under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1. Therefore, acoustic impacts on marine invertebrates under Alternative 1 would be inconsequential.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.1.1.2 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

Under Alternative 2, the number of sonar hours and noise generated by other acoustic sources used during training activities (Table 3.0-2) would increase compared to the numbers analyzed in the 2015 NWTT Final EIS/OEIS and compared to Alternative 1. Under Alternative 2, increases in the number of sonar hour would have no appreciable change on the impact conclusions for acoustic stressors as summarized above under Alternative 1 and as presented in the 2015 NWTT Final EIS/OEIS. Therefore, acoustic impacts on marine invertebrates under Alternative 2 would be negligible.

As stated in the 2015 NWTT Final EIS/OEIS and discussed above for Alternative 1, invertebrates throughout the Study Area may be exposed to non-impulse sounds generated by the same sound sources under Alternative 2. Acoustic impacts on marine invertebrates under Alternative 2 would be inconsequential because most marine invertebrates would not be close enough to intense sound sources to potentially experience impacts on sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior and become disoriented due to masking of relevant environmental sounds if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may also contribute to masking of relevant environmental sounds. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses would last only minutes. Furthermore, invertebrate species have their best sensitivity to sound below 1 kilohertz and would not be capable of detecting the majority of sonars and other acoustic sources used in the Study Area.

Non-impulsive sounds associated with training and testing under Alternative 2 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

Under Alternative 2, the number of sonar hours and noise generated by other acoustic sources used during testing activities (Table 3.0-2) would increase compared to the numbers analyzed in the 2015 NWTT Final EIS/OEIS and compared to Alternative 1. Under Alternative 2, increases in the number of sonar hour would have no appreciable change on the impact conclusions for acoustic stressors as summarized above under Alternative 1 and as presented in the 2015 NWTT Final EIS/OEIS. Therefore, acoustic impacts on marine invertebrates under Alternative 2 would be negligible.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of sonar and other transducers during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.1.1.3 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Acoustic stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from acoustic stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.2 Explosive Stressors

Explosives introduce loud, impulse, broadband sounds into the marine environment. Impulse sources are characterized by rapid pressure rise times and high peak pressures. Explosions produce high-pressure shock waves that could cause injury or physical disturbance due to rapid pressure changes. Impulse sounds are usually brief, but the associated rapid pressure changes can injure or startle marine invertebrates. While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.1 (Acoustic Stressors), remains applicable. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of explosive stressors within the Study Area.

As stated above and in the 2015 analysis, marine invertebrates are generally not sensitive to most sounds that would result from the proposed activities. Given that the activities would also be conducted in the same areas as described in the 2015 analysis, there would be no change to the conclusions.

Effects of explosions on marine invertebrates include physical disturbance, fragmentation, or mortality to sessile organisms and pelagic larvae. Energy from an explosion at the surface would dissipate below detectable levels before reaching the seafloor and would not injure or otherwise impact deep-water, benthic marine invertebrates. Additionally, the vast majority of explosions occur at distances greater than 3 nautical miles (NM) from shore, where water depths are greater than the depths where the majority of hard bottom associated invertebrates occur.

As discussed in Chapter 5 (Mitigation), the Navy will implement mitigation to avoid impacts from explosives on seafloor resources throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of live hard bottom, artificial reefs, and shipwrecks. The mitigation will consequently help to avoid potential impacts on invertebrates that inhabit these areas. In addition, procedural mitigations include the requirement to avoid jellyfish aggregations during the use of explosive torpedoes.

3.8.2.2.1 Impacts from Explosives

3.8.2.2.1.1 Impacts from Explosives Under Alternative 1

Impacts from Explosives under Alternative 1 for Training Activities

The quantity of explosives used during training activities under Alterative 1 would generally increase compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-7). The activities would occur in the same locations and in a similar manner as were analyzed previously, with underwater detonations typically occurring in waters greater than 200 ft. in depth and greater than 50 NM from shore, with the exception of mine countermeasure and neutralization testing proposed in the Offshore Area and existing mine warfare areas in Inland Waters (e.g., Crescent Harbor and Hood Canal Explosive Ordnance Disposal Training Ranges). Therefore, the impacts to marine invertebrates would be the same as those described in the 2015 NWTT Final EIS/OEIS. Both pelagic and benthic marine invertebrates could be impacted by explosive stressors. Explosions would likely kill or injure nearby marine invertebrates. The potential effects could include physical disturbance, fragmentation, or mortality to sessile organisms and pelagic larvae. Most explosions at the water surface would not injure benthic marine invertebrates because the explosive weights would be small compared to the water depth.

As stated in the 2015 NWTT Final EIS/OEIS, non-impulsive sounds from explosions associated with training and testing under Alternative 1 are not expected to impact the majority of marine invertebrates or cause more than a short-term behavioral disturbance (e.g., change in orientation or swim speeds) to those marine invertebrates capable of detecting nearby sound. Impacts to marine invertebrates from explosions would be inconsequential because most detonations would occur in deeper waters greater than 50 NM) from shore in the offshore training area, and less than 1 percent would occur in Inland Waters. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Explosives under Alternative 1 for Testing Activities

The quantity of explosives used during testing activities under Alterative 1 would generally increase (Table 3.0-7) compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately three times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore that other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine invertebrates would be the same as those described in the 2015 NWTT Final

EIS/OEIS and would be inconsequential because most detonations would occur greater than 50 NM from shore. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.2.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives under Alternative 2 for Training Activities

The quantity of explosives used during training activities under Alternative 2 would generally increase compared to levels presented above for Alternative 1 (Table 3.0-7) and levels presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine vegetation would be the same. As stated in the 2015 NWTT Final EIS/OEIS and above for Alternative 1, both pelagic and benthic marine invertebrates could be impacted by explosive stressors during training activities under Alternative 2. However, impacts to marine invertebrates from underwater and surface explosions conducted for training activities would be inconsequential because most detonations would occur greater than 50 NM from shore in the offshore training area, and less than 1 percent would occur in Inland Waters. As water depth increases away from shore, benthic and pelagic invertebrates would be less likely to be impacted by detonations at or near the surface. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Shockwaves created by explosions would impact invertebrates in a similar way, causing them to be disturbed rather than struck as water flows from around the explosion. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2. No population-level impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected under Alternative 2.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Explosives under Alternative 2 for Testing Activities

The quantity of explosives used during testing activities under Alterative 2 would generally be the same as Alternative 1 (Table 3.0-7), but would increase slightly compared to levels presented in the 2015 NWTT Final EIS/OEIS. The activities that use explosive munitions would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur in the Offshore Area approximately three times per year and would use explosives within the water column (see Chapter 2, Description of Proposed Action and Alternatives). This activity would occur closer to shore that other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives in the Offshore Area. Although this activity would occur closer to shore, it would typically occur in water depths greater than 100 feet. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1.

Pursuant to the EFH requirements of the MSA and implementing regulations, the use of explosives during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.2.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Explosive stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from explosive stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.3 Energy Stressors

The energy stressors that may impact marine invertebrates include in-water electromagnetic devices and high-energy lasers. The in-water electromagnetic devices stressor remains the same as analyzed in the 2015 NWTT Final EIS/OEIS; high-energy lasers is a new stressor analyzed in this Supplemental. While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.2 (Energy Stressors), remains valid. As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy lasers are designed to disable surface targets, rendering them immobile. The primary concern is the potential for an invertebrate to be struck with the laser beam at or near the water's surface, where extended exposure could result in injury or death.

Magnetic fields are not known to control spawning or larval settlement in any invertebrate species. Existing information suggests sensitivity to electric and magnetic fields in at least three marine invertebrate phyla: Mollusca, Arthropoda, and Echinodermata (Lohmann et al., 1995; Lohmann & Lohmann, 2006; Normandeau et al., 2011). A possible magnetic sense has been suggested in jellyfish as well, although this has not been demonstrated experimentally (Fossette et al., 2015). Much of the available information on magnetic field sensitivity of marine invertebrates pertains to crustaceans. For example, a magnetic compass sense has been demonstrated in the spiny lobster (*Panulirus argus*) (Lohmann et al., 1995; Lohmann & Lohmann, 2006), and researchers suggest subtle behavioral response to magnetic fields of about 1 millitesla (1,000 microtesla) in the Dungeness crab and American lobster (*Homarus americanus*) (Woodruff et al., 2013). A review of potential effects of undersea power cables on marine species provides a summary of numerous studies of the sensitivity of various invertebrate species to electric and magnetic fields (Normandeau et al., 2011). Electric field sensitivity is reported in the summary for only two freshwater crayfish species, while magnetic field sensitivity is reported for multiple marine invertebrate species, including molluscs, crustaceans, and echinoderms. Sensitivity thresholds range from 300 to 30,000 microtesla, depending on the species. Most responses consisted of behavioral changes, although non-lethal physiological effects were noted in two sea urchin species in a 30,000 microtesla field (embryo development) and a marine mussel exposed to 300–700 microtesla field strength (cellular processes). Marine invertebrate community structure was not found to be affected by placement of energized underwater power cables with field strengths of 73–100 microtesla (Love et al., 2016). Effects to eggs of the sea urchin *Paracentrotus lividus* and to brine shrimp (*Artemia* spp.) cysts have been reported at relatively high magnetic field strengths (750–25,000 microtesla) (Ravera et al., 2006; Shckorbatov et al., 2010). The magnetic field generated by the Organic Airborne and Surface Influence Sweep (a typical electromagnetic device used in Navy training and testing) is about 2,300 microtesla at the source. Field strength drops quickly with distance from the source, decreasing to 50 microtesla at 4 meters (m), 5 microtesla at 24 m, and 0.2 microtesla at 200 m from the source. Therefore, temporary disruption of navigation and directional orientation is the primary impact considered in association with magnetic fields.

Studies of the effects of low-voltage direct electrical currents in proximity to marine invertebrates suggest a beneficial impact to at least some species at appropriate current strength. American oysters (*Crassostrea virginica*) and various stony and soft corals occurring on substrates exposed to low-voltage currents (between approximately 10 and 1,000 microamperes) showed increased growth rates and survival (Arifin et al., 2012; Goreau, 2014; Jompa et al., 2012; Shorr et al., 2012). It is thought that the benefits may result from a combination of more efficient uptake of calcium and other structure-building minerals from the surrounding seawater, increased cellular energy production, and increased pH near the electrical currents. The beneficial effects were noted in a specific range of current strength; higher or lower currents resulted in either no observable effects or adverse effects. The moderate voltage and current associated with the Organic Airborne and Surface Influence Sweep are not expected to result in adverse effects to invertebrates. In addition, due to the short-term, transient nature of electromagnetic device use, there would be no beneficial effects associated with small induced electrical currents in structures colonized by invertebrates.

Marine invertebrates could be exposed to the laser during testing activities only if the beam misses the target. Should the laser strike the sea surface, individual invertebrates at or near the surface, such as jellyfish, floating eggs, and larvae, could potentially be exposed. The potential for exposure to a high-energy laser beam decreases rapidly as water depth increases and with time of day, as many zooplankton species migrate away from the surface during the day. Most marine invertebrates are not susceptible to laser exposure because they occur beneath the sea surface.

3.8.2.3.1 Impacts from In-Water Electromagnetic Devices

3.8.2.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same (Table 3.0-9) as those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As stated in the 2015 NWTT Final EIS/OEIS, the impact of in-water electromagnetic devices on marine invertebrates would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible invertebrates (e.g., some species of arthropods, mollusks, and echinoderms), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.8.2.3.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as Alternative 1 (Table 3.0-9) and those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As described above for Alternative 1, marine invertebrates may be exposed to in-water electromagnetic devices during training activities and only exposed to high-energy lasers during testing activities. The impact of these stressors on marine invertebrates under Alternative 2 would be inconsequential because (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges; (2) the number of activities involving the stressor is low; (3) exposures would be localized, temporary, and would cease with the conclusion of the activity; and (4) even for susceptible invertebrates (e.g., some species of arthropods, mollusks, and echinoderms), the consequences of exposure are limited to temporary disruptions to navigation and orientation under Alternative 2.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.8.2.3.2.1 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Energy stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from energy stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.3.3 Impacts from High-Energy Lasers

High-Energy Lasers were not proposed for use in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges.

This section analyzes the potential impacts of high-energy lasers on marine invertebrates. The primary concern for high-energy weapons testing is the potential for a marine invertebrate to be struck by a high-energy laser beam at or near the water's surface, which could result in injury or death, resulting from traumatic burns from the beam.

Marine invertebrates could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual invertebrates at or near the surface, such as jellyfish, floating eggs, and larvae could potentially be exposed. The potential for exposure to a high-energy laser beam decreases rapidly as water depth increases and with time of day, as many zooplankton species migrate away from the surface during the day. Most marine invertebrates are not susceptible to laser exposure because they occur beneath the sea surface.

3.8.2.3.3.1 Impacts from High-Energy Lasers Under Alternative 1

Impacts from High-Energy Lasers Under Alternative 1 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 1.

Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities

As shown in Table 3.0-10, a total of 54 testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 1. Invertebrates that do not occur at or near the sea surface would not be exposed due to the attenuation of laser energy with depth. Surface invertebrates such as squid, jellyfish, and zooplankton (which may include invertebrate larvae) exposed to high-energy lasers could be injured or killed, but the probability is low based on the relatively low number of events, very localized potential impact area of the laser beam, and the temporary duration of potential impact (seconds). Activities involving high-energy lasers are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level because of the relatively small number of individuals that could be impacted. The impact of high-energy lasers on marine invertebrates would be inconsequential because: (1) it is highly unlikely that a high-energy laser would miss its target, (2) it is highly unlikely that the laser would miss in such a way that the laser beam would strike a marine invertebrate, and (3) it is highly unlikely that the marine invertebrate would be at or near the surface, just as two equally unlikely events take place.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers during testing activities, as described under Alternative 1, would have no effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.3.3.2 Impacts from High-Energy Lasers under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

As shown in Table 3.0-10, a total of 54 testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1; as stated above, this represents a new activity not covered in the 2015 NWTT Final EIS/OEIS. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers during testing activities, as described under Alternative 2, would have no effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.3.3.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Energy stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from energy stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4 Physical Disturbance and Strike

The physical disturbance and strike stressors that may impact marine invertebrates include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.4.1 Impacts from Vessels and In-Water Devices

3.8.2.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are small and slow-moving, the impacts to marine invertebrates would be similar. The proposed increase of approximately 100 in-water devices would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increases slightly in the Inland Waters (from 916 to 918) and Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles. The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine invertebrate. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are unlikely to have an impact to marine invertebrates (small, slow-moving in-water devices), the impacts to marine invertebrates would be similar. The proposed increase of in-water devices would not change that conclusion. The activities would occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 2, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT Final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine invertebrate. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the impact of vessels and in-water devices on marine invertebrates would remain inconsequential because (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 2, activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4.2 Impacts from Military Expended Materials

Military expended materials include non-explosive practice munitions (Table 3.0-14), other military materials (Table 3.0-15), high explosives that may result in fragments (Table 3.0-16), and targets (Table 3.0-17).

3.8.2.4.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases slightly compared to ongoing activities.

Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14, Table 3.0-15, and Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine invertebrates would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts to marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended material during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.4.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are: (1) precision anchoring training, where anchors are lowered to the seafloor and recovered; (2) EOD mine countermeasures training exercises, where some mine targets may be moored to the seafloor; (3) crawler UUV tests in which UUVs "crawl" across the seafloor; and (4) various testing activities where small anchors are placed on the seafloor to hold instrumentation in place.

3.8.2.4.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of seafloor devices would increase from 10 to 40 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18) as part of the Precision Anchoring exercise. The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered and the activity is complete. Because of the nature of the activity, the risk to marine invertebrates would be discountable because (1) the area exposed to the stressor amounts to a small portion of footprint which is extremely small relative to most marine invertebrates' ranges; (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event; and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Under Alternative 1, activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of testing activities that include the use of seafloor devices would increase (Table 3.0-18) compared to ongoing activities (from 809 to 878). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby. However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for training activities.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as under Alternative 1 (Table 3.0-18) and would increase compared to ongoing activities (from 10 to 40). Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby. However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices would increase compared to both Alternative 1 (878 to 935) (Table 3.0-18) and ongoing activities (809 to 953). The majority of the activities involve mine shapes. Because of the nature of the activity, marine invertebrates on the seafloor may be impacted by seafloor devices by physically removing, crushing the individual, and temporarily increasing the turbidity (sediment suspended in the water) of waters nearby. However, the impact of seafloor devices on marine invertebrates would be inconsequential for the same reasons described above for Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.4.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from physical disturbance and strike stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5 Entanglement Stressors

The entanglement stressors that may impact marine invertebrates include (1) wires and cables, (2) decelerators/parachutes, and (3) biodegradable polymer. Biodegradable polymer is a new stressor not previously analyzed, but the other two stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.5.1 Impacts from Wires and Cables

Wires and cables include fiber optic cables, guidance wires, and sonobuoy wires (Table 3.0-19).

3.8.2.5.1.1 Impacts from Wires and Cables Under Alternative 1

Impacts from Wires and Cables Under Alternative 1 for Training Activities

Under Alternative 1, the number of wires and cables that would be expended during training activities (Table 3.0-19) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. No fiber optic cables are used in the NWTT Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 1, none were proposed in the previous analysis and no guidance wires would be expended in Inland Waters. As shown in (Table 3.0-19), the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 8,928 to 9,338), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Wires and Cables Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of wires and cables that would be expended during testing activities is increased (Table 3.0-19) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Fiber optic cables used in the Offshore Area would increase (20 to 36), guidance wires used in both the Offshore Area and the Inland Waters would increase (92to 152 in Offshore Areas and 155 to 230 in Inland Waters), and sonobuoy wires expended would also increase (1,000 to 4,049 in Offshore Areas and 6 to 48 in Inland Waters). Even though the number of cable and wires would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential because:

(1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one activity, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors as most would avoid entanglement and simply be temporarily disturbed. Activities involving fiber optic cables and guidance wires are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.1.2 Impacts from Wires and Cables Under Alternative 2

Impacts from Wires and Cables Under Alternative 2 for Training Activities

Under Alternative 2, the total number of wires and cables that would be expended during training activities (9,380) is generally consistent with the number proposed for use under Alternative 1 (9,340) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (8,928). No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 2, none were proposed in the previous analysis. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase (from 9,338 to 9,380), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential for the same reasons discussed above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Wires and Cables Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of wires and cables that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 4,712 to 6,958) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (1,395 to 6,958). Fiber optic cables used in the Offshore Area and Inland Waters would be the same as Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS. Guidance wires used in the Offshore Area would increase compared to Alternative 1 (from 152 to 192) and those proposed in the previous analysis (from 92 to 192). Guidance wires in Inland Waters would be the same as Alternative 1 (Table 3.0-19), but increase (from 155 to 230) compared to those proposed in the previous analysis. Sonobuoy wires expended in Offshore Areas would increase compared to Alternative 1 (from 4,049 to 6,255) and in the 2015 NWTT Final EIS/OEIS (from 1,000 to 6,255). Sonobuoy wires expended in Inland Waters would be the same as Alternative 1 (Table 3.0-19) and would increase compared to the 2015 NWTT Final EIS/OEIS (from 6 to 48). The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on marine invertebrates would be inconsequential for the same reasons discussed above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of fiber optic cables during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.1.3 Impacts from Wires and Cables Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes include small, medium, large, and extra-large decelerator parachutes (Table 3.0-20).

3.8.2.5.2.1 Impacts from Decelerators/Parachutes Under Alternative 1

Impacts from Decelerators/Parachutes Under Alternative 1 for Training Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during training activities increases (9,097 to 9,456) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (8,928 to 9,354), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area decreases from 24 to 4, and the number of large decelerators/parachutes in the Offshore Area decreases from 145 to 98 (Table 3.0-20). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, most marine invertebrates would never encounter a decelerator/parachute from training activities. The impact of decelerators/parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential for the same reasons described above for fiber optic cables and guidance wires. Activities involving decelerators/parachutes are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes during training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during testing activities is increased (1,181 to 1,983) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (1,068 to 1,759), and in the Inland Waters to increase from 113 to 224. No other sizes of decelerators/parachutes are proposed during testing activities. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons presented above for wires and cables.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.2.2 Impacts from Decelerators/Parachutes Under Alternative 2

Impacts from Decelerators/Parachutes Under Alternative 2 for Training Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during training activities increases compared to the number proposed for use under Alternative 1 (from 9,456 to 9,563) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (9,097 to 9,563). As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (9,354 to 9,394), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area increases from 4 to 24 compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The number of large decelerators/parachutes in the Offshore Area increases from 98 to 145 (Table 3.0-20) compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons detailed above under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes during training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 1,983 to 1,991) and in the 2015 NWTT Final EIS/OEIS (1,181 to 1,991). As shown in Table 3.0-20, the expenditure of small decelerators/parachutes would be the same in the Offshore Area compared to Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS (from 1,068 to 1,759). The expenditure of small decelerators/parachutes in Inland Waters would increase compared to both Alternative 1 (224 to 232) and the previous analysis (113 to 232). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on marine invertebrates would be inconsequential for the same reasons presented above for wires and cables.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.2.3 Impacts from Decelerators/Parachutes Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.5.3 Impacts from Biodegradable Polymer

Biodegradable polymers were not proposed for use in the 2015 NWTT Final EIS/OEIS, and for this Supplemental would be used only during proposed testing activities, not during training activities. For a discussion of where biodegradable polymers are used and how many activities would occur under each alternative, see Section 3.0.3.5.3 (Biodegradable Polymer). The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft rendering it ineffective. A biodegradable polymer is a high molecular weight polymer that degrades to smaller compounds as a result of microorganisms and enzymes. The rate of biodegradation could vary from hours to years and the type of small molecules formed during degradation can range from complex to simple products, depending on whether the polymers are natural or synthetic (Karlsson & Albertsson, 1998). Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will break down into small pieces within a few days to weeks. This will break down further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a marine invertebrate would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A marine invertebrate would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If a marine invertebrate were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor.

3.8.2.5.3.1 Impacts from Biodegradable Polymer Under Alternative 1

Impacts from Biodegradable Polymer Under Alternative 1 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 1.

Impacts from Biodegradable Polymer Under Alternative 1 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to only be conducted in the Inland Waters under Alternative 1. As detailed above and in the 2015 NWTT Final EIS/OEIS, marine invertebrates are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed. It is conceivable that relatively large pelagic invertebrates such as jellyfish would be temporarily entangled, although the probability is low due to the polymer design. The most likely effect would be temporary displacement as the material floats past an animal. Impacts on benthic species would not be expected. Activities involving biodegradable polymer would not yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymer during testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.3.2 Impacts from Biodegradable Polymer Under Alternative 2

Impacts from Biodegradable Polymer Under Alternative 2 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 2.

Impacts from Biodegradable Polymer Under Alternative 2 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 2, the same number as Alternative 1. As detailed above and in the 2015 NWTT Final EIS/OEIS, marine invertebrates are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed. It is conceivable that relatively large pelagic invertebrates such as jellyfish would be temporarily entangled, although the probability is low due to the polymer design. The most likely effect would be temporary displacement as the material floats past an animal. Impacts on benthic species would not be expected. Therefore, as described above for Alternative 1, activities involving biodegradable polymer would not yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymer during testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.5.3.3 Impacts from Biodegradable Polymer Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from entanglement stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.6 Ingestion Stressors

The ingestions stressors that may impact marine invertebrates include military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) and military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers). Biodegradable polymer is a new source for existing entanglement and ingestion stressors not previously analyzed, but the other stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.8.2.6.1 Impacts from Military Expended Materials – Munitions

Ingestion of intact military expended materials – munitions is not likely for most types of expended items because they are too large to be ingested by most marine invertebrates. Though ingestion of intact munitions or large fragments is conceivable in some circumstances (e.g., a relatively large invertebrate such as an octopus or lobster ingesting a small-caliber projectile), such a scenario is unlikely due to the animal's ability to discriminate between food and non-food items. Indiscriminate deposit- and detritus-feeding invertebrates, such as some marine worms, could potentially ingest munitions fragments that have degraded to sediment size. In addition, metal particles in the water column may be taken up by suspension feeders (e.g., copepods, mussels) (Chiarelli & Roccheri, 2014; Griscom & Fisher, 2004). Although most metals do not technically dissolve in water, many react with water to form a soluble compound, and researchers often refer to these compounds as dissolved metals. Investigations of silver ingestion by marine invertebrates found that the metal is less toxic when dissolved in water (Brix et al., 2012), and an investigation of metals in a nearshore area heavily influenced by industrial activities found that concentrations were substantially greater in the sediment than in the water column (Bazzi, 2014). The results of these studies suggest that suspension-feeding invertebrates could be less susceptible to impacts than invertebrates that might consume metal particles directly from the sediment.

3.8.2.6.1.1 Impacts from Military Expended Materials – Munitions Under Alternative 1

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.1.2 Impacts from Military Expended Materials – Munitions Under Alternative 2

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of military expended materials – munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – munitions of ingestible size associated with testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.1.3 Impacts from Military Expended Materials – Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from ingestion stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.6.2 Impacts from Military Expended Materials – Other than Munitions

3.8.2.6.2.1 Impacts from Military Expended Materials – Other than Munitions Under Alternative 1

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – other than munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with training activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during testing activities decreases (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to marine invertebrates. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, the impact on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with testing activities, as described under Alternative 1, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.2.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use under Alternative 1 and in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 2 increases slightly compared to Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts to marine invertebrates would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials – other than munitions on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with training activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during testing activities increases (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) compared to the number proposed for use under Alternative 1 and decreases slightly from ongoing activities. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to marine invertebrates. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, the impact on marine invertebrates would be inconsequential because most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials – other than munitions of ingestible size associated with testing activities, as described under Alternative 2, would have no adverse effect on sedentary invertebrate beds or reefs that constitute EFH or HAPCs within the Study Area.

3.8.2.6.2.3 Impacts from Military Expended Materials – Other than Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts from ingestion stressors on individual invertebrates, but would not measurably improve the status of invertebrate populations or subpopulations.

3.8.2.7 Secondary Stressors

Potential impacts on marine invertebrates exposed to stressors could occur indirectly through sediments and water quality. Stressors from Navy training and testing activities could pose secondary or indirect impacts on marine invertebrates via habitat, sediment, or water quality. Components of these stressors that could pose indirect impacts include (1) explosives and explosives byproducts; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.8.3.6 (Secondary Stressors) remains valid.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on marine invertebrates via water are likely to be inconsequential and not detectable for two reasons. First, most explosives and explosive degradation products have very low solubility in sea water. This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation are not likely to accumulate except within confined spaces. Second, a low concentration of byproducts, slowly delivered into the water column, is readily diluted to non-harmful concentrations. Filter feeders in the immediate vicinity of degrading explosives may be more susceptible to bioaccumulation of chemical byproducts. While marine invertebrates may be adversely impacted by the indirect effects of degrading explosives via water (Rosen & Lotufo, 2007; 2010), this is extremely unlikely in realistic scenarios.

Impacts on marine invertebrates, including zooplankton, eggs, and larvae, are likely only within a very small radius of the ordnance (1–6 feet [0.3–1.8 m]). These impacts may continue as the ordnance degrades over months to decades. Because most ordnance is deployed as projectiles, multiple unexploded or low-order detonations would accumulate on spatial scales of 1–6 feet (0.3–1.8 m); therefore, potential impacts are likely to remain local and widely separated. Given these conditions, the possibility of population-level impacts on marine invertebrates is inconsequential. However, if the sites of the depositions are the same over time, this could alter the benthic composition, affect bioaccumulation, and impact local invertebrate communities.

As stated in the 2015 NWTT Final EIS/OEIS, concentrations of metals in water are extremely unlikely to be high enough to cause injury or mortality to marine invertebrates; therefore, indirect impacts of metals via water are likely to be inconsequential and not detectable. Given these conditions, the possibility of population-level impacts on marine invertebrates is likely to be inconsequential and not detectable. In addition, concentrations of chemicals in sediment and water are not likely to cause injury or mortality to marine invertebrates; therefore, indirect impacts of chemicals via sediment and water are likely to be inconsequential and not detectable. Population-level impacts on marine invertebrates would be inconsequential and not detectable.

In addition, as stated in the 2015 NWTT Final EIS/OEIS, the only material that could impact marine invertebrates via sediment is plastics. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik, 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine invertebrates are most at risk via ingestion or bioaccumulation. Because plastics retain many of their chemical properties as they are physically degraded into microplastic particles (Singh & Sharma, 2008), the exposure risks to marine invertebrates are dispersed over time. Marine invertebrates could be indirectly impacted by chemicals from plastics but, absent bioaccumulation, these impacts would be limited to direct contact with the material. Because of these conditions, population-level impacts on marine invertebrates attributable to Navy-expended materials are likely to be inconsequential and not detectable.

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3.9 Fishes

3.9.1 Introduction and Methods

This section analyzes the potential impacts of the Proposed Action on fishes found in the Northwest Training and Testing (NWTT) Study Area (Study Area). Section 3.9 (Fishes) provides a synopsis of the United States (U.S.) Department of the Navy's (Navy's) determinations of the impacts of the Proposed Action on fishes. Section 3.9.2 (Affected Environment) introduces the species and taxonomic groups known to occur in the Study Area and discusses the baseline affected environment. The complete analysis of environmental consequences is in Section 3.9.3 (Environmental Consequences).

For this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), marine and anadromous fishes are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential impact on all fishes in general, by taxonomic groupings, and the 35 fish in the Study Area listed under the Endangered Species Act (ESA).

Major taxonomic groups in the Study Area are described in the 2015 NWTT Final EIS/OEIS and remain valid as written. Fish species listed under the ESA are updated in this document. Marine fish species that are regulated under the Magnuson-Stevens Fishery Conservation and Management Act are discussed in Section 3.9.2.5 (Federally Managed Fisheries). Additional general information on the biology, life history, distribution, and conservation of marine and anadromous fishes can be found on the websites of the following agencies and organizations, as well as many others:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Regional Fishery Management Councils
- International Union for Conservation of Nature
- Essential Fish Habitat Text Descriptions

Fishes are not distributed uniformly throughout the Study Area but are closely associated with a variety of habitats. Some species, such as large sharks, tuna, and billfishes, range across thousands of square miles (thousands of square kilometers), while others have small home ranges and restricted distributions (Helfman et al., 2009a). The movements of some open-ocean species may never overlap with coastal species that spend their lives within several hundred feet (a few hundred meters) of the shore. Even within species, the distribution and specific habitats in which individuals occur may be influenced by age, developmental stage, size, sex, reproductive condition, health, and other factors.

3.9.2 Affected Environment

For purposes of this Supplemental, the region of influence for fishes remains the same as that identified in the 2015 NWTT Final EIS/OEIS.

The 2015 NWTT Final EIS/OEIS provided a general overview of fish hearing and vocalizations and general threats. New information since the publication of the 2015 NWTT Final EIS/OEIS is included below to better understand potential stressors and impacts on fishes resulting from training and testing activities.

3.9.2.1 Hearing and Vocalization

A summary of fish hearing and vocalizations is described in the 2015 NWTT Final EIS/OEIS. Due to the availability of new literature, including revised sound exposure criteria, the information provided below will supplement the 2015 NWTT Final EIS/OEIS for fishes.

All fishes have two sensory systems that can detect sound in the water: the inner ear, which functions similarly to the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the body of a fish (Popper & Schilt, 2008). The lateral line system is sensitive to external particle motion arising from sources within a few body lengths of the animal. The lateral line detects particle motion at low frequencies from below 1 hertz (Hz) up to at least 400 Hz (Coombs & Montgomery, 1999; Hastings & Popper, 2005; Higgs & Radford, 2013; Webb et al., 2008). Generally, the inner ears of fish contain three dense otoliths (i.e., small calcareous bodies) that sit atop many delicate mechanoelectric hair cells within the inner ear of fishes, similar to the hair cells found in the mammalian ear. Sound waves in water tend to pass through the fish's body, which has a composition similar to water, and vibrate the otoliths. This causes a relative motion between the dense otoliths and the surrounding tissues, causing a deflection of the hair cells, which is sensed by the nervous system.

Although a propagating sound wave contains pressure and particle motion components, particle motion is most significant at low frequencies (up to at least 400 Hz) and is most detectible at high sound pressures or very close to a sound source. The inner ears of fishes are directly sensitive to acoustic particle motion rather than acoustic pressure (acoustic particle motion and acoustic pressure are discussed in Appendix D, Acoustic and Explosive Concepts). Historically, studies that have investigated hearing in, and effects to, fishes have been carried out with sound pressure metrics. Although particle motion may be the more relevant exposure metric for many fish species, there is little data available that actually measures it due to a lack of standard measurement methodology and experience with particle motion detectors (Hawkins et al., 2015; Martin et al., 2016). In these instances, particle motion can be estimated from pressure measurements (Nedelec et al., 2016a).

Some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as a gas-filled swim bladder (Astrup, 1999; Popper & Fay, 2010). The swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear (Radford et al., 2012). Fishes with a swim bladder generally have better sensitivity and can detect higher frequencies than fishes without a swim bladder (Popper & Fay, 2010; Popper et al., 2014). In addition, structures such as gas-filled bubbles near the ear or swim bladder, or even connections between the swim bladder and the inner ear, also increase sensitivity and allow for high-frequency hearing capabilities and better sound pressure detection.

Although many researchers have investigated hearing and vocalizations in fish species (Ladich & Fay, 2013; Popper et al., 2014), hearing capability data only exist for just over 100 of the currently known 34,000 marine and freshwater fish species (Eschmeyer & Fong, 2016). Therefore, fish hearing groups are defined by species that possess a similar continuum of anatomical features, which result in varying degrees of hearing sensitivity (Popper & Hastings, 2009b; Popper & Fay, 2010). Categories and descriptions of hearing sensitivities are further defined in this document (modified from Popper et al., 2014) as the following:

- Fishes without a swim bladder—hearing capabilities are limited to particle motion detection at frequencies well below 1 kilohertz (kHz).
- Fishes with a swim bladder not involved in hearing—species lack notable anatomical specializations, and primarily detect particle motion at frequencies below 1 kHz.
- Fishes with a swim bladder involved in hearing—species can detect frequencies below 1 kHz and possess anatomical specializations to enhance hearing and are capable of sound pressure detection up to a few kHz.

- Fishes with a swim bladder and high-frequency hearing—species can detect frequencies below 1 kHz and possess anatomical specializations and are capable of sound pressure detection at frequencies up to 10 kHz to over 100 kHz.

Data suggest that most species of marine fish either lack a swim bladder (e.g., sharks and flatfishes) or have a swim bladder not involved in hearing and can only detect sounds below 1 kHz. Some marine fishes (clupeiforms) with a swim bladder involved in hearing are able to detect sounds to about 4 kHz (Colleye et al., 2016; Mann et al., 2001; Mann et al., 1997). One subfamily of clupeids (i.e., Alosinae) can detect high- and very high-frequency sounds (i.e., frequencies from 10 to 100 kHz, and frequencies above 100 kHz, respectively), although auditory thresholds at these higher frequencies are elevated and the range of best hearing is still in the low-frequency range (below 1 kHz) similar to other fishes. Mann et al. (1997, 1998) theorize that this subfamily may have evolved the ability to hear relatively high sound levels at these higher frequencies in order to detect echolocations of nearby foraging dolphins. For fishes that have not had their hearing tested, such as deep sea fishes, the suspected hearing capabilities are based on the structure of the ear, the relationship between the ear and the swim bladder, and other potential adaptations such as the presence of highly developed areas of the brain related to inner ear and lateral line functions (Buran et al., 2005; Deng et al., 2011, 2013). It is believed that most fishes have their best hearing sensitivity from 100 to 400 Hz (Popper, 2003).

Species listed under the ESA within the Study Area include several salmonid and rockfish species, as well as Pacific eulachon and green sturgeon. There are no available data on the hearing capabilities of these specific ESA-listed species. Instead, each species is considered to be part of a hearing groups described above based on data from similar, or surrogate, species, and knowledge of that species physiology. As discussed above, most marine fishes investigated to date lack hearing capabilities greater than 1,000 Hz. This notably includes sturgeon and salmonid species, fishes that have a swim bladder that is not involved in hearing. Although it is assumed that sturgeon and salmon species can detect frequencies up to 1,000 Hz, available hearing data has only tested these species up to about 600 Hz (Hawkins & Johnstone, 1978; Kane et al., 2010; Lovell et al., 2005; Meyer et al., 2010). Rockfish also have a swim bladder that is not involved in hearing similar to Salmoniformes (Hastings & Popper, 2005) and therefore likely have similar hearing capabilities. Eulachon do not have a swim bladder (Gauthier & Horne, 2004). Available data suggest species without a swim bladder can detect sounds from 20 to 1,000 Hz, with best sensitivity at lower ranges (Casper et al., 2003; Casper & Mann, 2006; Casper & Mann, 2009; Myrberg, 2001). This data is largely derived from studies conducted using cartilaginous fishes, such as sharks and rays. There are no ESA-listed species that occur in the Study Area that have a swim bladder that is involved in hearing, or that have high frequency hearing (the two most sensitive hearing groups).

Some fishes are known to produce sound. Bony fishes can produce sounds in a number of ways and use them for a number of behavioral functions (Ladich, 2008, 2014). Over 30 families of fishes are known to use vocalizations in aggressive interactions, and over 20 families are known to use vocalizations in mating (Ladich, 2008). Sounds generated by fishes as a means of communication are generally below 500 Hz (Slabbekoorn et al., 2010). The air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and radiates sound into the water (Zelick et al., 1999). Sprague and Luczkovich (2004) calculated that silver perch, of the family Sciaenidae, can produce drumming sounds ranging from 128 to 135 decibels referenced to 1 micropascal (dB re 1 μPa). Female midshipman fish apparently detect and locate the "hums" (approximately 90 to 400 Hz) of vocalizing males during the breeding season (McIver et al., 2014; Sisneros & Bass, 2003). Sciaenids produce a variety of sounds, including calls produced by males on breeding grounds (Ramcharitar et al., 2001), and a "drumming" call produced during chorusing that suggests a seasonal pattern to reproductive-related function (McCauley & Cato, 2000). Other sounds produced by chorusing reef fishes include "popping," "banging," and "trumpet" sounds; altogether, these choruses produce sound levels 35 dB above background levels, at peak frequencies between 250 and 1,200 Hz, and source levels between 144 and 157 dB re 1 µPa (McCauley & Cato, 2000).

Additional research using visual surveys (such as baited underwater video) and passive acoustic monitoring continue to reveal new sounds produced by fishes, both in the marine and freshwater environments, and allow for specific behaviors to be paired with those sounds (Radford et al., 2018; Rountree et al., 2018; Rowell et al., 2018).

3.9.2.2 General Threats

A summary of the major threats to fish species within the Study Area are described in the 2015 NWTT Final EIS/OEIS. Overfishing and associated factors, such as bycatch, fisheries-induced evolution, and intrinsic vulnerability to overfishing were described. Three species present in the Study Area, coho salmon (*Oncorhynchus kisutch*) stocks in Hood Canal, Washington, along with Pacific ocean perch (*Sebastes alutus*) and yelloweye rockfish (*Sebastes ruberrimus*), were listed as overfished in a 2016 NOAA Fisheries report to Congress (National Marine Fisheries Service, 2016).

Pollution, including the effect of oceanic circulation patterns scattering coastal pollution throughout the open ocean, was described. The effects of organic and inorganic pollutants to marine fishes, including bioaccumulation of pollutants, behavioral and physiological changes, or genetic damage, were described, as well as entanglement in abandoned commercial and recreational fishing gear.

Other human-caused stressors on marine fishes described were the introduction of non-native species, climate change shifting fish distribution from lower to higher latitudes, aquaculture, energy production, vessel movement, and underwater noise.

Additional climate change related threats impacting marine fish and fisheries in addition to those described in the 2015 NWTT Final EIS/OEIS have been documented. In addition to affecting species ranges, increasing temperature has been shown to alter the sex-ratio in fish species that have temperature-dependent sex determination mechanisms (Ospina-Alvarez & Piferrer, 2008). It appears that diadromous and benthic fish species are most vulnerable to climate change impacts on abundance or productivity (Hare et al., 2016).

Ocean acidification, a climate change related process where increasing atmospheric carbon dioxide concentrations are reducing ocean pH and carbonate ion concentrations, may have serious impacts on fish development and behavior (Raven et al., 2005). Physiological development of fishes can be affected by increases in pH that can increase the size, density, and mass of fish otoliths (e.g., fish ear stones), which would affect sensory functions (Bignami et al., 2013). Ocean acidification may affect fish larvae behavior and could impact fish populations (Munday et al., 2009). A range of behavioral traits critical to survival of newly settled fish larvae are affected by ocean acidification. Settlement-stage larval marine fishes exposed to elevated carbon dioxide were less responsive to threats than controls (Munday et al., 2009). This decrease in sensitivity to risk might be directly related to impaired olfactory ability (Munday et al., 2009). Ocean acidification may cause a shift in phytoplankton community composition and biochemical composition that can impact the transfer of essential compounds to planktivorous organisms (Bermudez et al., 2016) and can cause shifts in community composition up the food chain.

Another effect of climate change is ocean deoxygenation. Netburn and Koslow (2015) found that the depth of the lower boundary of the deep scattering layer (so-called because the sonic pulses of a sonar can reflect off the millions of fish swim bladders) is most strongly correlated with dissolved oxygen concentration. Cao et al. (2014) modeled different sensitivities of ocean temperature, carbonate chemistry, and oxygen, in terms of both the sign and magnitude, and correlated them to the amount of climate change. Model simulations in a study by Cao et al. (2014) found that, by the year 2500, every degree increase of climate sensitivity will warm the ocean by 0.8°Celsius and will reduce ocean-mean dissolved oxygen concentration by 5.0 percent. Conversely, every degree increase of climate sensitivity buffers CO_2-induced reduction in ocean-mean carbonate ion concentration and pH by 3.4 percent and 0.02 units, respectively. These results have great implications for understanding the response of ocean biota to climate change. Keller et al. (2015) suggested that within the California Current System, shoaling of the oxygen minimum zone is expected to produce complex changes and onshore movement of the oxygen minimum zone that could lead to habitat compression for species with higher oxygen requirements while allowing expansion of species tolerant of low bottom dissolved oxygen.

With the exception of new information about overfishing and climate change, the extent of the effects of general threats has not changed since they were last described in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.3 Taxonomic Group Descriptions and Distribution

Seventeen taxonomic groups of fishes and their distribution in the Study Area (Offshore Area and Inshore Waters and the Western Behm Canal portion of the Study Area) were described in the 2015 NWTT Final EIS/OEIS and summarized in Table 3.9-1. Neither the taxonomic groups nor their distribution within the Study Area has changed since it was last described in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

Table 3.9-1: Taxonomic Groups of Fishes Within the Northwest Training and Testing Study Area

Taxonomic Groups[1]		Distribution Within Study Area		
Taxonomic Grouping	**Description**	**Offshore Area**	**Inland Waters**	**Western Behm Alaska**
Hagfish and lamprey (orders Myxiniformes and Petromyzontiformes)	Primitive and jawless with an eel-like body shape that prey on fishes, feed on dead fishes, or are parasitic	Water column, seafloor	Seafloor	Seafloor
Sharks, rays, and chimaeras (class Chondrichthyes)	Cartilaginous (non-bony) fishes, some of which are open ocean predators	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Eels and spiny eels (order Anguilliformes, order Elopiformes)	Undergo a unique larval stage with a small head and elongated body; very different from other fishes	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Sturgeons (order Acipenseriformes)	Cartilaginous skeleton, anadromous, and long lived	Water column, seafloor	Water column, seafloor	Water column, seafloor
Herring, Eulachon, and Salmonids (orders Clupeiformes, Osmeriformes, Esociformes, and Salmoniformes)	Some are anadromous while others are migratory between the ocean, bays, estuaries, and rivers	Surface	Surface, water column	Surface, water column
Lanternfishes (order Myctophiformes)	Largest group of deepwater fishes, most possess adaptations for low-light conditions	Water column	Water column, seafloor	Not Present
Lizardfishes and lancetfishes (order Aulopiformes)	Predatory fish typically found in deep waters	Seafloor	Water column, seafloor	Water column, seafloor
Cods, Hakes and Brotulas (orders Gadiformes and Ophidiiformes)	Important commercial fishery resources, associated with bottom habitats	Water column, seafloor	Water column, seafloor	Water column, seafloor
Toadfishes (order Batrachoidiformes)	Temperate and tropical a lie-in-wait predator	Seafloor	Seafloor	Seafloor

Table 3.9-1: Taxonomic Groups of Fishes Within the Northwest Training and Testing Study Area (continued)

Taxonomic Groups[1]		Distribution Within Study Area		
Taxonomic Grouping	**Description**	**Offshore Area**	**Inland Waters**	**Western Behm Alaska**
Pacific saury and Silversides and Pacific saury (orders Atheriniformes and Beloniformes)	Small-sized nearshore/coastal fishes, primarily feed on organic debris; also includes the surface-oriented flyingfishes	Surface	Surface, water column	Surface, water column
Opahs and Ribbonfishes, (order Lampridiformes)	Primarily open ocean or deepwater fishes	Surface, water column	Surface, water column	Surface, water column
Pipefish (order Gasterosteiformes)	Small mouth with tubular snout and armor like scales; shows a high level of parental care	None	Surface	Surface
Rockfishes (order Scorpaeniformes)	Larval and juvenile stages pelagic; depending on species, adults bottom oriented or pelagic	Surface, water column, seafloor	Surface, water column, seafloor	Surface, water column, seafloor
Gobies (order Perciformes: family Gobiidae)	Gobies are the largest and most diverse family of marine fishes, mostly found in bottom habitats of coastal areas	None	Bottom Habitat	Surface
Jacks, tunas, and Mackerels, (order Perciformes: families Carangidae, Scombridae)	Highly migratory predators found near the surface; they make up a major component of fisheries	Surface	Surface, water column	Surface, water column
Flounders (order Pleuronectiformes)	Occur in bottom habitats throughout the world where they are well camouflaged	Seafloor	Seafloor	Seafloor
Ocean sunfish (*Mola mola*) (order Tetraodontiformes)	Unique body shapes and characteristics to avoid predators	Surface, water column	Surface, water column	Surface, water column

[1] Taxonomic groups are based on the following commonly accepted references: Hart (1973); Helfman et al. (2009b); Moyle & Cech (2004); Nelson et al. (2016).

3.9.2.4 Endangered Species Act-Listed Species

There are 33 fish species occurring in the Study Area that are listed as either threatened or endangered under the ESA (Table 3.9-2). NMFS has listed 28 species of salmon and steelhead, two rockfish species, Pacific eulachon, and green sturgeon on the west coast, all of which occur within the Study Area. The U.S. Fish and Wildlife Service (USFWS) has listed bull trout throughout its range, which overlaps with the Study Area. In addition, nine species of concern occur within the Study Area. Candidate species are any species that are undergoing a status review that NMFS has announced through a Federal Register (FR) notice (71 FR 61022). Species of Concern are identified by NMFS when there is concern regarding species status, but for which insufficient information is available to indicate a need to list the species (69 FR 19975). Candidate species and Species of concern do not carry any procedural or substantive protections under the ESA (71 FR 61022). The emphasis on species-specific information in the following profiles will be on the ESA protected species because any threats or potential impacts on those species are subject to consultation with regulatory agencies.

Critical habitat and the associated Primary Constituent Elements (PCEs), if applicable, within the Study Area are identified and described. Potential impacts on critical habitat were assessed by determining the effects of the project on the PCEs of the critical habitat. Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if those areas contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. PCEs are defined as sites or habitat components that support one or more life stages deemed essential to the conservation of the species. Critical habitat maps were provided only for species in which the critical habitat extended into the Study Area.

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat has been designated for two threatened species: Puget Sound Steelhead Distinct Population Segment (DPS) and Lower Columbia River Coho Salmon Evolutionarily Significant Unit (ESU) (81 FR 9251). Critical habitat designated for Puget Sound steelhead and Lower Columbia River coho salmon is entirely freshwater and marine habitat has not been designated. As a result, there is no critical habitat for these two species in the Study Area. The Puget Sound/Georgia Basin DPS of canary rockfish has been delisted and its designated critical habitat removed (82 FR 7711). Also, bigeye thresher shark, common thresher shark, and smooth hammerhead shark (*Sphyrna zygaena*) have been removed from candidate status after status reviews determined that listing was not warranted (81 FR 18979; 81 FR 41934). Table 3.9-2 contains a summary of the status and presence of all ESA-listed fish species potentially found in the Study Area. The five-year status reviews for all Pacific salmon and steelhead were published in 2016 with no changes in listing status warranted (National Marine Fisheries Service, 2016). In addition, several salmonid hatchery programs have been either added or removed from their respective species' ESUs/DPSs (Jones 2015). With the exception of these recent changes in species status or the inclusion/exclusion of hatchery populations in ESUs/DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species and their Designated Critical Habitat, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species						
Chinook Salmon (*Oncorhynchus tshawytscha*)	Puget Sound ESU	T	Designated (Inland Waters)	✓	✓	✓
	Upper Columbia River Spring-Run ESU	E	Designated (Not in Study Area)	✓	n/a	✓
	Lower Columbia River ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	Upper Willamette River ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	Snake River Spring-Summer ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	Snake River Fall-Run ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	California Coastal ESU	T	Designated (Not in Study Area)	✓	n/a	n/a
	Central Valley, Fall and Late-Fall Run ESU	SOC[3]	Not Designated	✓	n/a	n/a
	Central Valley Spring-Run ESU	T	Designated (Not in Study Area)	✓	n/a	n/a
	Sacramento River Winter-Run	E	Designated (Not in Study Area)	✓	n/a	n/a

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species (continued)						
Coho Salmon (*Oncorhynchus kisutch*)	Lower Columbia ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	Oregon Coast ESU	T	Designated (Not in Study Area)	✓	n/a	✓
	Southern Oregon/Northern California Coast ESU	T	Designated (Not in Study Area)	✓	n/a	n/a
	Puget Sound/Strait of Georgia ESU	SOC[3]	Not Designated	✓	✓	✓
	Central California Coast	E	Designated (Not in Study Area)	✓	n/a	n/a
Chum Salmon (*Oncorhynchus keta*)	Hood Canal Summer-Run ESU	T	Designated (Inland Waters)	✓	✓	n/a
	Columbia River ESU	T	Designated (Not in Study Area)	✓	n/a	n/a
Sockeye Salmon (*Oncorhynchus nerka*)	Ozette Lake ESU	T	Designated (Not in Study Area)	✓	n/a	n/a
	Snake River ESU	E	Designated (Not in Study Area)	✓	n/a	n/a

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species (continued)						
Steelhead (*Oncorhynchus mykiss*)	Puget Sound DPS	T	Designated (Not in Study Area[4])	✓	✓	n/a
	Upper Columbia River DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Middle Columbia River DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Lower Columbia River DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Upper Willamette River DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Snake River Basin DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Northern California Coast DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Oregon Coast DPS	SOC[3]	Not Designated	✓	n/a	n/a
	California Central Valley DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Central California Coast DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	South-Central California Coast DPS	T	Designated (Not in Study Area)	✓	n/a	n/a
	Southern California DPS	E	Designated (Not in Study Area)	✓	n/a	n/a

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Salmonid Species (continued)						
Bull Trout (*Salvelinus confluentus*)	Coastal-Puget Sound DPS	T	Designated (Inland Waters)	n/a	✓	n/a
Rockfish Species						
Bocaccio Rockfish (*Sebastes paucispinis*)	Puget Sound/Georgia Basin DPS	E	Designated (Inland Waters)	n/a	✓	n/a
	Southern DPS (Northern California to Mexico)	SOC[3]	Not Designated	✓	n/a	n/a
Cowcod Rockfish (*Sebastes levis*)	Central Oregon to central Baja California and Guadalupe Island, Mexico	SOC[3]	Not Designated	✓	n/a	n/a
Yelloweye Rockfish (*Sebastes ruberrimus*)	Puget Sound/Georgia Basin DPS	T	Designated (Inland Waters)	n/a	✓	n/a

Table 3.9-2: Status and Presence of Endangered Species Act (ESA)-Listed Fish Species, Candidate Species, and Species of Concern Found in the Northwest Training and Testing Study Area (continued)

Species Name and Regulatory Status				Presence in Study Area		
Common Name (Scientific Name)	**Distinct Population Segment (DPS)[1]/ Evolutionarily Significant Unit (ESU)[2]**	**Federal Status**	**Critical Habitat Designation**	**Offshore Area**	**Inland Waters**	**Western Behm Canal**
Other Marine Fish Species						
Basking Shark (*Cetorhinus maximus*)	Eastern North Pacific DPS	SOC[3]	Not Designated	✓	n/a	n/a
Green Sturgeon (*Acipenser medirostris*)	Southern DPS	T	Designated (Offshore and Inland Waters)	✓	✓	n/a
	Northern DPS	SOC[3]	Not Designated	✓	✓	n/a
Pacific Cod (*Gadus macrocephalus*)	Salish Sea	SOC[3]	Not Designated	n/a	✓	n/a
Pacific Eulachon (*Thaleichthys pacificus*)	Southern DPS	T	Designated (Not in Study Area[4])	✓	✓	n/a
Pacific Hake (*Merluccius productus*)	Georgia Basin (Canada to Washington State) DPS	SOC[3]	Not Designated	n/a	✓	n/a

[1] A species with more than one DPS can have more than one ESA listing status, as individual DPSs can be either not listed under the ESA or can be listed as an endangered, threatened, or candidate species.
[2] ESU is a population of organisms that is considered distinct for purposes of conservation.
[3] Species of Concern status does not carry any procedural or substantive protections under the ESA, but these species are included in this table for informational purposes.
[4] Critical habitat does not overlap with any of the activities because it is a freshwater designation.
Notes: Federal Status: E = Endangered, T = Threatened, SOC = Species of Concern, n/a= not applicable

3.9.2.4.1 Salmonid Species

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for two species listed as threatened, the Lower Columbia River Coho Salmon ESU and Puget Sound Steelhead DPS, was designated (81 FR 9251). Since then, the 2016 five-year status reviews for all Pacific salmon and steelhead were published with no changes in listing status warranted for any of the listed salmon and steelhead (National Marine Fisheries Service, 2016). In addition, the listing status under the ESA of hatchery programs associated with 28 salmon ESUs and steelhead DPSs was reviewed in Jones (2015). The origin of each hatchery population and its divergence level from the source population was evaluated in determining removal from or addition to an ESU/DPS. Coded wire tagging (National Marine Fisheries Service, 2003; Weitkamp, 2010) and genetic analysis (Beacham et al., 2016; Tucker et al., 2012) has identified six Chinook salmon (Puget Sound, Upper Columbia River Spring, Lower Columbia River, Upper Willamette River, Snake River Spring-Summer, and Snake River Fall-Run) and three coho salmon (Puget Sound, Lower Columbia River, and Oregon Coast) ESUs with a potential of occurring in the vicinity of the Western Behm Canal. Recent literature has also documented toxic stormwater runoff as a species-specific threat to coho salmon in urbanized areas (Feist et al., 2017; McIntyre et al., 2018). With the exception of these recent changes in designated critical habitat, salmonid presence in Western Behm Canal, species-specific threats to coho salmon, or the inclusion/exclusion of hatchery populations in ESUs/DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.1 Chinook Salmon (*Oncorhynchus tshawytscha*)

A map of critical habitat designated for Puget Sound Chinook salmon in the Study Area was provided in Figure 3.9-1 of the 2015 NWTT Final EIS/OEIS.

The Sikes Act Improvement Act of 1997 (16 U.S.C. 670a) (Sikes Act) requires each military installation that includes land and water suitable for the conservation and management of natural resources to complete an integrated natural resources management plan (INRMP). NMFS and USFWS shall not designate (exempt) as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense (DoD), or designated for its use, that are subject to an INRMP if the Secretary of the Service determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. Under section 4(b)(2) of the ESA, the Services consider where a national security impact might exist where the benefits of exclusion outweigh the benefits of inclusion. An updated Figure 3.9-1, displaying Chinook salmon critical habitat and DoD areas excluded or exempted for designation, is provided below.

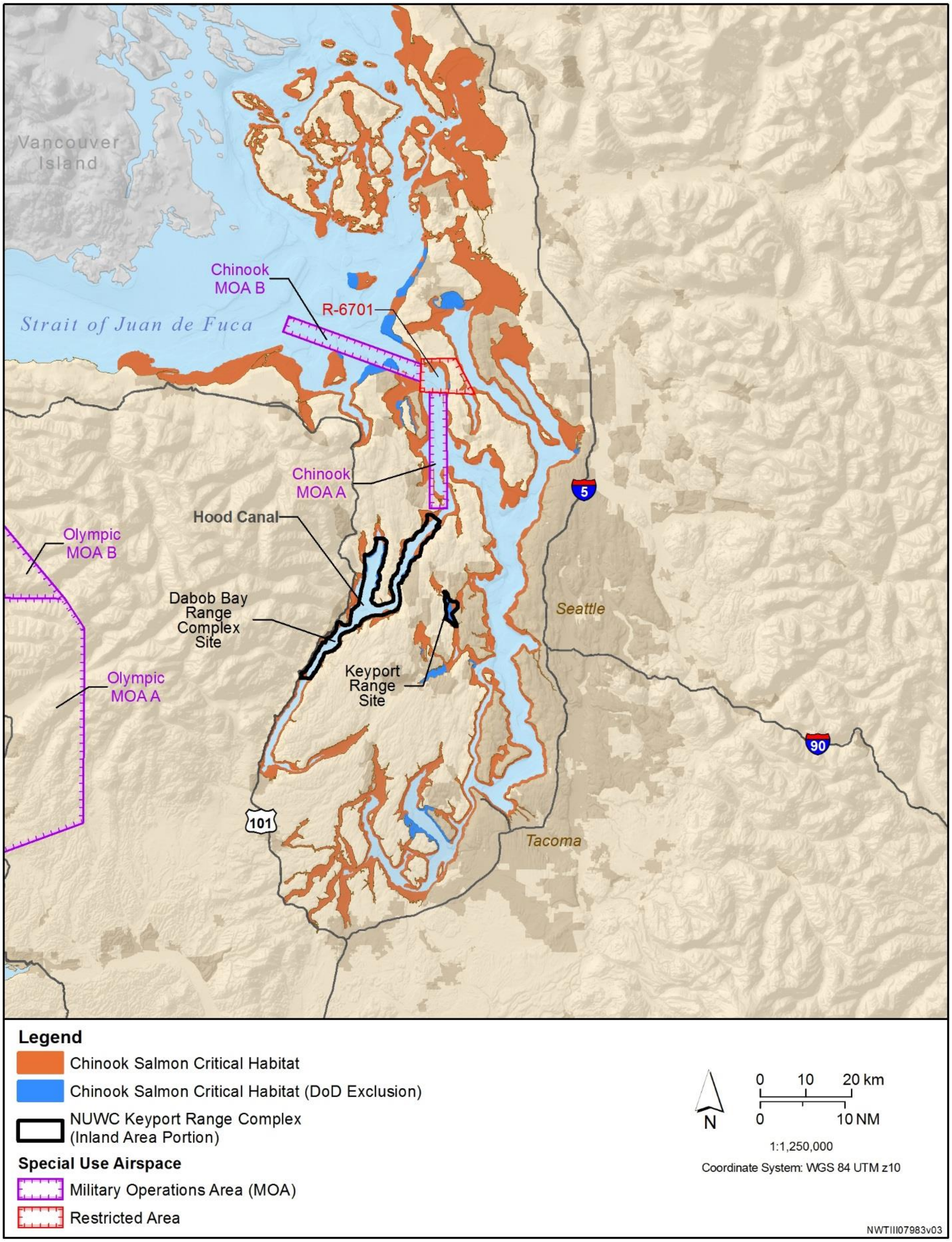


Figure 3.9-1: Marine Critical Habitat for the Puget Sound Chinook Salmon Evolutionarily Significant Units

Since the publication of the 2015 NWTT Final EIS/OEIS, the following changes have occurred in the number of hatchery programs included in five of the nine listed Chinook salmon ESUs (Jones, 2015): Upper Columbia River (decrease from 6 to 5), Lower Columbia River (decrease from 17 to 14), Upper Willamette River (decrease from 7 to 6), Snake River Spring/Summer Run (decrease from 15 to 11), and California Coastal (decrease from 6 to 0). Coded wire tag information indicates that adult Puget Sound, Lower Columbia River, Upper Willamette River, and Snake River Fall-Run Chinook salmon are likely to be seasonally present in the vicinity of the Western Behm Canal (National Marine Fisheries Service, 2003; Weitkamp, 2010). Genetic analysis of juvenile Chinook salmon sampled in the vicinity of the Western Behm Canal indicates the seasonal presence of juvenile Upper Columbia River Spring, Upper Willamette River, and Snake River Spring-Summer Chinook salmon (Tucker et al., 2012). With the exception of the changes in hatchery programs included in the five ESUs and species presence in the Western Behm Canal and the addition of the U.S. Navy lands and Navy security zones exempted or excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.2 Coho Salmon (*Oncorhynchus kisutch*)

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for the Lower Columbia River Coho ESU, listed as threatened, was designated (81 FR 9251). However, the critical habitat designation only includes the Lower Columbia River system and does not include the Study Area. The following changes have occurred in the number of hatchery programs included in two of the four listed coho salmon ESUs (Jones, 2015): Lower Columbia River (decrease from 25 to 21) and Central California Coast (decrease from 4 to 2). Genetic analysis of juvenile coho salmon sampled in the vicinity of the Western Behm Canal indicates the seasonal presence of juvenile Lower Columbia River, Oregon Coast, and Puget Sound coho salmon (Beacham et al., 2016). New information has documented a species-specific threat to coho salmon in the form of toxic stormwater runoff in urbanized regions creating recurrent prespawn die-offs of adult coho spawners (Feist et al., 2017; McIntyre et al., 2018). With the exception of the designation of critical habitat for the Lower Columbia River Coho ESU, the changes in hatchery programs included in the two ESUs, species presence in the Western Behm Canal, and the new species-specific threat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.3 Chum Salmon (*Oncorhynchus keta*)

Since the publication of the 2015 NWTT Final EIS/OEIS, the following changes have occurred in the number of hatchery programs included in the two listed chum salmon ESUs (Jones, 2015): Hood Canal Summer-Run (decrease from 8 to 4) and Columbia River (decrease from 3 to 2).

Exempted or excluded U.S. Navy lands and Navy security zones were not included on Figure 3.9-2 (Critical Habitat for the Hood Canal Summer-run chum ESU in the Study Area) of the 2015 NWTT Final EIS/OEIS. The sites below mean lower low water exempted or excluded from the Puget Sound Chinook salmon critical habitat in Section 3.9.2.4.1.1 [Chinook Salmon (*Oncorhynchus tshawytscha*)] of this document are also excluded from Hood Canal Summer-run chum critical habitat.

With the exception of the changes in hatchery programs included in the two ESUs and the exempted/excluded Hood Canal Summer-run chum salmon critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.4 Sockeye Salmon (*Oncorhynchus nerka*)

Since the publication of the 2015 NWTT Final EIS/OEIS, the number of hatchery programs included in the Lake Ozette sockeye salmon ESU decreased from 2 to 1 (Jones, 2015). With the exception of the reduction in hatchery programs included in the Lake Ozette ESU, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.5 Steelhead (*Oncorhynchus mykiss*)

Since the publication of the 2015 NWTT Final EIS/OEIS, critical habitat for the Puget Sound Steelhead DPS, listed as threatened, was designated (81 FR 9251). The following changes have occurred in the number of hatchery programs included in 8 of the 11 listed steelhead salmon DPSs (Jones 2015): Puget Sound (increase from 2 to 6), Upper Columbia River (decrease from 6 to 5), Lower Columbia River (decrease from 10 to 7), Upper Willamette River (increase from 0 to 1), Snake River Basin (increase from 6 to 7), Northern California (decrease from 2 to 1), California Central Valley (increase from 0 to 2), and Central California Coast (increase from 0 to 2). With the exception of the designation of critical habitat for the Puget Sound Steelhead DPS and the changes in hatchery programs included/excluded in the eight DPSs, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.6 Bull Trout (*Salvelinus confluentus*)

A map of critical habitat designated for bull trout in the Study Area is provided in Figure 3.9-2.

The Sikes Act requires that the USFWS shall not designate (exempt) as critical habitat any lands or other geographical areas owned or controlled by the DoD, or designated for its use, that are subject to an INRMP if the Secretary of the Service determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. Critical habitat is excluded on land held in trust by the United States for any tribe. Critical habitat on land subject to Habitat Conservation Plans (HCPs) is excluded under section 10(a)(1)(b) of the ESA. Under section 4(b)(2) of the ESA, the USFWS must consider where a national security impact might exist where the benefits of exclusion outweigh the benefits of inclusion. Figure 3.9-2 displays designated marine bull trout critical habitat, including areas excluded or exempted for the DoD, HCPs, or tribes.

Bull trout are managed as a single DPS, and the former Coastal-Puget Sound Bull Trout DPS has been incorporated into part of the Coastal Recovery Unit (U.S. Fish and Wildlife Service, 2015). A literature review indicates that individual bull trout have been documented to switch between fluvial and anadromous life histories in alternate years (Goetz, 2016). Acoustic tagged bull trout in Puget Sound are usually detected less than 0.4 kilometers (km) from the shoreline in water less than 4 m deep (Goetz, 2016; Hayes et al., 2011). Bull trout primarily enter marine waters to prey on surf smelt, sand lance, juvenile herring, shiner perch, three-spine stickleback, and juvenile salmonids at depths of less than 10 m (Goetz et al., 2004; Goetz, 2016). Bull trout occasionally enter water up to 25 m in depth (Goetz et al., 2004); to transit to the shoreline of Whidbey Island, they must cross Skagit Bay in waters 7–84 m in depth (Goetz, 2016). On a few rare occasions, bull trout have been tracked crossing water up to 250 m deep for as far as 6.9 km (Goetz, 2016), but do not maintain position in deep water (Hayes et al., 2011). Crossing water depths of over 10 m is unusual behavior.

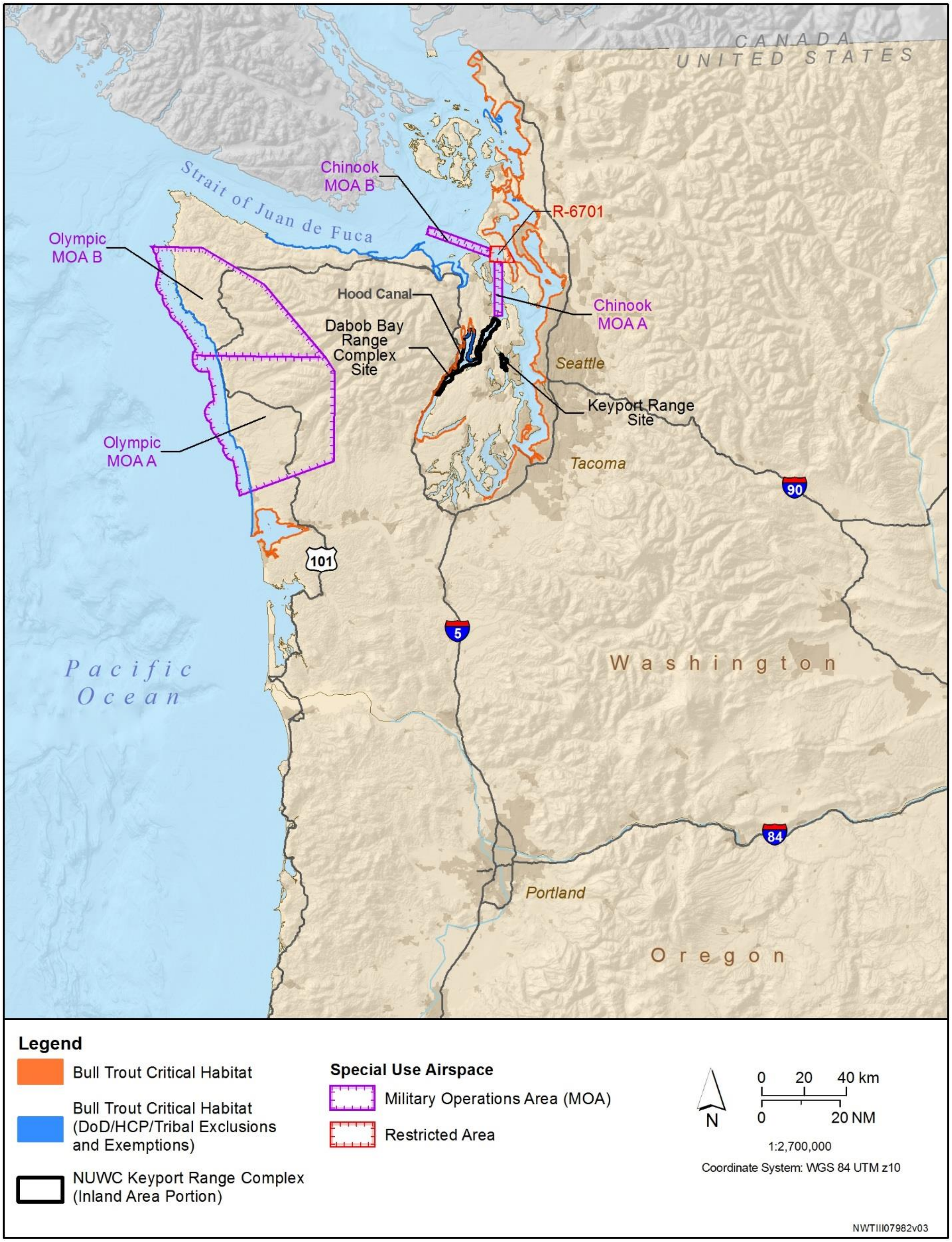


Figure 3.9-2: Marine Critical Habitat for the Bull Trout Distinct Population Segment

Bull trout in marine waters are shoreline-oriented (Goetz, 2016) and enter marine water for the primary purpose of foraging on smaller fish in the intertidal and subtidal zones of the photic zone, primarily in water less than 10 m in depth. Although bull trout in marine water will occasionally use areas deeper than 10 m, they do not maintain position and soon return to shallower water. Puget Sound anadromous bull trout enter marine waters in early spring, with residence time in salt water averaging two months, with a maximum of four months (Goetz, 2016). Anadromous bull trout on the Olympic coast of Washington State enter their natal streams at about the same time as Puget Sound bull trout (late spring and early summer), but overwinter in the Pacific Ocean or migrate through marine water to non-natal rain-fed streams, optimizing winter refugia and forage opportunities (Brenkman & Corbett, 2005; Goetz, 2016). Radio tags used during studies of Pacific coastal populations do not allow tracking in the ocean, and the only reports of captured bull trout along the Washington coast are from recreational anglers targeting surf perch in the surf zone (Brenkman, 2017).

The information on bull trout in the Study Area confirms the strong shoreline orientation of bull trout but has not substantially changed the conclusions of the 2015 NWTT Final EIS/OEIS. With the exception of the addition of DoD land exempted from critical habitat and Navy security zones, land subject to HCPs, and tribal land excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.1.7 Dolly Varden (*Salvelinus malma*)

A literature review indicates that Washington State populations of Dolly Varden have not been documented to exhibit an anadromous life history and are not found in marine waters within the Study Area. The only Washington State population of Dolly Varden not isolated above a barrier is a population in a small headwater tributary of the upper Quinault River with a resident life history (Goetz et al., 2004). The information on Dolly Varden in the Study Area has not substantially changed the conclusions of the 2015 NWTT Final EIS/OEIS. Dolly Varden are not listed as threatened in Washington State and are not present in marine waters in the Study Area. With the exception that Dolly Varden do not occur in the Study Area, the information presented in the 2015 NWTT Final EIS/OEIS remains valid; however, the inclusion of a species absent from the Study Area was in error.

3.9.2.4.2 Rockfish Species

A map of critical habitat designated for the Puget Sound/Georgia Basin DPSs of the bocaccio, and yelloweye rockfish in the Study Area is provided below in Figure 3.9-3. Since the publication of the 2015 NWTT Final EIS/OEIS, the Puget Sound/Georgia Basin canary rockfish DPS has been delisted and designated critical habitat removed (82 FR 7711).

The Sikes Act requires the NMFS shall not designate (exempt) as critical habitat any lands or other geographical critical habitat designated for its use that are subject to an INRMP if the Secretary of the Service determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. Under section 4(b)(2) of the ESA, the NMFS must consider where a national security impact might exist where the benefits of exclusion outweigh the benefits of inclusion. An updated Figure 3.9-3, displaying designated bocaccio and yelloweye rockfish critical habitat, including areas excluded or exempted for the DoD, HCPs, or tribes, is provided below.

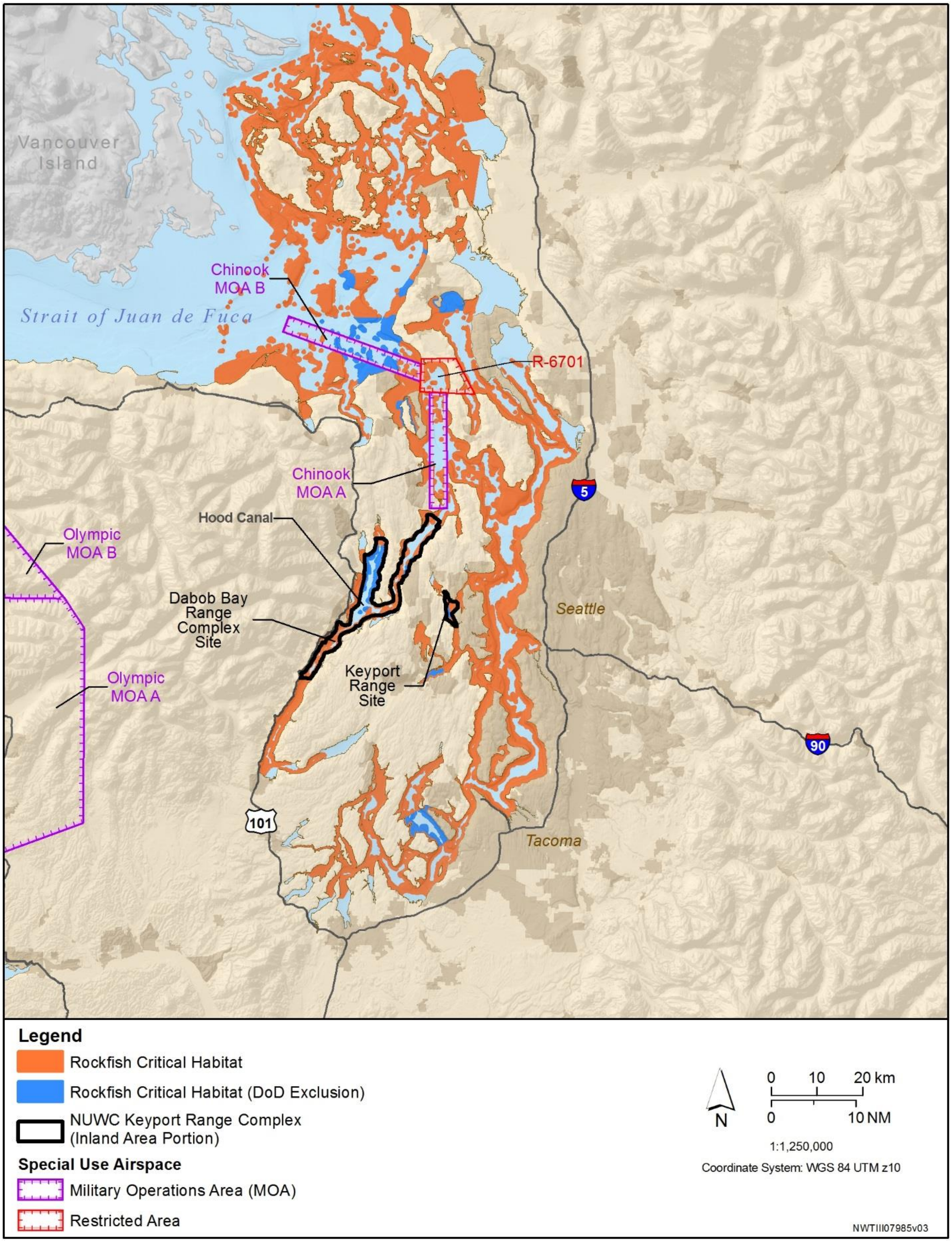


Figure 3.9-3: Critical Habitat for the Bocaccio and Yelloweye Rockfish Distinct Population Segments

A literature review found that the information on bocaccio and yelloweye rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. With the exception of the addition of the U.S. Navy lands and Navy security zones exempted or excluded from critical habitat, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.2.1 Bocaccio (*Sebastes paucispinis*)

A literature review found that the information on the Puget Sound/Georgia Basin and Southern DPSs of the bocaccio rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Additional information was added for U.S. Navy security zones not included as critical habitat on Figure 3.9-3. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.2.2 Canary Rockfish (*Sebastes pinniger*)

Since the publication of the 2015 NWTT final EIS/OEIS, the Puget Sound/Georgia Basin DPS of the canary rockfish has been delisted and designated critical habitat removed (82 FR 7711). These actions were based on newly obtained samples and genetic analysis that demonstrated that the Puget Sound/Georgia Basin canary rockfish population does not meet the DPS criteria and therefore does not qualify for listing under the ESA. Therefore, the ESA status and designated critical habitat information presented in the 2015 NWTT Final EIS/OEIS is no longer valid. Since the canary rockfish is no longer listed as federally threatened in the Study Area, it is not further addressed as an ESA listed species in this Supplemental.

3.9.2.4.2.3 Yelloweye Rockfish (*Sebastes ruberrimus*)

A literature review found that the information on the Puget Sound/Georgia Basin DPS of the yelloweye rockfish in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Additional information was added for U.S. Navy security zones not included as critical habitat on Figure 3.9-3. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.3 Other Species

A literature review found that the information on other fish species in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS.

Since the publication of the 2015 NWTT Final EIS/OEIS, a status review (81 FR 18980) of the bigeye thresher shark (*Alopias supercilious*) and common thresher shark (*Alopias vulpinus*) and a status review (81 FR 41934) of the smooth hammerhead shark determined that listing of these candidate species was unwarranted. Therefore, the candidate status information presented in the 2015 NWTT Final EIS/OEIS is no longer valid and bigeye and common thresher sharks and the smooth hammerhead shark are not addressed as ESA candidate species further in this Supplemental.

3.9.2.4.3.1 Pacific Eulachon (*Thaleichthys pacificus*)

A literature review found that the information on the Southern DPS of Pacific eulachon in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

3.9.2.4.3.2 Green Sturgeon (*Acipenser medirostris*)

A map of critical habitat designated for green sturgeon in the Study Area was provided in Figure 3.9-3 of the 2015 NWTT Final EIS/OEIS.

The Sikes Act Improvement Act of 1997 (16 U.S.C. 670a) (Sikes Act) requires each military installation that includes land and water suitable for the conservation and management of natural resources to complete an INRMP. NMFS and USFWS shall not designate (exempt) as critical habitat any lands or other geographical areas owned or controlled by the DoD, or designated for its use, that are subject to an INRMP if the Secretary of the Service determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. Under section 4(b)(2) of the ESA, the Services consider where a national security impact might exist where the benefits of exclusion outweigh the benefits of inclusion. An updated Figure 3.9-4, displaying green sturgeon critical habitat and DoD areas excluded or exempted for designation, is provided below.

NMFS (2009) determined that the Strait of Juan de Fuca and Whidbey Island Naval Restricted Area, Strait of Juan de Fuca Naval Air-to-Surface Weapon Range Restricted Area, Admiralty Inlet Naval Restricted Area, and Navy 3 Operating area are excluded from designated green sturgeon critical habitat. NMFS (2009) also determined that six Naval facilities with INRMPs overlap with the specific areas under consideration for critical habitat designation (all located in Puget Sound, WA). These installations include Bremerton Naval Hospital, Naval Air Station Everett, Naval Magazine Indian Island, Naval Fuel Depot Manchester, Naval Undersea Warfare Center Keyport, and Naval Air Station, Whidbey Island. The INRMPs from these facilities provide measures that would benefit green sturgeon and are therefore not eligible for designation as critical habitat.

A literature review found that the information on the Southern DPS of the North American green sturgeon in the Study Area has not substantially changed from what is included in the 2015 NWTT Final EIS/OEIS. Therefore, the information presented in the 2015 NWTT Final EIS/OEIS remains valid.

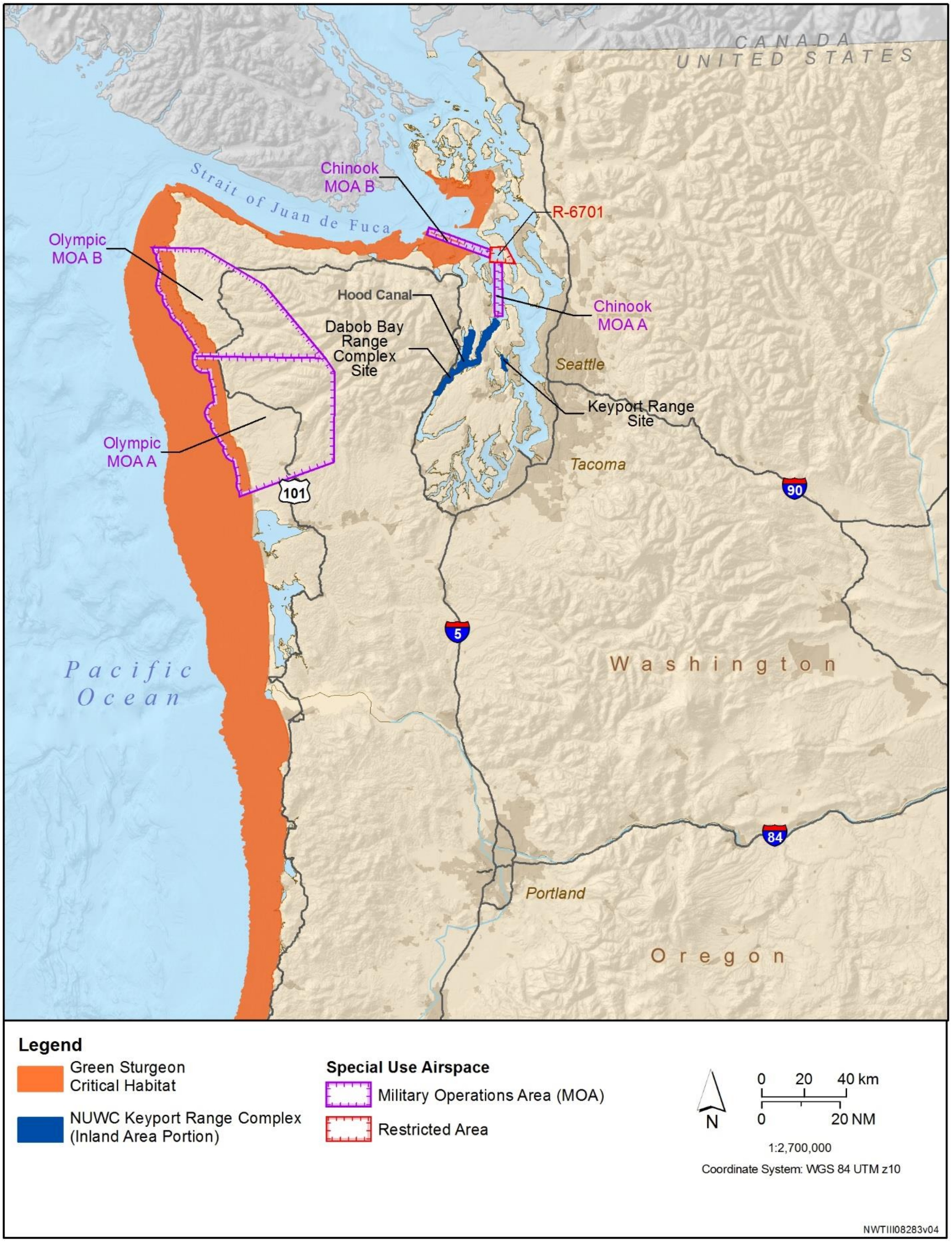


Figure 3.9-4: Critical Habitat for the Southern Distinct Population Segment of North American Green Sturgeon

3.9.2.5 Federally Managed Fisheries

Descriptions of Essential Fish Habitat (EFH) were presented in the 2015 NWTT Final EIS/OEIS. This Supplemental addresses the same activities within the Study Area that were addressed in the 2015 NWTT Final EIS/OEIS. The Pacific Fishery Management Council (Council) has four Fishery Management Plans (FMPs) in effect for the Groundfish, Coastal Pelagic, Highly Migratory, and Salmon Fishery Species in the Study Area. Although a few updates have occurred to the FMPs since the 2015 NWTT Final EIS/OEIS, none has changed or affected the previous information or analyses. As such, the general description of the EFH within the Study Area in the 2015 NWTT Final EIS/OEIS has not changed; thus, the information presented remains valid.

3.9.2.5.1 Groundfish Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Groundfish FMP. A recent review of the FMP and associated documents indicated that in June 2016, the Council adopted Amendment 27 to the plan, which reclassified big skate from an Ecosystem Component (EC) species to “in the fishery,” listed deacon rockfish in Table 3-1, and revised Chapter 5.5 to describe a new in-season process in California, which would occur outside of a Council meeting and allow NMFS to take action based upon attainment or projected attainment of Federal harvest limits of black rockfish, canary rockfish, and yelloweye rockfish. Additionally, updates to the FMP were made to clarify matters from Amendment 23 and acknowledge the successful rebuilding of canary rockfish and petrale sole. Since these amendments were included to help facilitate a sustainable groundfish fishery by reducing overall catch and did not impose new environmental baseline restrictions, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.2 Coastal Pelagic Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Coastal Pelagic FMP. A recent review of the FMP and associated documents indicated that no additional amendments to the plan have been adopted. Since additional amendments to the plan have not been adopted, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.3 Highly Migratory Fishery Management Plan

As presented in the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Plan has a Highly Migratory FMP. A recent review of the FMP and associated documents indicated that the Council has adopted or proposed three amendments to the plan. Amendment 3, adopted in 2015, added a suite of lower trophic level species to the FMP’s list of EC species. Consistent with the objectives of the Council’s FMPs and its Fishery Ecosystem Plan, Amendment 3 prohibits future development of directed commercial fisheries for the suite of EC species shared between all four FMPs (“Shared EC Species”) until and unless the Council has had an adequate opportunity to both assess the scientific information relating to any proposed directed fishery and consider potential impacts on existing fisheries, fishing communities, and the greater marine ecosystem. In March 2017, the Council was presented with proposed amendments, but did not finalize changes to the Highly Migratory Species FMP that would revise dated and inaccurate text as Amendment 4. Also in March 2017, the Council took final action to adopt Amendment 5 to the Fishery Management Plan for West U.S. Coast Fisheries for Highly Migratory Species. This amendment would create a Federal limited entry permit for the California large mesh drift gillnet fishery. Since these amendments did not impose new environmental baseline restrictions, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.2.5.4 Salmon Fishery Management Plan

As presented in Section 3.9.2.5.5 of the 2015 NWTT Final EIS/OEIS, the Pacific Fishery Management Council has a Pacific Coast Salmon FMP that manages chinook, coho, and pink (*Oncorhynchus gorbuscha*) salmon. A recent review of the FMP and associated documents indicated that one additional amendments to the plan was adopted in 2016 (Pacific Fishery Management Council, 2016). The new amendment added a suite of lower trophic level species to the FMP's list of Ecosystem Component species. The amendment also prohibits future development of commercial fisheries for those Ecosystem Component species that are shared between all four FMPs (e.g., round herring, Pacific sand lance, smelts, Pelagic squids) until the Council has had an adequate opportunity to assess both the scientific information relating to any proposed directed fishery and potential impacts on existing fisheries, fishing communities, and the greater marine ecosystem. Even though an additional amendment to the plan was adopted, the information in the 2015 NWTT Final EIS/OEIS remains valid. Therefore, no additional update to the 2015 NWTT Final EIS/OEIS is required.

3.9.3 Environmental Consequences

In the Proposed Action for this Supplemental, some modifications have been made to the quantity and type of acoustic stressors under the two action alternatives. Because of new activities being proposed, two new stressors would be introduced that could potentially affect marine species; high-energy lasers (as an Energy stressor), as detailed in Section 3.0.3.3.2.2 (High-Energy Lasers), and biodegradable polymer (as an Entanglement stressor), as detailed in Section 3.0.3.5.3 (Biodegradable Polymer).

The 2015 NWTT Final EIS/OEIS considered training and testing activities proposed to occur in the Study Area that may have the potential to impact marine fishes. The stressors applicable to marine fishes in the Study Area include the two new stressors as well as the same stressors considered in the 2015 NWTT Final EIS/OEIS:

- Acoustic (sonar and other transducers, vessel noise, aircraft noise, weapon noise)
- Explosives (in-air explosions, in-water explosions)
- Energy (in-water electromagnetic devices, high-energy lasers)
- Physical disturbance and strike (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (wires and cables, decelerators/parachutes, biodegradable polymer)
- Ingestion (military expended materials – munitions and military expended materials – other than munitions)
- Secondary (impacts on habitat and impacts on prey availability)

This section evaluates how and to what degree potential impacts on marine fishes from stressors described in Section 3.0.1 (Overall Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1, 2.5-2, and 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities described in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal and state regulations and standards relevant to marine fishes and reviewed scientific literature published since 2015 for new information on marine fishes that could update the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers standard operating procedures (see Section 2.3.3, Standard Operating Procedures) and mitigation measures that the Navy would implement to avoid potential impacts on marine fishes from stressors associated with the proposed training and testing activities (see Appendix K, Geographic Mitigation Assessment, for more details). Mitigation for marine fishes will be coordinated with NMFS through the ESA consultation process.

3.9.3.1 Acoustic Stressors

The analysis of effects to fishes follows the concepts outlined in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). This section begins with a summary of relevant data regarding acoustic impacts on fishes in Section 3.9.3.1.1 (Background). This is followed by an analysis of estimated impacts on fishes due to specific Navy acoustic stressors (sonar and other transducers, vessel noise, aircraft noise, and weapon noise). Additional explanations of the acoustic terms and sound energy concepts used in this section are found in Appendix D (Acoustic and Explosive Concepts).

The Navy will rely on the previous 2015 NWTT Final EIS/OEIS analysis for the analysis of vessel noise, and weapon noise, as there has been no substantive or otherwise meaningful change in the action, although new applicable and emergent science in regard to these sub-stressors is presented in the sections that follow. Due to available new literature, adjusted sound exposure criteria, and new acoustic effects modeling, the analysis provided in Section 3.9.3.1.2 (Impacts from Sonar and Other Transducers) and Section 3.9.3.1.4 (Impacts from Aircraft Noise) of this Supplemental supplants the 2015 NWTT Final EIS/OEIS for fishes, and changes estimated impacts for some species since the 2015 NWTT Final EIS/OEIS.

3.9.3.1.1 Background

Effects of human-generated sound on fishes have been examined in numerous publications (Hastings & Popper, 2005; Hawkins et al., 2015; Ladich & Popper, 2004; Lindseth & Lobel, 2018; Mann, 2016; National Research Council, 1994, 2003; Neenan et al., 2016; Popper, 2003, 2008; Popper & Hastings, 2009b; Popper et al., 2014; Popper et al., 2016; Popper & Hawkins, 2018). The potential impacts from Navy activities are based on the analysis of available literature related to each type of effect. In addition, a Working Group organized under the American National Standards Institute-Accredited Standards Committee S3, Subcommittee 1, Animal Bioacoustics, developed sound exposure guidelines for fish and sea turtles (Popper et al., 2014), hereafter referred to as the *ANSI Sound Exposure Guideline* technical report. Where applicable, thresholds and relative risk factors presented in the *ANSI Sound Exposure Guideline* technical report were used to assist in the analysis of effects on fishes from Navy activities.

There are limited studies of fish responses to aircraft and weapon noise. Based on the general characteristics of these sound types, for stressors where data is lacking (such as aircraft noise), studies of the effects of similar non-impulsive/continuous noise sources (such as sonar or vessel noise) are used to inform the analysis of fish responses. Similarly, studies of the effects from impulsive sources (such as air guns or pile driving) are used to inform fish responses to other impulsive sources (such as weapon noise). Where data from sonar and vessel noise exposures are also limited, other non-impulsive sources such as white noise may be presented as a proxy source to better understand potential reactions from fish. Additional information on the acoustic characteristics of these sources can be found in Appendix D (Acoustic and Explosive Concepts).

3.9.3.1.1.1 Injury

Injury refers to the direct effects on the tissues or organs of a fish. Moderate- to low-level noise from vessels, aircraft, and weapons use are described in Section 3.0.3.1 (Acoustic Stressors) and lacks the amplitude and energy to cause any direct injury. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on injury and the framework used to analyze this potential impact.

Injury due to Impulsive Sound Sources

Impulsive sounds, such as those produced by seismic air guns and impact pile driving, may cause injury or mortality in fishes. Mortality and potential damage to the cells of the lateral line have been observed in fish larvae, fry, and embryos after exposure to single shots from a seismic air gun within close proximity to the sound source (0.1 to 6 meters [m]) (Booman et al., 1996; Cox et al., 2012). However, exposure of adult fish to a single shot from an air gun array (four air guns) within similar ranges (6 m), has not resulted in any signs of mortality within seven days after exposure (Popper et al., 2016). Although injuries occurred in adult fishes, they were similar to injuries seen in control subjects (i.e., fishes that were not exposed to the air gun) so there is little evidence that the air gun exposure solely contributed to the observed effects.

Injuries, such as ruptured swim bladders, hematomas, and hemorrhaging of other gas-filled organs, have been reported in fish exposed to a large number of simulated impact pile driving strikes with cumulative sound exposure levels up to 219 decibels referenced to 1 micropascal squared seconds (dB re 1 μPa^2-s) under highly controlled settings where fish were unable to avoid the source (Casper et al., 2012b; Casper et al., 2013a; Casper et al., 2013b; Halvorsen et al., 2011; Halvorsen et al., 2012a; Halvorsen et al., 2012b). However, it is important to note that these studies exposed fish to 900 or more strikes as the studies goal was largely to evaluate the equal energy hypothesis, which suggests that the effects of a large single pulse of energy is equivalent to the effects of energy received from many smaller pulses (as discussed in Smith & Gilley, 2008). Halvorsen et al. (2011) and Casper et al. (2017) found that the equal energy hypothesis does not apply to effects of pile driving; rather, metrics relevant to injury could include, but not be limited to, cumulative sound exposure level, single strike sound exposure level, and number of strikes (Halvorsen et al., 2011). Furthermore, Casper et al. (2017) found the amount of energy in each pile strike and the number of strikes determines the severity of the exposure and the injuries that may be observed. For example, hybrid striped bass (white bass *Morone chrysops* x striped bass *Morone saxatilis*) exposed to fewer strikes with higher single strike sound exposure values resulted in a higher number of, and more severe, injuries than bass exposed to an equivalent cumulative sound exposure level that contained more strikes with lower single strike sound exposure values. This is important to consider when comparing data from pile driving studies to potential effects from an explosion. Although single strike peak sound pressure levels were measured during these experiments (at average levels of 207 dB re 1 μPa), the injuries were only observed during exposures to multiple strikes, therefore, it is anticipated that a peak value much higher than the measured values would be required to lead to injury in fishes exposed to a single strike, or, for comparison, to a single explosion.

These studies included species both with and without swim bladders. The majority of fish that exhibited injuries were those with swim bladders. Lake sturgeon (*Acipenser fulyescens*), a physostomous fish, was found to be less susceptible to injury from impulsive sources than Nile tilapia (*Oreochromis niloticus*) or hybrid striped bass, physoclistous fishes (Casper et al., 2017; Halvorsen et al., 2012a). As reported by Halvorsen et al. (2012a), the difference in results is likely due to the type of swim bladder in each fish. Physostomous fishes have an open duct connecting the swim bladder to their esophagus and may be able to quickly adjust the amount of gas in their body by gulping or releasing air. Physoclistous fishes do not have this duct; instead, gas pressure in the swim bladder is regulated by special tissues or glands. There were no mortalities reported during these experiments, and in the studies where recovery was observed, the majority of exposure related injuries healed within a few days in a laboratory setting. In many of these controlled studies, neutral buoyancy was determined in the fishes prior to exposure to the simulated pile driving. However, fishes with similar physiology to those described in these studies that are exposed to actual pile driving activities may show varying levels of injury depending on their state of buoyancy.

Debusschere et al. (2014) largely confirmed the results discussed in the paragraph above with caged juvenile European sea bass (*Dicentrarchus labrax*) exposed to actual pile driving operations. No differences in mortality were found between control and experimental groups at similar levels tested in the experiments described in the paragraph above (sound exposure levels up to 215–222 dB re 1 μPa^2-s), and many of the same types of injuries occurred. Fishes with injuries from impulsive sources such as these may not survive in the wild due to harsher conditions and risk of predation.

Other potential effects from exposure to impulsive sound sources include potential bubble formation and neurotrauma. It is speculated that high sound pressure levels may also cause bubbles to form from micronuclei in the blood stream or other tissues of animals, possibly causing embolism damage (Hastings & Popper, 2005). Fishes have small capillaries where these bubbles could be caught and lead to the rupturing of the capillaries and internal bleeding. It has also been speculated that this phenomena could take place in the eyes of fish due to potentially high gas saturation within the eye tissues (Popper & Hastings, 2009b). Additional research is necessary to verify if these speculations apply to exposures to non-impulsive sources such as sonars. These phenomena have not been well studied in fishes and are difficult to recreate under real-world conditions.

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), exposure to high intensity and long duration impact pile driving or air gun shots did not cause mortality, and fishes typically recovered from injuries in controlled laboratory settings. Species tested to date can be used as viable surrogates for investigating injury in other species exposed to similar sources (Popper et al., 2014).

Injury due to Sonar and Other Transducers

Non-impulsive sound sources (e.g., sonar, acoustic modems, and sonobuoys) have not been known to cause direct injury or mortality to fish under conditions that would be found in the wild (Halvorsen et al., 2012a; Kane et al., 2010; Popper et al., 2007). Potential direct injuries (e.g., barotrauma, hemorrhage or rupture of organs or tissue) from non-impulsive sound sources, such as sonar, are unlikely because of slow rise times,[1] lack of a strong shock wave such as that associated with an explosive, and relatively low

[1] Rise time: the amount of time for a signal to change from static pressure (the ambient pressure without the added sound) to high pressure. Rise times for non-impulsive sound typically have relatively gradual increases in pressure where impulsive sound has near-instantaneous rise to a high peak pressure. For more detail, see Appendix D (Acoustic and Explosive Concepts).

peak pressures. General categories and characteristics of Navy sonar systems are described in Section 3.0.3.1.1 (Sonar and Other Transducers).

The effects of mid-frequency sonar-like signals (1.5–6.5 kHz) on larval and juvenile Atlantic herring (*Clupea harengus*), Atlantic cod (*Gadus morhura*), saithe (*Pollachius virens*), and spotted wolffish (*Anarhichas minor*) were examined by Jørgensen et al. (2005). Researchers investigated potential effects on survival, development, and behavior in this study. Among fish kept in tanks and observed for one to four weeks after sound exposure, no significant differences in mortality or growth-related parameters between exposed and unexposed groups were observed. Examination of organs and tissues from selected herring experiments did not reveal obvious differences between unexposed and exposed groups. However, two (out of 42) of the herring groups exposed to sound pressure levels of 189 dB re 1 µPa and 179 dB re 1 µPa had a post-exposure mortality of 19 and 30 percent, respectively. It is not clear if this increased mortality was due to the received level or to other unknown factors, such as exposure to the resonance frequency of the swim bladder. Jørgensen et al. (2005) estimated a resonant frequency of 1.8 kHz for herring and saithe ranging in size from 6.3 to 7.0 centimeters, respectively, which lies within the range of frequencies used during sound exposures and therefore may explain some of the noted mortalities.

Individual juvenile fish with a swim bladder resonance in the frequency range of the operational sonars may be more susceptible to injury or mortality. Past research has demonstrated that fish species, size and depth influences resonant frequency (Løvik & Hovem, 1979; McCartney & Stubbs, 1971). At resonance, the swim bladder, which can amplify vibrations that reach the fishes hearing organs, may absorb much of the acoustic energy in the impinging sound wave. It is suspected that the resulting oscillations may cause mortality, harm the auditory organs or the swim bladder (Jørgensen et al., 2005; Kvadsheim & Sevaldsen, 2005). However, damage to the swim bladder and to tissues surrounding the swim bladder was not observed in fishes exposed to sonar at their presumed swim bladder resonant frequency (Jørgensen et al., 2005). The physiological effect of sonars on adult fish is expected to be less than for juvenile fish because adult fish are in a more robust stage of development, the swim bladder resonant frequencies would be lower than that of mid-frequency active sonar, and adult fish have more ability to move from an unpleasant stimulus (Kvadsheim & Sevaldsen, 2005). Lower frequencies (i.e., generally below 1 kHz) are expected to produce swim bladder resonance in adult fishes from about 10 to 100 centimeters (McCartney & Stubbs, 1971). Fish, especially larval and small juveniles, are more susceptible to injury from swim bladder resonance when exposed to continuous signals within the resonant frequency range.

Hastings (1995) found "acoustic stunning" (loss of consciousness) in blue gouramis (*Trichogaster trichopterus*), a freshwater species, following an eight-minute continuous exposure to a 150 Hz pure tone with a sound pressure level of 198 dB re 1 µPa. This species of fish has an air bubble in the mouth cavity directly adjacent to the animal's braincase that may have caused this injury. Hastings (1991; 1995) also found that goldfish (*Carassius auratus*), also a freshwater species, exposed to a 250 Hz continuous wave sound with peak pressures of 204 dB re 1 µPa for two hours, and blue gourami exposed to a 150 Hz continuous wave sound at a sound pressure level of 198 dB re 1 µPa for 0.5 hour did not survive. These studies are examples of the highest known levels tested on fish and for relatively long durations. Stunning and mortality due to exposure to non-impulsive sound exposure has not been observed in other studies.

Three freshwater species of fish, the rainbow trout (*Oncorhynchus mykiss*), channel catfish (*Ictalurus punctatus*), and the hybrid sunfish (*Lepomis* sp.), were exposed to both low- and mid-frequency sonar

(Kane et al., 2010; Popper et al., 2007). Low-frequency exposures with received sound pressure levels of 193 dB re 1 µPa occurred for either 324 or 648 seconds. Mid-frequency exposures with received sound pressure levels of 210 dB re 1 µPa occurred for 15 seconds. No fish mortality resulted from either experiment, and during necropsy after test exposures, both studies found that none of the subjects showed signs of tissue damage related to exposure (Kane et al., 2010; Popper et al., 2007).

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), although fish have been injured and killed due to intense, long-duration non-impulsive sound exposures, fish exposed under more realistic conditions have shown no signs of injury. Those species tested to date can be used as viable surrogates for estimating injury in other species exposed to similar sources.

3.9.3.1.1.2 Hearing Loss

Researchers have examined the effects on hearing in fishes from sonar-like signals, tones, and different non-impulsive noise sources. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on hearing loss and the framework used to analyze this potential impact.

Exposure to high-intensity sound can cause hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller, 1974). A temporary threshold shift (TTS) is a temporary, recoverable loss of hearing sensitivity. A TTS may last several minutes to several weeks, and the duration may be related to the intensity of the sound source and the duration of the sound (including multiple exposures). A permanent threshold shift (PTS) is non-recoverable, results from the destruction of tissues within the auditory system, permanent loss of hair cells, or damage to auditory nerve fibers (Liberman, 2016), and can occur over a small range of frequencies related to the sound exposure. However, the sensory hair cells of the inner ear in fishes are regularly replaced over time when they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al., 1993; Popper et al., 2014; Smith et al., 2006). Consequently, PTS has not been known to occur in fishes, and any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Popper et al., 2005; Popper et al., 2014; Smith et al., 2006). Although available data for some terrestrial mammals have shown signs of nerve damage after severe threshold shifts (e.g., Kujawa & Liberman, 2009; Lin et al., 2011) it is not known if damage to auditory nerve fibers could also occur in fishes, and if so, whether fibers would recover during this process. As with TTS, the animal does not become deaf but requires a louder sound stimulus, relative to the amount of PTS, to detect a sound within the affected frequencies.

Hearing Loss due to Impulsive Sound Sources

Popper et al. (2005) examined the effects of a seismic air gun array on a fish with a swim bladder that is involved in hearing, the lake chub (*Couesius plumbeus*), and two species that have a swim bladder that is not involved in hearing, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*), a salmonid. In this study, the lowest received cumulative sound exposure level (5 shots with a mean sound pressure level of 177 dB re 1 µPa) at which effects were noted was 186 dB re 1 μPa^2-s. The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 air gun shots, but not for the broad whitefish. Hearing loss was approximately 20 to 25 dB at some frequencies for both species, and full recovery of hearing took place within 18 hours after sound exposure. Examination of the sensory surfaces of the ears after allotted recovery times (one hour for five shot exposures, and up to 18 hours for 20 shot exposures) showed no damage to sensory hair cells in any of the fish from these exposures (Song et al., 2008).

McCauley et al. (2003) and McCauley and Kent (2012) showed loss of a small percent of sensory hair cells in the inner ear of caged fish exposed to a towed air gun array simulating a passing seismic vessel. Pink snapper (*Pargus auratus*), a species that has a swim bladder that is not involved in hearing, were exposed to multiple air gun shots for up to 1.5 hours (McCauley et al., 2003) where the maximum received sound exposure levels exceeded 180 dB re 1 µPa^2-s. The loss of sensory hair cells continued to increase for up to at least 58 days post exposure to 2.7 percent of the total cells. Gold band snapper (*Pristipomoides multidens*) and sea perch (*Lutjanus kasmira*), both fishes with a swim bladder involved in hearing, were also exposed to a towed air gun array simulating a passing seismic vessel (McCauley & Kent, 2012). Although received levels for these exposures have not been published, hair cell damage increased as the range of the exposure (i.e., range to the source) decreased. Again, the amount of damage was considered small in each case (McCauley & Kent, 2012). It is not known if this hair cell loss would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in the inner ear and only a small portion were affected by the sound (Lombarte & Popper, 1994; Popper & Hoxter, 1984). The question remains as to why McCauley and Kent (2012) found damage to sensory hair cells while Popper et al. (2005) did not; however, there are many differences between the studies, including species and the precise sound source characteristics.

Hastings et al. (2008) exposed a fish with a swim bladder that is involved in hearing, the pinecone soldierfish (*Myripristis murdjan*), and three species that have a swim bladder that is not involved in hearing, the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*), to an air gun array. Fish in cages were exposed to multiple air gun shots with a cumulative sound exposure level of 190 dB re 1 µPa^2-s. The authors found no hearing loss in any fish examined up to 12 hours after the exposures.

In an investigation of another impulsive source, Casper et al. (2013b) found that some fishes may actually be more susceptible to barotrauma (e.g., swim bladder ruptures, herniations, and hematomas) than hearing effects when exposed to simulated impact pile driving. Hybrid striped bass (white bass [*Morone chrysops*] x striped bass [*Morone saxatilis*]) and Mozambique tilapia (*Oreochromis mossambicus*), two species with a swim bladder not involved in hearing, were exposed to sound exposure levels between 213 and 216 dB re 1 µPa^2-s. The subjects exhibited barotrauma, and although researchers began to observe signs of inner ear hair cell loss, these effects were small compared to the other non-auditory injuries incurred. Researchers speculated that injury might occur prior to signs of hearing loss or TTS. These sound exposure levels may present the lowest threshold at which hearing effects may begin to occur. Overall, PTS has not been known to occur in fishes tested to date. Any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Popper et al., 2005; Popper et al., 2014; Smith et al., 2006). The lowest sound exposure level at which TTS has been observed in fishes with a swim bladder involved in hearing is 186 dB re 1 µPa^2-s. As reviewed in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), fishes without a swim bladder, or fishes with a swim bladder that is not involved in hearing, would be less susceptible to hearing loss (i.e., TTS) than fishes with swim bladders involved in hearing, even at higher levels and longer durations.

Hearing Loss due to Sonar and Other Transducers

Several studies have examined the effects of the sound exposures from low-frequency sonar on fish hearing (i.e., Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Hearing was measured both immediately post exposure and for up to several days thereafter (Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Maximum received sound pressure levels were 193 dB re 1 µPa for 324 or

648 seconds (a cumulative sound exposure level of 218 or 220 dB re 1 µPa²-s, respectively) at frequencies ranging from 170 to 320 Hz (Kane et al., 2010; Popper et al., 2007) and 195 dB re 1 µPa for 324 seconds (a cumulative sound exposure level of 215 dB re 1 µPa²-s) in a follow-on study (Halvorsen et al., 2013). Two species with a swim bladder not involved in hearing, the largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*), showed no loss in hearing sensitivity from sound exposure immediately after the test or 24 hours later. Channel catfish, a fish with a swim bladder involved in hearing, and some specimens of rainbow trout, a fish with a swim bladder not involved in hearing, showed a threshold shift (up to 10 to 20 dB of hearing loss) immediately after exposure to the low-frequency sonar when compared to baseline and control animals. Small thresholds shifts were detected for up to 24 hours after the experiment in some channel catfish. Although some rainbow trout showed signs of hearing loss, another group showed no hearing loss. The different results between rainbow trout test groups are difficult to understand, but may be due to development or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency sonar. Examination of the inner ears of the fish during necropsy revealed no differences from the control groups in ciliary bundles or other features indicative of hearing loss. The maximum time fish were held post exposure before sacrifice was 96 hours (Kane et al., 2010).

The same investigators examined the potential effects of mid-frequency active sonar on fish hearing and the inner ear (Halvorsen et al., 2012c; Kane et al., 2010). The maximum received sound pressure level was 210 dB re 1 µPa at a frequency of 2.8 to 3.8 kHz for a total duration of 15 seconds (cumulative sound exposure level of 220 dB re 1 µPa²-s). Out of the species tested (rainbow trout and channel catfish), only one test group of channel catfish showed any hearing loss after exposure to mid-frequency active sonar. The investigators tested catfish during two different seasons and found that the group tested in October experienced TTS, which recovered within 24 hours, but fish tested in December showed no effect. It was speculated that the difference in hearing loss between catfish groups might have been due to the difference in water temperature during the testing period or due to differences between the two stocks of fish (Halvorsen et al., 2012c). Any effects on hearing in channel catfish due to sound exposure appeared to be short-term and non-permanent (Halvorsen et al., 2012c; Kane et al., 2010).

Some studies have suggested that there may be some loss of sensory hair cells due to high intensity sources, indicating a loss in hearing sensitivity; however, none of those studies concurrently investigated the subjects' actual hearing range after exposure to these sources. Enger (1981) found loss of ciliary bundles of the sensory cells in the inner ears of Atlantic cod following one to five hours of exposure to pure tone sounds between 50 and 400 Hz with a sound pressure level of 180 dB re 1 µPa. Hastings (1995) found auditory hair-cell damage in goldfish, a freshwater species with a swim bladder that is involved in hearing. Goldfish were exposed to 250 Hz and 500 Hz continuous tones with maximum peak sound pressure levels of 204 dB re 1 µPa and 197 dB re 1 µPa, respectively, for about two hours. Similarly, Hastings et al. (1996) demonstrated damage to some sensory hair cells in oscars (*Astronotus ocellatus*) observed one to four days following a one-hour exposure to a pure tone at 300 Hz with a sound pressure level of 180 dB re 1 µPa, but no damage to the lateral line was observed. Both studies found a relatively small percentage of total hair cell loss from hearing organs despite long duration exposures. Effects from long-duration noise exposure studies are generally informative; however, they are not necessarily a direct comparison to intermittent short-duration sounds generated during Navy activities involving sonar and other transducers.

As noted in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), some fish species with a swim bladder that is involved in hearing may be more susceptible to TTS from high-intensity non-impulsive sound sources, such as sonar and other transducers, depending on the duration and frequency content of the exposure. Fishes with a swim bladder involved in hearing and fishes with high-frequency hearing may exhibit TTS from exposure to low- and mid-frequency sonar, specifically at cumulative sound exposure levels above 215 dB re 1 μPa^2-s. Fishes without a swim bladder and fishes with a swim bladder that is not involved in hearing would be unlikely to detect mid- or other high-frequency sonars and would likely require a much higher sound exposure level to exhibit the same effect from exposure to low-frequency active sonar.

Hearing Loss due to Vessel Noise

Little data exist on the effects of vessel noise on hearing in fishes. However, TTS has been observed in fishes exposed to elevated background noise and other non-impulsive sources (e.g., white noise). Caged studies on pressure sensitive fishes (i.e., fishes with a swim bladder involved in hearing and those with high-frequency hearing) show some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., Scholik & Yan, 2002a; Smith et al., 2004b; Smith et al., 2006). Smith et al. (2004b; 2006) exposed goldfish, to noise with a sound pressure level of 170 dB re 1 µPa and found a clear relationship between the amount of hearing loss and the duration of exposure until maximum hearing loss occurred at about 24 hours of exposure. A 10-minute exposure resulted in 5 dB of TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al., 2004b). Recovery times were not measured by investigators for shorter exposure durations. It is important to note that these exposures were continuous and subjects were unable to avoid the sound source for the duration of the experiment.

Scholik and Yan (2001) demonstrated TTS in fathead minnows (*Pimephales promelas*), another pressure sensitive species with similar hearing capabilities as the goldfish, after a 24-hour continuous exposure to white noise (0.3 to 2.0 kHz) at 142 dB re 1 µPa, that did not recover 14 days post-exposure. This is the longest threshold shift documented to have occurred in a fish species, with the actual duration of the threshold shift being unknown, but exceeding 14 days. However, the same authors found that the bluegill sunfish (*Lepomis macrochirus*), a species that primarily detects particle motion and lacks specializations for hearing, did not show statistically significant elevations in auditory thresholds when exposed to the same stimulus (Scholik & Yan, 2002b). This demonstrates that fishes with a swim bladder involved in hearing and those with high frequency hearing may be more sensitive to hearing loss than fishes without a swim bladder or those with a swim bladder not involved in hearing. Studies such as these should be treated with caution in comparison to exposures in a natural environment, largely due to the confined nature of the controlled setting where fishes are unable to avoid the sound source (e.g., fishes are held stationary in a tub), and due to the long, continuous durations of the exposures themselves (sometimes days to weeks). Fishes exposed to vessel noise in their natural environment, even in areas with higher levels of vessel movement, would only be exposed for a short duration (seconds or minutes) as vessels are transient and pass by.

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), some fish species with a swim bladder that is involved in hearing may be more susceptible to TTS from long duration continuous noise, such as broadband[2] white noise, depending on the duration of the exposure (thresholds are proposed based on continuous exposure of 12 hours). However, it is not likely that TTS would occur in fishes with a swim bladder not involved in hearing or in fishes without a swim bladder.

3.9.3.1.1.3 Masking

Masking refers to the presence of a noise that interferes with a fish's ability to hear biologically important sounds including those produced by prey, predators, or other fishes. Masking occurs in all vertebrate groups and can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. Human-generated continuous sounds (e.g., some sonar, vessel or aircraft noise, and vibratory pile driving) have the potential to mask sounds that are biologically important to fishes. Researchers have studied masking in fishes using continuous masking noise, but masking due to intermittent, short-duty cycle sounds has not been studied. Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on masking and the framework used to analyze this potential impact.

Masking is likely to occur in most fishes due to varying levels of ambient or natural noise in the environment such as wave action, precipitation, or other animal vocalizations (Popper et al., 2014). Ambient noise during higher sea states in the ocean has resulted in elevated thresholds in several fish species (Chapman & Hawkins, 1973; Ramcharitar & Popper, 2004). Although the overall intensity or loudness of ambient or human-generated noise may result in masking effects in fishes, masking may be most problematic when human-generated signals or ambient noise levels overlap the frequencies of biologically important signals (Buerkle, 1968, 1969; Popper et al., 2014; Tavolga, 1974).

Wysocki and Ladich (2005) investigated the influence of continuous white noise exposure on the auditory sensitivity of two freshwater fish with notable hearing specializations for sound pressure detection, the goldfish and the lined Raphael catfish (*Platydoras costatus*), and a freshwater fish without notable specializations, the pumpkinseed sunfish (*Lepomis gibbosus*). For the goldfish and catfish, baseline thresholds were lower than masked thresholds. Continuous white noise with a sound pressure level of approximately 130 dB re 1 µPa at 1 m resulted in an elevated threshold of 23 to 44 dB within the subjects' region of best sensitivity between 500 and 1000 Hz. There was less evidence of masking in the sunfish during the same exposures with only a shift of 11 dB. Wysocki and Ladich (2005) suggest that ambient sound regimes may limit acoustic communication and orientation, especially in animals with notable hearing specializations for sound pressure detection.

Masking could lead to potential fitness costs depending on the severity of the reaction (Radford et al., 2014; Slabbekoorn et al., 2010). For example, masking could result in changes in predator-prey relationships potentially inhibiting a fish's ability to detect predators and therefore increase its risk of predation (Astrup, 1999; Mann et al., 1998; Simpson et al., 2015; Simpson et al., 2016). Masking may also limit the distance over which fish can communicate or detect important signals (Alves et al., 2016; Codarin et al., 2009; Ramcharitar et al., 2001; Ramcharitar et al., 2006; Stanley et al., 2017), including sounds emitted from a reef for navigating larvae (Higgs, 2005; Neenan et al., 2016). If the masking signal is brief (a few seconds or less), biologically important signals may still be detected, resulting in little effect to the individual. If the signal is longer in duration (minutes or hours) or overlaps with important

[2] A sound or signal that contains energy across multiple frequencies.

frequencies for a particular species, more severe consequences may occur such as the inability to attract a mate and reproduce. Holt and Johnston (2014) were the first to demonstrate the Lombard effect in one species of fish, a potentially compensatory behavior where an animal increases the source level of its vocalizations in response to elevated noise levels. The Lombard effect is currently understood to be a reflex that may be unnoticeable to the animal, or it could lead to increased energy expenditure during communication.

The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) highlights a lack of data that exists for masking by sonar but suggests that the narrow bandwidth and intermittent nature of most sonar signals would result in only a limited probability of any masking effects. In addition, most sonars (mid-, high-, and very high-frequency) are above the hearing range of most marine fish species, eliminating the possibility of masking for these species. In most cases, the probability of masking would further decrease with increasing distance from the sound source.

In addition, no data are available on masking by impulsive signals (e.g., impact pile driving and air guns) (Popper et al., 2014). Impulsive sounds are typically brief, lasting only fractions of a second, where masking could occur only during that brief duration of sound. Biological sounds can typically be detected between pulses within close distances to the source unless those biological sounds are similar to the masking noise, such as impulsive or drumming vocalizations made by some fishes (e.g., cod or haddock). Masking could also indirectly occur because of repetitive impulsive signals where the repetitive sounds and reverberations over distance may create a more continuous noise exposure.

Although there is evidence of masking as a result of exposure to vessel noise, the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) does not present numeric thresholds for this effect. Instead, relative risk factors are considered and it is assumed the probability of masking occurring is higher at near to moderate distances from the source (up to hundreds of meters) but decrease with increasing distance (Popper et al., 2014).

3.9.3.1.1.4 Physiological Stress

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on physiological stress and the framework used to analyze this potential impact. A fish must first be able to detect a sound above its hearing threshold and above the ambient noise level before a physiological stress reaction can occur. The initial response to a stimulus is a rapid release of stress hormones into the circulatory system, which may cause other responses such as elevated heart rate and blood chemistry changes. Although an increase in background sound has been shown to cause stress in humans and animals, only a limited number of studies have measured biochemical responses by fishes to acoustic stress (e.g., Goetz et al., 2015; Madaro et al., 2015; Remage-Healey et al., 2006; Smith et al., 2004a; Wysocki et al., 2006; Wysocki et al., 2007) and the results have varied. Researchers have studied physiological stress in fishes using predator vocalizations, non-impulsive or continuous, and impulsive noise exposures.

A stress response that has been observed in fishes includes the production of cortisol (a stress hormone) when exposed to sounds such as boat noise, tones, or predator vocalizations. Nichols et al. (2015) found that giant kelpfish (*Heterostichus rostratus*) had increased levels of cortisol with increased sound level and intermittency of boat noise playbacks. Cod exposed to a short-duration upsweep (a tone that sweeps upward across multiple frequencies) across 100 to 1,000 Hz had increases in cortisol levels, which returned to normal within one hour post-exposure (Sierra-Flores et al., 2015). Remage-Healey et al. (2006) found elevated cortisol levels in Gulf toadfish (*Opsanus beta*) exposed to low-frequency bottlenose dolphin sounds. The researchers observed none of these effects in toadfish exposed to low-frequency snapping shrimp "pops."

A sudden increase in sound pressure level (i.e., presentation of a sound source) or an increase in overall background noise levels can increase hormone levels and alter other metabolic rates indicative of a stress response, such as increased ventilation and oxygen consumption (Pickering, 1981; Popper & Hastings, 2009a; Radford et al., 2016; Simpson et al., 2015; Simpson et al., 2016; Smith et al., 2004a, 2004b; Spiga et al., 2017). Similarly, reef fish embryos exposed to boat noise have shown increases in heart rate, another indication of a physiological stress response (Jain-Schlaepfer et al., 2018). Although results have varied, it has been shown that chronic or long-term (days or weeks) exposures of continuous man-made sounds can lead to a reduction in embryo viability (Sierra-Flores et al., 2015) and slowed growth rates (Nedelec et al., 2015).

However, not all species tested to date show these reactions. Smith et al. (2004a) found no increase in corticosteroid, a class of stress hormones, in goldfish exposed to a continuous, band-limited noise (0.1–10 kHz) with a sound pressure level of 170 dB re 1 µPa for one month. Wysocki et al. (2007) exposed rainbow trout to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for nine months with no observed stress effects. Growth rates and effects on the trout's immune systems were not significantly different from control animals held at a sound pressure level of 110 dB re 1 µPa.

Fishes may have physiological stress reactions to sounds that they can hear. Generally, stress responses are more likely to occur in the presence of potentially threatening sound sources, such as predator vocalizations, or during the sudden onset of impulsive signals rather than from non-impulsive or continuous sources such as vessel noise or sonar. Stress responses are typically brief (a few seconds to minutes) if the exposure is short or if fishes habituate or learn to tolerate the noise that is being presented. Exposure to chronic noise sources can lead to more severe impacts such as reduced growth rates, which may lead to reduced survivability for an individual. It is assumed that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.9.3.1.1.5 Behavioral Reactions

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on behavioral reactions and the framework used to analyze this potential impact. Behavioral reactions in fishes have been observed due to a number of different types of sound sources. The majority of research has been performed using air guns (including large-scale seismic surveys), sonar, and vessel noise. Fewer observations have been made on behavioral reactions to impact pile driving noise; although fish are likely to show similar behavioral reactions to any impulsive noise within or outside the zone for hearing loss and injury.

As with masking, a fish must first be able to detect a sound above its hearing threshold and above the ambient noise level before a behavioral reaction can potentially occur. Most fishes can only detect low-frequency sounds with the exception of a few species that can detect some mid and high frequencies (above 1 kHz).

Studies of fishes have identified the following basic behavioral reactions to sound: alteration of natural behaviors (e.g., startle or alarm), and avoidance (LGL Ltd Environmental Research Associates et al., 2008; McCauley et al., 2000; Pearson et al., 1992). In the context of this Supplemental, and to remain consistent with available behavioral reaction literature, the terms "startle" and "alarm" and "response" or "reactions" will be used synonymously.

In addition, observed behavioral effects to fish could include disruption to or alteration of natural activities such as swimming, schooling, feeding, breeding, and migrating. Sudden changes in sound level can cause fish to dive, rise, or change swimming direction. However, there is evidence that some fish may habituate to repeated exposures or learn to tolerate noise that is not seemingly unthreatening (e.g., Bruintjes et al., 2016; Nedelec et al., 2016b; Radford et al., 2016).

Behavioral reactions often vary depending on the type of exposure or the sound source present. Changes in sound intensity may be more important to a fishes' behavior than the maximum sound level. Sounds that fluctuate in level or have intermittent pulse rates tend to elicit stronger responses from fish than even stronger sounds with a continuous level (Neo et al., 2014; Schwarz & Greer, 1984). Interpreting behavioral responses can be difficult due to species-specific behavioral tendencies, motivational state (e.g., feeding or mating), an individual's previous experience, and whether or not the fish are able to avoid the source (e.g., caged versus free-swimming subjects). Results from caged studies may not provide a clear understanding of how free-swimming fishes may react to the same or similar sound exposures (Hawkins et al., 2015).

<u>**Behavioral Reactions due to Impulsive Sound Sources**</u>

It is assumed that most species would react similarly to impulsive sources (i.e., air guns and impact pile driving). These reactions include startle or alarm responses and increased swim speeds at the onset of impulsive sounds (Fewtrell & McCauley, 2012; Pearson et al., 1992; Roberts et al., 2016a; Spiga et al., 2017). Data on behavioral reactions in fishes exposed to impulsive sound sources is mostly limited to studies using caged fishes and the use of seismic air guns (Løkkeborg et al., 2012). Several species of rockfish (*Sebastes* species) in a caged environment exhibited startle or alarm reactions to seismic air gun pulses between peak-to-peak sound pressure levels of 180 dB re 1 µPa and 205 dB re 1 µPa (Pearson et al., 1992). More subtle behavioral changes were noted at lower sound pressure levels, including decreased swim speeds. At the presentation of the sound, some species of rockfish settled to the bottom of the experimental enclosure and reduced swim speed. Trevally (*Pseudocaranx dentex*) and pink snapper (*Pagrus auratus*) also exhibited alert responses as well as changes in swim depth, speed, and schooling behaviors when exposed to air gun noise (Fewtrell & McCauley, 2012). Both trevally and pink snapper swam faster and closer to the bottom of the cage at the onset of the exposure. However, trevally swam in tightly cohesive groups at the bottom of the test cages while pink snapper exhibited much looser group cohesion. These behavioral responses were seen during sound exposure levels as low as 147 up to 161 dB re 1 μPa^2-s but habituation occurred in all cases, either within a few minutes or within 30 minutes after the final air gun shot (Fewtrell & McCauley, 2012; Pearson et al., 1992).

Some studies have shown a lack of behavioral reactions to air gun noise. Herring exposed to an approaching air gun survey (from 27 to 2 km over six hours), resulting in single pulse sound exposure levels of 125 to 155 dB re 1 μPa^2-s, did not react by changing direction or swim speed (Pena et al., 2013). Although these levels are similar to those tested in other studies which exhibited responses (Fewtrell & McCauley, 2012), the distance of the exposure to the test enclosure, the slow onset of the sound source, and a strong motivation for feeding may have affected the observed response (Pena et al., 2013). In another study, Wardle et al. (2001) observed marine fish on an inshore reef before, during, and after an air gun survey at varying distances. The air guns were calibrated at a peak level of 210 dB re 1 µPa at 16 m and 195 dB re 1 µPa at 109 m from the source. Other than observed startle responses and small changes in the position of pollack, when the air gun was located within close proximity to the test site (within 10 m), they found no substantial or permanent changes in the behavior of the fish on the reef throughout the course of the study. Behavioral responses to impulsive sources are more likely to occur within near and intermediate (tens to hundreds of meters) distances from the source as opposed to far distances (thousands of meters) (Popper et al., 2014).

Unlike the previous studies, Slotte et al. (2004) used fishing sonar (38 kHz echo sounder) to monitor behavior and depth of blue whiting (*Micromesistius poutassou*) and Norwegian spring herring (*Clupea harengus L.*) spawning schools exposed to air gun signals. They reported that fishes in the area of the air guns appeared to go to greater depths after the air gun exposure compared to their vertical position prior to the air gun usage. Moreover, the abundance of animals 30–50 km away from the air guns increased during seismic activity, suggesting that migrating fish left the zone of seismic activity and did not re-enter the area until the activity ceased. It is unlikely that either species was able to detect the fishing sonar, however, it should be noted that these behavior patterns may have also been influenced by other factors such as motivation for feeding, migration, or other environmental factors (e.g., temperature, salinity, etc.) (Slotte et al., 2004).

Alterations in natural behavior patterns due to exposure to pile driving noise have not been studied as thoroughly, but reactions noted thus far are similar to those seen in response to seismic surveys. These changes in behavior include startle responses, changes in depth (in both caged and free-swimming subjects), increased swim speeds, changes in ventilation rates, changes in attention and anti-predator behaviors, and directional avoidance (e.g., Hawkins et al., 2014; Mueller-Blenkle et al., 2010; Neo et al., 2015; Roberts et al., 2016a; Spiga et al., 2017). The severity of response varied greatly by species and received sound pressure level of the exposure. For example, some minor behavioral reactions such as startle responses were observed during caged studies with a sound pressure level as low as 140 dB re 1 µPa (Neo et al., 2014). However, only some free-swimming fishes avoided pile driving noise at even higher sound pressure levels between 152 and 157 dB re 1 µPa (Iafrate et al., 2016). In addition, Roberts et al. (2016a) observed that although multiple species of free swimming fish responded to simulated pile driving recordings, not all responded consistently and in some cases, only one fish would respond while the others continued feeding from a baited remote underwater video, and others responded to different strikes. The repetition rate of pulses during an exposure may also have an effect on what behaviors were noted and how quickly these behaviors recovered as opposed to the overall sound pressure or exposure level (Neo et al., 2014). Neo et al. (2014) observed slower recovery times in fishes exposed to intermittent sounds (similar to pile driving) compared to continuous exposures.

As summarized in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), species may react differently to the same sound source depending on a number of variables, such as the animal's life stage or behavioral state (e.g., feeding, mating). Without specific data, it is assumed that fishes react similarly to all impulsive sounds outside the zone for hearing loss and injury. Observations of fish reactions to large-scale air gun surveys are informative, but not necessarily directly applicable to analyzing impacts from the short-term, intermittent use of all impulsive sources. It is assumed that fish have a high probability of reacting to an impulsive sound source within near and intermediate distances (tens to hundreds of meters), and a decreasing probability of reaction at increasing distances (Popper et al., 2014).

Behavioral Reactions due to Sonar and Other Transducers

Behavioral reactions to sonar have been studied both in caged and free-swimming fish although results can often-times be difficult to interpret depending on the species tested and the study environment. Jørgensen et al. (2005) showed that caged cod and spotted wolf fish (*Anarhichas minor*) lacked any response to simulated sonar between 1 and 8 kHz. However, within the same study, reactions were seen in juvenile herring. It is likely that the sonar signals were inaudible to the cod and wolf fish (species that lack notable hearing specializations), but audible to herring which do possess hearing capabilities in the frequency ranges tested.

Doksæter et al. (2009; 2012) and Sivle et al. (2012; 2014) studied the reactions of both wild and captive Atlantic herring to the Royal Netherlands Navy's experimental mid-frequency active sonar ranging from 1 to 7 kHz. The behavior of the fish was monitored in each study either using upward looking echosounders (for wild herring) or audio and video monitoring systems (for captive herring). The source levels used within each study varied across all studies and exposures with a maximum received sound pressure level of 181 dB re 1 µPa and maximum cumulative sound exposure level of 184 dB re 1 $µPa^2$·s. No avoidance or escape reactions were observed when herring were exposed to any sonar sources. Instead, significant reactions were noted at lower received sound levels of different non-sonar sound types. For example, dive responses (i.e., escape reactions) were observed when herring were exposed to killer whale feeding sounds at received sound pressure levels of approximately 150 dB re 1 µPa (Sivle et al., 2012). Startle responses were seen when the cages for captive herring were hit with a wooden stick and with the ignition of an outboard boat engine at a distance of one meter from the test pen (Doksaeter et al., 2012). It is possible that the herring were not disturbed by the sonar, were more motivated to continue other behaviors such as feeding, or did not associate the sound as a threatening stimulus. Based on these results (Doksaeter et al., 2009; Doksaeter et al., 2012; Sivle et al., 2012), Sivle et al. (2014) created a model in order to report on the possible population-level effects on Atlantic herring from active naval sonar. The authors concluded that the use of naval sonar poses little risk to populations of herring regardless of season, even when the herring populations are aggregated and directly exposed to sonar.

There is evidence that elasmobranchs (cartilaginous fish including sharks and rays) also respond to human-generated sounds. Myrberg and colleagues did experiments in which they played back sounds (e.g., pulsed tones below 1 kHz) and attracted a number of different shark species to the sound source (e.g., Casper et al., 2012a; Myrberg et al., 1976; Myrberg et al., 1969; Myrberg et al., 1972; Nelson & Johnson, 1972). The results of these studies showed that sharks were attracted to irregularly pulsed low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey. However, sharks are not known to be attracted to continuous signals or higher frequencies that they presumably cannot hear (Casper & Mann, 2006; Casper & Mann, 2009).

Only a few species of marine fishes can detect sonars above 1 kHz (see Section 3.9.2.1, Hearing and Vocalization), meaning that most fishes would not detect most mid-, high-, or very high-frequency Navy sonars. The few marine species that can detect above 1 kHz and have some hearing specializations may be able to better detect the sound and would therefore be more likely to react. However, researchers have found little reaction by adult fish in the wild to sonars within the animals' hearing range (Doksaeter et al., 2009; Doksaeter et al., 2012; Sivle et al., 2012). The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) suggests that fish able to hear sonars would have a low probability of reacting to the source within near or intermediate distances (within tens to hundreds of meters) and a decreasing probability of reacting at increasing distances.

Behavioral Reactions due to Vessel Noise

Vessel traffic also contributes to the amount of noise in the ocean and has the potential to affect fishes. Several studies have demonstrated and reviewed avoidance responses by fishes (e.g., herring and cod) to the low-frequency sounds of vessels (De Robertis & Handegard, 2013; Engås et al., 1995; Handegard et al., 2003). Misund (1997) found fish ahead of a ship that showed avoidance reactions did so at ranges of 50 to 150 m. When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance or downward compression of the school.

As mentioned in Section 3.9.3.1.1.5 (Behavioral Reactions), behavioral reactions are quite variable depending on a number of factors such as (but not limited to) the type of fish, its life history stage, behavior, time of day, location, the type of vessel, and the sound propagation characteristics of the water column (Popper et al., 2014; Schwarz & Greer, 1984). Reactions to playbacks of continuous noise or passing vessels generally include basic startle and avoidance responses, as well as evidence of distraction and increased decision-making errors. Other specific examples of observed responses include increased group cohesion, increased distractions or evidence of modified attention, changes in vertical distribution in the water column, changes in swim speeds, and changes in feeding efficacy such as reduced foraging attempts and increased mistakes (i.e., lowered discrimination between food and non-food items) (e.g., Bracciali et al., 2012; De Robertis & Handegard, 2013; Handegard et al., 2015; Nedelec et al., 2015; Nedelec et al., 2017a; Neo et al., 2015; Payne et al., 2015; Purser & Radford, 2011; Sabet et al., 2016; Simpson et al., 2015; Simpson et al., 2016; Voellmy et al., 2014a; Voellmy et al., 2014b).

Behavioral responses may also be dependent on the type of vessel that fish are exposed to. For example, juvenile damselfish (*Pomacentrus wardi*) exposed to sound from a two-stroke engine resulted in startle responses, reduction in boldness (increased time spent hiding, less time exhibiting exploratory behaviors) and space use (maximum distance ventured from shelter), as well as more conservative reactions to visual stimuli analogous to a potential predator. However, damselfish exposed to sound from a four-stroke engine generally displayed similar responses as control fish exposed to ambient noise (e.g., little or no change in boldness) (McCormick et al., 2018).

Vessel noise has also led to changes in anti-predator response, but these responses vary by species. During exposures to vessel noise, juvenile Ambon damselfish (*Pomacentrus amboinensis*) and European eels showed slower reaction times and lacked startle responses to predatory attacks, and subsequently showed signs of distraction and increased their risk of predation during both simulated and actual predation experiments (Simpson et al., 2015; Simpson et al., 2016). Spiny chromis (*Acanthochromis polyacanthus*) exposed to chronic boat noise playbacks for up to 12 consecutive days spent less time feeding and interacting with offspring, and displayed increased defensive acts. In addition, offspring survival rates were also lower at nests exposed to chronic boat noise playbacks versus those exposed to ambient playbacks (Nedelec et al., 2017b). This suggests that chronic or long-term exposures could have more severe consequences than brief exposures.

In contrast, larval Atlantic cod showed a stronger anti-predator response and were more difficult to capture during simulated predator attacks (Nedelec et al., 2015). There are also observations of a general lack of response to shipping and pile driving playback noise by grey mullet (*Chelon labrosus*) and two-spotted gobys (*Gobiusculus flavescens*) (Roberts et al., 2016b). Mensinger et al. (2018) found that Australian snapper (*Pagrus auratus*) located in a protected area showed no change in feeding behavior or avoidance during boat passes, whereas snapper in areas where fishing occurs startled and ceased feeding behaviors during boat presence. This supports that location and past experience also have an influence on whether fishes react.

Although behavioral responses such as those listed above were often noted during the onset of most sound presentations, most behaviors did not last long and animals quickly returned to baseline behavior patterns. In fact, in one study, when given the chance to move from a noisy tank (with sound pressure levels reaching 120–140 dB re 1 µPa) to a quieter tank (sound pressure levels of 110 dB re 1 µPa), there was no evidence of avoidance. The fish did not seem to prefer the quieter environment and continued to swim between the two tanks comparable to control sessions (Neo et al., 2015). However, many of these reactions are difficult to extrapolate to real-world conditions due to the captive environment in which testing occurred. Most fish species should be able to detect vessel noise due to its low-frequency content and their hearing capabilities (see Section 3.9.2.1, Hearing and Vocalization). The *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) suggests that fishes have a high to moderate probability of reacting to nearby vessel noise (i.e., within tens of meters) with decreasing probability of reactions with increasing distance from the source (hundreds or more meters).

3.9.3.1.1.6 Long-Term Consequences

Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on potential pathways for long-term consequences. Mortality removes an individual fish from the population and injury reduces the fitness of an individual. Few studies have been conducted on any long-term consequences from repeated hearing loss, stress, or behavioral reactions in fishes due to exposure to loud sounds (Hawkins et al., 2015; Popper & Hastings, 2009a; Popper et al., 2014). Repeated exposures of an individual to multiple sound-producing activities over a season, year, or life stage could cause reactions with costs that can accumulate over time to cause long-term consequences for the individual. These long-term consequences may affect the survivability of the individual, or if impacting enough individuals may have population-level effects, including alteration from migration paths, avoidance of important habitat, or even cessation of foraging or reproductive behavior (Hawkins et al., 2015). Conversely, some animals habituate to or become tolerant of repeated exposures over time, learning to ignore a stimulus that in the past has not accompanied any overt threat. In fact, Sivle et al. (2016) predicted that exposures to sonar at the maximum levels tested would only result in short-term disturbance and would not likely affect the overall population in sensitive fishes such as herring.

3.9.3.1.2 Impacts from Sonar and Other Transducers

The overall use of sonar and other transducers for training and testing would be similar to what was analyzed in the 2015 NWTT Final EIS/OEIS for some activities and would increase for other activities (see Tables 2.5-1, 2.5-2, and 3.0-2 for details). Although individual activities may vary some from those previously analyzed, and some new systems using new technologies will be tested under Alternative 1 and 2, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid.

Sonar and other transducers proposed for use are transient in most locations because activities that involve sonar and other transducers take place at different locations and many platforms are generally moving throughout the Study Area. Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. General categories and characteristics of these systems and the number of hours these sonars will be operated are described in Section 3.0.3.1.1 (Sonar and Other Transducers). The activities that use sonar and other transducers are described in Appendix A (Navy Activities Descriptions).

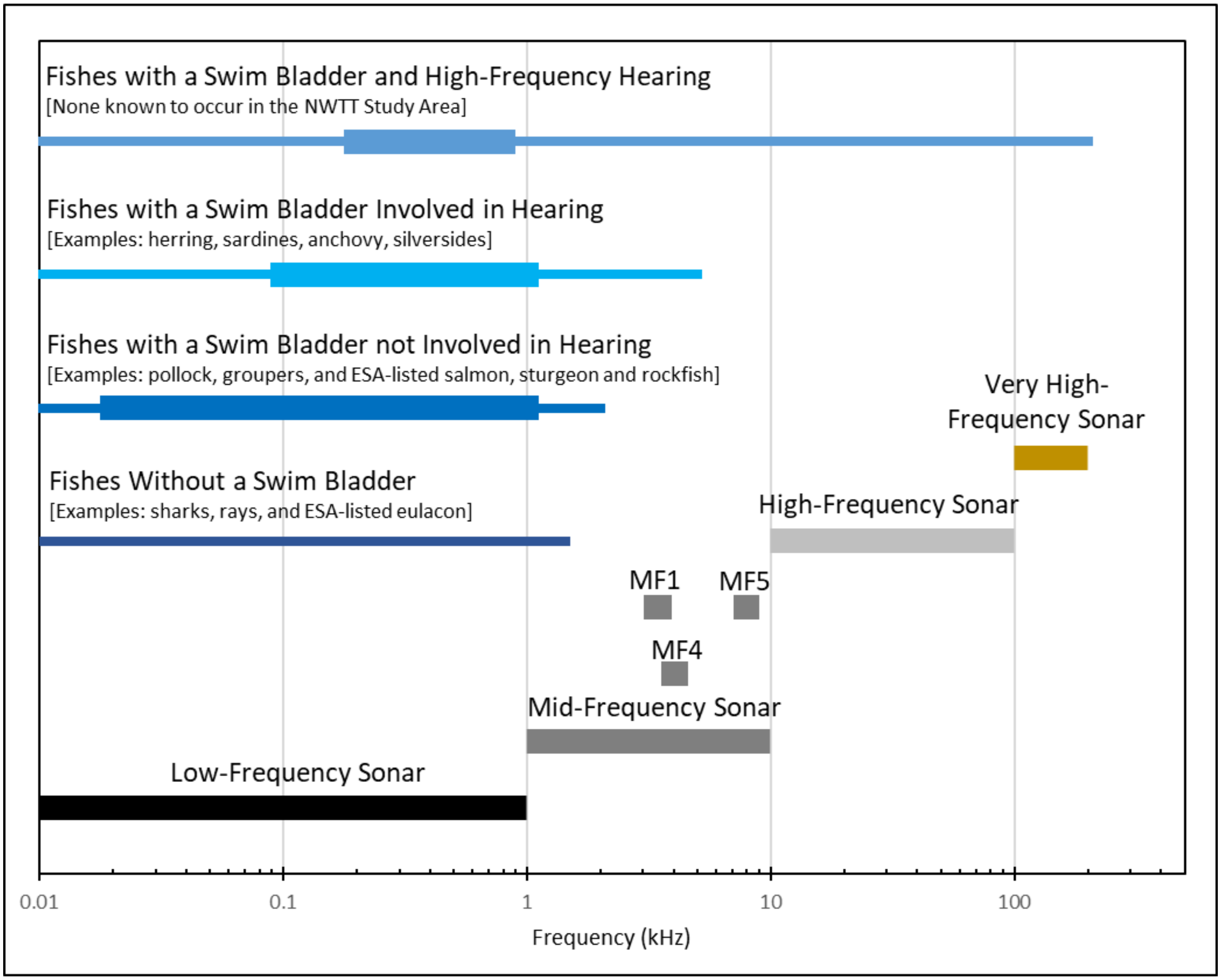
As described under Section 3.9.3.1.1.1 (Injury – Injury due to Sonar and Other Transducers), direct injury from sonar and other transducers is highly unlikely because injury has not been documented in fish exposed to sonar (Halvorsen et al., 2012c; Halvorsen et al., 2013; Popper et al., 2007) and therefore is not considered further in this analysis.

Fishes are not equally sensitive to noise at all frequencies. Fishes must first be able to hear a sound in order to be affected by it. As discussed in Section 3.9.2.1 (Hearing and Vocalization), many marine fish species tested to date hear primarily below 1 kHz. For the purposes of this analysis, fish species were grouped into one of four fish hearing groups based on either their known hearing ranges (i.e., audiograms) or physiological features that may be linked to overall hearing capabilities (i.e., swim bladder with connection to, or in close proximity to, the inner ear). Figure 3.9-5 provides a general summary of hearing threshold data from available literature (e.g., Casper & Mann, 2006; Deng et al., 2013; Kéver et al., 2014; Mann et al., 2001; Ramcharitar et al., 2006) to demonstrate the potential overall range of frequency detection for each hearing group.

Due to data limitations, these estimated hearing ranges may be overly conservative in that they may extend beyond what some species within a given fish hearing group may actually detect. For example, although most sharks are most sensitive to lower frequencies, well below 1 kHz, the bull shark has been tested and can detect frequencies up to 1.5 kHz (Kritzler & Wood, 1961; Myrberg, 2001) and therefore represents the uppermost known limit of frequency detection for this hearing group. These upper bounds of each fish hearing groups' frequency range are outside of the range of best sensitivity for the majority of fishes within that group. As a result, fishes within each group would only be able to detect those upper frequencies at close distances to the source, and from sources with relatively high source levels. Figure 3.9-5 is not a composite audiogram but rather displays the basic overlap in potential frequency content for each hearing group with Navy defined sonar classes (i.e., low-, mid-, high- and very high-frequency) as discussed under Section 3.0.3.1.1 (Sonar and Other Transducers – Classification of Sonar and Other Transducers).

Systems within the low-frequency sonar class present the greatest potential for overlap with fish hearing. Some mid-frequency sonars and other transducers may also overlap some species' hearing ranges, but to a lesser extent than low-frequency sonars. For example, the only hearing groups that have the potential to detect mid-frequency sources within bins MF1, MF4 and MF5 are fishes with a swim bladder involved in hearing and with high-frequency hearing. It is anticipated that most marine fishes would not hear, or be affected by, mid-frequency Navy sonars or other transducers with operating frequencies greater than about 1–4 kHz. Only a few fish species (i.e., fish with a swim bladder and high-frequency hearing specializations) can detect, and therefore be potentially affected by, high- and very high-frequency sonars and other transducers.

The most probable impacts from exposure to sonar and other transducers are TTS (for more detail see Section 3.9.3.1.1.2, Hearing Loss), masking (for more detail see Section 3.9.3.1.1.3, Masking), physiological stress (for more detail see Section 3.9.3.1.1.4, Physiological Stress), and behavioral reactions (for more detail see Section 3.9.3.1.1.5, Behavioral Reactions). Analysis of these effects are provided below.



Notes: Thin blue lines represent the estimated minimum and maximum range of frequency detection for each group. All hearing groups are assumed to hear down to 0.01 kHz regardless of available data. Thicker portions of each blue line represent the estimated the minimum and maximum range of best sensitivity for that group. Currently, no data are available to estimate the range of best sensitivity for fishes without a swim bladder. Although each sonar class is represented graphically by the horizontal black, grey and brown bars, not all sources within each class would operate at all the displayed frequencies. Example mid-frequency classes are provided to further demonstrate this. kHz = kilohertz, MF1 = 3.5 kHz, MF4 = 4 kHz, MF5 = 8 kHz.

Figure 3.9-5: Fish Hearing Group and Navy Sonar Bin Frequency Ranges

3.9.3.1.2.1 Methods for Analyzing Impacts from Sonar and Other Transducers

The Navy performed a quantitative analysis to estimate the range to TTS for fishes exposed to sonar and other transducers used during Navy training and testing activities. Inputs to the quantitative analysis included sound propagation modeling in the Navy Acoustic Effects Model to the sound exposure criteria and thresholds presented below. Although ranges to effect are predicted, density data for fish species within the Study Area are not available; therefore, it is not possible to estimate the total number of individuals that may be affected by sound produced by sonar and other transducers.

Criteria and thresholds to estimate impacts from sonar and other transducers are presented below in Table 3.9-3. Thresholds for hearing loss are typically reported in cumulative sound exposure level so as to account for the duration of the exposure. Therefore, thresholds reported in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) that were presented in other metrics were converted to sound exposure level based on the signal duration reported in the original studies (see Halvorsen et al., 2012c; Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). General research findings from these studies can be reviewed in Section 3.9.3.1.1.2 (Hearing Loss).

Table 3.9-3: Sound Exposure Criteria for TTS from Sonar

Fish Hearing Group	TTS from Low-Frequency Sonar (SEL_{cum})	TTS from Mid-Frequency Sonar (SEL_{cum})
Fishes without a swim bladder	NC	NC
Fishes with a swim bladder not involved in hearing	> 210	NC
Fishes with a swim bladder involved in hearing	210	220
Fishes with a swim bladder and high-frequency hearing	210	220

Notes: TTS = Temporary Threshold Shift, SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), NC = effects from exposure to sonar is considered to be unlikely, therefore no criteria are reported, > indicates that the given effect would occur above the reported threshold.

For mid-frequency sonars, fishes with a swim bladder involved in hearing have shown signs of hearing loss because of mid-frequency sonar exposure at a maximum received sound pressure level of 210 dB re 1 μPa for a total duration of 15 seconds. To account for the total duration of the exposure, the threshold for TTS is a cumulative sound exposure level of 220 dB re 1 μPa^2-s (Halvorsen et al., 2012c; Kane et al., 2010). The same threshold is used for fishes with a swim bladder and high frequency hearing as a conservative measure although fishes in this hearing group have not been tested for the same impact. TTS has not been observed in fishes with a swim bladder that is not involved in hearing exposed to mid-frequency sonar. Fishes within this hearing group do not sense pressure well and typically cannot hear at frequencies above 1 kHz (Halvorsen et al., 2012c; Popper et al., 2014). Therefore, no criteria were proposed for fishes with a swim bladder that is not involved in hearing from exposure to mid-frequency sonars as it is considered unlikely for TTS to occur. Fishes without a swim bladder are even less susceptible to noise exposure; therefore, TTS is unlikely to occur, and no criteria are proposed for this group either.

For low-frequency sonar, as described in Section 3.9.3.1.1.2 (Hearing Loss), exposure of fishes with a swim bladder has resulted in TTS (Halvorsen et al., 2013; Kane et al., 2010; Popper et al., 2007). Specifically, fishes with a swim bladder not involved in hearing showed signs of hearing loss after exposure to a maximum received sound pressure level of 193 dB re 1 μPa for 324 and 648 seconds (cumulative sound exposure level of 218 and 220 dB re 1 μPa^2-s, respectively) (Kane et al., 2010; Popper et al., 2007). In addition, exposure of fishes with a swim bladder involved in hearing to low-frequency sonar at a sound pressure level of 195 dB re 1 μPa for 324 seconds (cumulative sound exposure level of 215 dB re 1 μPa^2-s) resulted in TTS (Halvorsen et al., 2013). Although the results were variable, it can be assumed that TTS may occur in fishes within the same hearing groups at similar exposure levels. As a conservative measure, the threshold for TTS from exposure to low-frequency sonar for all fish hearing groups with a swim bladder was rounded down to a cumulative sound exposure level of 210 dB re 1 µPa^2-s.

Criteria for high- and very-high-frequency sonar were not available in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014); however, only species with a swim bladder involved in hearing and with high-frequency specializations, such as shad, could potentially be affected. The majority of fish species within the Study Area are unlikely to be able to detect these sounds. There is little data available on hearing loss from exposure of fishes to these high-frequency sonars. Due to the lack of available data, and as a conservative measure, effects to these hearing groups from high-frequency sonars would utilize the lowest threshold available for other hearing groups (a cumulative sound exposure level of 210 dB re 1 µPa^2-s), but effects would largely be analyzed qualitatively.

3.9.3.1.2.2 Impact Ranges for Sonar and Other Transducers

The following section provides ranges to specific effects from sonar and other transducers. Ranges are calculated using criteria from Table 3.9-4 and the Navy Acoustic Effects Model. Only ranges to TTS were predicted based on available data. Sonar durations of 1, 30, 60 and 120 seconds were used to calculate the ranges below. However, despite the variation in exposure duration, ranges were almost identical across these durations and therefore were combined and summarized by bin in the table below. General source levels, durations, and other characteristics of these systems are described in Section 3.0.3.1.1 (Sonar and Other Transducers).

Table 3.9-4: Ranges to Temporary Threshold Shift from Four Representative Sonar Bins

Fish Hearing Group	*Range to Effects (meters)*			
	Sonar Bin LF4 Low-frequency	*Sonar Bin MF1 Hull-mounted surface ship sonars (e.g., AN/SQS-53C and AN/SQS-61)*	*Sonar Bin MF4 Helicopter-deployed dipping sonars (e.g., AN/AQS-22)*	*Sonar Bin MF5 Active acoustic sonobuoys (e.g., DICASS)*
Fishes without a swim bladder	NR	NR	NR	NR
Fishes with a swim bladder not involved in hearing	0	NR	NR	NR
Fishes with a swim bladder involved in hearing	0	6 (0 - 11)	0	0
Fishes with a swim bladder and high frequency hearing	0	6 (0 - 11)	0	0

Notes: Ranges to TTS represent modeled predictions in different areas and seasons within the Study Area. The average range to TTS is provided as well as the minimum to the maximum range to TTS in parenthesis. Where only one number is provided the average, minimum, and maximum ranges to TTS are the same.
LF = low-frequency, MF = mid-frequency, NR = no criteria are available and therefore no range to effects are estimated.

3.9.3.1.2.3 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. Use of sonar and other transducers would typically be transient and temporary. General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplement EIS/OEIS compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 3.0-2 and 3.0-3.

Only a few species of shad within the Clupeidae family, subfamily Alosinae, are known to be able to detect high-frequency sonar and other transducers (greater than 10 kHz) and are considered a part of the fish hearing group for species with a swim bladder that have high-frequency hearing. However, these species are not present in the NWTT Study Area. Other marine fishes would probably not detect these high-frequency sounds and therefore would not experience masking, physiological stress, or behavioral disturbance.

Under Alternative 1, training activities would fluctuate each year to account for the natural variation of training cycles and deployment schedules. Some unit-level anti-submarine warfare training requirements would be conducted using synthetic means (e.g., simulators) or would be completed through other training exercises. However, training activities using low- and some mid-frequency sonars within most marine and anadromous fishes hearing range (< 2kHz) would not fluctuate between years. Overall, use of sources in this frequency range are less common during training activities than testing activities, and occur less often than sources with higher frequency content. Although training activities using sonar and other transducers could occur throughout the Study Area, low-and some mid-frequency sonars within the hearing range of most fish only occur in the NWTT Offshore area.

As discussed above, most marine fish species are not expected to detect sounds in the mid-frequency range (above a few kHz) of most operational sonars. The fish species that are known to detect mid-frequencies (i.e., those with swim bladders, including some sciaenids [drum], most clupeids [herring, shad], and potentially deep-water fish such as myctophids [lanternfish]) do not have their best sensitivities in the range of the operational sonars. Thus, fishes may only detect the most powerful systems, such as hull-mounted sonar, within a few kilometers; and most other, less powerful mid-frequency sonar systems, for a kilometer or less. Fishes with a swim bladder involved in hearing and with high-frequency hearing are more susceptible to hearing loss due to exposure to mid-frequency sonars. However, the maximum estimated range to TTS for these fish hearing groups is equal to or less than 10 m for only the most powerful sonar bins. Fishes within these hearing groups would have to be very close to the source and the source levels would have to be relatively high in order to experience this effect.

Most mid-frequency active sonars used in the Study Area would not have the potential to substantially mask key environmental sounds or produce sustained physiological stress or behavioral reactions due to the limited time of exposure resulting from the moving sound sources and variable duty cycles. However, it is important to note that some mid-frequency sonars have a high duty cycle or are operated continuously. This may increase the risk of masking, but only for important biological sounds that overlap with the frequency of the sonar being operated. Furthermore, although some species may be able to produce sound at higher frequencies (greater than 1 kHz), vocal marine fishes, such as sciaenids, largely communicate below the range of mid-frequency levels used by most sonars. Any such effects would be temporary and infrequent as a vessel operating mid-frequency sonar transits an area. As such, mid-frequency sonar use is unlikely to impact individuals. Long-term consequences for fish populations due to exposure to mid-frequency sonar and other transducers are not expected.

All marine fish species can likely detect low-frequency sonars and other transducers. However, low-frequency active sonar use is rare during training activities and most low-frequency active operations are conducted in deeper waters, usually beyond the continental shelf break. The majority of fish species, including those that are the most highly vocal, exist on the continental shelf and within nearshore, estuarine areas. However, some species may still be present where low-frequency sonar and other transducers are used. Most low-frequency sonar sources do not have a high enough source level to cause TTS. Although highly unlikely, if TTS did occur, it may reduce the detection of biologically significant sounds but would likely recover within a few minutes to days.

The majority of fish species exposed to sonar and other transducers within near (tens of meters) to far (thousands of meters) distances of the source would be more likely to experience; mild physiological stress; brief periods of masking; behavioral reactions such as startle or avoidance responses, although risk would be low even close to the source; or no reaction. However, based on the information provided in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), the relative risk of these effects at any distance are expected to be low. Due to the transient nature of most sonar operations, overall effects would be localized and infrequent, only lasting a few seconds or minutes. Based on the low level and short duration of potential exposure to low-frequency sonar and other transducers, long-term consequences for fish populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization) and as shown in Figure 3.9-5, all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by low- and some mid-frequency (< 2kHz) sonars and other transducers. Pacific eulachon do not have a swim bladder and cannot detect frequencies above 1 kHz. ESA-listed salmon species, rockfish, and green sturgeon have a swim bladder not involved in hearing and may be able to detect some mid-frequency sources below 2 kHz, but they are not particularly sensitive to these frequencies. Therefore, impacts from mid-, high- or very high-frequency sonar and other transducers are not expected for any ESA-listed and proposed species.

All ESA-listed salmon species are present in the NWTT Offshore Area throughout the year. In addition, the ESA-listed Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, Puget Sound DPS of Steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the NWTT Inland Waters. Puget Sound/Georgia Basin DPS of rockfish and yelloweye rockfish only occur in the NWTT Inland Waters. Training activities that use sonar and other transducers with frequency content at or below 2 kHz are not operated in the NWTT Inland Waters, therefore fishes that occur in the NWTT Inland Waters would not be exposure to these sources. Green sturgeon and Pacific eulachon occur throughout the Study Area and could be exposed to low-frequency sonar in the NWTT Offshore Area. There are no low- or mid-frequency (< 2kHz) sources operated in Western Behm Canal during training activities, therefore ESA-listed species that occur there would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the NWTT Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to sonar and other transducers.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of sonar and other transducers during training activities, as described under Alternative 1, would have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. The use of sonar and other transducers may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.1.1 (Sonar and Other Transducers). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Overall use of sonar and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Testing activities using sonar and other transducers would occur throughout the Study Area, with the majority of use occurring in the NWTT Inland Waters. Low-frequency sources are operated more frequently under testing activities than under training activities, including low- and some mid-frequency sonars (< 2kHz) that operate within most fish hearing ranges. In addition, some new systems using new technologies will be tested under Alternative 1 compared to systems analyzed in the 2015 NWTT Final EIS/OEIS. Although the general impacts from sonar and other transducers under testing would be similar to those described under training, there would be more impacts under testing activities as all marine fishes can detect low frequency sources.

Hearing loss in fishes from exposure to sonar and other transducers is unlikely. Although unlikely, if TTS did occur, it would occur within tens of meters of the source and only in select hearing groups. The majority of fish species exposed to sonar and other transducers within near (tens of meters) to far (thousands of meters) distances of the source would be more likely to experience; mild physiological stress; brief periods of masking; behavioral reactions such as startle or avoidance responses, although risk would be low even close to the source; or no reaction. However, based on the information provided in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), the relative risk of these effects at any distance are expected to be low. Long-term consequences for individual fish are unlikely in most cases because acoustic exposures are intermittent, transient and unlikely to repeat over short periods. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization) and as shown in Figure 3.9-5, all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by low- and some mid-frequency (< 2kHz) sonars and other transducers. Pacific eulachon do not have a swim bladder and cannot detect frequencies above 1 kHz. ESA-listed salmon species, rockfish, and green sturgeon have a swim bladder not involved in hearing and may be able to detect some mid-frequency sources below 2 kHz, but they are not particularly sensitive to these frequencies. Therefore, impacts from mid-, high- or very high-frequency sonar and other transducers are not expected for any ESA-listed and proposed species.

All ESA-listed salmon species are present in the NWTT Offshore Area throughout the year. In addition, the ESA-listed Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, Puget Sound DPS of Steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the NWTT Inland Waters. The only species that are present in Western Behm Canal include the Puget Sound ESU, Upper Columbia River Spring-Run ESU, Lower Columbia River ESU, Upper Willamette River ESU, Snake River Spring-Summer ESU, and Snake River Fall-Run ESU of Chinook salmon, as well as the Lower Columbia ESU and the Oregon Coast ESU of Coho salmon. Puget Sound/Georgia Basin DPS of bocaccio rockfish and yelloweye rockfish only occur in the NWTT Inland Waters and would only be exposed to sources in this portion of the Study Area. Green sturgeon and Pacific eulachon occur throughout the Study Area.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the NWTT Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to sonar and other transducers.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of sonar and other transducers during testing activities, as described under Alternative 1, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. The use of sonar and other transducers may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.1.2.4 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an increase in sonar use compared to Alternative 1, however the use of sonars and other transducers equal to or less than 2 kHz would remain the same between Alternative 1 and 2. The locations, types, and severity of predicted impacts would be similar to those described above in Section 3.9.3.1.2.3 (Impacts from Sonar and Other Transducers Under Alternative 1 – Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities). The hours of use of sonars and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Pursuant to the ESA, the use of sonar and other transducers during training activities, as described under Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. The use of sonar and other transducers may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.1.1 (Sonar and Other Transducers), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of activities that could occur within a given year. This would result in an increase in sonar use compared to Alternative 1, including sonars and other transducers equal to or less than 2 kHz. However, the locations, types, and severity of predicted impacts would be similar to those described above in Section 3.9.3.1.2.3 (Impacts from Sonar and Other Transducers Under Alternative 1 – Impacts from Sonar and Other Transducers Under Alternative 1 for Testing

Activities). The hours of use of sonars and other transducers in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Pursuant to the ESA, the use of sonar and other transducers during testing activities, as described under Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. The use of sonar and other transducers may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of sonar and other transducers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.2.5 Impacts from Sonar and Other Transducers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.1.3 Impacts from Vessel Noise

Fishes may be exposed to noise from vessel movement. A detailed description of the acoustic characteristics and typical sound levels of vessel noise are in Section 3.0.3.1.2 (Vessel Noise). Vessel movements involve transits to and from ports to various locations within the Study Area, including commercial ship traffic as well as recreational vessels in addition to U.S. Navy vessels. Many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer vessel-associated acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

Pursuant to the ESA, vessel noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. Vessel noise produced during training and testing activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA in that regard under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, vessel noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.4 Impacts from Aircraft Noise

Fishes that occur near or at the waters' surface may be exposed to aircraft noise, although this is considered to be unlikely. Fixed, rotary-wing, and tilt-rotor aircraft are used during a variety of training and testing activities throughout the Study Area. Tilt-rotor impacts would be similar to fixed-wing or helicopter impacts depending which mode the aircraft is in. Most of these sounds would be concentrated around airbases and fixed ranges within the range complex. Aircraft noise could also occur in the waters immediately surrounding aircraft carriers at sea during takeoff and landing. Aircraft produce extensive airborne noise from either turbofan or turbojet engines. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary-wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al., 2003). A detailed description of aircraft noise as a stressor is in Section 3.0.3.1.3 (Aircraft Noise).

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. The analysis of impacts from aircraft noise in this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for fishes, and may result in changes to estimated impacts for some species since the 2015 NWTT Final EIS/OEIS.

3.9.3.1.4.1 Methods for Analyzing Impacts from Aircraft Noise

The amount of sound entering the ocean from aircraft would be very limited in duration, sound level, and affected area. Due to the low level of sound that could enter the water from aircraft, hearing loss is not further considered as a potential effect. Potential impacts considered are masking of other biologically relevant sounds, physiological stress, and changes in behavior. Reactions by fishes to these specific stressors have not been recorded however, fishes would be expected to react to aircraft noise as they would react to other transient sounds (e.g., vessel noise).

For this analysis, the Navy assumes that some fish at or near the water surface may exhibit startle reactions to certain aircraft noise if aircraft altitude is low. This could mean a hovering helicopter, for which the sight of the aircraft and water turbulence could also cause a response, or a low-flying or super-sonic aircraft generating enough noise to be briefly detectable underwater or at the air-water interface. Because any fixed-wing aircraft noise would be brief, the risk of masking any sounds relevant to fishes is very low. The *ANSI Sound Exposure Guidelines* for fishes did not consider this acoustic stressor (Popper et al., 2014).

3.9.3.1.4.2 Impacts from Aircraft Noise Under Alternative 1

Impacts from Aircraft Noise Under Alternative 1 for Training Activities

Fishes may be exposed to aircraft-generated noise throughout the Study Area. Characteristics of aircraft noise are described in Section 3.0.3.1.3 (Aircraft Noise). Activities with aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Aircraft training activities would usually occur adjacent to Navy airfields, installations, and in Special Use Airspace within the Study Area.

Under Alternative 1, activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. Increases and decreases are shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2.

In most cases, exposure of fishes to fixed-wing aircraft presence and noise would be brief as the aircraft quickly passes overhead. Fishes would have to be at or near the surface at the time of an overflight to be exposed to appreciable sound levels. Due to the low sound levels in water, it is unlikely that fishes would respond to most fixed-wing aircraft or transiting helicopters. Because most overflight exposure would be brief and aircraft noise would be at low received levels, only startle reactions, if any, are expected in response to low altitude flights. Similarly, the brief duration of most overflight exposures would limit any potential for masking of relevant sounds.

Daytime and nighttime activities involving helicopters may occur for extended periods of time, up to a couple of hours in some areas. During these activities, helicopters would typically transit throughout an area but could also hover over the water. Longer event durations and periods of time where helicopters hover may increase the potential for behavioral reactions, startle reactions, masking, and physiological stress. Low-altitude flights of helicopters during some activities, which often occur under 100 ft. altitude, may elicit a stronger startle response due to the proximity of a helicopter to the water; the slower airspeed and longer exposure duration; and the downdraft created by a helicopter's rotor.

If fish were to respond to aircraft noise, only short-term behavioral or physiological reactions (e.g., avoidance and increased heart rate) would be expected. Therefore, long-term consequences for individuals would be unlikely and long-term consequences for populations are not expected.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting aircraft noise and could be exposed throughout the Study Area. However, due to the small area within which sound could potentially enter the water and the extremely brief window the sound could be present, exposures of fishes to aircraft noise would be extremely rare and in the event that they did occur, would be very brief (seconds).

Designated critical habitat for the Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and the Southern DPS of green sturgeon overlap the Study Area in the NWTT Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to aircraft noise.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, aircraft noise produced during training activities, as described under Alternative 1, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. Aircraft noise produced during training activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Aircraft Noise Under Alternative 1 for Testing Activities

Characteristics of aircraft noise are described in Section 3.0.3.1.3 (Aircraft Noise). Activities with aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). Aircraft testing activities would usually occur adjacent to Navy airfields, installations, and in special use airspace within the Study Area. Under Alternative 2, activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS. Increases and decreases are shown in Tables 2.5-1 and 2.5-2 for proposed activities under Alternative 1 and 2.

Proposed testing activities under Alternative 1 that involve aircraft differ in number and location from training activities under Alternative 1; however, the types and severity of impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise Under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during testing activities, as described under Alternative 1, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. Aircraft noise produced during testing activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.1.4.3 Impacts from Aircraft Noise Under Alternative 2

Impacts from Aircraft Noise Under Alternative 2 for Training Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), and Section 3.0.3.1.3 (Aircraft Noise), training activities under Alternative 2 include a minor increase in the number of events that involve aircraft as compared to Alternative 1; however, the training locations, types of aircraft, and severity of predicted impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise Under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during training activities, as described under Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, sockeye salmon; or Pacific eulachon. Aircraft noise produced during training activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Aircraft Noise Under Alternative 2 for Testing Activities

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), and Section 3.0.3.1.3 (Aircraft Noise), testing activities under Alternative 2 include a minor increase in the number of events that involve aircraft as compared to Alternative 1; however, the training locations, types of aircraft, and severity of predicted impacts would not be discernible from those described above in Section 3.9.3.1.4.2 (Impacts from Aircraft Noise Under Alternative 1 – Impacts from Aircraft Noise under Alternative 1 for Training Activities).

Pursuant to the ESA, aircraft noise produced during testing activities, as described under Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. Aircraft noise produced during testing activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, aircraft noise produced during testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.1.4.4 Impacts from Aircraft Noise Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.1.5 Impacts from Weapon Noise

Fishes may be exposed to sounds caused by the firing of weapons, objects in flight, and impact of non-explosive munitions on the water's surface, which are described in Section 3.0.3.1.4 (Weapons Noise). In general, these are impulsive sounds (such as those discussed under Section 3.0.3.2, Explosive Stressors) generated in close vicinity to or at the water surface, with the exception of items that are launched underwater. The firing of a weapon may have several components of associated noise. Firing of guns could include sound generated in air by firing a gun (muzzle blast) and a crack sound due to a low amplitude shock wave generated by a supersonic projectile flying through the air. Most in-air sound would be reflected at the air-water interface. Underwater sounds would be strongest just below the surface and directly under the firing point. Any sound that enters the water only does so within a narrow cone below the firing point or path of the projectile. Vibration from the blast propagating through a ship's hull, the sound generated by the impact of an object with the water surface, and the sound generated by launching an object underwater are other sources of impulsive sound in the water. Sound due to missile and target launches is typically at a maximum at initiation of the booster rocket and rapidly fades as the missile or target travels downrange. Due to the transient nature of most activities that produce weapon noise, overall effects would be localized and infrequent, only lasting a few seconds or minutes. Reactions by fishes to these specific stressors have not been recorded however, fishes would be expected to react to weapon noise as they would react to other transient impulsive sounds.

Activities may vary slightly from those previously analyzed in the 2015 NWTT Final EIS/OEIS, but the overall determinations presented remain valid. Increases and decreases shown in Tables 2.5-1 and 2.5-2 for activities proposed under Alternative 1 and 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Acoustic stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer acoustic stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for acoustic impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

Pursuant to the ESA, weapon noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, will have no effect on designated critical habitat for bull trout (Coastal Puget Sound DPS); bocaccio rockfish (Puget Sound/Georgia Basin DPS); yelloweye rockfish (Puget Sound/Georgia Basin DPS); green sturgeon; Chinook (Puget Sound ESU), chum (Hood Canal Summer-Run ESU), steelhead, coho, and sockeye salmon; or Pacific eulachon. Weapon noise produced during training and testing activities may affect ESA-listed salmonid species, rockfish species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA under Alternative 1.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, weapon noise produced during training and testing activities, as described under Alternative 1 and Alternative 2, may affect EFH species within the Study Area.

3.9.3.2 Explosive Stressors

Explosions in the water or near the water surface can introduce loud, impulsive, broadband sounds into the marine environment. But, unlike other acoustic stressors, explosives release energy at a high rate producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on fishes are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will in part rely on data for fish impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on fishes in Section 3.9.3.2.1 (Background). The ways in which an explosive exposure could result in immediate effects or lead to long-term consequences for an animal are explained in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), and this section follows that framework.

Due to the availability of new literature, adjusted sound exposure criteria, and new acoustic effects modeling, the analysis provided in Section 3.9.3.2.2 (Impacts from Explosives) of this Supplemental will supplant the 2015 NWTT Final EIS/OEIS for fishes.

3.9.3.2.1 Background

The effects of explosions on fishes have been studied and reviewed by numerous authors (Keevin & Hempen, 1997; O'Keeffe, 1984; O'Keeffe & Young, 1984; Popper et al., 2014). A summary of the literature related to each type of effect forms the basis for analyzing the potential effects from Navy activities. The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on fishes potentially resulting from Navy training and testing activities. Fishes could be exposed to a range of impacts depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior, potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.9.3.2.1.1 Injury

Injury refers to the direct effects on the tissues or organs of a fish. The blast wave from an in-water explosion is lethal to fishes at close range, causing massive organ and tissue damage (Keevin & Hempen, 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, depth, physical condition of the fish, and perhaps most importantly, the presence of a swim bladder (Keevin & Hempen, 1997; Wright, 1982; Yelverton et al., 1975; Yelverton & Richmond, 1981). At the same distance from the source, larger fishes are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fishes oriented sideways to the blast suffer the greatest impact (Edds-Walton & Finneran, 2006; O'Keeffe, 1984; O'Keeffe & Young, 1984; Wiley et al., 1981; Yelverton et al., 1975). Species with a swim bladder are much more susceptible to blast injury from explosives than fishes without them (Gaspin, 1975; Gaspin et al., 1976; Goertner et al., 1994).

If a fish is close to an explosive detonation, the exposure to rapidly changing high pressure levels can cause barotrauma. Barotrauma is injury due to a sudden difference in pressure between an air space inside the body and the surrounding water and tissues. Rapid compression followed by rapid expansion of airspaces, such as the swim bladder, can damage surrounding tissues and result in the rupture of the airspace itself. The swim bladder is the primary site of damage from explosives (Wright, 1982; Yelverton et al., 1975). Gas-filled swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves (Goertner, 1978). Swim bladders are a characteristic of most bony fishes with the notable exception of flatfishes (e.g., halibut). Sharks and rays are examples of fishes without a swim bladder. Small airspaces, such as micro-bubbles that may be present in gill structures, could also be susceptible to oscillation when exposed to the rapid pressure increases caused by an explosion. This may have caused the bleeding observed on gill structures of some fish exposed to explosions (Goertner et al., 1994). Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different densities. Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin & Hempen, 1997).

Several studies have exposed fish to explosives and examined various metrics in relation to injury susceptibility. Sverdrup (1994) exposed Atlantic salmon (1 to 1.5 kg [2 to 3 lb.]) in a laboratory setting to repeated shock pressures of around 2 MPa (300 psi) without any immediate or delayed mortality after a week. Hubbs and Rechnitzer (1952) showed that fish with swim bladders exposed to explosive shock fronts (the near-instantaneous rise to peak pressure) were more susceptible to injury when several feet below the water surface than near the bottom. When near the surface, the fish began to exhibit injuries around peak pressure exposures of 40 to 70 psi. However, near the bottom (all water depths were less than 100 feet [ft.]) fish exposed to pressures over twice as high exhibited no sign of injury. Yelverton et al. (1975) similarly found that peak pressure was not correlated to injury susceptibility; instead, injury susceptibility of swim bladder fish at shallow depths (10 ft. or less) was correlated to the metric of positive impulse (Pa-s), which takes into account both the positive peak pressure, the duration of the positive pressure exposure, and the fish mass, with smaller fish being more susceptible.

Gaspin et al. (1976) exposed multiple species of fish with a swim bladder, placed at varying depths, to explosive blasts of varying size and depth. Goertner (1978) and Wiley (1981) developed a swim bladder oscillation model, which showed that the severity of injury observed in those tests could be correlated to the extent of swim bladder expansion and contraction predicted to have been induced by exposure to the explosive blasts. Per this model, the degree of swim bladder oscillation is affected by ambient pressure (i.e., depth of fish), peak pressure of the explosive, duration of the pressure exposure, and exposure to surface rarefaction (negative pressure) waves. The maximum potential for injury is predicted to occur where the surface reflected rarefaction (negative) pressure wave arrives coincident with the moment of maximum compression of the swim bladder caused by exposure to the direct positive blast pressure wave, resulting in a subsequent maximum expansion of the swim bladder. Goertner (1978) and Wiley et al. (1981) found that their swim bladder oscillation model explained the injury data in the Yelverton et al. (1975) exposure study and their impulse parameter was applicable only to fishes at shallow enough depths to experience less than one swim bladder oscillation before being exposed to the following surface rarefaction wave.

O’Keeffe (1984) provides calculations and contour plots that allow estimation of the range to potential effects of in-water explosions on fish possessing swim bladders using the damage prediction model developed by Goertner (1978). O’Keeffe’s (1984) parameters include the charge weight, depth of burst, and the size and depth of the fish, but the estimated ranges do not take into account unique propagation environments that could reduce or increase the range to effect. The 10 percent mortality range shown below in Table 3.9-5 is the maximum horizontal range predicted by O'Keeffe (1984) for 10 percent of fish suffering injuries that are expected to not be survivable (e.g., damaged swim bladder or severe hemorrhaging). Fish at greater depths and near the surface are predicted to be less likely to be injured because geometries of the exposures would limit the amplitude of swim bladder oscillations.

Table 3.9-5: Range to 10% Mortality from In-Water Explosions for Fishes with a Swim Bladder

Weight of Pentolite (lb.) [NEW, lb.][1]	Depth of Explosion (ft.) [m]	10% Mortality Maximum Range (ft.) [m]		
		1 oz. Fish	1 lb. Fish	30 lb. Fish
10 [13]	10 [3]	530 [162]	315 [96]	165 [50]
	50 [15]	705 [214]	425 [130]	260 [79]
	200 [61]	905 [276]	505 [154]	290 [88]
100 [130]	10 [3]	985 [300]	600 [183]	330 [101]
	50 [15]	1,235 [376]	865 [264]	590 [180]
	200 [61]	1,340 [408]	1,225 [373]	725 [221]
1,000 [1,300]	10 [3]	1,465 [447]	1,130 [344]	630 [192]
	50 [15]	2,255 [687]	1,655 [504]	1,130 [344]
	200 [61]	2,870 [875]	2,390 [728]	1,555 [474]
10,000 [13,000]	10 [3]	2,490 [759]	1,920 [585]	1,155 [352]
	50 [15]	4,090 [1,247]	2,885 [879]	2,350 [716]
	200 [61]	5,555 [1,693]	4,153 [1,266]	3,090 [942]

[1] Explosive weights of pentolite converted to net explosive weight using the peak pressure parameters in Swisdak (1978). lb. = pounds, NEW = net explosive weight, oz. = ounce.
Data from O'Keeffe (1984)

In contrast to fish with swim bladders, fishes without swim bladders have been shown to be more resilient to explosives (Gaspin, 1975; Gaspin et al., 1976; Goertner et al., 1994). For example, some small (average 116 mm length; approximately 1 oz.) hogchokers (*Trinectes maculatus*) exposed less than 5 ft. from a 10 lb. pentolite charge immediately survived the exposure with slight to moderate injuries, and only a small number of fish were immediately killed; however, most of the fish at this close range did suffer moderate to severe injuries, typically of the gills or around the otolithic structures (Goertner et al., 1994).

Studies that have documented caged fishes killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Yelverton et al., 1975). Mortality in free-swimming (uncaged) fishes may be higher due to increased susceptibility to predation. Fitch and Young (1948) found that the type of free-swimming fish killed changed when blasting was repeated at the same location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts.

Fitch and Young (1948) also investigated whether a significant portion of fish killed would have sunk and not been observed at the surface. Comparisons of the numbers of fish observed dead at the surface and at the bottom in the same affected area after an explosion showed that fish found dead on the bottom comprised less than 10 percent of the total observed mortality. Gitschlag et al. (2000) conducted a more detailed study of both floating fishes and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. Results were highly variable. They found that 3 to 87 percent (46 percent average) of the red snapper killed during a blast might float to the surface. Currents, winds, and predation by seabirds or other fishes may be some of the reasons that the magnitude of fish mortality may not have been accurately captured.

There have been few studies of the impact of underwater explosives on early life stages of fish (eggs, larvae, juveniles). Fitch and Young (1948) reported mortality of larval anchovies exposed to underwater blasts off California. Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. Similar to adult fishes, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fish (Settle et al., 2002). Explosive shock wave injury to internal organs of larval pinfish and spot exposed at shallow depths was documented by Settle et al. (2002) and Govoni et al. (2003; 2008) at impulse levels similar to those predicted by Yelverton et al. (1975) for very small fish. Settle et al. (2002) provide the lowest measured received level that injuries have been observed in larval fish. Researchers (Faulkner et al., 2006; Faulkner et al., 2008; Jensen, 2003) have suggested that egg mortality may be correlated with peak particle velocity exposure (i.e., the localized movement or shaking of water particles, as opposed to the velocity of the blast wave), although sufficient data from direct explosive exposures is not available.

Rapid pressure changes could cause mechanical damage to sensitive ear structures due to differential movements of the otolithic structures. Bleeding near otolithic structures was the most commonly observed injury in non-swim bladder fish exposed to a close explosive charge (Goertner et al., 1994).

As summarized by the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), exposure to explosive energy poses the greatest potential threat for injury and mortality in marine fishes. Fishes with a swim bladder are more susceptible to injury than fishes without a swim bladder. The susceptibility also probably varies with size and depth of both the detonation and the fish. Fish larvae or juvenile fish may be more susceptible to injury from exposure to explosives.

3.9.3.2.1.2 Hearing Loss

There are no direct measurements of hearing loss in fishes due to exposure to explosive sources. The sound resulting from an explosive detonation is considered an impulsive sound and shares important qualities (i.e., short duration and fast rise time) with other impulsive sounds such as those produced by air guns. PTS in fish has not been known to occur in species tested to date and any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Popper et al., 2005; Popper et al., 2014; Smith et al., 2006).

As reviewed in Popper et al. (2014), fishes without a swim bladder, or fishes with a swim bladder not involved in hearing, would be less susceptible to hearing loss (i.e., TTS), even at higher level exposures. Fish with a swim bladder involved in hearing may be susceptible to TTS within very close ranges to an explosive. General research findings regarding TTS in fishes as well as findings specific to exposure to other impulsive sound sources are discussed in Section 3.9.3.1.1.2 (Hearing Loss).

3.9.3.2.1.3 Masking

Masking refers to the presence of a noise that interferes with a fish's ability to hear biologically important sounds including those produced by prey, predators, or other fish in the same species (Myrberg, 1980; Popper et al., 2003). This can take place whenever the noise level heard by a fish exceeds the level of a biologically relevant sound. As discussed in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise. Masking may lead to a change in vocalizations or a change in behavior (e.g., cessation of foraging, leaving an area).

There are no direct observations of masking in fishes due to exposure to explosives. The *ANSI Sound Exposure Guideline* technical report (2014) highlights a lack of data that exist for masking by explosives but suggests that the intermittent nature of explosions would result in very limited probability of any masking effects and if masking were to occur it would only occur during the duration of the sound. General research findings regarding masking in fishes due to exposure to sound are discussed in detail in Section 3.9.3.1.1.3 (Masking). Potential masking from explosives is likely to be similar to masking studied for other impulsive sounds such as air guns.

3.9.3.2.1.4 Physiological Stress

Fishes naturally experience stress within their environment and as part of their life histories. The stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. However, if the magnitude and duration of the stress response is too great or too long, then it can have negative consequences to the organism (e.g., decreased immune function, decreased reproduction). Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities) provides additional information on physiological stress and the framework used to analyze this potential impact.

Research on physiological stress in fishes due to exposure to explosive sources is limited. Sverdrup et al. (1994) studied levels of stress hormones in Atlantic salmon after exposure to multiple detonations in a laboratory setting. Increases in cortisol and adrenaline were observed following the exposure, with adrenaline values returning to within normal range within 24 hours. General research findings regarding physiological stress in fishes due to exposure to acoustic sources are discussed in detail in Section 3.9.3.1.1.4 (Physiological Stress). Generally, stress responses are more likely to occur in the presence of potentially threatening sound sources such as predator vocalizations or the sudden onset of impulsive signals. Stress responses may be brief (a few seconds to minutes) if the exposure is short or if fishes habituate or learn to tolerate the noise. It is assumed that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.9.3.2.1.5 Behavioral Reactions

As discussed in Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities), any stimuli in the environment can cause a behavioral response in fishes, including sound and energy produced by explosions. Alterations in natural behavior patterns due to exposure to explosions have not been studied as thoroughly, but reactions are likely to be similar to reactions studied for other impulsive sounds such as those produced by air guns (e.g., startle response, changes in swim speed and depth). Impulsive signals, particularly at close range, have a rapid rise time and higher instantaneous peak pressure than other signal types, making them more likely to cause startle or avoidance responses. General research findings regarding behavioral reactions from fishes due to exposure to impulsive sounds, such as those associated with explosions, are discussed in detail in Section 3.9.3.1.1.5 (Behavioral Reactions).

As summarized by the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014), species may react differently to the same sound source depending on a number of variables, such as the animal's life stage or behavioral state (e.g., feeding, mating). Without data that are more specific it is assumed that fishes with similar hearing capabilities react similarly to all impulsive sounds outside or within the zone for hearing loss and injury. Observations of fish reactions to large-scale air gun surveys are informative, but not necessarily directly applicable to analyzing impacts from the short-term, intermittent use of all impulsive sources. Fish have a higher probability of reacting when closer to an impulsive sound source (within tens of meters), and a decreasing probability of reaction at increasing distances (Popper et al., 2014).

3.9.3.2.1.6 Long-Term Consequences

Long-term consequences to a population are determined by examining changes in the population growth rate. For additional information on the determination of long-term consequences, see Section 3.0.3.7 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Physical effects from explosive sources that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment or chronic masking, which could affect navigation, foraging, predator avoidance, or communication. The long-term consequences due to individual behavioral reactions, masking and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies, especially for fish species that live for multiple seasons or years. For example, a lost reproductive opportunity could be a measurable cost to the individual; however, short-term costs may be recouped during the life of an otherwise healthy individual. These factors are taken into consideration when assessing risk of long-term consequences.

3.9.3.2.2 Impacts from Explosives

This section analyzes the impacts on fishes due to in-water and in-air explosives that would be used during Navy training and testing activities, synthesizing the background information presented above.

As discussed above, sound and energy from underwater explosions are capable of causing mortality, injury, hearing loss, masking, physiological stress, or a behavioral response, depending on the level and duration of exposure. The death of an animal would eliminate future reproductive potential, which is considered in the analysis of potential long-term consequences to the population. Exposures that result in non-auditory injuries may limit an animal's ability to find food, communicate with other animals, or interpret the surrounding environment. Impairment of these abilities can decrease an individual's chance of survival or affect its ability to reproduce. Temporary threshold shift can also impair an animal's abilities, although the individual may recover quickly with little significant effect.

The overall use of explosives for training and testing activities would be similar to what is currently conducted and several new testing activities would occur (see Tables 2.5-1 and 2.5-2 for details). Although activities may vary from those previously analyzed, the overall determinations presented in the 2015 NWTT Final EIS/OEIS remain valid, but have been improved upon under this current Draft Supplemental.

3.9.3.2.2.1 Methods for Analyzing Impacts from Explosives

The Navy performed a quantitative analysis to estimate ranges to effect for fishes exposed to underwater explosives during Navy training and testing activities. Inputs to the quantitative analysis included sound propagation modeling in the Navy's Acoustic Effects Model to the sound exposure criteria and thresholds presented below. Density data for fish species within the Study Area are not currently available; therefore, it is not possible to estimate the total number of individuals that may be affected by explosive activities.

<u>**Criteria and Thresholds used to Estimate Impacts on Fishes from Explosives**</u>

Mortality and Injury from Explosives

Criteria and thresholds to estimate impacts from sound and energy produced by explosive activities are presented below in Table 3.9-6. In order to estimate the longest range at which a fish may be killed or mortally injured, the Navy based the threshold for mortal injury on the lowest pressure that caused mortalities in the study by Hubbs and Rechnitzer (1952), consistent with the recommendation in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014). As described in Section 3.9.3.2.1.1 (Injury), this threshold likely over-estimates the potential for mortal injury. The potential for mortal injury has been shown to be correlated to fish size, depth, and geometry of exposure, which are not accounted for by using a peak pressure threshold. However, until fish mortality models are developed that can reasonably consider these factors across multiple environments, use of the peak pressure threshold allows for a conservative estimate of maximum impact ranges.

Due to the lack of detailed data for onset of injury in fishes exposed to explosives, thresholds from impact pile driving exposures (Halvorsen et al., 2011; Halvorsen et al., 2012a; Halvorsen et al., 2012b) were used as a proxy for the analysis in the AFTT DEIS. Upon re-evaluation, it was decided that pile driving thresholds are too conservative and not appropriate to use in the analysis of explosive effects on fishes. Therefore, injury criteria have been revised as follows.

Thresholds for the onset of injury from exposure to an explosion are not currently available and recommendations in the *ANSI Sound Exposure Guideline* technical report (Popper et al., 2014) only provide qualitative criteria for consideration. Therefore, available data from existing explosive studies were reviewed to provide a conservative estimate for a threshold to the onset of injury (Gaspin, 1975; Gaspin et al., 1976; Hubbs & Rechnitzer, 1952; Settle et al., 2002; Yelverton et al., 1975).

Table 3.9-6: Sound Exposure Criteria for Mortality and Injury from Explosives

Fish Hearing Group	*Onset of Mortality*	*Onset of Injury*
	SPL_{peak}	*SPL_{peak}*
Fishes without a swim bladder	229	220
Fishes with a swim bladder not involved in hearing	229	220
Fishes with a swim bladder involved in hearing	229	220
Fishes with a swim bladder and high-frequency hearing	229	220

Note: SPL_{peak} = Peak sound pressure level.

It is important to note that some of the available literature is not peer-reviewed and may have some caveats to consider when reviewing the data (e.g., issues with controls, limited details on injuries observed, etc.) but this information may still provide a better understanding of where injurious effects would begin to occur specific to explosive activities. The lowest threshold at which injuries were observed in each study were recorded and compared for consideration in selecting criteria. As a conservative measure, the absolute lowest peak sound pressure level recorded that resulted in injury, observed in exposures of larval fishes to explosions (Settle et al., 2002), was selected to represent the threshold to injury.

The injury threshold is consistent across all fish regardless of hearing groups due to the lack of rigorous data for multiple species. It is important to note that these thresholds may be overly conservative, as there is evidence that fishes exposed to higher thresholds than the those in Table 3.9-6 have shown no signs of injury (depending on variables such as the weight of the fish, size of the explosion, and depth of the cage). It is likely that adult fishes and fishes without a swim bladder would be less susceptible to injury than more sensitive hearing groups and larval species.

The number of fish killed by an in-water explosion would depend on the population density near the blast, as well as factors discussed throughout Section 3.9.3.2.1.1 (Injury) such as net explosive weight, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of fish, a large number of fish could be killed. However, the probability of this occurring is low based on the patchy distribution of dense schooling fish. Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

Fragments produced by exploding munitions at or near the surface may present a high-speed strike hazard for an animal at or near the surface. In water, however, fragmentation velocities decrease rapidly due to drag (Swisdak & Montanaro, 1992). Because blast waves propagate efficiently through water, the range to injury from the blast wave would likely extend beyond the range of fragmentation risk.

Hearing Loss from Explosives

Criteria and thresholds to estimate TTS from sound produced by explosive activities are presented below in Table 3.9-7. Direct (measured) TTS data from explosives are not available. Criteria used to define TTS from explosives is derived from data on fishes exposed to seismic air gun signals (Popper et al., 2005) as summarized in the ANSI Sound Exposure Guideline technical report (Popper et al., 2014). TTS has not been documented in fishes without a swim bladder from exposure to other impulsive sources (pile driving and air guns). Although it is possible that fishes without a swim bladder could receive TTS from exposure to explosives, fishes without a swim bladder are typically less susceptible to hearing impairment than fishes with a swim bladder. If TTS occurs in fishes without a swim bladder, it would likely occur within the range of injury; therefore, no thresholds for TTS are proposed. General research findings regarding hearing loss in fishes as well as findings specific to exposure to other impulsive sound sources are discussed in Section 3.9.3.1.1.2 (Hearing Loss).

Table 3.9-7: Sound Exposure Criteria for Hearing Loss from Explosives

Fish Hearing Group	*TTS (SEL_{cum})*
Fishes with a swim bladder not involved in hearing	> 186
Fishes with a swim bladder involved in hearing	186
Fishes with a swim bladder and high-frequency hearing	186

Notes: TTS = Temporary Threshold Shift, SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB re 1 μPa^2-s]), > indicates that the given effect would occur above the reported threshold.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), exposure to sound produced from seismic air guns at a cumulative sound exposure level of 186 dB re 1 μPa^2-s has resulted in TTS in fishes with a swim bladder involved in hearing (Popper et al., 2005). TTS has not occurred in fishes with a swim bladder not involved in hearing and would likely occur above the given threshold in Table 3.9-7.

3.9.3.2.2.2 Impact Ranges for Explosives

The following section provides estimated range to effects for fishes exposed to sound and energy produced by explosives. Ranges are calculated using criteria from Table 3.9-8 and Table 3.9-9 and the Navy Acoustic Effects Model. Fishes within these ranges would be predicted to receive the associated effect. Ranges may vary greatly depending on factors such as the cluster size, location, depth, and season of the event.

Table 3.9-8 provides range to mortality and injury for all fishes. Only one table (Table 3.9-9) is provided for range to TTS for all fishes with a swim bladder. However, ranges to TTS for fishes with a swim bladder not involved in hearing would be shorter than those reported because this effect has not been observed in fishes without a swim bladder exposed to the described TTS threshold.

Table 3.9-8: Range to Mortality and Injury for All Fishes from Explosives

Bin	*Range to Effects (meters)*	
	Onset of Mortality	*Onset of Injury*
	229 SPL_{peak}	*220 SPL_{peak}*
E1 (0.25 lb. NEW)	50 (45–50)	124 (120–140)
E2 (0.5 lb. NEW)	64 (60–65)	163 (150–170)
E3 (2.5 lb. NEW)	114 (110–260)	328 (160–1,525)
E4 (5 lb. NEW)	150 (140–370)	466 (350–1,025)
E5 (10 lb. NEW)	177 (170–180)	447 (430–460)
E7 (60 lb. NEW)	424 (320–1,025)	1,142 (775–2,275)
E8 (100 lb. NEW)	644 (380–1,275)	1,708 (950–3,275)
E10 (500 lb. NEW)	644 (625–650)	1,478 (1,275–1,525)
E11 (650 lb. NEW)	1,287 (725–3,025)	3,913 (2,025–7,275)

Notes: SPL_{peak} = Peak sound pressure level. Range to effects represent modeled predictions in different areas and seasons within the Study Area. Each cell contains the estimated average, minimum and maximum range to the specified effect.

Table 3.9-9: Range to TTS for Fishes with a Swim Bladder from Explosives

Bin	*Cluster Size*	*Range to Effects (meters)* TTS[1] SEL$_{cum}$
E1 (0.25 lb. NEW)	1	< 53 (45–55)
	18	< 207 (160–280)
E2 (0.5 lb. NEW)	1	< 58 (55–60)
	5	< 118 (110–120)
E3 (2.5 lb. NEW)	1	< 161 (140–600)
	19	< 709 (160–2,525)
E4 (5 lb. NEW)	1	< 225 (180–480)
E5 (10 lb. NEW)	1	< 158 (150–200)
	20	< 574 (550–600)
E7 (60 lb. NEW)	1	< 974 (675–1,775)
E8 (100 lb. NEW)	1	< 1,110 (725–1,775)
E10 (500 lb. NEW)	1	< 570 (550–650)
E11 (650 lb. NEW)	1	< 2,693 (1,525–5,025)

Notes: SEL$_{cum}$ = Cumulative sound exposure level, TTS = Temporary Threshold Shift, "<" indicates that the given effect would occur at distances less than the reported range(s).
Range to effects represent modeled predictions in different areas and seasons within the Study Area. Each cell contains the estimated average, minimum and maximum range to the specified effect.

3.9.3.2.2.3 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during training activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Under Alternative 1, there could be fluctuation in the amount of explosions that would occur annually, although potential impacts would be similar from year to year. Training activities involving explosives would be concentrated in the NWTT Offshore Area. Generally, explosives occur at distances greater than 50 NM from shore. In addition, a very small amount of mine neutralization training activities would occur in the Inland Areas of the Study Area. There are no training activities that involve the use of explosives in the Western Behm Canal, therefore there would be no impacts on fishes that occur in these areas. In addition, the Navy will implement mitigation to avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area (see Appendix K, Geographic Mitigation Assessment, for more details), which will consequently also help avoid potential impacts on fishes that shelter and feed on live hard bottom, artificial reefs, and shipwrecks. The Navy will also implement mitigation measures for Explosive Mine Neutralization Activities Involving Navy divers specifically to avoid impacts on ESA-listed bull trout and salmonids (see Chapter 5, Mitigation, for more details).

Sound and energy from explosions could result in mortality and injury, on average, for hundreds to even thousands of meters from some of the largest explosions. Exposure to explosions could also result in hearing loss in nearby fishes. The estimated range to each of these effects based on explosive bin size is provided in Table 3.9-8 and Table 3.9-9. Generally, explosives that belong to larger bins (with large net explosive weights) produce longer ranges within each effect category. However, some ranges vary depending upon a number of other factors (e.g., number of explosions in a single event, depth of the charge, etc.). Fishes without a swim bladder, adult fishes, and larger species would generally be less susceptible to injury and mortality from sound and energy associated with explosive activities than small, juvenile or larval fishes. Fishes that experience hearing loss could miss opportunities to detect predators or prey, or show a reduction in interspecific communication.

If an individual fish were repeatedly exposed to sound and energy from underwater explosions that caused alterations in natural behavioral patterns or physiological stress, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity. If detonations occurred close together (within a few seconds), there could be the potential for masking to occur but this would likely happen at farther distances from the source where individual detonations might sound more continuous. Training activities involving explosions are generally dispersed in space and time. Consequently, repeated exposure of individual fishes to sound and energy from in-water explosions over the course of a day or multiple days is not likely and most behavioral effects are expected to be short-term (seconds or minutes) and localized. Exposure to multiple detonations over the course of a day would most likely lead to an alteration of natural behavior or the avoidance of that specific area.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by explosives. All ESA-listed salmon species are present in the NWTT Offshore Area throughout the year. In addition, the ESA-listed Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, Puget Sound DPS of Steelhead, and Coastal-Puget Sound DPS of bull trout also occur in the NWTT Inland Waters. Salmon of all sizes and age classes could be exposed to explosives in these described areas throughout the year depending on specific seasonal migrations. Bocaccio rockfish and yelloweye rockfish only occur in the NWTT Inland Waters. Due to their preference for rocky habitats and the extremely low level of training activities that involve the use of explosives that occur in the NWTT Inland Waters, the likelihood of exposure to explosions would be rare. Green sturgeon and Pacific eulachon occur throughout the Study Area. As discussed above, there are no explosive activities in Western Behm Canal, therefore ESA-listed species that occur there would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between training activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, the Coastal-Puget Sound DPS of bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and Southern DPS of green sturgeon overlap the Study Area in the NWTT Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. However, it is unlikely that training activities involving explosives would occur in portions of the Inland Waters designated as critical habitat, nor would they occur close to shore as explosives are typically detonated 50 NM from shore. In addition, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to explosives.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during training activities, as described under Alternative 1, may affect designated critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), green sturgeon, Chinook (Puget Sound ESU), and chum salmon (Hood Canal Summer-Run ESU), and may affect ESA-listed salmonid species, green sturgeon, and rockfish species. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Explosives Under Alternative 1 for Testing Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions). General characteristics, quantities, and net explosive weights of in-water explosives used during testing activities under Alternative 1 are provided in Section 3.0.3.2 (Explosive Stressors). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Under Alternative 1, there could be fluctuation in the amount of explosions that would occur annually, although potential impacts would be similar from year to year. Testing activities involving explosives would occur only in the NWTT Offshore Area. Therefore, there would be no impacts on fishes that occur in the Inland Waters or Western Behm Canal. Generally, explosives occur at distances greater than 50 NM from shore and would occur in the same general locations and in a similar manner as previously analyzed in the 2015 NWTT Final EIS/OEIS, with one exception. A new mine countermeasure and neutralization testing activity would occur closer to shore than other activities analyzed in the 2015 NWTT Final EIS/OEIS that involved the use of in-water explosives. However, this activity would occur approximately three times per year and in water depths greater than 100 ft. (see Chapter 2, Description of Proposed Action and Alternatives).

Explosives are used less frequently under testing activities than under training activities. Some testing activities may occur closer to shore than training activities but these activities would only occur a few times in any given year. Overall, the general impacts from explosives under testing would be similar to those described above in Section 3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Training Activities). In addition, the Navy will implement mitigation to avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area (see Appendix K, Geographic Mitigation Assessment, for more details), which will consequently also help avoid potential impacts on fishes that shelter and feed on live hard bottom, artificial reefs, and shipwrecks.

As discussed previously in Section 3.9.2.1 (Hearing and Vocalization), all ESA-listed fish species that occur in the Study Area are capable of detecting sound produced by explosives. All ESA-listed salmon species are present in the NWTT Offshore Area throughout the year. Salmon of all sizes and age classes could be exposed to explosives in these described areas throughout the year depending on specific seasonal migrations. Bocaccio rockfish and yelloweye rockfish only occur in the NWTT Inland Waters, and thus would not be affected by explosives testing. Green sturgeon and Pacific eulachon occur throughout the Study Area. As discussed above, there are no explosive testing activities in Inland Waters or the Western Behm Canal, therefore ESA-listed species that occur there would not be impacted.

Impacts on ESA-listed fishes, if they occur, would be similar to impacts on fishes in general. However, due to the short-term, infrequent and localized nature of these activities, ESA-listed fishes are unlikely to be exposed multiple times within a short period. In addition, physiological and behavioral reactions would be expected to be brief (seconds to minutes) and infrequent based on the low probability of co-occurrence between testing activities and these species. Although individuals may be impacted, long-term consequences for populations would not be expected.

Designated critical habitat for the Puget Sound ESU of Chinook salmon, Hood Canal Summer-Run ESU of chum salmon, the Coastal-Puget Sound DPS of Bull trout, the Puget Sound/Georgia Basin DPS of bocaccio and yelloweye rockfish, and Southern DPS of green sturgeon overlap the Study Area in the NWTT Inland Waters. In addition, designated critical habitat for bull trout and green sturgeon occur in the nearshore coastal areas of the Study Area. Since explosives testing does not take place in Inland Waters, these critical habitats would not be affected. In addition, most of the physical and biological features for the anadromous ESA-listed species are generally not applicable to the Study Area (e.g., features associated with freshwater riverine habitat). While activities could occur in close proximity to designated critical habitat, no adverse effects to any physical or biological features (e.g., water quality, habitat structure, prey availability, or unobstructed passageways) are anticipated from exposure to explosives.

Although green sturgeon critical habitat largely occurs in the nearshore coastal areas of the Study Area and most testing activities would occur beyond 50 NM from shore, some mine countermeasure testing activities would occur closer to shore and would therefore overlap a portion green sturgeon critical habitat. Most of the defined physical and biological features would not be affected by explosives (e.g., water flow and water quality). However, the use of explosives within the critical habitat may affect a small number of prey items.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during testing activities, as described under Alternative 1, will have no effect on designated critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and no effect on bocaccio rockfish and yelloweye rockfish. The use of explosives during testing activities may affect designated critical habitat for bull trout (Coastal Puget Sound DPS), green sturgeon, Chinook (Puget Sound ESU), and chum salmon (Hood Canal Summer-Run ESU), and may affect ESA-listed salmonid species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS as required by Section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.2.2.4 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), training activities under Alternative 2 reflects the maximum number of training activities that could occur within a given year. This would result in an increase of explosive use compared to Alternative 1. The locations, types, and severity of predicted impacts would be similar to those described above in Section 3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Training Activities). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during training activities, as described under Alternative 2, may affect designated critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), green sturgeon, Chinook (Puget Sound ESU), and chum salmon (Hood Canal Summer-Run ESU). The use of explosives during training activities may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Explosives Under Alternative 2 for Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Section 3.0.3.2 (Explosive Stressors), and Appendix A (Navy Activities Descriptions), testing activities under Alternative 2 reflects the maximum number of testing activities that could occur within a given year. This would result in the same amount of explosive use compared to Alternative 1 for testing activities. The locations, types, and severity of predicted impacts would be similar to those described above in Section 3.9.3.2.2.3 (Impacts from Explosives Under Alternative 1 – Impacts from Explosives Under Alternative 1 for Testing Activities). The number of explosive sources in this Supplemental compared with the totals analyzed in the 2015 NWTT Final EIS/OEIS are described in Tables 2.5-1 and 2.5-2.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of explosives during testing activities, as described under Alternative 2, will have no effect on designated critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS), and will have no effect on bocaccio rockfish and yelloweye rockfish. The use of explosives during testing activities may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and designated critical habitat for bull trout (Coastal Puget Sound DPS), and green sturgeon.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of explosives associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.2.2.5 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Explosive stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for explosive impacts on individual fishes, but would not measurably improve the overall distribution or abundance of fishes.

3.9.3.3 Energy Stressors

The energy stressors that may impact fishes include in-water electromagnetic devices and high-energy lasers. Only one new energy stressor (high-energy lasers) used in testing activities differs from the energy stressors that were previously analyzed in the 2015 NWTT Final EIS/OEIS. Use of low-energy lasers was analyzed and dismissed as an energy stressor in the 2015 NWTT Final EIS/OEIS in Section 3.0.5.3.2.2 (Lasers). However, at that time high-energy laser weapons were not part of the proposed action for the Study Area.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons are designed to disable surface targets, rendering them immobile. Fish could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual fish at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. Most fish are unlikely to be exposed to laser activities because they primarily occur more than a few meters below the sea surface.

3.9.3.3.1 Impacts from In-Water Electromagnetic Devices

3.9.3.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same (Table 3.0-9) as those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of in-water electromagnetic devices on fishes would be inconsequential because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area.

Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998). Therefore, potential impacts on recruitment are not be expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of in-water electromagnetic devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 1.

3.9.3.3.1.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities involving the use of in-water electromagnetic devices would remain the same as Alternative 1 (Table 3.0-9) and those proposed in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be the same as those described above for Alternative 1 and presented in the 2015 NWTT Final EIS/OEIS. As described above for Alternative 1, marine fishes may be exposed to in-water electromagnetic devices during training activities. As stated in the 2015 NWTT Final EIS/OEIS, in-water electromagnetic devices would not cause any potential risk to fishes because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source), (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water, and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area.

Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary and would not impact an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998). Therefore, potential impacts on recruitment are not be expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of in-water electromagnetic devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of in-water electromagnetic devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

No in-water electromagnetic devices are proposed for testing activities under Alternative 2.

3.9.3.3.1.3 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Energy stressors, as listed above, would not be introduced into the marine environment. In-water electromagnetic devices as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for energy impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.3.2 Impacts from High-Energy Lasers

High-Energy Lasers were not proposed for use in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.0.3.3.2.2 (High-Energy Lasers), high-energy laser weapons testing activities involve evaluating the effectiveness of a high-energy laser deployed from a surface ship or helicopter to create small but critical failures in potential targets from short ranges.

This section analyzes the potential impacts of high-energy lasers on marine fishes. The primary concern for high-energy weapons testing is the potential for a fish to be struck by a high-energy laser beam at or near the water's surface, which could result in injury or death, resulting from traumatic burns from the beam. Fish could be exposed to a laser only if the beam missed the target. Should the laser strike the sea surface, individual fish at or near the surface could be exposed. The potential for exposure to a high-energy laser beam decreases as the water depth increases. Most fish are unlikely to be exposed to laser activities because they primarily occur more than a few meters below the sea surface.

3.9.3.3.2.1 Impacts from High-Energy Lasers Under Alternative 1

<u>Impacts from High-Energy Lasers Under Alternative 1 for Training Activities</u>

No high-energy lasers are proposed for training activities under Alternative 1.

<u>Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities</u>

As shown in Table 3.0-10, a total of 54 testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 1. Fish species may be exposed to high-energy lasers. Fishes are unlikely to be exposed to high-energy lasers based on (1) the relatively low number of events (54 per year throughout the entire Study Area), (2) the very localized potential impact area of the laser beam, (3) the temporary duration of potential impact (seconds), (4) the low probability of fish at or near the surface at the exact time and place a laser misses its target, and (5) the low probability of a laser missing its target.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of high-energy lasers during testing activities, as described under Alternative 1, would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS). The use of high-energy lasers may affect ESA-listed salmonid species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.3.2.2 Impacts from High-Energy Lasers under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

No high-energy lasers are proposed for training activities under Alternative 2.

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

As shown in Table 3.0-10, a total 54 testing activities involving the use of high-energy lasers are proposed to be conducted in the Offshore Area under Alternative 2, the same as under Alternative 1 and as stated above represents a new activity not covered in the 2015 NWTT Final EIS/OEIS. Therefore, the impacts would be the same as described under Alternative 1.

Pursuant to the ESA, the use of high-energy lasers during testing activities, as described under Alternative 2 would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), yelloweye rockfish (Puget Sound/Georgia Basin DPS), and green sturgeon (Southern DPS). The use of high-energy lasers may affect ESA-listed salmonid species, green sturgeon, and Pacific eulachon. The Navy will consult NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of high-energy lasers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.3.2.3 Impacts from High-Energy Lasers Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Energy stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer energy stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for energy impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4 Physical Disturbance and Strike Stressors

The physical disturbance and strike stressors that may impact marine fishes include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.4.1 Impacts from Vessels and In-Water Devices

As stated in the 2015 NWTT Final EIS/OEIS, with few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. There is minimal potential strike impact other than bottom-crawling unmanned underwater vehicles. Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area, although some fish groups may be more susceptible to strike potential than others. In addition, the potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality.

3.9.3.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would increase (Table 3.0-12 and Table 3.0-13) compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would decrease slightly in the Offshore Area (from 1,156 to 1,144 annual activities) and in the Inland Waters (from 368 to 327), so there would still be a net decrease in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously. There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are small and slow moving, the impacts on fishes would be similar. The proposed increase of approximately 100 in-water devices would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of vessels and in-water devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices (Table 3.0-12 and Table 3.0-13) would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Offshore Area (from 181 to 283 annual activities), and increases slightly in the Inland Waters (from 916 to918) and Western Behm Canal (60 to 63).

There is also an overall increase in the use of in-water devices during testing activities in the Study Area (Table 3.0-13), all of which are associated with small, slow-moving, and unmanned underwater vehicles.

The number of testing activities increases in the Offshore Areas (156 to 215), Inland Waters (576 to 664), and in the western Behm Canal (8 to 19). The proposed increase of in-water devices would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS. The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine fish. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of vessels and in-water devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, the combined number of proposed training activities involving the movement of vessels and the use of in-water devices would be slightly greater than Alternative 1 (Table 3.0-12 and Table 3.0-13) and greater than those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase in the Study Area compared to Alternative 1 (1,471 for Alternative 1 compared to 1,658 for Alternative 2), and increases (1,524 to 1,658) compared to levels presented in the 2015 NWTT Final EIS/OEIS (Table 3.0-12).

There would also be a slight total increase in the use of in-water devices compared to Alternative 1 (600 for Alternative 1 compared to 620) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (496 to 620) (Table 3.0-13). All of the increased in-water device activities are associated with small, slow-moving unmanned underwater vehicles. Because the increases are to activities in which the in-water devices are unlikely to have an impact on marine fishes (small, slow-moving in-water devices), the impacts on fishes would be similar. The proposed increase of in-water devices would not change that conclusion. The activities would occur in the same locations and in a similar manner as were analyzed previously. Under Alternative 2, the risk of a strike from vessels and in-water devices used in training and testing activities on an individual fish would be extremely low because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Therefore, impacts on fish or fish populations would be negligible.

Similar to most other fish species described above, ESA-listed fish species would be able to sense pressure changes in the water column and swim quickly, and are likely to escape collision with vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during training activities, as described under Alternative 2, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of vessels and in-water devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the combined number of proposed testing activities involving the movement of vessels and the use of in-water devices would increase compared to Alternative 1 (Table 3.0-12 and Table 3.0-13) and those proposed in the 2015 NWTT Final EIS/OEIS. Vessel movement would increase slightly in the Offshore Area compared to Alternative 1 (from 283 to 295) and would increase compared to numbers presented in the 2015 NWTT Final EIS/OEIS (from 181 to 295). Vessel movements would increase in the Inland Waters compared to Alternative 1 (from 918 to 1,028) and would increase compared to numbers presented in the 2015 NWTT final EIS/OEIS (from 916 to 1,028). Similarly, vessel movement would increase in the Western Behm Canal (from 63 to 77) compared to Alternative 1 and would increase from 60 to 77 compared to the 2015 NWTT Final EIS/OEIS, resulting in a net increase in the Study Area.

There would also be a slight increase in the use of in-water devices compared to Alternative 1 (898 for Alternative 1 compared to 932) and an increase from levels presented in the 2015 NWTT final EIS/OEIS (740 to 932) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these vessel and in-water device activities remain unlikely to result in a strike to any marine fish. The proposed increase of vessel and in-water device activities would not change that conclusion. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, the impact of vessels and in-water devices on marine fishes would remain inconsequential because (1) most fish can detect and avoid vessel and in-water device movements, and (2) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of vessels and in-water devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of vessels and in-water devices associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4.2 Impacts from Military Expended Materials

Military expended materials include non-explosive practice munitions (Table 3.0-14), other military materials (Table 3.0-15), high explosives that may result in fragments (Table 3.0-16), and targets (Table 3.0-17).

3.9.3.4.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS).The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-16) are combined, the number of items proposed to be expended under Alternative 1 increases slightly compared to ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts on fishes would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use military expended materials during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Table 3.0-14, Table 3.0-15, and Table 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of military expended materials on marine fishes would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during training activities, as described under Alternative 2, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-16 are combined, the number of items proposed to be expended under Alternative 2 increases compared to Alternative 1 and ongoing activities. Although there are a few new activities such as mine countermeasure and neutralization testing and kinetic energy weapon testing that would generate military expended materials, impacts on marine invertebrates would be expected to be the same as those described above and would be inconsequential for the same reasons described above for vessels and in-water devices.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.4.3 Impacts from Seafloor Devices

3.9.3.4.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

Under Alternative 1, the number of training activities that include the use of seafloor devices would increase from 10 to 40 compared to ongoing activities, all of which would occur in the Inland Waters (Table 3.0-18) as part of the Precision Anchoring exercise. The activity is comprised of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom. The anchor is later recovered and the activity is complete. As discussed in the 2015 NWTT Final EIS/OEIS, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 1, training activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of seafloor devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of testing activities that include the use of seafloor devices (Table 3.0-18) would increase compared to ongoing activities (from 809 to 878). The majority of the activities involve the temporary placement of mine shapes in Inland Waters. As discussed in the 2015 NWTT Final EIS/OEIS, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 1, testing activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.4.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as under Alternative 1 (Table 3.0-18) and would increase compared to ongoing activities (from 10 to 40). As described above under Alternative 1, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 2, training activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during training activities, as described under Alternative 2, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of seafloor devices may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of seafloor devices associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of testing activities that include the use of seafloor devices would increase compared to both Alternative 1 (878 to 953) (Table 3.0-18) and ongoing activities (809 to 953). As described above under Alternative 1, it would be highly unlikely that a seafloor device strikes an individual fish because they are able to detect and avoid falling objects through the water column. It is possible, although extremely unlikely, that a fish on the seafloor could be struck by a falling object such as an anchor. Under Alternative 2, testing activities involving seafloor devices are not expected to yield any behavioral changes or lasting impacts on the survival, growth, recruitment, or reproduction of fish species at the population level.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of seafloor devices during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.4.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbance and strike impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5 Entanglement Stressors

Entanglement stressors that may impact fishes include (1) fiber optic cables and guidance wires, and (2) decelerators/parachutes. Biodegradable polymer is a new stressor not previously analyzed, but the other two stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.5.1 Impacts from Wires and Cables

Wires and cables include fiber optic cables, guidance wires, and sonobuoy wires (Table 3.0-19).

3.9.3.5.1.1 Impacts from Wires and Cables Under Alternative 1

Impacts from Wires and Cables Under Alternative 1 for Training Activities

Under Alternative 1, the number of wires and cables that would be expended during training activities (Table 3.0-19) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 1, compared to none proposed in the previous analysis. No guidance wires would be expended in Inland Waters. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 8,928 to 9,338), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, while individual fish susceptible to entanglement would encounter wires and cables, including guidance wires, fiber optic cables, and sonobuoy wires during training and testing activities, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate for wires and cables is low, (2) the types of fishes that are susceptible to these items is limited, (3) there is restricted overlap with susceptible fishes, and (4) the physical characteristics of the wires and cables reduce entanglement risk to fishes compared to monofilament used for fishing gear. Potential impacts from exposure to fiber optic cables and guidance wires are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during with training activities, as described under Alternative 1, would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and would have no effect on bocaccio rockfish and yelloweye rockfish. The use of wires and cables may affect critical habitat for green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Wires and Cables Under Alternative 1 for Testing Activities

Under Alternative 1, the total number of wires and cables that would be expended during testing activities (Table 3.0-19) is increased compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Fiber optic cables used in the Offshore Area would increase (20 to 36), guidance wires used in both the Offshore Area and the Inland Waters would increase (from 92 to 152 in Offshore Areas and 155 to 230 in Inland Waters), and sonobuoy wires expended would also increase (1,000 to 4,049 in Offshore Areas and 6 to 48 in Inland Waters). Even though the number of cable and wires would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same.

As stated in the 2015 NWTT Final EIS/OEIS, while individual fish susceptible to entanglement would encounter wires and cables, including guidance wires, fiber optic cables, and sonobuoy wires during training and testing activities, the long-term consequences of entanglement are unlikely for either individuals or populations because (1) the encounter rate for wires and cables is low, (2) the types of fishes that are susceptible to these items is limited, (3) there is restricted overlap with susceptible fishes, and (4) the physical characteristics of the wires and cables reduce entanglement risk to fishes compared to monofilament used for fishing gear. Potential impacts from exposure to fiber optic cables and guidance wires are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of wires and cables may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.1.2 Impacts from Wires and Cables Under Alternative 2

Impacts from Wires and Cables Under Alternative 2 for Training Activities

Under Alternative 2, the total number of wires and cables that would be expended during training activities (9,380) is generally consistent with the number proposed for use under Alternative 1 (9,340) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (8,928). No fiber optic cables are used in the Study Area under training, either in the previous analysis or this Supplemental. Two guidance wires are proposed to be expended in the Offshore Area under Alternative 2, none were proposed in the previous analysis. As shown in Table 3.0-19, the expenditure of sonobuoy wires in the Offshore Area is proposed to increase slightly (from 9,338 to 9,380), and no sonobuoys are proposed to be used in the Inland Waters, where none were proposed previously. The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these wires and cables is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on fishes would be inconsequential for the same reasons discussed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during with training activities, as described under Alternative 2, would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and would have no effect on bocaccio rockfish and yelloweye rockfish. The use of wires and cables may affect critical habitat for green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, and Pacific eulachon. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Wires and Cables Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of wires and cables that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 4,712 to 6,958) (Table 3.0-19) and in the 2015 NWTT Final EIS/OEIS (1,395 to 6,958). Fiber optic cables used in the Offshore Area and Inland Waters would be the same as Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS. Guidance wires used in the Offshore Area would increase compared to Alternative 1 (from 152 to 192) and those proposed in the previous analysis (from 92 to 192). Guidance wires in Inland Waters would be the same as Alternative 1 (Table 3.0-19), but increase (from 155 to 230) compared to those proposed in the previous analysis. Sonobuoy wires expended in Offshore Areas would increase compared to Alternative 1 (from 4,049 to 6,255) and in the 2015 NWTT Final EIS/OEIS (from 1,000 to 6,255). Sonobuoy wires expended in Inland Waters would be the same as Alternative 1 (Table 3.0-19) and would increase compared to the 2015 NWTT Final EIS/OEIS (from 6 to 48). The activities that expend wires and cables would generally occur in the same locations and in a similar manner as were analyzed previously. As stated in the 2015 NWTT Final EIS/OEIS, the impact of wires and cables on fishes would be inconsequential for the same reasons discussed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon are not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of wires and cables during testing activities, as described under Alternative 2, would have no effect on critical habitat for steelhead, coho, sockeye, Pacific eulachon, bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of wires and cables may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species, and may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS). The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of wires and cables associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.1.3 Impacts from Wires and Cables Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5.2 Impacts from Decelerators/Parachutes

Decelerators/parachutes include small, medium, large, and extra-large decelerator parachutes (Table 3.0-20).

3.9.3.5.2.1 Impacts from Decelerators/Parachutes Under Alternative 1

Impacts from Decelerators/Parachutes Under Alternative 1 for Training Activities

Under Alternative 1, the total number of decelerators/parachutes that would be expended during training activities increases (9,097 to 9,456) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (8,928 to 9,354), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area decreases from 24 to 4, and the number of large decelerators/parachutes in the Offshore Area decreases from 145 to 98 (Table 3.0-20). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same.

As described in the 2015 NWTT Final EIS/OEIS, it would be very unlikely that fishes would encounter and become entangled in any decelerators/parachutes or sonobuoy accessories. This is mainly due to the size of the range complexes and the resulting widely scattered decelerators/parachutes. If a few individual fish were to encounter and become entangled in a decelerator/parachute, the growth, survival, annual reproductive success, or lifetime reproductive success of the population as a whole would not be impacted directly or indirectly.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during with training activities, as described under Alternative 2, would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and would have no effect on bocaccio rockfish and yelloweye rockfish. The use of decelerators/parachutes may affect critical habitat for green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

<u>**Impacts from Decelerators/Parachutes Under Alternative 1 for Testing Activities**</u>

Under Alternative 1, the total number of decelerators/parachutes that would be expended during testing activities increases (1,181 to 1,983) compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area increases (1,068 to 1,759), and increases from 113 to 224 in the Inland Waters. No other sizes of decelerators/parachutes are proposed during testing activities. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons presented above for wires and cables.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of decelerators/parachutes may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.2.2 Impacts from Decelerators/Parachutes Under Alternative 2

<u>**Impacts from Decelerators/Parachutes Under Alternative 2 for Training Activities**</u>

Under Alternative 2, the total number of decelerators/parachutes that would be expended during training activities increases compared to the number proposed for use under Alternative 1 (from 9,456 to 9,563) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (9,097 to 9,563). As shown in Table 3.0-20, the expenditure of small size decelerators/parachutes in the Offshore Area is proposed to increase (9,354 to 9,394), and no small decelerators/parachutes are proposed to be used in the Inland Waters, where none were proposed previously. The number of medium decelerators/parachutes in the Offshore Area increases from 4 to 24 compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The number of large decelerators/parachutes in the Offshore Area increases from 98 to 145 (Table 3.0-20) compared to Alternative 1 and is the same as the 2015 NWTT Final EIS/OEIS. The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Because the number and locations of these decelerators/parachutes is similar to those analyzed in the 2015 NWTT Final EIS/OEIS, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons detailed above under Alternative 1.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during with training activities, as described under Alternative 2, would have no effect on critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS) and would have no effect on bocaccio rockfish and yelloweye rockfish. The use of decelerators/parachutes may affect critical habitat for green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Decelerators/Parachutes Under Alternative 2 for Testing Activities

Under Alternative 2, the total number of decelerators/parachutes that would be expended during testing activities increases compared to the number proposed for use under Alternative 1 (from 1,983 to 1,991) (Table 3.0-20) and in the 2015 NWTT Final EIS/OEIS (1,181 to 1,991). As shown in Table 3.0-20, the expenditure of small decelerators/parachutes would be the same in the Offshore Area compared to Alternative 1 and increase compared to the 2015 NWTT Final EIS/OEIS (from 1,068 to 1,759). The expenditure of small decelerators/parachutes in Inland Waters would increase compared to both Alternative 1 (224 to 232) and the previous analysis (113 to 232). The activities that expend decelerators/parachutes would generally occur in the same locations and in a similar manner as were analyzed previously. Even though the number of decelerators/parachutes would increase during testing activities, the locations are similar to those analyzed in the 2015 NWTT Final EIS/OEIS, and impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, the impact of decelerators/parachutes on fishes would be inconsequential for the same reasons presented above for wires and cables.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of decelerators/parachutes may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of decelerators/parachutes associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.2.3 Impacts from Decelerators/Parachutes Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.5.3 Impacts from Biodegradable Polymer

Biodegradable polymers were not proposed for use in the 2015 NWTT Final EIS/OEIS, and for this Supplemental would be used only during proposed testing activities, not during training activities. For a discussion of where biodegradable polymers are used and how many activities would occur under each alternative, see Section 3.0.3.5.3 (Biodegradable Polymer). The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft, rendering it ineffective. A biodegradable polymer is a high molecular weight polymer that degrades to smaller compounds as a result of microorganisms and enzymes. The rate of biodegradation could vary from hours to years and the type of small molecules formed during degradation can range from complex to simple products, depending on whether the polymers are natural or synthetic (Karlsson & Albertsson, 1998). Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will break down into small pieces within a few days to weeks. This will break down further and dissolve into the water column within weeks to a few months. The final products which are all environmentally benign will be dispersed quickly to undetectable concentrations. Unlike other entanglement stressors, biodegradable polymers only retain their strength for a relatively short period of time, therefore the potential for entanglement by a fish would be limited. Furthermore, the longer the biodegradable polymer remains in the water, the weaker it becomes making it more brittle and likely to break. A fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. If a fish were to encounter the polymer a few hours after it was expended, it is very likely that it would break easily and would no longer be an entanglement stressor.

3.9.3.5.3.1 Impacts from Biodegradable Polymer Under Alternative 1

Impacts from Biodegradable Polymer Under Alternative 1 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 1.

Impacts from Biodegradable Polymer Under Alternative 1 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to only be conducted in the Inland Waters under Alternative 1. The impact of biodegradable polymers on fish would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time and a fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of biodegradable polymers during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of biodegradable polymers may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymers associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.5.3.2 Impacts from Biodegradable Polymer Under Alternative 2

Impacts from Biodegradable Polymer Under Alternative 2 for Training Activities

No biodegradable polymers are proposed to be used for training activities under Alternative 2.

Impacts from Biodegradable Polymer Under Alternative 2 for Testing Activities

As shown in Table 3.0-21, four testing activities involving the use of biodegradable polymers are proposed to be conducted in the Inland Waters under Alternative 2, the same as Alternative 1. The impact of biodegradable polymers on fishes would be inconsequential because biodegradable polymers only retain their strength for a relatively short period of time and a fish would have to encounter the biodegradable polymer immediately after it was expended for it to be a potential entanglement risk. As detailed above and in the 2015 NWTT Final EIS/OEIS, fish are not particularly susceptible to entanglement stressors, including biodegradable polymers and would likely only be temporarily disturbed.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of biodegradable polymers during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of biodegradable polymers may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of biodegradable polymers associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.5.3.3 Impacts from Biodegradable Polymer Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Entanglement stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would remain unchanged after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer entanglement stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for entanglement impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.6 Ingestion Stressors

The ingestions stressors that may impact fishes include military expended materials from munitions (non-explosive practice munitions and fragments from high-explosives) and military expended materials other than munitions (fragments from targets, chaff and flare components, decelerators/parachutes, and biodegradable polymers). Biodegradable polymer is a new stressor not previously analyzed, but the other stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

3.9.3.6.1 Impacts from Military Expended Materials – Munitions

The military expends materials during training and testing in the Study Area that could become ingestion stressors, including non-explosive practice munitions (small- and medium-caliber), fragments from explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small decelerators/parachutes. Metal items eaten by marine fish are generally small (such as fishhooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological impacts could occur as a result of consuming metal or plastic materials (Dantas et al., 2012; Davison & Asch, 2011; Possatto et al., 2011). Ingestion of plastics has been shown to increase hazardous chemicals in fish leading to liver toxicity of fishes (Rochman et al., 2013). Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential impact on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small decelerators/parachutes, and end caps and pistons from flares and chaff cartridges are considered to be of ingestible size for a fish.

3.9.3.6.1.1 Impacts from Military Expended Materials – Munitions Under Alternative 1

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 1 decreases from ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, as described in Section 3.1.4.1 (Explosives and Explosive Byproducts) and Table 3.1-7 in the 2015 NWTT Final EIS/OEIS, the majority of explosives byproducts from commonly used explosives materials that may be consumed (by fishes) are naturally occurring compounds in the marine environment. For example, 98 percent (by weight) of the explosives byproducts of royal demolition explosive (RDX) consistent of nitrogen, carbon dioxide, water, carbon monoxide, ammonia, and hydrogen. An encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out, and would not consume toxic materials. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials- munitions of ingestible size during with training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials- munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials- munitions of ingestible size associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials – munitions that would be used during testing activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions (non-explosive practice munitions and fragments from high explosives) are combined, the number of items proposed to be expended under Alternative 1 increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials- munitions of ingestible size during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials- munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials- munitions of ingestible size associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.6.1.2 Impacts from Military Expended Materials – Munitions Under Alternative 2

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Training Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during training activities (Table 3.0-14 and Table 3.0-16) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 increases compared to both Alternative 1 (Table 3.0-14 and Table 3.0-16) and ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials- munitions of ingestible size during with training activities, as described under Alternative 2, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials- munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials- munitions of ingestible size associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials – munitions that would be used during testing activities is generally consistent with the number proposed for use under Alternative 1 (Table 3.0-14 and Table 3.0-16) and greater than the numbers presented in in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from munitions are combined, the number of items proposed to be expended under Alternative 2 decreases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same as stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials- munitions of ingestible size during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials- munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials- munitions of ingestible size associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.6.1.3 Impacts from Military Expended Materials – Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for ingestion impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.6.2 Impacts from Military Expended Materials – Other than Munitions

3.9.3.6.2.1 Impacts from Military Expended Materials – Other than Munitions Under Alternative 1

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Training Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during training activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 1 increases from ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might “taste” an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during with training activities, as described under Alternative 1, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials other than munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with training activities, as described under Alternative 1, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military expended materials other than munitions that would be used during testing activities (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) decreases compared to the number proposed for use in the 2015 NWTT Final EIS/OEIS. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to fishes. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during testing activities, as described under Alternative 1, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials other than munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with testing activities, as described under Alternative 1, may affect EFH species within the Study Area.

3.9.3.6.2.2 Impacts from Military Expended Materials – Other than Munitions Under Alternative 2

<u>Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Training Activities</u>

Under Alternative 2, the number of military expended materials other than munitions that would be used during training activities is generally consistent with the number proposed for use under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials other than munitions (fragments from targets, chaff and flare components, and biodegradable polymers) are combined, the number of items proposed to be expended under Alternative 2 increases slightly compared to Alternative 1 and increases compared to ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on fishes would be expected to be the same. As stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during with training activities, as described under Alternative 2, would have no effect on critical habitat for bull trout (Coastal Puget Sound DPS), bocaccio rockfish (Puget Sound/Georgia Basin DPS), and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials other than munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with training activities, as described under Alternative 2, may affect EFH species within the Study Area.

Impacts from Military Expended Materials – Other than Munitions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military expended materials other than munitions that would be used during testing activities is increased compared to the number proposed for use under Alternative 1 (Table 3.0-17, Table 3.0-20, Table 3.0-21, and Table 3.0-22) and decreases slightly from ongoing activities. Other than the addition of biodegradable polymer, which would occur four times annually in the Inland Waters, the activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material will breakdown into small pieces within a few days to weeks, eventually dissolving into the water column as environmentally benign products. Being benign, if ingested, the remnants of the biodegradable polymer would pose limited risk to fishes. Even though there would be a substantial increase in the number of military expended material – other than munitions and as stated in the 2015 NWTT Final EIS/OEIS and above under Alternative 1, ingestion of military expended materials other than munitions could result in sublethal or lethal effects to a small number of individuals, but the likelihood of a fish encountering an expended item is dependent on where that species feeds and the amount of material expended. Furthermore, an encounter may not lead to ingestion, as a fish might "taste" an item and then expel it, in the same manner that a fish would take a lure into its mouth then spit it out. Therefore, the number of fishes potentially impacted by ingestion of military expended materials such as munitions would be low and population-level effects are not expected.

Designated critical habitat for steelhead, coho, sockeye, and Pacific eulachon is not present in the Study Area and would not be impacted.

Pursuant to the ESA, the use of military expended materials other than munitions of ingestible size during testing activities, as described under Alternative 2, would have no effect on critical habitat for bocaccio rockfish (Puget Sound/Georgia Basin DPS) and yelloweye rockfish (Puget Sound/Georgia Basin DPS). The use of military expended materials other than munitions of ingestible size may affect critical habitat for Chinook (Puget Sound ESU), chum salmon (Hood Canal Summer-Run ESU), bull trout (Coastal Puget Sound DPS), and green sturgeon (Southern DPS), and may affect ESA-listed salmonid species, green sturgeon, Pacific eulachon, and rockfish species. The Navy will consult with NMFS and USFWS, as required by section 7(a)(2) of the ESA.

Pursuant to the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations, the use of military expended materials other than munitions of ingestible size associated with testing activities, as described under Alternative 2, may affect EFH species within the Study Area.

3.9.3.6.2.3 Impacts from Military Expended Materials – Other than Munitions Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Ingestion stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer ingestion stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for ingestion impacts on individual fish, but would not measurably improve the status of fish populations or subpopulations.

3.9.3.7 Secondary Stressors

Stressors from training and testing activities could pose secondary or indirect impacts on fishes via habitat, sediment, and water quality. These include (1) explosives and byproducts; (2) metals; (3) chemicals; (4) other materials such as targets, chaff, and plastics; and (5) impacts on fish habitat.

While the number of training and testing activities would change under this supplement, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.9.3.6 (Secondary Stressors) remains valid. The changes in training and testing activities are not substantial and would not result in an overall change to existing environmental conditions or an increase in the level or intensity of secondary stressors within the Study Area.

As stated in the 2015 NWTT Final EIS/OEIS, indirect impacts of explosives and unexploded ordnance on marine fishes via water could not only cause physical impacts, but prey might also have behavioral reactions to underwater sound. For example, the sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Secondary impacts from underwater explosions would be temporary, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts of underwater detonations and explosive ordnance use under the proposed action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Study Area.

Indirect impacts of explosives and unexploded ordnance to fishes via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways is discussed in Section 3.1 (Sediments and Water Quality). Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen & Lotufo, 2010). TNT and its degradation products impact developmental processes in fishes and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al., 2008; Rosen & Lotufo, 2010). It is likely that various lifestages of fishes could be impacted by the indirect impacts of degrading explosives within a very small radius of the explosive (1–6 ft.), but these impacts are expected to be short term and localized.

Certain metals are harmful to fishes at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang & Rainbow, 2008). Metals are introduced into seawater and sediments as a result of Navy training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials. Indirect impacts of metals to fishes via water involve concentrations that are several orders of magnitude lower than concentrations achieved via bioaccumulation in the sediments. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in seawater are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fishes would be indirectly impacted by toxic metals via the water.

Several military training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants for rockets, missiles, and torpedoes. The greatest risk to fishes from flares, missile, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Fishes may be exposed by contact with contaminated water or ingestion of contaminated sediments. Since perchlorate is highly soluble, it does not readily absorb to sediments. Therefore, missile and rocket fuel poses no risk of indirect impact on fishes via sediment. In contrast, propylene glycol dinitrate and nitrodiphenylamine, the principal toxic components of torpedo fuel (OTTO Fuel II), adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Sun et al., 1996; U.S. Department of the Navy, 1996a, 1996b; Walker & Kaplan, 1992). It is conceivable that various lifestages of fishes could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades.

As described in the 2015 NWTT Final EIS/OEIS, some military expended materials (e.g., decelerators/parachutes) could become remobilized after their initial contact with the sea floor (e.g., by waves or currents) and could be reintroduced as an entanglement or ingestion hazard for fishes. In some bottom types (without strong currents, hard-packed sediments, and low biological productivity), items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. While these items remain intact sitting on the bottom, they could potentially remain ingestion hazards. These potential impacts may cease only (1) when the military expended materials are too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials become encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials become permanently buried. In this scenario, a parachute could initially sink to the seafloor, but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result. The entanglement stressor would eventually cease to pose an entanglement risk as it becomes encrusted or buried, or degrades.

Secondary stressors can also involve impacts on habitat (sediment or water quality) or prey (i.e., impacting the availability or quality of prey) that have the potential to affect fish species. Secondary stressors that may affect ESA-listed species only include those related to the use of explosives. Secondary effects on prey and habitat from the release of metals, chemicals, and other materials into the marine environment during training and testing activities are not anticipated. In addition to directly impacting ESA-listed species, underwater explosives could impact other species in the food web, including those that these species prey upon. The impacts of explosions would differ depending upon the type of prey species in the area of the blast. In addition to physical effects of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to explosions that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals. The abundances of prey species near the detonation point could be diminished for a short period of time, affecting prey availability for ESA-listed species feeding in the vicinity. Any effects to prey, other than those located within the impact zone when the explosive detonates, would be temporary. Direct impacts on fishes by affecting the availability or quality of prey is low and would not be expected.

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3.10 Cultural Resources

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3.10 Cultural Resources

3.10.1 Affected Environment

The National Environmental Policy Act (NEPA) requires consideration of impacts on the "human environment" consisting of natural, built, and social environments and the relationship of people to them through culture. Compliance requirements for cultural resources are established by federal statutes (out to 12 nautical miles [NM] from shore), state law in specific circumstances, regulations, and executive orders that are presented in detail in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (U.S. Department of the Navy, 2015).

Sociocultural elements, such as traditions, lifeways, religious practices, community values, and social institutions may be considered by some groups to be types of cultural resources, especially within tribal communities whose traditional interaction with the natural world is integral to their culture. Considering the social consequences of a proposed action is challenging and arguably better addressed within the framework of a separate and holistic social impact assessment. This supplement, however, is organized using the 2015 NWTT Final EIS/OEIS, which sought to consider cultural and historic elements of the human environment within and between the three following sections: Section 3.10 (Cultural Resources), Section 3.11 (American Indian and Alaska Native Traditional Resources), and Section 3.12 (Socioeconomic Resources). Combined, these sections seek to provide a full analysis of the potential impacts from the Proposed Action on sociocultural elements of American Indian/Alaska Native communities and American history. For the purposes of this section, discussions of impacts to cultural resources will primarily focus on physical cultural resources such as those defined in the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act, and other types described in the 2015 NWTT Final EIS/OEIS. Other resources considered to be of cultural significance include air, water, and other wildlife. Impacts to these resources are discussed in Section 3.1 (Sediments and Water Quality), Section 3.2 (Air Quality), Section 3.3 (Marine Habitats), Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), Section 3.6 (Birds), Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fishes).

The Supplemental EIS/OEIS (Supplemental) must be read in conjunction with the 2015 NWTT Final EIS/OEIS and Record of Decision, which provide more detailed and in-depth information.

In this section cultural resources are divided into three major categories:

- Archaeological
- Architectural
- Traditional

For the purposes of this analysis, the Study Area is largely confined to the water and air, with potential impacts on land under Military Operations Areas on the Olympic Peninsula. Therefore, the archaeological discussion of this section focuses on pre-contact inundated sites, and shipwrecks and submerged aircraft that have archaeological value but have lost structural integrity to a sufficient degree they are no longer able to convey their history to divers and other members of the public. Architectural resources include standing buildings, structures, landscapes, and other built-environment resources of historic or aesthetic significance, but for this analysis primarily consist of structurally integral shipwrecks and submerged aircraft. Traditional cultural resources may include archaeological sites, structures, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that American Indians or other groups consider essential for the preservation of traditional culture.

The 2015 NWTT Final EIS/OEIS Study Area, as defined in the NHPA, reflected the fact that there were no activities with the potential to directly impact cultural resources or impact historic properties on land. For this Supplemental, the Navy conducted a Noise Study (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Areas) for aircraft training activities conducted within Special Use Airspace (SUA) comprising the Olympic Military Operations Areas (MOAs), the Warning Areas W-237A and W-237B, and transit routes of flight to the MOAs and back, which is a typical event. On-land cultural resources are discussed in this section, but the focus remains on the in-water events as there are no activities with the potential to directly impact cultural resources on land. Reflecting this marine focus, the Navy will continue to assess direct stressors on submerged prehistoric sites, shipwrecks and submerged aircraft (resources that fit in either the archaeological or architectural categories, depending on their structural integrity), and will consider indirect auditory (noise), visual, and atmospheric stressors on traditional cultural resources in this Supplemental. Traditional cultural resources associated with beliefs or cultural practices of a living culture, subculture, or community. These beliefs and practices must be rooted in the group's history and must be important in maintaining the cultural identity of the group. Prehistoric archaeological sites and artifacts, historic and contemporary locations of traditional events, sacred places, landscapes, and resource collection areas, including fishing, hunting, and gathering areas, may be traditional cultural resources. The Affected Environment discussion is organized by area (i.e., the Offshore Area, Inland Waters, Western Behm Canal).

As stated in the 2015 NWTT Final EIS/OEIS, the United States (U.S.) is a party to The Convention Concerning the Protection of the World Cultural and Natural Heritage. Accordingly, the Department of Defense's cultural resources policy and environmental regulations require compliance with the terms of the Convention. The addendum (addendum section 402) to the National Historic Preservation Act (recodified at 54 United States Code part 307101[e], *Consideration of Undertaking on Property, International Federal Activities Affecting Historic Properties*) requires an assessment by federal agencies of project impacts on historic properties located outside U.S. territorial waters that are identified on the World Heritage List or on the applicable country's equivalent of the NRHP. The Olympic National Park in Washington is the only World Heritage site in the Study Area.

3.10.1.1 Archaeological

In the 2015 NWTT Final EIS/OEIS, as discussed in Section 3.10.2.1 (Marine Archaeological Sites), potential marine archaeological sites and features included prehistoric sites associated with early maritime migrations inundated during deglaciation and located on the continental shelf, and prehistoric and historic sites that were intentionally placed in or under water such as canoe runs; petroglyphs and pictographs; fish weirs and traps; reef net anchors; trash dumps; piers, wharves, docks, and bridges; dams; and marine railways (Stilson et al., 2003). In this Supplemental, information is presented for pre-contact archaeology underwater within the Study Area.

Coastal (i.e., from the low tide line to the high tide line) archaeological sites within the Study Area have largely been recognized in two settings: shell middens in littoral areas and sites located in riverine areas. In general, shell middens occur just above the mean high tide line. The oldest dated coastal shell midden site in Washington is approximately 4,000 years old, but the majority are less than 3,000 years old as that is around the time when the current sea level stabilized. Shell middens may indicate sites such as villages, camp sites, or shellfish processing areas that contain organically rich dark soil with shell fragments or shells, artifacts, and fire-cracked rocks near saltwater shorelines (Stilson et al., 2003). Pre-contact marine archaeological sites recognized by Stilson in Washington include canoe runs; petroglyphs and pictographs; fish weirs and traps; reef net anchors; and shell middens (Stilson et al., 2003).

3.10.1.1.1 Offshore Area

The Offshore Area only comes into contact with the shore at the Quinault Range Site, and there are no known terrestrial or inundated sites at this location. Based on the predictive model used in the 2015 NWTT Final EIS/OEIS (ICF International et al., 2013), the Offshore Area has an increased probability for inundated prehistoric sites in the large embayments of Gray's Harbor and Willapa Bay, which were produced as rising sea level drowned large incised river valleys of the paleolandscape. No subsurface sampling of marine deposits has been conducted, and no inundated prehistoric sites have been identified. Based on data sources reviewed in the 2015 NWTT Final EIS/OEIS (Section 3.10.1.3.2, Data Sources), no pre-contact archaeological features in or under water have been identified in the Offshore Area since the review of data sources from 2015.

Olympic Peninsula

The Olympic MOAs and other restricted or warning area airspace are situated over areas of the Olympic Peninsula. Though the MOAs overlay federal, tribal, state, municipal, and private lands, the cultural resources found within the Olympic National Park provide a representation of those found on the Olympic Peninsula. Interwoven throughout the Olympic National Park's diverse landscape is an array of cultural and historic sites that tell the human story of the park. More than 650 archeological sites document 12,000 years of human occupation of Olympic National Park lands. Historic sites reveal clues about the 200-year history of exploration, homesteading, and community development in the Pacific Northwest (U.S. Department of the Interior, 2016). There are two sites listed in the NRHP located within the Olympic National Park: the Ozette Indian Village Archeological Site (74000916) and the Wedding Rock Petroglyphs (76000951).

3.10.1.1.2 Inland Waters

Based on the predictive model used in the 2015 NWTT Final EIS/OEIS (ICF International et al., 2013), the Inland Waters have a lower probability for inundated prehistoric sites because of the lack of paleolandscape features (e.g., estuaries and streams) associated with concentrated resource availability. No subsurface sampling of marine deposits has been conducted, and no inundated prehistoric sites have been identified. Based on data sources reviewed in the 2015 NWTT Final EIS/OEIS (Section 3.10.1.3.2, Data Sources), no prehistoric or historic sites that were intentionally placed in or under water have been identified in the Study Area.

3.10.1.1.3 Western Behm Canal, Alaska

As discussed in the 2015 NWTT Final EIS/OEIS, a predictive model developed by Monteleone (2013) did not identify specific paleolandscape settings of inundated prehistoric sites associated with early maritime migrations. Although underwater surveys were conducted to test the model, no areas in the Western Behm Canal were surveyed (Monteleone, 2013). No inundated prehistoric sites have been previously identified in the Western Behm Canal. The Western Behm Canal portion of the Study Area meets the shore in many places; however, pre-contact archaeological resources are not located within the Study Area. Therefore, this category is not discussed further for the Western Behm Canal.

3.10.1.2 Architectural

As discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.2.2 (Known Wrecks, Obstructions, Occurrences, or Unknowns), submerged resources in the region may include shipwrecks, airplanes, or pieces of ship components, such as cannons or guns. After review of the National Register Information System, National Oceanic and Atmospheric Administration Automated Wreck and Obstruction

Information System, and Bureau of Ocean Energy Management's Alaskan shipwreck inventory data regarding submerged cultural resources in the region of influence (Bureau of Ocean Energy Management, 2011; National Oceanic and Atmospheric Administration, 2017; National Park Service, 2017), the information from the 2015 NWTT Final EIS/OEIS has been updated in the sections that follow and is depicted in red-orange dots as new shipwrecks or obstructions in Figure 3.10-1, Figure 3.10-2, Figure 3.10-3, Figure 3.10-4, and Figure 3.10-5. Additional discoveries are made as survey methods become more sophisticated and new areas explored.

3.10.1.2.1 Offshore Area

As presented in the 2015 NWTT Final EIS/OEIS, the eastern boundary of the Offshore Area at Washington abuts the coastline and includes a 1-mile-wide surf zone of Quinault Range Site. The Offshore portion of the Study Area contains several Navy shipwrecks and submerged naval aircraft (Grant et al., 1996). Besides the Quinault Range Site, the Offshore Area contains wrecks such as *Prince Arthur* in 1903, the *P.J. Pirrie* in 1920, nine ships wrecked between Quillayute Rocks and Cape Alava, five at Destruction Island, and four near Hoh Head (National Oceanic and Atmospheric Administration, 1993). The documented submerged cultural resources in and near the Study Area are primarily associated with maritime trade, transport, and military activities, and include many shipwrecks. In particular, the Olympic coast of Washington is a ship graveyard as a result of the isolated, rocky shores; heavy ship traffic; and ferocious weather and wave action. As shown in Figure 3.10-1**,** more than a dozen wrecks have been documented in and near the Olympic Coast National Marine Sanctuary (Galasso, 2017).

In Oregon and Northern California, the Study Area boundary is 12 NM off the coastline (Chief of Naval Operations Instruction M-5090.1). Cultural resources discovered in the international waters of the Offshore Area would not be listed in either the state registers or the NRHP. However, it is Navy policy to treat shipwrecks and other unclassified, potentially cultural, obstructions as though they are eligible for the NRHP within U.S. territorial waters. Known shipwrecks and obstructions off the coast of Oregon and Northern California are shown in Figure 3.10-1**.**

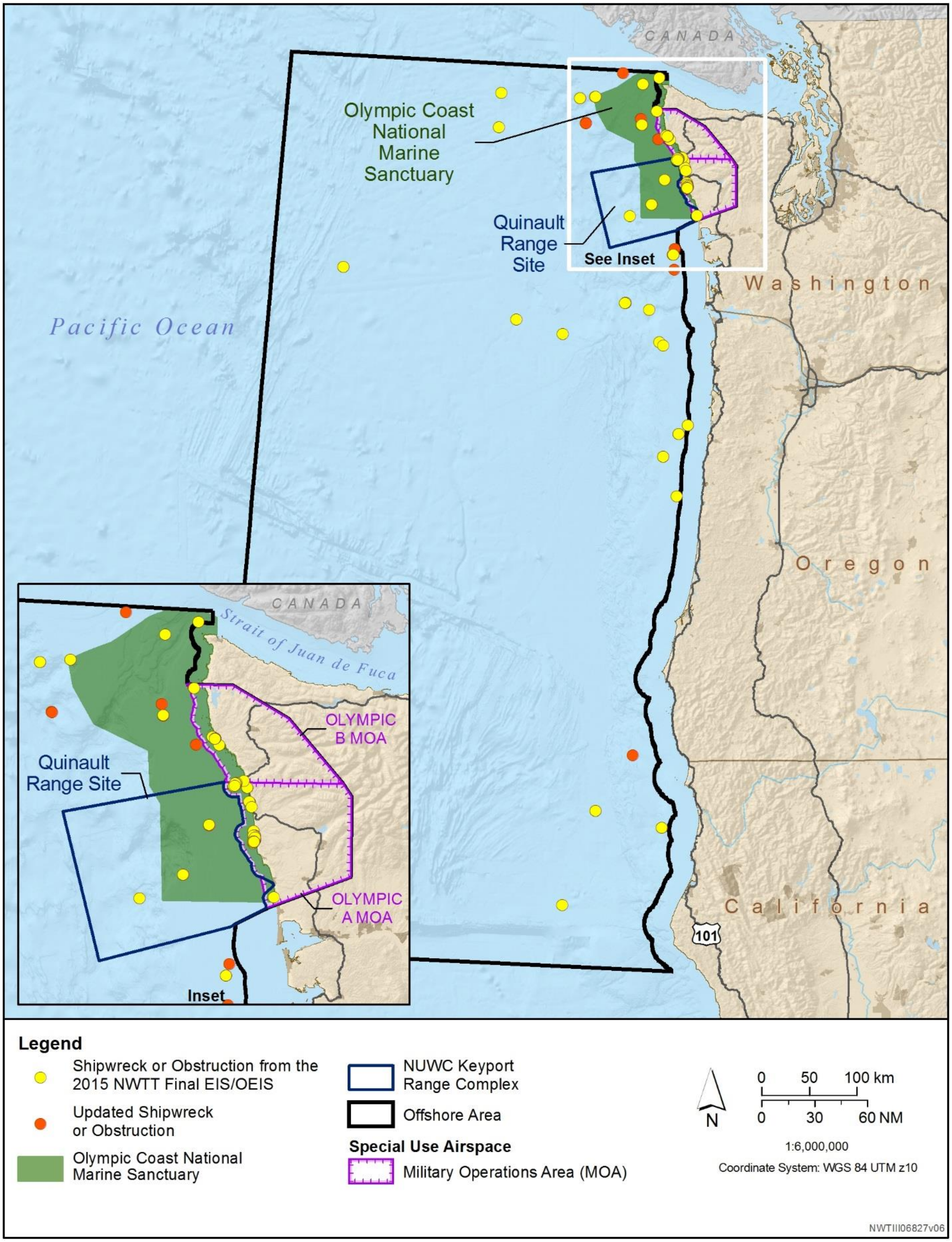

Figure 3.10-1: Known Shipwrecks and Obstructions in the Offshore Area

3.10.1.2.1.1 Olympic Peninsula

The MOAs over the Olympic Peninsula are part of the Study Area and there are 31 sites listed in the NRHP located within the Olympic National Park, including historic districts, stations, and other architectural resources. Under the Olympic MOAs on the Olympic Peninsula, seven sites are listed or eligible for listing in the NRHP. These sites are the Beaver School, Fifteen Mile Shelter, Pelton Creek Shelter, Kestner Homestead, Destruction Island Light Station, Lake Quinault Lodge, and Ole Mickelson Cabin.

These sites are also listed in the Washington Heritage Register. Under the MOAs there are three sites (Huelsdonk Homestead, Adam House Copeland, and Smith-Mansfield House) listed in the Washington Heritage Register and three other sites (Wesseler Barn, Barn and the Fletcher, Fred Barn) listed in the Washington Heritage Barn Register.

3.10.1.2.2 Inland Waters

As presented in the 2015 NWTT Final EIS/OEIS, the Inland Waters contain an extensive collection of wrecks and submerged aircraft as shown in Figure 3.10-2, Figure 3.10-3, and Figure 3.10-4. Updated data or newly discovered shipwrecks and obstructions since the publishing of the 2015 NWTT Final EIS/OEIS are shown in red on the figures. Six known shipwrecks lie within 2 miles of the shoreline boundary of Naval Base Kitsap Bangor (Figure 3.10-4). More than 10 shipwrecks are within or near the Naval Undersea Warfare Center Division, Keyport Range Complex, including the *Laurel*, the *Elk*, the *A.R. Robinson*, the *R.M. Hasty*, the *Orion*, the *B.C. Company No. 4*, the *Union*, the *Curlew*, the *Nokomis*, and an unnamed vessel, as shown in Figure 3.10-4 (U.S. Department of the Navy, 2010, 2015).

3.10.1.2.3 Western Behm Canal, Alaska

As presented in the 2015 NWTT Final EIS/OEIS, the Western Behm Canal contains shipwrecks such as steamers, a skiff, a ferry, a salmon troller, and numerous gas screws; these shipwrecks may be eligible for the NRHP. The databases that were queried have been updated since publication of the 2015 NWTT Final EIS/OEIS, and results of the search indicate that there are no new shipwrecks or obstructions within or on the border of the Study Area (Figure 3.10-5). New or newly found shipwrecks and obstructions occur outside of the Southeast Alaska Acoustic Measurement Facility. Islands shown on Figure 3.10-5 are depicted differently than they were in the 2015 NWTT Final EIS/OEIS. The figure shown in the 2015 NWTT Final EIS/OEIS was incorrect in its depiction of these islands; that depiction has been corrected in this Supplemental.

This figure shows the known shipwrecks or obstructions in the Northern Part of the Inland Waters that were in the 2015 NWTT Final EIS/OEIS and have been updated since that time.

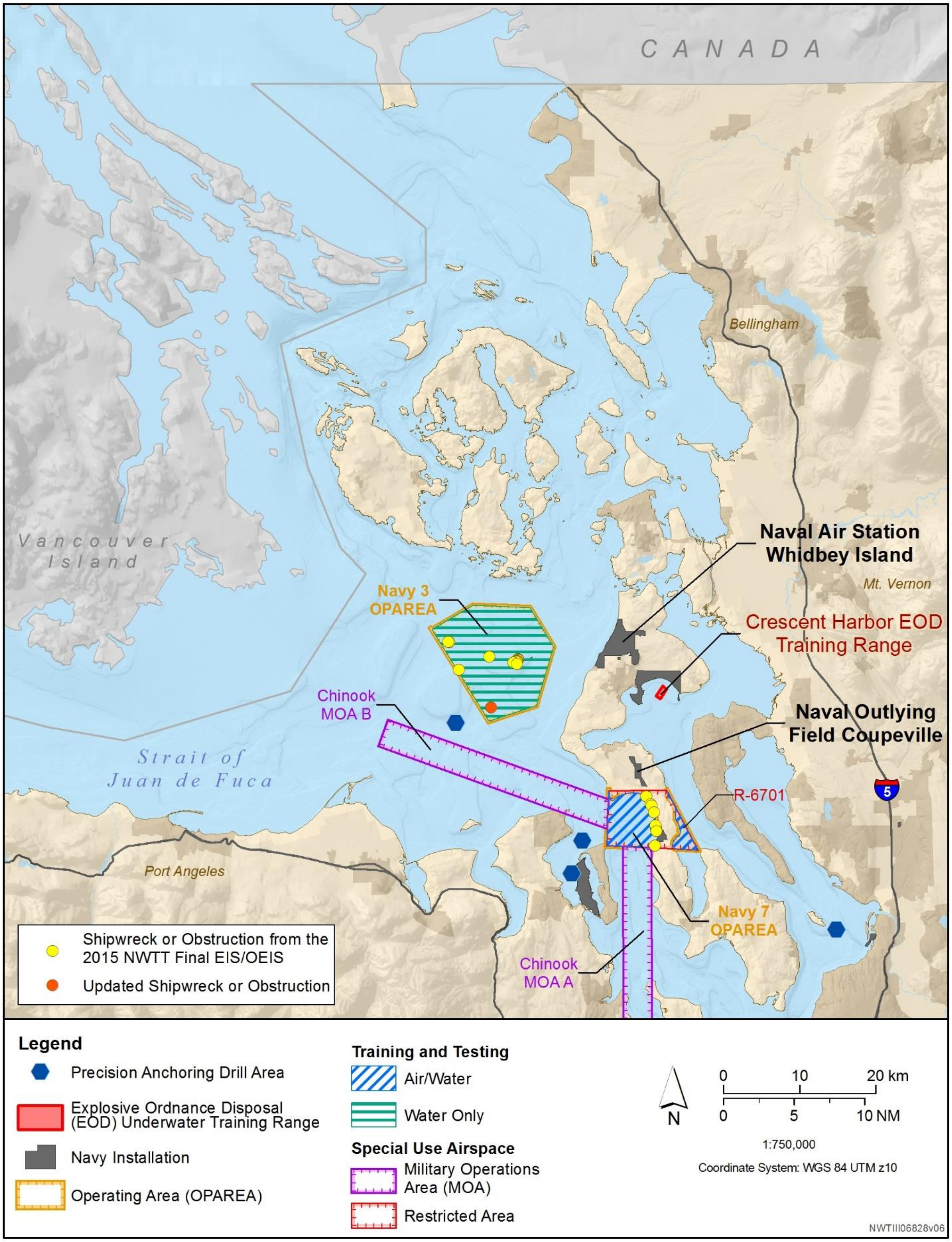

Figure 3.10-2: Known Shipwrecks and Obstructions in the Northern Part of the Inland Waters

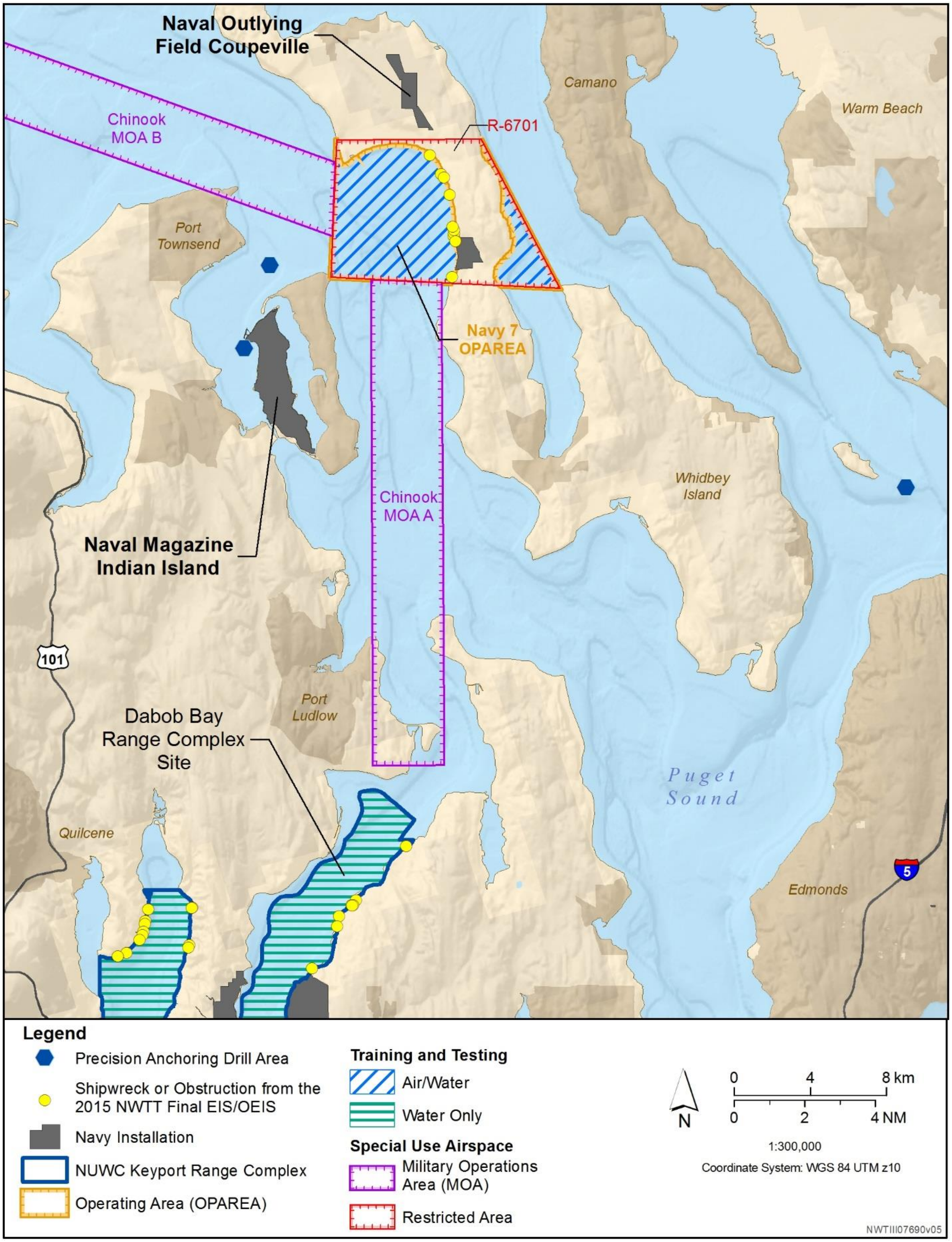

Figure 3.10-3: Known Shipwrecks and Obstructions in the Central Part of the Inland Waters

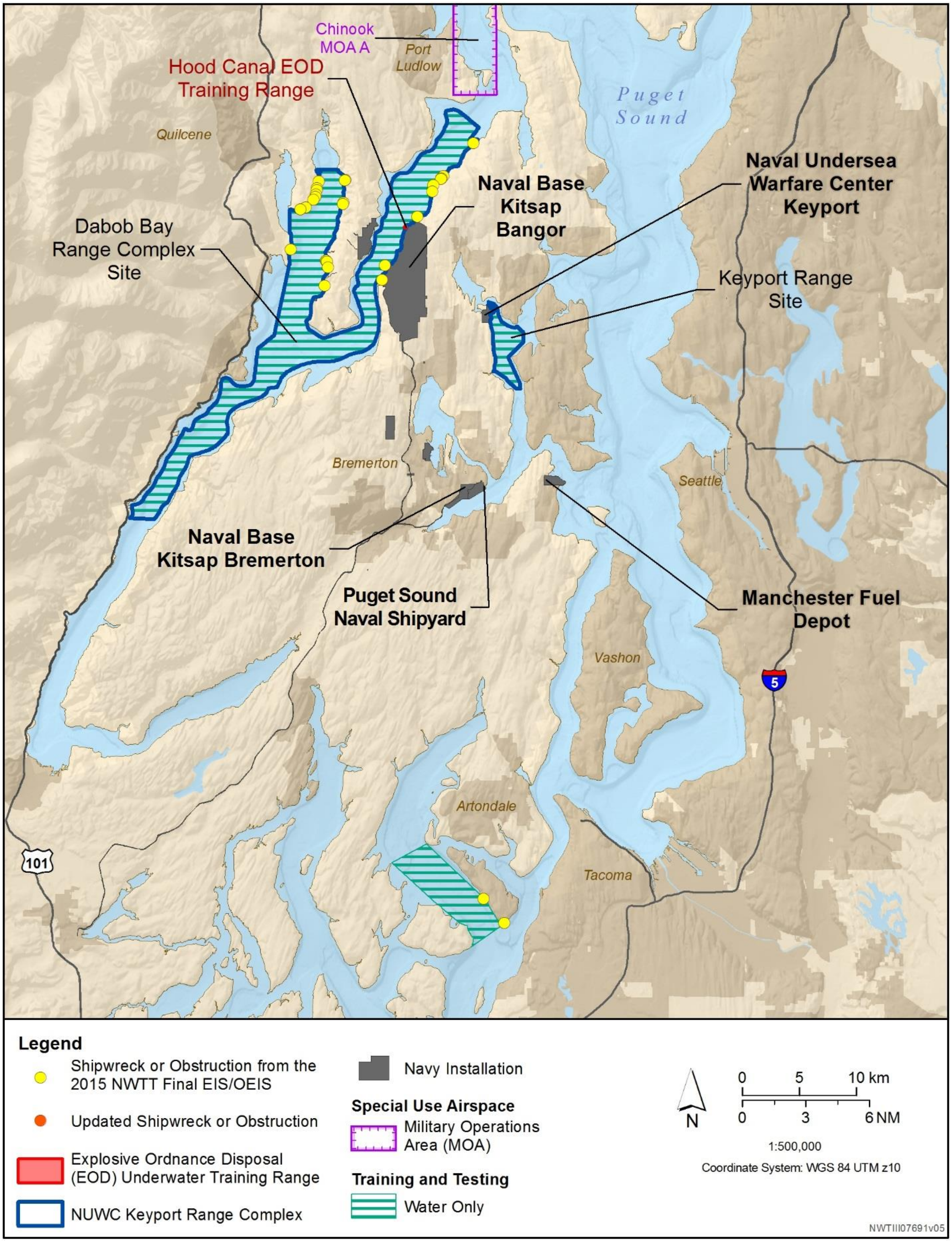

Figure 3.10-4: Known Shipwrecks and Obstructions in the Southern Part of the Inland Waters

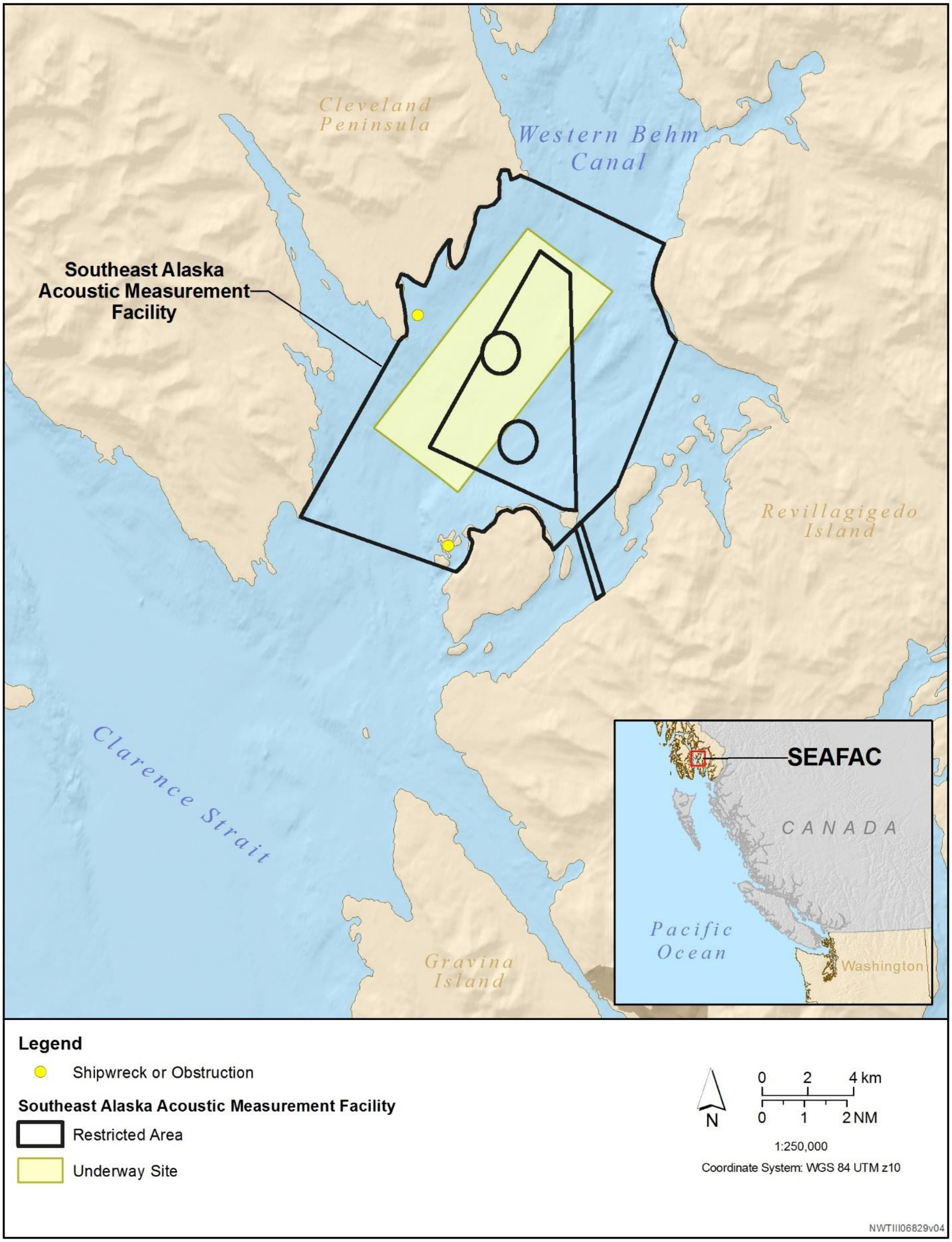

Figure 3.10-5: Known Shipwrecks and Obstructions in the Western Behm Canal, Alaska

3.10.1.3 Traditional Cultural Resources

Traditional cultural resources were defined, described, and identified within the Study Area in the 2015 NWTT Final EIS/OEIS. Traditional cultural resources can make up or be components of traditional cultural properties; properties of traditional, religious, and cultural importance; sacred sites; and traditional cultural landscapes. Some terms are specifically defined, while others have varied and evolving definitions. These types of resources and their definitions are often intrinsically tied to the unique cultural history and experience of a Tribe, Alaska Native, or other community in a specific area or place. Federal and state agencies have not identified a standardized way in the planning process to account and consider traditional cultural resources as they relate to living communities. The Navy is currently consulting to fulfill its statutory responsibilities with regards to traditional cultural resources that may be impacted by activities. The Navy intends to conduct a good faith effort to identify, assess, and, when possible, avoid or minimize impacts on them (see Section 3.11, American Indian and Alaska Native Traditional Resources, for detail on some of these natural resources with cultural value).

3.10.1.3.1 Offshore Area

To date, federally recognized tribes have expressed concerns regarding the adequacy of the Navy's consideration of the Tribe's natural, cultural, and social resources and potential impacts on those resources by Navy activities. Additionally, in comments provided by the Hoh Tribe during the scoping period for the NWTT Supplemental, the Tribe specifically requested that the Navy take further steps to address and consider its impacts on the Tribe's Traditional Cultural Landscape to "inform both the NEPA and NHPA processes and associated Navy responsibilities to identify impacts on the broad human-environment relationship resulting from project activities."

Ongoing consultations continue to further define traditional cultural properties in the Offshore Area. Therefore, traditional cultural resources are not discussed further for the Offshore Area.

3.10.1.3.1.1 Olympic Peninsula

Local communities are closely and directly linked to the Olympic Peninsula in culture, heritage, and tradition. They also provide important historical information and give meaning to the Peninsula's landscape. Six federally recognized Tribes of the Olympic Peninsula—the Hoh, Makah, Quinault, Quileute, Lower Elwha Klallam, and Jamestown S'Klallam—have lived in this area since time immemorial and continue to maintain strong relationships to the lands and waters. Within the Olympic Peninsula, the Olympic National Park's outstanding attributes have also led to international recognition. In 1976 the park was designated as an International Biosphere Reserve in the Man and the Biosphere Program by United Nations Educational, Scientific, and Cultural Organization. International recognition came again in 1981 when the park was declared a World Heritage Site by the World Heritage Convention, joining it to a system of natural and cultural properties that are considered irreplaceable treasures of outstanding universal value (U.S. Department of the Interior, 2016).

3.10.1.3.2 Inland Waters

The Port Gamble S'Klallam Tribe has indicated that the marine waters used by tribal fishermen are composed of a network of sites (including submerged, near shore, intertidal, and marine) within the context of a traditional cultural landscape; the tribe believes that this network of sites is likely to be considered eligible for the NRHP as a traditional cultural property. In March 2018, the Lummi Nation resolved the Salish Sea is eligible for listing in the NRHP as a National Historic Landmark and inclusion in the World Heritage List "for its association with the culture, traditions, and history of the Lummi people." Consultations will result in further identification of traditional cultural properties and inform the Navy as it assesses potential impacts to them.

3.10.1.3.3 Western Behm Canal, Alaska

After literary and academic research into this area, the Navy found that there were no cultural resources eligible for or listed in the NRHP or as traditional cultural properties identified in the Western Behm Canal. Additionally, no cultural resources eligible for or listed in the Alaska State Register have been identified in the Western Behm Canal.

3.10.1.4 Current Requirements and Practices

As stated in the 2015 NWTT Final EIS/OEIS, the Navy has established mitigation measures to reduce potential impacts on cultural resources from training and testing activities. Mitigation measures include using inert ordnance; avoiding known shipwreck sites; not conducting precision anchoring; explosive mine countermeasure and neutralization activities; or, explosive mine neutralization activities involving Navy divers within a certain distance of shipwrecks. See Appendix K (Geographic Mitigation Assessment) of this Supplemental for mitigation measures.

3.10.1.4.1 Avoidance of Obstructions

As stated in the 2015 NWTT Final EIS/OEIS, the military routinely avoids locations of known obstructions, including submerged cultural resources (Appendix K, Geographic Mitigation Assessment), such as historic shipwrecks. Known obstructions are avoided to prevent damage to sensitive equipment and vessels, and to ensure the accuracy of training and testing activities.

3.10.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS considered training and testing activities that were proposed to occur in the Study Area which may have the potential to impact cultural resources. The stressors applicable to cultural resources in the Study Area are similar to stressors in the 2015 NWTT Final EIS/OEIS and include

- **explosive** (in-water explosives)
- **physical disturbance, strike, visual intrusions** (anchors, deposition of military expended materials)
- **acoustic** (aircraft noise)
- **cultural** (limiting access/temporary change of use)
- **visual and atmospheric**

This section evaluates how and to what degree potential impacts on cultural resources from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities presented in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this Supplemental can be easily compared.

The Navy conducted a review of federal regulations and standards relevant to the treatment of cultural resources and reviewed literature published since 2015 for new information on cultural resources that could adjust the analysis presented in the 2015 NWTT Final EIS/OEIS. The analysis presented in this section also considers standard operating procedures discussed in Section 2.3.3 (Standard Operating Procedures) and mitigation measures that are presented in Chapter 5 (Mitigation) and Appendix K (Geographic Mitigation Assessment). The Navy would implement these measures to avoid potential impacts on cultural resources from stressors associated with the proposed training and testing activities. Mitigation measures and procedures for cultural resources will be developed with the Washington Department of Archaeology and Historic Preservation (the Washington State Historic Preservation Office) and the Alaska Department of Natural Resources, Division of Parks & Outdoor Recreation, Office of History and Archaeology and in consultation with consulting and interested parties.

3.10.2.1 Explosive Stressors

3.10.2.1.1 Impacts from Explosives

Explosive stressors that have the potential to impact cultural resources are shock (pressure) waves and vibrations from explosions (such as explosive torpedoes, missiles, bombs, and projectiles) and cratering created by underwater explosions. While the number of training and testing activities would change under this supplement, the locations of activities presented in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions) remain the same.

No training activities with underwater detonations on or near the ocean bottom are proposed in the Offshore Area or Western Behm Canal under any alternative, and no testing activities with underwater detonations on or near the ocean bottom are proposed in the Western Behm Canal portion of the Study Area under any alternative; therefore, only training activities in the Inland Waters portion of the Study Area and testing activities in the Offshore Area and Inland Waters will be analyzed for impacts from underwater explosives shock (pressure) waves and cratering.

3.10.2.1.1.1 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Under Alternative 1, there is no change to the level, type of training, or locations for training using explosives (see Table 3.0-7) in the Inland Waters; therefore, the analysis in the 2015 NWTT Final EIS/OEIS remains applicable. Training activities with an explosive stressor remain the same, the number and location of cultural resources has not changed significantly within the Study Area, and the military routinely avoids locations of known obstructions, which includes submerged historic resources as discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions). These events would occur in designated and well-established Explosive Ordnance Disposal (EOD) Training Ranges where no cultural resources have been identified. It is unlikely that these resources could be disturbed by the use of seafloor devices. Therefore, it is unlikely that cultural resources could be disturbed from shock waves or cratering created by underwater explosions during training activities that use explosives. As stated in the 2015 analysis, no impacts on cultural resources from shock waves created by underwater detonations are expected.

In summary, given that the training activities would be conducted in the same areas as described in the 2015 NWTT Final EIS/OEIS, the amount of shock (pressure) waves, vibrations, or cratering from explosives would not appreciably change the conclusions. Therefore, the conclusion from the 2015 NWTT Final EIS/OEIS, that no impacts on cultural resources from shock waves created by underwater detonations at depth are expected, remains valid. Explosive stressors resulting from underwater explosions creating shock (pressure) waves, vibrations, and cratering of the seafloor would not impact submerged cultural resources within the Study Area under Alternative 1 because known submerged cultural resources would be avoided during training exercises.

Impacts from Explosives Under Alternative 1 for Testing Activities

Under Alternative 1, mine countermeasure and neutralization testing and torpedo explosive testing activities are proposed in the Offshore Area. This is a new activity as compared to the 2015 NWTT Final EIS/OEIS (see Table 2.5-2). Although mine countermeasure and neutralization testing could occur on the sea floor, explosives would only be used in the water column at least 75 feet above the bottom. Torpedo explosive testing would also occur in the water column, as described in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2); although tempo would increase, the military routinely avoids locations of known obstructions, which includes submerged cultural resources as discussed in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions). Therefore, it is unlikely that cultural resources could be disturbed or destroyed from shock waves or cratering created by underwater explosions during testing activities. Therefore, no impacts on cultural resources from shock waves created by underwater detonations are expected.

3.10.2.1.1.2 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that would involve the use of underwater explosives in the Inland Waters would stay the same compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1) and would be the same compared to Alternative 1. These events would occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. It is unlikely that these resources could be disturbed by the use of seafloor devices.

In summary, given that the training activities would be conducted in the same areas as described in the 2015 NWTT Final EIS/OEIS, the amount of shock (pressure) waves, vibrations, or cratering from explosives would not appreciably change the conclusions. Therefore, the conclusion from the 2015 NWTT Final EIS/OEIS, that no impacts on cultural resources from shock waves created by underwater detonations at depth are expected, would remain valid. Therefore, the analysis presented in the 2015 NWTT Final EIS/OEIS, Section 3.10.3.1.1 (Impacts from Explosive Shock [Pressure] Waves from Underwater Explosions) and Section 3.10.3.1.2 (Impacts from Explosives – Cratering) remains valid. Explosive stressors resulting from underwater explosions creating shock (pressure) waves, vibrations, and cratering of the seafloor would not impact submerged cultural resources within U.S. territorial waters under Alternative 2 because known submerged cultural resources are avoided during training exercises.

Impacts from Explosives Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that would involve the use of underwater explosives in the Offshore Area would stay the same compared to the number of activities proposed in under Alternative 1. Therefore, underwater explosions under Alternative 2 would not impact cultural resources as described under Alternative 1.

3.10.2.1.1.3 Impacts from Explosives Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Explosive stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer explosive stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts on submerged cultural resources.

3.10.2.2 Physical Disturbance and Strike Stressors

3.10.2.2.1 Impacts from In-Water Devices

The physical disturbance and strike stressors that may impact cultural resources include military expended materials and seafloor devices.

3.10.2.2.1.1 Impacts from In-Water Devices Under Alternative 1

Impacts from In-Water Devices Under Alternative 1 for Training Activities

Under Alternative 1, there is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with small, slow-moving unmanned underwater vehicles. The proposed increase of over 100 in-water devices between both the Offshore Area and the Inland Waters would not change the conclusion presented in the 2015 NWTT Final EIS/OEIS.

As stated in the 2015 NWTT Final EIS/OEIS, the impact of physical disturbance and strike stressors on cultural resources would be insignificant for in-water devices because (1) the types of activities associated with towed systems are conducted in areas where the sea floor is deeper than the length of the tow lines; and (2) devices are designed and operated within the water column and do not contact the seafloor. Activities involving towed and other in-water devices are not expected to impact submerged cultural resources. In-water crawlers would not disturb the bottom enough to disturb buried or imbedded archaeological resources. Similarly, anchors placed by divers on the seafloor or deployed in a controlled manner by vessels would not dig or plow along the bottom and disturb cultural resources. Therefore, as stated in the 2015 NWTT Final EIS/OEIS, training activities using in-water devices would be unlikely to impact cultural resources.

Impacts from In-Water Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-13). As described in the 2015 NWTT Final EIS/OEIS, the testing activities in the Offshore Area would include activities where in-water devices would contact bottom substrates, such as with certain types of unmanned underwater vehicles in the Quinault Range Site at Pacific Beach in the tidal zone. This portion of the Study Area is a high-energy environment with sandy bottom/beach where intact cultural resources are unlikely to exist, and known cultural resources would be avoided. Testing activities in the Inland Waters portion of the Study Area would also include activities using in-water devices that contact bottom substrates. For the same reasons as listed for training activities, impacts from in-water devices are not anticipated.

Testing activities would occur in the same locations and in a similar manner as were analyzed previously. In spite of these increases, and as described in the 2015 NWTT Final EIS/OEIS, these in-water device activities remain unlikely to impact cultural resources. For the same reasons as listed under the analysis for training activities, testing activities using in-water devices, in the Study Area would not impact cultural resources.

3.10.2.2.1.2 Impacts from In-Water Devices Under Alternative 2

Impacts from In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, training activities with in-water devices would not increase significantly in the Offshore Area or Inland Waters compared to Alternative 1. Therefore, the analysis for Alternative 2 would be the same as under Alternative 1.

Impacts from In-Water Devices Under Alternative 2 for Testing Activities

Testing activities under Alternative 2 that include in-water devices in the Study Area would not increase significantly in the Offshore Area or Inland Waters compared to Alternative 1. Therefore, impacts on cultural resources from testing activities under Alternative 2 would be the same as described under Alternative 1.

3.10.2.2.1.3 Impacts from In-Water Devices Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors from in-water devices associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts on submerged cultural resources.

3.10.2.2.2 Impacts from Military Expended Materials

Military expended materials that could impact cultural resources include heavy inert practice munitions (Table 3.0-14), other military materials (Table 3.0-15), explosive munitions that may result in fragments (Table 3.0-16), and targets (Table 3.0-17) that could strike or settle on shipwrecks, submerged aircraft, or other pre-historic or historic structures standing on the seafloor.

3.10.2.2.2.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. The majority of military training items would be expended in the open ocean, where the deposition of military expended materials would occur and where shipwrecks and other cultural resources would less commonly be found. Areas in the Inland Waters where military expended materials would settle to the seafloor are the same areas where they have settled in the past.

There would be no impact of military expended materials on cultural resources under Alternative 1 because: (1) most anticipated expended munitions would be small objects and fragments that would slowly drift to the seafloor after striking the ocean surface, (2) expended materials would not alter the archaeological or cultural characteristics of the submerged cultural resource if they should sink on the resource itself or in the vicinity, and (3) it is unlikely these materials would come into contact with or remain on submerged cultural resource. Therefore, activities involving military expended materials are not expected to impact submerged cultural resources.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. As described under training activities for military expended materials, the majority would be expended in open oceans where shipwrecks and other cultural resources are less commonly found and where the likelihood these materials permanently come to rest on or near these resources is low. For the same reasons as stated in the analysis for military expended materials and impacts on cultural resources under training activities, there would be no impact on submerged cultural resources as a result of Alternative 1.

3.10.2.2.2.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

Under Alternative 2, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on cultural resources would be the same as described under training activities for Alternative 1, and activities involving military expended materials would have no impact on submerged cultural resources.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

Under Alternative 2, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. Compared to the 2015 NWTT Final EIS/OEIS numbers, the single category of stationary sub-surface targets is proposed to increase from 5,422 to 7,317 in the Inland Waters and from 7 to 3,335 in the Offshore Area (Table 3.0-17). These targets are typically recovered and, while they are appropriately included in the military expended materials category, pose limited risk of physical disturbance and strike to cultural resources, as known cultural resources are avoided during testing activities. There is an increase in all of the other military expended materials except for mine shapes (non-explosive and recovered) in the Inland Waters, which decrease from 12,982 to 5,266. Therefore, activities involving military expended materials are not expected to impact submerged cultural resources.

3.10.2.2.2.3 Impacts from Military Expended Materials Under the No Action Alternative

Under the No Action Alternative, the proposed testing and training activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors from military expended materials associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts on submerged cultural resources.

3.10.2.2.3 Impacts from Seafloor Devices

Several training and testing activities include the use of seafloor devices—items that may contact the ocean bottom temporarily. The activities and the specific seafloor devices are (1) precision anchoring training, where ship anchors are lowered to the seafloor and recovered; (2) EOD mine countermeasures training exercises, where some mine targets may be moored to the seafloor; and (3) various testing activities where anchors are placed on the seafloor to hold instrumentation in place.

3.10.2.2.3.1 Impacts from Seafloor Devices Under Alternative 1

Impacts from Seafloor Devices Under Alternative 1 for Training Activities

No training activities with seafloor devices are proposed in the Offshore Area under Alternative 1 (see Table 3.0-18), therefore having no impact on cultural resources in the Offshore Area. Under Alternative 1, the number of training activities that include the use of ship anchors (as seafloor devices) would increase from 10 to 40, in the Inland Waters as part of the Precision Anchoring exercise. The activity consists of a vessel navigating to a precise, pre-determined location and releasing the ship's anchor to the bottom (see Figure 3.10-2). The ship anchor is later recovered and the activity is complete. These training events would not impact cultural resources because the military routinely avoids locations of known obstructions, especially when anchoring ships. As stated in the 2015 NWTT Final EIS/OEIS, the impact of seafloor devices such as heavy ship anchors on cultural resources could be damaging; however, impacts are unlikely because seafloor devices are stationary or move slowly across the bottom (in the case of crawlers), and have a selection criterion for precision anchoring to purposefully avoid shipwrecks, obstructions, and other cultural resources. Mine Neutralization EOD Training activities would remain at the same location and event amount (13) under Alternative 1 as discussed in the 2015 NWTT Final EIS/OEIS. These events would occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. It is unlikely that these resources could be disturbed by the use of seafloor devices. Therefore, activities involving seafloor devices are not expected to impact submerged cultural resources.

Impacts from Seafloor Devices Under Alternative 1 for Testing Activities

Under Alternative 1, the number of testing activities that include the use of seafloor devices would decrease by approximately 20 percent in the Offshore Area for anchors to secure mine shapes, and increase in the Inland Waters from 433 to 512 for anchors (as shown in Table 3.0-18). The majority of the activities involve the temporary placement of anchors on the seafloor. When the test is completed, the anchors are recovered, again at a slow speed. The testing activities in the Western Behm Canal would include activities where seafloor devices would contact bottom substrates. Heavy ship anchors could still damage resources, however, these testing events would not impact cultural resources because the military routinely avoids locations of known obstructions, especially when anchoring ships. As stated in the 2015 NWTT Final EIS/OEIS, the impact of seafloor devices on cultural resources would be unlikely because (1) seafloor devices are either stationary or move slowly along the bottom, causing little or no disturbance of seafloor sediments which may have the potential to contain cultural resources; and (2) the military routinely avoids locations of known obstructions, which include submerged historic resources. Mine shapes would not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Therefore, itis unlikely that these resources could be disturbed by the use of seafloor devices. Activities involving seafloor devices are not expected to impact submerged cultural resources.

3.10.2.2.3.2 Impacts from Seafloor Devices Under Alternative 2

Impacts from Seafloor Devices Under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities that include the use of seafloor devices would be the same as described under Alternative 1 for Precision Anchoring in the Inland Waters. However, mine shape use would increase from 13 to 21 under Alternative 2. For the same reasons as stated under training activities under Alternative 1 for seafloor devices, activities involving seafloor devices are not expected to impact submerged cultural resources because (1) seafloor devices are either stationary or move very slowly along the bottom, causing little or no disturbance of seafloor sediments which may have the potential to contain cultural resources; and (2) the military routinely avoids locations of known obstructions which include submerged cultural resources. Mine shapes would not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Therefore, it is unlikely that these resources could be disturbed by the use of seafloor devices. For these reasons, training activities involving seafloor devices are not expected to impact submerged cultural resources.

Impacts from Seafloor Devices Under Alternative 2 for Testing Activities

Under Alternative 2, the number of testing activities that include the use of seafloor devices would be greater than the number described under Alternative 1. Anchoring would be at 536 activities compared to 512 in the Inland Waters, and 71 rather than 70 in the Offshore Area under Alternative 2. Mine use would increase from 54 to 55 activities in the Offshore Area, from 454 to 478 activities in the Inland Waters, and remain the same in the Western Behm Canal. The majority of the activities involve the temporary placement of anchors on the seafloor. These anchors travel through the water column before encountering the seafloor. Although these anchors could be traveling slowly, reducing risk to cultural resources, heavy anchors could still damage resources. Mine shapes would not impact cultural resources for the same reasons as discussed under training: that the military routinely avoids locations of known obstructions, and that mine activities would only occur in designated and well-established EOD Training Ranges where no cultural resources have been identified. Due to the nature of the testing activities and for the reasons stated in the training activities analysis for seafloor device impacts on cultural resources, testing activities involving seafloor devices are not expected to impact submerged cultural resources.

3.10.2.2.3.3 Impacts from Seafloor Devices Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors from seafloor devices associated with the Proposed Action would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for impacts on submerged cultural resources.

3.10.2.3 Acoustic

The Noise Study (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Areas) concluded that the noise exposure within the Olympic MOAs and W-237 is within the Department of Defense's (DoD's) Noise Zone 1, with Day Night Average Sound Levels below 65 A-weighted decibels (dBA) for the entire area studied. A flyover event at 14,000–15,000 ft. Mean Sea Level (MSL) would be detectable at about 69 dBA at the highest peaks and ridgelines along the flight transit routes between NAS Whidbey Island and the Olympic MOAs (ground elevations of about 4,500–8,000 feet) (see Table 4-7 of Appendix J, Airspace Noise Analysis for the Olympic Military Operations Areas). Flyover event noise levels would be lower at locations below the highest peaks and ridgelines. At ground level (ground elevations of about 300 ft. to 3,500 ft.) MSL the flyover noise levels along transit routes would be about 57 dBA. Small portions of the land area underlying the Olympic MOAs, at elevations above 4,000 ft. MSL (less than 1 percent of the total area), could be exposed to maximum noise levels of 101 dBA if an EA-18G flies directly overhead at their lowest operating altitude. This exposure level would be incredibly brief as the aircraft would be traveling at high speeds. However, this maximum noise level is unlikely to occur since the highest altitudes in the MOAs occur within and near the boundary offset, and most of these noise-generating training activities occur within the interior of the MOAs and W-237, not at the boundaries. These training activities generally occur in the interior of the MOAs and W-237 to reduce the likelihood of exceeding the limits of these designated airspaces and to avoid spilling out of the airspace boundaries. Since the noise exposure within the Olympic MOAs and W-237 is within the DoD's Noise Zone 1, on-land historic properties are not analyzed further, and there would be no significant impact on cultural resources from noise in the Olympic MOAs.

3.10.2.4 Limiting Access/Temporary Change of Use

Limits to access and temporary changes of use in the Study Area are discussed in Section 3.11 (American Indian and Alaska Native Traditional Resources); please see Section 3.11.2 (Environmental Consequences) for the analysis and conclusions.

3.10.2.5 Visual and Atmospheric

Visual and atmospheric stressors would result from observation of aircraft, their lights, and condensation trails (aka contrails), which are a visual representation of atmospheric changes. Continuing aircraft flights within the altitude restrictions of established air space, however, may result in minimal and temporary changes to a visual setting on the ground but unlikely to result in more-than-de-minimis visual intrusions or unwanted aesthetic impacts. This limits the extent to which a visual impact from the observation of aircraft would be experienced at a cultural resource location. Contrails may readily evaporate but do mark the temporary presence of aircraft, albeit nonintrusive due to altitude and distance, especially when the presence of contrails from private and commercial aircraft are taken into consideration. Due to the altitude of the aircraft, only minimal and temporary impacts would occur as a result of visual and atmospheric stressors to cultural resources.

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3.11 American Indian and Alaska Native Traditional Resources

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3.11 American Indian and Alaska Native Traditional Resources

3.11.1 Affected Environment

For purposes of this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), the Study Area for American Indian and Alaska Native traditional resources remains the same as that identified in the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS. As presented in the 2015 NWTT Final EIS/OEIS, there are 56 federally recognized Tribes and Nations (hereinafter referred to as Tribes) with traditional resources (e.g., plants, animals, usual and accustomed [U&A] fishing grounds) in the Study Area. The Study Area is divided into three distinct regions for American Indian and Alaska Native traditional resources evaluation: the Offshore Area; the Inland Waters; and Western Behm Canal, Alaska. Several types of traditional resources are present in the Study Area, including various plants and animals as well as Tribal marine resource gathering areas (e.g., traditional fishing areas; whaling areas; and seaweed-, mussel-, abalone-, and clam-gathering grounds). These traditional resources include off-reservation treaty U&A fishing grounds, some of which extend beyond 12 nautical miles (NM).

Protected tribal resources, as defined in Department of Defense Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes* (U.S. Department of Defense, 2018), are "those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by or reserved by or for Indian tribes through treaties, statutes, judicial decisions, or E.O.s [Executive Orders], including Tribal trust resources." Tribal trust resources are Indian lands or treaty rights to certain resources. These resources include plants, animals, and locations associated with hunting, fishing, and gathering activities for subsistence or ceremonial use. For the purposes of this section, the term "traditional resources" will be used to encompass protected tribal resources.

The connection between native peoples and tribal resources varies between individuals, cultures, and the unique interactions they have with the plants, animals, waters, and earth they encounter during their life journey. This connection holds another layer of complexity when considering what information and stories are passed down from previous generations of tribal members. A Statement from the Hopland Band of Pomo Indians, California was shared as part of the 'Intertribal Sinkyone Wilderness Council et al v. National Marine Fisheries Service et al.' case filed January 26, 2012 (Intertribal Sinkyone Wilderness Council, 2012). The statement describes cultural traditions that are vital to the traditions, physical health, and spiritual health shared by many Tribes along the Pacific coastline.

American Indian and Alaska Native historic properties (i.e., cultural resources eligible for listing in the National Register of Historic Places under the National Historic Preservation Act) are discussed in Section 3.10 (Cultural Resources).

3.11.1.1 Government-to-Government Consultation

The United States (U.S.) Department of the Navy (Navy) will continue government-to-government communications with several tribes in Washington, California, and Alaska in accordance with Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, and Navy consultation policies as needed. It is Navy policy to establish permanent government-to-government working relationships with tribal governments that are built upon respect, trust, and openness. Under these policies, the Navy is required to consider tribal comments and concerns prior to making a final decision on a proposed action. However, reaching formal agreement with a tribe or obtaining tribal approval prior to a final decision is not required.

During the preparation of the 2015 NWTT Draft EIS/OEIS, the Navy consulted with federally recognized Tribes. On February 7, 2018, the Navy invited 56 federally recognized Tribes to consider initiating government-to-government consultation for the Proposed Action in this Supplemental (see Section 3.11.1.1, Government-to-Government Consultation). Tribes and their concerns regarding the Navy's training and testing activities are summarized below.

Certain Tribes in the Puget Sound region have expressed concerns regarding the potential of Navy training and testing activities to impede access to adjudicated treaty U&A fishing grounds and stations as well as concerns regarding the potential for Maritime Security Operations to damage tribal fishing gear. The Navy continues to communicate with the Jamestown S'Klallam Tribe, Lower Elwha Tribal Community, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Upper Skagit, and Suquamish Indian Tribe of the Port Madison Reservation regarding these concerns and improving on-water vessel coordination in order to eliminate or minimize potential impacts to tribal fishing in these co-use marine waterways. Also, the Navy continues to communicate with potentially affected tribes for activities conducted in Crescent Harbor.

Since 2015, the Navy has engaged in government-to-government consultation with the Intertribal Sinkyone Wilderness Council, representing the Cahto Tribe of Laytonville Rancheria; Coyote Valley Band of Pomo Indians of California; Hopland Band of Pomo Indians; Pinoleville Pomo Nation, California; Potter Valley Tribe, California; Redwood Valley Little River Band of Pomo Indians; Round Valley Indian Tribes, Round Valley Reservation, California; Scotts Valley Band of Pomo Indians of California; and Sherwood Valley Rancheria of Pomo Indians of California regarding potential impacts to traditional resources in the marine environment to address the Tribes' resistance to Navy training and testing activities within the Study Area.

Based on Navy policies for tribal consultation, the Navy protects culturally sensitive information identified by Tribes, as well as government-to-government consultation information, from public disclosure; consultation documents are maintained in the Navy's administrative record and are not included as an attachment to this document. However, comments submitted by Tribes and Tribal organizations during the public comment period and Navy's response to comments, which are separate and distinct from government-to-government consultations, will be provided in Chapter 8 (Public Involvement and Distribution).

3.11.1.2 American Indian and Alaska Native Tribes

3.11.1.2.1 Offshore Area

As discussed in Section 3.11.1.4 (Federal Trust Responsibility and Federally Secured Off-Reservation Fishing Rights) of the 2015 NWTT Final EIS/OEIS, 18 federally recognized Tribes are currently or historically associated with the Offshore Area. The Navy has received updated information from 10 of these Tribes and the InterTribal Sinkyone Wilderness Council as shown in Table 3.11-1 and has considered this information in this analysis. Each of the 10 Tribes is a member of the InterTribal Sinkyone Wilderness Council that is comprised of 10 federally recognized North Coast Tribes in California. The Council is a non-profit land conservation consortium that owns and manages 4,000 acres of redwood forestland (InterTribal Wilderness land) along the Lost Coast north of Fort Bragg, California. Please see profile regarding InterTribal Sinkyone Wilderness Council.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	Cahto Tribe of the Laytonville Rancheria	The name Cahto (Kato) means loosely "People of the Lake" or "Lake People," and refers to an ancient lakeshore where the Cahto people once lived, although we, the inhabitants of the six villages of the Long Valley, called ourselves the Tlokyáhan or "Grass People." Our homeland is comprised of mountains and hills covered with fir, pine, oak and redwoods and is veined with streams. A nearby 4,213-foot-high mountain summit is named Cahto peak in our honor. Besides gathering the plentiful nuts, seeds, berries, roots, bulbs, and tubers, we hunted for deer, rabbits, quail, and fish to provide additional food for our people. We traveled within our traditional homeland to where the food was plentiful, and to the Mendocino coast to harvest seaweed and fish. Today, once a year the Cahto retrace their migrations to the coast using sacred trails in remembrance of the ancient tradition.
Traditional Resources	Coyote Valley Band of Pomo Indians of California	The Coyote Valley Band of Pomo Indians live on the Coyote Valley Reservation located in Redwood Valley, California. Traditionally, subsistence is based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). The Tribe still practices their traditional songs, dances and spiritual ways. Currently, the economy is based on gaming, hotel, convenience store, and gas station (Tiller, 2005).
Traditional Resources	Hopland Band of Pomo Indians, California	The Hopland Band of the Pomo Indians resides in northwestern California south of Ukiah. Traditional territory includes Humboldt County to San Pablo Bay; fishing and gathering trips to the Pacific Ocean were seasonally based. Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). Currently, the economy is based on agriculture, commercial development, and gaming (Tiller, 2005).
Traditional Resources	Pinoleville Pomo Nation, California	The Pinoleville Pomo Nation resides in northern California in Mendocino and Lake Counties (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope. seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Lowy, 1978). Currently, the economy is based on agriculture.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	Potter Valley Tribe, California	The Potter Valley Tribe resides in northern California northeast of Ukiah and Tribal members are of the Little Lake Pomo Band (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978). Currently, the economy is based on commercial development.
Traditional Resources	Redwood Valley Little River Band of Pomo Indians	The Redwood Valley Little River Band of Pomo Indians resides northeast of Redwood Valley in Mendocino County along the northeastern side of the Russian River valley. Members of the Redwood Valley Little River Band of Pomo Indians belong to the Northern Pomo (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and ocean fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978).
Traditional Resources	Robinson Rancheria of Pomo Indians	The Robinson Rancheria of Pomo Indians is located northwest of Sacramento, California. Traditionally, subsistence was based on acorns, nuts, seeds, root plants, waterfowl, and lake and stream fish such as suckers, pike, and carp (McLendon & Lowy, 1978; McLendon & Oswalt, 1978). Currently, the economy is based on commercial development, gaming and tourism (Tiller, 2005).
Traditional Resources	Round Valley Indian Tribes Round Valley Reservation	The Round Valley Indian Tribes reside on the Round Valley Reservation located in the northeastern portion of Mendocino County, California. The greater area was the aboriginal traditional territory of the Yuki Tribe, until 1858 when the Round Valley Reservation was established with the establishment of the Nome Cult Farm. Now the reservation is home to the Yuki, Concow, Pomo, Nomlacki, Wailacki, and Pit River Indians. The tribal territory reached from the mountains around the valley to the coast. Traditionally foods as well as medicinal and personal needs remained to be gathered from this vast area. Subsistence came from gathering from trees, roots, grasses, brush and most other plant life (Seeds, berries, nuts, leaves, stems, and roots were utilized); large and small game; vertebrates and invertebrates (i.e., deer, elk, birds, surf fish, shellfish, eel, salmon, steelhead, otter, etc.) were harvested from the waterways in and around the tribal territory.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	***Tribe***	***Brief Profile****
Traditional Resources	Scotts Valley Band of Pomo Indians of California	The Scotts Valley Band of Pomo Indians resides on the Sugar Bowl Rancheria in northern California (Tiller, 2005). Traditionally, subsistence was based on acorns, nuts, seeds, root plants, deer, elk, antelope, seal, sea lion, and lake, stream, and sea-going fish (Bean & Theodoratus, 1978; McLendon & Oswalt, 1978).
Traditional Resources	Sherwood Valley Rancheria of Pomo Indians of California	Sherwood Valley Rancheria is located within aboriginal homelands we have used and occupied since time immemorial. Our homeland extends from approximately the Highway 101 corridor, through the Redwood Forests on to the Coast. As the original stewards of this land we retain original usufructuary rights to protect the land, air, water, and food sources upon our homeland. We have freely gathered coastal resources since time immemorial, and protection of the aboriginal food sources and traditional gathering places is a fundamental human right. Sherwood Valley Rancheria was established under Secretarial Order in 1909. Sherwood Valley is the successor in interest to ownership of the Mendocino Indian Reservation, established by Act of Congress on March 3, 1853. Sherwood Valley Rancheria is governed under a Constitution and Bylaws duly adopted and approved by the Secretary of the Interior on July 25, 1974. The Sherwood Valley Rancheria Tribal Council, as representatives of individual tribal members, strives to promote and perpetuate the protection of natural resources for future generations.

Table 3.11-1: Offshore Area – Updates for American Indian Tribes and Traditional Resources (continued)

Resource Type	*Tribe*	*Brief Profile**
Traditional Resources	**InterTribal Sinkyone Wilderness Council** is a consortium comprised of the following federally recognized Tribes: • Cahto Tribe of Laytonville Rancheria • Coyote Valley Band of Pomo Indians • Hopland Band of Pomo Indians • Redwood Valley Little River Band of Pomo Indians • Pinoleville Pomo Nation • Potter Valley Tribe • Robinson Rancheria of Pomo Indians • Round Valley Indian Tribes • Scotts Valley Band of Pomo Indians • Sherwood Valley Rancheria of Pomo Indians	The InterTribal Sinkyone Wilderness Council is a non-profit consortium of 10 sovereign Tribal Nations whose duty is to protect culturally important traditional lands and waters of its member Tribes. Established in 1986, the Sinkyone Council is charged with safeguarding the coastal rainforest and ocean ecosystems on which its member Tribes depend for their cultural ways of life, traditional foods, wellbeing, and identity. It owns and manages 4,000 acres of redwood rainforest in northwestern Mendocino County, California that includes portions of nine coastal watersheds. InterTribal Sinkyone lands are situated within California's Coastal Zone. The Study Area encompasses marine waters situated within the traditional territories of several west coast Tribal Nations. The Sinkyone Council's 10 member Tribes each retain important cultural, ancestral, historic, and contemporary ties to ocean and coastal areas within the Navy's Study Area, specifically the portion of traditional Sinkyone Tribal territorial marine waters, (and adjacent) estuarine waters and coastal environments that are situated between the Mendocino-Humboldt county line and the mouth of the Mattole River. An abundance of extant oral and written evidence substantiates the Tribes' assertions of historical, current and ongoing coastal and maritime cultural uses and ways of life including traditional gathering, fishing, harvesting, ceremonial and other practices within and adjacent to marine waters situated within the Study Area. These areas have been a part of the Tribes' traditional territories for millennia. This area of the Study Area is located within the documented and acknowledged geographical boundaries of traditional Sinkyone Tribal territory held and controlled by the original Sinkyone coastal peoples from which enrolled members of the Council's member Tribes are directly descended.

*The Navy met with the InterTribal Sinkyone Wilderness Council and received these updates in 2018 and 2019. These profiles are direct quotes from the tables received by the Navy (InterTribal Sinkyone Wilderness Council, 2018) and (InterTribal Sinkyone Wilderness Council, 2019). Each of the 10 Tribes is a member of the lnterTribal Sinkyone Wilderness Council that is comprised of 10 federally recognized North Coast Tribes in California. The Council is a non-profit land conservation consortium that owns and manages 4,000 acres of redwood forestland (lnterTribal Wilderness land) along the Lost Coast north of Fort Bragg, California.

Four Tribes, listed below, have off-reservation Treaty U&A fishing grounds in co-use navigable water areas in Washington where the Navy conducts training and testing in the Offshore Area:

- Hoh Indian Tribe
- Makah Indian Tribe of the Makah Reservation
- Quileute Tribe of the Quileute Reservation
- Quinault Indian Nation

The following 14 Washington, Oregon, and California federally recognized Tribes have traditional resources (e.g., migratory fish species, specifically salmon, that migrate upstream into the inland waters) in co-use navigable water areas where the Navy conducts training and testing activities in the Offshore Area:

- Big Lagoon Rancheria, California
- Cher-Ae Heights Indian Community of the Trinidad Rancheria, California
- Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, Oregon
- Confederated Tribes of Grand Ronde Community of Oregon, Oregon
- Confederated Tribes of Siletz Indians of Oregon, Oregon
- Confederated Tribes of the Chehalis Reservation, Washington
- Coquille Indian Tribe, Oregon
- Cowlitz Indian Tribe, Washington
- Elk Valley Rancheria, California
- Resighini Rancheria, California
- Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation, Washington
- Tolowa Dee-ni' Nation, California (listed as Smith River Rancheria in the 2015 NWTT Final EIS/OEIS)
- Wiyot Tribe (formerly the Table Bluff Rancheria), California
- Yurok Tribe of the Yurok Reservation, California

Also, 15 federally recognized Tribes with traditional use areas inland of the Oregon and California coast may have traditional resource habitat in the Offshore Area; these migratory marine resources (e.g., salmon, steelhead, lamprey eel, and sturgeon) travel the rivers upstream into the Tribes' traditional territories and are part of the local subsistence and ceremonial activities of the Tribes:

- Cahto Tribe of the Laytonville Rancheria, California
- Confederated Tribes of the Warm Springs Reservation, Oregon
- Cow Creek Band of Umpqua Tribe of Indians, Oregon
- Coyote Valley Band of Pomo Indians of California, California
- Hoopa Valley Tribe, California
- Hopland Band of Pomo Indians, California
- Karuk Tribe, California
- Klamath Tribes, California
- Pinoleville Pomo Nation, California
- Potter Valley Tribe, California
- Redwood Valley Little River Band of Pomo Indians
- Robinson Rancheria, California
- Round Valley Indian Tribes, Round Valley Reservation, California

- Scotts Valley Band of Pomo Indians of California
- Sherwood Valley Rancheria of Pomo Indians of California

The traditional use areas and resources for these Tribes as discussed in the 2015 NWTT Final EIS/OEIS have not changed.

3.11.1.2.2 Inland Waters

Twenty federally recognized Tribes are currently or were historically associated with the Inland Waters. In Washington, these 20 Tribes have federally secured off-reservation Treaty U&A fishing rights in co-use navigable waters where the Navy conducts training and testing in the Inland Waters:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Lower Elwha Tribal Community
- Lummi Tribe of the Lummi Reservation
- Makah Indian Tribe of the Makah Reservation
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of the Puyallup Reservation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Squaxin Island Tribe of the Squaxin Island Reservation
- Stillaguamish Tribe of Indians of Washington
- Suquamish Indian Tribe of the Port Madison Reservation
- Swinomish Indian Tribal Community
- Tulalip Tribes of Washington
- Upper Skagit Indian Tribe

There is no new or updated information, since the 2015 NWTT Final EIS/OEIS, regarding the traditional use areas and resources for these Tribes as discussed in the 2015 NWTT Final EIS/OEIS.

3.11.1.2.3 Western Behm Canal, Alaska

Four federally recognized Alaska Native Tribes are currently or historically associated with the Western Behm Canal in co-use navigable waters where the Navy conducts testing:

- Central Council of the Tlingit and Haida Indian Tribes
- Ketchikan Indian Corporation
- Metlakatla Indian Community, Annette Island Reserve
- Organized Village of Saxman

The traditional use areas and resources for these Tribes as discussed in the 2015 NWTT Final EIS/OEIS have not changed.

3.11.1.3 Tribal Fishing Areas and Use

As presented in the 2015 NWTT Final EIS/OEIS, many of the marine species found within the Study Area are culturally significant to the Tribes of coastal Washington, Oregon, California, and Alaska. Tribes harvest traditional resources for ceremonial and subsistence uses as well as for commercial enterprises (i.e., Tribal fisheries). Tribal fisheries are place-oriented and, in some cases, limited to the adjudicated U&A fishing grounds. For this reason, the availability and health of marine resources and supporting habitats is a concern for Tribes in the Study Area.

3.11.1.3.1 Offshore Area

The U&A fishing grounds for the Hoh Indian Tribe, Makah Indian Tribe of the Makah Reservation, Quileute Tribe of the Quileute Reservation, and the Quinault Indian Nation include Olympic Peninsula Rivers and watersheds, and offshore areas. These Tribes utilize the Northwest Indian Fisheries Commission (NWIFC), which provides technical support to Western Washington member tribes for intertribal fisheries management and harvest policy. Tribal U&A fishing grounds were established in offshore areas beyond U.S. territorial waters (greater than 12 NM), including within Olympic Coast National Marine Sanctuary as described in the 2015 NWTT Final EIS/OEIS.

In addition to tribes that have off-reservation Treaty U&A fishing grounds in co-use navigable waters, there are 14 Washington, Oregon, and California federally recognized Tribes that have traditional resources (e.g., migratory fish species, specifically salmon that migrate upstream into the inland waters) in co-use navigable waters (as described in the 2015 NWTT Final EIS/OEIS, Section 3.11.2.1.1, Offshore Area). Also, there are 15 federally recognized Tribes with traditional use areas inland to the Oregon and California coast that may have traditional resource habitat in Offshore Areas associated with migratory marine resources (e.g. salmon, steelhead, lamprey eel, and sturgeon) (as described in the 2015 NWTT Final EIS/OEIS, Section 3.11.2.1.1, Offshore Area).

3.11.1.3.1.1 Salmon Fisheries

Commercial, ceremonial, and subsistence fishing for salmon in the Offshore Area as described in the 2015 NWTT Final EIS/OEIS has not changed except as for variable changes in salmon population health.

3.11.1.3.1.2 Groundfish Fisheries

Treaty rights to fish for groundfish in the Offshore Area are the same now as they were described in the 2015 NWTT Final EIS/OEIS.

3.11.1.3.1.3 Pacific Halibut Fisheries

Commercial, ceremonial, and subsistence fishing for Pacific halibut in the Offshore Area as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.1.4 Shellfish Harvests

Along the Pacific coastal sandy beaches from the Columbia River to Kalaloch, federal management plans are signed each year between Washington Department of Fish and Wildlife and Tribal governments with razor clam harvest rights and substantial treaty harvest of Dungeness crab. Razor clam harvests are set and monitored within each of the five management beaches: Twin Harbors from Willapa Bay north to the south jetty at the mouth of Grays Harbor, Copalis Beach from the north jetty at the mouth of Grays Harbor to the Copalis River, Mocrocks from the Copalis River to the Moclips River (south boundary of the Quinault Indian Reservation), and Kalaloch from the South Beach campground to Olympic National Park Beach Trail 3 (U.S. Department of the Navy, 2006).

3.11.1.3.2 Inland Waters

As stated in the 2015 NWTT Final EIS/OEIS, 20 American Indian Tribes have U&A fishing grounds (including the Strait of Juan de Fuca, Puget Sound, and inland rivers in the Inland Waters of the Study Area). These tribes include:

- Confederated Tribes and Bands of the Yakama Nation
- Jamestown S'Klallam Tribe
- Lower Elwha Tribal Community
- Lummi Tribe of the Lummi Reservation
- Makah Indian Tribe of the Makah Reservation
- Muckleshoot Indian Tribe
- Nisqually Indian Tribe
- Nooksack Indian Tribe
- Port Gamble S'Klallam Tribe
- Puyallup Tribe of the Puyallup Reservation
- Samish Indian Nation
- Sauk-Suiattle Indian Tribe
- Skokomish Indian Tribe
- Snoqualmie Indian Tribe
- Squaxin Island Tribe of the Squaxin Island Reservation
- Stillaguamish Tribe of Indians of Washington
- Suquamish Indian Tribe of the Port Madison Reservation
- Swinomish Indian Tribal Community
- Tulalip Tribes of Washington
- Upper Skagit Indian Tribe

The Western Washington Treaty Tribes created the NWIFC to coordinate fisheries management of these Tribes for implementation of orders arising from the 1974 *United States v. Washington* decision. As stated previously, this commission provides technical support to American Indian Tribes assisting in intertribal coordination on harvest policy. The Columbia River Treaty Tribes created the Columbia River Intertribal Fish Commission (U.S. Department of the Navy, 2015).

Since the 2015 NWTT Final EIS/OEIS, the Makah Tribal Council issued its "Makah Ocean Policy" (2017) to assist the Makah Tribal Government in asserting its sovereign authority to protect the Makah Tribe's culture and the continued exercise of its treaty-reserved rights. This policy includes, among other things, guiding principles, historical ocean use, and consultation procedures.

3.11.1.3.2.1 Salmon Fisheries

As presented in the 2015 NWTT Final EIS/OEIS, each Tribe regulates its own fisheries, including allowable gear and locations individually within its U&A fishing grounds. Salmon fisheries are co-managed between the NWIFC, referenced above, and the State Department of Fish and Wildlife to establish harvest limits and timing of fisheries. A coordinated management approach is applied if these areas overlap the U&A fishing grounds of other Tribes. Commercial, ceremonial, and subsistence fishing for salmon in the Inland Waters has not changed from its description in the 2015 NWTT Final EIS/OEIS.

3.11.1.3.2.2 Pacific Halibut Fisheries

Commercial, ceremonial, and subsistence fishing for Pacific halibut in the Inland Waters as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.2.3 Shellfish Harvest

Commercial, ceremonial, and subsistence harvesting of shellfish in the Inland Waters as described in the 2015 NWTT Final EIS/OEIS has not changed.

3.11.1.3.3 Western Behm Canal, Alaska

As discussed in the 2015 NWTT Final EIS/OEIS, the Western Behm Canal is within the Ketchikan Nonsubsistence Use Area, which precludes subsistence uses of resources in Western Behm Canal by both Alaska Native Tribes and non-native fishermen (U.S. Department of the Navy, 2015).

3.11.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS considered training and testing activities that were projected to occur between 2015 and 2020 in the Study Area and analyzed how associated stressors might impact Tribal traditional resources. Stressors applicable to Tribal traditional resources in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS:

- Impeding access to Tribal U&A fishing grounds or other traditional fishing areas in co-use navigable waters
- Changes to the availability of marine resources or habitat
- Loss or damage to Tribal fishing gear

This section evaluates how and to what degree potential impacts on Tribal traditional resources from stressors described in Section 3.0 (Introduction) may have changed since the analysis was completed for the 2015 NWTT Final EIS/OEIS. Proposed training and testing activities, the number of times each activity would be conducted annually, and the locations within the Study Area where the activity would typically occur under each alternative are presented in Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives). The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing under this supplement can be easily compared.

The analysis presented in this section also considers standard operating procedures described in Section 2.3.3 (Standard Operating Procedures), and mitigation measures described in Chapter 5 (Mitigation). The Navy would implement these measures to avoid potential impacts on Tribal traditional resources from stressors associated with the proposed training and testing activities.

The specific analysis of the training and testing activities presented in this section considers relevant components and associated data with the geographic location of the activity and Tribal traditional resources and incorporates analysis from applicable sections such as Section 3.9 (Fishes), Section 3.10 (Cultural Resources), and Section 3.12 (Socioeconomic Resources). Training activities are not proposed in the Western Behm Canal; therefore, only the Offshore Area and the Inland Waters are analyzed under training activities.

3.11.2.1 Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas

3.11.2.1.1 Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas

As stated in the Affected Environment section, the U&A fishing grounds in co-use navigable waters and the NWTT Study Area have not changed since the 2015 NWTT Final EIS/OEIS. U&A fishing grounds are located in the Inland Waters portion of the Study Area and in portions of the Offshore Area located off the coast of Washington. No U&A fishing grounds exist in Western Behm Canal or portions of the Offshore Area located off the coasts of Oregon or California. Because traditional resources in the Western Behm Canal are not available for subsistence uses by Alaska Native Tribes, no impact on Alaska Native accessibility of traditional fishing areas would occur as a result of testing activities. Traditionally, some Oregon and California Tribes procured marine resources directly from coastal and nearshore areas (less than 12 NM). These traditional fishing and harvesting areas are outside the Study Area, and access to these areas would not be affected by the Proposed Action. This was the conclusion reached in the 2015 NWTT Final EIS/OEIS; as the underlying facts have not changed, the Navy's conclusion remains valid for this SEIS/OEIS.

3.11.2.1.1.1 Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 1

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, Navy training activities in the Offshore Area under Alternative 1 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel (33 CFR 165).

The exclusion zone for Explosive Ordnance Disposal training could temporarily impede Tribal access to portions of their U&A fishing grounds in the Inland Waters. However, the exclusion zones would be temporary (up to four hours per event) and infrequent (six times per year), and would affect a relatively small area in Hood Canal and Crescent Harbor. Navy training activities in Inland Waters under Alternative 1 could also temporarily impede Tribal access to portions of their U&A fishing grounds because of Maritime Security Operations, such as Transit Protection System training events. The Navy would communicate with potentially affected Tribes in advance to de-conflict schedules where possible. In addition, the U.S. Coast Guard (USCG) Maritime Force Protection Unit would provide notification of Transit Protection System events to Tribal Fisheries Enforcement Officers. Coastal Riverine Group One also provides notifications to Tribal Fisheries Enforcement Officers when they escort high-value units from NAVSTA Everett and Bremerton.

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2 and Table 2.5-3). Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. As stated in the 2015 NWTT Final EIS/OEIS, the Navy normally has the ability to obtain a clear range for testing activities in the Offshore Area without asking other vessels to leave the area. Navy testing activities would not prevent the use of an area by fishing or other vessels, absent unusual circumstances. Navy testing activities in the Offshore Area under Alternative 1 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel.

Alternative 1 would include testing of explosive torpedoes. However, this activity would be conducted greater than 50 NM off the coast of Washington, outside of U&A fishing grounds. Testing events using aircraft in the Offshore Area under Alternative 1 would not affect access to U&A fishing grounds. As part of the consultation effort during preparation of the 2015 NWTT Final EIS/OEIS, the Navy engaged in consultation with Tribes that have U&A fishing grounds that overlap the Quinault Range Site to exchange range and fishing schedule information to de-conflict schedules where possible. This exchange of schedule information continues to occur.

Under Alternative 1, some new activities would occur in the Inland Waters portion of the Study Area such as at-sea sonar testing with non-explosive torpedoes, non-explosive torpedo testing, mine countermeasure and neutralization, undersea warfare testing, and vessel signature evaluation (see Tables 2.5-2 and 2.5-3). When required to accomplish a test safely and efficiently, the Navy may restrict marine traffic and request the USCG to issue notices to mariners (NTMs). Restrictions placed on marine traffic during testing activities in Inland Waters under the Alternative 1 could temporarily impede Tribal access to portions of their U&A fishing grounds. Although these restrictions would temporarily impact U&A fishing grounds, information exchange between the Tribes and Navy currently helps to ensure schedules are de-conflicted where possible, and they will continue to coordinate to de-conflict schedules where possible.

The Western Behm Canal is within the Ketchikan Nonsubsistence Use Area (Alaska Department of Fish and Game, 2011), which precludes subsistence uses of resources in the Western Behm Canal by both Alaska Native and non-Native fishermen. Because traditional resources in the Western Behm Canal are not available for subsistence uses by Alaska Native Tribes, no impact on Alaska Native accessibility of traditional fishing areas would occur as a result of testing activities.

3.11.2.1.1.2 Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 2

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1), and in some cases vary slightly from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, Navy training activities in the Offshore Area under Alternative 2 are not likely to impede access to U&A fishing grounds except in rare instances where a vessel attempts to enter an established safety zone during ongoing activities or if it approaches too close to a Navy vessel (33 CFR 165).

Impacts on U&A access in the Inland Waters as a result of the training activities under Alternative 2 would be the same as described under Alternative 1.

Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-2 and Table 2.5-3), but would not change from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid.

Impacts on U&A access in the Offshore Area, Inland Waters, and Western Behm Canal as a result of testing activities under Alternative 2 would be the same as described under Alternative 1.

3.11.2.1.1.3 Impacts from Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Other military activities not associated with this Proposed Action would continue to occur. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Impeding access to U&A fishing grounds or traditional fishing areas by Navy training and testing activities would not occur in the Offshore Area, Inland Waters, or Western Behm Canal. Therefore, existing U&A fishing grounds or traditional fishing area access would either remain unchanged or would improve slightly after cessation of ongoing at-sea training and testing activities.

3.11.2.2 Changes in the Availability of Marine Resources or Habitat

3.11.2.2.1 Impacts from Changes in the Availability of Marine Resources or Habitat

As described in the 2015 NWTT Final EIS/OEIS, the availability and health of marine resources is a concern for Tribes with U&A fishing grounds in the Study Area, as well as those with U&A fishing grounds in inland areas outside the Study Area. In many cases, the main traditional resources harvested in these inland U&A fishing grounds are species such as shellfish, salmon, steelhead, or sturgeon that complete a portion of their life-cycle in marine environments. The availability of harvested traditional resource species could be affected if training and testing activities resulted in the following issues:

- A measurable reduction in a population or stock caused by direct impacts such as mortality or indirect impacts on water quality and habitat.
- Bioaccumulation of contaminates to levels where fish or shellfish would be unhealthy to consume.
- Mobile species avoiding U&A fishing grounds or altering their migratory patterns in response to disturbances.

When resource population levels dip, it becomes more likely that the Tribal and state co-managers will close a fishery to harvest, reduce the duration of open seasons, or reduce the catch quota. Furthermore, when there are less fish, more effort and time must be expended to catch the same number of fish. Where fish populations are low, greater effort means more commercial fishermen may give up fishing as their main source of income.

Impacts from Changes in the Availability of Marine Resources or Habitat Under Alternative 1, Alternative 2, and the No Action Alternative for Training and Testing

In this SEIS/OEIS, the Navy has analyzed potential impacts of Alternative 1, Alternative 2, and the No Action Alternative on resources harvested by Tribes and associated habitat in the following sections of this EIS/OEIS: 3.1 (Sediments and Water Quality), 3.3 (Marine Habitats), 3.7 (Marine Vegetation), 3.8 (Marine Invertebrates), and 3.9 (Fishes). Based on the analyses in these sections, the Proposed Action could directly affect individuals of some species harvested by Tribes, including mortality in a relatively small number of individuals. However, there would be no population- or stock-level impacts and there would be no measurable change in availability. Impacts on water quality and habitat would be localized and negligible, and would not be expected to affect availability of resources for harvest by Tribes. The Proposed Action is not expected to contribute to bioaccumulation in fish and shellfish species harvested by the Tribes based on the types and quantities of potential contaminates released and their fate and transport in the environment. Disturbances associated with the Proposed Action would be intermittent, of short duration, and widely dispersed, and are not expected to cause harvested species to avoid U&A fishing grounds or alter their migratory patterns.

Chapter 5 (Mitigation) describes protective measures the Navy implements within the Study Area. Although some of the measures specifically address species listed under the Endangered Species Act, many of them would also benefit species harvested by Tribes.

The Proposed Action is not expected to have a measurable effect on the availability of marine resources for harvest by Tribes.

3.11.2.3 Loss of Fishing Gear

3.11.2.3.1 Impacts from Loss of Fishing Gear

As discussed in Section 3.11.2.1 (Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas) Tribal fishing activities and Navy training and testing activities occur in co-use areas in the Inland Waters portion of the Study Area and in portions of the Offshore Area located off the coast of Washington. Consequently, the potential exists for interactions between naval vessels and equipment and Tribal fishing gear. Loss or damage to gear is a concern for Tribal fishermen because it can result in lost fishing opportunities and increase the cost of fishing, which could ultimately reduce harvest and income.

The 2015 NWTT Final EIS/OEIS describes the types of fishing gear used in the Study Area, and states that any gear that is designed to be fished unattended, either in the water column or on the bottom (e.g., gillnets, longlines, pots), would be most susceptible to snagging by a vessel or mobile in-water device. However, Tribal fishermen mark their gear in accordance with fishing regulations and the Navy uses standard navigational practices to avoid potential interactions with fixed gear. In addition, the Navy would coordinate with the USCG to issue NTMs that advise Tribal Fisheries Enforcement Officers on locations of planned training and testing activities when the activity will involve a potential hazard to navigation. Activities based from a range craft with full maneuverability would not require a NTM. Interactions between mobile fishing gear such as a trawl (i.e., a net towed by a vessel along the bottom or in the water column) and naval vessels is unlikely because the vessels involved would avoid each other. Interactions between mobile gear and a fixed in-water device such as testing equipment would also be unlikely because fixed devices would be clearly marked on the surface with a buoy. These practices have not changed; therefore, the conclusions from the 2015 NWTT Final EIS/OEIS remain valid.

As discussed in the 2015 NWTT Final EIS/OEIS, mobile fish gear located on or near the bottom could encounter military expended materials that the Navy would be unable to recover. These items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intentionally designed to sink to the bottom after serving their purpose (e.g., sonobuoys), so they would not represent an entanglement risk to fishing gear. Military expended materials used in the Study Area have not changed; therefore, the conclusions from the 2015 NWTT Final EIS/OEIS analysis remain valid.

As discussed in Section 3.11.1.1 (Government-to-Government Consultation) of this SEIS/OEIS, the Navy and several Tribes with U&A fishing grounds in the Study Area are engaged in ongoing government-to-government consultation. The potential for interactions between Tribal fishing gear and naval vessels and equipment is a topic of mutual interest addressed through the consultation process. As discussed in Section 3.11.2.1 (Impeding Access to U&A Fishing Grounds or Traditional Fishing Areas), several Tribes and the Navy have implemented or are continuing formal communication procedures to de-conflict schedules where possible. These communications, in addition to standard NTMs issued by USCG, help to avoid and minimize the potential for lost or damaged Tribal fishing gear associated with Navy training and testing activities. Any claims for loss or damage to fishing gear related to Navy activities are addressed through the Navy's claims adjudication process. Information on admiralty claims can be found at the Navy Judge Advocate General's Corps website: http://www.jag.navy.mil/organization/code_11.htm.

3.11.2.3.1.1 Impacts from Loss of Fishing Gear Under Alternative 1

Impacts from Loss of Fishing Gear Under Alternative 1 for Training Activities

The Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. The amount of some military expended material items would increase and some would decrease under Alternative 1, although not by a significant amount, and not with materials that are large enough to cause a loss of fishing gear (see Table 2.5-1). Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, Tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy training activities in the Offshore Area would be rare under Alternative 1.

In the Inland Waters, loss or damage to Tribal fishing gear could reduce fishing opportunities while the gear is being replaced or repaired, and could increase the amount of effort and resources required to catch the same amount of fish. The USCG Maritime Force Protection Unit would continue to provide notification of locations of planned training activities to Tribal Fisheries Enforcement Officers. Information exchange between the Tribes and the Navy helps ensure schedules are de-conflicted when possible.

Impacts from Loss of Fishing Gear Under Alternative 1 for Testing Activities

As discussed under training activities, the Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. The number of some military expended material would increase under Alternative 1, however in some cases military expended materials from testing activities would decrease. Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, Tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy testing activities in the Offshore Area would be rare under Alternative 1.

Under Alternative 1, the Navy is retaining the Carr Inlet Operating Area (OPAREA) and infrequent operational and acoustic research studies could be conducted in the area under Alternative 1. As discussed in the 2015 NWTT Final EIS/OEIS, the nature of activity and the in-water infrastructure at Carr Inlet OPAREA has changed since the dis-establishment of the shore lab in 2009. Fixed buoys and hydrophones are no longer in place. Use of this area under Alternative 1 may include temporary placement of underwater testing devices. Appropriate safety procedures and temporary marine traffic restrictions would be used to avoid interactions with fishing gear. The public would continue to be notified via published announcement in local newspapers and in the local USCG NTM if the Navy plans testing activities in the Carr Inlet OPAREA. The Navy would coordinate with the USCG to issue NTMs that advise Tribal Fisheries Enforcement Officers on locations of planned testing activities when the activity would involve a potential hazard to navigation. Activities based from a range craft with full maneuverability would not require a NTM. Information exchange between the Tribes and the Navy helps ensure schedules are de-conflicted when possible.

Pierside sonar and acoustic testing would be performed under Alternative 1 at Naval Base Kitsap Bremerton in Sinclair Inlet, Naval Base Kitsap Bangor Waterfront in Hood Canal, and Naval Station Everett. Existing security restrictions prevent public access at Navy pierside locations; therefore, fishing gear would not be affected by these activities.

As discussed in the 2015 NWTT Final EIS/OEIS, most of the materials and items used during testing are recovered after use in the Inland Waters. Military expended materials could present a risk to fishing gear located on the bottom, but the probability of encountering these items would be low. Standard procedures used to ensure safety, security, and testing data integrity; and procedures for communicating with Tribes that have U&A fishing grounds in testing areas would continue to be implemented under Alternative 1 and would minimize the risk of fishing gear damage. Implementing these procedures would make damage to fishing gear from Navy testing activities in Inland Waters rare under Alternative 1.

The Western Behm Canal is within the Ketchikan Nonsubsistence Use Area (Alaska Department of Fish and Game, 2011), which precludes subsistence uses of resources in the Western Behm Canal by both Alaska Native and non-Native fishermen. Because the Western Behm Canal is a Nonsubsistence Use Area, loss or damage to Alaska Native fishing equipment would not occur as a result of testing activities resulting in vessel or in-water device strikes. No testing activities resulting in the deposition of military expended materials occur in the Western Behm Canal.

3.11.2.3.1.2 Impacts from Loss of Fishing Gear Under Alternative 2

<u>Impacts from Loss of Fishing Gear Under Alternative 2 for Training Activities</u>

Under Alternative 2, the number of proposed training activities in the Offshore Area and Inland Waters would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1), and in some cases vary slightly from the number of activities proposed under Alternative 1. Given that the activities would be conducted in the same areas as described in the 2015 analysis, and that the number of training activities would not change significantly, the analysis and impact conclusions from the 2015 NWTT Final EIS/OEIS remains valid. Therefore, the analysis presented for training activities in the Offshore Area under Alternative 1 also applies to Alternative 2. Damage to fishing gear from Navy training activities in the Offshore Area would be rare under Alternative 2.

Training activities under Alternative 2 would be the same for the Inland Waters as described in the Offshore Area (see Table 2.5-1). Therefore, the analysis presented for training activities in Inland Water under Alternative 1 also applies to Alternative 2. The USCG Maritime Force Protection Unit would provide notification of the location of planned training events to Tribal Fisheries Enforcement Officers.

Information exchange between the Tribes and the Navy helps ensure schedules are de-conflicted when possible.

Impacts from Loss of Fishing Gear Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities in the Offshore Area, Inland Waters, and Western Behm Canal would change from the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3), and in some cases vary slightly from the number of activities proposed under Alternative 1. In the Offshore Area, as discussed for Alternative 1, the change in testing activity is not expected to increase damage to fishing gear and the testing of explosive torpedoes would be conducted greater than 50 NM off the coast of Washington, outside of U&A fishing grounds. The Navy normally has the ability to avoid areas that are actively being used by other vessels, which reduces the potential to encounter and damage fishing gear in the Offshore Area. Under Alternative 2, the number of military expended material items, including sonobuoys, chaff, and flares, would not change significantly from Alternative 1. Therefore, as discussed and concluded in the 2015 NWTT Final EIS/OEIS, Tribal fishermen using bottom trawls may encounter these materials, but the probability would remain low. Damage to fishing gear from Navy testing activities in the Offshore Area would be rare under Alternative 2.

In the Inland Waters, use of the Carr Inlet OPAREA may include temporary placement of underwater testing devices. Appropriate safety procedures and temporary marine traffic restrictions would be used to avoid interactions with fishing gear. Existing security restrictions prevent public access at Navy pierside locations; therefore, fishing gear would not be affected by these activities. Military expended materials could present a risk to gear used to fish on the bottom due to snagging of fishing line, snagging of nets, or tangling of other bottom traps. The probability of encountering military expended materials that would impact fishing gear would be low. Standard procedures used to ensure safety, security, and testing data integrity; and procedures for communicating with Tribes that have U&A fishing grounds in testing areas would continue to be implemented under Alternative 2 and would minimize the risk of fishing gear damage. Damage to fishing gear from Navy testing activities in Inland Waters is expected to be rare under Alternative 2.

Testing activities under Alternative 2 would remain the same as discussed under Alternative 1 in the Western Behm Canal and therefore would have no impact on loss of fishing gear in the area under Alternative 2.

3.11.2.3.1.3 Impacts from Loss of Fishing Gear Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct proposed at-sea training and testing activities in the Study Area. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Loss of fishing gear due to Navy activities would not occur in the Offshore Area, Inland Waters, or Western Behm Canal. Military expended materials may still remain in the water column or on the bottom of the seafloor in the Offshore Area, Inland Waters, or Western Behm Canal after cessation of training and testing at-sea activities, but cessation would not measurably improve the condition of the environment throughout the Study Area because the impacts are so minimal under Alternatives 1 or 2. Therefore, American Indian fishing gear retention rates would either remain unchanged or would improve slightly after cessation of ongoing at-sea training and testing activities.

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3.12 Socioeconomic Resources

3.12.1 Introduction and Methods

The purpose of this section is to supplement the analysis of impacts on socioeconomic resources presented in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS) with new information relevant to proposed changes in training and testing activities conducted at sea. Information presented in the 2015 NWTT Final EIS/OEIS that remains valid is noted as such and referenced to the appropriate sections. Any new or updated information describing the affected environment and analysis of impacts on socioeconomic resources associated with the Proposed Action is provided in this section.

3.12.2 Affected Environment

The socioeconomic resources analyzed in this Supplemental EIS/OEIS (Supplemental) are the same as the resources identified and analyzed in the 2015 NWTT Final EIS/OEIS. The training and testing activities described in Chapter 2 (Description of Proposed Action and Alternatives) of this Supplemental are generally consistent with the training and testing activities analyzed in the 2015 NWTT Final EIS/OEIS and are representative of activities that the Department of Defense has been conducting in the NWTT Study Area for decades.

The concerns over socioeconomic resources and how they may be impacted by the proposed training and testing activities are similar to those as previously described in the 2015 NWTT Final EIS/OEIS. The United States (U.S.) Navy's operating procedures to prevent or lessen impacts on local socioeconomic resources, as described in the 2015 NWTT Final EIS/OEIS, remain applicable and will continue to be implemented.

As described in detail in the 2015 NWTT Final EIS/OEIS, the socioeconomic analysis evaluated how elements of the human environment might be affected by ongoing and proposed training and testing activities in the Study Area. The Navy identified three broad socioeconomic elements, based on their association with human activities and livelihoods in the Study Area:

- commercial transportation and shipping (Section 3.12.2.1)
- commercial and recreational fishing (Section 3.12.2.2)
    - Usual and accustomed fishing by Pacific Northwest American Indian tribes and nations and Alaska Natives is analyzed in Section 3.11 (American Indian and Alaska Native Traditional Resources)
- tourism and recreation (Section 3.12.2.3)

Each of these resources is an aspect of the human environment that involves economics (e.g., employment, income, or revenue) and social conditions (e.g., enjoyment and quality of life) in the Study Area. These three elements were chosen as the focus of the analysis in this section because of their importance to the local economy and the way of life in the region, and the potential for these elements to be impacted by the proposed training and testing activities.

Data and information from government technical documents and reports, scientific journals, and the Navy's marine resources database of publications were reviewed to assess any changes in the socioeconomic environment from conditions described in the 2015 NWTT Final EIS/OEIS. Based on this review, socioeconomic resources in the marine environment have not changed appreciably since 2015.

A complete description of the extent of the Study Area, including special use airspace, sea space, and pierside and inland facilities, is provided in Section 2.1 (Description of the Northwest Training and Testing Study Area). Briefly, training and testing activities proposed in this Supplemental would occur in one or more of these three Study Area subdivisions:

- Offshore Area (Pacific Northwest Operations Area, including the surf zone at Pacific Beach and the Olympic Military Operations Areas [MOAs])
- Inland Waters (Washington State inland waters)
- Western Behm Canal (Southeast Alaska Acoustic Measurement Facility [SEAFAC])

There are over 192,000 Sailors, Marines, civil servants, military retirees, and their family members who live and work in the Pacific Northwest. Washington State's second-largest employment sector is defense, with $12.7 billion in spending each year. The immediate and surrounding communities in which Navy personnel live and work benefit from over $7.6 billion being added to the economy each year, along with the Navy's life-saving mutual aid for emergency response and search and rescue capabilities.

Navy leadership and the regional environmental team are actively involved in community partnerships in the Pacific Northwest and Alaska in a number of ways. For example, Navy personnel provide support for search and rescue operations, fire protection and response services, medical transportation, and humanitarian assistance and disaster relief. Strategic engagement efforts within communities allow the Navy to strengthen relationships with federal, state, and local agencies; tribes; and non-governmental organizations.

3.12.2.1 Commercial Transportation and Shipping

The Navy conducts training and testing activities in areas where commercial transportation and shipping also occurs. Notifications of potentially hazardous operations are communicated to all vessels and operators by use of Notices to Mariners (NTMs), issued by the United States Coast Guard (USCG), and Notices to Airmen (NOTAMs), issued by the Federal Aviation Administration (FAA).

Following a review of recent literature, including government technical documents, reports, and scientific journals, the information presented on ocean traffic in the Study Area, as described in the 2015 NWTT Final EIS/OEIS, has not appreciably changed.

3.12.2.1.1 Ocean Traffic

Commercial shipping is a significant component of the regional economy. Commercial goods are transported through the Offshore Area to the major international ports of Seattle, WA; Tacoma, WA; and Portland, OR, as well to smaller domestic ports in Washington's inland waters. The maritime Port of Seattle-Tacoma was the nation's sixth-highest ranked port (out of 150) by value of shipments for international waterborne trade (imports + exports) in 2015. Over $83 billion of goods passed through the two ports (American Association of Port Authorities, 2016). While the two ports specialize in international trade, domestic trade is also a major function of both ports. Tacoma and Seattle were ranked 28th and 29th, respectively, for total trade (foreign and domestic) by volume (tons) in 2015. The volume of international trade at the ports of Seattle and Tacoma peaked in 2012 at nearly 20.5 million metric tons, declining to just under 19 million metric tons in 2015 (Figure 3.12-1). While recent trends show a decline, the volume of goods in 2015 is approximately equivalent to pre-recession totals (U.S. Maritime Administration, 2015). Farther to the south, the Port of Portland was ranked 34th in total trade (foreign and domestic) by volume (U.S. Army Corps of Engineers, 2016).

Together, the ports of Tacoma and Seattle had the sixth-highest number of port calls of container vessels in the United States in 2015 (U.S. Maritime Administration, 2016). The active commercial shipping industry at these three major U.S. international ports has a direct economic impact on numerous businesses and jobs that support the shipping industry, from dock workers to trucking companies, and, indirectly, smaller businesses in the food and retail sector. The Port of Seattle supported over 43,000 jobs (direct and indirect) in 2013 and generated over $3 billion in business revenue and $322 million in state and local taxes in 2013 (Port of Seattle, 2014).

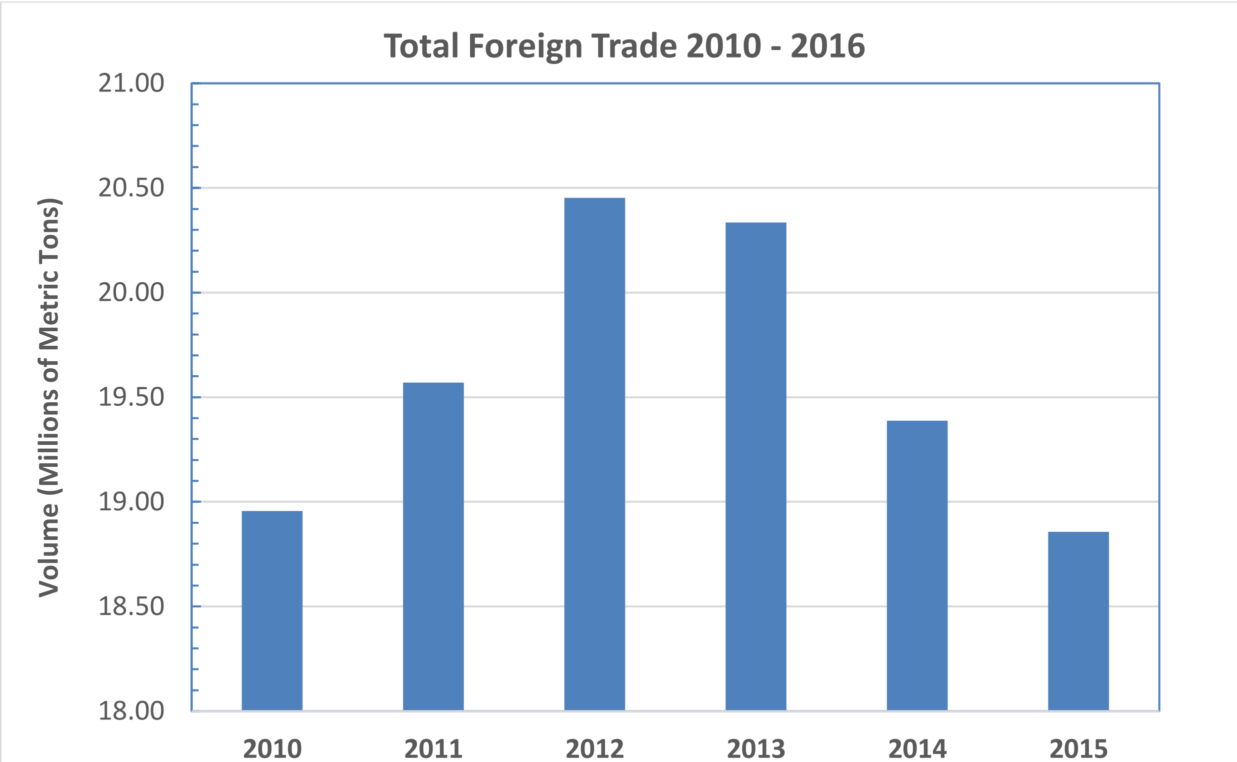

Figure 3.12-1: Total Waterborne Foreign Trade at the Ports of Seattle and Tacoma from 2010 to 2015

A port call is equivalent to two vessel transits (one inbound and one outbound), which is a more relevant metric for assessing potential interactions between commercial shipping and the proposed training and testing activities. More than 1,700 vessels called at the ports of Tacoma and Seattle combined, and 500 called at the Port of Portland, Oregon in 2015 (U.S. Maritime Administration, 2016). Considering only these three major ports, over 4,400 vessel transits occurred in 2015, transporting over 113 million tons of cargo (U.S. Maritime Administration, 2016). Different ports are equipped to handle different types of cargo, and each specialization creates a need for particular types of businesses and industries to support port operations. Sixty percent of all port calls at the ports of Tacoma and Seattle combined were from container vessels, and 55 percent of vessels transiting up the Columbia River to the Port of Portland carried dry bulk goods (e.g., ore, wood, limestone, cement, and sugar). Offloading, rail, and trucking companies at each port specialize in the transport of container units and dry bulk goods to regional distribution centers.

Refer to Section 3.12.2.1.1 (Commercial Shipping) in the 2015 Final NWTT EIS/OEIS for additional details.

3.12.2.1.1.1 Offshore Area

Most vessels entering or leaving ports in Washington, Oregon, and northern California travel northwest, southwest, or south through the Study Area without incident or delay. Shipping to and from the south typically follows the coastline. Smaller vessels may travel within 3 or 12 nautical miles (NM) from shore and remain shoreward of the Study Area, but larger commercial shipping vessels typically remain farther from shore. Ships traveling overseas between ports in the Study Area, Hawaii, and the Far East typically travel via the most direct route or the great circle route (Figure 3.12-2).

3.12.2.1.1.2 Inland Waters

There are six smaller ports in Inland Waters portion of the Study Area, four of which are ranked by the U.S. Army Corps of Engineers annually to be in the top 150 U.S. ports by cargo volume (Table 3.12-1). The Port of Vancouver is not in the Study Area and is not a U.S. port, but data on the port are included to show that the majority of vessel transits through the Strait of Juan de Fuca transit north to Vancouver. In addition to transferring cargo, these smaller ports are used by other commercial vessels, such as ferries that transport people and vehicles across Puget Sound and whale-watching vessels that take passengers on excursions into Puget Sound and surrounding waters. These activities have been co-occurring with military activities with minimal interactions for years.

Table 3.12-1: Smaller Ports in the Inland Waters Portion of the Study Area Ranked by Cargo Volume in 2015

Port	Rank	Cargo Volume (tons)	Vessel Transits
Anacortes	54	9,519,828	410
Grays Harbor	106	2,202,538	168
Everett	124	1,599,169	236
Olympia	136	1,137,908	Not Available
Port Angeles	NR	–	488
Cherry Point	NR	–	518
Vancouver, Canada[1]	NR	138,082,585	6,252

[1]If ranked as a U.S. port, Vancouver, Canada would have ranked third in total trade.

Source: U.S. Army Corps of Engineers (2016); U.S. Maritime Administration (2016); Vancouver Fraser Port Authority (2017); NR = Not Ranked

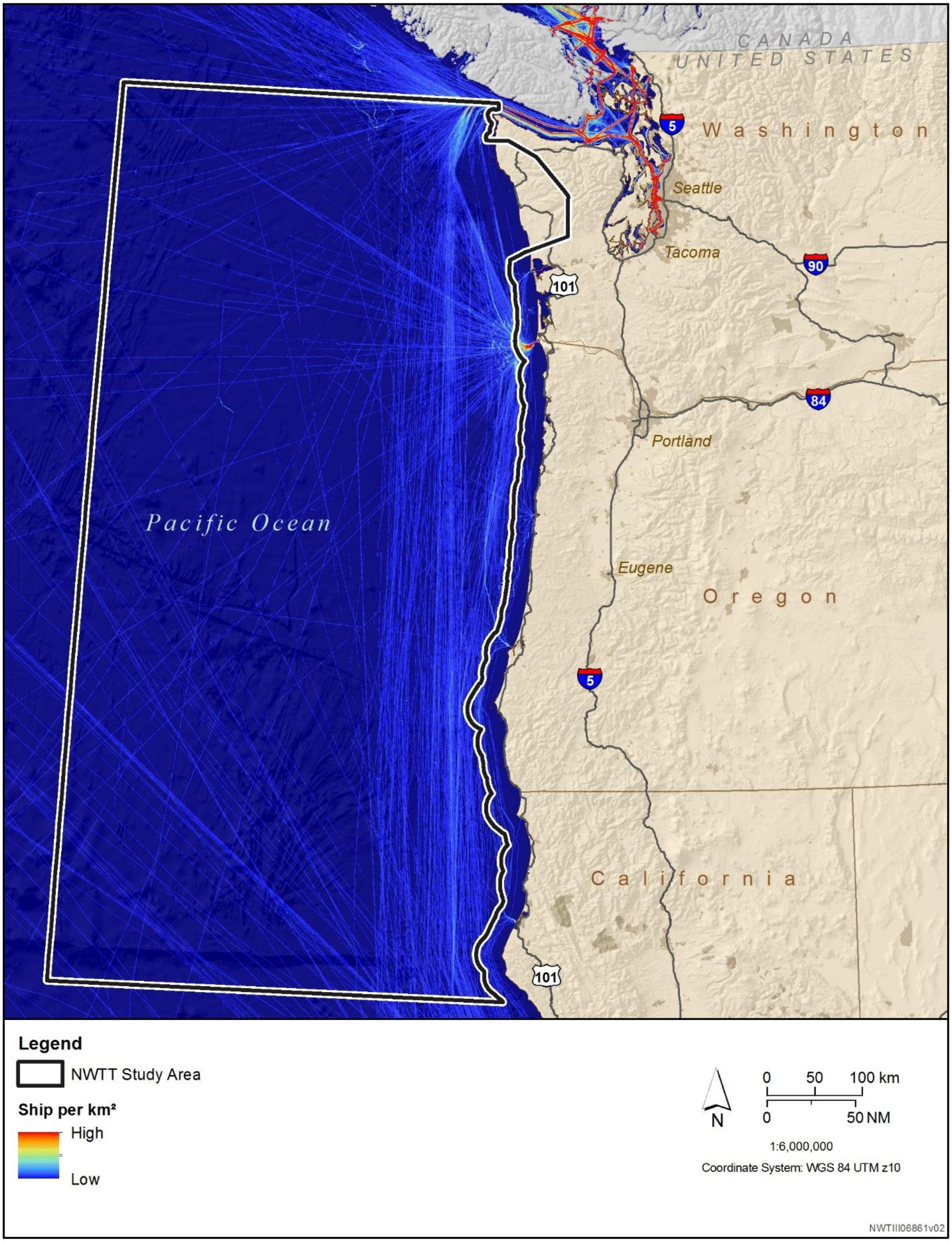

Figure 3.12-2: Relative Density of Vessel Traffic Along Shipping Routes in the Offshore Area

Over 1,300 port calls at smaller ports in the Inland Waters portion of the Study Area occurred in 2015 (U.S. Maritime Administration, 2016). Assuming each port call is equivalent to two vessel transits, over 2,600 vessel transits were handled by those ports in 2015 (Table 3.12-1). Vessels accessing the ports of Seattle and Tacoma also transit through the Inland Waters portion of the Study area. As noted in Section 3.12.2.1.1 (Ocean Traffic), over 3,400 vessel transits to and from these two major ports occurred in 2015. Combined with totals from the smaller ports, approximately 6,000 vessel transits through the Inland Waters portion of the Study Area took place in 2015. The relative density of vessels in the Inland Waters portion of the Study Area is shown in (Figure 3.12-3).

The Port of Vancouver, Canada, is a major commercial port, handling over 138 million tons of cargo and receiving 3,126 foreign vessels in 2015 (Vancouver Fraser Port Authority, 2017) (Table 3.12-1). Vessels accessing the port transit through the Strait of Juan de Fuca then head north navigating through the Haro Strait between Vancouver Island and the San Juan Islands. Victoria, located on the southern tip of Vancouver Island, is a popular cruise ship and tourist destination for both international and U.S. travelers. In 2015, 227 cruise ships carrying over 533,000 passengers visited Victoria (Greater Victoria Harbour Authority, 2017). The port also handles daily ferry traffic from Port Angeles and Seattle. With the exception of ferry transits from Seattle, vessel traffic associated with Canadian ports mainly occurs in the Strait of Juan de Fuca.

The Keyport Range site, Dabob Bay Range Complex, Carr Inlet Operations Area, Navy 3 and Navy 7 OPAREAs, and several pierside facilities are all located within the Inland Waters portion of the Study Area (see Figure 2.2-3). The Navy limits or restricts access to certain areas (e.g., Crescent Harbor) to maintain the safety of the public and military personnel when potentially dangerous activities are being conducted (e.g., mine warfare training). Access to pierside locations is restricted at all times.

Navigational obstructions may occur in a small portion of Keyport Range Site tests; in these cases (as for current activities), an NTM is issued. In addition, the USCG has published a final rule establishing protection zones extending 500 yards (yd.) around all Navy vessels in navigable waters of the United States and within the boundaries of the Coast Guard Pacific Area (32 Code of Federal Regulations [CFR] Part 761). All vessels must proceed at a no-wake speed when within a protection zone. Non-military vessels are not permitted to enter within 100 yd. of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol.

Dabob Bay Range Complex and Hood Canal military operating areas are charted on navigational charts. When activities are occurring in Dabob Bay, the Navy will activate yellow, white, and red warning lights positioned at Sylopash Point, Pulali Point, Whitney Point, Zelatched Point, and the southeast end of Bolton Peninsula to notify non-military vessels of the status of the range. Yellow or alternating white and yellow lights indicate the following concerns:

- Non-military vessels should proceed with caution;
- Range activities are in progress, but no noise-sensitive acoustic measurement tests are in progress; or
- Vessels should be prepared to shut down engines when lights change to red.

Red or alternating white and red lights indicate the following concerns:

- Range activities involving critical measurements are in progress;

- Engines should be stopped until red beacons have been shut off, indicating the test is completed; and
- Advice of Navy personnel on guard boats should be followed when in or near the range site. Typically, boat passage is permitted between tests when the yellow beacons are operating.

Pierside sonar maintenance testing within the Study Area is conducted within the Puget Sound at Naval Base Kitsap Bremerton, Naval Base Kitsap Bangor Waterfront, and Naval Station Everett. Activities at these pierside locations are conducted in the established waterfront restricted areas for those installations. Additional information about restricted areas associated with these facilities, including access by the public, is provided in 33 CFR 334.1240 (Sinclair Inlet), 33 CFR 334.1220 (Hood Canal, Bangor), and 33 CFR 334.1215 (Port Gardner, Everett Naval Base).

3.12.2.1.1.3 Western Behm Canal, Alaska

The Port of Ketchikan is located approximately 10 miles south of Western Behm Canal and SEAFAC. Ketchikan is a commercial port and was ranked 145th out of 150 ports in total trade by cargo volume (tons) in 2015 (U.S. Army Corps of Engineers, 2016). The port transferred almost 1 million tons of cargo, over 90 percent in domestic trade, in 2015, indicating its importance to southeast Alaska. Major commodities included oil and fuel, building products (e.g., wood and concrete), and groceries (U.S. Army Corps of Engineers, 2016). While salmon fishing remains an important industry in Ketchikan's economy, tourism and the passenger cruise industry are now the primary economic drivers. More than 800,000 passengers visit Ketchikan annually. In 2014, the port reported nearly 500 port calls by cruise vessels, all between April and September (Ketchikan Visitors Bureau, 2015). Western Behm Canal is not part of the route used by large vessels, including cruise ships, but small craft tourism traffic (e.g., sight-seeing and charter fishing) in the Canal is directly influenced by cruise ship port calls in Ketchikan. In addition, recreational and commercial fishing boats, as well as private transportation craft, use Western Behm Canal regularly.

Western Behm Canal includes five restricted areas (see Figure 2.2-4); the largest, Area 5, spans the width of the Canal and encompasses Areas 1, 2, and 3. During operations, the Navy can close the restricted areas to all vessel traffic. Typically, such closures do not exceed 20 minutes. Notices to Mariners announcing restricted access are issued on average 10 times per year; about 8–12 events occur annually that require restrictions on vessel traffic to ensure that the participant vessel (usually a submarine, which is out of the visual observation of small boat operators) has a clear sea space to navigate safely. Notices to Mariners usually extend for a period of four or five days, but limitations on vessel traffic typically last for 20 minutes and occur up to twice per hour. During these times, small vessels (30 feet [ft.] or less) transiting through Western Behm Canal are required to stay within 1,000 yds. of the shoreline, maintain a maximum speed of 5 knots, and be in radio contact with SEAFAC. The Navy uses the radio contact to ensure that all vessels comply with the navigation rules during these critical periods. On occasion, the engine of a transiting vessel may create noise that interferes with data collection during a test. When this occurs, SEAFAC may request that the vessel operator voluntarily turn off the engine during the period of data collection. Alternatively, SEAFAC may delay data collection until the vessel has cleared the area. When testing is not being conducted, vessel traffic is not restricted, but permanent restrictions on anchors, nets, towing, and dumping remain in force. Additional information on transiting the restricted areas in Western Behm Canal are provided in 33 CFR 334.1275 (West Arm Behm Canal, Ketchikan, Alaska, restricted areas) and summarized in Section 3.13 (Public Health and Safety).

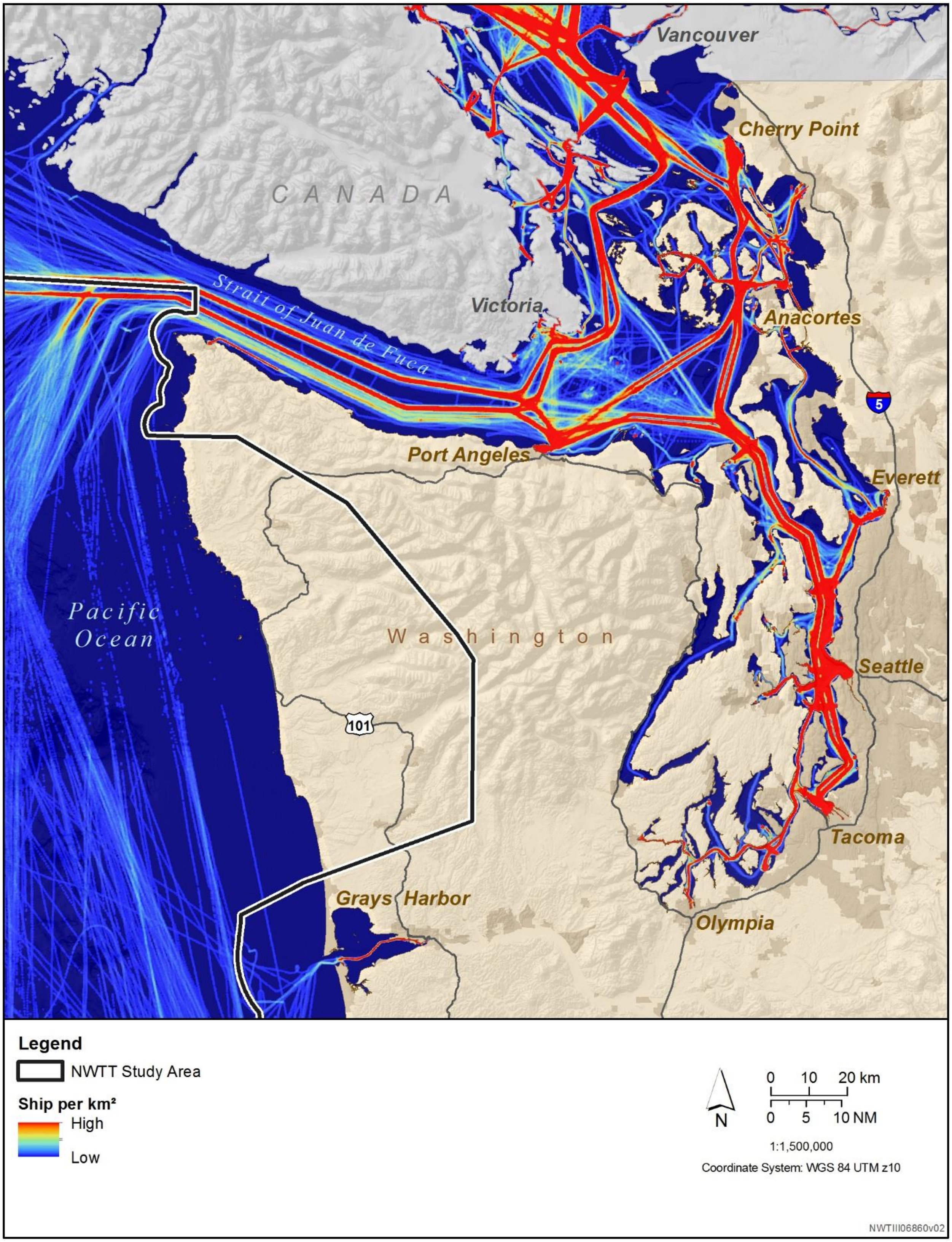

Figure 3.12-3: Relative Density of Vessel Traffic Along Shipping Routes in the Inland Waters Portion of the Study Area

The Navy conducts tests in the Western Behm Canal throughout the year. However, during the peak tourism and fishing season of May 1 through September 15, the Navy conducts acoustic measurement tests that require only transitory restrictions in Area 5 (see Figure 2.2-4) for a total of no more than 15 days. This timeframe is within the popular cruise ship season when visitation and recreational use of Western Behm Canal is highest. This is also the time when vessel traffic associated with commercial fishing is highest.

Public notification (e.g., NTMs) that the Navy will conduct operations in Western Behm Canal is given at least 72 hours in advance to the following Ketchikan contacts: USCG, Ketchikan Gateway Borough Planning Department, Harbor Master, Alaska Department of Fish and Game, KRBD radio, KTKN radio, and the Ketchikan Daily News.

3.12.2.1.2 Air Traffic

Air traffic refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are promulgated by the FAA to define permissible uses of designated airspace and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general. Common airways over the Study Area are depicted in Figure 3.12-4.

A detailed description of special use airspace (military operating areas, restricted airspace, and warning areas) used by the military is provided in Chapter 2 (Description of Proposed Action and Alternatives).

3.12.2.1.2.1 Offshore Area

Air routes and airways in the Study Area are primarily managed by the Seattle Air Route Traffic Control Center located near the Seattle-Tacoma International Airport, the largest commercial airport in the region. The Seattle Terminal Radar Approach Control coordinates approach services for the Seattle-Tacoma International Airport and has over 450,000 operations per year for southern and central Puget Sound. Based on the available information, air traffic in the Offshore Area, as described in the 2015 Final NWTT EIS/OEIS, has not appreciably changed.

3.12.2.1.2.2 Inland Waters

The special use airspace in the Puget Sound portion of the Study Area consists of Restricted Area 6701 (R-6701) and Chinook MOAs (Figure 3.12-5). Naval Air Station Whidbey Approach Control, an FAA-certified control facility, not only provides service to military aircraft operating out of Naval Air Station Whidbey Island, it also provides approach control service for 18 outlying civilian and USCG airfields and 12 locations for the ambulance service Airlift Northwest. Prior to potentially hazardous training and testing activities involving aircraft, air traffic access restrictions are released to the aviation community through a NOTAM and broadcast on their Automated Terminal Information System. Based on the available information, air traffic in the Inland Waters portion of the Study Area (Figure 3.12-5), as described in the 2015 Final NWTT EIS/OEIS, has not appreciably changed.

3.12.2.1.2.3 Western Behm Canal, Alaska

Controlled airspace (Figure 3.12-4) similar to a temporary flight restriction exists over the SEAFAC area in Western Behm Canal during acoustic tests. SEAFAC currently issues an informal request to aircraft flying below 3,000 ft. above mean sea level to divert around Restricted Area 5 during testing events. At this time, SEAFAC is not using a formal NOTAM to alert aircraft of upcoming testing events. The temporary flight restriction extends up to 3,000 ft. and has a radius of 1 NM. It is intended to keep floatplanes with tourists or fishermen at a distance when SEAFAC is conducting acoustic tests.

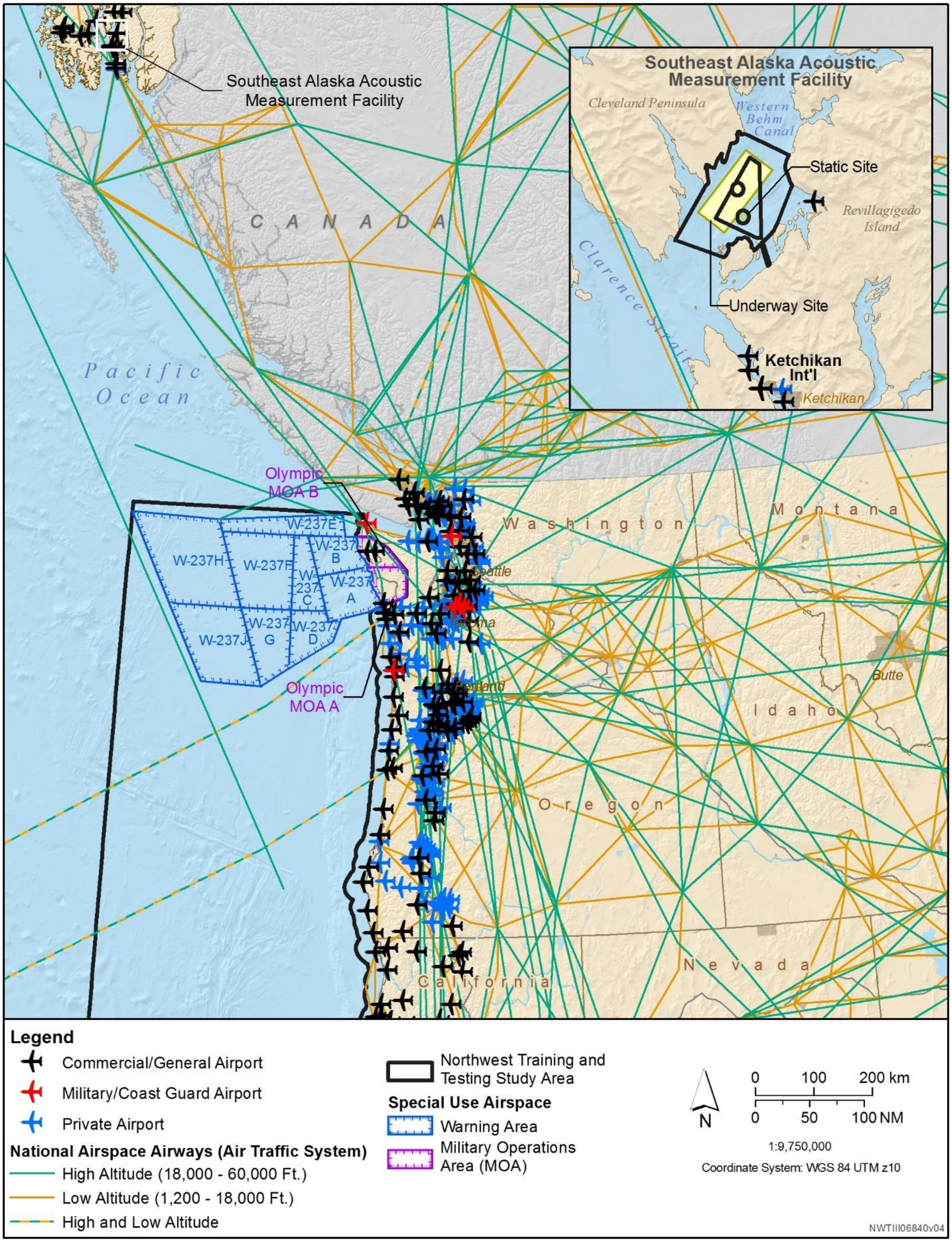

Figure 3.12-4: Airspace and Air Traffic Airways in the Northwest United States

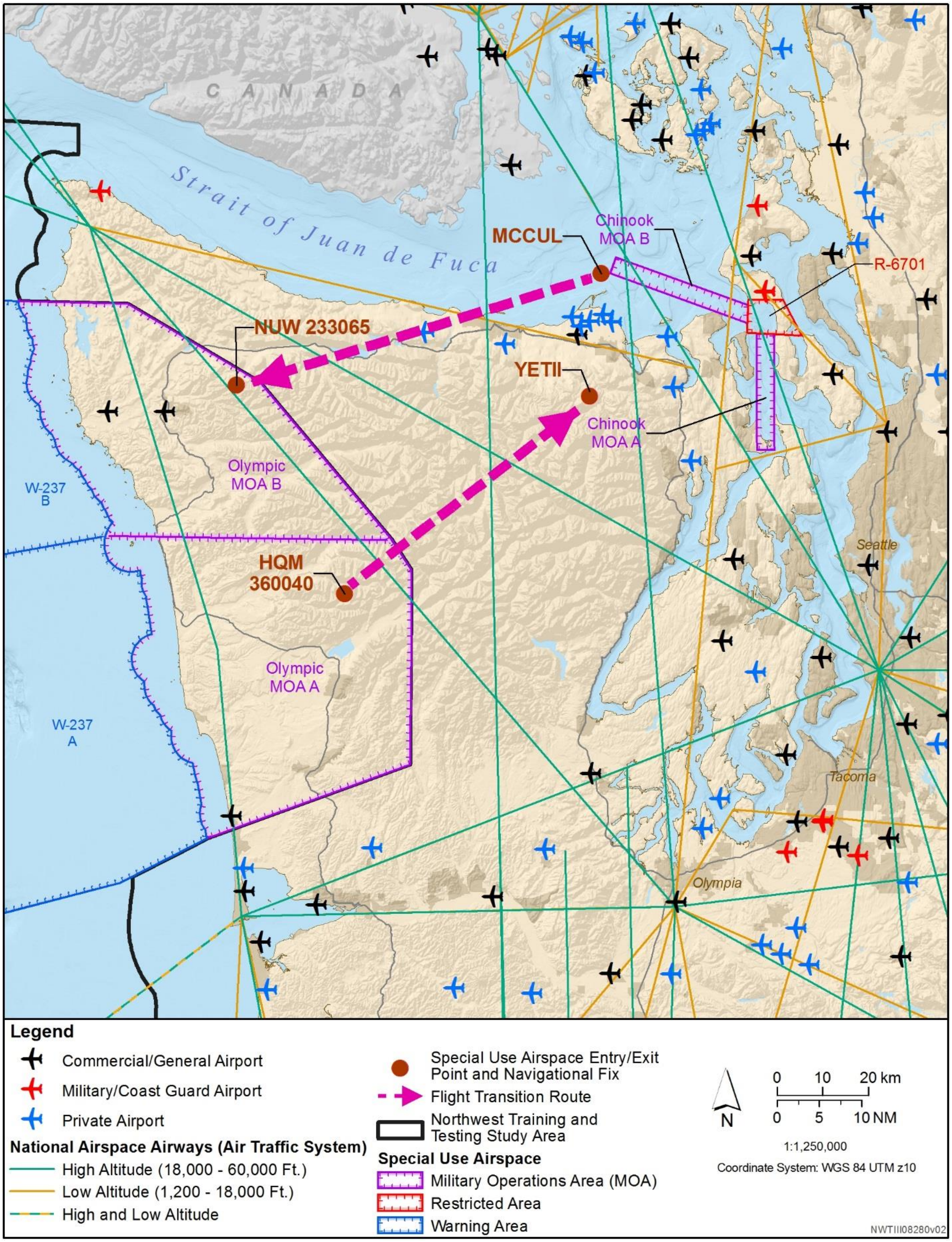

Figure 3.12-5: Airspace and Air Traffic Airways in Inland Waters Area

3.12.2.1.3 Vehicle Traffic

3.12.2.1.3.1 Inland Waters

The only portion of the Study Area with vehicular traffic that could be impacted by military activities is in the Inland Waters area, specifically that portion of State Route 104 in northern Kitsap County and eastern Jefferson County around the Hood Canal Floating Bridge. The route extends across the Hood Canal Floating Bridge, a drawbridge with two 300-ft. spans that can open to allow marine traffic to pass. During openings, vehicle traffic on State Route 104 queues and back-ups occur. In 2016, an average of 18,000 vehicles crossed the bridge each day, and there were 394 bridge openings (in 2015) (Hughes, 2017).

Commercial or recreational vessels intending to pass through will contact the bridge crew at least one hour before the opening (Washington State Department of Transportation, 2011). The Washington Department of Transportation uses a variety of electronic notification systems, including highway signage, web site notices, and subscriber alerts, to notify the public of upcoming openings. Vehicle traffic is held at the traffic control gates located on the bridge during openings for commercial or recreational vessels. These openings last for 10–45 minutes, though clearance of the traffic queue will take longer, particularly in summer months when tourism traffic is at its peak (Washington Department of Transportation, 2017).

Bridge openings to accommodate Navy vessels (e.g., submarines) may take longer, lasting for up to 60 minutes, because multiple large vessels must often pass the bridge in close formation, requiring that both spans are retracted to their maximum extent. Traffic can queue for up to 4 miles on either side, depending on the time of day and season. These longer bridge openings also receive advance notice via notification boards on approaching highways; however, the lead-time can be less than the state mandated minimum of one hour for national security reasons (non-military openings require a minimum lead time of one hour).

3.12.2.2 Commercial and Recreational Fishing

Commercial fishing takes place throughout the Offshore Area, from nearshore waters adjacent to the mainland to the offshore fishing grounds. For the entire United States, approximately 35 percent of commercial fisheries landings (by volume) are caught between 0 and 3 NM from shore, and 60 percent are caught between 3 and 200 NM from shore. The remaining 5 percent are caught on the high seas (beyond 200 NM from shore) or in foreign waters (National Marine Fisheries Service, 2016a).

3.12.2.2.1 Offshore Area

The Pacific Fishery Management Council is one of eight regional fishery management councils established by the Magnuson Fishery Conservation and Management Act of 1976 and is responsible for managing fishery resources along the coasts of California, Oregon, and Washington. The council has defined five main fisheries for the region: groundfish (e.g., flounder, sole), highly migratory species (e.g., tuna), coastal pelagic species (e.g., anchovy, mackerel, herring, sardines), Pacific halibut, and salmon (Pacific Fishery Management Council, 2017).

The NMFS maintains a database of commercial fisheries landings by state and species or species group. In 2015, commercial landings for Washington State totaled 154,568,143 pounds and were valued at nearly $300 million (fifth-highest in the nation) (National Marine Fisheries Service, 2016b). Shrimp landings, specifically brine, penaeid, spot, and ocean shrimp were the highest by volume in 2015 at over 42 million pounds. Landings of groundfish species and salmon species were the second- and third-largest species groups by volume, respectively (Figure 3.12-6). The value of commercial landings by species or group did not coincide with the volume.

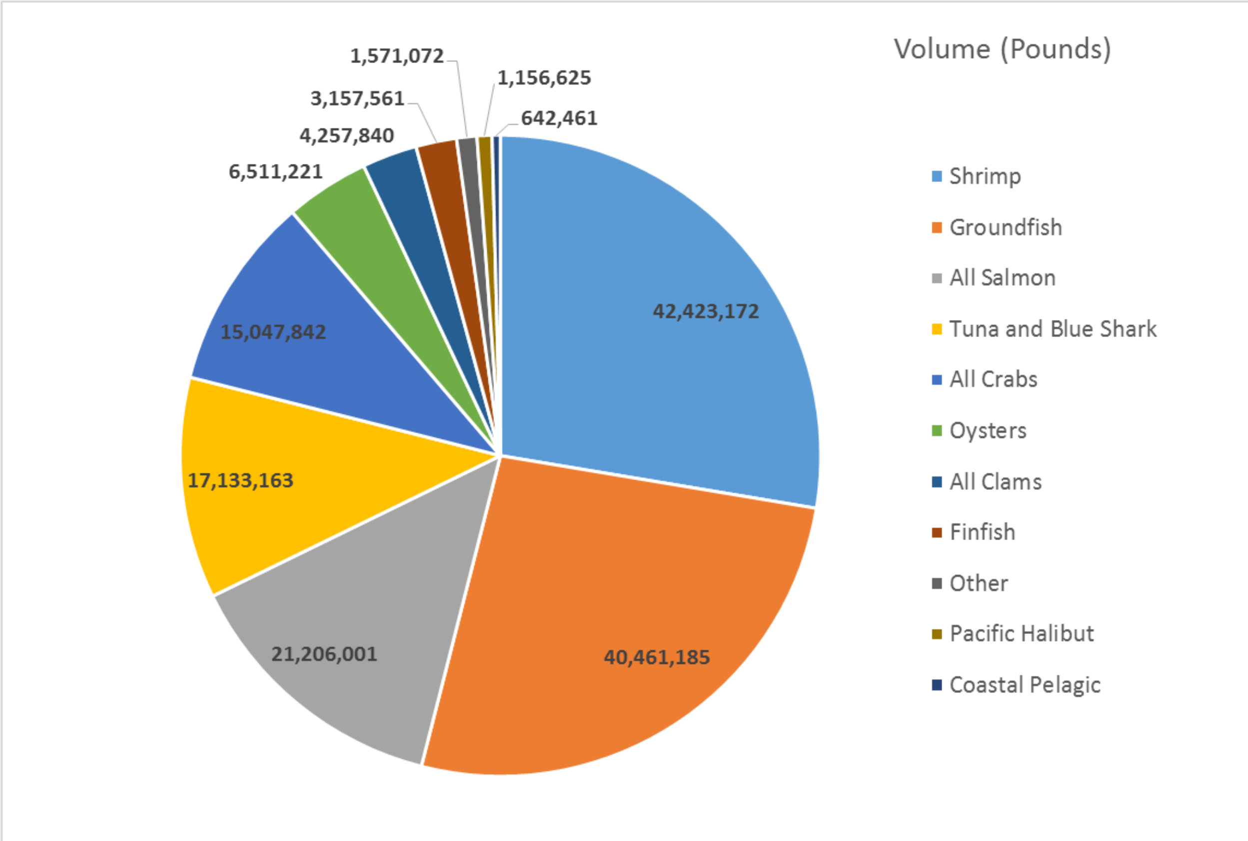

Figure 3.12-6: Volume of Commercial Landings by Species Group in Washington State Waters in 2015

Clams (over $75 million) and crabs (over $72 million) made up nearly half of the value of all landings in 2015, whereas shrimp ($33 million) were the fourth-most valued species group and salmon ($27 million) the fifth (Figure 3.12-7). As reported in the 2015 Final NWTT EIS/OEIS, in 2011, the total value of commercial landings was approximately $290 million. By 2015, the value of commercial landings increased by approximately 3 percent.

Recent trends in commercial fisheries landings are mixed. The overall value of commercial fisheries landings in the State of Washington declined from 2013 through 2016, and the volume (pounds) of commercial landings declined between 2013 and 2015 but increased by approximately 10 percent between 2015 and 2016 (National Marine Fisheries Service, 2016b). The data suggest that the volume and potentially the value, which historically follows a similar trend, of fisheries landings in the State of Washington may begin trending upwards.

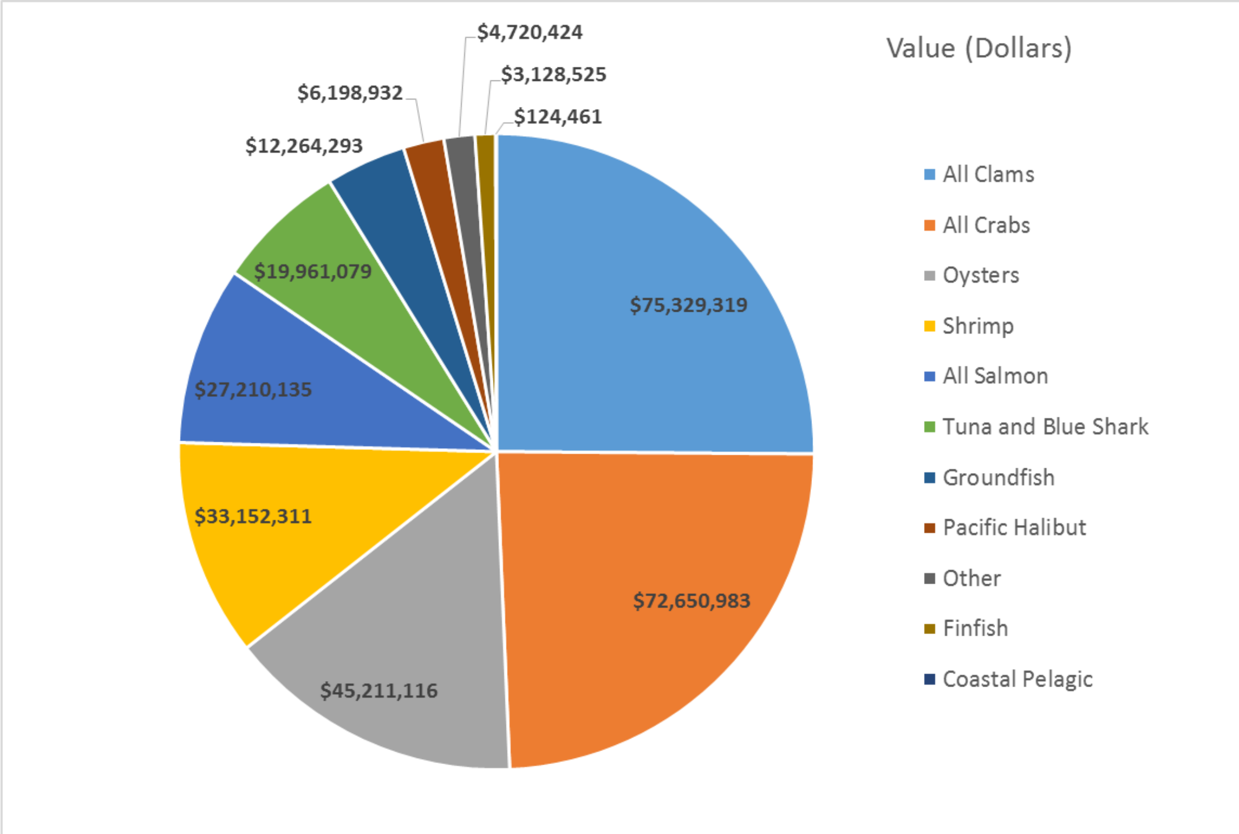

Figure 3.12-7: Value of Commercial Landings by Species Group in Washington State Waters in 2015

Commercial landings in Oregon were 194,575,317 pounds with a value of just under $114 million (11th-highest value in the nation) (National Marine Fisheries Service, 2016b). Over 86 percent of landings by volume (pounds) were from groundfish species and shrimp (Figure 3.12-8). While not at the same proportion as the volume, the two species groups with the highest value in 2015 were also shrimp and groundfish species, which made up over 66 percent of the total value of all landings (Figure 3.12-9).

Commercial landings in Oregon followed a trend similar to landings in the State of Washington from 2013 through 2016. However, in Oregon both the volume and value of commercial landings increased from 2015 to 2016 (National Marine Fisheries Service, 2016b). The data suggest that the volume and the value of fisheries landings in Oregon may begin trending upwards.

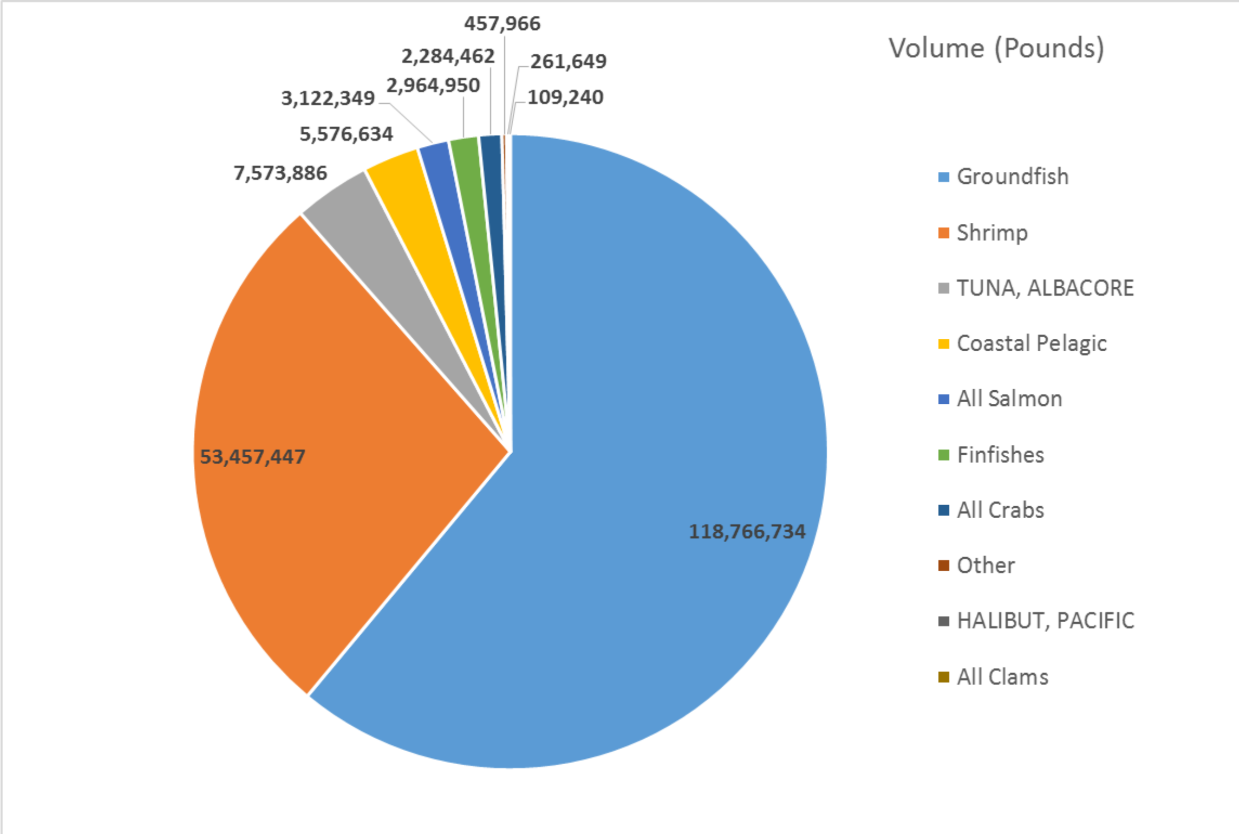

Figure 3.12-8: Volume of Commercial Landings by Species Group in Oregon Waters in 2015

Commercial fishing is important to the economies of several communities that fish in the Offshore Area, as described in Section 3.12.2.2.1 (Offshore Area) of the 2015 Final NWTT EIS/OEIS and identified in Pacific Fishery Management Council (2015). The communities include Astoria, Oregon; Bellingham, Washington; Brookings, Oregon; Coos Bay, Oregon; Newport, Oregon; and Port Orford, Oregon. These communities tend to have small populations, are geographically isolated, and are heavily dependent on commercial and recreational fishing and on tourism. Changes in the regional and national economy since NMFS's 2006 community assessment have certainly affected many if not all of these communities to some degree; however, the dependency of these communities on commercial and recreational fishing is unlikely to have changed appreciably. These communities continue to be dependent on income from fisheries and would be vulnerable to substantial changes in their ability to access fishery resources and to fluctuations in the value of commercial landings.

Recreational fishing in the Offshore Area is concentrated in nearshore areas due to the smaller size and limited capabilities of typical recreational fishing vessels and the time required to complete a trip farther offshore if the vessel plans to return to port the same day. However, some recreational fishers travel up to 100 miles from shore seeking pelagic species like albacore tuna (Washington Department of Fish and Wildlife, 2018). Consequently, only approximately 10 percent of recreational fishing trips nationwide are in federal waters (beyond 3 NM from shore). Nationally, most of the recreational catch in 2015 came from inland waters (55 percent in numbers of fish), with 33 percent from state waters (0–3 NM from shore for all Pacific states) and almost 10 percent from beyond 3 NM. The majority of trips in the Pacific region fished primarily in inland waters (National Marine Fisheries Service, 2016a).

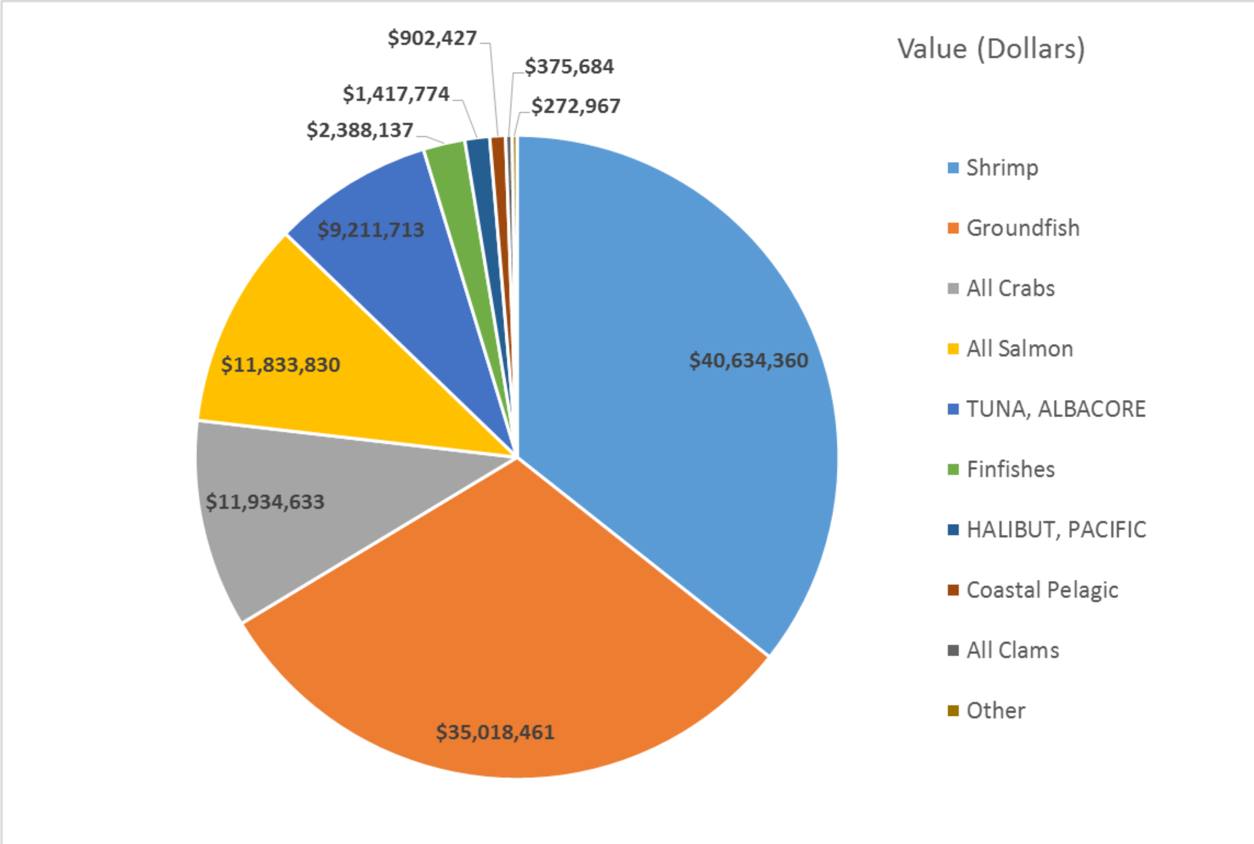

Figure 3.12-9: Value of Commercial Landings by Species Group in Oregon Waters in 2015

The economies of some small coastal communities are dependent on income from recreational fishing in the Offshore Area. The Oregon ports of Newport, Garibaldi, Brookings, and Charleston are the most heavily engaged Northwest ports in chartered recreational fishing, and these communities (as well as others) would be affected by substantial changes to the abundance or accessibility of species targeted by recreational fishers (Pacific Fishery Management Council & National Marine Fisheries Service, 2015).

3.12.2.2.2 Inland Waters

Washington's commercial fishing industry was the third-largest producer of edible seafood in the United States in 2015 behind Alaska and Louisiana (National Marine Fisheries Service, 2016b). However, it is noteworthy that over 90 percent of seafood consumed in the United States is imported (although a significant portion is caught by American fishers and processed overseas), and despite being the third-largest producer, Washington fishers accounted for just 6 percent of edible seafood landings (National Marine Fisheries Service, 2016a).

Washington State is one of the largest producers of farmed shellfish in the nation and is a leading producer of naturally grown shellfish, most of which come from Puget Sound. Wild salmon species support a variety of fisheries in the Puget Sound region, including sport, commercial, and tribal fisheries (Pacific Fishery Management Council, 2016). Puget Sound also supports a growing salmon aquaculture industry, which is controversial because of the potential impacts the farmed Atlantic salmon could have on native species (e.g., introduce parasites, compete for food should the farmed salmon escape). A "spill" of approximately 250,000 farmed Atlantic salmon into Puget Sound in August 2017 brought the controversy to the forefront (Mapes, 2017). While a preliminary investigation indicated that the escaped salmon were not able to feed and died from starvation, subsequent findings contradicted that assertion and reported that Atlantic salmon continued to be caught by tribal fishermen through December 2017 (Cauvel, 2017; Mapes, 2018). The results of an investigation conducted by the State concluded that negligence by the owner was the cause of the release (Mapes, 2018). In February 2018, it was reported that 19 captured Atlantic salmon all tested positive for piscine orthoreovirus, a highly contagious and debilitating virus that could affect native salmon species (Wild Fish Conservancy, 2018). The incident and its consequences for native salmon led Governor Jay Inslee to sign a bill banning the farming of Atlantic salmon in Washington State waters (Ryan, 2018).

The Penn Cove Mussel Farm in Coupeville Washington exports large quantities of its highly renowned Penn Cove Mussels annually(Penn Cove Shellfish, 2017). Commercial and tribal traditional fisheries are conducted with purse seine or gill nets, primarily in the open waterways of Puget Sound and Hood Canal (Washington Department of Fish and Wildlife, 2012). American Indian and Alaska Native tribal and subsistence fishing is analyzed in Section 3.11 (American Indian and Alaska Native Traditional Resources). Commercial landings at ports serving fisheries in the Inland Waters portion of the Study Area for 2015 are shown in Table 3.12-2.

Table 3.12-2: Commercial Landings at Ports in the Inland Waters Portion of the Study Area in 2015

Washington Inland Waters Port	Volume (Millions of Pounds)	Value (Millions of Dollars)
Anacortes	5.9	20.6
Bellingham	13.3	25.4
Blaine	2.3	8.5
Neah Bay	5.6	8.9
Everett	1.6	1.8
Olympia	2.5	17.2
Port Townsend	1.5	4.7*
Seattle	6.4	24.5
Shelton	9.6	34.2
Tacoma	1.9	5.9

*2014 landings
Source: National Marine Fisheries Service (2016c)

In 2015, marine recreational anglers took 4 million trips and caught a total of over 14 million fish in Washington, Oregon, and California waters. Almost 92 percent of the trips were made in California, 5 percent were in Oregon waters, and approximately 3 percent (135,000) were in Washington State waters (National Marine Fisheries Service, 2016a). As noted in Section 3.12.2.2.1 (Offshore Area), most trips in the Pacific region fished primarily inland waters (National Marine Fisheries Service, 2016a), suggesting that most of the 135,000 trips in Washington State occurred in inland waters. Recreational fishing, crabbing, and clamming typically occurs throughout the inlets of Puget Sound and Hood Canal. Recreational sportfishing in public waterways in Washington State, which consists largely of waters in the Inland Waters portion of the Study Area, contributed an estimated $805 million in 2014 to the regional economy and recorded over 19.5 million participant days (Briceno & Schundler, 2015). Motorized boating and sailing expenditures contributed an additional $1.6 billion to the economy, and expenditures on non-motorized paddle sports totaled over $578 million and recoded 7.7 million participant days. Daily expenditures on motorized and non-motorized boating and related activities ranged from $75 to $88 per person (Briceno & Schundler, 2015). These and other recreational activities that rely on access to inland waters make a valuable contribution to the Washington State economy.

3.12.2.2.3 Western Behm Canal, Alaska

Commercial landings at the port of Ketchikan in 2015 totaled 84 million pounds and had a value of nearly $40 million (National Marine Fisheries Service, 2016b). Salmon in the state waters near Ketchikan represents a large portion of the harvest for Ketchikan residents and visitors. As of September 22, 2017, the Alaska Department of Fish and Game reported that 21 trollers fishing in the Western Behm Canal and Neets Bay area had caught approximately 236,000 chum salmon and made 1,142 landings in 2017. Trolling effort typically declines through September as the days become shorter (Alaska Department of Fish and Game, 2017). Other important commercial fisheries in the area include sea cucumber, sea urchin, herring spawn, and shrimp.

Commercial fishing and seafood processing at the port of Ketchikan is a vital part of the local economy. Income by Ketchikan based fishers in 2012 was estimated to be $26.6 million. These earnings contributed to the local economy through property and sales taxes, purchases of homes, rentals, hotels, entertainment, fuel, vehicles, food, repair and maintenance parts, transportation, medical, and other services. Virtually every business in Ketchikan benefits financially from commercial fishing and the related industries of seafood processing and transportation (United Fishermen of Alaska, 2013).

Several open water areas near SEAFAC are considered as heavy or moderate recreational fishing areas. These waters include portions of Western Behm Canal around Betton and Back Islands, Clover Passage, Clover Pass, Smuggler's Cove, and Helm Bay (Ketchikan Gateway Borough, 2007).

3.12.2.3 Tourism and Recreation

Coastal tourism and recreation can be defined as the full range of tourism, leisure, and recreation activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities). Also included is ecotourism (e.g., whale watching) and recreational activities such as boating, cruises, swimming, fishing, surfing, snorkeling, and self-contained underwater breathing apparatus (SCUBA) diving. Both tourists and locals also enjoy visiting the Olympic National Park and Olympic National Forest and other areas on the Olympic Peninsula to participate in activities such as hiking, camping, observing nature (e.g., bird watching), photography, and simply being outdoors.

Water sports are popular among residents of and visitors to Washington. Many communities and individual residences have piers or private docks located adjacent to the Inland Waters area and along the coastline and participate in a variety of recreational activities, including recreational fishing, which is discussed in Section 3.12.2.2 (Commercial and Recreational Fishing). Other popular water sports include motorized and non-motorized boating, kayaking, swimming, and SCUBA diving. In 2014, Washington State recorded over 28 million participant days of motorized and non-motorized boating activities and over 40 million participant days for swimming, SCUBA diving, and related activities (Briceno & Schundler, 2015). Swimming and related activities like tubing are the most popular water sports, but are not likely to occur in the Study Area, because the vast majority of swimmers remain close to shore and far from areas used for at-sea training and testing, which in many cases occur more than 12 NM from shore. Expenditures on motorized and non-motorized boating activities, which could occur in the same locations as some training and testing activities, totaled over $2.3 billion in 2014, averaging between

$75 and $88 per person per day. The per-person, per-day expenditures on boating activities were exceeded only by SCUBA diving, for which individuals spent an average of $119 per day and total expenditures were over $130 million. In comparison, per-person, per-day expenditures on swimming averaged just $20 and on tubing were $44 (Briceno & Schundler, 2015).

Other than swimming, the most popular water sport activity in 2014 was fishing, which recorded 19.5 million participant days with average expenditures of $41 per person per day (Briceno & Schundler, 2015). Recreational fishing is discussed in Section 3.12.2.2 (Commercial and Recreational Fishing).

3.12.2.3.1 Offshore Area

Tourism and recreation within the Study Area occurs primarily within Puget Sound; however, a variety of tourism and recreational activities also occur in the Offshore Area. These activities include whale watching, which occurs March through November with peak tourism activity in the summer, and charter boat fishing. Whale watching by boat primarily occurs along the Oregon coast (Newport and Depoe Bay) and Northern California (Fort Bragg). Gray whales are the most commonly observed species, found about 5 miles off the coast during their southward migration in December and January and as close as one-half mile during their northward migration, which extends from March through June (Oregon Coast Visitors Association, 2018). Whale watching off the Washington coast occurs from boat- and land-based operations (O'Connor et al., 2009).

As noted above, portions of the Olympic National Park and Olympic National Forest underlie airspace that is part of the Study Area, and both of these natural areas attract tourists and locals into the state. Visitation at the park has increased each year since 2013 and totaled almost 3.4 million people in 2016 (National Park Service, 2017). Summer is the most popular time to visit the park, and in nearly every year since 1979, August has had the highest number of recreation visitors to the park with over 764,000 in 2017. Since 1979, visitation has been lowest in winter and early spring. On average, between 85,000 and 113,000 people visited the park during November through March between the years 1979 and 2017 (National Park Service, 2018).

The Olympic MOAs partially overlap the Olympic National Park, Olympic National Forest, Colonel Bob Wilderness Area, and Pacific Beach as well as other sites popular with locals and tourists (Figure 3.12-10). Approximately 24 percent of the Olympic National Park and 27 percent of the Olympic National Forest lies beneath the Olympic MOAs. All of the Colonel Bob Wilderness Area and Pacific Beach State Park underlie the Olympic MOAs as do several other points of interest and recreation areas located on the peninsula. As part of the Proposed Action, the Navy would continue to use the Olympic MOAs in the same manner proposed in the 2015 Final NWTT EIS/OEIS. The Olympic Coast National Marine Sanctuary, located offshore of the Olympic Peninsula, also attracts tourists and is analyzed in Chapter 6 (Additional Regulatory Considerations). A substantial number of tourists accessing locations on the Olympic Peninsula come by car across the Hood Canal Bridge, which is located in the Inland Waters portion of the Study Area and discussed in in Section 3.12.2.1.3 (Vehicle Traffic).

Data reported by the National Ocean Economics Program show that the tourism and recreation industry in Washington coastal counties increased steadily from 2010 to 2014 (National Ocean Economics Program, 2017c). The number of businesses specializing in ocean-related activities increased by 2 percent from 5,017 in 2010 to 5,125 in 2014. Even though the increase in the number of establishments was modest, the number of jobs in the industry rose by 12 percent over the five-year time span. Wages paid out in the industry increased by 25 percent, and the industry contribution to Gross Domestic Product grew by 23 percent (National Ocean Economics Program, 2017c). Data available through 2016 for the broader leisure and hospitality industry in coastal and inland counties in Washington State indicate that the tourism and recreation industry has continued to grow beyond 2014 (National Ocean Economics Program, 2017b).

Coastal counties in Oregon (i.e., Clatsop, Coos, Curry, Douglas, Lane, Lincoln, and Tillamook) showed similar economic growth from 2010 through 2014 despite a 3.4 percent decline in the number of businesses specializing in ocean-related activities (National Ocean Economics Program, 2017a). Employment in the ocean tourism and recreation industry increased by 6 percent, wages were up by 24 percent, and the contribution to Gross Domestic Product rose by 26 percent between 2010 and 2014.

3.12.2.3.2 Inland Waters

The Inland Waters portion of the Study Area, including Puget Sound and Hood Canal, offer a wide variety of recreational activities for tourists and residents both on the water and along the shoreline. Recreational boating and other ocean-related activities contribute millions of dollars to the regional economy. In 2014, there were approximately 9.3 million participant days recorded by visitors accessing Washington State public waterways, which consists largely of waterways of the Inland Waters portion of the Study Area. Visitors participated in numerous recreational activities, including fishing, motorized boating and sailing, and non-motorized paddle sports (Briceno & Schundler, 2015). Expenditures in 2014 were highest for recreational activities associated with public waters, highlighting their importance to businesses supporting those activities. Water recreation includes a number of activities with high trip and equipment expenditures, especially activities involving motorized boating (Briceno & Schundler, 2015). Visitors who participated in recreational activities spent over $692 million in 2014 and contributed to multiple economic sectors in the region (e.g., hotels, food and beverage, retail) in addition to supporting businesses that cater directly to fishing and other water-based activities, such as SCUBA diving (Briceno & Schundler, 2015).

Popular outdoor activities in the Inland Waters area include boating, canoeing, swimming, diving, wildlife viewing, fishing, backpacking, bird watching, camping, hunting, kayaking, mountain biking, and hiking (Go Northwest!, 2017). Tourism is especially important to the economies in the towns of Coupeville and Langley, both waterfront towns on Whidbey Island that cater to tourists.

Vendors along the shoreline of Dabob Bay in Hood Canal offer a wide variety of boats to rent for recreational activities; services include recreational tours and group events. State parks on the shores of Hood Canal include Belfair, Twanoh, Potlatch, Triton Cove, Scenic Beach, Dosewallips, Kitsap Memorial, and Shine Tidelands (Figure 3.12-10). There are also a number of public marinas located along Hood Canal.

Puget Sound's good underwater visibility, rich sea life, and largely pristine diving conditions make it a popular destination for divers visiting the northwest. Charter dive trips to specific sites (Figure 3.12-10) are often published and booked as many as six months in advance. Diving occurs year round, though the number of trips to popular dive sites peaks during the summer, and most dive charters are scheduled for weekends. The tourism industry is linked to multiple sectors of the Washington State economy and relies on access to public waterways, including Puget Sound, to continue attracting visitors and tourism related businesses to the state (Briceno & Schundler, 2015).

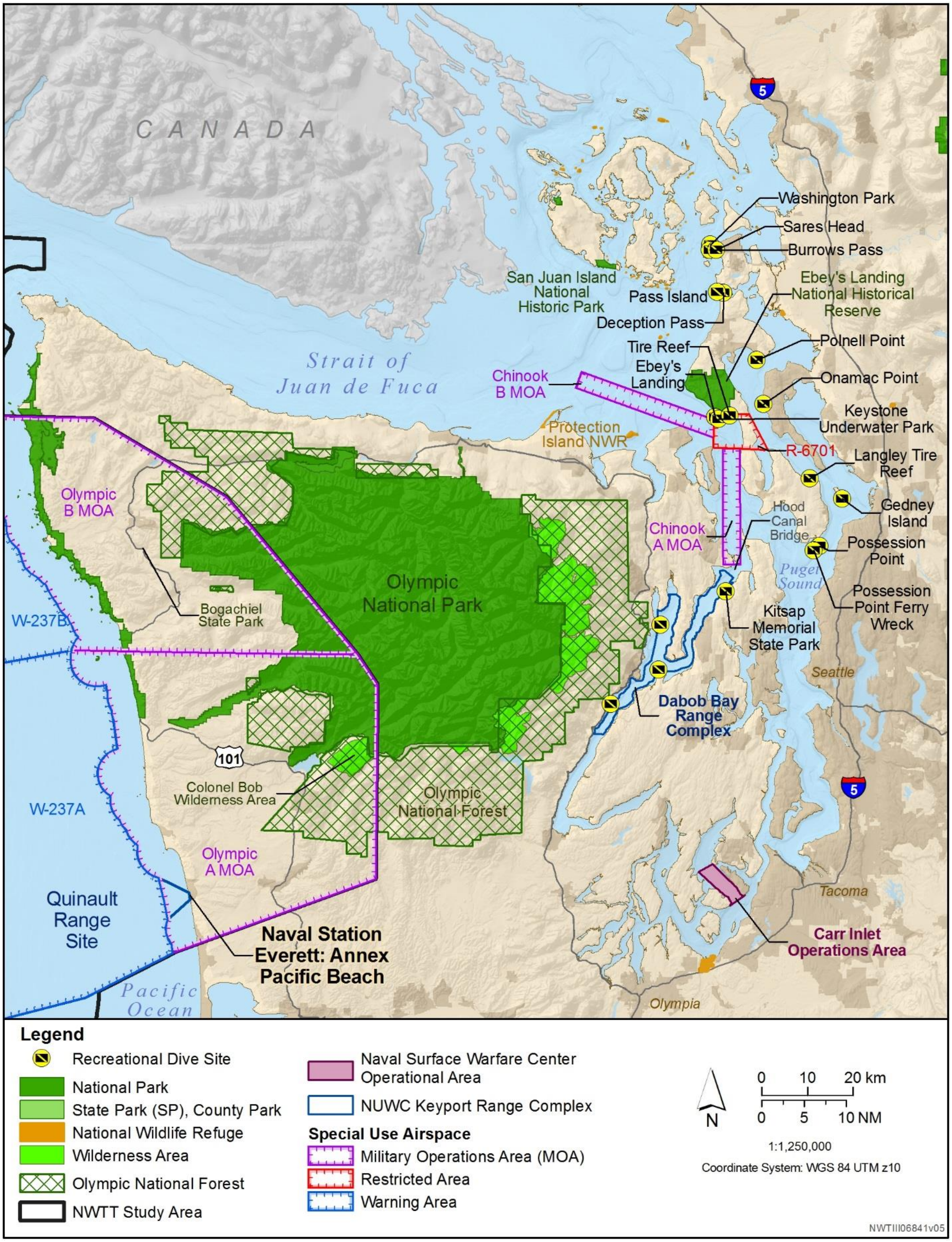

Figure 3.12-10: Recreational Areas in the Inland Waters Portion of the Study Area

3.12.2.3.3 Western Behm Canal, Alaska

There are no protected recreational areas within the Western Behm Canal portion of the Study Area, but Behm Canal is near the Misty Fjords National Monument and approximately 10 miles south of the major cruise ship stopover in Ketchikan, Alaska. Over 800,000 passengers visit Ketchikan annually. In 2014, the port reported nearly 500 port calls by cruise vessels, which only visit Ketchikan between April and September (Ketchikan Visitors Bureau, 2015). Visitors to Ketchikan can charter a fishing vessel or a float plane to access more remote marine areas.

Areas of Western Behm Canal near the SEAFAC are used for water-based recreation, and at least some of those participants are likely to be tourists. As noted above, several open-water areas near the SEAFAC are considered to be heavy or moderate recreational boating and fishing areas. Clover Pass, which is immediately west of the SEAFAC, is one of the area's main boating and sport fishing areas and is highly regarded for its scenic value.

With its three marinas and three resorts, the area is also very popular with sport fishers for nearshore and open water fishing, as well as for diving (Ketchikan Gateway Borough, 2007). Some of the popular recreational areas in the immediate vicinity of the SEAFAC include

- Betton Island State Marine Park: Uses include kayaking, boating, beachcombing, SCUBA diving, camping, fishing, hunting, wildlife viewing, and commercial guide activity (Ketchikan Gateway Borough, 2007).
- Grant and Joe Islands State Marine Park: The park is well known as a kayak resting area and for picnicking and camping. This park is accessible by boat and float plane only, which makes it less accessible to visitors (Ketchikan Gateway Borough, 2007).

3.12.3 Environmental Consequences

The 2015 NWTT Final EIS/OEIS analyzed training and testing activities currently occurring in the Study Area and considered all potential stressors related to socioeconomic resources. Stressors applicable to socioeconomic resources in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS:

- **Accessibility** (to the ocean and the airspace)
- **Airborne acoustics**
- **Physical disturbance and strike** (aircraft, vessels and in-water devices, military expended materials)
- **Secondary** (availability of resources)

This section evaluates how and to what degree potential impacts on socioeconomic resources from stressors described in Section 3.0.1 (General Approach to Analysis) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Tables 2.5-1 through 2.5-3 list the proposed training and testing activities and include the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the incremental changes in the proposed levels of training and testing can be easily identified. The annual number and location of activities that include various types of stressors that could impact socioeconomic resources are shown in Tables 3.0-9 through 3.0-22. Activities involving vessel movements (Table 3.0-12), for example, have the potential to impact accessibility.

3.12.3.1 Accessibility (to the Ocean and the Airspace)

Navy training and testing activities have the potential to temporarily limit access to areas of the ocean and airspace for a variety of human activities associated with transportation and shipping, commercial and recreational fishing, and tourism and other recreational activities in the Study Area. Access is most often affected when the Navy establishes a temporary, localized, safety zone or buffer zone around certain activities and actively restricts non-military activities within the zone. Training and testing activities involving the use of vessels and other in-water devices and aircraft have the greatest potential to impact accessibility to areas of the ocean or airspace.

The Navy searched for and reviewed publically available resources, including government documents and reports, scientific journals, and on-line databases for new socioeconomic data and information on activities occurring in the Study Area and published since 2015. New information on commercial fisheries and tourism was added to Section 3.12.2.2 (Commercial and Recreational Fishing) and Section 3.12.2.3 (Tourism and Recreation). Limiting access to areas that are popular for fishing and other activities conducted by the public is a factor potentially impacting recreational fishing, and tourism and related recreational activities. The data and supporting information presented in Section 3.12.2.2 (Commercial and Recreational Fishing) and Section 3.12.2.3 (Tourism and Recreation) describing economic indicators for ocean-related recreation and tourism show that trends for the industry have been positive in recent years and are likely to continue to show growth.

3.12.3.1.1 Impacts on Accessibility Under Alternative 1

3.12.3.1.1.1 Impacts on Accessibility Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training events involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). While the number of events involving vessel movements in the Offshore Area would decrease from about 1,100 to under 600 annually, events with vessel movements in the Inland Waters would increase from about 370 to nearly 700 annually. Overall, this results in about a 17 percent decrease in events involving vessel movements in the Study Area. The activities would occur in the same locations and in a similar manner as were analyzed previously.

There is an overall increase in the use of in-water devices (Table 3.0-13), all of which are associated with unmanned underwater vehicle use. The proposed increase of approximately 120 events using in-water devices in the Study Area would not substantially increase potential impacts on accessibility. While the vast majority of activities using in-water devices occur in the Offshore Area, 65 of these activities would occur in the Inland Waters area compared with just 1 proposed in the 2015 NWTT Final EIS/OEIS.

The number of annual events with aircraft movements in the Offshore Area (Table 3.0-11) would increase by 12 percent (from 6,311 to 7,047) and would increase from 100 to 143 events in the Inland Waters area. Training activities using aircraft are primarily conducted in offshore warning areas and in the Olympic MOAs. The offshore warning areas do not overlap with commercial airways; however, the Olympic MOAs overlap with several high-altitude commercial airways: J105, J54, and T257 (Figure 3.12-4). Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts on accessibility, if any were to occur, would likely temporarily affect general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5).

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training activities would avoid those areas. Potential impacts on commercial and recreational fishing and tourism and recreation are reduced by alerting the public of upcoming activities. When training activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues NTMs and the FAA issues NOTAM to allow the public to plan accordingly and ultimately to ensure the safety of military personnel and the public. When necessary, ocean areas and airspace used by the military are restricted for short periods of time (typically on the order of hours) to allow a training activity to be conducted with minimal potential for interruptions and risks to public safety. Once the activity is complete, the ocean or airspace is available for use by the public, except for areas where a permanent danger zone or restricted area has previously been designated (e.g., Dabob Bay restricted area; see 33 CFR 334.1260)

Furthermore, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity.

There has been no appreciable change to the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation, as summarized in this section, remain the same.

3.12.3.1.1.2 Impacts on Accessibility Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would increase compared to those proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-12 and Table 3.0-13). While activities with vessel movements would increase substantially in the Offshore Area (from 138 to 308 annually), activities with vessel movements decrease in the Inland Waters (from 944 to 817 annually). There would also be an overall increase of approximately 60 percent in the use of in-water devices (from about 740 to 1,200) (Table 3.0-13). The activities would occur in the same locations and in a similar manner as were analyzed previously.

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 258, decrease in the Inland Waters from 456 to 61, and would remain at 4 annual events in Western Behm Canal (Table 3.0-11). Aircraft movements in the Offshore Area are primarily conducted in warning areas, which do not overlap with commercial or general aviation airways, and in the Olympic MOAs, which overlap with several high-altitude commercial airways: J105, J54, and T257 (Figure 3.12-4). The majority of aircraft movements over the Inland Waters area are from aircraft transiting to the Offshore Area and inland airfields (see Tables 2.5-1, 2.5-2, and 2.5-3). The reduction in aircraft movements in the Inland Waters area would reduce the potential impacts on general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5). Overall, the changes in the use of vessels, in-water devices, and aircraft as described in Chapter 2 (Description of Proposed Action and Alternatives) and in the 2015 NWTT Final EIS/OEIS would not substantially change potential impacts on accessibility.

In Western Behm Canal, the Navy limits vessel traffic only when essential to the success of test events. Historically, the Navy has ensured that 89 percent of the peak tourism and fishing season is unaffected by restrictions, and the remaining 11 percent is only affected by requirements that transiting vessels reduce speed when testing is occurring, resulting in only brief delays. Navy activities that have the potential to conflict with other uses of Western Behm Canal, including commercial and recreational fishing, are minimized through specific provisions in 33 CFR Section 334, including short-duration closures and advanced public notification through NTMs. Navy activities have occurred in Western Behm Canal for approximately 20 years while minimizing impacts on other users.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and testing activities would avoid those areas. Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities. When testing activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues NTMs and the FAA issues NOTAM to allow the public to plan accordingly and ultimately to ensure the safety of military personnel and the public. When necessary, ocean areas and airspace used by the military are restricted for short periods of time (typically on the order of hours) to allow a testing activity to be conducted with minimal potential for interruptions and risks to public safety. Once the activity is complete, the ocean or airspace is available for use by the public, except for areas where a permanent danger zone or restricted area has previously been designated (e.g., Dabob Bay restricted area; see 33 CFR 334.1260).

Furthermore, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity.

There has been no appreciable change to the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation, as summarized in this section, remain the same.

3.12.3.1.2 Impacts on Accessibility Under Alternative 2

3.12.3.1.2.1 Impacts on Accessibility Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training events involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed in the 2015 NWTT Final EIS/OEIS (about 2,100 events per year) and would be about 11 percent greater than under Alternative 1 (Table 3.0-12 and Table 3.0-13). Activities with vessel movements would decrease in the Offshore Area from about 1,200 to 600 events annually compared with ongoing activities and would increase by 35 events per year compared with Alternative 1 (Table 3.0-12). Under Alternative 2, activities with in-water device movements would increase from about 500 ongoing events per year to about 650 events, similar to under Alternative 1 (Table 3.0-13).

Activities with aircraft movements in the Offshore Area would increase by 13 percent (from about 6,300 to 7,100 annually) under Alternative 2 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-11). Activities with aircraft movements would increase by about 100 events annually compared with the number of events under Alternative 1. Training activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4), with the exception of aircraft activities occurring in the Olympic MOAs, which do overlap with several high-altitude commercial airways: J105, J54, and T257. Activities with aircraft movements in the Inland Waters area would increase to 165 compared with 100 ongoing events and 143 events under

Alternative 1. Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts on accessibility, if any were to occur, would likely temporarily affect general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula (Figure 3.12-5). Given the limited increase, potential impacts on general aviation and other small aircraft flying over the Inland Waters and Olympic Peninsula would be consistent with the analysis and conclusions presented in the 2015 NWTT Final EIS/OEIS. The slight increases in training events including vessel movements, aircraft movements, and in-water devices would have the same or similar impacts on socioeconomic resources described in Section 3.12.3.1.1.1 for Alternative 1.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training activities would avoid those areas. Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities, as described in Section 3.12.3.1.1.1 for Alternative 1. The results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation are the same as described in Section 3.12.3.1.1.1 for Alternative 1.

3.12.3.1.2.2 Impacts on Accessibility Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities involving the movement of vessels or the use of in-water devices would remain generally consistent with those proposed under Alternative 1 (Table 3.0-12 and Table 3.0-13). While activities with vessel movements would increase substantially in the Offshore Area (from 138 to 317 annually), activities with vessel movements would decrease in the Inland Waters area from 944 to 831 annually. There would also be an overall increase of approximately 64 percent in the use of in-water devices (from about 740 to 1,200) in the Study Area, with increases proposed in both the Offshore area (128 to 303) and in the Inland Waters area (604 to 905) (Table 3.0-13). A decrease from 60 to 40 events with in-water devices is proposed for Western Behm Canal. The total number of events with vessel movements or in-water device movements would be less than 3 percent greater than under Alternative 1. The activities would occur in the same locations and in a similar manner as analyzed previously.

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 260 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS and would be essentially the same as under Alternative 1. Testing activities with aircraft would decrease in the Inland Waters from 456 ongoing events to 61 events under Alternative 2, and would continue to be 4 annual events in Western Behm Canal (Table 3.0-11). Potential impacts on general aviation and other small aircraft flying over the Inland Waters area and Olympic Peninsula would be consistent with analysis and conclusions under Alternative 1 and less likely to occur than during ongoing activities. The slight increases in testing activities including vessel movements, aircraft movements, and in-water devices would have the same impacts on socioeconomic resources described in Section 3.12.3.1.1.2 for Alternative 1.

No impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and testing activities would avoid those areas. Potential impacts on commercial and recreational fishing, and tourism and related forms of recreation are reduced by alerting the public of upcoming activities, as described in Section 3.12.3.1.1.2 for Alternative 1. The results of the analysis of impacts from limitations on accessibility to the ocean and airspace on transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation are the same as described in Section 3.12.3.1.1.2 for Alternative 1.

3.12.3.1.3 Impacts on Accessibility Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Limits on accessibility to the ocean and airspace as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer limits on accessibility within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for limiting accessibility by the public, but would not measurably improve accessibility to the ocean and airspace in the Study Area.

The same limitations on accessing portions of the Study Area designated as danger zones, restricted areas, and warning areas as described in the 2015 NWTT Final EIS/OEIS and in the CFR would still apply. Refer to 33 CFR (Navigation and Navigable Waters) Part 334 (Danger Zone and Restricted Area Regulations), 33 CFR 165.1401 (Safety Zones), 14 CFR 73.1 (Special Use Airspace) for specific regulations regarding these ocean areas and airspace.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.2 Airborne Acoustics

Loud noises generated from military training and testing activities such as weapons firing, in-air explosions, and transiting aircraft have the potential to disrupt recreational activities such as wildlife viewing, boating, fishing, and scuba diving. In addition to local residents, tourists participate in these activities in the Study Area. Encountering loud noises, particularly those that occur suddenly and nearby, could interfere with the enjoyment of several types of recreational activities. Disturbance from continuous albeit less intense noises could also affect the enjoyment of an activity.

Airborne acoustics from military activities would occur on a temporary basis and only when weapons firing and in-air explosions occur or as aircraft transit through an area. Military training and testing activities involving weapons firing and in-air explosions would only occur when the military can confirm the area is clear of non-participants (e.g., a recreational vessel). This procedure further reduces the likelihood that noise from these activities, which are taking place far from non-participants, would disturb residents or tourists engaged in recreational activities on the water. Activities involving weapons firing and explosives are not conducted in the Olympic MOAs. Furthermore, with the exception of Air Combat Maneuver and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOAs, most naval training and testing activities involving aircraft occur more the 12 NM from shore and those that occur closer to shore are typically at least 3 NM offshore. Recreational activities are largely conducted within a few miles of shore, which would minimize any overlap and disturbance from noises generated far offshore. Refer to Tables 2.5-1, 2.5-2, and 2.5-3 for information on the locations of Navy activities that use aircraft or munitions. Detailed information on each training and testing activity, including location and the types of stressors associated with the activity (e.g., airborne acoustics), is presented in Appendix A (Navy Activities Descriptions).

The analysis presented in the 2015 NWTT Final EIS/OEIS concluded that training and testing activities could have moderate, intermittent impacts from airborne noise (referred to as airborne acoustics in this Supplemental) on socioeconomic resources, depending on the proximity of the Navy activity to the resource participant. Explosive munitions and large-caliber, non-explosive munitions are the primary sources of weapons-related noise. All training activities using explosive munitions are conducted at least 50 NM from shore, and testing activities using explosives would be conducted at least 12 NM from shore. Training and testing activities using large-caliber, non-explosive munitions would take place at least 20 NM from shore. Since the most intense concentration of offshore socioeconomic activities is within 3 NM of the coast, airborne acoustics from training and testing activities using large-caliber weapons and explosive munitions would not have a significant potential to impact socioeconomic resources. Refer to Section 3.0.3.1.4 (Weapons Noise) for a detailed discussion of the types of airborne acoustics generated by weapons use.

Airborne acoustics generated by aircraft overflights are the type of acoustic disturbance most likely to be encountered by those participating in activities related to socioeconomic resources, because military aircraft transiting to airspace offshore often need to fly over populated areas, including the Olympic Peninsula, or need to conduct activities in the Olympic MOAs. In general, airborne acoustics from aircraft overflights only generate an acoustic disturbance at the moment it is heard, and noise from an overflight disturbance would only accumulate for the duration of a specific event. For example, as described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas), multiple aircraft flying above the Olympic Peninsula would generate, on average, low level (37 dBA) noise, because more than 95 percent of overflights would occur above 10,000 ft. Mean Sea Level (MSL), placing the source of the noise, an aircraft, and the receptor, a person on the ground, thousands of feet apart. In a worst case scenario with an individual located at an elevation of 4,000-4,500 ft. (approximately 0.09 percent of the land area under the Olympic MOAs) and an EA-18G (one of the loudest fixed-wing aircraft) flying directly over that individual at an altitude of 6,000 MSL, the analysis shows that the maximum noise level would be 100.6 dBA, and noise at this level would last for an average of 0.12 second per flight. Most of the terrain beneath the Olympic MOAs (more than 77 percent) is at an elevation of 1,000 ft. or less, thereby creating a buffer of at least 5,000 ft. between an individual on the ground and an aircraft at the lowest permissible altitude (6,000 ft. MSL). For more than 77 percent of the area, the maximum noise level would be 84.4 dBA. Aircraft flying at higher altitudes or not directly over an individual on the ground would generate less intense sound at ground level (i.e., the distance between the aircraft and the individual would be greater allowing for greater dissipation or spreading of sound). Aircraft entering or exiting the Olympic MOAs do so at specific points (see Table J-2 in Appendix J) and at a minimum altitude of 10,000 ft. MSL. At a ground elevation of 4,500 ft. MSL, the maximum noise level at the entry and exit points for any aircraft would be 58.2 dBA. At sea level (i.e., 0 ft. MSL) the maximum noise level would be 51.1 dBA. See Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) for more details.

The disturbance from a single aircraft transiting over land or nearshore areas to conduct a training or testing activity in the Offshore Area would be brief (seconds) and have no lasting impact on socioeconomic resources (e.g., commercial transportation and shipping, air traffic, commercial and recreational fishing, and tourism and recreation). Aircraft movements that occur more than 3 NM from the coast are less likely to impact socioeconomic resources, and aircraft that fly at higher altitudes while over land and nearshore areas are also less likely to cause a significant impact on socioeconomic resources. Section 3.0.3.1.3 (Aircraft Noise) in this Supplemental provides a detailed discussion of the types of airborne acoustics generated by military aircraft.

In addition to the broader socioeconomic resources listed in the paragraph above, the less quantifiable social resource described generally as the enjoyment of a natural setting, like the Olympic National Park, may also be impacted by airborne acoustics. While noise levels can be measured and noise sources can be compared to each other using well-established metrics, the perception of a noise by individuals and their reaction to the same noise heard simultaneously may vary widely. While some visitors to a natural setting like the Olympic National Park may be disturbed by an aircraft overflight, others may not even register the event.

In 2010, the National Park Service conducted an acoustic monitoring study within the Olympic National Park, measuring both natural sounds and noise generate by human activities (National Park Service, 2016). Noise sampling took place at five sites, with three of those sites (Hoh River Trail, Third Beach Trail, and Lake Ozette) beneath the Olympic MOAs. The purpose of the noise monitoring effort was to characterize existing sound levels in the park and to use the data to estimate a natural ambient acoustic baseline in the park from sounds collected at the five sites, as well as identify the sources of recorded sounds. The study reported the percentage of time that measured noise levels exceeded four noise thresholds indicative of disturbance at each of the measurement locations for the winter season. The fourth and highest level, 60 dBA, provided a basis for estimating impacts on normal voice communications at 3 ft., which is the most relevant threshold for hikers and visitors to the park. Noise levels at Hoh River Trail and Third Beach Trail exceeded 60 dBA less than 1 percent of the time during daytime and nighttime monitoring. Noise levels at Lake Ozette exceeded 60 dBA just 1.2 percent of the time in daytime measurements and 1.4 percent of the time in nighttime measurements (National Park Service, 2016).

The data also show that natural sounds dominated between 7 a.m. and 7 p.m. at each of the three sites beneath the Olympic MOAs. At the Hoh River Trail site, natural sounds were audible 83 percent of the time. Sounds from aircraft, including fixed-wing aircraft and helicopters, were audible 12 percent of the time, and other human sounds were audible 5 percent of the time. At Third Beach Trail, natural sounds were audible 91 percent of the time, and sounds from aircraft and other human activities were audible 5 percent and 4 percent of the time, respectively. At Lake Ozette, the most remote site, natural sounds were recorded 93 percent of the time. Aircraft sounds were audible 7 percent of the time and other human sounds less than 1 percent of the time.

Lake Crescent, which is located approximately 20 km east of the eastern edge of Olympic MOA B, was the site most affected by human sounds (primarily vehicle noise from the highway). Human-generated sounds dominated the sound spectrum 58 percent of the time. Noise from high-altitude jets were audible 7.2 percent of the time, and lower-altitude fixed-wing aircraft and helicopters were audible 0.3 percent of the time. Naturally occurring sounds were louder than human-generated sounds 35 percent of the time. (National Park Service, 2016). The data for the National Park Service study were collected in 2010 but are considered relevant to the Proposed Action, because the tempo of Navy training and testing activities involving aircraft is generally consistent with the baseline data, as presented in Section 3 of Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas).

As described in the examples above, in general, noise intensity or loudness decreases with distance from the sound source. In the case of aircraft overflights, noise levels perceived on the ground are expected to be higher at higher elevations. This correlation is supported by the results presented in the noise study in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas). A scenario similar to the examples described above but taken from the study illustrates how noise may be perceived by a visitor to the park. Suppose a hiker is beneath the Olympic MOAs at a terrain height of 300 ft. (a likely situation given that 45 percent of the Olympic MOA overlays terrain between 0 and 500 ft.). In a worst-case scenario, if an EA-18G flew directly over the hiker at full power and at the lowest permissible altitude (6,000 ft. MSL), the hiker would be exposed to noise at 82.9 dBA. That is similar to the sound level the hiker might experience 5 meters from a busy roadway. However, as noted above, the sound of the jet would be at this intensity for only an instant as the jet flies directly overhead, decreasing rapidly as the jet flies away from the hiker. If the jet did not fly directly over the hiker (a more likely occurrence), then the highest noise experienced by the hiker would be less than 82.9 dBA, dissipating with increasing distance between the jet and the hiker.

While higher elevations in the Olympic National Park would receive higher noise levels, the areas with the highest elevations are located in the eastern half of the park; the MOAs only overlay the western portion of the park, and in total, only approximately 27 percent of the entire park. Based on the data and analysis presented in the National Park Service noise study, aircraft overflight noise is only a very small portion of the sounds detectable in the Olympic National Park. An individual visitor may still be disturbed by an aircraft overflight; however, for the vast majority of the time, visitors are exposed to naturally occurring sounds, and to a lesser extent, noise from other human sources not associated with the Proposed Action, including noise from commercial and general aviation aircraft.

Refer to Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS for more information on the potential impacts of airborne acoustics (airborne noise) in the Study Area. Refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) for more information on noise levels that visitors to the Olympic National Park and other areas beneath the Navy's Olympic MOAs could experience.

3.12.3.2.1 Impacts on Airborne Acoustics Under Alternative 1

3.12.3.2.1.1 Impacts on Airborne Acoustics Under Alternative 1 for Training Activities

Under Alternative 1, the number of annual events with aircraft movements in the Offshore Area (Table 3.0-11) would increase by 12 percent (from 6,311 to 7,047) and in the Inland Waters area would increase from 100 to 143 events. Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and shipping vessels would not be delayed by airborne acoustics. A slight increase in the number of activities with aircraft movements in the Inland Waters would increase potential impacts on commercial and recreational fishing, and tourism and related forms of recreation occurring inland and on adjacent land areas. However, these changes would not appreciably change the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from airborne acoustics on commercial and recreational fishing, and tourism and related forms of recreation remain valid.

Aircraft overflights from Air Combat Maneuver training activities and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOAs have the potential to disturb land-based recreational and tourism activities (e.g., hiking) in the Olympic National Park and other areas on the Olympic Peninsula. While airborne acoustics from aircraft overflights are likely to be heard and may disturb some visitors to the national park, economic indicators representing tourism and recreational activities in the region, including in the national park, have been trending upwards in recent years and are projected to continue to increase (see Section 3.12.2.3.1, Offshore Area). The Navy has been conducting aircraft activities in the Olympic MOAs for decades, and those same economic indicators have been steadily increasing over much of that time (National Ocean Economics Program, 2018a, 2018b).

From 2015 through 2017, the average annual number of Navy EA-18G aircraft transits to and from the Olympic MOAs was 2,224. Under Alternative 1, EA-18G transits to and from the Olympic MOAs are proposed to increase by 300 per year. This proposed increase equates to, on average, less than one additional transit per day over a calendar year.

As described in detail in the Airspace Noise Analysis for the Olympic Military Operations Areas (Appendix J), visitors to the national park, national forests, and wilderness areas on the Olympic Peninsula would potentially be affected by and respond to individual flyover events by aircraft transiting to and from NAS Whidbey Island. The highest elevations along the flight transit routes between NAS Whidbey Island and the Olympic MOAs range from approximately 4,500 to 8,000 ft. MSL. An EA-18G flying at an altitude of 10,000 ft. MSL directly over an 8,000 ft. peak could produce maximum noise levels of up to 97 dBA at ground level (i.e., at a distance of 2,000 ft.) (see Table J-7 of Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). Maximum noise levels would be lower at elevations below the highest peaks and ridgelines and where the aircraft is not directly overhead. The noise level also depends on the engine power used by the aircraft at the time of overflight. At ground level elevations near sea level (i.e., 0 ft. MSL), where the distance between the aircraft at an altitude of 10,000 ft. MSL and a receptor is approximately 10,000 ft., the maximum noise level would be 73 dBA (see Table J-7 of Appendix J, Airspace Noise Analysis for the Olympic Military Operations Area). Although noise from overflights during transit could be higher than average background noise levels in the national park, national forest, and wilderness areas, on average they would not be substantially above the range of commonly heard natural sounds in the national park or nearby areas (National Park Service, 2016). At the Hurricane Ridge site, which is the closest site to the YETII reporting point, the daytime median ambient noise level was 24.4 dBA. After removing noise from all aircraft overflights, the median ambient noise level was reduced to 23.4 dBA, and noise from only natural sounds was measured at 23.1 dBA.

Visitors to the national park, national forests, and wilderness areas on weekends or at night will rarely hear an EA-18G aircraft, because EA-18G training flights typically occur Monday through Friday and during daylight hours.

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas), which concludes that noise exposure within the Olympic MOAs and W-237, including noise from aircraft transiting from NAS Whidbey, is within the Department of Defense Noise Zone 1, with Day Night Average Sound Levels below 65 dBA for the entire area studied. Small portions of the land area underlying the Olympic MOAs, at elevations above 4,000 ft. MSL (less than 1 percent of the total area), could be exposed to greater noise levels for periods of 1 second or less per aircraft sortie. It is unlikely that many visitors to the national park would be at locations above 4,000 ft. MSL when aircraft are present and be exposed to the higher noise levels.

As concluded in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS and summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics (airborne noise) generated by training activities would be temporary, of short duration, localized, and generally far enough from areas popular with tourists and residents (i.e., more than 3 NM from shore) to have a negligible impact on socioeconomic resources. Some visitors to areas underlying the Olympic MOAs (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOAs. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

3.12.3.2.1.2 Impacts on Airborne Acoustics Under Alternative 1 for Testing Activities

Under Alternative 1, testing activities involving aircraft movements in the Offshore Area would increase from 113 to 258 events, decrease in the Inland Waters from 456 to 61 events, and would remain at 4 annual events in Western Behm Canal (Table 3.0-11). Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and commercial shipping vessels would not be delayed by airborne acoustics. Aircraft movements in the Offshore Area, with the exception of the Olympic MOAs, are primarily conducted in offshore warning areas far enough from people and areas popular with tourists (e.g., more than 3 NM from shore) to have a negligible impact on most recreation and tourism-related activities. The majority of aircraft overflights in the Inland Waters area are from aircraft transiting to the Offshore Area and activities occurring in the Olympic MOAs (see Tables 2.5-2 and 2.5-3). In spite of increases in some aircraft movements, airborne acoustics from aircraft overflights would not substantially increase potential impacts on commercial and recreational fishing, and tourism and related forms of recreation, because these changes would not appreciably change the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. As summarized in Section 3.12.3.2 (Airborne Acoustics) and in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS, airborne acoustics (noise) generated by testing activities would be temporary, of short duration, and localized.

Some visitors to areas underlying the Olympic MOAs (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 52 dBA less than 0.3 percent of the time. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOAs. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

3.12.3.2.2 Impacts on Airborne Acoustics Under Alternative 2

3.12.3.2.2.1 Impacts on Airborne Acoustics Under Alternative 2 for Training Activities

Under Alternative 2, activities with aircraft movements in the Offshore Area would increase by 13 percent (from about 6,311 to 7,047 annually) compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS (Table 3.0-11). Activities with aircraft movements would increase by about 100 events annually compared with the number of events under Alternative 1. Training activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4); however, the Olympic MOAs overlap with several high-altitude commercial airways: J105, J54, and T257. Activities with aircraft movements in the Inland Waters area would increase to 165 compared with 100 ongoing events and 143 events under Alternative 1.

Aircraft overflights from Air Combat Maneuver training activities and Electronic Warfare Training – Aircraft activities occurring in the Olympic MOAs have the potential to disturb land-based recreational and tourism activities (e.g., hiking) in the Olympic National Park. Relatively few events involving aircraft movements would occur in the Inland Waters area, consistent with the ongoing level of activity. Impacts from airborne acoustics would be temporary and dependent on the perceptions and sensitivity to noise of individuals primarily on the Olympic Peninsula. While airborne acoustics from aircraft overflights are likely to be heard and may disturb some visitors to the Olympic National Park, economic indicators representing tourism and recreational activities in the region, including in the national park, have been trending upwards in recent years and are projected to continue to increase (see Section 3.12.2.3.1, Offshore Area). The Navy has been conducting aircraft activities in the Olympic MOAs for decades, and those same economic indicators have been steadily increasing over much of that time (National Ocean Economics Program, 2018a, 2018b).

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas), which concludes that noise exposure within the Olympic MOAs and W-237, including noise from aircraft transiting from NAS Whidbey is within the Department of Defense Noise Zone 1, with Day-Night Average Sound Levels below 65 dBA for the entire area studied. Small portions of the land area underlying the Olympic MOAs, at elevations above 4,000 ft. MSL (less than 1 percent of the total area), could be exposed to greater noise levels for periods of 1 second or less per aircraft sortie. It is unlikely that many visitors to the national park would be at locations above 4,000 ft. when aircraft are present and be exposed to higher noise levels. Some visitors to areas underlying the Olympic MOAs (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOAs (National Park Service, 2016). Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

As concluded in Section 3.12.3.3 (Aircraft and Vessel Noise) in the 2015 NWTT Final EIS/OEIS and summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics (airborne noise) generated by at-sea training activities would be temporary, of short duration, localized, and generally far enough from areas popular with tourists and residents (i.e., more than 3 NM from shore) to have a negligible impact on socioeconomic resources. Airborne acoustics are not expected to impact commercial transportation and shipping, because these types of activities are generally not sensitive to occasional noise from aircraft overflights, and shipping vessels would not be delayed by airborne acoustics. The slight increases in training activities with aircraft movements would have the same impacts on commercial and recreational fishing, and tourism and related forms of recreation described in Section 3.12.3.2.1.1 for Alternative 1.

3.12.3.2.2.2 Impacts on Airborne Acoustics Under Alternative 2 for Testing Activities

Testing activities using aircraft are primarily conducted in offshore warning areas, which do not overlap with commercial airways (Figure 3.12-4). Testing activities involving aircraft movements in the Offshore Area would increase from 113 to 260 compared with the number of events proposed in the 2015 NWTT Final EIS/OEIS and would be essentially the same as under Alternative 1. Testing activities with aircraft would decrease in the Inland Waters from 456 ongoing events to 61, and would continue to be 4 annual events in Western Behm Canal (Table 3.0-11).

As summarized above in Section 3.12.3.2 (Airborne Acoustics), airborne acoustics generated by testing activities would be temporary, of short duration, localized, and generally far enough from people and areas popular with tourists (e.g., more than 3 NM from shore) to have a negligible impact. Some visitors to areas underlying the Olympic MOAs (e.g., Olympic National Park) may occasionally experience aircraft overflight noise. While this may impact the enjoyment of the park or other outdoor areas for some people, analysis summarized above and described in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) indicates that the disturbance would be transient, lasting only a few seconds per overflight, and exceed 60 dBA less than 2 percent of the time during daytime and nighttime hours. For the majority of the daytime and nighttime, natural sounds are more prevalent than anthropogenic sounds in the areas of the National Park beneath the Olympic MOAs (National Park Service, 2016).

For a more detailed analysis of airborne acoustics on the Olympic Peninsula, refer to Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas), which concludes that noise exposure within the Olympic MOAs and W-237, including noise from aircraft transiting from NAS Whidbey is within the Department of Defense Noise Zone 1, with Day Night Average Sound Levels below 65 A-weighted decibels (dBA) for the entire area studied. Considering that trends in economic indicators have historically increased and are projected to continue to increase, disturbances from airborne acoustics on the Olympic Peninsula are expected to have a negligible impact on socioeconomic resources in the Study Area.

3.12.3.2.3 Impacts on Airborne Acoustics Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Disturbances from airborne acoustic stressors as listed above would not be introduced into the marine environment.

Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer disturbances from airborne acoustics within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for disturbances from airborne acoustics, but would not measurably change the frequency or severity of disturbances from airborne acoustics experienced by the public in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.3 Physical Disturbance and Strike Stressors

The evaluation of impacts on socioeconomic resources from physical disturbance and strike stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (e.g., explosive and non-explosive munitions, other military expended materials, and ocean bottom deployed devices), or resting on the ocean floor (e.g., anchors, mines, targets) that may damage or encounter civilian equipment. These stressors remain the same as analyzed in the 2015 NWTT Final EIS/OEIS.

Physical encounters that damage equipment and infrastructure could disrupt the collection (e.g., of fisheries resources) and transport of products, which could impact industry revenue or operating costs. Socioeconomic resources potentially impacted by encounters with military vessels, devices, and objects include commercial transportation and shipping, commercial and recreational fishing, and tourism and related forms of recreation.

As discussed above in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the majority of recreational fishing and tourism and related forms of recreation in the Study Area takes place in nearshore waters (within 3 NM from shore), and the military conducts the training and testing activities involving munitions or other expended materials farther offshore, beyond 12 NM for activities using munitions. Therefore, most recreational fishing and tourism activities would not occur in close proximity to physical disturbance and strike stressors.

Larger commercial fishing vessels are more likely to go beyond 3 NM and approach areas where the military trains and tests and may be in close proximity to physical disturbance and strike stressors. To avoid conflicts with civilian vessels, the military follows standard operating procedures to visually scan an area to ensure that non-participants (i.e., civilian vessels and aircraft) are not present. If non-participants are present, the military delays, moves, or postpones the activity. Refer to Section 2.3.3 (Standard Operating Procedures) for additional information on standard operating procedures. Appendix A (Navy Activities Descriptions) lists standard operating procedures that are implemented for each activity to ensure the safety of civilians and military personnel.

Commercial shipping vessels transport goods internationally and would be expected to transit through offshore waters en route to domestic and foreign ports. Shipping vessels follow established routes which are avoided by the military during training and testing activities, and both military and civilian vessels in proximity to each other are expected to communicate their positions. In addition, the military provides advance notification of training and testing activities to the public through NTMs and other means of communication as described in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]) and in the 2015 NWTT Final EIS/OEIS. For these reasons, a direct strike or collision with a shipping vessel is unlikely.

Additional information of physical disturbance and strike stressors and the potential for interactions with commercial fishing vessels and gear is described in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS.

3.12.3.3.1 Impacts from Physical Disturbance and Strike Under Alternative 1

3.12.3.3.1.1 Impacts from Physical Disturbance and Strike Under Alternative 1 for Training Activities

Under Alternative 1, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the slight increases in training activities including vessel movements, aircraft movements, and in-water devices would not appreciably change from the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. Under Alternative 1, the number of military materials that would be expended during training activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 are combined, the number of items proposed to be expended under Alternative 1 is approximately 7 percent less than ongoing activities. The largest changes are in the number of explosive and non-explosive large-caliber projectiles and medium-caliber projectiles used under Alternative 1 (Table 3.0-14 and 3.0-16). The number of non-explosive large-caliber projectiles increases by about 6,000, and the number of medium-caliber projectiles decreases by about 16,000 (Table 3.0-14). The number of explosive large-caliber projectiles and explosive medium-caliber projectiles both decrease under Alternative 1 (390 to 172 annually for large caliber and 6,368 to 550 annually for medium caliber) (Table 3.0-16). The activities that expend military materials, including munitions, would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly reduced.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.1.2 Impacts from Physical Disturbance and Strike Under Alternative 1 for Testing Activities

Under Alternative 1, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the increases in testing activities including vessel movements, aircraft movements, and in-water devices would not appreciably change from the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS. Under Alternative 1, the number of military materials that would be expended during testing activities is generally consistent with the number proposed for use in the 2015 NWTT Final EIS/OEIS. When the amount of military expended materials from (Tables 3.0-14 through 3.0-22) are combined, the number of items proposed to be expended under Alternative 1 is approximately 12 percent less than ongoing activities. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly reduced.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.2 Impacts from Physical Disturbance and Strike Under Alternative 2

3.12.3.3.2.1 Impacts from Physical Disturbance and Strike Under Alternative 2 for Training Activities

Under Alternative 2, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), training activities including vessel movements, aircraft movements, and in-water devices would remain generally consistent with those proposed under Alternative 1. The number of military materials that would be expended during training activities is generally equivalent to the number proposed for use under Alternative 1. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 is combined, the number of items proposed to be expended under Alternative 2 is approximately 13 percent more than under Alternative 1 (and approximately 5 percent greater than in ongoing activities). As under Alternative 1, the largest changes are in the number of explosive and non-explosive medium-caliber projectiles (Tables 3.0-14 and 3.0-16). The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly greater.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.2.2 Impacts from Physical Disturbance and Strike Under Alternative 2 for Testing Activities

Under Alternative 2, physical disturbance and strike stressors that may impact socioeconomic resources include (1) vessels and in-water devices, (2) aircraft, and (3) military expended materials. These three categories represent the same stressors analyzed in the 2015 NWTT Final EIS/OEIS.

As discussed in Section 3.12.3.1 (Accessibility [to the Ocean and the Airspace]), the increases in testing activities including vessel movements, aircraft movements, and of in-water devices would remain generally consistent with those proposed under Alternative 1. The number of military materials that would be expended during testing activities is generally consistent with the number proposed for use under Alternative 1. When the amount of military expended materials from Tables 3.0-14 through 3.0-22 are combined, the number of items proposed to be expended under Alternative 2 is approximately 16 percent more than under Alternative 1. The activities that expend military materials would occur in the same locations and in a similar manner as were analyzed previously. Therefore, the impacts on socioeconomic resources from physical disturbance and strike by military expended materials would be expected to be the same or slightly greater.

Therefore, the conclusions presented in Section 3.12.3.2 (Physical Disturbance and Interactions) of the 2015 NWTT Final EIS/OEIS remain valid. Specifically, due to implementation of the Navy's standard operating procedures and the unlikely occurrence of physical interactions between military vessels, aircraft, and expended materials with civilian vessels and aircraft, the potential for impacts on socioeconomic resources from physical disturbance and strike interactions is negligible.

3.12.3.3.3 Impacts from Physical Disturbance and Strike Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer physical disturbance and strike stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for physical disturbances and strikes, but would not measurably change the number of times the public is exposed to physical disturbance and strike stressors in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

3.12.3.4 Secondary Impacts

Secondary stressors resulting in indirect impacts on socioeconomic resources are discussed in Section 3.12.3.4 (Secondary Impacts) of the 2015 NWTT Final EIS/OEIS. A secondary stressor, as defined in this section, is a stressor that has the potential to affect a socioeconomic resource as a result of a direct effect on another non-socioeconomic resource. For example, if a training activity has the potential to affect certain types of fish, and those same fish are part of an economically important fishery, then the effect of the stressor on those fish species could have an indirect, or secondary, effect on the socioeconomic resource of commercial fishing.

The secondary stressor of resource availability pertains to the potential for loss of fisheries resources, including some invertebrates, within the Study Area, which is relevant to commercial, recreational, and traditional fishing practices as well as tourism. Additionally, impacts on marine mammal populations would have the potential to impact revenue for whale watching businesses if a substantial number of whales were to leave the area. Analysis in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fishes) determined, however, that no population-level impacts on marine species are anticipated from the proposed training and testing activities. For these reasons, there would be no secondary impacts on commercial and recreational fishing and tourism in the Study Area.

As discussed in Section 3.12.2.1.3 (Vehicle Traffic), openings of the Hood Canal Bridge can result in long delays and back-ups at the bridge, particularly during the summer tourism season when traffic is heaviest. The delays could result in a secondary impact on recreational activities and tourism on the Olympic Peninsula if visitors are unable to reach their destinations in a timely manner and choose to cancel their activity. While a training or testing activity may require a bridge opening to allow a Navy vessel to pass through the canal, occasional openings to accommodate Navy vessels are not likely to delay a significant portion of visitors to the Olympic Peninsula. Although delayed, many people would continue with their plans anyway. Also, tourists and local visitors planning recreational activities on the Olympic Peninsula are more likely to do so on weekends and holidays when openings to allow the passage of Navy vessels are less likely. Therefore, secondary impacts on recreational activities and tourism would be negligible.

3.12.3.4.1 Secondary Impacts Under Alternative 1 and Alternative 2

Analyses in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fishes) concluded that population level impacts on marine species from training and testing activities under Alternative 1 and Alternative 2 are not anticipated. Based on these conclusions, secondary impacts on transportation or shipping, commercial or recreational fishing, or tourism are not anticipated.

There has been no appreciable change to the existing environmental conditions as presented in the 2015 NWTT Final EIS/OEIS, and the results of the analysis of impacts from secondary stressors on transportation and shipping, commercial and recreational fishing, and tourism remain the same.

3.12.3.4.2 Secondary Impacts Under the No Action Alternative

Under the No Action Alternative, proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. Secondary stressors impacting resource availability as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing training and testing activities would result in fewer secondary stressors from the availability of resources within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing training and testing activities under the No Action Alternative would lessen the potential for secondary stressors, but would not measurably improve the availability of resources associated with secondary impacts on socioeconomic resources in the Study Area.

Not conducting the proposed at-sea training and testing activities may have negative impacts on the socioeconomic resources of coastal areas in Washington State, Oregon, and northern California. Communities located along inland waters in Washington State and southeast Alaska may also be impacted. The number of jobs and types of jobs, particularly in coastal communities, that depend on the support of Navy personnel residing or transiting through those communities may be impacted. The Navy and Navy personnel are an important and often stabilizing contributor to the local and regional economies, and a reduced Navy presence could negatively impact certain businesses. For example, vessels and associated equipment used specifically for training and testing activities would no longer be needed if all training and testing ceased. Consequently, the civilian and Navy personnel supporting those activities may be relocated, reassigned, or have to find other employment. The secondary effects from reducing the number of personnel who support at-sea training and testing activities could include a decline in revenue for local businesses frequented by Navy personnel and their families, such as businesses in the food services, retail, and housing sectors. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is likely that many coastal communities with a Navy presence would be impacted.

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3.13 Public Health and Safety

3.13.1 Affected Environment

For purposes of this Supplemental, the region of influence for public health and safety remains the same as was identified in Section 2.1 (Description of the Northwest Training and Testing Study Area) of the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS (the NWTT Study Area). This includes the Puget Sound; the Strait of Juan de Fuca; the Southeast Alaska Acoustic Measurement Facility; and waters off the coasts of Washington, Oregon, and northern California (see Figure 1.1-1). However, each stressor may only affect portions of the total region of influence. For this reason, each stressor will specify the portions of the Study Area that are relevant to the analysis.

3.13.1.1 Overview

3.13.1.1.1 Sea Space

Sea space accessibility within the Study Area is the same as described in the 2015 NWTT Final EIS/OEIS. Only select areas have activity restrictions or prohibitions on access to reserve capacity for training and testing activities performed by the United States (U.S.) Department of the Navy (Navy) in accordance with Title 33 Code of Federal Regulations Part 334 (Danger Zone and Restricted Area Regulations). Danger Zones and Restricted Areas within the Study Area include the Southeast Alaska Acoustic Measurement Facility and select portions of the Puget Sound, which can be viewed on nautical charts provided by the National Oceanic and Atmospheric Administration.

The Navy continues to request the U.S. Coast Guard to publish upcoming training and testing activities in their three channels for disseminating information to the public: the Notice to Mariners (NTM) (a weekly publication that notifies mariners of changes or deficiencies in navigational aids, new maps, channel depths, naval operations, and regattas), the Local NTM (a weekly publication that is more focused on particular areas, and the Marine Broadcast NTM (a radio broadcast that provides important information from the weekly NTM publications). These notices are posted prior to performing any activities that would require activating restrictions or establishing safety zones on the water as specified in Title 33 Code of Federal Regulations Subpart 72.01, and detailed in Section 3.13.2.1.1 (Sea Space) of the 2015 NWTT Final EIS/OEIS.

3.13.1.1.2 Airspace

General information on airspace within the Study Area is still the same as the 2015 NWTT Final EIS/OEIS, is still relevant, and can be viewed in Section 3.13.2.1.2 (Airspace) of the 2015 NWTT Final EIS/OEIS. Topics that were discussed in the previous EIS/OEIS included how weather conditions may determine whether pilots fly under visual flight rules or instrument flight rules, and how notices to airmen are published by the Federal Aviation Administration (FAA) and provide information on when and if special use airspace would be active. It is the responsibility of any licensed pilots to be knowledgeable and compliant with all types of airspace and of any notices to airmen that are in effect.

3.13.1.2 Safety and Inspection Procedures

As stated in the 2015 NWTT Final EIS/OEIS, the Navy complies with all applicable regulations and uses best practices, including standard operating procedures, to ensure public health and safety. This may be accomplished by utilizing communication and notification channels provided by the U.S. Coast Guard and the FAA as described above, considering the location when planning activities, and ensuring that training and testing areas are clear of nonparticipants before commencing.

3.13.1.3 Aviation Safety

Navy requirements outlined in OPNAVINST 3500.39C, *Operational Risk Management*, provide a process to maintain readiness in peacetime and achieve success in combat while safeguarding people and resources. The FAA is responsible for ensuring safe and efficient use of U.S. airspace by military and civilian aircraft and for supporting national defense requirements. In order to fulfill these requirements, the FAA has established safety regulations, airspace management guidelines, a civil-military common system, and cooperative activities with the U.S. Department of Defense. The primary safety concern with regard to military training flights is the potential for aircraft mishaps to occur, which could be caused by mid-air collisions with other aircraft or objects, weather difficulties, mechanical failures, pilot error, or bird/wildlife air strike hazards.

There is no generally recognized threshold of air safety that defines acceptable or unacceptable conditions. Instead, the focus of airspace managers is to reduce risks through a number of measures. These include, but are not limited to, providing and disseminating information to airspace users, requiring appropriate levels of training for those using the airspace, setting appropriate standards for equipment performance and maintenance, defining rules governing the use of airspace, and assigning appropriate and well-defined responsibilities to the users and managers of the airspace. When these safety measures are implemented, risks are minimized, even though they can never be eliminated.

3.13.1.4 Submarine Navigation Safety

Methods for preserving submarine navigation safety are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.4, Submarine Navigation Safety) and remain applicable and valid.

3.13.1.5 Surface Vessel Navigational Safety

The Navy's methods for ensuring navigational safety for surface vessels are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.5, Surface Vessel Navigational Safety) and involve practicing the fundamentals of safe navigation, posting lookouts to scan for navigational hazards, or utilizing support boats, radar, and other auxiliary equipment to determine that all safety criteria are met. These safety methods remain applicable and valid.

3.13.1.6 Sonar Safety

Surface vessel and submarine sonar use is described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.6, Sound Navigation and Ranging [Sonar] Safety). When applicable, the Navy adheres to Naval Sea Systems Command Instruction 3150.2, Appendix 1A, which provides guidance for protecting divers during active sonar use, including the use of buffer zones. Guidance for protecting divers remains applicable and valid.

3.13.1.7 Explosive Ordnance Detonation Safety

Methods for ensuring explosive detonations associated with training and testing activities are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.7, Explosive Ordnance Detonation Safety) and remain applicable and valid. Procedures for safety planning related to underwater detonations include

- ensuring impact areas and targets are clear;
- coordinating with submarine operational authorities on the use of underwater ordnance;
- receiving permission from range safety officers or test safety officers before commencing firing;
- ensuring units and targets remain in their assigned areas and units fire in accordance with current safety instructions; and

- conducting detonation activities only during daylight hours.

As discussed in the 2015 NWTT Final EIS/OEIS, some training and testing activities use ordnance as shown in Table 2.4-1 and Table 2.4-2. The type of ordnance that would be used for the Proposed Action would be the same as identified in the 2015 NWTT Final EIS/OEIS. As such, the procedures for handling and storing of ordnance remain applicable and valid.

3.13.1.8 Weapons Firing and Ordnance Expenditure Safety

Safety procedures that are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.2.8, Weapons Firing and Ordnance Expenditure Safety) are still applicable and valid. Safety continues to be a primary consideration for all training and testing activities. Before commencing any firing, the Navy uses standard procedures and best practices to ensure that hazard areas and buffer zones are clear of all nonparticipants.

3.13.1.9 Laser Safety

High-energy lasers were not analyzed in the 2015 NWTT Final EIS/OEIS; however, the Proposed Action in this Supplemental adds new testing activities for the development of high-energy laser weapon systems, identified in Table 2.9 and Section A.2.6.7 (Radar and Other System Testing) of Appendix A (Navy Activities Descriptions). High-energy lasers would be used during testing activities that involve system and component tests. Low-energy lasers, analyzed in the 2015 NWTT Final EIS/OEIS, are used for precision range finding, as target designation/illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures, as well as for non-lethal deterrent. The Office of the Chief of Naval Operations Instruction 5100.27B/Marine Corps Order 5104.1C, *Navy Laser Hazards Control Program*, prescribes Navy and Marine Corps policy and guidance in the identification and control of laser hazards to prevent damaging a person’s eyes with low-energy lasers or physically harming a person with high-energy lasers. The Navy observes strict precautions and has written instructions in place for laser users to ensure that non-participants are not exposed to intense light energy. Laser safety procedures for aircraft require an initial pass over the target before laser activation to ensure that target areas are clear. During actual laser use, aircraft run-in headings are also restricted to avoid unintentional contact with personnel or non-participants. Personnel participating in laser training activities are required to complete appropriate laser safety courses that are approved by the Navy’s Administrative Lead Agent and the Lead Navy Technical Laboratory (U.S. Department of the Navy, 2008).

3.13.2 Environmental Consequences

The 2015 NWTT Final EIS/OEIS analyzed training and testing activities currently occurring in the Study Area and considered all potential stressors related to public health and safety. Stressors applicable to public health and safety in the Study Area are the same stressors analyzed in the 2015 NWTT Final EIS/OEIS with the exception of explosive stressors (see Table 3.0-1). In the 2015 NWTT Final EIS/OEIS, explosives were addressed under acoustic stressors; however, for purposes of this analysis, explosives will be analyzed as a separate stressor. The following are stressors analyzed for public health and safety and include stressor description updates from the 2015 NWTT Final EIS/OEIS:

- **Underwater Energy** (sonar and underwater explosives)
- **In-Air Energy** (radar and lasers)
- **Physical Interactions** (aircraft, vessels, in-water devices/targets, munitions, seafloor devices)

- **Secondary** (impacts on water quality from explosives and explosives byproducts, metals, chemicals other than explosives, and other materials)

This section evaluates how and to what degree potential impacts on public health and safety from stressors described in Section 3.0 (Introduction) may have changed since the analysis presented in the 2015 NWTT Final EIS/OEIS was completed. Table 2.5-1, Table 2.5-2, and Table 2.5-3 in Chapter 2 (Description of Proposed Action and Alternatives) list the proposed training and testing activities and includes the number of times each activity would be conducted annually and the locations within the Study Area where the activity would typically occur under each alternative. In addition to the tables in Chapter 2, Table 3.0-2 through Table 3.0-22 show the amounts and locations that specific activities, such as lasers or sonar, would be utilized during training and testing activities. The tables also present the same information for activities proposed in the 2015 NWTT Final EIS/OEIS so that the proposed levels of training and testing can be easily compared. The Navy conducted a review of federal and state regulations and standards relevant to public health and safety and reviewed literature published since 2015 for new information that could inform the analysis presented in the 2015 NWTT Final EIS/OEIS. The review concluded that there are no new regulations or standards regarding public health and safety and no new information that would alter the impact conclusions for the 2015 NWTT Final EIS/OEIS.

The analysis presented in this section also considers standard operating procedures, which can be found in Chapter 5 (Mitigation) of the 2015 NWTT Final EIS/OEIS with updated and additional standard operating procedures being presented in Section 2.3.3 (Standard Operating Procedures) of this Supplemental, and mitigation measures that are presented in Chapter 5 (Mitigation). The Navy would implement these measures to avoid potential impacts on public health and safety from stressors associated with the proposed training and testing activities.

3.13.2.1 Underwater Energy

Sources of underwater energy can be found in training and testing activity descriptions in Appendix A (Navy Activities Descriptions), and are generally the same as those discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.1, Underwater Energy). In-water electromagnetic devices, active sonar, underwater explosions, vessel movements, aircraft overflights, mine warfare training devices, and unmanned underwater vehicles encompass the various sources of underwater energy that would be used. Only recreational swimmers and self-contained underwater breathing apparatus (SCUBA) divers who are underwater and within an unsafe distance (600–3,000 yards) of training and testing activities, as prescribed in the *U.S. Dive Manual* (U.S. Department of the Navy, 2011a), would potentially be exposed to the underwater energy produced by these stressors.

The effect of active sonar on humans varies with the sonar frequency. Generally, mid- to low-frequencies have the greatest effect since they fall within the range of human hearing (20 hertz to 20 kilohertz). In addition to acoustic stressors, underwater explosions produce pressure waves that can cause physical injury depending on the size, type, and depth of the explosive charge and the distance between the person and the explosive. Electromagnetic energy sources and their potential impacts on public health and safety are discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.1, Underwater Safety) and remain applicable in this discussion. In addition, standard safety buffers that are specified in Department of Defense Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields* (U.S. Department of Defense, 2009a), and Military Standard 464A, *Electromagnetic Environmental Effects: Requirements for Systems* (U.S. Department of Defense, 2002), would continue to be implemented to ensure public safety.

3.13.2.1.1 Impacts from Underwater Energy Under Alternative 1

Impacts from Underwater Energy Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that would generate underwater energy would generally increase from the 2015 NWTT Final EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Table 2.5-1). Standard operating procedures, which are described in Section 2.3.3 and include clearing ranges prior to training activities, are in place to ensure that military activities do not overlap with non-military activities (e.g., boating, swimming, scuba diving, and fishing). Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, training activities that could affect public health and safety are often held far from popular swimming and dive areas, reducing the potential for exposure. In addition, the NTMs posted by the U.S. Coast Guard alert the public of scheduled events so that they can avoid being in the same areas. The military's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 1 would be unlikely. Therefore, increases shown in Tables 2.5-1, 2.5-2, and 2.5-3 for training activities proposed under Alternative 1 do not change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Impacts from Underwater Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that would generate underwater energy would generally increase from the 2015 NWTT Final EIS/OEIS (see Chapter 2, Description of Proposed Action and Alternatives, Tables 2.5-2, and 2.5-3). Standard operating procedures, which are described in Section 2.3.3 and include clearing ranges prior to testing activities, are in place to ensure that military activities do not overlap with non-military activities (e.g., boating, swimming, and fishing). Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, testing activities that could affect public health and safety are often held far from popular swimming and dive areas, reducing the potential for exposure. In addition, the NTMs posted by the U.S. Coast Guard alert the public of scheduled events so that they can avoid being in the same areas. The military's safety procedures would ensure that the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely. Therefore, increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 1 do not change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

3.13.2.1.2 Impacts from Underwater Energy Under Alternative 2

Impacts from Underwater Energy Under Alternative 2 for Training Activities

Under Alternative 2, the number of some proposed training activities that would produce underwater energy would increase as compared to Alternative 1. Increases shown in Tables 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. In general, sources of underwater energy stressors would become more frequent with the implementation of Alternative 2; however, standard operating procedures, which are described in Section 2.3.3, are in place to ensure that military activities do not overlap with recreational or commercial activities. Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, training activities that could affect public health and safety are often held far from popular swim and dive areas, reducing the potential for exposure. The military's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 2 would be unlikely.

Impacts from Underwater Energy Under Alternative 2 for Testing Activities

Under Alternative 2, the number of some proposed testing activities that would produce underwater energy would increase as compared to Alternative 1. Increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. In general, sources of underwater energy stressors would become more frequent with the implementation of Alternative 2; however, standard operating procedures, which are described in Section 2.3.3, are in place to ensure that military activities do not overlap with recreational or commercial activities. Since the only potential receptors of underwater energy stressors are recreational swimmers and divers, testing activities that could affect public health and safety are often held far from popular swim and dive areas, reducing the potential for exposure. The military's safety procedures would ensure that the potential for testing activities to impact public health and safety under Alternative 2 would be unlikely.

3.13.2.1.3 Impacts from Underwater Energy Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities no associated with the Proposed Action would continue to occur. Underwater energy stressors as described above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less underwater energy within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from underwater energy stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy, such as radar, navigational aids, high-energy lasers, and electronic warfare systems, aircraft noise, surface explosions, and lasers. Current practices for protecting military personnel and the public are described in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.2, Affected Environment) and remain applicable to this analysis. Important practices include abiding by minimum flight elevations, communicating to the public through notification channels when training and testing activities are scheduled, enforcing restriction areas and danger zones, and ensuring non-participants are clear of an area before using hazardous equipment. In addition, procedures for laser safety are described above in Section 3.13.1.9 (Laser Safety), as well as in Section 2.3.3.1 (High-Energy Laser Safety). Training and testing activities that involve electromagnetic energy and lasers are described in Appendix A (Navy Activities Descriptions). While there would be slight changes in the number of activities from what was described in the 2015 NWTT Final EIS/OEIS and high-energy lasers would be added to the action, the activities associated with the Proposed Action would generally be the same was what was analyzed in the 2015 NWTT Final EIS/OEIS.

High-energy lasers are used as weapons to disable surface targets; however, high-energy lasers would only be used during testing activities to test auxiliary systems. The Navy would operate high-energy laser equipment in accordance with procedures defined in the Office of the Chief of Naval Operations Instruction 5100.23G, Navy Safety and Occupational Health Program Manual (U.S. Department of the Navy, 2011b). The Occupational Safety and Health Administration (OSHA) has detailed the biological effects that laser beams may have on humans (Occupational Safety and Health Administration, 2018).

Risks include damage to the eyes or skin after immediate exposure. The level of damage is dependent on the strength of the beam. A comprehensive safety program exists for the use of lasers. Current Navy safety procedures protect individuals from the hazard of injuries caused by laser energy. Laser safety requirements for aircraft and vessels mandate verification that target areas are clear before commencing training. In the case of aircraft, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

As a stressor, loud noises and vibrations generated from Navy training and testing activities such as aircraft overflights and vessel activities have the potential to disrupt or potentially injure (i.e., hearing loss, even ruptured ear drums, etc.) people in the Study Area. The training and testing activities that introduce the most noise into the environment are those that involve aircraft flights. A detailed description of current noise conditions and noise levels that would result from the Proposed Action is available in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas). Long, repeated exposure to noises exceeding 85 dB has been found to result in noise-induced hearing loss (National Institute on Deafness and Other Communication Disorders, 2017). The louder the noise, the shorter the time necessary for the noise to result in noise-induced hearing loss. OSHA has established duration thresholds for various noise levels to protect people in the workplace from experiencing noise-induced hearing loss. According to OSHA, people can be exposed to 90 dB for eight hours a day without experiencing noise-induced hearing loss (Occupational Safety and Health Administration, 2008). OSHA has also determined that noises above 140 dB are not safe for any duration of time (Occupational Safety and Health Administration, 2008). Although OSHA standards are technically applicable to the workplace environment, they are useful as a measure of comparison to determine if noise will result in health impacts in other settings. Loud noise below the OSHA standards does not directly impact human health, but a possible secondary impact from loud noises and vibrations is elevated levels of stress, which can occasionally impact a person's health by causing annoyance, impairing sleep, and impacting cognitive performance (Schomer, 2005; Stansfeld & Matheson, 2003; U.S. Department of Defense, 2009b).

3.13.2.2.1 Impacts from In-Air Energy Under Alternative 1

Impacts from In-Air Energy Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that would produce in-air energy would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). There are multiple ways to quantify noise. This analysis looks at the Day Night Average Sound Level (DNL) (an average noise level over an eight-hour period) and the instantaneous noise level (the noise level at a given instant in time). According to the noise analysis performed in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas), the maximum DNL that would be generated at the highest elevations underneath the Olympic Military Operations Areas (MOAs) under Alternative 1 is 37 decibels (dB). For reference, Figure 3.13-1 shows A-weighted noise levels from typical sources (Cowan, 1994). A-weighted scales place less weight on low and high frequency noises since the human ear is less sensitive to sound in these ranges. According to the figure, an average noise level of 40 dB would mean that the average noise level at the highest elevations would be similar to a quiet urban area during the day. This is only a minor increase from the baseline DNL of 36 dB. DNLs of less than 65 dB are considered to be compatible with most land uses because although training would be audible at times, it would not be disruptive or cause human health problems. However, Alternative 1 would generate noises that are above the 90 dB level established by OSHA. This analysis looks at the duration and volume of those noises to determine if they would result in noise-induced hearing loss. The maximum instantaneous noise level (not DNL) of 101 dB would not increase between the baseline and

Alternative 1. Instead, there would only be an increase in the frequency of the maximum instantaneous noise level. In baseline conditions the maximum instantaneous noise level would be experienced approximately four minutes over the course of a year, while the maximum instantaneous noise level would be experienced for approximately five minutes in Alternative 1. This means that the highest elevations would sound like a noisy textile mill for approximately five minutes a year, while the rest of the year it sounds like a quiet urban area. The five minutes a year is also not from a single event that would last five minutes, but rather numerous events, which are spread throughout the year, that result in this noise level for a duration of approximately 0.12 second. While this is a 25 percent increase from baseline conditions, the OSHA standard for exposure durations to noise levels of 102 dB is 1.5 hours per day before permanently affecting ones hearing, which is significantly longer than 0.12 second or even five minutes. In addition, the areas that these volumes would occur at are some of the most remote areas with the least human presence within the Olympic Mountains. It would be unlikely for anybody to be in the area at the time of these maximum levels. The maximum instantaneous noise level that would be experienced in the majority of the area (75 percent) underneath the MOAs is 85 dB. Figure 3.13-1 indicates that 85 dB is similar to hearing a garbage disposal run or a large truck driving 50 feet away. In general, the noise analysis presented in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) indicates that instantaneous noise levels would exceed 90 dB for approximately 202 hours out of the year. This translates to roughly 45 minutes a day if weekends are excluded. However, OSHA has determined that noise levels of 90 dB would have to be experienced for approximately eight hours a day before resulting in noise-induced hearing loss. These noise levels are also only experienced in the higher elevation areas of the Olympic Mountains, which make up approximately 4.25 percent of the region. Not only is this a five-minute increase per day from baseline conditions, which would be basically unnoticeable to hikers, but exposure to these volumes would never be long enough to result in noise-induced hearing loss according to OSHA standards (Occupational Safety and Health Administration, 2008). Increases in noise levels from the baseline would therefore not have a noticeable impact on public health and safety. In addition, standard operating procedures are in place to ensure that in-air energy stressors from training activities would not impact public health and safety. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

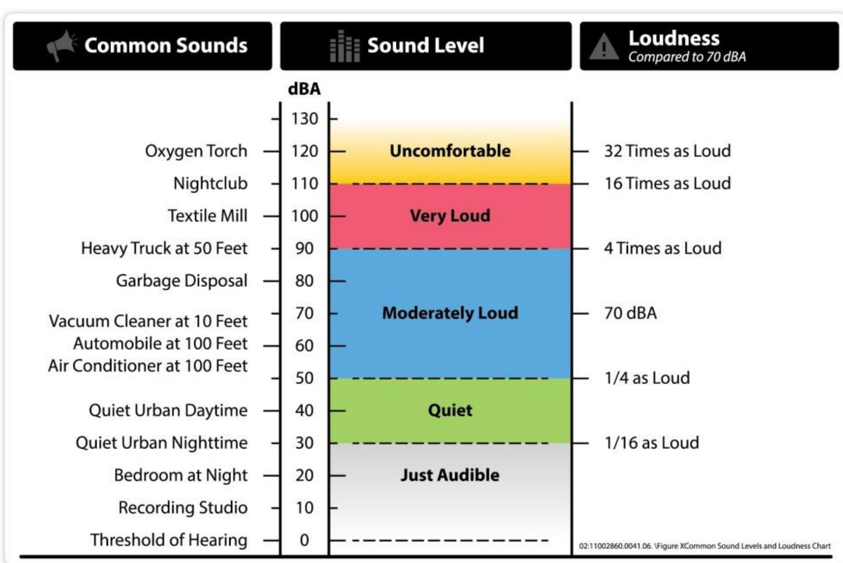

Figure 3.13-1: A-Weighted Sound Levels from Typical Sources

Impacts from In-Air Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that would produce in-air energy would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). In addition, high-energy lasers, which were not previously analyzed, would be used during testing activities. It is unlikely that the public would be exposed to high-energy lasers from testing activities because high-energy laser tests would occur either at sea, far from potential receptors, or in docked testing facilities that have restricted access and standard operating procedures for laser use that would further prevent participants and non-participants from coming into contact with a laser. Standard operating procedures described above would also prevent other in-air energy stressors from affecting public health and safety. Therefore, the general increase in the frequency of in-air energy stressors under Alternative 1 would not significantly change the impact conclusions presented in the 2015 MITT Final EIS/OEIS (Section 3.13.3.2, In-Air Energy) and would not increase potential for testing activities to impact public health and safety.

3.13.2.2.2 Alternative 2

Impacts from In-Air Energy Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that would produce in-air energy would increase as compared to Alternative 1 (see Table 2.5-1). Although there would be a minor increase in aircraft training activities within the MOAs, the noise levels generated under Alternative 1 and Alternative 2 are roughly equivalent. Therefore, the impacts that noise would have on public health and safety would be similar to the impacts of Alternative 1. In addition, standard operating procedures are in place to ensure that in-air energy stressors from training activities would not impact public health and safety. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Impacts from In-Air Energy Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that would produce in-air energy would increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). In addition, high-energy lasers, which is new in this Supplemental, would be used during testing activities. It is unlikely that the public would be exposed to high-energy lasers from testing activities because high-energy laser tests would occur either at sea, far from potential receptors, or in docked testing facilities that have restricted access and standard operating procedures for laser use that would further prevent participants and non-participants from coming into contact with a laser. Standard operating procedures described above would also prevent other in-air energy stressors from affecting public health and safety. Therefore, the general increase in the frequency of in-air energy stressors, standard operating procedures for electromagnetic energy and lasers would prevent personnel and non-participants from being exposed to these stressors. The military's safety procedures would ensure that the potential for training and testing activities to impact public health and safety under Alternative 2 would be unlikely.

3.13.2.2.3 Impacts from In-Air Energy Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with this Proposed Action would continue to occur. In-air energy stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less in-air energy within the Study Area where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from in-air energy stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.3 Physical Interactions

As discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.3, Physical Interactions), military aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials have the potential to directly encounter recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers. Instances of physical interactions that could pose the most risk to the safety of both civilians and Navy personnel include vessel collisions, aircraft collisions, munition discharge, and encountering unexploded ordnance. Methods for providing notice to non-participants of Navy training and testing activities, procedures for minimizing encounters with military expended materials, and a discussion of unexploded ordnance are all outlined in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.3, Physical Interactions) as well as in Sections 3.13.1.1.1 (Sea Space), 3.13.1.1.2 (Airspace), and 3.13.1.2 (Safety and Inspection Procedures) of this Supplemental.

3.13.2.3.1 Alternative 1

Impacts from Physical Interactions Under Alternative 1 for Training Activities

Under Alternative 1, the number of proposed training activities that could lead to physical interactions between the Navy and non-participants would generally decrease as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). In addition, the standard operating procedures that are in place ensure that training activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming training events would alert non-participants of where and when training events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would end up on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Impacts from Physical Interactions Under Alternative 1 for Testing Activities

Under Alternative 1, the number of proposed testing activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). However, the standard operating procedures that are in place ensure that testing activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming testing events would alert non-participants of where and when testing events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would either end up on closed off ranges or on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

3.13.2.3.2 Alternative 2

Impacts from Physical Interactions Under Alternative 2 for Training Activities

Under Alternative 2, the number of proposed training activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to Alternative 1 (see Table 2.5-1). However, the standard operating procedures that are in place ensure that training activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming training events would alert non-participants of where and when training events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would end up on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

Impacts from Physical Interactions Under Alternative 2 for Testing Activities

Under Alternative 2, the number of proposed testing activities that could lead to physical interactions between the Navy and non-participants would generally increase as compared to Alternative 1 (see Tables 2.5-2 and 2.5-3). However, the standard operating procedures that are in place ensure that testing activities would not lead to interactions between Navy vessels, aircraft, munitions, or other objects and non-participants. In addition, the communication channels that the Navy uses to inform the public of upcoming testing events would alert non-participants of where and when testing events would occur so that they may avoid these areas. While there is potential for unexploded ordnance, ordnance would either end up on closed off ranges or on the ocean bottom, and would therefore be highly unlikely to be stumbled upon by anybody. Therefore, the increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS.

3.13.2.3.3 Impacts from Physical Interactions Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with the Proposed Action would continue to occur. Physical interaction stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in fewer physical interaction stressors within the marine environment where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from physical interaction stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

3.13.2.4 Secondary Stressors

As discussed in the 2015 NWTT Final EIS/OEIS (Section 3.13.3.4, Secondary Impacts), public health and safety has the potential to be impacted if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality of explosives and explosives byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). In addition, public health and safety could be impacted by a contaminated food supply, which can include fish located within the Study Area. Sections 3.9 (Fishes) and 3.12 (Socioeconomic Resources) discuss the impacts that the Proposed Action would have on fish and fisheries in the Study Area.

3.13.2.4.1 Impacts from Secondary Stressors Under Alternative 1

Impacts from Secondary Stressors Under Alternative 1 for Training Activities

Under Alternative 1, there would be a general increase in the number of proposed training activities that could release secondary stressors into the environment as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Table 2.5-1). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources) increases shown in Table 2.5-1 for training activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply.

Impacts from Secondary Stressors Under Alternative 1 for Testing Activities

Under Alternative 1, there would be a general increase in the number of proposed testing activities that could release secondary stressors into the environment as compared to the number of activities proposed in the 2015 NWTT Final EIS/OEIS (see Tables 2.5-2 and 2.5-3). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources) increases shown in Table 2.5-1 for testing activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply.

3.13.2.4.2 Impacts from Secondary Stressors Under Alternative 2

Impacts from Secondary Stressors Under Alternative 2 for Training Activities

Under Alternative 2, there would be a general increase in the number of proposed training activities that could release secondary stressors into the environment as compared Alternative 1 (see Table 2.5-1). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources) increases shown in Table 2.5-1 for training activities proposed under Alternative 2 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply.

Impacts from Secondary Stressors Under Alternative 2 for Testing Activities

Under Alternative 2, there would be a general increase in the number of proposed testing activities that could release secondary stressors into the environment as compared to Alternative 1 (see Tables 2.5-2 and 2.5-3). According to the discussions presented in Sections 3.1 (Sediments and Water Quality), 3.9 (Fishes), and 3.12 (Socioeconomic Resources) increases shown in Tables 2.5-2 and 2.5-3 for testing activities proposed under Alternative 1 do not appreciably change the impact conclusions presented in the 2015 NWTT Final EIS/OEIS. Although a general increase in some activities and military expended materials would occur, the implementation of Alternative 1 would not significantly degrade sediment or water quality or contaminate the food supply.

3.13.2.4.3 Impacts from Secondary Stressors Under the No Action Alternative

Under the No Action Alternative, the proposed training and testing activities would not occur. Other military activities not associated with the Proposed Action would continue to occur. Secondary stressors as listed above would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

Discontinuing the training and testing activities would result in less secondary stressors within the Study Area where training and testing activities have historically been conducted. Therefore, discontinuing at-sea training activities under the No Action Alternative would lessen the potential for impacts on public health and safety from secondary stressors, but would not measurably improve the condition of public health and safety throughout the Study Area.

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4 Cumulative Impacts

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4 Cumulative Impacts

This chapter (1) defines cumulative impacts, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative impacts, (3) analyzes the incremental interaction the Proposed Action may have with other actions with coincidental effects, and (4) evaluates cumulative impacts potentially resulting from these interactions of the coincidental effects on the same environmental resource. For this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental), the approach to analysis of cumulative impacts has not changed significantly since the 2015 Northwest Training and Testing (NWTT) Final EIS/OEIS.

4.1 Definition of Cumulative Impacts

The approach taken in the analysis of cumulative impacts follows the objectives of the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) Regulations, and CEQ Guidance. Cumulative impacts are defined in 40 Code of Federal Regulations, Section 1508.7.

A cumulative impact is the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 Code of Federal Regulations [CFR] section 1508.7). This analysis does not incorporate by reference the 2015 NWTT Final EIS/OEIS, but rather builds upon it for an updated look at cumulative impact potential.

4.2 Scope of Cumulative Analysis

The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the temporal (relating to time) extent in which the coincidental effects could be expected to occur. For this Supplemental, the Study Area defines the geographic extent of the cumulative impacts analysis. In general, the Study Area includes those areas previously identified in Chapter 3 (Affected Environment and Environmental Consequences) for the respective resource areas, and is the same Study Area as described in the 2015 NWTT Final EIS/OEIS. The time frame for cumulative impacts centers on the timing of the Proposed Action (see Chapter 2, Description of Proposed Action and Alternatives).

Another factor influencing the scope of cumulative impacts analysis involves identifying other actions to consider. In addition to identifying the geographic scope and time frame for the previously completed and currently ongoing actions, the analysis also includes the identification of "reasonably foreseeable" actions (i.e., anticipated future actions). For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Documents used to identify other actions include notices of intent for EISs and Environmental Assessments (EAs), management plans, land use plans, and other planning related studies. Additionally, Naval Air Station Whidbey Island (NASWI) staff provided information on local and regional actions, as well as previously completed, currently ongoing, and reasonably foreseeable future actions at Ault Field and Outlying Landing Field Coupeville. Finally, local websites for local news outlets were searched for articles pertaining to ongoing and future actions that would need to be included in this analysis.

Multiple Navy actions are ongoing within the Pacific Northwest Region; however, each NEPA document addresses a specific Proposed Action, separated from other actions by its purpose and need, independent utility, timing, and geographic location. Some NEPA documents are stand-alone documents; others tier off of and/or expand the analyses of other existing NEPA documents. NEPA documents for at-sea training (e.g., the 2015 NWTT Final EIS/OEIS) focus on training and testing activities occurring within a range complex and/or Military Operating Area and involve different types of aircraft, ships, and range complex enhancements. However, NEPA documents that analyze a specific type of aircraft operation at a military airfield (in this case, the Growler) are focused in and around that airfield and its facility needs. While the Navy has analyzed, and is currently analyzing, various other projects in the area, those projects are not preconditions for Growler operations at the NASWI complex. Growler operations at the NASWI complex are not a precondition for larger military readiness activities on range complexes in the Pacific Northwest. Even in the absence of these Growler operations, military training in the Pacific Northwest would continue independently from this Proposed Action, as analyzed in the documents referenced in Section 1.6 (The Environmental Planning Process). Each of the documents includes the results of a cumulative impact analysis that was conducted at the time the document was prepared; thus, the combined impacts of all of these activities are being captured in multiple documents.

4.3 Past, Present, and Reasonably Foreseeable Actions

This section focuses on past, present, and reasonably foreseeable future projects at and near the Study Area. In determining which projects to include in the cumulative impacts analysis, a preliminary determination was made regarding the past, present, or reasonably foreseeable action. Specifically, using the first fundamental question included in Section 4.1 (Definition of Cumulative Impacts), it was determined whether a relationship exists such that the affected resource areas of the Proposed Action (included in this Supplemental) might interact with the affected resource area of a past, present, or reasonably foreseeable action. If no such potential relationship exists, the project was not carried forward into the cumulative impacts analysis. In accordance with CEQ guidance (Council on Environmental Quality, 2005), these actions considered but excluded from further cumulative effects analysis are not catalogued here because the intent is to focus the analysis on the meaningful actions relevant to inform decision making. Projects included in this cumulative impacts analysis are listed and briefly described in Table 4.3-1.

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Military Mission, Testing, and Training Activities						
Airfield Vegetation Management	Naval Air Station Whidbey Island	Conduct long-term vegetation management (both on and off-Base) to control visual obstructions and pests affecting airfield operations. This project, when considered with the Proposed Action, would not cumulatively impact resources.				O
Bangor Transit Protection Program Pier and Support Facilities	Naval Base (NAVBASE) Kitsap Bangor	This project consists of a new floating pier with finger piers, connected to the shore by a trestle and ramp. Total overwater area is approximately 1.6 acres. On-land facilities would include a new operations and headquarters building with a footprint of 9,000 $ft.^2$, and parking lots totaling 22,000 $ft.^2$ This project, when considered with the Proposed Action, could add to the cumulative impacts on air quality, sediments and water quality, marine habitats, marine vegetation, marine invertebrates, fishes, birds, and marine mammals.			C	C/O
CVN 65 Reactor Disposal/ Facility work at Port of Benton (P-458)	Port of Benton, Washington	Develop/Upgrade dry dock infrastructure to support existing and future workload. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological, cultural, and socioeconomic resources.				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
EA-18G Growler Airfield Operations	NASWI Complex	The Navy proposes to home base up to 36 additional EA-18G (Growler) aircraft at NASWI to support an expanded Department of Defense (DoD) electronic attack mission. Due to the increase in aircraft and pilots, the Navy will need to conduct more Growler operations at the NASWI Complex, which includes Field Carrier Landing Practice that occurs at Ault Field and Outlying Landing Field Coupeville. The Navy announced the preparation of an EIS in September 2013. In October 2014, the Navy revised the scope of the EIS and invited the public to comment. The Draft EIS was available for public review November 2016 to February 2017. The Navy held public meetings on December 5–9, 2016. The Final EIS is expected to be released in Fall 2018. These proposed operations, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, noise, socioeconomic resources, cultural resources, and American Indian and Alaska Native Traditional resources.	Minimization measures, such as Navy occupational noise exposure prevention procedures (e.g., hearing protection and monitoring), would continue to be required at the NASWI complex in compliance with all applicable Occupational Safety and Health Administration and Navy occupational noise exposure regulations. The Navy is also considering other noise-reduction measures, such as constructing and operating a noise-suppression facility for engine maintenance (also known as a "hush house") at NASWI. As well as actively researching engine design solutions to reduce overall sound emissions from the engines of the FA-18E/F "Super Hornet" and Growler. Along with other measures that may reduce the number of FCLPs required in the future. Measures developed by the Navy to avoid, minimize, or mitigate impacts on cultural resources were identified as part of evaluating environmental consequences.			O
Electromagnetic Measurement Ranging System	NAVBASE Kitsap Bangor Hood Canal	The Navy constructed and operates an Electromagnetic Measurement Ranging System located on NAVBASE Kitsap Bangor lands and				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		adjacent waters in Hood Canal (Hood Canal Military Operating Area North) Bangor, Washington. This system, when considered with the Proposed Action, may cumulatively impact biological resources in the Study Area. Currently, the project is on hold. No NEPA has been completed, and no construction has occurred.				
Environmental Assessment (EA) for Electronic Warfare Range	Airspace of the Olympic Peninsula	The Navy published the Pacific Northwest Electronic Warfare Final EA in August 2014. The EA analyzed impacts of the Navy using a fixed transmitter site and up to three mobile transmitter trucks in U.S. Forest Service (USFS) lands. The Navy issued a Finding of No Significant Impact on August 28, 2014, and the USFS issued a Decision Notice on July 31, 2017, that approved the Navy's permit to drive and operate the mobile transmitter trucks on existing USFS roads for a 5-year period.		O	O	O
Establishment and Modification of Oregon Military Training Airspace	Offshore Area	The U.S. Air Force has completed NEPA process for the proposed establishment and modification of Oregon Military Training Airspace EIS. The additional airspace is over the Pacific Northwest surf/sub-surf operating area and includes new areas such as W-570 B, C, D, and W-570 A. Other changes to airspace are only in name. The Oregon Air National Guard is the primary user of W-93 and W-570 special use airspace in the Offshore Area. Oregon Air National Guard flights in W-93 and W-570 are primarily air combat		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		maneuver training flights. These flights occur throughout the year and include the use of chaff and flares in W-570.				
Establishment and Modification of Oregon Military Training Airspace (continued)	Offshore Area	On rare occasions, self-defense flares may be used during training. This airspace, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, and cultural resources. As of December 7, 2017, the updated airspace was established.		O	O	O
Explosives Handling Wharf Maintenance (EHW-1)	NAVBASE Kitsap Bangor	The Navy is continuing a construction project to conduct necessary repairs and maintenance on the EHW-1 facility. This multiyear project involves removal and replacement of deteriorated steel or concrete piles. NMFS has issued an incidental Harassment Authorization (IHA) to the Navy to incidentally harass, by Level B harassment, five species of marine mammals incidental to pile driving and removal associated with the project. This is the third such incidental harassment authorization for similar work on the same structure. Phased repair of this structure is expected to continue until 2024. This project, when considering the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, marine vegetation, marine invertebrates, fishes, birds, and cultural resources.	Mitigation measures for this action include marine mammal zones of influence or mitigation zones to prevent Level A harassment, visual monitoring, sound attenuation devices, acoustic measurements, timing restrictions (to avoid migratory ESA-listed species), the soft-start procedure (a warning or innate noise before beginning pile driving), and daylight construction. There are also mitigation measures to protect fish and the marbled murrelet.	C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Explosives Handling Wharf Maintenance (EHW-2)	NAVBASE Kitsap Bangor	The Navy completed a construction project for necessary repairs and maintenance on the EHW-2 facility. This multiyear project involved removal and replacement of deteriorated steel or concrete piles. NMFS issued an incidental harassment authorization to the Navy for Level B harassment of five species of marine mammals incidental to pile driving and removal associated with the project. Additionally, the project included replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings (U.S. Department of the Navy, 2012a). This project was completed in 2015 and would not contribute to impacts when considered with the Proposed Action.		C	O	O
Fender Pile Removal and Replacement, Pier 4	NAVBASE Kitsap Bremerton	The Navy wrote an EA on Fender Pile Removal and Replacement at Pier 4. The base serves as homeport for a nuclear aircraft carrier and other Navy vessels, and contains a shipyard that is capable of overhauling and repairing all types and sizes of ships by alteration, construction, deactivation, and dry-docking. Pier 4 was completed in 1922 and needed substantial maintenance to support ship repair and other activities to maintain Navy vessels. The Navy removed approximately 80 deteriorating timber fender piles and replaced them with steel fender	Minimization measures were implemented and included an Incidental Harassment Authorization from the NMFS; the issuance criteria required that the unintentional taking of marine mammals authorized by an IHA would have a negligible impact on the species or stock and, where relevant, would not have an unmitigable adverse impact on the availability of the species or stock for subsistence uses.	C		

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		piles. This project, when considered with the Proposed Action, could add to the cumulative impacts on any of the resources discussed in this Supplemental as the impacts to water resources, noise, and biological resources would be temporary and not significant.				
Hawaii and Southern California Training and Testing (HSTT) EIS/OEIS	Hawaii and Southern California	The Navy has prepared two iterations of this EIS/OEIS and is preparing the third to assess the potential environmental impacts associated with two categories of military readiness activities: training and testing. The water-based training covered in the HSTT EIS/OEIS is considered at-sea training and does not include land-based components. In the EIS/OEIS, the Navy assesses military readiness activities that could potentially impact human and natural resources, especially marine mammals, sea turtles, and other marine resources. The range of alternatives includes a No Action Alternative and other reasonable courses of action. The Draft HSTT EIS/OEIS third iteration was released in October 2017. Resource areas include air quality, biology (marine species), and public health and safety. The emission of criteria pollutants resulting from activities in the Study Area would not cause a violation or contribute to an ongoing violation of the National Ambient Air Quality Standards. This project, when considered with the Proposed Action, could add to the cumulative impacts on marine mammals, sea turtles, fishes, and birds.	Procedural mitigation is mitigation that the Navy will implement whenever and wherever an applicable training or testing activity takes place within the Study Area. Procedural mitigation generally involves (1) the use of one or more trained Lookouts to diligently observe for specific biological resources within a mitigation zone, (2) requirements for Lookouts to immediately communicate sightings of specific biological resources to the appropriate watch station for information dissemination, and (3) requirements for the watch station to implement mitigation until certain recommencement conditions have been met. Mitigation areas are geographic locations within the Study Area where the Navy will implement additional measures to (1) avoid or reduce impacts on biological or cultural resources that are not	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
			observable by Lookouts from the water's surface (i.e., resources for which procedural mitigation cannot be implemented); and (2) in combination with procedural mitigation, to effect the least practicable adverse impact on marine mammal species or stocks and their habitat. The Navy completed an extensive assessment of the Study Area to develop its mitigation areas. For Phase III, this included reanalyzing existing Phase II mitigation areas; assessing additional habitat areas suggested by the public, NMFS, other governmental agencies, and non-governmental organizations; and considering other habitats identified internally by the Navy.			
Hood Canal Bedlands Encroachment Protection Easement	Hood Canal	The Navy and Washington Department of Natural Resources signed a restrictive easement on July 7, 2014. The Navy paid $720,000 for the easement, which precludes construction in the easement area. The easement covers 4,804 acres (ac.) of aquatic land, from -18 feet (ft.) mean lower low water down to 70 ft. mean lower low water. The restrictive easement will prevent construction and development in the footprint of the easement. It will not affect public access, privately owned lands, recreational uses,		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		aquaculture, or geoduck harvest. All 4,804 ac. overlays designated critical habitat for ESA-listed salmonid species. The restrictive easement area also protects large tracts of wild stock geoduck and extensive eelgrass habitat. The easement will protect the area for 55 years. The Department of Natural Resources will continue to manage the land under its aquatic lands program. Other reasonably foreseeable future actions include a series of easements on the east side of the Hood Canal. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources and cultural resources in a positive manner through restricting construction and protecting various biological resources.				
Integrated Natural Resource Management Plan (INRMP)	Commander, Navy Region Northwest (CNRNW) Installations: NBK (Bangor, Bremerton, Keyport, and Zelatched Point); NASWI.	INRMPs were revised for multiple CNRNW INRMPs between fiscal year 2012 and 2018. The Sikes Act, U.S. Department of the Navy Policy, and DoD instruction require that annual and 5-year reviews for operation and effect of INRMPs occur with federal and state partners. The Navy, U.S. Fish and Wildlife Service (USFWS), and state wildlife agencies participate in these reviews. NMFS is also invited to participate.	Minimization and mitigation measures pertaining to natural resource management are described in the INRMPs.	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Integrated Natural Resource Management Plan (INRMP) (continued)	NAVSTA Everett; Pacific Beach Annex; NAVMAG Indian Island; and SEAFAC	The INRMP is generally updated every 5 years, and management actions prescribed in it are implemented to contribute to the conservation and rehabilitation of installation natural resources. These projects, when considered with the Proposed Action, could add to the cumulative impacts on biological resources in a positive manner through the conservation and rehabilitation efforts.		O	O	O
Land-Water Interface (P-983)/Service Pier Extension (P-834) Supplemental SEAWOLF Class Service Pier Extension	Naval Base Kitsap Bangor, Silverdale, WA	Construct an extension of the Service Pier. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, cultural resources, and socioeconomic resources.				C/O
Manchester Fuel Tank Replacement (P-856)	Naval Base Kitsap	Construct aboveground fuel storage tanks and replace current system of underground storage tanks. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources and socioeconomic resources.				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Marine Structure Maintenance and Pile Replacement Activities	NAVBASE Kitsap Bangor, Bremerton, Keyport, Manchester, Zelatched Point and Naval Station Everett	Navy proposes to conduct maintenance and repair activities of marine waterfront structures at six Navy locations within Navy Region Northwest. The Navy released the Draft EA for public review and comment in August 2017, and NMFS released the Navy's MMPA permit application for public review in July 2017. The repairs, maintenance, and replacement of piles will continue through 2022. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources (specifically marine mammals), cultural resources, air quality, and noise.	General best management practices, mitigation, and minimization measures may be implemented for all in-water repair and replacement activities. Additional minimization measures have been added to protect marine mammals, ESA-listed species, and designated critical habitats. These measures include vibratory installation of piles where possible, noise attenuation and performance measures for impact pile driving, and marine mammal monitoring.			C/O
Naval Health Clinic Oak Harbor, Whidbey Island, Washington (P-262)	Oak Harbor, Washington	Construct new facility to serve as medical clinic, dental clinic, and birthing center. This project, when considered with the Proposed Action, does not have the potential to cumulatively impact resources.				C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Naval Special Operations Training	Puget Sound and Coastal Southwestern Washington	The Navy proposes to conduct small unit, intermediate and advanced land and cold-water maritime training for Navy Special Operations personnel. The training would occur in selected nearshore lands and in the inland waters of Puget Sound, including Hood Canal, as well as the southwestern Washington coast, with the permission of willing property owners. Training would comply with federal and state laws and be consistent with existing non-military use. The project and proposed areas are under development, and public outreach meetings were held in May 2017 for the development of an EA. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, cultural resources, and socioeconomic resources.				O
P-188 Replace Fuel Pipeline	NASWI	In 2014 the Navy replaced an existing 55-year-old, 5-mile-long cross-island pipeline and pumping system that transfers fuel from the Seaplane Base to Ault Field at NASWI. The pipeline finished under budget and ahead of schedule in 2014 and would not cumulatively impact resources, when considered with the Proposed Action.		C	O	O
P-8A Multi-Mission Aircraft	NASWI	Homebasing of 12 P-8A Multi-Mission Maritime Aircraft (MMA) squadrons and one Fleet Replacement Squadron is proposed to occur to replace the current maritime patrol aircraft, the		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		P-3C Orion, at existing maritime patrol homebases. The action will result in the homebasing of six fleet squadrons (42 aircraft) at NASWI, Washington. Informal consultation with the USFWS in accordance with section 7(a)(2) of the ESA for the Proposed Action concluded with a letter of concurrence from the USFWS on May 13, 2013. The Record of Decision (ROD) was signed in June 2014, and the transition to the P-8A aircraft is currently underway. Most recently Boeing installed a new P-8A Poseidon training center at NASWI that contains simulators to help transition the aircrews effectively and efficiently prior to operating the P-8A MMA. The first P-8A MMA arrived on the base in October 2016. Based on the ROD, there will be an overall increase of 18 aircraft at the base by 2020. This project, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, socioeconomic resources, noise, American Indian, and cultural resources.				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
P-993 Pier and Support Facilities for Transit Protection System at U.S. Coast Guard Air Station/Sector Field Office	USCG Air Station/ Sector Field Office Port Angeles	This project consisted of the construction of a 22,303 square foot pier and 8,300 square foot building for an Alert Forces Facility (single-story sleeping and administration building); a Ready Service Armory (an ammunition and weapons storage facility); diesel fuel, marine storage tank, and distribution system; and site improvements including utilities, parking, lighting, security improvements, and landscaping at the USCG AIRSTA/SFO Port Angeles to support the USCG Maritime Force Protection Unit mission. The Transit Protection System (TPS) pier is designed to provide full hotel services (electricity, potable water, sewer, Internet, phone, fire protection, pier lighting, and fueling lines) and dedicated mooring for up to seven TPS vessels. Construction of the project started in the summer of 2016 was completed in 2018. The new pier and support facilities would has a design life of 50 years (U.S. Department of the Navy, 2015b). This project, when considered with the Proposed Action, could add to the cumulative impacts on biological resources, noise, cultural resources, American Indian, and socioeconomic resources.	The construction included mitigation measures to protect marine mammals and habitat in the project area.	C	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Port Security Barrier (PSB)	NAVBASE Kitsap Bremerton	This project would extend the existing floating fence approximately 1,000 feet to the shoreline, enclosing approximately 6.5 acres of water. The PSB is presently connected to the end of Pier 7, and extension of the PSB will reduce the safety risk to individuals that may otherwise enter the highly industrialized and very active naval shipyard. Extension of the PSB is pending issuance of a permit by the U.S. Army Corps of Engineers. This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.				C
Readiness and Environmental Protection Integration Program/ Encroachment Protection Partnering Agreement Transactions	Hood Canal	Under the Readiness and Environmental Protection Integration Program, the Navy has established a multi-year agreement with The Trust for Public Lands, Washington Department of Natural Resources, and Jefferson Land Trust. To date, the Navy and its partners have purchased protective easements on 5,149 ac. of upland and shoreline properties around Hood Canal, including protection of approximately 2 miles of the riparian corridor along the Dosewallips River. The Navy purchased a restrictive easement to maintain 3,607 ac. of working forest as a buffer and permanently protect these lands from development. These areas provide protection for designated critical		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	Location	Project Description	Summary of Impact Minimization and Mitigation Measures[1]	Project Timeframe C = Construction O = Operation X = Other		
				Past	Present	Future
		habitat for ESA-listed salmonid species. Additional Readiness and Environmental Protection Initiative transactions are underway within the agreement area around Hood Canal. This project, when considered with the Proposed Action, beneficially and cumulatively impacts biological resources, and American Indian and commercial fishing.				
Seismic Retrofit of Building 431	NAVBASE Kitsap Bremerton	The Navy performed repair and construction for seismic upgrades and renovation of a ship maintenance machine shop facility, which is within the coastal zone. The project included seismic retrofit renovation of all architectural, mechanical, and electrical systems, demolishing portions of the building interior and hazardous material remediation. This project, when considered with the Proposed Action, would not cumulatively impact resources.		C	C	
Ship Maintenance and Waterfront Operations	Naval Station Everett (NSE) (P-173)	Construct new Ship Maintenance and Waterfront Operations Facility, demolish and consolidate substandard and inadequate temporary facilities, and relocate ship support operations to waterfront. This project, could add to the cumulative impacts on biological, cultural, and socioeconomic resources.				C/O
SPECWAR NW Training	Western Washington	Naval Special Warfare in-water and on-land training in western Washington State. Due to the nature of this training, being no-trace left behind, and the lack of weapon involvement, this project			O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		alone would have no significant impacts on resources considered in this analysis. Therefore, this project, when considered with the Proposed Action, would not cumulatively impact resources.				
Surveillance Towed Array Sensor System Low Frequency Active Sonar	Pacific Ocean, Atlantic Ocean, Indian Ocean, and the Mediterranean Sea	The Navy utilizes Surveillance Towed Array Sensor System Low Frequency Active Sonar systems onboard several T-AGOS class vessels in the western and central North Pacific Ocean, not including polar waters, and the southwestern Indian Ocean. The Navy is currently conducting covered SURTASS LFA sonar activities pursuant to a National Defense Exemption (under the Marine Mammal Protection Act). This exemption expires in August of 2019 and Navy is in the process of updating its relevant environmental planning and compliance documents. The underwater sound produced by this activity may contribute to the cumulative impacts on marine mammals and sea turtles in the Study Area (U.S. Department of the Navy, 2012b).		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Transit Protection Program (TPP) Pier and Support Facilities	Naval Base Kitsap Bangor (P-907/P-932)	Build fixed-pile or floating pontoon main pier and finger piers at K/B Spit. This project, when considered with the Proposed Action, could add to the cumulative impacts on biological, cultural, American Indian, and socioeconomic resources.				C/O
USCG Training	California, Oregon, and Washington	The USCG conducts training throughout the Study Area. In California, District 11 conducts search and rescue, homeland security, law enforcement, marine safety, and aids to navigation missions in over 3.3 million square miles (mi.^{2}) of water. The District 13 Coast Guard unit is located in the Pacific Northwest along the coasts of Oregon and Washington. District 13 conducts the same operational duties as the units in District 11 and covers more than 460,000 mi.^{2} of the Pacific Ocean. These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.	USCG activities that were part of the Proposed Action in the 2015 NWTT Final EIS/OEIS and continue to be analyzed in this Supplemental under the Proposed Action include Maritime Security Operations, where USCG personnel participate. The following USCG activities are not part of the Proposed Action for this Supplemental and are analyzed only for their cumulative impact: • Small- and medium-caliber weapons firing from ships, similar to that of the Navy's Gunnery Exercises (Surface-to-Surface) • Flight training in W-237. This flight training includes low-altitude helicopter flights but does not include expenditure of munitions or any other materials	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
			• Shipboard aircraft operations, such as deck landing qualification training • Shipboard maneuvering and engineering training (e.g., abandon ship, anchoring, full power trials, man overboard, and flooding) • Search and rescue training			
VAQ Electronic Attack Squadron Expeditionary Wing	NASWI	The Navy prepared an EA to analyze the transition of the Expeditionary Electronic Attack squadrons (VAQ) at NASWI from the aging EA-6B Prowler to the newer EA-18G Growler in the 2012–2014 timeframe. The 2012 EA analyzed retaining three expeditionary VAQ squadrons that operated Prowlers and their transition to Growler, in addition to relocating a reserve squadron to NASWI, and resulted in a finding of no significant impact. Training for these Growler aircrew was included as part of the Proposed Action in the NWTT Final EIS/OEIS (2015a). This transition, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, and cultural resources.		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Waterfront Improvements	NAVBASE Kitsap Bremerton	This proposed action would consist of two main projects: (1) development of a new Multi-Mission Dry Dock (M2D2) and (2) Reconstruction of existing Dry Dock 6. This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, and cultural resources.				C/O
Waterfront Service Craft Piers	Naval Station Everett (P-65)	Construct new pier(s) to replace Piers D and E (small craft berthing piers). This project, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, sea turtles, birds, marine vegetation, marine invertebrates, fishes, American Indian, and cultural resources.				C/O
Whidbey Island Extend Shoreline Erosion Protection System South	Whidbey Island	The Navy is constructing an extended shoreline erosion protection system on Whidbey Island near Ault field off of Saratoga Street and Lexington Street. These activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, and birds.			C	C
Wind Energy Project	NRS(T) Jim Creek	Installation of 10 wind turbines on Wheeler Mountain and Blue Mountain. Turbine utility would be privately operated under 30-year lease.				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		This project is currently on hold; however, if implemented in the future, these activities, when considered with the Proposed Action, could add to the cumulative impacts on sediments and water quality, air quality, marine habitats, marine mammals, and birds.				
Non-Military Actions						
Aquaculture	Oceans worldwide	Globally, 29 percent of stocks are fished at biologically unsustainable levels, and aquaculture helps meet demand and offsets stress to wild populations (National Marine Fisheries Service, 2015). Aquaculture production reached an all-time high of 97 million metric tons in 2013 and is the fastest growing form of food production, at 6 percent per year globally. Forty-seven percent of aquaculture operations occur in the Pacific Ocean. Salmon and shellfish aquaculture have existed since the 1970s in the Puget Sound. In April of 2018, Washington passed HB 2957, to phase out non-native fish farming in Washington State by 2022; which will eliminate threats from Atlantic salmon net pen farming and protect native salmon populations. Aquaculture introduces excess fecal matter, fish pellets, and introduced chemicals into the environment which harms the marine ecosystem (Audubon Washington, 2018). The threats of aquaculture operations on wild fish populations include reduced water quality,		C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		competition for food, predation by escaped or released farmed fishes, the spread of disease and parasites, and reduced genetic diversity (Kappel, 2005). These threats become apparent when farmed fish escape and enter the natural ecosystem (Hansen & Windsor, 2006; Ormerod, 2003). The Marine Aquaculture Policy provides direction to enable the development of sustainable marine aquaculture (National Marine Fisheries Service, 2015).				
Commercial and General Aviation Activities		Commercial and general aviation are retained for analysis and discussion due to associated emissions from aviation activities and effects on greenhouse gas on air quality and climate change. These activities, when considered with the Proposed Action, could add to the cumulative impacts on air quality, birds, cultural, Native American, and socioeconomic resources.		O	O	O
Commercial Fishing (Section 3.12.2.2, Commercial and Recreational Fishing)	Pacific Ocean	Commercial and recreational fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Fishing can adversely affect fish populations, other species, and habitats. Potential impacts of fishing include overfishing of targeted species, bycatch, entanglement, and habitat destruction, all of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidentally to	Various bycatch mitigation technologies, quotas, and seasonal restrictions required per the fishery-specific permit process. Operational regulations, seasonal restrictions, licensing, and quotas are used to mitigate negative effects of recreational fishing.	O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		normal fishing operations. Use of mobile fishing gear such as bottom trawls disturbs the seafloor and reduces habitat structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), habitat destruction, and the generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine animals (i.e., microplastic ingestion by birds and fishes). Fishing can also have a profound influence on individual targeted species populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	***Location***	***Project Description***	***Summary of Impact Minimization and Mitigation Measures[1]***	***Project Timeframe C = Construction O = Operation X = Other***		
				Past	***Present***	***Future***
		ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al., 2010). For example, entanglement in nets from the Pacific Northwest coastal salmon fisheries has been shown to increase mortality in seabirds (Hamel et al., 2009). Habitat destruction caused by bottom trawling and other fishing methods also contributes to the negative effects of commercial and recreation fishing on multiple species, such as the North American groundfish (Melnychuk et al., 2013).				
Continued operational activities of the network of moored buoys and coastal stations	Pacific Ocean and Coastal Areas of the United States	The National Data Buoy Center (NDBC) has prepared a Programmatic EA to analyze the continued operation of the NDBC program. The NDBC network of buoys includes Coastal Weather Buoys, land based Coastal-Marine Automated Network stations, Tropical Atmosphere Ocean Array, and Deep-ocean Assessment and Reporting of Tsunamis. The NDBC proposes to continue the use of these buoys and stations in order to provide quality in-situ marine observations in a safe and sustainable manner to understand and predict		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		changes in weather, climate, oceans, and coasts (National Data Buoy Center, 2017).				
Hood Canal In-Lieu Fee Mitigation Program	Hood Canal	The Hood Canal In-Lieu Fee Mitigation Program is a voluntary program sponsored by the Hood Canal Coordinating Council. Entities pursuing development on aquatic resources such as wetlands or shoreline habitats can purchase mitigation credits to offset unavoidable adverse impacts to these resources within the Hood Canal watershed. The primary goal of the program is to increase aquatic resource functions in the Hood Canal watershed. The program is intended to ensure no net loss through the preservation, enhancement, establishment, and restoration of ecological functions within target watersheds. This will be accomplished through the establishment and management of mitigation sites. The service area for the Hood Canal Coordinating Council In-Lieu Fee Program encompasses Hood Canal and those portions of Water Resource Inventory Areas 14, 15, 16, and 17 draining to Hood Canal, defined by a line extending from Foul Weather Bluff to Tala Point, south through the Great Bend to its terminus near the town of Belfair, Washington. The service area is divided into two components for the In-Lieu Fee Program. The first is the Freshwater Environment, which generally includes areas landward of the marine riparian zone, including freshwater and estuarine		X	X	X

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		wetlands and streams up to and excluding any National Park or National Forest Lands. The second is the Marine/Nearshore Environment, which extends from the marine riparian area at the top of the coastal bluffs to the adjacent aquatic intertidal and subtidal zones. The mitigation strategy selected for each permitted impact will be based on an assessment of type and degree of disturbance to the landscape or drift cell.				
Marine Spatial Plan for Washington's Pacific Coast	Washington's Pacific Coast	The Washington Department of Ecology created a Marine Spatial Plan, adopted in June 2018, which provided: a consistent way of evaluating future ocean use proposals; a new base of scientific information on coastal uses and resources; a framework to coordinate decisions for new ocean uses; and protections for sensitive ecological areas and fishing. This plan is a tool to assist state agencies and others in evaluating and engaging in proposals or new ocean uses and guide potential applicants as they develop those proposals (Washington Department of Ecology, 2017).		X	X	X
Maritime Traffic (Commercial Transportation and Shipping)	Pacific Ocean	Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area. Section 3.12 (Socioeconomic Resources) provides additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		impacts analysis include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels. Therefore, maritime traffic could add to the cumulative impacts on marine mammals and sea turtles in the Study Area.				
Marine Tourism/Whale Watching	Puget Sound	In April of 2018, the Pacific Whale Watch Association adopted new guidelines for marine tourism in the Puget Sound. These guidelines are meant to keep endangered whales, such as the Southern Resident Killer Whale population and humpback whales, safe around commercial and private boats. These guidelines include implementing a "slow zone" of 7 knots within 1 kilometer of whales; staying 200 yards from Southern Resident killer whales; limiting viewing time to 1 hour in the vicinity of a group of whales, or limiting viewing time to 30 minutes if there are 10 or more vessels within 1 kilometer of the whales.(Donaldson, 2018).	Regulations under the ESA and MMPA prohibit vessels from approaching killer whales within 200 yards and from parking in the path of whales when in the Inland Waters of Washington State. Certain vessels are exempt from the prohibitions (76 Federal Register 20870).	O	O	O
Pacific Marine Energy Center South Energy Test Site	6 NM southwest of Newport, OR	The Oregon State University proposes to build a grid-connected offshore wave energy test site. It would be about 33 miles in area and is in the planning and permitting stages of development. The project is still undergoing geophysical surveys, finalizing locations of terrestrial project infrastructure, conducting cultural surveys, and completing draft license applications, as well as proposing future research. If successful they will				C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		finalize, design, receive permits for, and construct and commission the test site (Batten, 2017). This project could add to the cumulative impacts on biological resources, transportation, American Indian, and cultural resources.				
Pleasant Harbor Master Planned Resort	Black Point Peninsula	In November 2007, a programmatic Final EIS was issued in association with an Amendment to re-designate the 256 acres from rural residential to Master Planned Resort. The proposed Master Planned Resort is located south of Brinnon, Washington, on the Black Point Peninsula, on the western shore of the Hood Canal. Under Alternative 1, an 18-hole golf course, 890 residential units, 49,772 $ft.^2$ of commercial space, and resort-related amenities on a 231 ac. site (with 33 ac. of natural area preserved and 2.2 million cubic yards of earthwork required for golf course grading) would be built. Alternative 2 consists of the golf course, 890 residential units, 52,650 ft. of commercial space with resort-related amenities, and 80 ac. of natural area preserved with 1 million cubic yards of earthwork for golf course grading. Finally, under the No Action Alternative, the Master Planned Resort would not be constructed. The Final Supplemental EIS was released in December 2015 (Jefferson County, 2015). Jefferson County government held meetings in 2016 with tribes in				C

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		the area to understand their concerns with the proposed development. A Staff Report on the application for a Development Agreement and Development Regulations was received on January 4, 2016; the Planning Commission Public Hearing occurred on January 6, 2016; and on August 14, 2017 the Board of County Commissioners meeting watched a presentation on the Pleasant Harbor Master Planned Resort (Jefferson County, 2017). With respect to the Proposed Action, could add to the cumulative impacts on biological resources, water quality, transportation, Native American, and socioeconomic resource.				
Seismic Surveys	Global	Seismic surveys are typically accomplished by towing a sound source such as an airgun array that emits acoustic energy in timed intervals behind a research vessel. The transmitted acoustic energy is reflected and received by an array of hydrophones. This acoustic information is processed to provide information about geological structure below the seafloor. The oil and gas industry uses seismic surveys to search for new hydrocarbon deposits. In addition, academic geologists use them to study plate tectonics and other topics. In Washington and the Pacific Northwest, seismic surveys are mostly used for collecting marine seismic reflection data		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		to investigate the earthquake hazard in the region. The underwater sound produced by these surveys could add to the cumulative impacts on marine life, including marine mammals. For example, the potential exists to expose some animals to sound levels exceeding 180 decibels (dB) referenced to (re) 1 micropascal (μPa) root mean square, which would in turn potentially result in temporary or permanent loss of hearing (Bureau of Ocean Energy Management, 2011). All seismic surveys conducted by U.S. vessels are subject to the MMPA authorization process administered by the NMFS, as well as the NEPA process associated with issuing MMPA authorizations. Seismic surveys could add to the cumulative impacts on biological resources, including marine mammals, fishes, sea turtles, and invertebrates.				

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Tesoro Anacortes Refinery Clean Products Upgrade Project (CPUP) Vessel Traffic Assessment Technical Report	Fidalgo Bay, Skagit County, Washington	The Clean Products Upgrade Project, located approximately 70 miles north of Seattle, would include construction of an Aromatics Recovery Unit, installation of a new Marine Vapor Emission Control System, and on-shore facility upgrades and expansions. The Vessel Traffic Assessment Technical Report demonstrates vessel traffic levels in the study area and shows the current shipping plan and impacts to vessel traffic in the Salish Sea, impacts to vessel traffic days, and comprehensive vessel traffic management systems (CH2m, 2016). With respect to the Proposed Action, the project could add to the cumulative impacts on biological resources, sediments and water quality, transportation and noise, water resources, air quality, Native American, and cultural resources.	Existing passive and active mitigation measures were found to be adequate for the anticipated volume of vessel traffic associated with the proposed action and other anticipated development in the Study Area.	C	O	O
The Seattle Multimodal Ferry Terminal at Colman Dock Project	Seattle	This project began with an environmental process and preliminary design from 2012 to 2015, with the final design and permitting process occurring from 2015 to 2017. Construction began in 2017 and is expected to continue through 2023. The terminal will remain open throughout construction. The project is expected to ensure the Colman Dock facility can continue to provide safe and reliable ferry service between Seattle and communities in Kitsap County and the Olympic Peninsula; improve safety by meeting current seismic standards; reduce conflicts between vehicles, bicycles, and		C	C	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		pedestrians; improve pedestrian circulation and accessibility; remove 7,400 tons of creosote-treated timber piles from Elliott Bay; open an area of shoreline and near-shore habitat; provide stormwater treatment for all new and replaced areas of the trestle; and provide opportunities for remediation of contaminated sediments (Washington Department of Transportation, 2017). With respect to the Proposed Action, the project could add to the cumulative impacts on biological resources, sediments and water quality, transportation and noise, with temporary impacts on water resources, air quality, and cultural resources.				
Undersea Communication Cables	Oceans worldwide	Submarine cables provide the primary means of voice, data, and Internet connectivity between the mainland United States and the rest of the world (Federal Communications Commission, 2017). The Federal Communications Commission grants licenses authorizing cable applicants to install, own, and operate submarine cables and associated landing stations in the United States. Cables are installed by specialized boats across flat ocean surfaces and dug into the seabed in shallow areas. Over 550,000 mi. of cables currently exist in the world's oceans. Potential impacts of installation and maintenance activities would include noise and vessel strike from boat traffic, and increased seafloor disturbance and sedimentation in		C/O	C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		localized areas where the cable is installed. Likewise, electromagnetic fields are generated by some cables that may be sensed by and affect the migration behavior of some fish, sharks, rays, and eels (Bureau of Ocean Energy Management, 2016). With respect to the Proposed Action, this project could add to the cumulative impacts on noise and biological resources, including both marine species and marine habitats.				
Washington State's Marine Spatial Plan and EIS	Pacific Ocean adjacent to Washington State coastline	The Marine Spatial Plan Study Area consists of marine waters of the Pacific Ocean adjacent to Washington's coastline from the intertidal zone out to the continental slope. The plan provides information and guidance intended for use throughout the development of new ocean use proposal along the coast. It assists agencies, tribal governments, and others in evaluating and engaging in proposals for new ocean uses and guides potential applicants as they develop those proposals. The proposals for new ocean uses, if implemented, could add to the cumulative impacts on biological resources (marine species, habitat, and vegetation) and water quality.	Proposed mitigation would depend on the project chosen.		C/O	C/O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Research and Conservation						
Academic Research	Global	Wide-scale academic research is conducted in the Study Area by federal entities, such as the Navy and National Oceanic and Atmospheric Administration/NMFS, as well as state and private entities and other partnerships. Although academic research aims to capture data without disturbing the ambient conditions of the ocean environment, vessels contribute to traffic, noise, and strike hazard; seismic activity contributes noise; and various other collection methods, such as trawling, could be disruptive to the ecosystems under observation. Impacts from academic research operations can be similar to the impacts expected from oil and gas airgun survey activities, which can cause death in microscopic animals due to powerful sound wave creation. These sound waves can also kill or injure fishes and invertebrates. With respect to the Proposed Action, academic research could add to the cumulative impacts on noise and biological resources, including both marine species and marine habitats.		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Ocean Pollution and Ecosystem Alteration						
Climate Change (Section 3.2, Air Quality)	Global	Predictions of long-term negative environmental impacts due to climate change include sea level rise; changes in ocean surface temperature; changes in weather patterns with increases in the severity of storms and droughts; changes to local and regional ecosystems; ocean acidification; shrinking glaciers and sea ice; thawing permafrost; a longer growing season; and shifts in plant and animal ranges. Anthropogenic greenhouse gas emissions have changed the physical and chemical properties of the oceans, including a 1-degree Celsius temperature rise, increased carbon dioxide absorption, decreased pH, and alteration of carbonate chemistry (Poloczanska et al., 2016). Observations of species responses that have been linked to anthropogenic climate change are widespread, and trends include shifts in species distribution to higher latitudes and deeper locations, earlier onset of spring and later arrival of fall, and declines in calcification. Climate change is likely to impact the Study Area negatively and will contribute added stressors to all resources in the Study Area.		X	X	X
Hypoxic Zones	Global	Hypoxia, or low oxygen, is an environmental phenomenon where the concentration of dissolved oxygen in the water column decreases		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		to a level that can no longer support living aquatic organisms. Hypoxia occurs from the rapid growth and decay of algal blooms in response to excess nutrient loading (primarily nitrogen and phosphorus from agriculture runoff, sewage treatment plants, bilge water, and atmospheric deposition). Animals that encounter the Dead Zones flee, experience physiological stress, or suffocate (National Oceanic and Atmospheric Administration, 2016; Texas A&M University, 2011, 2014). Hypoxic zones can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017). In the northern part of the California Current System in the Offshore Area of the Study Area, a seasonal decline in oxygen concentrations and increasing hypoxia (dead zones) occurring over the summer upwelling season has increased over the past few years. With respect to the Proposed Action, hypoxia could add to the cumulative impacts on biological resources, water quality, and socioeconomic resource.				
Marine Debris (Section 3.1.3.2, Marine Debris, Military Expended Materials, and	Global	Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment (National Marine Fisheries Service, 2006). Common types of marine debris include various forms of plastic and abandoned		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Marine Sediments)		fishing gear. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service, 2006). Plastic debris is a major concern because it degrades slowly and many plastics float. The floating debris is transported by currents throughout the oceans and has been discovered accumulating in oceanic gyres (Law et al., 2010). Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as polychlorinated biphenyl and dichlorodiphenyltrichloroethane, which accumulate up to one million times more in plastic than in ocean water (Mato et al., 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre it is estimated that the fishes in this area are ingesting 12,000–24,000 U.S. tons of plastic debris a year (Davison & Asch, 2011). Marine Debris is likely to impact the Study Area negatively and will contribute added stressors to all resources in the Study Area. With respect to the Proposed Action, marine debris could add to the cumulative impacts on biological resources, water quality, and socioeconomic resource.				
Noise	Global	Vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction,		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
		and naval and other use of sound navigation and ranging are most likely to contribute to increases in ocean noise. Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. Appendix D (Acoustic and Explosive Concepts) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This section describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma. With respect to the Proposed Action, noise can cumulatively add to the impacts on marine mammals, and sea turtles in the Study Area.				
Pollution (Section 3.1, Sediments and	Global	Common ocean pollutants are derived from land-based activities and include toxic compounds such as metals, pesticides, and other organic		O	O	O

Table 4.3-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation X = Other*		
				Past	*Present*	*Future*
Water Quality)		chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from non-point sources (stormwater runoff from watersheds), point sources (wastewater treatment plant discharges), other land-based sources (windblown debris), spills, dumping, vessels, and atmospheric deposition.				
		Bilgewater is a mix of water, oily fluids, lubricants, and grease, cleaning fluids, and other wastes that are pumped out periodically from vessel holding tanks, either to a reception facility onshore or treated with a bilge oil-separator and discharged at sea. Discharging sewage within 3 NM of the coast is largely prohibited under the Clean Water Act. The main risk of oil or other petroleum product spills is from ships, whether carrying petroleum to and from ports or in fuel tanks and from pipelines and onshore facilities that transport and store oil and gas. With respect to the Proposed Action, pollution could add to the cumulative impacts on sediments and water quality, biological resources, air quality, socioeconomic resource, and public health and safety.				

[1] Some projects/activities did not list specific impacts minimization measures (such as avoidance techniques, standard operating procedures, or industry best management practices) or mitigation requirements; either official documentation of project descriptions could not be obtained or did not specify these actions. In most cases, site-specific actions are to be developed as specific projects are developed.

Notes: EA = Environmental Assessment, EIS = Environmental Impact Statement, ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act, NMFS = National Marine Fisheries Service, OEIS = Overseas Environmental Impact Statement, U.S. = United States, USFWS = U.S. Fish and Wildlife Service

4.4 Resource-Specific Cumulative Impacts

In accordance with CEQ Guidance (Council on Environmental Quality, 1997), the following cumulative impacts analysis focuses on impacts that are "truly meaningful." The level of analysis for each resource is commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences) and the level to which impacts from the Proposed Action are expected to mingle with similar impacts from existing activities. A full analysis of potential cumulative impacts is provided for marine mammals, sea turtles, marine invertebrates, and fish. The rationale is also provided for an abbreviated analysis of the following resources: sediments and water quality, air quality, marine habitats, birds, marine vegetation, fishes, cultural resources, Native American and Alaska Native Traditional Resources, socioeconomic resources, and public health and safety.

4.4.1 Sediments and Water Quality

Based on the analysis in Section 3.1 (Sediments and Water Quality), which supplements the analysis presented in the 2015 NWTT Final EIS/OEIS, sediments and water quality would still be below applicable standards and guidelines that are established to protect sediments and water quality. Furthermore, the Proposed Action would not result in long-term and widespread changes in environmental conditions, such as nutrient loading, turbidity, salinity, or pH (a measure of the degree to which a solution is either acidic [pH less than 7.0] or basic [pH greater than 7.0]). Therefore, the incremental contribution of the Proposed Action to cumulative impacts on sediments and water quality would be low, and further analysis of cumulative impacts is not warranted.

4.4.2 Air Quality

The incremental contribution of the Proposed Action to cumulative impacts would be low and would still be below applicable state, federal, and USEPA standards and guidelines based on the analysis presented in Section 3.2 (Air Quality) of this Supplemental and the reasons summarized below:

- All of the air emissions sources proposed in this Supplemental are mobile sources and do not impact the current attainment status.
- Few stationary offshore air pollutant emission sources exist within the Study Area and few are expected in the foreseeable future.
- International regulations by the International Maritime Organization required commercial shipping vessels to switch to lower-sulfur fuel near U.S. and international coasts beginning in 2012 (National Oceanic and Atmospheric Administration, 2011). In addition, the International Maritime Organization is set to impose a new 0.5 percent sulfur cap on marine fuel emissions (International Maritime Organization, 2017). The DoD has released the *Operational Energy Strategy: Implementation Plan*, which will reduce demand, diversify energy sources, and integrate energy consideration into planning (U.S. Department of Defense, 2012). Since then, the Navy has released the 2016 Operational Energy Strategy, which builds on the successes of the 2011 Operational Energy Strategy (U.S. Department of Defense, 2016).

Under this Supplemental, the contribution of proposed increases in training and testing under the Proposed Action would still be negligible based on the reasons presented above. Construction-related activities associated with the additional projects could generate increased air emissions; however, air quality in the region would remain below *de minimis* levels due to the quick dispersive nature of emissions. Therefore, further analysis of cumulative impacts on air quality is not warranted.

4.4.3 Marine Habitats

The incremental contribution of the Proposed Action to cumulative impacts would be negligible based on the analysis presented in Section 3.3 (Marine Habitats) of this Supplemental, and the reasons summarized below:

- Most of the proposed activities that might affect marine habitats would occur in areas where hard bottom does not occur.
- Impacts on soft-bottom habitats would be confined to a limited area, and recovery would occur quickly.

Therefore, further analysis of cumulative impacts on marine habitats is not warranted.

4.4.4 Marine Mammals

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.4 (Marine Mammals) detailed the potential for impacts on marine mammals from the various stressors related to Navy training and testing activities. As discussed in Section 3.4.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of marine mammals in the Study Area. Analysis of cumulative impacts on marine mammals was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.6 (Marine Mammals).

In association with the 2015 NWTT Final EIS/OEIS, National Marine Fisheries Service (NMFS) determined that within the Study Area only acoustic stressors and explosive stressors could potentially result in harassment and/or the incidental taking of marine mammals from Navy training and testing activities (National Oceanic and Atmospheric Administration, 2015) and that none of the other stressors would result in significant adverse impacts or jeopardize the continued existence of any Endangered Species Act (ESA) listed marine mammals (National Marine Fisheries Service, 2014). In addition, NMFS determined that the vast majority of impacts expected from sonar exposure and underwater detonations are behavioral in nature, temporary and comparatively short in duration, relatively infrequent, and specifically not of the type or severity that would be expected to be additive for the small portion of the stocks and species likely to be exposed, and they therefore would not contribute to cumulative impacts.

NMFS specifically incorporated the impacts from other past and ongoing anthropogenic activities into their negligible impact analyses pursuant to Marine Mammal Protection Act (MMPA) and ESA (National Marine Fisheries Service, 2014; National Oceanic and Atmospheric Administration, 2015). The NMFS Biological Opinion included an explanation of how the results of NMFS' baseline and effects analyses in Biological Opinions relate to those contained in the cumulative impact section of the 2015 NWTT Final EIS/OEIS. NMFS found that Navy training and testing activities are not likely to jeopardize the continued existence of threatened or endangered species in the NWTT Study Area during any single year or as a result of the cumulative impacts of the 5-year authorization under the MMPA (ending in 2020). There has been no emergent science that would necessitate changes to conclusions reached by Navy or NMFS (as a cooperating agency) in association with the 2015 NWTT Final EIS/OEIS with regard to marine mammals. It has long been understood that the cumulative effects of stressors on marine organisms in general and marine mammal populations in particular is extremely difficult to predict (National Academies of Sciences Engineering and Medicine, 2017). Recognizing the difficulties with measuring trends in marine mammal populations, the focus has been on indicators for adverse impacts, including health and other population metrics (National Academies of Sciences Engineering and Medicine, 2017).

This recommended use of population indicators is the approach Navy has presented in the previous environmental analyses of Navy training and testing activities; see in particular the 2015 NWTT Final EIS/OEIS Section 3.4.4.1 (Summary of Monitoring and Observations During Navy Activities) and the update to that information in this Supplemental (Section 3.4.3.4, Summary of Monitoring and Observations During Navy Activities Since 2015). Since the 2015 analyses, neither the present nor the reasonably foreseeable actions detailed in Table 4.3-1 change the previous assessment that the Navy's contribution to any cumulative impacts on marine mammal populations would be negligible.

Based on the analysis presented in Section 3.4 (Marine Mammals) of this Supplemental, and the reasons summarized above relating to the 2015 NWTT Final EIS/OEIS, the incremental contribution of the Proposed Action to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on marine mammals is not warranted.

4.4.5 Sea Turtles

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.5 (Sea Turtles) detailed the potential for impacts on sea turtles from the various stressors related to Navy training and testing activities. As discussed in Section 3.5.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of sea turtles in the Study Area. Analysis of cumulative impacts on sea turtles was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.7 (Sea Turtles).

Use of acoustic stressors (sonar and other active acoustic sources) and use of explosives have occurred since the 2015 completion of the NWTT Final EIS/OEIS Record of Decision and the 2015 NMFS Biological Opinion. There have been no known adverse effects to sea turtles, impacts on leatherback sea turtle prey items, or population impacts that were not otherwise previously analyzed or accounted for in the 2015 NWTT Final EIS/OEIS or the NMFS Biological Opinion pursuant to the ESA (National Oceanic and Atmospheric Administration, 2015) with regard to acoustic or explosive stressors. Therefore, because there have been no known adverse effects to sea turtles, use of acoustic stressors and explosives would not contribute to cumulative impacts.

There has been no emergent science that would necessitate changes to conclusions reached by Navy or NMFS (as a cooperating agency) in association with the 2015 NWTT Final EIS/OEIS. Since the 2015 analyses, neither the present nor the reasonably foreseeable actions detailed in Table 4.3-1 change the previous assessment that the Navy's contribution to any cumulative impacts on sea turtles would be negligible.

Based on the analysis presented in Section 3.5 (Sea Turtles) of this Supplemental, and the reasons summarized above relating to the 2015 NWTT Final EIS/OEIS, the incremental contribution of the Proposed Action to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on sea turtles is not warranted.

4.4.6 Birds

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.6 (Birds) detailed the potential for impacts on birds from the various stressors related to Navy training and testing activities. As discussed in Section 3.6.2 (Environmental Consequences) of this Supplemental, in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of birds in the Study Area. Analysis of cumulative impacts on birds was specifically addressed in the 2015 NWTT Final EIS/OEIS Section 4.4.8 (Birds).

Marine birds, including ESA-listed species (marbled murrelets and short-tailed albatrosses) in the Offshore Area are threatened by continued overfishing, pollution, shipping, and oil and gas development (Bureau of Ocean Energy Management, 2017; Melnychuk et al., 2013; Wisniewska et al., 2018). Many of these actions are currently present, but are expected to increase in the future (U.S. Fish and Wildlife Service, 2016). Approximately 90 percent of the world's fisheries are already overfished threatening the ocean life and habitat. The shipping industry is expected to increase as global trade grows, particularly trans-Pacific container ship trade. Increasing the size of ships carrying containers and cargo goods increase oil spills, dumping of trash, ballast water, and oily waste. Therefore, the aggregate impacts of past, present, and reasonably foreseeable future actions may have a significant effect on birds. The Proposed Action could also result in injury and mortality to individual birds from underwater explosions, sonar, and strikes. Injury and mortality that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. In the USFWS 2016 Biological Opinion on activities described in the 2015 NWTT Final EIS/OEIS, the United States Fish and Wildlife Service determined that the relative contribution of military training activities to overall injury and mortality of marbled murrelets and short-tailed albatrosses would be low compared to other major threats to marine birds, such as pervasive plastic debris deposition in the marine environment, bycatch, point and non-point source pollution from land, and other sources of pollution from non-military activities (U.S. Fish and Wildlife Service, 2016).

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the combined noise of shipping activities and aircraft noise, and sounds associated with underwater explosions and sonar use, would result in harmful additive impacts on birds.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with the Proposed Action to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a seabird affected by ocean pollution would be more susceptible to stressors associated with the Proposed Action.

The analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.6 (Birds) detailed the potential for impacts on birds from the various stressors related to Navy training and testing activities. As discussed in this Supplemental (Section 3.6.2, Environmental Consequences), in general there have been no substantial changes to the activities analyzed in the 2015 NWTT Final EIS/OEIS that would change the conclusions reached regarding populations of birds in the Study Area. Analysis of cumulative impacts on birds was specifically addressed in the 2015 NWTT Final EIS/OEIS, Section 4.4.8 (Birds).

In summary, based upon the analysis in Section 3.6 (Birds), and the reasons summarized above, the incremental contribution of the Proposed Action to cumulative impacts on bird populations would be low. Therefore, further analysis of cumulative impacts on birds is not warranted.

4.4.7 Marine Vegetation

The incremental contribution of the Proposed Action to cumulative impacts would be negligible based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized below:

- Most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow.
- Impacts would be localized, recovery would occur quickly, and no population level impacts would be expected.
- The Proposed Action would not result in impacts that have been historically significant to marine vegetation. For example, the Proposed Action would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses. Furthermore, the Proposed Action would not result in long-term or widespread changes in environmental conditions, such as turbidity, salinity, pH, or water temperature that could impact marine vegetation.
- The Proposed Action would have no effect on ESA-listed species of marine vegetation and would not result in the destruction or adverse modification of critical habitat.

Under this Supplemental, the contribution of proposed increases in training and testing under the Proposed Action would be low, based on the reasons presented above. Impacts on marine vegetation from projects such as pollution, and climate change could result in long-term or widespread changes in secondary stressors to the environment that would change environmental conditions such as turbidity, salinity, pH, or water temperature that would impact marine vegetation. However, these impacts are expected to be localized, recovery would occur quickly, and no population-level impacts would be expected. Therefore, further analysis of cumulative impacts on marine vegetation is not warranted.

4.4.8 Marine Invertebrates

Based upon the analysis in Section 3.8 (Marine Invertebrates), the invertebrate mortality impacts of the Proposed Action under this Supplemental would be cumulative with other actions that cause mortality (e.g., commercial fishing). Under this Supplemental, stressors from the Proposed Action would have no effect or would not significantly impact marine invertebrates. However, the incremental contribution of the Proposed Action to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on marine invertebrates is not warranted.

4.4.9 Fishes

4.4.9.1 Impacts of the Proposed Action that May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.9 (Fishes) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.9 (Fish), it is anticipated that the Proposed Action would affect fish species within the Study Area, including ESA-listed fish species. Fishes could be affected by acoustic stressors (sonar and other transducers, air guns, pile driving, vessel noise, and weapons noise), explosives, energy stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices, pile driving), entanglement (wires and cables, decelerators/parachutes), and ingestion of military expended materials. The majority of potential impacts include short-term behavioral and physiological responses. For example, fish species that are exposed to sonar and other transducers within their hearing range or that are within close proximity to vessel or weapons noise may experience brief periods of masking or behavioral reactions, such as startle or avoidance responses, or no reaction at all. Other stressors (such as explosives) could also result in injury or mortality to a relatively small number of individuals. As described in Section 3.9.3 (Environmental Consequences), long-term consequences for most individual fishes or populations are unlikely because exposures from the majority of stressors are intermittent, transient, and unlikely to repeat over short periods.

The general region of influence for fishes extends beyond the Study Area boundaries for some species because the Study Area represents only a portion of the available habitat during its lifecycle, such as anadromous species that spend part of their lifecycle in freshwater. Fishes are usually not distributed uniformly throughout the Study Area, but are typically associated with a specific habitat type (e.g., soft bottom, reef, or open water) or can utilize a variety of habitats at different life stages. The distribution and specific habitats in which an individual of a single fish species occurs may also be influenced by its size, sex, reproductive condition, and other factors such as water temperature and depth. The highest number and diversity of fishes typically occur where the habitat is most diverse; thus, coastal ecosystems tend to support a greater diversity of species than oceanic and deep-sea habitats (Moyle & Cech, 2004).

4.4.9.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for fish include the following:

- Mortality associated with vessel strikes, commercial fisheries, bycatch, and entanglement in fishing and other gear
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as "other environmental considerations" in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed in the ocean pollution section (Section 4.5.9.1.4). Commercial fishing and overfishing is the primary cause of stress and entanglement. Therefore, these stressors are discussed in the commercial and recreational fishing section (see Section 4.5.9.1.6).

As stated in the 2015 NWTT Final EIS/OEIS and in Section 3.9 (Fish) in this Supplemental, with few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. Except for bottom-crawling unmanned underwater vehicles, there is minimal potential strike impact. Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area, although some fish groups may be more susceptible to strike potential than others. In addition, the potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality.

Underwater noise can be a threat to marine fishes. Anthropogenic noise is generated from a variety of sources including commercial shipping, oil and gas exploration and production activities, commercial and recreational fishing (including fish-finding sonar, fathometers, and acoustic deterrent devices), recreational boating, whale watching activities and other marine transportation vessels such as ferries, marine and coastal development (i.e., construction of bridges, ferry terminals, windfarms, etc.), and research (including sound from air guns, sonar, and telemetry). Vessel noise in particular is a major contributor to anthropogenic noise in the ocean and is intensively produced in inland waters. Commercial shipping's contribution to ambient noise in the ocean increased by as much as 12 dB between approximately the 1960s and 2005 (Hildebrand, 2009; McDonald et al., 2008). Frisk (2012) confirmed the trend and reported that between 1950 and 2007 ocean noise in the 25 to 50 Hz frequency range increased 3.3 dB per decade, resulting in a cumulative increase of approximately 19 dB over a baseline of 52 dB (decibels re 1 $\mu Pa^2/Hz$). The increase in noise is associated with an increase in commercial shipping, which correlates with global economic growth (Frisk, 2012). Miksis-Olds and Nichols (2015) found low-frequency ocean sound levels have decreased in the South Atlantic and Equatorial Pacific Oceans, similar to a trend of slightly decreasing low-frequency noise levels in the Northeast Pacific. In addition to vessels, other sources of underwater noise include pile-driving activity (Carlson et al., 2007; Casper et al., 2012; Casper et al., 2013a; Casper et al., 2013b; Dahl et al., 2015; Debusschere et al., 2014; Feist et al., 1992; Halvorsen et al., 2012; Popper et al., 2006; Ruggerone et al., 2008; Stadler & Woodbury, 2009), sonar (California Department of Transportation, 2001; Carlson et al., 2007; Mueller-Blenkle et al., 2010; Popper et al., 2006), seismic activity (Popper & Hastings, 2009), and offshore construction projects (Foderaro, 2015).

Noise can cause permanent injury in some marine animals (Popper et al., 2005). Physiological responses to noise have shown a variety of results. For example, the giant kelpfish (*Heterostichus rostratus*) exhibited acute stress response when exposed to intermittent recorded boat engine noise (Nichols et al., 2015). In another study, Holles et al. (2013) found that local, low-intensity noise from recreational boat engines has the capacity to disrupt settlement in coral reef fish larvae, which may lead to impacts on recruitment to adult populations.

Chemicals and debris are the two most common types of pollutants in the marine environment. Global oceanic circulation patterns result in the accumulation of a considerable amount of pollutants and debris scattered throughout the open ocean and concentrated in gyres and other places (Crain et al., 2009). Pollution initially impacts fishes that occur near the sources of pollution, but may also affect future generations from effects to reproduction and increased mortality across life stages.

Chemical pollutants in the marine environment that may impact marine fishes include organic pollutants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil) and inorganic pollutants (e.g., heavy metals) (Pew Oceans Commission, 2003). High chemical pollutant levels in marine fishes may cause behavioral changes, physiological changes, or genetic damage (Goncalves et al., 2008; Moore, 2008; Pew Oceans Commission, 2003). Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism from inhabiting a contaminated habitat or from ingesting food or prey containing the contaminated substance (Newman, 1998), or from ingesting the substance directly (Moore, 2008). Bioaccumulation of pollutants (e.g., metals and organic pollutants) is also a concern to human health because people consume top predators with high pollutant loads.

Marine debris is a widespread global pollution problem, and trends suggest that accumulations are increasing as plastic production rises (Rochman et al., 2013). Debris includes plastics, metals, rubber, textiles, derelict fishing gear, vessels, and other lost or discarded items. Derelict fishing gear include abandoned nets and lines that pose a threat to fishes. Due to body shape, habitat use, and feeding strategies, some fishes are more susceptible to marine debris entanglement than others (Musick et al., 2000; Ocean Conservancy, 2010). Entanglement in abandoned commercial and recreational fishing gear has caused declines for some marine fishes.

Microplastics (i.e., plastics less than 5mm in size) in the marine environment are well documented, and interactions with marine biota, including numerous fish species have been described worldwide (Lusher et al., 2016). Plastic waste in the ocean chemically attracts hydrocarbon pollutants such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane, which accumulate up to one million times more in plastic than in ocean water (Mato et al., 2001). Fishes can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. Rochman et al., (2015) found marine debris in 28 percent of the individual fish examined and in 55 percent of all fish species analyzed.

Coastal development and increased human population activities in coastal areas, such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds, will continue to have impacts on fish.

Exploitation from commercial and recreational fishing is the single-biggest cause of changes in fish populations and communities (Moyle & Cech, 2004). Historic and current overfishing largely contributed to the listing of ESA-protected marine species (Crain et al., 2009; Kappel, 2005). Overfishing of a resource results from both legal and illegal fishing (poaching) and bycatch of resources in quantities above a sustainable level. By the end of 2015, 28 managed fish stocks in the U.S. were on the overfishing list and 38 stocks were on the overfished list, while the number of rebuilt fish stocks since 2000 increased to 39 (National Marine Fisheries Service, 2016a).

In recent decades, commercial fisheries have targeted the larger, predatory, and sometimes higher-priced fish species. Gradually, the fishing pressure could make the larger species more scarce, and fishing will move towards the smaller species (Pauly & Palomares, 2005). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kauparinen & Merila, 2007). Fisheries-induced evolution is a change in genetic composition of the population that results from intense fishing pressure, such as a reduction in the overall size and growth rates of fishes in a population. Intrinsic vulnerability is when certain life history traits (e.g., large body size, late maturity age, low growth rate, low offspring production) result in a species being more susceptible to overfishing than others (Cheung et al., 2007).

Although these factors are a concern for fisheries worldwide, fisheries off the U.S. West Coast are managed conservatively, in keeping with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Fish stocks within the Study Area that were historically overfished have recovered or are recovering from their overfished status and contributing to the overall trend of increasing abundance of U.S. marine fish stocks (National Marine Fisheries Service 2013, National Marine Fisheries Service 2014b).

4.4.9.3 Cumulative Impacts on Fish

The Proposed Action could also result in injury and mortality to individual fish from underwater explosions, sonar, and strikes. Injury and mortality that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. However, the relative contribution to the overall injury and mortality would be low compared to other actions, such as bycatch, storm runoff, plastic debris, and other non-military activities (as discussed in Section 4.5.9.1, Impacts of Other Actions).

It is likely that distant shipping and aircraft noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping and aircraft noise, and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on fish.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with the Proposed Action to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a fish affected by ocean pollution would be more susceptible to stressors associated with the Proposed Action.

In summary, based upon the analysis in Section 3.9 (Fishes), the aggregate impacts of past, present, and other reasonably foreseeable future actions contributing multiple water quality, noise, and physical risks to fishes would likely continue to have significant effects on individual fishes and fish populations. However, Navy training and testing activities are generally isolated from other activities in space and time and the majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration. Although it is possible that the Proposed Action could contribute incremental stressors to a small number of individuals, which would further compound effects on a given individual already experiencing stress, it is not anticipated that the Proposed Action has the potential to put additional stress on entire populations already in significant decline. Therefore, it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present, and reasonably foreseeable future actions, would not result in measurable additional significant impacts on fishes in the Study Area or beyond.

4.4.10 Cultural Resources

4.4.10.1 Impacts of the Proposed Action That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.10 (Cultural Resources) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.10 (Cultural Resources), the Proposed Action could result in impacts on submerged prehistoric sites and previously unidentified submerged historic resources if certain training and testing activities are conducted where these resources occur. Stressors that could impact cultural resources include underwater explosions on or near the bottom, use of towed-in-water devices, and use of ocean bottom deployed devices. Because cultural resources are considered nonrenewable resources, these impacts would be considered long-term and permanent.

The Navy avoids locations of known obstructions to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises. Known obstructions include some historic shipwrecks; however, it is unknown if all submerged obstructions, historic shipwrecks, or other cultural resources have yet been discovered in the Study Area.

4.4.10.2 Impacts of Other Actions

With a few exceptions, most of the other actions described in Table 4-1 that are not related to the Proposed Action, but retained for cumulative impacts analysis, would involve some form of disturbance to the ocean bottom. Exceptions include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged cultural resources. For example, ocean bottom disturbance would occur from construction related activities such as ship anchoring, and installation of wind turbine piers. Any physical disturbance on the continental shelf and ocean floor could inadvertently damage or destroy submerged prehistoric sites and submerged historic resources.

The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the National Historic Preservation Act (NHPA) apply to actions in territorial waters. Federal agency procedures have been implemented to identify cultural resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, the Bureau of Ocean Energy Management, Regulation and Enforcement has procedures in place to identify the probability for the presence of submerged historic resources and the locations submerged prehistoric sites shoreward from the 148 ft. (45.1 m) isobath, and for project redesign and relocation to avoid identified resources (Minerals Management Service, 2007). Nonetheless, inadvertent impacts could occur if unidentified submerged cultural resources are present.

4.4.10.3 Cumulative Impacts on Cultural Resources

Impacts on submerged cultural resources from other actions would typically be avoided or mitigated through implementing federal agency programs. However, impacts could occur if mitigation measures cannot be implemented as intended or if inadvertent disturbance or destruction of unidentified resources occurs. Disturbance or destruction of a submerged prehistoric site would diminish the overall archaeological record and decrease the potential for meaningful research on Paleomarine traditions (6,500–5,000 Before Present) and early European explorers of the Northwest coast (1700s–1800s). Disturbance or destruction of a submerged historic site, including a shipwreck, could diminish the overall record for these resources and decrease the potential for meaningful research on these resources. Based upon the analysis in Section 3.10 (Cultural Resources), when considered with other actions (see Table 4.3-1), the Proposed Action would not contribute to and increase the cumulative impacts on submerged prehistoric and historic resources. Further analysis of cumulative impacts on cultural resources is not warranted.

The Olympic National Park was accepted as a World Heritage Site in 1981. Because most of the Olympic National Park is designated as wilderness, the natural soundscape is an important element and prevalent in much of the park. The National Park Service regards natural and cultural sounds as part of a web of resources that must be protected. Threats to natural soundscape come from development and other human activities inside and outside the park (National Park Service, 2008). Based on the analysis in the noise study for this Supplemental (Appendix J, Airspace Noise Analysis for the Olympic Military Operations Areas), overall noise impacts from the Electronic-warfare aircraft (EA)-18 Growlers while training within the Olympic Military Operating Areas (MOAs) increased by 1 A-weighted decibel (dBA), for a total of 40 dBA estimated under the Proposed Action. Although the flyover event noise levels during transit (less than one minute) would be higher than average background noise levels in the national park and wilderness areas, they are not substantially above the range of noise levels that can occur under natural conditions, as the baseline average is about 35 dBA or below and the proposed aircraft activity average hovers around 36 dBA. In addition, the noise levels experienced within the MOAs would not result in any risks to public health and safety. The Occupational Safety and Health Administration has concluded that noises above 90 dBA have the potential to result in noise-induced hearing loss. However, these levels would have to be experienced for approximately eight hours before having any permanent affect. The Proposed Action would only result in these levels for approximately 45 minutes a day, which means that even if combined with other noises in the area, they would not likely result in adverse effects to peoples' hearing. Therefore, when considered with other actions (see Table 4.3-1), the contribution of the Proposed Action of this Supplemental EIS/OEIS to the Olympic

National Park soundscape would be short term, intermittent, and temporary. Therefore, although the Proposed Action would increase the overall noise under the Olympic MOAs by 1 dBA, impacts on key resources or the value of the Olympic National Park would not be significant.

4.4.11 Native American and Alaska Native Traditional Resources

4.4.11.1 Impacts of the Proposed Action that May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.11 (American Indian and Alaska Native Traditional Resources) under this Supplemental and the analysis presented in the 2015 NWTT Final EIS/OEIS Section 3.11 (American Indian and Alaska Native Traditional Resources), the Proposed Action could result in impacts on American Indian and Alaska Native protected tribal resources and other traditional resources by impeding, generally for brief duration, access to areas of co-use such as usual and accustomed (U&A) fishing grounds, which may prevent fishing in limited seasons. Stressors that could impact American Indian and Alaska Native Traditional resources include impeding access to U&A fishing grounds or traditional fishing areas, changes in the availability of marine resources or habitat, and loss of fishing gear.

The Navy has established protective measures to reduce potential effects on cultural and natural resources from training and testing exercises. While most of these protective measures focus on protection of the natural environment, they also benefit culturally valued natural resources, such as salmon and shellfish. Some of the protective measures include avoidance of known submerged obstructions, use of inert ordnance and passive tracking and acoustical tools, and avoidance of sensitive habitats to ensure that significant concentrations of sea life are not present.

The Navy strives to maintain safety and accommodate, to the extent possible, access to tribes' usual and accustomed areas in co-use navigable waters. The Navy provides the U.S. Coast Guard (USCG) with information on the locations of potentially hazardous training or testing activities at sea so the USCG can issue Notices to Mariners. In some instances, the Navy has directly notified affected American Indian tribes and nations to ensure that their activities in usual and accustomed fishing areas can avoid any potentially hazardous training or testing locations at sea. Advance communication of intent directly and through notice to mariners (NTMs) issued by the USCG increases the ability of the Tribes and Navy to share use of the Study Area with less conflict, reducing the potential for lost or damaged Tribal fishing gear. Any claims for loss or damage to fishing gear related to Navy activities are addressed through the Navy's claims adjudication process. Information on admiralty claims can be found at the Navy Judge Advocate General's Corps website: http://www.jag.navy.mil/organization/code_11.htm. Reduced access to human activities in the ocean or inland waterways would be an impact if it directly contributed to loss of income, revenue, or employment, or if cultural knowledge is lost because tribal members cannot teach their children and grandchildren to fish in areas where they were taught by their ancestors.

4.4.11.2 Impacts of Other Actions

Actions that would disturb the ocean bottom could impact submerged American Indian and Alaska Native Traditional resources. For example, ocean bottom disturbance would occur from installing a piling in a former oyster bed of significance to a tribe or nation. Any physical disturbance on the continental shelf and ocean floor (including the Inland Waters and the Western Behm Canal) could inadvertently damage or destroy submerged fishing gear, or areas of traditional or cultural significance.

Other actions that could impact American Indian and Alaska Native Traditional Resources include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise.

The construction of the Seattle Multimodal Ferry Terminal at Colman Dock Project, has the potential to impact American Indian Traditional Resources. The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the NHPA apply to actions in territorial waters. Federal agency procedures have been implemented to identify American Indian and Alaska Native Traditional resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, traditional resources along with archaeological and architectural resources are protected by various laws and their implementing regulations: the NHPA of 1966 as amended in 2006, the American Indian Religious Freedom Act of 1978, and the Native American Graves Protection and Repatriation Act of 1990. Within state territorial waters (0–3 NM), the NHPA is the guiding mandate; within U.S. territorial waters (0–12 NM), the NEPA is the primary mandate. Areas beyond 12 NM are beyond the jurisdiction of NEPA, but they are covered by Executive Order 12114. Nonetheless, inadvertent impacts could occur if unidentified submerged tribal or traditional resources are present.

4.4.11.3 Cumulative Impacts on Native American and Alaska Native Traditional Resources

The success of American Indian tribal fisheries has been impacted by long-term changes in the environment that can reduce fish stocks due to impacted water quality, reduced habitat—especially spawning habitat for salmon runs, and increased commercial harvests. The Navy has an active consultation process in place and will continue to consult on a government-to-government basis with potentially affected American Indian tribes and nations regarding Navy activities that may have the potential to impact protected tribal treaty rights and resources. The Navy's other measures to prevent pollution from its own operations and sustain or improve habitat value help to offset some of the cumulative impacts. Pursuant to the Navy's government-to-government consultation with federally-recognized American Indian and Alaska Native tribes and nations, agreements (both formal and informal) regarding protocols or tribal mitigation measures may be developed to reduce or eliminate impacts on protected tribal treaty reserved rights and protected tribal resources.

4.4.12 Socioeconomic Resources

As stated in the 2015 NWTT Final EIS/OEIS, the Proposed Action could contribute to impacts on accessibility to nearshore areas popular for commercial and recreational fishing and some tourism activities that access the marine environment. However, limits on accessibility to these areas are not expected to significantly impact these resources, because restrictions would be temporary and of short duration (hours). To ensure public safety, access to waters within exclusion areas would be limited during military training and testing activities. The same limitations on accessing portions of the Study Area designated as restricted areas, and warning areas as described in the 2015 NWTT Final EIS/OEIS and in the CFR would still apply. Refer to 33 CFR (Navigation and Navigable Waters) Part 334 (Danger Zone and Restricted Area Regulations), 33 CFR 165.1401 (Safety Zones), and 14 CFR 73.1 (Special Use Airspace) for specific regulations regarding these ocean areas and airspace. In addition, the USCG has published a final rule establishing protection zones extending 500 yards (yd.) around all Navy vessels in navigable waters of the United States and within the boundaries of Coast Guard Pacific Area (32 CFR Part 761). All vessels must proceed at a no-wake speed when within a protection zone. Non-military vessels are not permitted to enter within 100 yd. of a U.S. naval vessel, whether underway or moored, unless authorized by an official patrol. Refer to Section 3.12.2.1.1.2 (Inland Waters) for more information on accessibility to areas of the Study Area.

When training or testing activities are scheduled that require specific areas to be free of non-participating vessels and aircraft, the military requests that the USCG issues an NTM and that the Federal Aviation Administration issues a notice to airmen (NOTAM), as applicable for the activity. These measures are intended to alert the public of pending training or testing activities and to ensure the safety of the public and military personnel. Providing advance notice of scheduled activities should allow members of the public to avoid unexpected delays or interruptions to their planned activities due to restrictions on accessing areas used for military activities.

4.4.12.1 Resource Trends

The maritime ports of Seattle and Tacoma (combined) were the nation's sixth-highest ranked port (out of 150) by value of shipments for international waterborne trade (imports + exports) in 2015. The port has not ranked as high since 2011, when it was fifth in the nation (American Association of Port Authorities, 2016). The volume of international trade at Seattle-Tacoma peaked in 2012 at nearly 20.5 million metric tons, declining to just under 19 million metric tons in 2015. While recent trends show a decline, the volume of goods in 2015 is approximately equivalent to pre-recession totals (U.S. Maritime Administration, 2015).

Recent trends in commercial fisheries landings are mixed. The value of commercial fisheries landings in the State of Washington declined from 2013 through 2016 (the latest year available), and the volume (measured in pounds) of commercial landings declined between 2013 and 2015 but increased by approximately 10 percent in 2016. Commercial landings in Oregon followed a similar trend from 2013 through 2016; however, both the volume and value of commercial landings in Oregon increased from 2015 to 2016 (National Marine Fisheries Service, 2016b). These trends suggest that the volume and value of fisheries landings in the State of Washington and Oregon may begin trending upwards in 2017.

Portions of the Olympic National Park and Olympic National Forest underlie the Olympic MOAs (special use airspace) and are within the Study Area, and draw tourists into the State of Washington. Visitation at the park has increased each year since 2013 and was almost 3.4 million people in 2016 (National Park Service, 2017). Other economic sectors associated with the tourism industry have also been trending upwards. Airborne noise generated by aircraft overflights continues to be a concern for some visitors to the Olympic National Park (Rudzitis, 2018). While visitation to the park does not appear to be impacted, the enjoyment of the park by some visitors could be disturbed by aircraft overflights and may be temporarily interrupted. Tourism continues to be popular in the inland waters area including Puget Sound and Hood Canal (see Section 3.12.2.2.2, Inland Waters, for details). As described in Section 3.12.2.2.3 (Western Behm Canal, Alaska), tourism, primarily via larger cruise ships, continues to be seasonally popular in southeast Alaska waterways, although large cruise ships do not enter Behm Canal.

4.4.12.2 Impacts of Other Actions

Waterways in the Study Area are heavily traveled by commercial, recreational, and other vessels, including military and USCG vessels. Several major commercial ports are located in or near the Study Area, including the ports of Seattle and Tacoma in southern Puget Sound, and the Canadian ports of Vancouver and Victoria. Vessels transiting to and from U.S. and Canadian ports use the Strait of Juan de Fuca. Van Dorp and Merrick (2017) estimate that there are 8,300 transits of deep draft vessels through the Strait of Juan de Fuca annually, with 5,500 accessing Canadian Ports and the other 3,700 transiting through Puget Sound at Admiralty Inlet. Within Washington state waters, the USCG Vessel Traffic Service handles approximately 170,000 ferry transits annually. Commercial vessel traffic has the potential to limit access by the public to waterways, which would also include access by tourism related activities and businesses (e.g., whale watching vessels).

Several commercial airways traverse the Olympic Peninsula and Olympic National Park, connecting major airports in the region, including the Seattle-Tacoma International Airport, Portland International Airport, and the Olympia Regional Airport (see Figure 3.12-4 and Figure 3.12-5). There are also numerous smaller commercial and general aviation airports in the region, including on the Olympic Peninsula. Airborne noise generated by commercial and private aircraft using airways traversing the Olympic National Park may disturb, or otherwise impact the enjoyment of, individuals visiting the park.

Aquaculture activities using inland waters in Puget Sound have been shown to impact social and economic resources in the Inland Waters portion of the Study Area, as demonstrated by the August 2017 spill of farmed Atlantic salmon off Cypress Island (Mapes, 2018). Initially, it was assumed that the escaped salmon were not able to feed and died from starvation. Subsequent findings contradicted that assertion, and Atlantic salmon continued to be caught by tribal fishermen through December 2017 (Cauvel, 2017; Mapes, 2018). The possibility of future spills of farmed salmon and the risk that they would pose to the survival of native salmon species led Governor Inslee to sign into law a ban on the farming of Atlantic Salmon in Washington State waters (Ryan, 2018). The State's remaining Atlantic salmon farms would cease operations by 2022, once their existing leases with the Washington Department of Natural Resources expire.

4.4.12.3 Cumulative Impacts on Socioeconomic Resources

The analysis in Section 3.12 (Socioeconomic Resources) indicates that the impacts of the Proposed Action on socioeconomic resources would be negligible. The Proposed Action is not expected to contribute to cumulative socioeconomic impacts. Cumulative impacts from intermittent and short-term impacts on accessibility to areas within the Study Area, physical disturbances and interactions, airborne acoustics that disturb people on the ground (e.g., in the Olympic National Park), and secondary impacts (e.g., to tourism) resulting from effects on marine species populations are not anticipated. No cumulative impacts on commercial transportation and shipping are anticipated, because major shipping routes and airways are well defined, and training and testing activities would avoid those areas. The Navy would continue to reduce or avoid impacts on commercial and recreational fishing and tourism and recreation by continuing to notify the public of upcoming activities that may limit accessibility to certain areas of the Study Area popular participants in these activities. Broader socioeconomic metrics generally indicate that the region in prospering economically. For example, data reported by the National Ocean Economics Program show that the tourism and recreation industry in Washington coastal counties increased steadily from 2010 to 2014 (National Ocean Economics Program, 2017b). Short duration limits on accessibility, potentially impacting recreational and tourism related activities, are expected to be intermittent and have no long-term, cumulative impacts. Airborne acoustics from aircraft overflights in the Olympic MOAs, potentially impacting recreational and tourism activities on the Olympic Peninsula, are expected to be brief (seconds) and discrete and are not expected to have long-term negative impacts on the enjoyment of the Olympic Peninsula, including Olympic National Park. No cumulative negative impacts on the economies of Northern California, Oregon, Washington, or southeast Alaska are anticipated.

4.4.13 Public Health and Safety

The analysis presented in Section 3.13 (Public Health and Safety) of this Supplemental demonstrates that the Proposed Action would not contribute incrementally to public health and safety. Under this

Supplemental, the Proposed Action is not expected to contribute incrementally to cumulative public health and safety impacts. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 Summary of Cumulative Impacts

The analyses presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicate that the incremental contribution of the Proposed Action to cumulative impacts on sediments and water quality, air quality, marine habitats, marine vegetation, marine invertebrates, and public health and safety would not rise to a level of significance. Marine mammals, sea turtles, birds, fishes, cultural resources, Native American and Alaska Native Traditional resources, and socioeconomic resources are the primary resources of concern for this cumulative impacts analysis:

- Due to past and present activities, several marine mammal species, all sea turtles, one bird, and multiple fish species occurring in the Study Area are ESA-listed.
- These resources would be impacted by multiple present and reasonably foreseeable future actions.
- Explosive detonations and vessel strikes under the Proposed Action have the potential to disturb, injure, or kill marine mammals, sea turtles, birds, and fish.
- The use of sonar and other non-impulsive sound sources under the Proposed Action has the potential to disturb or injure marine mammals, sea turtles, birds, and fish.
- Impacts on American Indian traditional resources could occur during training and testing activities due to short-term reduced access to tribal usual and accustomed fishing grounds in the Inland Waters. Impacts from training and testing activities would not alter fishes and other marine species population levels or the availability of these resources for tribal use. Loss or damage to American Indian fishing equipment from vessel and in-water device strikes, and inadvertent snagging of military expended materials, could occur in the Offshore Area and in the Inland Waters, reducing fishing opportunities while fishing equipment is being replaced or repaired and increasing the amount of effort and resources required to catch the same amount of fish.

In summary, based on the analysis presented in Section 3.4 (Marine Mammals), 3.5 (Sea Turtles), 3.6 (Birds), 3.9 (Fishes), 3.10 (Cultural Resources), 3.11 (American Indian and Alaska Native Traditional Resources), and 3.12 (Socioeconomic Resources), the current aggregate impacts of past, present, and other reasonably foreseeable future actions are not significantly different than the assessment in the 2015 NWTT Final EIS/OEIS. No new information or circumstances are significant enough to warrant further cumulative impact review.

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5.1 Introduction

This chapter describes the mitigation measures that the United States (U.S.) Department of the Navy (Navy) will implement to avoid or reduce potential impacts from the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) Proposed Action. This chapter has been updated in its entirety since Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of the 2015 NWTT EIS/OEIS (U.S. Department of the Navy, 2015). As a cooperating agency for the Proposed Action, the U.S. Coast Guard will implement applicable mitigation measures developed by the Navy for the Proposed Action.

The Navy will also implement standard operating procedures specific to training and testing activities conducted under the Proposed Action. In many cases, standard operating procedures provide a benefit to environmental and cultural resources, some of which have high socioeconomic value in the Study Area. Standard operating procedures differ from mitigation measures because standard operating procedures are designed to provide for safety and mission success, whereas mitigation measures are designed specifically to avoid or reduce potential environmental impacts. An example of a standard operating procedure is that ships operated by or for the Navy have personnel assigned to stand watch at all times when underway. Watch personnel monitor their assigned sectors for any indication of danger to the ship and the personnel on board, such as a floating or partially submerged object or piece of debris, periscope, surfaced submarine, wisp of smoke, flash of light, or surface disturbance. The Navy also avoids known navigation hazards that appear on navigational charts, such as submerged wrecks and obstructions. As a standard collision avoidance procedure, watch personnel also monitor for marine mammals that have the potential to be in the direct path of the ship. The standard operating procedures to avoid collision hazards are designed for safety of the ship and the personnel on board. This is different from mitigation measures for vessel movement, which require vessels to maneuver to avoid marine mammals by specified distances to avoid or reduce the potential for physical disturbance and strike of marine mammals, as described in Section 5.3.4.1 (Vessel Movement). In this example, the benefit of the mitigation measure for vessel movement is additive to the benefit of the standard operating procedure for vessel safety. Standard operating procedures that apply to the Proposed Action and are generally consistent with those included in the 2015 NWTT Final EIS/OEIS are described in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring) of that document. Standard operating procedures that apply to the Proposed Action and were not included in, or require a clarification from, the 2015 NWTT Final EIS/OEIS are discussed in Section 2.3.3 (Standard Operating Procedures) of this Draft Supplemental.

In addition to the mitigation measures and standard operating procedures specific to the Proposed Action, the Navy has existing routine operating instructions (e.g., training manuals) and local installation instructions (e.g., Integrated Natural Resource Management Plans) that were developed to meet other safety and environmental compliance requirements or initiatives. For example, the Naval Air Training and Operating Procedures Standardization General Flight and Operating Instructions Manual (CNAF M-3710.7) contains naval air training procedures pertaining to safe operations of aircraft, which includes requirements to minimize the disturbance of wildlife. Aviation units are required to avoid noise-sensitive areas, such as breeding farms, resorts, beaches, national parks, national monuments, and national recreational areas. They are also required to avoid disturbing wild fowl in their natural habitats and to avoid firing directly at large fish, whales, or other wildlife. These requirements are in addition to mitigation measures developed for the Proposed Action. The Navy will continue complying with applicable operating instructions and local installation instructions within the Study Area, as appropriate.

5.1.1 Benefits of Mitigation

The Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses indicate that certain acoustic, explosive, and physical disturbance and strike stressors have the potential to impact certain biological or cultural resources. The Navy developed mitigation measures for those stressors and will implement the mitigation for either action alternative. The Navy considered the benefits of mitigation in the environmental analyses for both Alternative 1 and Alternative 2 of the Proposed Action in this Draft Supplemental. In addition to analyzing mitigation measures pursuant to the National Environmental Policy Act (NEPA), the Navy designed its mitigation measures to achieve one or more benefits, such as the following:

- Effect the least practicable adverse impact on marine mammal species or stocks and their habitat, and have a negligible impact on marine mammal species and stocks (as required under the Marine Mammal Protection Act [MMPA]);
- Ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat (as required under the Endangered Species Act [ESA]);
- Avoid or minimize adverse effects on essential fish habitat (as required under the Magnuson-Stevens Fishery Conservation and Management Act); and
- Avoid adversely impacting shipwrecks (as required under the Abandoned Shipwreck Act and National Historic Preservation Act).

The Navy will coordinate its mitigation with the appropriate regulatory agencies, including the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), through the consultation and permitting processes. The Final Supplemental, Navy and NMFS Records of Decision, MMPA Regulations and Letters of Authorization, and ESA Biological Opinion will document all mitigation measures that the Navy will implement under the Proposed Action. The final suite of mitigation measures that will be included in the Final Supplemental will represent the maximum level of mitigation that is practical for the Navy to implement when balanced against impacts to safety, sustainability, and the ability to continue meeting its mission requirements. Should the Navy require a change in how it implements mitigation based on national security concerns, evolving readiness requirements, or other factors (e.g., significant changes in the best available science), the Navy will engage the appropriate agencies and reevaluate its mitigation through adaptive management or the appropriate consultations. The Navy's adaptive management approach is discussed in Section 5.1.2.2.1.1 (Adaptive Management). This approach will be coordinated with NMFS during the consultation and permitting processes and will be included in the MMPA Regulations and Letters of Authorization.

5.1.2 Compliance Initiatives

To disseminate its mitigation requirements to the appropriate personnel and meet other compliance requirements for the MMPA and ESA, the Navy will continue using the Protective Measures Assessment Protocol and its ongoing monitoring and reporting initiatives, as described in the sections below.

5.1.2.1 Protective Measures Assessment Protocol

To disseminate requirements to the personnel who are required to implement mitigation during training and testing activities, the Navy will continue inputting its mitigation measures into the Protective Measures Assessment Protocol and appropriate governing instructions. The Protective Measures Assessment Protocol is a software tool that serves as the Navy's comprehensive data source for at-sea mitigation. The software tool provides personnel with notification of the required mitigation measures and a visual display of the planned training or testing activity location overlaid with relevant environmental data (e.g., mapped locations of live hard bottom). Navy policy requires applicable personnel to access the Protective Measures Assessment Protocol during the event planning process. This helps ensure that personnel receive mitigation instructions prior to the start of training and testing activities and that mitigation is implemented appropriately.

5.1.2.2 Monitoring, Research, and Reporting Initiatives

Many of the Navy's monitoring programs, research programs, and reporting initiatives have been ongoing for more than a decade and will continue as a compliance requirement for the MMPA or ESA, or both. The Navy and NMFS use the information contained within monitoring, research, activity, and incident reports when evaluating the effectiveness and practicality of mitigation and determining if adaptive adjustments to mitigation may be appropriate. These reports also facilitate better understandings of the biological resources that inhabit the Study Area and the potential impacts of the Proposed Action on those resources.

5.1.2.2.1 Marine Species Research and Monitoring Programs

Through its marine species research and monitoring programs, the Navy is one of the nation's largest sponsors of scientific research on and monitoring of marine species. Detailed information on these programs is provided in Section 3.0.1.1.1 (Marine Species Monitoring and Research Programs). Navy research programs focus on investments in basic and applied research that increase fundamental knowledge and advance naval technological capabilities. Navy monitoring programs focus on the potential impacts of training and testing activities on biological resources. For example, the Navy Living Marine Resources Program is sponsoring an ongoing study on hearing and estimated acoustic impacts in three species of auk, which will help the Navy refine its assessment of potential impacts from training and testing activities on seabirds, including the marbled murrelet. The Navy has also sponsored several projects on seabird density and distribution to improve baseline knowledge about ESA-listed seabirds in the Study Area.

Other projects, such as those sponsored by the U.S. Navy Marine Species Monitoring Program, primarily focus on marine mammals and sea turtles. Monitoring reports are available to the public on the U.S. Navy Marine Species Monitoring webpage (https://www.navymarinespeciesmonitoring.us/). The Navy will post future reports online as they become available. Specific details regarding the content of the reports will be coordinated with the appropriate agencies through the consultation and permitting processes. Additional information about the U.S. Navy Marine Species Monitoring Program, including its adaptive management and strategic planning components, is provided in the sections below.

5.1.2.2.1.1 Adaptive Management

Adaptive management is an iterative process of decision-making that accounts for changes in the environment and scientific understanding over time through a system of monitoring and feedback. Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself (Williams et al., 2009). Adaptive management focuses on learning and adapting, through partnerships of natural resource managers, scientists, and other stakeholders. Adaptive management helps managers maintain flexibility in their decisions and provides them the latitude to change direction to improve understanding of ecological systems and achieve management objectives. Taking action to improve progress toward desired outcomes is another function of adaptive management.

The Navy's adaptive management review process and reporting requirements serve as the basis for evaluating performance and compliance. The process involves technical review meetings and ongoing discussions between the Navy, NMFS, the Marine Mammal Commission, and other experts in the scientific community. An example of a revision to the compliance monitoring structure as a result of adaptive management is the development of the Strategic Planning Process, which is a planning tool for the selection and management of monitoring investments (U.S. Department of the Navy, 2013). Through adaptive management, the Strategic Planning Process has been incorporated into the Integrated Comprehensive Monitoring Program, which is described below.

5.1.2.2.1.2 Integrated Comprehensive Monitoring Program

The Navy developed an Integrated Comprehensive Monitoring Program to serve as the overarching framework for coordinating its marine species monitoring efforts and as a planning tool to focus its monitoring priorities pursuant to ESA and MMPA requirements (U.S. Department of the Navy, 2010). The purpose of the Integrated Comprehensive Monitoring Program is to coordinate monitoring efforts across regions and to allocate the most appropriate level and type of monitoring effort for each range complex based on a set of standardized objectives, regional expertise, and resource availability. The Integrated Comprehensive Monitoring Program does not identify specific field work or individual projects. It is designed to provide a flexible, scalable, and adaptable framework using adaptive management and the Strategic Planning Process to periodically assess progress and reevaluate objectives.

The Integrated Comprehensive Monitoring Program is evaluated through the adaptive management review process to: (1) assess progress, (2) provide a matrix of goals and objectives, and (3) make recommendations for refinement and analysis of monitoring and mitigation techniques. This process includes conducting an annual adaptive management review meeting where the Navy and NMFS jointly consider the prior year's goals, monitoring results, and related scientific advances to determine if monitoring plan modifications are warranted to address program goals more effectively. Modifications to the Integrated Comprehensive Monitoring Program that result from annual adaptive management review discussions are incorporated by an addendum or revision to the Integrated Comprehensive Monitoring Program as needed. The Integrated Comprehensive Monitoring Program will be routinely updated as the program evolves and progresses.

The Strategic Planning Process serves to guide the investment of resources to most efficiently address Integrated Comprehensive Monitoring Program objectives and intermediate scientific objectives. Navy-funded monitoring projects relating to the impact of Navy training and testing activities on protected marine species are designed to accomplish one or more of the following top-level goals, as described in the Integrated Comprehensive Monitoring Program charter:

- Increase the understanding of the likely occurrence of marine mammals and ESA-listed marine species in the vicinity of the action (e.g., presence, abundance, distribution, density).
- Increase the understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed marine species to any of the potential stressors associated with the

action (e.g., acoustics, explosives, physical disturbance and strike of military expended materials) through a better understanding of one or more of the following: (1) the nature of the action and its surrounding environment (e.g., sound-source characterization, propagation, ambient noise levels), (2) the affected species (e.g., life history, dive patterns), (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part), and (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving, or feeding areas).

- Increase the understanding of how individual marine mammals or ESA-listed marine species respond behaviorally or physiologically to the specific stressors associated with the action and in what context (e.g., at what distance or received level).
- Increase the understanding of how anticipated individual responses to individual stressors or anticipated combinations of stressors may impact either: (1) the long-term fitness and survival of an individual, or (2) the population, species, or stock (e.g., through impacts on annual rates of recruitment or survival).
- Increase the understanding of the effectiveness of mitigation and monitoring.
- Improve the understanding and record of the manner in which the Navy complies with its Incidental Take Authorizations and Incidental Take Statements.
- Increase the probability of detecting marine mammals through improved technology or methods within the mitigation zones (to improve mitigation effectiveness) and generally (to better achieve monitoring goals).

The Navy established a Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Plan and existing MMPA Regulations and Letters of Authorization. The Scientific Advisory Group was also tasked with developing objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not specifically prescriptive, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Integrated Comprehensive Monitoring Program. Key recommendations included:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from effort-based compliance metrics (e.g., completing a pre-determined amount of survey hours or days), with the intent to design and conduct monitoring projects according to scientific objectives rather than effort expended.
- Approaching the monitoring program holistically and selecting projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.1.2.2.1.3 Strategic Planning Process

The U.S. Navy Marine Species Monitoring Program has evolved and improved as a result of adaptive management review and the Strategic Planning Process through changes that include:

- Recognizing the limitations of effort-based compliance metrics;

- Developing a strategic approach to monitoring based on recommendations from the Scientific Advisory Group;
- Shifting focus to projects based on scientific objectives that facilitate generation of statistically meaningful results upon which natural resources management decisions may be based;
- Focusing on priority species or areas of interest as well as best opportunities to address specific monitoring objectives to maximize return on investment; and
- Increasing transparency of the program and management standards, improving collaboration among participating researchers, and improving accessibility to monitoring data and results.

As a result of the changes outlined above due to the implementation of the Strategic Planning Process, the U.S. Navy Marine Species Monitoring Program has undergone a transition. Intermediate scientific objectives now serve as the basis for developing and executing new monitoring projects across Navy training and testing areas in the Atlantic and Pacific Oceans. Implementation of the Strategic Planning Process involves coordination among fleets, system commands, Chief of Naval Operations Energy and Environmental Readiness Division, NMFS, and the Marine Mammal Commission with five primary steps:

- **Identify overarching intermediate scientific objectives.** Through the adaptive management process, the Navy coordinates with NMFS and the Marine Mammal Commission to review and revise the list of intermediate scientific objectives that guide development of individual monitoring projects. Examples include addressing information gaps in species occurrence and density, evaluating behavioral responses of marine mammals to Navy training and testing activities, and developing tools and techniques for passive acoustic monitoring.
- **Develop individual monitoring project concepts.** This step generally takes the form of soliciting input from the scientific community in terms of potential monitoring projects that address one or more of the intermediate scientific objectives. This can be accomplished through a variety of forums, including professional societies, regional scientific advisory groups, and contractor support.
- **Evaluate, prioritize, and select monitoring projects.** Navy technical experts and program managers review and evaluate monitoring project concepts and develop a prioritized ranking. The goal of this step is to establish a suite of monitoring projects that address a cross-section of intermediate scientific objectives spread over a variety of range complexes.
- **Execute and manage selected monitoring projects.** Individual projects are initiated through appropriate funding mechanisms and include clearly defined objectives and deliverables, such as data, reports, or publications.
- **Report and evaluate progress and results.** Progress on individual monitoring projects is updated through the U.S. Navy Marine Species Monitoring Program website as well as annual monitoring reports submitted to NMFS. Both internal review and discussions with NMFS through the adaptive management process are used to evaluate progress toward addressing the primary objectives of the Integrated Comprehensive Monitoring Program and serve to periodically recalibrate the focus of the monitoring program.

These steps serve three primary purposes: (1) to facilitate the Navy in developing specific projects addressing one or more intermediate scientific objectives, (2) to establish a more structured and collaborative framework for developing, evaluating, and selecting monitoring projects across areas where the Navy conducts training and testing activities, and (3) to maximize the opportunity for input and involvement across the research community, academia, and industry. This process is designed to integrate various elements, including:

- Integrated Comprehensive Monitoring Program top-level goals,
- Scientific Advisory Group recommendations,
- Integration of regional scientific expert input,
- Ongoing adaptive management review dialog between NMFS and the Navy,
- Lessons learned from past and future monitoring of Navy training and testing, and
- Leveraging of research and lessons learned from other Navy-funded science programs.

The Strategic Planning Process will continue to shape the future of the U.S. Navy Marine Species Monitoring Program and serve as the primary decision-making tool for guiding investments. Information on monitoring projects currently underway in the Atlantic and Pacific oceans, as well as results, reports, and publications, can be accessed through the U.S. Navy Marine Species Monitoring Program website.

5.1.2.2.2 Training and Testing Activity Reports

The Navy developed a classified data repository known as the Sonar Positional Reporting System to maintain an internal record of underwater sound sources (e.g., active sonar) used during training and testing. The Sonar Positional Reporting System facilitates reporting pursuant to the Navy's MMPA Regulations and Letters of Authorization. Using data from the Sonar Positional Reporting System and other relevant sources, the Navy will continue to provide the NMFS Office of Protected Resources with classified or unclassified (depending on the data) annual reports on the training and testing activities that use underwater sound sources. In its annual training and testing activity reports, the Navy will describe the level of training and testing conducted during the reporting period. Unclassified annual training and testing activity reports that have been submitted to NMFS can be found on the NMFS Office of Protected Resources and U.S. Navy Marine Species Monitoring Program webpages.

5.1.2.2.3 Incident Reports

The Navy's mitigation measures and many of its standard operating procedures are designed to prevent incidents involving biological and cultural resources, such as aircraft strikes, vessel strikes, and impacts on submerged historic properties and seafloor resources. The Navy has been collecting data on such incidents (if they have occurred) for more than a decade and will continue doing so under the Proposed Action. To provide information on incidents involving biological or cultural resources, the Navy will submit reports to the appropriate management authorities as described below:

- **Birds:** As described in Section 5.1.3 (Aircraft Safety) of the 2015 NWTT Final EIS/OEIS, bird strikes present an aviation safety risk for aircrews and aircraft. The Navy will report all aircraft strikes of birds per standard operating procedures. In addition to this standard operating procedure, the Navy will notify the appropriate regulatory agency (e.g., USFWS), immediately or as soon as operational security considerations allow, if it observes an injured or dead ESA-listed bird species (that is, or may be, attributable to Navy activities) during post-explosive event monitoring.
- **Marine Mammals, Sea Turtles, and ESA-Listed Species:** The Navy will notify the appropriate regulatory agency (e.g., NMFS, USFWS) immediately or as soon as operational security considerations allow if it observes the following that is (or may be) attributable to Navy activities: (1) a vessel strike of a marine mammal or sea turtle during training or testing, (2) a stranded, injured, or dead marine mammal or sea turtle during training or testing, or (3) an injured or dead marine mammal, sea turtle, or ESA-listed species during post-explosive event monitoring. The Navy will provide relevant information pertaining to the incident (e.g., vessel speed). Additional details on these incident reporting requirements will be included in the

Notification and Reporting Plan. The Navy will continue to provide the appropriate personnel with training on marine species incidents and their associated reporting requirements to aid the data collection and reporting processes (see Section 5.3.1, Environmental Awareness and Education). Information on marine mammal strandings is included in the *Marine Mammal Strandings Associated with U.S. Navy Sonar Activities* technical report (U.S. Department of the Navy, 2017a).

- **Cultural Resources:** In the event the Navy impacts a historic property (e.g., archaeological resource, shipwreck), it will commence consultation with the appropriate State Historic Preservation Officer in accordance with 36 Code of Federal Regulations section 800.13(b)(3).

5.2 Mitigation Development Process

The Navy, in coordination with the appropriate regulatory agencies, developed its initial suite of mitigation measures for Phase I of environmental planning (2010–2015) and subsequently revised those mitigation measures for the 2015 NWTT Final EIS/OEIS in Phase II (2015–2020). For this Draft Supplemental (which represents Phase III of environmental planning), the Navy is working collaboratively with the appropriate regulatory agencies to develop and refine its mitigation, which will be finalized through the consultation and permitting processes. The mitigation development process involves reanalyzing existing mitigation measures implemented under the 2015 NWTT Final EIS/OEIS and analyzing new mitigation recommendations received from Navy and NMFS scientists, other governmental agencies, the public, and non-governmental organizations during the NEPA, consultation, and permitting processes. The Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, mitigation will effectively avoid or reduce potential impacts from the Proposed Action and will be practical to implement. The Navy operational community (i.e., leadership from the aviation, surface, subsurface, and special warfare communities; leadership from the research and acquisition community; and training and testing experts), environmental planners, and scientific experts provided input on the effectiveness and practicality of mitigation implementation. Navy Senior Leadership reviewed and approved the mitigation measures included in this Draft Supplemental.

Mitigation measures that the Navy will implement under the Proposed Action are organized into two categories: procedural mitigation measures and mitigation areas. The sections below provide definitions of mitigation terminology, background information pertinent to the mitigation development process, and information about the mitigation effectiveness and practicality criteria. Additional activity or stressor-specific details, such as the level of effect to which a procedural mitigation measure is expected to mitigate and if a measure has been modified from the 2015 NWTT Final EIS/OEIS is provided throughout Section 5.3 (Procedural Mitigation to be Implemented). A draft biological assessment and operational analysis of mitigation areas that the Navy considered for the Study Area is provided in Appendix K (Geographic Mitigation Assessment) of this Draft Supplemental. The Navy will finalize development of its mitigation areas during the consultation and permitting processes and will summarize all finalized mitigation areas in Section 5.4 (Mitigation Areas to be Implemented) of the Final Supplemental. Section 5.5 (Measures Considered but Eliminated) contains information on measures that did not meet the appropriate balance between being effective and practical to implement, and therefore will not be implemented under the Proposed Action.

5.2.1 Procedural Mitigation Development

Procedural mitigation is mitigation that the Navy will implement whenever and wherever training or testing activities involving applicable acoustic, explosive, and physical disturbance and strike stressors take place within the Study Area. Procedural mitigation generally involves: (1) the use of one or more trained Lookouts to observe for specific biological resources within a mitigation zone, (2) requirements for Lookouts to immediately communicate sightings of specific biological resources to the appropriate watch station for information dissemination, and (3) requirements for the watch station to implement mitigation until a pre-activity commencement or during-activity recommencement condition has been met.

Procedural mitigation primarily involves Lookouts observing for marine mammals and sea turtles. For some activities, Lookouts may also be required to observe for additional biological resources, such as ESA-listed seabirds, jellyfish aggregations, or floating vegetation. For example, the Navy implements procedural mitigation for several activities that have the potential to overlap the range of ESA-listed marbled murrelets or short-tailed albatross. In this chapter, the term “floating vegetation” refers specifically to floating concentrations of detached kelp paddies and *Sargassum*. Jellyfish aggregations and floating vegetation can be indicators of potential marine mammal or sea turtle presence because marine mammals and sea turtles have been known to seek shelter in, feed on, or feed among them. For example, young sea turtles have been known to hide from predators and eat the algae associated with floating concentrations of *Sargassum*. The Navy observes for additional biological resources prior to the initial start or during the conduct of certain activities to offer an additional layer of protection for marine mammals and sea turtles.

To consider the benefits of procedural mitigation to marine mammals and sea turtles within the MMPA and ESA impact estimates, the Navy conservatively factored mitigation effectiveness into its quantitative analysis process, as described in the technical report titled *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2018). The Navy’s quantitative analysis assumes that Lookouts will not be 100 percent effective at detecting all individual marine mammals and sea turtles within the mitigation zones for each activity. This is due to the inherent limitations of observing marine species and because the likelihood of sighting individual animals is largely dependent on observation conditions (e.g., time of day, sea state, mitigation zone size, observation platform) and animal behavior (e.g., the amount of time an animal spends at the surface of the water). This is particularly true for sea turtles, small marine mammals, and marine mammals that display cryptic behaviors (e.g., surfacing to breathe with only a small portion of their body visible from the surface). Throughout Section 5.3 (Procedural Mitigation to be Implemented), discussions about the likelihood that a Lookout would observe a marine mammal or sea turtle pertain specifically to animals that are available to be observed (i.e., on, above, or just below the water’s surface). The benefits of procedural mitigation measures for species that were not included in the quantitative analysis process (e.g., birds, fish) are discussed qualitatively.

Data inputs for assessing and developing procedural mitigation included operational data described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, data on marine mammal and sea turtle impact ranges obtained through acoustic modeling, data on bird and fish hearing, marine species monitoring and density data, and the most recent guidance from NMFS and the USFWS. Background information on the data that were used to develop the ranges to effect is provided in Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), and Section 3.6 (Birds).

5.2.1.1 Lookouts

Lookouts perform similar duties as the standard watch personnel described in Section 5.1.2 (Vessel Safety) of the 2015 NWTT Final EIS/OEIS, such as personnel on the bridge watch team and personnel stationed for man-overboard precautions. Lookouts are designated the responsibility of helping meet the Navy's mitigation requirements by visually observing mitigation zones. The number of Lookouts designated for each training or testing activity is dependent upon the number of personnel involved in the activity (i.e., manning restrictions) and the number and type of assets available (i.e., equipment and space restrictions).

Depending on the activity, a Lookout may be positioned on a ship (i.e., surface ships and surfaced submarines), on a small boat (e.g., a rigid-hull inflatable boat), in an aircraft, on a pier, or on shore. Certain platforms, such as aircraft and small boats, have manning or space restrictions; therefore, the Lookout on these platforms is typically an existing member of the aircraft or boat crew who is responsible for other essential tasks (e.g., a pilot who is also responsible for navigation). Some platforms are minimally manned and are therefore either physically unable to accommodate more than one Lookout or divert personnel from mission-essential tasks, including safe and secure operation of propulsion, weapons, and damage control systems that ensure safety of the ship and the personnel on board. The number of Lookouts specified for each activity in Section 5.3 (Procedural Mitigation to be Implemented) represents the maximum number of Lookouts that can be designated for those activities without requiring additional personnel or reassigning duties. The Navy is unable to position Lookouts on unmanned surface vehicles, unmanned aerial systems, unmanned underwater vehicles, and submerged submarines, or have Lookouts observe during activities that use systems deployed from or towed by unmanned platforms, except in limited circumstances when escort vehicles are already participating in the activity.

When Lookouts are positioned in a fixed-wing aircraft or rotary-wing aircraft (i.e., helicopter), mission requirements determine the flight parameters (altitude, flight path, and speed) for that aircraft. For example, most fixed-wing aircraft sorties occur above 3,000 feet (ft.), while most rotary-wing sorties associated with mine countermeasure activities occur at altitudes as low as 75–100 ft. Similarly, when Lookouts are positioned on a vessel, mission requirements determine the operational parameters (course and speed) for that vessel.

The Navy's passive acoustic devices (e.g., remote acoustic sensors, expendable sonobuoys, passive acoustic sensors on submarines) can complement visual observations for marine mammals when passive acoustic assets are already participating in an activity. The passive acoustic devices can detect vocalizing marine mammals within the frequency bands already being monitored by Navy personnel. Marine mammal detections from passive acoustic devices can alert Lookouts to possible marine mammal presence in the vicinity. Lookouts can use the information from passive acoustic detections to assist their visual observations of the mitigation zone. Based on the number and type of passive acoustic devices that are typically used, passive acoustic detections do not provide range or bearing to a detected animal in order to determine its location or confirm its presence in a mitigation zone. Therefore, it is not practical for the Navy to implement mitigation in response to passive acoustic detections alone (i.e., without a visual sighting of an animal within the mitigation zone). Additional information about passive acoustic devices is provided in Section 5.5.3 (Active and Passive Acoustic Monitoring Devices).

5.2.1.2 Mitigation Zones

Mitigation zones are areas at the surface of the water within which applicable training or testing activities will be ceased, powered down, or modified to protect specific biological resources from an auditory injury (permanent threshold shift [PTS]), non-auditory injury (from impulsive sources), or direct strike (e.g., vessel strike) to the maximum extent practicable. Mitigation zones are measured as the radius from a stressor. Implementation of procedural mitigation is most effective when mitigation zones are appropriately sized to be realistically observed during typical training and testing activity conditions.

The Navy customized its mitigation zone sizes and mitigation requirements for each applicable training and testing activity category or stressor. The Navy developed each mitigation zone to be the largest area that: (1) Lookouts can reasonably be expected to observe during typical activity conditions (i.e., most environmentally protective), and (2) the Navy can commit to implementing mitigation without impacting safety, sustainability, or the ability to meet mission requirements. The Navy designed the mitigation zones for most acoustic and explosive stressors according to its source bins. As described in Section 3.0.3.1.1 (Sonar and Other Transducers), sonars and other transducers are grouped into classes that share an attribute, such as frequency range or purpose of use. Classes are further sorted by bins based on the frequency or bandwidth, source level, and when warranted, the application in which the source would be used. As described in Section 3.0.3.2.1.1 (Explosions in Water), explosives detonated in water are binned by net explosive weight. Mitigation does not pertain to stressors that do not have the potential to impact biological resources (e.g., *de minimis* acoustic and explosive sources that do not have the potential to impact marine mammals).

Discussions throughout Section 5.3 (Procedural Mitigation to be Implemented) about the level of effect that will likely be mitigated for marine mammals and sea turtles are based on a comparison of the mitigation zone size to the predicted impact ranges for the applicable source bins with the longest average ranges to PTS. These conservative discussions represent the worst-case scenario for each activity category or stressor. The mitigation zones will oftentimes cover all or a larger portion of the predicted average ranges to PTS for other comparatively smaller sources with shorter impact ranges (e.g., sonar sources used at a lower source level, explosives in a smaller bin). The discussions are primarily focused on how the mitigation zone sizes compare to the ranges to PTS; however, depending on the activity category or stressor, the mitigation zones are oftentimes large enough to also mitigate within a portion of the ranges to temporary threshold shift (TTS). TTS is a threshold shift that is recoverable. Background information on PTS, TTS, and marine mammal and sea turtle hearing groups is presented in the U.S. Department of the Navy (2017b) technical report titled *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*.

5.2.1.3 Procedural Mitigation Implementation

The Navy takes several courses of action in response to a sighting of an applicable biological resource in a mitigation zone. First, a Lookout will communicate the sighting to the appropriate watch station. Next, the watch station will implement the prescribed mitigation, such as delaying the initial start of an activity, powering down sonar, ceasing an explosive detonation, or maneuvering a vessel. If floating vegetation is observed in the mitigation zone prior to the initial start of an activity, the activity will either be relocated to an area where floating vegetation is not observed in concentrations, or the initial start of the activity will be delayed until the mitigation zone is clear of floating vegetation concentrations. There are no requirements to cease activities if vegetation floats into the mitigation zone after activities commence. For sightings of marine mammals, sea turtles, and seabirds within a mitigation zone prior to the initial start of or during applicable activities, the Navy will continue mitigating until one of the five conditions listed below has been met. The conditions are designed to allow a sighted animal to leave the mitigation zone before the initial start of an activity or before an activity resumes.

- The animal is observed exiting the mitigation zone;

- The animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the stressor source;
- The mitigation zone has been clear from any additional sightings for a specific wait period;
- For mobile activities, the stressor source has transited or has been relocated a distance equal to double that of the mitigation zone size beyond the location of the last sighting; or
- For activities using hull-mounted sonar, the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

To supplement the implementation of procedural mitigation, the Navy has agreed to undertake reporting initiatives for certain activities or resources based on previous consultations with NMFS and the USFWS, as summarized in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives) and detailed where applicable in Section 5.3 (Procedural Mitigation to be Implemented). For some activities, the Navy also agreed during previous consultations with NMFS or the USFWS to adapt some of its procedural mitigation for particular resources at certain locations and plans to continue these mitigation measures for the Proposed Action. For example, the Navy will continue implementing mitigation for ESA-listed bull trout at the Crescent Harbor and Hood Canal Explosive Ordnance Disposal ranges, as discussed in Section 5.3.3.7 (Explosive Mine Neutralization Activities Involving Navy Divers).

5.2.2 Mitigation Area Development

Mitigation areas are geographic locations within the Study Area where the Navy will implement mitigation measures to: (1) avoid or reduce potential impacts on biological or cultural resources that are not observable by Lookouts from the water's surface (i.e., resources for which procedural mitigation cannot be implemented), (2) in combination with procedural mitigation, to effect the least practicable adverse impact on marine mammal species or stocks and their habitat, or (3) in combination with procedural mitigation, ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat.

The Navy conducted an extensive assessment of the Study Area to develop the mitigation areas included in this Draft Supplemental. The Navy reanalyzed existing mitigation areas implemented under the 2015 NWTT Final EIS/OEIS; assessed additional habitat areas suggested by the public, NMFS, other governmental agencies, and non-governmental organizations; and considered other habitats identified internally by the Navy. Data inputs for mitigation area assessment and development included the operational information described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, predicted activity impact footprints, and marine species monitoring and density data.

A draft biological assessment and operational analysis of the mitigation areas that the Navy considered for the Study Area is provided in Appendix K (Geographic Mitigation Assessment). The appendix includes background information and additional details for each of the areas considered, such as areas identified during the NEPA scoping process. The Navy will finalize development of its mitigation areas during the consultation and permitting processes and will summarize its finalized mitigation areas in Section 5.4 (Mitigation Areas to be Implemented) of the Final Supplemental.

The Navy considers a mitigation area to be effective if it meets the following criteria:

- **The mitigation area is a key area of biological or ecological importance or contains cultural resources:** The best available science suggests that the mitigation area contains submerged cultural resources (e.g., shipwrecks) or is particularly important to one or more species or resources for a biologically important life process (e.g., foraging, migration, reproduction) or ecological function (e.g., live hard bottom that provides critical ecosystem functions); and

- **The mitigation will result in an avoidance or reduction of impacts:** Implementing the mitigation will likely avoid or reduce potential impacts on: (1) species, stocks, or populations of marine mammals based on data regarding their seasonality, density, and behavior; or (2) other biological or cultural resources based on their distribution and physical properties. Furthermore, implementing the mitigation will not shift or transfer adverse effects from one species to another (e.g., to a more vulnerable or sensitive species).

The benefits of mitigation areas are considered qualitatively and have not been factored into the quantitative analysis process or reductions in take for MMPA and ESA impact estimates. Mitigation area benefits are discussed in terms of the context of impact avoidance or reduction.

5.2.3 Practicality of Implementation

Mitigation measures are expected to have some degree of impact on the training and testing activities that implement them (e.g., modifying where and when activities occur, ceasing an activity in response to a sighting). The Navy is able to accept a certain level of impact on its military readiness activities because of the benefit that mitigation measures provide for avoiding or reducing impacts on environmental and cultural resources. The Navy's focus during mitigation assessment and development is that mitigation measures must meet the appropriate balance between being effective and practical to implement. To evaluate practicality, the Navy operational community conducted an extensive and comprehensive assessment to determine how and to what degree potential mitigation measures would be compatible with planning, scheduling, and conducting training and testing activities under the Proposed Action in order to meet the Navy's Title 10 requirements.

5.2.3.1 Assessment Criteria

The purpose and need of the Proposed Action is to ensure that the Navy meets its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The Navy is statutorily mandated to protect U.S. national security by being ready, at all times, to effectively prosecute war and defend the nation by conducting operations at sea, as outlined in Title 10 section 5062 of the United States Code. The Navy's mission is achieved in part by conducting training and testing within the Study Area in accordance with established military readiness requirements. Training requirements have been developed through many years of iteration and adaptation and are designed to ensure that Sailors achieve the levels of readiness needed to properly respond to the multitude of contingencies they may face during military missions and combat operations. Activities are planned and scheduled in accordance with the Optimized Fleet Response Plan, which details instructions on manning distribution, range scheduling, operational requirements, maintenance and modernization plans, quality of work and life for personnel, achieving training capabilities, and meeting strategic readiness objectives.

To achieve the highest skill proficiency and most accurate testing results possible, the Navy conducts activities in a variety of realistic tactical oceanographic and environmental conditions. Such conditions include variations in bathymetry, topography, surface fronts, and sea surface temperatures. Training activities must be as realistic as possible to provide the experiences and stressors necessary to successfully execute all required military missions and combat operations. Degraded training would result in units being unqualified to conduct the range of military operations required by operational

Commanders. The inability of such Commanders to meet national security objectives would result in not only the increased risk to life, but also the degradation of national security. Testing activities must be as realistic as possible for the Navy to conduct accurate acoustic research to validate acoustic models; conduct accurate engineering tests of acoustic sources, signal processing algorithms, and acoustic interactions; and to effectively test systems and platforms (and components of these systems and platforms) to validate whether they perform as expected and determine whether they are operationally effective, suitable, survivable, and safe for their intended use by the fleet. Testing must be completed before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions.

As described in Chapter 2 (Description of Proposed Action and Alternatives), the Navy requires access to sea space and airspace throughout the Study Area within pierside locations, nearshore areas, and large-scale open ocean areas of the high seas. Each area plays a critical role in the Navy's ability to plan, schedule, and effectively execute military readiness activities. The locations where training and testing occur must be situated in a way that allows the Navy to complete its activities without physical or logistical obstructions. The Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances so they do not interfere with one another. Some training and testing activities require continuous access to large and unobstructed areas, consisting potentially of tens or thousands of square miles. This provides personnel the ability to develop competence and confidence in their capabilities across multiple types of weapons and sensors, and the ability to train to communicate and operate in a coordinated fashion as required during military missions and combat operations. For example, some training exercises may require large areas of the littorals, open ocean, and nearshore areas for realistic and safe anti-submarine warfare training. The Navy also requires large areas of sea space because it trains in a manner to avoid observation by potential adversaries. Modern sensing technologies make training on a large scale without observation more difficult. A foreign military's continual observation of U.S. Navy training in predictable geographic areas and timeframes would enable foreign nations to gather intelligence and subsequently develop techniques, tactics, and procedures to potentially and effectively counter U.S. naval operations. Other activities may be conducted on a smaller and more localized scale, with training or testing at discrete locations that are critical to certain aspects of military readiness.

The locations for training and testing activities are selected to maximize efficiency while supporting specific mission and safety requirements, deconflict sea space and airspace, and minimize the time personnel must spend away from home. Training and testing locations are typically selected based on their proximity to homeports, home bases, associated training ranges, testing facilities, air squadrons, and existing infrastructure to reduce travel time and associated costs. Activities involving the use of rotary-wing aircraft typically occur in proximity to shore or refueling stations due to fuel restrictions and safety requirements. Testing events are typically located near systems command support facilities, which provide critical infrastructure support and technical expertise necessary to conduct testing. Logistical support of range testing can only efficiently and effectively occur when the support is co-located with the testing activities. These same principles also apply to pierside and at-sea testing that must occur in proximity to naval harbors. Testing event site locations and associated field activities were originally established to support specific Navy mission testing needs using a selection process that included testing requirements, cost of living, availability of personnel, and low level of crowding from industry and development.

During its assessment to determine how and to what degree the implementation of mitigation would be compatible with meeting the purpose and need of the Proposed Action, the Navy considered a mitigation measure to be practical to implement if it met all criteria discussed below:

- **Implementing the mitigation is safe:** Mitigation measures must not increase safety risks to Navy personnel and equipment, or to the public. When assessing whether implementing a mitigation measure would be safe, the Navy factored in the potential for increased pilot fatigue; accelerated fatigue-life of aircraft; typical fuel restrictions of participating aircraft; locations of refueling stations; proximity to aircraft emergency landing fields, critical medical facilities, and search and rescue capabilities; space restrictions of the observation platforms; the ability to de-conflict platforms and activities to ensure that training and testing activities do not impact each other; and the ability to avoid interaction with non-Navy sea space and airspace uses, such as established commercial air traffic routes, commercial vessel shipping lanes, and areas used for energy exploration or alternative energy development. Other safety considerations included identifying if mitigation measures would reasonably allow Lookouts to safely and effectively maintain situational awareness while observing the mitigation zones during typical activity conditions, or if the mitigation would increase the safety risk for personnel. For example, the safety risk would increase if Lookouts were required to direct their attention away from essential mission requirements.
- **Implementing the mitigation is sustainable:** One of the primary factors that the Navy incorporates into the planning and scheduling of its training and testing activities is the amount and type of available resources, such as funding, personnel, and equipment. Mitigation measures must be sustainable over the life of the Proposed Action, meaning that they will not require the use of resources in excess of what is available. When assessing whether implementing a mitigation measure would be sustainable, the Navy considered if the measure would require excessive time on station or time away from homeport for Navy personnel, require the use of additional personnel (i.e., manpower) or equipment (e.g., adding a small boat to serve as an additional observation platform), or result in additional operational costs (e.g., increased fuel consumption, equipment maintenance, or acquisition of new equipment).
- **Implementing the mitigation allows the Navy to continue meeting its mission requirements:** The Navy considered if each individual measure and the iterative and cumulative impact of all potential measures would be within the Navy's legal authority to implement. The Navy also considered if mitigation would modify training or testing activities in a way that would prevent individual activities from meeting their mission objectives and if mitigation would prevent the Navy from meeting its national security requirements or statutorily-mandated Title 10 requirements, such as by:
  - Impacting training and testing realism or preventing ready access to ranges, operating areas, facilities, or range support structures (which would reduce realism and present sea space and airspace conflicts).
  - Impacting the ability for Sailors to train and become proficient in using sensors and weapon systems as would be required in areas analogous to where the military operates or causing an erosion of capabilities or reduction in perishable skills (which would result in a significant risk to personnel or equipment safety during military missions and combat operations).
  - Impacting the ability for units to meet their individual training and certification requirements (which would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders).

- Impacting the ability to certify forces to deploy to meet national security tasking (which would limit the flexibility of Combatant Commanders and warfighters to project power, engage in multi-national operations, and conduct the full range of naval warfighting capabilities in support of national security interests).
- Impacting the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research to meet research objectives, effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet, or complete shipboard maintenance, repairs, or pierside testing prior to at-sea operations (which would not allow the Navy to ensure safety, functionality, and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements).
- Requiring the Navy to provide advance notification of specific times and locations of Navy platforms, such as platforms using active sonar (which would present national security concerns).
- Reducing the Navy's ability to be ready, maintain deployment schedules, or respond to national emergencies or emerging national security challenges (which would present national security concerns).

5.2.3.2 Factors Affecting Practicality

Two of the factors that influenced whether procedural mitigation measures met the practicality criteria were the number of times mitigation measures would likely be implemented and the duration over which the activity would likely be ceased due to mitigation implementation. The number of times mitigation would likely be implemented is largely dependent on the size of the mitigation zone. As a mitigation zone size increases, the area of observation increases by an order of magnitude. This is because mitigation zones are measured as the radius (r) from a stressor but apply to circular area (A) around that stressor ($A = \pi * r^2$, where π is a constant that is approximately equal to 3.14). For example, a 100-yard (yd.) mitigation zone is equivalent to an area of 31,416 square yd. A 200 yd. mitigation zone is equivalent to an area of 125,664 square yd. Therefore, increasing a mitigation zone from 100 yd. to 200 yd. (i.e., doubling the mitigation zone radius) would quadruple the mitigation zone area (the area over which mitigation must be implemented). Similarly, increasing a mitigation zone from 1,000 yd. to 4,000 yd. (i.e., quadrupling the mitigation zone radius) would increase the mitigation zone area by a factor of 16. Increasing the area over which mitigation must be implemented consequently increases the number of times mitigation would likely be implemented during that activity.

The duration over which mitigation is implemented can differ considerably depending on the mitigation zone size, number of animal sightings, behavioral state of animals sighted (e.g., travelling at a fast pace on course to exit the mitigation zone, milling slowly in the center of the mitigation zone), and which pre-activity commencement or during-activity recommencement condition is met before the activity can commence or resume after each sighting. The duration of mitigation implementation typically equates to the amount of time the training or testing activity will be extended. The impact that extending the length of an activity has on safety, sustainability, and the Navy's ability to accomplish the activity's intended objectives varies by activity. This is one reason why the Navy tailors its mitigation zone sizes and mitigation requirements by activity category or stressor and the platforms involved.

As described in Section 5.2.1 (Procedural Mitigation Development), the Navy will mitigate for each applicable sighting and will continue mitigating until one of five conditions has been met. In some instances, such as if an animal dives underwater after a sighting, it may not be possible for a Lookout to visually verify if the animal has exited the mitigation zone. The Navy cannot delay or cease activities indefinitely for the purpose of mitigation due to impacts on safety, sustainability, and the Navy's ability to continue meeting its mission requirements. To account for this, one of the pre-activity commencement and during-activity recommencement conditions is an established post-sighting wait period of 30 minutes (min.) or 10 min., based on the platforms involved. Wait periods are designed to allow animals the maximum amount of time practical to resurface (i.e., become available to be observed by a Lookout) before activities resume. When developing the length of its wait periods, the Navy factored in the assumption that mitigation may need to be implemented more than once. For example, an activity may need to be delayed or ceased for more than one 30 min. or 10 min. period.

The Navy assigns a 30 min. wait period to activities conducted from vessels and that involve aircraft that are not typically fuel constrained (e.g., maritime patrol aircraft). A 30 min. period covers the average dive times of most marine mammals and a portion of the dive times of sea turtles and deep-diving marine mammals (i.e., sperm whales, dwarf and pygmy sperm whales [Kogia whales], and beaked whales) (U.S. Department of the Navy, 2017c). The Navy determined that a 30 min. wait period is the maximum wait time that is practical to implement during activities involving vessels and aircraft that are not typically fuel constrained to allow the activities to continue meeting their intended objectives. Implementing a longer wait period (such as 45 min. or 60 min. to cover the average dive times of sea turtles and additional marine mammal species) would be impractical to implement. Activities are scheduled to occur at specific locations within specific timeframes based on range scheduling and for sea space deconfliction. Increasing the wait period, and consequently, the amount of time activities would need to be delayed or extended in order to accomplish their intended objectives, would impact activity realism or cause sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements. For example, delaying an explosive activity for multiple wait periods could result in personnel not being able to detonate an explosive before the participating platforms are required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

The Navy assigns a 10 min. wait period to activities involving aircraft that are typically fuel constrained (e.g., rotary-wing aircraft, fighter aircraft). A 10 min. period covers a portion, but not the average, dive times of marine mammals and sea turtles (U.S. Department of the Navy, 2017c). The Navy determined that a 10 min. wait period is the maximum wait time that is practical to implement during activities involving aircraft that are typically fuel constrained. Increasing the wait period, and consequently the amount of time the training or testing activity would need to be extended in order to accomplish its intended objective, would require aircraft to depart the activity area to refuel in order to safely complete the event. If the wait period was implemented multiple times, the aircraft would be required to depart the activity area to refuel multiple times. Refueling events would vary in duration, depending on the activity location and proximity to the nearest refueling station. Multiple refueling events would generally be expected to extend the length of the activity by two to five times or more. This would impact activity realism, could cause air space or sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements, would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area, and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. For example, delaying an Anti-Submarine Warfare Tracking Exercise – Helicopter activity for multiple wait periods could result in personnel not being able to effectively search for, detect, classify, localize, and track a simulated threat submarine before the rotary-wing aircraft is required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

Factors that influenced whether a mitigation area measure met the practicality criteria included the historical use and projected future use of geographic locations for training and testing activities under the Proposed Action, and the relative importance of each location. The frequency that an area is used for training or testing does not necessarily equate to that area's level of importance for meeting an individual activity objective, or collectively, the Navy's mission requirements. While frequently used areas can be essential to one or more types of military readiness activities, some infrequently used areas are critical for a particular training exercise, testing mission, or research project.

5.3 Procedural Mitigation to be Implemented

The first procedural mitigation measure (Section 5.3.1, Environmental Awareness and Education) is designed to aid Lookouts and other personnel with observation, environmental compliance, and reporting responsibilities. The remaining procedural mitigation measures are organized by stressor type and training or testing activity category.

5.3.1 Environmental Awareness and Education

The Navy will continue to implement procedural mitigation to provide environmental awareness and education to the appropriate personnel to aid visual observation, environmental compliance, and reporting responsibilities, as outlined in Table 5.3-1.

Table 5.3-1: Environmental Awareness and Education

Procedural Mitigation Description
Stressor or Activity • All training and testing activities, as applicable
Resource Protection Focus • Marine mammals • Sea turtles • Birds
Mitigation Requirements • Appropriate personnel (including civilian personnel) involved in mitigation and training or testing activity reporting under the Proposed Action will complete one or more modules of the U.S. Navy Afloat Environmental Compliance Training Series, as identified in their career path training plan. Modules include: – **Introduction to the U.S. Navy Afloat Environmental Compliance Training Series.** The introductory module provides information on environmental laws (e.g., ESA, MMPA) and the corresponding responsibilities that are relevant to Navy training and testing activities. The material explains why environmental compliance is important in supporting the Navy's commitment to environmental stewardship. – **Marine Species Awareness Training.** All bridge watch personnel, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare and mine warfare rotary-wing aircrews, Lookouts, and equivalent civilian personnel must successfully complete the Marine Species Awareness Training prior to standing watch or serving as a Lookout. The Marine Species Awareness Training provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures. Navy biologists developed Marine Species Awareness Training to improve the effectiveness of visual observations for biological resources, focusing on marine mammals and sea turtles, and including floating vegetation, jellyfish aggregations, and flocks of seabirds. – **U.S. Navy Protective Measures Assessment Protocol.** This module provides the necessary instruction for accessing mitigation requirements during the event planning phase using the Protective Measures Assessment Protocol software tool. – **U.S. Navy Sonar Positional Reporting System and Marine Mammal Incident Reporting.** This module provides instruction on the procedures and activity reporting requirements for the Sonar Positional Reporting System and marine mammal incident reporting.

The Navy requires Lookouts and other personnel to complete their assigned environmental compliance responsibilities (e.g., mitigation, reporting requirements) before, during, and after training and testing activities. Marine Species Awareness Training was first developed in 2007 and has since undergone numerous updates to ensure that the content remains current, with the most recent product approved by NMFS and released by the Navy in 2014. In 2014, the Navy developed a series of educational training modules, known as the Afloat Environmental Compliance Training program, to ensure Navywide compliance with environmental requirements. The Afloat Environmental Compliance Training program, including the updated Marine Species Awareness Training, helps Navy personnel from the most junior Sailors to Commanding Officers gain a better understanding of their personal environmental compliance roles and responsibilities. Additional information on the Protective Measures Assessment Protocol is provided in Section 5.1.2.1 (Protective Measures Assessment Protocol), and additional information on training and testing activity and incident reports is provided in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives).

From an operational perspective, the interactive web-based format of the U.S. Navy Afloat Environmental Compliance Training Series is ideal for providing engaging and educational content that is cost effective and convenient to access by personnel who oftentimes face rotating job assignments. The U.S. Navy Afloat Environmental Compliance Training Series has resulted in an improvement in the quality and accuracy of training and testing activity reports, incident reports, and Sonar Positional Reporting System reports submitted by Navy operators. Improved reporting quality indicates that the U.S. Navy Afloat Environmental Compliance Training Series is helping to facilitate Navywide environmental compliance as intended.

Lookouts and members of the operational community have demonstrated enhanced knowledge and understanding of the Navy's environmental compliance responsibilities since the development of the U.S. Navy Afloat Environmental Compliance Training Series. For example, it is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, has contributed to a Navy-wide reduction in vessel strikes of marine mammals in areas where the Navy trains and tests. This indicates that the environmental awareness and education program is helping to improve the effectiveness of mitigation implementation. A more detailed analysis of vessel strikes is presented in Section 3.4.2.4 (Impacts from Physical Disturbance and Strike) of this Draft Supplemental.

5.3.2 Acoustic Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the acoustic stressors or activities discussed in the sections below. In addition to procedural mitigation, the Navy will implement mitigation for acoustic stressors within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations. Mitigation area requirements for acoustic stressors are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.2.1 Active Sonar

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from active sonar, as outlined in Table 5.3-2. In the 2015 NWTT Final EIS/OEIS, the Navy's active sonar mitigation zones were based on associated average ranges to PTS. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the sizes of these mitigation zones. The Navy determined that the current mitigation zones for active sonar are the largest areas within which it is practical to implement mitigation; therefore, it will continue implementing these same mitigation zones under the Proposed Action.

Table 5.3-2: Procedural Mitigation for Active Sonar

Procedural Mitigation Description
Stressor or Activity • Low-frequency active sonar, mid-frequency active sonar, high-frequency active sonar – For vessel-based active sonar activities, mitigation applies only to sources that are positively controlled and deployed from manned surface vessels (e.g., sonar sources towed from manned surface platforms). – For aircraft-based active sonar activities, mitigation applies only to sources that are positively controlled and deployed from manned aircraft that do not operate at high altitudes (e.g., rotary-wing aircraft). Mitigation does not apply to active sonar sources deployed from unmanned aerial systems or aircraft operating at high altitudes (e.g., maritime patrol aircraft).
Resource Protection Focus • Marine mammals • Sea turtles (only for sources <2 kilohertz [kHz])
Number of Lookouts and Observation Platform • Hull-mounted sources: – 1 Lookout: Platforms with space or manning restrictions while underway (at the forward part of a small boat or ship) and platforms using active sonar while moored or at anchor (including pierside) – 2 Lookouts: Platforms without space or manning restrictions while underway (at the forward part of the ship) • Sources that are not hull-mounted: – 1 Lookout on the ship or aircraft conducting the activity
Mitigation Requirements • Mitigation zones: – 1,000 yd. power down, 500 yd. power down, and 200 yd. or 100 yd. shut down for low-frequency active sonar ≥200 decibels (dB) and hull-mounted mid-frequency active sonar – 200 yd. or 100 yd. shut down for low-frequency active sonar <200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of active sonar transmission. • During the activity: – Low-frequency active sonar ≥200 decibels (dB) and hull-mounted mid-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources <2 kHz); power down active sonar transmission by 6 dB if a marine mammal or sea turtle is observed within 1,000 yd. of the sonar source; power down an additional 4 dB (10 dB total) if a marine mammal or sea turtle is observed within 500 yd.; cease transmission if a cetacean, sea turtle, or pinniped in the NWTT Offshore Area or Western Behm Canal is observed within 200 yd.; cease transmission if a pinniped in NWTT Inland Waters is observed within 100 yd. (except if hauled out on, or in the water near, man-made structures and vessels). – Low-frequency active sonar <200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources <2 kHz); cease transmission if a cetacean, sea turtle, or pinniped in the NWTT Offshore Area or Western Behm Canal is observed within 200 yd. of the sonar source; cease transmission if a pinniped in NWTT Inland Waters is observed within 100 yd. (except if hauled out on, or in the water near, man-made structures and vessels).

Table 5.3-2: Procedural Mitigation for Active Sonar (continued)

Procedural Mitigation Description
• Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing or powering up active sonar transmission) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonar source; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-deployed sonar sources or 30 min. for vessel-deployed sonar sources; (4) for mobile activities, the active sonar source has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting; or (5) for activities using hull-mounted sonar, the Lookout concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave, and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

The Navy is clarifying in the table that the mitigation zone for low-frequency active sonar sources at or above 200 dB will be the same as the mitigation implemented for hull-mounted mid-frequency active sonar; whereas low-frequency active sonar sources below 200 dB will implement the same mitigation zone as high-frequency active sonar and mid-frequency active sonar sources that are not hull-mounted. The Navy is also clarifying that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting active sonar activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The mitigation zone sizes and proximity to the observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zones. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones. Pinnipeds use Navy structures (e.g., submarines, security barriers) as haul-outs at several locations within NWTT Inland Waters, despite these areas being heavily trafficked for the past several decades. Because these animals are present in NWTT Inland Waters consistently throughout the year, the Navy would be unable to avoid them entirely unless they were physically removed from the water or haul-out locations. Efforts to remove or relocate pinnipeds away from Navy activities in NWTT Inland Waters would likely result in higher animal stress levels or behavioral disturbances and would present logistical constraints due to the number of animals that are typically present in these locations at any given time. For this reason, the Navy implements a smaller active sonar shut down mitigation zone for pinnipeds observed in NWTT Inland Waters than for other marine mammals and pinnipeds observed in the NWTT Offshore Area or Western Behm Canal.

Section 3.4.2.1.2 (Impacts from Sonar and Other Transducers) of this Draft Supplemental provides a full analysis of the potential impacts of sonar on marine mammals and includes the impact ranges for various source bins. For low-frequency active sonar at 200 dB or more and hull-mounted mid-frequency active sonar, bin MF1 has the longest predicted ranges to PTS. For the highest source level in bin MF1, the 1,000 yd. and 500 yd. power down mitigation zones extend beyond the average ranges to PTS for marine mammals. The 200 yd. shut down mitigation zone extends beyond the average ranges to PTS for low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The ranges to PTS for the 200 yd. shut down mitigation zone were calculated based on full power transmissions and do not consider that the impact ranges would be reduced if the 1,000 yd. and 500 yd. power down mitigation measures are implemented in response to a marine mammal sighting in those mitigation zones. If an animal is first sighted in the 1,000 yd. or 500 yd. power down mitigation zone, the source level reduction would shorten the ranges to PTS, and the 200 yd. shut down mitigation would then extend beyond the average ranges to PTS for all marine mammal hearing groups. The 100 yd. shut down mitigation zone applicable only to pinnipeds observed in NWTT Inland Waters extends beyond the average ranges to PTS for otariids and phocids.

For low-frequency active sonar below 200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar, bin HF4 has the longest predicted ranges to PTS. For the highest source level in bin HF4, the 200 yd. shut down mitigation zone extends beyond the average ranges to PTS for marine mammals. The 100 yd. shut down mitigation zone applicable only to pinnipeds observed in NWTT Inland Waters extends beyond the average ranges to PTS for otariids and phocids. In summary, the mitigation zones for active sonar will help avoid or reduce the potential for exposure to PTS for marine mammals.

The active sonar mitigation zones also extend into a portion of the average ranges to TTS for marine mammals; therefore, mitigation will help avoid or reduce the potential for some exposure to higher levels of TTS. Active sonar sources that fall within lower source bins or are used at lower source levels have shorter impact ranges than those discussed above; therefore, the mitigation zones will extend further beyond or into the average ranges to PTS and TTS for these sources. The analysis in Section 3.4.2.1.2 (Impacts from Sonar and Other Transducers) of this Draft Supplemental indicates that pygmy and dwarf sperm whales (*Kogia* whales) are the only deep-diving marine mammal species that could potentially experience PTS impacts from active sonar in the Study Area. The 30 min. wait period for vessel-deployed sources will cover the average dive times of marine mammal species that could experience PTS from sonar in the mitigation zone, except for *Kogia* whales. The 10 min. wait period for aircraft-deployed sources will cover a portion, but not the average, dive times of marine mammals.

Section 3.5.2.1.2 (Impacts from Sonar and Other Transducers) provides a full analysis of the potential impacts of sonar on sea turtles. Due to sea turtle hearing capabilities, the mitigation only applies to sea turtles during the use of sources below 2 kHz. The range to auditory effects for most active sonar sources in sea turtle hearing range (e.g., LF4) is zero meters. Impact ranges are longer (i.e., up to tens of meters) for active sonars with higher source levels. The mitigation zones for active sonar extend beyond the ranges to PTS and TTS for sea turtles; therefore, mitigation will help avoid or reduce the potential for exposure to these effects for sea turtles.

As described previously, the mitigation zones developed for this Draft Supplemental are based on the largest areas within which it is practical for the Navy to implement mitigation during training and testing within the Study Area. Training and testing with active sonar is essential to national security. Active sonar is the only reliable technology for detecting and tracking potential enemy diesel-electric submarines. For example, small diesel-electric submarines operate quietly and may hide in shallow coastal and littoral waters. The ability to effectively operate active sonar is a highly perishable skill that must be repeatedly practiced during realistic training. Naval forces must train in the same mode and manner in which they conduct military missions and combat operations. Anti-submarine warfare training typically involves the periodic use of active sonar to develop the “tactical picture,” or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). This can take from several hours to multiple days and typically occurs over vast areas with varying physical and oceanographic conditions (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature). Sonar operators train to avoid or reduce interference and sound-reducing clutter from varying ocean floor topographies and environmental conditions, practice coordinating their efforts with other sonar operators in a strike group, develop skill proficiency in detecting and tracking submarines and other threats, and practice the focused endurance vital to effectively working as a team in shifts around the clock until the conclusion of the event.

Increasing the mitigation zone sizes would result in a larger area over which active sonar would need to be powered down or shut down in response to a sighting, and therefore would likely increase the number of times that these mitigation measures would be implemented. This would extend the length of the activity, significantly diminish event realism, and prevent activities from meeting their intended objectives. It would also create fundamental differences between how active sonar would be used in training and how active sonar should be used during military missions and combat operations. For example, additional active sonar power downs or shut downs would prevent sonar operators from developing and maintaining awareness of the tactical picture during training events. Without realistic training in conditions analogous to military missions and combat operations, sonar operators cannot become proficient in effectively operating active sonar. Sonar operators, vessel crews, and aircrews would be expected to operate active sonar during military missions and combat operations in a manner inconsistent with how they were trained.

During integrated training, multiple vessels and aircraft may participate in an exercise using different warfare components simultaneously. Degrading the value of one training element results in a degradation of the training value of the other training elements. Degrading the value of training would cause a reduction in perishable skills and diminished operational capability, which would significantly impact military readiness. Each of these factors would ultimately impact the ability for units to meet their individual training and certification requirements and the Navy's ability to certify forces to safely deploy to meet national security tasking. Diminishing proficiency or eroding active sonar capabilities would present a significant risk to personnel safety during military missions and combat operations and would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders.

Increasing the number of times that the Navy must power down or shut down active sonar transmissions during testing activities would result in similar consequences to activity realism. For example, at-sea sonar testing activities are required in order to calibrate or document the functionality of sonar and torpedo systems while a ship or submarine is in an open ocean environment. Additional powering down or shutting down active sonar transmissions would prevent this activity from meeting its intended objective, such as verifying if the ship meets design acoustic specifications. These types of impacts would impede the ability of researchers, program managers, and weapons system acquisition programs to meet research objectives and testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements, and would impede shipboard maintenance, repairs, or pierside testing prior to at-sea operations.

For activities that involve aircraft (e.g., activities involving rotary-wing aircraft that use dipping sonar or sonobuoys to locate submarines or submarine targets), extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption. Increasing the mitigation zone sizes would not result in a substantial reduction of injurious impacts because, as described above, the mitigation zones extend beyond the average ranges to PTS for sea turtles and marine mammals.

In summary, the operational community determined that implementing procedural mitigation for active sonar beyond what is detailed in Table 5.3-2 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.2.2 Weapons Firing Noise

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, and seabirds from weapons firing noise, as outlined in Table 5.3-3.

Table 5.3-3: Procedural Mitigation for Weapons Firing Noise

Procedural Mitigation Description
Stressor or Activity • Weapons firing noise associated with large-caliber gunnery activities
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelets and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout positioned on the ship conducting the firing – Depending on the activity, the Lookout could be the same one described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles) or Section 5.3.4.3 (Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions)
Mitigation Requirements • Mitigation zone: – 30° on either side of the firing line out to 70 yd. from the muzzle of the weapon being fired • Prior to the initial start of the activity: – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, relocate or delay the start of weapons firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, cease weapons firing. • Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing weapons firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the firing ship; (3) the mitigation zone has been clear from any additional sightings for 30 min.; or (4) for mobile activities, the firing ship has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

In the 2015 NWTT Final EIS/OEIS, the weapons firing noise mitigation zone was based on the associated average ranges to PTS. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing the same mitigation zone size under the Proposed Action. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting weapons firing activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals, sea turtles, and seabirds throughout the mitigation zone. Section 3.6.2.1.5 (Impacts from Weapons Noise) provides a full analysis of the potential impacts of weapon noise on birds. Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species for weapon noise during large-caliber weapons firing. Although there is a low likelihood that marbled murrelets and short-tailed albatross will occur in locations where the Navy conducts large-caliber gunnery activities, the mitigation will help the Navy further avoid or reduce potential impacts (e.g., startle response) on these ESA-listed bird species and other seabird species that occur offshore.

Section 3.4.2.1.5 (Impacts from Weapon Noise) and Section 3.5.2.1.5 (Impacts from Weapon Noise) of this Draft Supplemental provide an analysis of the potential impacts of weapon noise on marine mammals and sea turtles, respectively. As described in Section 3.0.5.3.1.3 (Weapons Firing, Launch, and Impact Noise) of the 2015 NWTT Final EIS/OEIS, underwater sounds from large-caliber weapons firing activities would be strongest just below the surface and directly under the firing point. Any sound that enters the water only does so within a narrow cone below the firing point or path of the projectile. The mitigation zone extends beyond the distance to which marine mammals and sea turtles would likely experience PTS or TTS from weapons firing noise; therefore, mitigation will help avoid or reduce the potential for exposure to these impacts. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone.

As described previously, the mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation for this activity. Increasing the mitigation zone would result in a larger area over which weapons firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times weapons firing would be ceased. However, increasing the mitigation zone size would not result in a substantial reduction of injurious impacts because the mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals.

Large-caliber gunnery training activities may involve a single ship firing or may be conducted as part of a larger exercise involving multiple ships. Surface ship crews learn to track targets (e.g., with radar), engage targets, practice defensive marksmanship, and coordinate their efforts within the context of larger activities. Increasing the number of times that the Navy must cease weapons firing during training would decrease realism and impact the ability for Navy Sailors to train and become proficient in using large-caliber guns as required during military missions and combat operations. For example, additional ceasing of the activity would reduce the crew's ability to react to changes in the tactical situation or respond to an incoming threat, which could result in a delay to the ship's training schedule. When training is undertaken in the context of a coordinated exercise involving multiple ships, degrading the value of one of the training element results in a degradation of the training value of the other training elements. These factors would ultimately impact the ability for units to meet their individual training and certification requirements, and the Navy's ability to certify forces to deploy to meet national security tasking.

In summary, the operational community determined that implementing procedural mitigation for weapons firing noise beyond what is detailed in Table 5.3-3 would be incompatible with the practicality assessment criteria for safety and mission requirements.

5.3.3 Explosive Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the explosives discussed in the sections below. Section 3.4.2.2 (Explosive Stressors), Section 3.5.2.2 (Explosive Stressors), and Section 3.6.2.2 (Explosive Stressors) provide a full analysis of the potential impacts of explosives on marine mammals, sea turtles, and birds, respectively, including predicted impact ranges. In addition to procedural mitigation, the Navy will implement mitigation for explosives within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations (e.g., within a specified distance from shore). Mitigation area requirements for explosives are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.3.1 Explosive Sonobuoys

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive sonobuoys, as outlined in Table 5.3-4. In the 2015 NWTT Final EIS/OEIS, explosive sonobuoys had two mitigation zone sizes based on net explosive weight and the associated average ranges to PTS. When developing mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the mitigation zone size by 250 yd. for sonobuoys using up to 2.5 lb. net explosive weight so that explosive sonobuoys will implement a 600 yd. mitigation zone, regardless of net explosive weight, to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-4. The mitigation zone for explosive sonobuoys is now based on the largest area within which it is practical to implement mitigation.

Table 5.3-4: Procedural Mitigation for Explosive Sonobuoys

Procedural Mitigation Description
Stressor or Activity • Explosive sonobuoys
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft or on a small boat • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.

Table 5.3-4: Procedural Mitigation for Explosive Sonobuoys (continued)

Procedural Mitigation Description
<u>Mitigation Requirements</u> • Mitigation zone: – 600 yd. around an explosive sonobuoy • Prior to the initial start of the activity (e.g., during deployment of a sonobuoy field, which typically lasts 20–30 min.): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of sonobuoy or source/receiver pair detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease sonobuoy or source/receiver pair detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonobuoy; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing mitigation for this Draft Supplemental, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. There are typically multiple platforms in the vicinity of activities that use explosive sonobuoys (e.g., safety aircraft). When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3

(Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Some activities that use explosive sonobuoys involve detonations of a single sonobuoy or sonobuoy pair, while other activities involve deployment of a field of sonobuoys that may be dispersed over a large distance. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing the mitigation zone around a single sonobuoy, sonobuoy pair, or a smaller sonobuoy field than when observing a sonobuoy field dispersed over a large distance. When observing large sonobuoy fields, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Bin E3 has the longest predicted impact ranges for explosive sonobuoys used in the Study Area (e.g., MK-61 SUS sonobuoys). For the largest explosive in bin E3, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E3. Smaller explosives in bin E3 and explosives in smaller source bins (E1) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. This is particularly true when observations occur from a small boat or during observations of a large field of sonobuoys. The use of additional personnel and equipment (aircraft or small boats) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive sonobuoys or an explosive sonobuoy field.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, during Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft (SUS) events, additional ceasing of the activity would not allow the Navy to effectively test sensors and systems that are used to detect and track submarines and ensure that systems perform to specifications and meet operational requirements. Such testing is required to ensure functionality and accuracy in military mission and combat conditions. Extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the activity length would extend by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive sonobuoys beyond what is detailed in Table 5.3-4 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.2 Explosive Torpedoes

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive torpedoes, as outlined in Table 5.3-5.

Table 5.3-5: Procedural Mitigation for Explosive Torpedoes

Procedural Mitigation Description
Stressor or Activity • Explosive torpedoes
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2,100 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during deployment of the target): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

Table 5.3-5: Procedural Mitigation for Explosive Torpedoes (continued)

Procedural Mitigation Description
• After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In the 2015 NWTT Final EIS/OEIS, the explosive torpedo mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action.

The post-activity observations for explosive torpedoes are a continuation from the 2015 NWTT Final EIS/OEIS and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive torpedoes, there are additional observation aircraft, support vessels (e.g., range craft for torpedo retrieval), or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources.

Explosive torpedo activities involve detonations at a target located down range of the firing platform. Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Some species of sea turtles forage on jellyfish, and some of the locations where explosive torpedo activities could occur support high densities of jellyfish throughout parts of the year. Observing for indicators of marine mammal and sea turtle presence (including jellyfish aggregations) will further help avoid or reduce potential impacts on these resources within the mitigation zone. The post-activity observations for marine mammals and sea turtles will help the Navy determine if any resources were injured during the activity.

Bin E11 has the longest predicted impact ranges for explosive torpedoes used in the Study Area. For the largest explosive in bin E11, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for low-frequency cetaceans, high-frequency cetaceans, and phocids. The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E11. Explosive torpedoes in smaller source bins (e.g., E8) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. The use of additional personnel and observation platforms would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive torpedoes.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, the Navy conducts Torpedo (Explosive) Testing events to test the functionality of torpedoes and torpedo launch systems. These events often involve aircrews locating, approaching, and firing a torpedo on an artificial target. They require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military missions and combat operations. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Therefore, an increase in mitigation would impede the Navy's ability to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive torpedoes beyond what is detailed in Table 5.3-5 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.3 Explosive Medium-Caliber and Large-Caliber Projectiles

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, and seabirds from explosive gunnery activities, as outlined in Table 5.3-6.

Table 5.3-6: Procedural Mitigation for Explosive Medium-Caliber and Large-Caliber Projectiles

Procedural Mitigation Description
Stressor or Activity • Gunnery activities using explosive medium-caliber and large-caliber projectiles   – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelets and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout on the vessel conducting the activity   – For activities using explosive large-caliber projectiles, depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.2 (Weapons Firing Noise) • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.

Mitigation Requirements
• Mitigation zones:
  – 200 yd. (for seabirds) or 600 yd. (for marine mammals and sea turtles) around the intended impact location for explosive medium-caliber projectiles
  – 1,000 yd. (for marine mammals and sea turtles) around the intended impact location for explosive large-caliber projectiles
• Prior to the initial start of the activity (e.g., when maneuvering on station):
  – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear.
  – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, relocate or delay the start of firing.
• During the activity:
  – Observe the mitigation zone for marine mammals, sea turtles, and seabirds; if observed, cease firing.
• Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity:
  – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 30 min. for vessel-based firing; or (4) for activities using mobile targets, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.
• After completion of the activity (e.g., prior to maneuvering off station):
  – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures.
  – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In the 2015 NWTT Final EIS/OEIS, explosive gunnery activity mitigation zones were based on guidance from the USFWS for seabirds and net explosive weight and the associate average ranges to PTS for marine mammals and sea turtles. When developing mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the marine mammal and sea turtle mitigation zone sizes by 400 yd. to enhance protections to the maximum extent practicable. These increases are reflected in Table 5.3-6. The marine mammal and sea turtle mitigation zones for explosive medium-caliber and large-caliber projectiles are now based on the largest areas within which it is practical to implement mitigation. The seabird mitigation zone remains consistent with USFWS guidance.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing the mitigation for this Draft Supplemental, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Large-caliber gunnery activities involve vessels firing projectiles at targets located up to 6 nautical miles (NM) down range. Medium-caliber gunnery activities in the Study Area involve vessels firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species and sea turtles when observing mitigation zones located at the furthest firing distances. The Navy will implement larger mitigation zones for large-caliber gunnery activities than for medium-caliber gunnery activities for marine mammals and sea turtles due to the nature of how the activities are conducted. During large-caliber gunnery activities, Lookouts typically have access to high-powered binoculars mounted on the ship deck. This will enable observation of the distant mitigation zone in combination with hand-held binoculars and naked-eye scanning. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during explosive medium-caliber weapons firing. Although there is a low likelihood that marbled murrelets and short-tailed albatross will occur in locations where the Navy conducts medium-caliber gunnery activities, the mitigation will help the Navy further avoid or reduce potential impacts on these ESA-listed bird species, as well as other seabird species that could occur offshore. The Navy will not implement mitigation for seabirds during explosive large-caliber gunnery events because Lookouts would not be effective at detecting seabirds from the distant firing location, even with the use of high-powered binoculars.

The mitigation applies only to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. Given the speed of the projectiles and mobile target, and the long ranges that projectiles typically travel, it is not possible to definitively predict or to effectively observe where the projectile fragments will fall. For gunnery activities using explosive medium-caliber and large-caliber projectiles, the potential military expended material fall zone can only be predicted within thousands of yards, which can be up to 6 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from the explosives because the detonations occur in air. Based on the extremely low potential for projectile fragments to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation for gunnery activities using airborne targets would not be effective at avoiding or reducing potential impacts.

Bin E5 (e.g., 5-in. projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 1,000 yd. mitigation zone. Bin E2 (e.g., 40-millimeter [mm] projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 600 yd. mitigation zone. The 1,000 yd. and 600 yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The 1,000 yd. and 600 yd. mitigation zones extend beyond the respective average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average ranges to PTS for high-frequency cetaceans. The mitigation zones also extend beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E5 and bin E2. Explosives in smaller source bins (e.g., E1) have shorter predicted impact ranges; therefore, the mitigation zones will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zones for marine mammals and sea turtles developed for this Draft Supplemental are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective. One of the mission-essential safety protocols for explosive gunnery activities is a requirement for event participants (including the Lookout) to maintain focus on the activity area to ensure safety of Navy personnel and equipment, and the public. The typical activity areas for medium-caliber and large-caliber gunnery activities coincide with the applicable mitigation zones; therefore, the Lookout can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity area. However, if the mitigation zone sizes increased, the Lookout would need to redirect attention to observe beyond the activity area. This would not meet the safety criteria since personnel would be required to direct attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities. Similarly, positioning platforms closer to the intended impact location would increase safety risks related to proximity to the detonation location and path of the explosive projectile.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times firing would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the Navy must train its gun crews to coordinate with other participating platforms (e.g., small boats launching a target, other firing platforms), locate and engage surface targets (e.g., remote controlled high-speed targets), and practice precise defensive marksmanship to disable threats.

Depending on the type of target being used, additional stopping of the activity could result in the target needing to be recovered and relaunched, which would cause a significant loss of training time. These types of impacts would reduce the number of opportunities that gun crews have to fire on the target and cause significant delays to the training schedule. Therefore, an increase in mitigation would impede the ability for gun crews to train and become proficient in using their weapons as required during military missions and combat operations and would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions). Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive medium-caliber and large-caliber projectiles beyond what is detailed in Table 5.3-6 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.4 Explosive Missiles

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive missiles, as outlined in Table 5.3-7.

Table 5.3-7: Procedural Mitigation for Explosive Missiles

Procedural Mitigation Description
<u>Stressor or Activity</u> • Aircraft-deployed explosive missiles   – Mitigation applies to activities using a surface target
<u>Resource Protection Focus</u> • Marine mammals • Sea turtles
<u>Number of Lookouts and Observation Platform</u> • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.

<u>Mitigation Requirements</u>
• Mitigation zone:
  – 2,000 yd. around the intended impact location
• Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone):
  – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear.
  – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing.
• During the activity:
  – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing.

Table 5.3-7: Procedural Mitigation for Explosive Missiles (continued)

Procedural Mitigation Description
• Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In the 2015 NWTT Final EIS/OEIS, the explosive missile mitigation zone was based on charge size and associated average ranges to PTS. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone for explosive missiles is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing the mitigation for this Draft Supplemental, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. For example, during typical explosive missile exercises, two aircraft circle the activity location. One aircraft clears the intended impact location while the other fires, and vice versa. A third aircraft is typically present for safety or proficiency inspections. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Missile exercises conducted under the Proposed Action involve firing munitions at a target typically located up to 15 NM down range, and infrequently up to 75 NM down range. Due to the distance between the mitigation zone and the observation platform, the Lookout will have a better likelihood of detecting marine mammals and sea turtles during close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

The mitigation applies to aircraft-deployed missiles because aircraft can fly over the intended impact area prior to commencing firing. Mitigation would be ineffective for vessel-deployed missiles because of the inability for a Lookout to detect marine mammals or sea turtles from a vessel from the distant firing position. It would not be effective or practical to have a vessel conduct close-range observations of the mitigation zone prior to firing due to the length of time it would take to complete observations and transit back to the firing position, and the costs associated with increased fuel consumption.

The mitigation applies to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. For example, telemetry-configured anti-air missiles used in training are designed to detonate or simulate a detonation near a target, but not as a result of a direct strike on a target. Given the speed of missiles and mobile targets, the high altitudes involved, and the long ranges that missiles typically travel, it is not possible to definitively predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be 75 NM from the firing location; and thousands of yards for short range events, which can occur 15 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from explosives because the detonations occur in air. Based on the extremely low potential for military expended materials to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation would not be effective at avoiding or reducing impacts.

Bin E10 (e.g., Harpoon missiles) has the longest predicted impact ranges for explosive missiles used in the Study Area. The 2,000 yd. mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E10.

As described previously, the mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., aircraft) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Similarly, positioning platforms closer to the intended impact location (as would be required if mitigation applied to vessel-deployed missiles) would increase safety risks related to proximity to the detonation location and path of the explosive missile.

Increasing the mitigation zone size would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. Explosive missile events require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military missions and combat operations. For activities using missiles in the larger net explosive weight category, the flyover distance between the mitigation zone and the firing location can extend upwards of 75 NM; therefore, even aircraft with larger fuel capacities would need to depart the activity area to refuel if the length of the activity was extended. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness of the activity area and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. These types of impacts would cause a significant loss of training or testing time, reduce the number of opportunities that aircrews have to fire on the target, and cause a significant delay to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons as required during military missions and combat operations, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive missiles beyond what is detailed in Table 5.3-7 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.5 Explosive Bombs

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive bombs, as outlined in Table 5.3-8. In the 2015 NWTT Final EIS/OEIS, the explosive bombing mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone for explosive bombs is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone under the Proposed Action.

Table 5.3-8: Procedural Mitigation for Explosive Bombs

Procedural Mitigation Description
Stressor or Activity • Explosive bombs
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in the aircraft conducting the activity • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2,500 yd. around the intended target • Prior to the initial start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment. • During the activity (e.g., during target approach): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of this activity. In accordance with the 2015 NWTT Final EIS/OEIS consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. When developing mitigation for this Draft Supplemental, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Bombing exercises involve an aircraft deploying munitions at a surface target located beneath the firing platform. During target approach, aircraft maintain a relatively steady altitude of approximately 1,500 ft. Lookouts, by necessity for safety and mission success, primarily focus their attention on the water surface surrounding the intended detonation location (i.e., the mitigation zone). Being positioned in an aircraft gives the Lookout a good vantage point for observing marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Bin E10 (e.g., 500 lb. bomb) has the longest predicted impact ranges for explosive bombs used in the Study Area. The 2,500 yd. mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest bombs in bin E10. Smaller bombs in bin E10 (e.g., 250 lb. bomb) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and aircraft would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of the intended explosive bomb detonation location.

Increasing the mitigation zone would result in a larger area over which explosive bomb deployment would need to be ceased in response to a sighting, and therefore would likely increase the number of times explosive bombing activities would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, critical components of a Bombing Exercise Air-to-Surface training activity are the assembly, loading, delivery, and assessment of an explosive bomb. The activity requires focused situational awareness of the activity area and continuous coordination between multiple training components. The training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and loading munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity area to refuel, aircrew would lose the ability to maintain situational awareness of the activity area, effectively coordinate with other participating platforms, and complete all training components as required during military missions and combat operations. If multiple refueling events were required, the activity length would be extended by two to five times or more, which would cause a significant loss of training time and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. This would reduce the number of opportunities that aircrews have to approach targets and deploy bombs, which would cause a significant delay to the training schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons. This would prevent units from meeting their individual training and certification requirements and deploying with the required level of readiness necessary to accomplish their missions. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive bombs beyond what is detailed in Table 5.3-8 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.6 Explosive Mine Countermeasure and Neutralization Activities

The Navy has developed new procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive mine countermeasure and neutralization activities, as outlined in Table 5.3-9. The mitigation applies to all explosive mine countermeasure and neutralization activities except those that involve the use of Navy divers, which are discussed in Section 5.3.3.7 (Explosive Mine Neutralization Activities Involving Navy Divers).

The types of charges used in these activities are positively controlled, which means the detonation is controlled by the personnel conducting the activity and is not authorized until the mitigation zone is clear at the time of detonation. When developing the new mitigation for this Draft Supplemental, the Navy analyzed a range of potential mitigation zone sizes for the type of explosives used during explosive mine countermeasure and neutralization activities under the Proposed Action. The Navy will adopt mitigation zones that are consistent with the ones used during comparable activities in other at-sea training and testing Study Areas. The mitigation zones for explosive mine countermeasure and neutralization activities are based on the largest areas within which it is practical for the Navy to implement mitigation during the types of activities conducted under the Proposed Action. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The post-activity observations will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Table 5.3-9: Procedural Mitigation for Explosive Mine Countermeasure and Neutralization Activities

Procedural Mitigation Description
Stressor or Activity • Explosive mine countermeasure and neutralization activities
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on a vessel or in an aircraft when implementing the smaller mitigation zone • 2 Lookouts (one positioned in an aircraft and one on a small boat) when implementing the larger mitigation zone • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 600 yd. around the detonation site for activities using ≤ 5 lb. net explosive weight – 2,100 yd. around the detonation site for activities using > 5–60 lb. net explosive weight • Prior to the initial start of the activity (e.g., when maneuvering on station; typically, 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to detonation site; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (typically 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

For the 600 yd. mitigation zone, the small observation area and proximity to the observation platform will result in a high likelihood that the Lookout will be able to detect marine mammals and sea turtles throughout the mitigation zone (regardless of the type of observation platform used). For the 2,100 yd. mitigation zone, the Lookout on a small boat will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) or splashes of individual marine mammals than cryptic marine mammal species and sea turtles near the mitigation zone perimeter, while the Lookout positioned in an aircraft will help increase the chance that marine mammals and sea turtles will be detected throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Bin E7 (e.g., 60 lb. mine) has the longest predicted impact ranges for explosives that apply to the 2,100 yd. mitigation zone. Bin E4 (e.g., 5 lb. net explosive weight charge) has the longest predicted impact ranges for explosives that apply to the 600 yd. mitigation zone. The 2,100 yd. and 600 yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The 2,100 yd. mitigation zone extends beyond the respective average ranges to PTS for sea turtles, low-frequency cetaceans, mid-frequency cetaceans, otariids, and phocids, and into a portion of the average ranges to PTS for high-frequency cetaceans. The 600 yd. mitigation zone extends beyond the respective average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for low-frequency cetaceans, high-frequency cetaceans, and phocids. The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E7 and bin E4. Smaller explosives within bin E7 and bin E4 have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the mitigation zones developed for this Draft Supplemental are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., small boats, aircraft) would be unsustainable due to increased operational costs and an exceedance of available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence observation vessels within the vicinity of detonations.

Increasing the mitigation zone sizes would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish realism in a way that would prevent the activity from meeting its intended objectives. For example, Mine Countermeasure and Neutralization Testing events require focused situational awareness of the activity area and coordination of tactics between amphibious warfare ships, mine warfare ships, surface combatants, and rotary-wing aircraft crews to ensure systems can effectively neutralize threat mines and mine-like objects. During these events, personnel evaluate the system’s ability to detect and destroy mines from an airborne mine countermeasures-capable rotary-wing aircraft in advance of delivery to the fleet for operational use. Extending the length of these activities would require aircraft to depart the activity area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more. This would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft.

These types of impacts would result in a significant loss of testing time (which would reduce the Navy's ability to validate whether mine neutralization systems perform as expected) and cause a significant delay to the testing schedule. Therefore, an increase in mitigation would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activities would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive mine countermeasure and neutralization activities beyond what is detailed in Table 5.3-9 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.7 Explosive Mine Neutralization Activities Involving Navy Divers

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, seabirds, and fish from explosive mine neutralization activities involving Navy divers as outlined in Table 5.3-10. Navy divers participating in these activities may be explosive ordnance disposal personnel.

Table 5.3-10: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers

Procedural Mitigation Description
Stressor or Activity • Explosive mine neutralization activities involving Navy divers
Resource Protection Focus • Marine mammals • Seabirds (marbled murrelets) • Fish (bull trout and salmonids)
Number of Lookouts and Observation Platform • 2 Lookouts on one small boat for activities using < 0.1 lb. net explosive weight, one of which will be a Navy biologist • 2 Lookouts on two small boats with one Lookout each, one of which will be a Navy biologist, for activities using > 0.5–2.5 lb. net explosive weight • All divers placing the charges on mines will support the Lookouts while performing their regular duties and will report applicable sightings to the lead Lookout, the supporting small boat, or the Range Safety Officer. • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 100 yd. (for seabirds) around the detonation site during activities using < 0.1 lb. net explosive weight – 400 yd. (seabirds) or 500 yd. (marine mammals) around the detonation site during activities using > 0.5–2.5 lb. net explosive weight • Prior to the initial start of the activity (starting 30 min. before the first planned detonation): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear.

Table 5.3-10: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers (continued)

Procedural Mitigation Description
– Observe the mitigation zone for marine mammals and seabirds; if observed, relocate or delay the start of detonations. – Pre-event observations of the mitigation zones for seabirds will include naked eye scanning along transect lines no more than 50 meters (m) wide using vessel speeds between 5 and 10 knots. – The Navy will ensure the area is clear of marine mammals for 30 min. prior to commencing a detonation. – A Navy biologist will serve as the lead Lookout and will make the final determination that the mitigation zone is clear of any biological resource sightings prior to the commencement of a detonation. The Navy biologist will maintain radio communication with the unit conducting the event and the other Lookout. • During the activity: – Observe the mitigation zone for marine mammals and seabirds; if observed, cease detonations. – To the maximum extent practicable depending on mission requirements, safety, and environmental conditions, boats will position themselves near the mid-point of the mitigation zone radius (but outside of the detonation plume and human safety zone), will position themselves on opposite sides of the detonation location (when two boats are used), and will travel in a circular pattern around the detonation location with one Lookout observing inward toward the detonation site and the other observing outward toward the perimeter of the mitigation zone. – The Navy will use only positively controlled charges (i.e., no time-delay fuses). – The Navy will use the smallest practicable charge size for each activity. – Activities will be conducted in Beaufort Sea state number 2 conditions or better and will not be conducted in low visibility conditions. • Commencement/recommencement conditions after a marine mammal or seabird sighting before or during the activity: – The Navy will allow a sighted marine mammal or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the detonation site; or (3) the mitigation zone has been clear from any additional sightings for 30 min. • After each detonation and the completion of an activity (for 30 min): – Observe the vicinity of where detonations occurred and immediately downstream of the detonation location; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred. – If any injured or dead seabirds or fish are observed, notify the appropriate Navy Region Environmental Director, Navy Pacific Fleet Environmental Office, and local base wildlife biologist and include information on the number of adults or juveniles and species, if possible. – The Navy will submit a mitigation summary report to the USFWS after the completion of each activity.

Table 5.3-10: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers (continued)

Procedural Mitigation Description
• Additional requirements: – At the Hood Canal Explosive Ordnance Disposal Range and Crescent Harbor Explosive Ordnance Disposal Range, naval units will obtain permission from the appropriate designated Command authority prior to conducting explosive mine neutralization activities involving the use of Navy divers. – At the Hood Canal Explosive Ordnance Disposal Range, during February, March, and April (the juvenile migration period for Hood Canal summer-run chum), the Navy will not use > 0.5–2.5 lb. net explosive weight detonations. – At the Hood Canal Explosive Ordnance Disposal Range, during August, September, and October (the adult migration period for Hood Canal summer-run chum and Puget Sound Chinook), the Navy will avoid using > 0.5–2.5 lb. net explosive weight detonations to the maximum extent practicable unless necessitated by mission requirements. • At the Crescent Harbor Explosive Ordnance Disposal Range, the Navy will conduct explosive activities at least 1,000 m from the closest point of land to avoid or reduce impacts on fish (e.g., bull trout) in nearshore habitat areas.

In the 2015 NWTT Final EIS/OEIS, the marine mammal mitigation zone for explosive mine neutralization activities involving Navy divers was based on net explosive weight and the associated average ranges to PTS. The seabird mitigation zones were based on guidance from the USFWS. Mitigation does not apply to sea turtles or short-tailed albatross because they are not likely to occur at the locations where the Navy conducts explosive mine neutralization activities involving Navy divers in the Study Area. When developing the mitigation for this Draft Supplemental, the Navy analyzed the potential for increasing the size of the marine mammal mitigation zone. The Navy identified an opportunity to increase the marine mammal mitigation zone by 100 yd. to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-10. The marine mammal mitigation zone for explosive mine neutralization activities involving the use of Navy divers is now based on the largest area within which it is practical to implement mitigation for the charge sizes used under the Proposed Action. The seabird mitigation zones remain consistent with USFWS guidance. The post-activity observations are a continuation from the 2015 NWTT Final EIS/OEIS and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for this activity.

The charges used during explosive mine neutralization activities involving Navy divers in the Study Area are all positively controlled, which means that the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation. This will allow Lookouts time to continuously observe the mitigation zone for biological resources right up to the point of detonation. By using the smallest practicable positive control charge for each activity (e.g., using 1.5 lb. net explosive weight in place of 2.5 lb. net explosive weight if the training objective can still be met), the Navy will be able to minimize potential impacts while maintaining the ability to accomplish the required training objectives. The pre-activity observations will typically entail a line transect survey (with each transect being no more than approximately 50 m wide) at speeds ranging between approximately 5–10 knots. The primary Lookouts for this activity will not include the boat drivers; however, the boat drivers will support the Lookouts while performing their regular duties. The small observation area and proximity to observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zone. Observing for indicators of marine mammal presence will further help avoid or reduce impacts on these resources within the mitigation zone.

Conducting activities in Beaufort sea state number 2 conditions or better (i.e., good visibility conditions) and having the Navy divers, boat drivers, and other personnel (typically four to five people per unit) support the Lookouts while performing their regular duties will increase the likelihood that marine mammals and seabirds will be detected prior to and during the activity. Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during this activity. The mitigation for fish will help the Navy avoid or reduce impacts on bull trout year-round at the Crescent Harbor Explosive Ordnance Disposal Range and during seasonal salmonid migrations at the Hood Canal Explosive Ordnance Disposal Range.

Bin E3 has the longest predicted impact ranges for explosives used for these activities in the Study Area. The 500 yd. mitigation zone extends beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for marine mammals. The mitigation zone extends beyond the average ranges to PTS for low-frequency cetaceans, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans and phocids. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E3. Smaller explosives within bin E3 have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the marine mammal mitigation zone developed for this Draft Supplemental is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. Because mine neutralization activities involve training Navy divers in the safe handling of explosive charges, one of the mission-essential safety protocols required of all event participants, including Lookouts, is to maintain focus on the activity area to ensure safety of personnel and equipment. The typical mine neutralization activity area coincides with the marine mammal mitigation zone size developed for this Draft Supplemental; therefore, Lookouts can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity area. However, if the marine mammal mitigation zone size increased, Lookouts would need to redirect their attention beyond the activity area. This would not meet the safety criteria since personnel would be required to direct their attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased. This would extend the length of the activities and cause significant safety risks for Navy divers and loss of training time. Ceasing an activity (e.g., fuse initiation) with divers in the water would have safety implications for diver air consumption and bottom time. It would also impede the ability for Navy divers to complete the training exercise with the focused endurance as required during military missions and combat operations. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the number of opportunities that divers would have to locate and neutralize mines would be reduced. Divers would then not be able to gain skill proficiency in precise identification and evaluation of a threat mine, safe handling of explosive material during charge placement, and effective charge detonation or fuse initiation. Mine neutralization activities involving the use of Navy divers only take place during daylight hours for safety reasons; therefore, extending the length of the activity could delay the activity into the next day or next several days, which would significantly impact training schedules for all participating platforms. Therefore, an increase in mitigation would impede the ability for Navy divers to train and become proficient in mine neutralization and would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions).

In summary, the operational community determined that implementing procedural mitigation for explosive mine neutralization activities involving Navy divers beyond what is detailed in Table 5.3-10 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.4 Physical Disturbance and Strike Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the physical disturbance and strike stressors or activities discussed in the sections below. Section 3.4.2.4 (Impacts from Physical Disturbance and Strike), Section 3.5.2.4 (Physical Disturbance and Strike Stressors), and Section 3.6.2.4 (Physical Disturbance and Strike Stressors) provide a full analysis of the potential impacts of physical disturbance and strikes on marine mammals, sea turtles, and birds, respectively. In addition to procedural mitigation, the Navy will implement mitigation for physical disturbance and strike within mitigation areas, such as requirements to prohibit or limit certain activities in certain locations (e.g., within a specified distance from shore). Mitigation area requirements for physical disturbance and strike stressors are detailed in Appendix K (Geographic Mitigation Assessment).

5.3.4.1 Vessel Movement

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for vessel strikes of marine mammals and sea turtles, as outlined in Table 5.3-11.

Table 5.3-11: Procedural Mitigation for Vessel Movement

Procedural Mitigation Description
Stressor or Activity • Vessel movement – The mitigation will not be applied if: (1) the vessel's safety is threatened, (2) the vessel is restricted in its ability to maneuver (e.g., during launching and recovery of aircraft or landing craft, during towing activities, when mooring, during Transit Protection Program exercises or other events involving escort vessels), (3) the vessel is operated autonomously, or (4) when impractical based on mission requirements (e.g., during test body retrieval by range craft).
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout on the vessel that is underway
Mitigation Requirements • Mitigation zones: – 500 yd. (for surface ships) around whales – 200 yd. (for surface ships) around other marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – 100 yd. (for small boats, such as range craft) around marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – Within the vicinity of sea turtles • During the activity: – When underway, observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance. • Additional requirements: – Prior to Small Boat Attack exercises at Naval Station Everett, Naval Base Kitsap Bangor, or Naval Base Kitsap Bremerton, Navy event planners will coordinate with Navy biologists during the event planning process. Navy biologists will work with NMFS to determine the likelihood of marine mammal presence in the planned training location. Navy biologists will notify event planners of the likelihood of species presence as they plan specific details of the event (e.g., timing, location, duration). The Navy will provide additional environmental awareness training to event participants. The training will alert participating ship and aircraft crews to the possible presence of marine mammals in the training location. Lookouts will use the information to assist their visual observation of applicable mitigation zones and to aid in the implementation of procedural mitigation. – If a marine mammal or sea turtle vessel strike occurs, the Navy will follow the established incident reporting procedures.

The procedural mitigation measures for vessel movement are a continuation from the 2015 NWTT Final EIS/OEIS based on the largest area within which it is practical for the Navy to implement mitigation and guidance from NMFS for vessel strike avoidance. The Navy is clarifying in the table that the mitigation zones for training activities will be the same as the mitigation zones for testing activities under the Proposed Action. Although the Navy is unable to position Lookouts on unmanned vessels, as a standard operating procedure, some vessels that operate autonomously have embedded sensors that aid in avoidance of large objects. The embedded sensors may help those unmanned vessels avoid vessel strikes of marine mammals.

As discussed in Section 5.3.1 (Environmental Awareness and Education), it is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, has contributed to a

Navy-wide reduction of vessel strikes of marine mammals across areas where the Navy trains and tests. The Navy is able to detect if a whale is struck due to the diligence of standard watch personnel and Lookouts stationed specifically to observe for marine mammals while a vessel is underway. In the unlikely event that a vessel strike of a marine mammal occurs, the Navy will notify the appropriate regulatory agency immediately or as soon as operational security considerations allow per the established incident reporting procedures described in Section 5.1.2.2.3 (Incident Reports). The Navy's incident reports include relevant information pertaining to the incident, including but not limited to vessel speed.

The mitigation zones for marine mammals is smaller for small boats to account for variations in mission requirements and activity locations (e.g., range craft operating in a narrow channels). Similarly, a mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements. The small mitigation zone sizes and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zones while vessels are underway. Mitigation for Small Boat Attack exercises includes Navy biologists working with NMFS and Navy event planners to consider the likelihood of marine mammal presence as specific details of the event are planned (e.g., timing, location, duration), which will help the Navy further avoid or reduce potential impacts on marine mammals in NWTT Inland Waters.

As described in Section 5.1.2 (Vessel Safety) of the 2015 NWTT Final EIS/OEIS, Navy vessels are required to operate in accordance with applicable navigation rules. Applicable rules include the Inland Navigation Rules (33 Code of Federal Regulations 83) and International Regulations for Preventing Collisions at Sea (72 COLREGS), which were formalized in the Convention on the International Regulations for Preventing Collisions at Sea, 1972. These rules require that vessels proceed at a safe speed so proper and effective action can be taken to avoid collision and so vessels can be stopped within a distance appropriate to the prevailing circumstances and conditions. In addition to complying with navigation requirements, Navy ships transit at speeds that are optimal for fuel conservation, to maintain ship schedules, and to meet mission requirements. Vessel captains use the totality of the circumstances to ensure the vessel is traveling at appropriate speeds in accordance with navigation rules. Depending on the circumstances, this may involve adjusting speeds during periods of reduced visibility or in certain locations.

Navy vessel operators need to train to proficiently operate vessels as they would during military missions and combat operations, including being able to react to changing tactical situations and evaluate system capabilities. For example, during training activities involving flight operations from an aircraft carrier, the vessel must maintain a certain wind speed over the deck to launch or recover aircraft. Depending on wind conditions, the aircraft carrier itself must travel at a certain speed to generate the wind required to launch or recover aircraft. Implementing vessel speed restrictions would increase safety risks for Navy personnel and equipment and the public during the training event and would reduce skill proficiency in a way that would increase safety risks during military missions and combat operations. Furthermore, vessel speed restrictions would not allow the Navy to continue meeting its training requirements due to diminished realism of training exercises.

The Navy needs to test the full range of its vessel and system capabilities to ensure safety and functionality in conditions analogous to military missions and combat operations. For example, during non-explosive torpedo testing activities, the Navy must operate its vessels using speeds typical of military missions and combat operations to accurately test the functionality of its acoustic countermeasures and torpedo systems during firing. Vessel speed restrictions would not allow the Navy to continue meeting its testing program requirements due to diminished realism of testing events.

Researchers, program managers, and weapons system acquisition programs would be unable to conduct accurate acoustic research to meet research objectives and effectively test vessels and vessel-deployed systems and platforms before full-scale production or delivery to the fleet. Such testing is required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

In summary, the operational community determined that implementing procedural mitigation for vessel movements beyond what is detailed in Table 5.3-11 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.4.2 Towed In-Water Devices

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from towed in-water devices, as outlined in Table 5.3-12. Vessels involved in towing in-water devices will implement the mitigation described in Section 5.3.4.1 (Vessel Movement), in addition to the mitigation outlined in Table 5.3-12.

Table 5.3-12: Procedural Mitigation for Towed In-Water Devices

Procedural Mitigation Description

<u>Stressor or Activity</u>
• Towed in-water devices
  – Mitigation applies to devices towed from a manned surface platform or manned aircraft, or when a manned support craft is already participating in an activity involving in-water devices being towed by unmanned platforms
  – The mitigation will not be applied if the safety of the towing platform or in-water device is threatened

<u>Resource Protection Focus</u> • Marine mammals • Sea turtles
<u>Number of Lookouts and Observation Platform</u> • 1 Lookout positioned on the towing platform or support craft

<u>Mitigation Requirements</u>
• Mitigation zones:
  – 250 yd. (for in-water devices towed by aircraft or surface ships) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels)
  – 100 yd. (for in-water devices towed by small boats, such as range craft) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels).
  – Within the vicinity of sea turtles
• During the activity (i.e., when towing an in-water device)
  – Observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance.

The mitigation zones for towed in-water devices are a continuation from the 2015 NWTT Final EIS/OEIS based on the largest area within which it is practical for the Navy to implement mitigation. The Navy is clarifying in the table that the mitigation zones for training and testing activities will be the same under the Proposed Action. The small mitigation zone sizes and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zones. The mitigation zone for marine mammals is smaller for in-water devices that are towed by small boats to account for variations in mission requirements and activity locations (e.g., range craft operating in a narrow channels). Similarly, a mitigation zone size is not specified for sea turtles to allow flexibility based on towing platform type and mission requirements.

Mission and safety requirements determine the operational parameters (e.g., course) for in-water device towing platforms. Towed-in water devices must be towed at certain speeds and water depths for stability, which are controlled in part by the towing platform's speed and directional movements. Because these devices are towed and not self-propelled, they generally have limited maneuverability and are not able to make immediate course corrections. For example, a high degree of pilot skill is required when rotary-wing aircraft are deploying in-water devices, safely towing them at relatively low speeds and altitudes, and recovering them. The aircraft can safely alter course to shift the route of the towed device in response to a sighted marine mammal or sea turtle up to a certain extent (i.e., up to the size of the mitigation zone) while still maintaining the parameters needed for stable towing. However, the aircraft would be unable to further alter its course to more drastically course-correct the towed device without decreasing towing stability, which would have implications for safety of personnel and equipment.

In summary, the operational community determined that implementing procedural mitigation for towed in-water devices beyond what is detailed in Table 5.3-12 would be incompatible with the practicality assessment criteria for safety.

5.3.4.3 Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals, sea turtles, and seabirds from small-, medium-, and large-caliber non-explosive practice munitions, as outlined in Table 5.3-13.

The mitigation zone is conservatively designed to be several times larger than the impact footprint for large-caliber non-explosive practice munitions, which are the largest projectiles used for these activities. Small-caliber and medium-caliber non-explosive practice munitions have smaller impact footprints than large-caliber non-explosive practice munitions; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles.

Large-caliber gunnery activities involve vessels firing projectiles at a target located up to 6 NM down range. Small- and medium-caliber gunnery activities involve vessels or aircraft firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing mitigation zones around targets located close to the firing platform. When observing activities that use a target located far from the firing platform, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone. Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

Table 5.3-13: Procedural Mitigation for Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

Procedural Mitigation Description
Stressor or Activity • Gunnery activities using small-, medium-, and large-caliber non-explosive practice munitions   – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles • Seabirds (marbled murrelets and short-tailed albatross)
Number of Lookouts and Observation Platform • 1 Lookout positioned on the platform conducting the activity   – Depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.2 (Weapons Firing Noise)

Mitigation Requirements
• Mitigation zone:
  – 200 yd. around the intended impact location
• Prior to the initial start of the activity (e.g., when maneuvering on station):
  – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear.
  – Observe the mitigation zone for marine mammals and sea turtles (small-, medium-, and large-caliber activities) and seabirds (small- and medium-caliber activities); if observed, relocate or delay the start of firing.
• During the activity:
  – Observe the mitigation zone for marine mammals and sea turtles (small-, medium-, and large-caliber activities) and seabirds (small- and medium-caliber activities); if observed, cease firing.
• Commencement/recommencement conditions after a marine mammal, sea turtle, or seabird sighting before or during the activity:
  – The Navy will allow a sighted marine mammal, sea turtle, or seabird to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-based firing or 30 min. for vessel-based firing; or (4) for activities using a mobile target, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

Due to the difficulty of differentiating bird species, the Navy will implement mitigation for all seabird species during non-explosive small- and medium-caliber weapons firing. The mitigation will help the Navy further avoid or reduce potential impacts on ESA-listed marbled murrelets and short-tailed albatross and other seabird species that occur offshore. The Navy will not implement mitigation for seabirds during non-explosive large-caliber gunnery events because Lookouts would not be effective at detecting seabirds from the distant firing location, even with the use of high-powered binoculars.

5.3.4.4 Non-Explosive Missiles

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive missiles, as outlined in Table 5.3-14. The mitigation zone for non-explosive missiles is conservatively designed to be several times larger than the impact footprint for the largest non-explosive missile used for these activities. Smaller non-explosive missiles have smaller impact footprints than the largest non-explosive missile used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles.

Table 5.3-14: Procedural Mitigation for Non-Explosive Missiles

Procedural Mitigation Description
Stressor or Activity • Aircraft-deployed non-explosive missiles – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft
Mitigation Requirements • Mitigation zone: – 900 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

Mitigation applies to activities using non-explosive missiles fired from aircraft at targets that are typically located up to 15 NM down range, and infrequently up to 75 NM down range. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting marine mammals and sea turtles during the close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone during the close-range observations. The mitigation only applies to aircraft-deployed missiles for the reasons discussed in Section 5.3.3.4 (Explosive Missiles). Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

5.3.4.5 Non-Explosive Bombs and Mine Shapes

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive bombs and mine shapes, as outlined in Table 5.3-15.

Table 5.3-15: Procedural Mitigation for Non-Explosive Bombs and Mine Shapes

Procedural Mitigation Description
Stressor or Activity • Non-explosive bombs • Non-explosive mine shapes during mine laying activities
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft
Mitigation Requirements • Mitigation zone: – 1,000 yd. around the intended target • Prior to the initial start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment or mine laying. • During the activity (e.g., during approach of the target or intended minefield location): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment or mine laying. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment or mine laying) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target or minefield location; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

The mitigation zone for non-explosive bombs and mine shapes is conservatively designed to be several times larger than the impact footprint for the largest non-explosive bomb used for these activities. Smaller non-explosive bombs and mine shapes have smaller impact footprints than the largest non-explosive bomb used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller military expended materials. Activities involving non-explosive bombing and mine laying involve aircraft deploying munitions or mine shapes from a relatively steady altitude of approximately 1,500 ft. at a surface target or in an intended minefield located beneath the aircraft. Due to the mitigation zone size, proximity to the observation platform, and the good vantage point from an aircraft, Lookouts will be able to observe the entire mitigation zone during approach of the target or intended minefield location. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone.

5.4 Mitigation Areas to be Implemented

A draft biological assessment and operational analysis of mitigation areas that the Navy considered for the Study Area is provided in Appendix K (Geographic Mitigation Assessment). The Navy will finalize development of its mitigation areas during the consultation and permitting processes and will summarize all finalized measures in this section of the Final Supplemental.

5.5 Measures Considered but Eliminated

As described in Section 5.2 (Mitigation Development Process), the Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, the mitigation will be effective at avoiding or reducing impacts and practical to implement. The assessment included consideration of mitigation recommendations received during scoping on this Proposed Action or through public comments and consultations on past environmental compliance documents applicable to the Study Area. The operational community determined that implementing procedural mitigation beyond what is detailed in Section 5.3 (Procedural Mitigation to be Implemented) would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements. Information about why implementing additional mitigation measures for active sonar, explosives, active and passive acoustic monitoring devices, thermal detection systems, third-party observers, foreign navy mitigation, and reporting requirements would be impractical is provided in the sections below. A draft biological assessment and operational analysis of mitigation areas that the Navy considered for the Study Area is provided in Appendix K (Geographic Mitigation Assessment) and will be summarized in Section 5.4 (Mitigation Areas to be Implemented) of the Final Supplemental.

When analyzing all potential mitigation measures collectively, the operational community determined that adopting certain mitigation measures would result in the Navy losing utilization of sea space and airspace required to support training and testing of naval forces in the Study Area. Certain measures would restrict or prohibit Navy training and testing throughout most of the Study Area except in very narrow circumstances. For example, blanket limitations or restrictions on the level, number, or timing (seasonal or time of day) of training and testing activities within discrete or broad-scale areas of water (e.g., embayments and large swaths of the littorals and open ocean), or other areas vital to mission requirements would prevent the Navy from accessing its ranges, operating areas, facilities, or range support structures necessary to meet the purpose and need of the Proposed Action. As described in Section 5.2.3 (Practicality of Implementation), the Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances such that these activities do not interfere with one another, and so that Navy units can train to communicate and operate in a coordinated fashion over tens or hundreds of square miles, as required during military missions and combat operations. The Navy also needs to maintain access to sea space with the unique, challenging, and diverse environmental and oceanographic features (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature) analogous to military mission and combat conditions to achieve the highest skill proficiency and most accurate testing results possible.

Threats to national security are constantly evolving. The Navy requires the ability to adapt training and testing to meet these emerging threats. Restricting access to broad-scale areas of water would impact the ability for Navy training and testing to evolve as threats evolve. Eliminating opportunities for the Navy to train and test in a myriad of at-sea conditions would put U.S. forces at a tactical disadvantage during military missions and combat operations. This would also present a risk to national security if potential adversaries were to be alerted to the environmental conditions within which the U.S. Navy is prohibited from training and testing. Restricting large areas of ocean or other smaller areas that are critical to Navy training and testing would make training and concealment much more difficult and would adversely impact the Navy's ability to perform its statutory mission.

5.5.1 Active Sonar

When assessing and developing mitigation, the Navy considered reducing active sonar training and testing hours, modifying active sonar sound sources, implementing time-of-day restrictions and restrictions during surface ducting conditions, replacing active sonar training and testing with synthetic activities (e.g., computer simulated training), and implementing active sonar ramp-up procedures. The Navy determined that it would be practical to implement certain restrictions on the use of active sonar in the Study Area, as detailed in Section 5.3.2.1 (Active Sonar) and Appendix K (Geographic Mitigation Assessment). As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix A (Navy Activities Descriptions), and Appendix K (Geographic Mitigation Assessment), training and testing activities are planned and scheduled based on numerous factors and data inputs, such as compliance with the Optimized Fleet Response Plan. Information on why training and testing with active sonar is essential to national security is presented in Section 5.3.2.1 (Active Sonar). The Navy uses active sonar during military readiness activities only when it is essential to training missions or testing program requirements since active sonar has the potential to alert opposing forces to the operating platform's presence. Passive sonar and other available sensors are used in concert with active sonar to the maximum extent practicable.

The Navy currently uses, and will continue to use, computer simulation to augment training and testing whenever possible. As discussed in Section 1.4.1 (Why the Navy Trains), simulators and synthetic training are critical elements that provide early skill repetition and enhance teamwork; however, they cannot duplicate the complexity faced by Sailors during military missions and combat operations for the types of active sonar used under the Proposed Action (e.g., hull-mounted mid-frequency active sonar). Just as a pilot would not be ready to fly solo after simulator training, operational Commanders cannot allow military personnel to engage in military missions and combat operations based merely on simulator training. Similarly, in testing a system that is being developed, simulation can be used during the initial stages of development, but ultimately the system must be tested under conditions analogous to those faced during military missions and combat operations. Systems that have undergone maintenance need to be tested, and not simulated, to ensure that the system is operating correctly.

Sonar operators must train to effectively handle bottom bounce and sound passing through changing currents, eddies, and across changes in ocean temperature, pressure, salinity, depth, and in surface ducting conditions. Sonar systems must be tested in these conditions to ensure functionality and accuracy in military mission and combat conditions. The Navy tests its active sonar systems in areas analogous to where the Navy trains and operates. This includes a nighttime testing requirement for some active sonar systems, and a requirement to test in a variety of locations and environmental conditions depending on the testing program objectives. Training and testing in both good visibility (e.g., daylight, favorable weather conditions) and low visibility (e.g., nighttime, inclement weather conditions) is vital because environmental differences between day and night and varying weather conditions affect sound propagation and the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day. This affects sound propagation and could affect how sonar systems function and are operated.

Submarines may hide in the higher ambient noise levels of shallow coastal waters and surface ducts. Surface ducting occurs when water conditions, such as temperature layers and lack of wave action, result in little sound energy penetrating beyond a narrow layer near the surface of the water. Avoiding surface ducting conditions would be impractical because ocean conditions contributing to surface ducting change frequently, and surface ducts can be of varying duration. Surface ducting can also lack uniformity and may or may not extend over a large geographic area, making it difficult to determine where to reduce power and for what periods. Submarines have long been known to take advantage of the phenomena associated with surface ducting to avoid being detected by sonar. When surface ducting occurs, active sonar becomes more useful near the surface but less useful at greater depths. As noted by the U.S. Supreme Court in *Winter v. Natural Resources Defense Council Inc.*, 555 U.S. 7 (2008), because surface ducting conditions occur relatively rarely and are unpredictable, it is especially important for the Navy to be able to train under these conditions when they occur. Training with active sonar in these conditions is a critical component of military readiness because sonar operators need to learn how sonar transmissions are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively under these conditions. Reducing power or shutting down active sonar based on environmental conditions as a mitigation would affect a Commander’s ability to develop the tactical picture. It would also prevent sonar operators from training in conditions analogous to those faced during military missions and combat operations, such as during periods of low visibility.

Active sonar signals are designed explicitly to provide optimum performance at detecting underwater objects (e.g., submarines) in a variety of acoustic environments. The Navy assessed the potential for implementing active sonar signal modification as mitigation. At this time, the science on the differences in potential impacts of up or down sweeps of the sonar signal (e.g., different behavioral reactions) is extremely limited and requires further development. If future studies indicate that modifying active sonar signals (i.e., up or down sweeps) could be an effective mitigation approach, then the Navy will investigate if and how the mitigation would affect the sonar's performance.

Active sonar equipment power levels are set consistent with mission requirements. Active sonar ramp-up procedures are used during seismic surveys and some foreign navy sonar activities. Ramping up involves slowly increasing sound levels over a certain length of time until the optimal source level is reached. The intent of ramping up a sound source is to alert marine mammals with a low sound level to deter them from the area and avoid higher levels of sound exposure. The best available science does not suggest that ramp-up would be an effective mitigation tool for U.S. Navy active sonar training and testing activities under the Proposed Action. Wensveen et al. (2017) found that active sonar ramp-up was not an effective method for reducing impacts on humpback whales because most whales did not display strong behavioral avoidance to the sonar signals. The study suggested that sonar ramp-up could potentially be more effective for other more behaviorally responsive species but would likely also depend on the context of exposure. For example, ramp-up would be less effective if animals have a strong motivation not to move away from their current location, such as when foraging. Dunlop et al. (2016) and von Benda-Beckmann et al. (2014) found that implementing ramp-up as a mitigation may be effective for some activities in some situations. Additionally, von Benda-Beckmann et al. (2014) found that the main factors limiting ramp-up effectiveness for a typical anti-submarine warfare activity are a high source level, a moving sonar source, and long silences between consecutive sonar transmissions. Based on the source levels, vessel speeds, and sonar transmission intervals that will be used during typical active sonar activities under the Proposed Action, the Navy has determined that ramp-up would be an ineffective mitigation measure for the active sonar activities analyzed in this Draft Supplemental.

Implementing active sonar ramp-up procedures during training or testing under the Proposed Action would not be representative of military mission and combat conditions and would significantly impact training and testing realism. For example, during an anti-submarine warfare exercise using active sonar, ramp-ups have the potential to alert opponents (e.g., target submarines) to the transmitting vessel's presence. This would defeat the purpose of the training by allowing the target submarine to detect the searching unit and take evasive measures, thereby denying the sonar operator the opportunity to learn how to locate the submarine. Similarly, testing program requirements determine test parameters to accurately determine whether a system is meeting its operational and performance requirements; therefore, implementing ramp-up during testing activities would impede the Navy's ability to collect essential data for evaluation of a system's capabilities.

Reducing realism in training impedes the ability for Navy Sailors to train and become proficient in using active sonar, erodes capabilities, and reduces perishable skills. These impacts would result in a significant risk to personnel safety during military missions and combat operations and would prevent units from meeting their individual training and certification requirements. Therefore, implementing additional mitigation that would reduce training realism would ultimately prevent units from deploying with the required level of readiness necessary to accomplish their missions and impede the Navy's ability to certify forces to deploy to meet national security tasking. Reducing realism in testing would impact the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research and effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet. These tests are required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

5.5.2 Explosives

When assessing and developing mitigation, the Navy considered reducing the number and size of explosives and limiting the locations and time of day of explosive training and testing in the Study Area. The Navy determined that it would be practical to implement certain restrictions on the use of explosives in the Study Area, as detailed in Section 5.3.3 (Explosive Stressors) and Appendix K (Geographic Mitigation Assessment). As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix K (Geographic Mitigation Assessment), Appendix A (Navy Activities Descriptions), the locations and timing of the training and testing activities that use explosives vary throughout the Study Area based on range scheduling, mission requirements, testing program requirements, and standard operating procedures for safety and mission success.

Activities that involve explosive ordnance are inherently different from those that involve non-explosive practice munitions. For example, critical components of an explosive Bombing Exercise Air-to-Surface include the assembly, loading, delivery, and assessment of the explosive bomb. The explosive bombing training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and the loading of munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. An air-to-surface bombing exercise using non-explosive practice munitions can train aircrews on valuable skills to locate and accurately deliver munitions on a target; however, it cannot effectively replicate the critical components of an explosive activity in terms of assembly, loading, delivery, and assessment of an explosive bomb.

Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive training activities would impede the ability for Navy Sailors to train and become proficient in using explosive weapons systems (which would result in a significant risk to personnel safety during military missions and combat operations), and would ultimately prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions) and impede the Navy's ability to certify forces to deploy to meet national security tasking.

Similar to training, the Navy is required to test its explosives to quantify the compatibility of weapons with the platform from which they will be launched or released in military missions and combat operations. Such testing requires the use of the actual explosive ordnance that will be used during training exercises, military missions, and combat operations. Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive testing events would impact the ability of researchers, program managers, and weapons system acquisition programs to effectively test systems and platforms (and components of these systems and platforms). Such testing must be conducted before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

5.5.3 Active and Passive Acoustic Monitoring Devices

When assessing and developing mitigation, the Navy considered using active and passive acoustic monitoring devices as procedural mitigation. During Surveillance Towed Array Sensor System low-frequency active sonar (which is not part of the Proposed Action), the Navy uses a specially-designed adjunct high-frequency marine mammal monitoring active sonar known as "HF/M3" to mitigate potential impacts. HF/M3 can only be towed at slow speeds and operates like a fish finder used by commercial and recreational fishermen. Installing the HF/M3 adjunct system on the tactical sonar ships used under the Proposed Action would have implications for safety and mission requirements due to impacts on speed and maneuverability. Furthermore, installing the system would significantly increase costs associated with designing, building, installing, maintaining, and manning the equipment. The Navy will not install the HF/M3 system or other adjunct marine mammal monitoring devices as mitigation under the Proposed Action. However, Navy assets with passive acoustic monitoring capabilities that are already participating in an activity will continue to monitor for marine mammals, as described in Section 5.2.1 (Procedural Mitigation Development) and Section 5.3 (Procedural Mitigation to be Implemented). Significant manpower and logistical constraints make constructing and maintaining additional passive acoustic monitoring systems for each training and testing activity under the Proposed Action impractical. Diverting platforms with passive acoustic monitoring capabilities to monitor training and testing events would impact their ability to meet their mission requirements and would reduce the service life of those systems.

The Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals. For example, at the Southern California Offshore Range, the Pacific Missile Range Facility off Kauai, Hawaii, and the Atlantic Undersea Test and Evaluation Center in the Bahamas, the Navy can monitor instrumented ranges in real-time or through data recorded by hydrophones. The Navy has sponsored numerous studies that have produced meaningful results on marine mammal occurrence, distribution, and behavior on these ranges through the U.S. Navy Marine Species Monitoring Program. For information on the U.S. Navy Marine Species Monitoring Program, see Section 5.1.2.2.1 (Marine Species Research and Monitoring Programs).

Although the Navy's instrumented ranges are helping to facilitate a better understanding of the species that are present in those areas, instrumented ranges were not developed for the purpose of mitigation, and therefore do not have the capabilities to be used effectively for mitigation. To develop an estimated position for an individual marine mammal, the animal's vocalizations must be detected on at least three hydrophones. The vocalizations must be loud enough to provide the required signal to noise ratio on those hydrophones. The hydrophones must have the required bandwidth and dynamic range to capture that signal. Detection capabilities are generally degraded under noisy conditions (such as high sea state) that affect signal to noise ratio. The ability to detect and develop an estimated position for marine mammals on the Navy's instrumented ranges depends of numerous factors, such as behavioral state (e.g., only vocalizing animals can be detected), species (e.g., species vocalize at varying rates, call types, and source levels), animal location relative to the passive acoustic receivers (hydrophones), and location on the range. The Navy's hydrophones cannot track the real-time locations of individual animals with dispersed and directional vocalizations with the level of precision needed for effective mitigation. Even marine mammals that have been vocalizing for extended periods of time have been known to stop vocalizing for hours at a time, which would prevent the Navy from obtaining or maintaining an accurate estimate of that animal's location. In addition, the Navy does not currently have the capability to perform data processing for large baleen whales in real-time. Determining if an animal is located within a mitigation zone within the timeframes required for mitigation would be prohibited by the amount of time it takes to process the data.

If a vocalizing animal is detected on only one or two hydrophones, estimating its location is not possible, and the location of the animal would be assigned generally within the detection radius around each hydrophone. The detection radius of a hydrophone is typically much larger than the mitigation zone for the activities conducted on instrumented ranges. The Navy does not have a way to verify if that vocalizing animal is located within the mitigation zone or at a location down range. Mitigating for passive acoustic detections based on unknown animal locations would essentially increase the mitigation zone sizes for each activity to that of the hydrophone detection radius. Increasing the mitigation zone sizes beyond what is described for each activity is impractical for the reasons described throughout Section 5.3 (Procedural Mitigation to be Implemented).

In summary, although the Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals, at this time it would not be effective or practical for the Navy to monitor instrumented ranges for real-time mitigation or to construct additional instrumented ranges as a tool to aid in the implementation of mitigation.

5.5.4 Thermal Detection Systems and Unmanned Aerial Vehicles

Thermal detection technology is designed to allow observers to detect the difference in temperature between a surfaced marine mammal (i.e., the body or blow of a whale) and the environment (i.e., the water and air). Although thermal detection may be reliable in some applications and environments, current technologies are limited by their: (1) reduced performance in certain environmental conditions, (2) inability to detect certain animal characteristics and behaviors, (3) low sensor resolution and narrow fields of view, and (4) high cost and low lifecycle (Boebel, 2017; Zitterbart et al., 2013).

Thermal detection systems can be effective at detecting some types of marine mammals in a limited range of marine environmental conditions. Current thermal detection systems have proven more effective at detecting large whale blows than the bodies of small animals, particularly at a distance (Zitterbart et al., 2013). The effectiveness of current technologies has not been demonstrated for small marine mammals. Thermal detection systems exhibit varying degrees of false positive detections (i.e., incorrect notifications) due in part to their low sensor resolution and reduced performance in certain environmental conditions. False positive detections may incorrectly identify other features (e.g., birds, waves, boats) as marine mammals. In one study, Zitterbart et al. (2013) reported a false positive rate approaching one incorrect notification per four minutes of observation.

Thermal detection systems are generally thought to be most effective in cold environments, which have a large temperature differential between an animal's temperature and the environment. Two studies that examined the effectiveness of thermal detection systems for marine mammal observations are Zitterbart et al. (2013), which tested a thermal detection system and automatic algorithm in polar waters between 34–50 degrees Fahrenheit, and a Navy-funded study in subtropical and tropical waters. Zitterbart et al. (2013) found that current technologies have limitations regarding temperature and survey conditions (e.g., rain, fog, sea state, glare, ambient brightness), for which further effectiveness studies are required. The Office of Naval Research Marine Mammals and Biology program funded a project (2013-2018) to test the thermal limits of infrared-based automatic whale detection technology. That project focused on capturing whale spouts at two different locations featuring subtropical and tropical water temperatures, optimizing detector/classifier performance on the collected data, and testing system performance by comparing system detections with concurrent visual observations.

The Navy has also been investigating the use of thermal detection systems with automated marine mammal detection algorithms for future mitigation during training and testing, including on autonomous platforms. For example, the Defense Advanced Research Projects Agency funded six initial studies to test and evaluate infrared-based thermal detection technologies and algorithms to automatically detect marine mammals on an unmanned surface vehicle. Based on the outcome of these initial studies, follow-on efforts and testing are planned for 2018-2019.

Thermal detection systems are currently used by some specialized U.S. Air Force aircraft for marine mammal mitigation. These systems are specifically designed for and integrated into Air Force aircraft and cannot be added to Navy aircraft. Only certain Navy aircraft have specialized infrared capabilities, and these capabilities are only for fine-scale targeting within a narrow field of view. The only thermal imagery sensors aboard Navy surface ships are associated with specific weapons systems, and these sensors are not available on all vessels. These sensors are typically used only in select training events, have a limited lifespan before requiring expensive replacement, and are not optimized for marine mammal observations within the Navy's mitigation zones. For example, as described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles), Lookouts are required to observe a 1,000 yd. mitigation zone around the intended impact location during explosive large-caliber gunnery activities. In addition to observing for marine mammals, one of the activity's mission-essential requirements is for event participants, including Lookouts, to maintain focus on the mitigation zone to ensure safety of Navy personnel and equipment and the public. Lookouts would not be able to observe the 1,000 yd. mitigation zone using the Navy's thermal imagery sensors due to their narrow fields of view and technological design specific to fine-scale targeting. Such observations would be ineffective for marine mammals and would prevent Lookouts from effectively maintaining focus on the activity area and implementing mission-essential safety protocols.

The effectiveness of even the most advanced commercially available thermal detection systems with technological designs specific to marine mammal observations is highly dependent on environmental conditions, animal characteristics, and animal behaviors (Zitterbart et al., 2013). Considering the range of environmental conditions and diversity of marine mammal species found throughout the Study Area, the use of thermal detection systems would be less effective than the traditional techniques currently employed by the Navy, such as naked-eye scanning, hand-held binoculars, and high-powered binoculars mounted on a ship deck. Furthermore, high false positive rates of thermal detection systems could result in the Navy implementing mitigation for other features incorrectly identified as marine mammals. Increasing the instances of mitigation implementation based on incorrectly-identified features would have significant impacts on the ability for training and testing activities to accomplish their intended objectives, without providing any mitigation benefit to the species. In addition, thermal detection systems are designed to detect marine mammals and do not have the capability to detect other resources for which the Navy is required to implement mitigation. Requiring Lookouts to use thermal detection systems would prevent them from detecting and mitigating for sea turtles and other biological resources (e.g., floating vegetation, jellyfish aggregations).

As discussed in Section 5.3 (Procedural Mitigation to be Implemented), the Navy's procedural mitigation measures include the maximum number of Lookouts the Navy can assign to each activity based on available manpower and resources. It would be impractical to add personnel to serve as additional Lookouts for the sole purpose of thermal detection system use. For example, the Navy does not have available manpower to add Lookouts to use thermal detection systems in tandem with existing Lookouts who are using traditional observation techniques.

In summary, thermal detection systems have not been sufficiently studied both in terms of their effectiveness within the environmental conditions found in the Study Area and their compatibility with Navy training and testing. The Navy plans to continue researching thermal detection systems to determine their effectiveness and compatibility with Navy applications. If the technology matures to the state where thermal detection is determined to be an effective mitigation tool during training and testing, the Navy will assess the practicality of using the technology during training and testing events and retrofitting its observation platforms with thermal detection devices. The assessment will include an evaluation of the budget and acquisition process (including costs associated with designing, building, installing, maintaining, and manning equipment that is expensive and has a relatively short lifecycle before key system components need replacing); logistical and physical considerations for device installment, repair, and replacement (e.g., conducting engineering studies to ensure there is no electronic or power interference with existing shipboard systems); manpower and resource considerations for training personnel to effectively operate the equipment; and considerations of potential security and classification issues. New system integration on Navy assets can entail up to 5 to 10 years of effort to account for acquisition, engineering studies, and development and execution of systems training. The Navy will provide information to NMFS about the status and findings of Navy-funded thermal detection studies and any associated practicality assessments at the annual adaptive management meetings. Information about the Navy's adaptive management program is included in Section 5.1.2.2.1.1 (Adaptive Management).

5.5.5 Third-Party Observers

When assessing and developing mitigation, the Navy considered using third-party observers during training and testing to aid in the implementation of procedural mitigation. The use of third-party observers to conduct pre- or post-activity biological resource observations would be an ineffective mitigation because marine mammals would likely move into or out of the activity area, and mitigation must be implemented at the time the activity is taking place.

There are significant manpower and logistical constraints that make using third-party observers for every training and testing activity under the Proposed Action impractical. Training and testing activities often occur simultaneously and in various regions throughout the Study Area, some of which last for days or weeks at a time. Having third-party observers embark on Navy vessels or aircraft would result in safety and security clearance issues. Training and testing event planning includes careful consideration of capacity limitations when placing personnel on participating aircraft and vessels. The Navy is unable to add third-party observers on a ship or substitute a Navy Lookout with a third-party observer without causing a berthing shortage or exceedance of other space limitations, or impacting the ability for Lookouts to complete their other mission-essential duties. The use of third-party observers also presents national security concerns due to the requirement to provide advance notification of specific times and locations of Navy platform movements and activities (e.g., vessels using active sonar).

Reliance on the availability of third-party personnel for mitigation would be impractical because training and testing activity timetables oftentimes cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for third-party aircraft or vessels to complete surveys, refuel, or transit on station would extend the length of the activity in a way that would diminish realism and delay training and testing schedules. Hiring third-party civilian vessels or aircraft to observe Navy training and testing activities would also be unsustainable due to the significant associated costs. Because many training and testing activities take place offshore, the amount of time observers would spend on station would be limited due to aircraft fuel restrictions. Fuel restrictions and distance from shore would increase safety risks should mechanical problems arise. The presence of civilian aircraft or vessels in the vicinity of training and testing activities would present increased safety risks due to airspace conflicts and proximity to explosives.

5.5.6 Foreign Navy Mitigation

When assessing and developing mitigation, the Navy considered adopting the mitigation measures implemented by foreign navies. Mitigation measures are carefully developed for and assessed by each individual navy based on the potential impacts of their activities on the biological resources that live in their Study Areas, and the practicality of mitigation implementation based on their training mission and testing program requirements and the resources available for mitigation. The U.S. Navy's readiness considerations differ from those of foreign navies based on each navy's strategic reach, global mission, country-specific legal requirements, and geographic considerations. Most non-U.S. navies do not possess an integrated strike group and do not have integrated training requirements. The U.S. Navy's training is built around the integrated warfare concept and is based on the U.S. Navy's capabilities, the threats faced, the operating environment, and the overall mission. For this reason, not all measures developed for foreign navies would be effective at reducing impacts of U.S. Navy training or testing, or practical to implement by the U.S. Navy (and vice versa). For example, some navies implement active sonar ramp-up as mitigation for marine mammals; however, as described in Section 5.5.1 (Active Sonar), the U.S. Navy determined that active sonar ramp-up would be an ineffective mitigation measure for training and testing activities under the Proposed Action and would be impractical to implement because it would significantly impact training and testing realism.

The U.S. Navy will implement mitigation measures that have been determined to be effective at avoiding or reducing impacts from the Proposed Action and practical to implement by the U.S. Navy. Many of these measures are the same as, or comparable to, those implemented by foreign navies. For example, most navies implement some form of procedural mitigation to cease certain activities if a marine mammal is observed in a mitigation zone (Dolman et al., 2009). Some navies also implement geographic mitigation to restrict activities within particularly important marine mammal breeding, feeding, or migration habitats. The U.S. Navy will implement several mitigation measures and environmental compliance initiatives that are not implemented by foreign navies. For example, as discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the U.S. Navy will continue to sponsor scientific monitoring and research and comply with stringent reporting requirements.

5.5.7 Reporting Requirements

When assessing and developing mitigation, the Navy considered increasing its reporting requirements, such as additional reporting of vessel speeds and marine species observations. As discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the Navy developed its reporting requirements in conjunction with NMFS to be consistent with mission requirements and balance the usefulness of the information to be collected with the practicality of collecting it. The Navy's training and testing activity reports and incident reports are designed to verify implementation of mitigation; comply with current permits, authorizations, and consultation requirements; and improve future environmental analyses. In the unlikely event that a vessel strike of a marine mammal should occur, the Navy would provide NMFS with relevant information pertaining to the incident, including but not limited to vessel speed.

Additional reporting would be ineffective as mitigation because it would not result in modifications to training or testing activities or further avoidance or reductions of potential impacts. For example, additional reporting of vessel speed data would not result in modifications to vessel speeds (e.g., speed restrictions) or reduce the already low potential for vessel strikes of marine mammals for the reasons described in Section 5.3.4.1 (Vessel Movement). Lookouts are not trained to make species-specific identification and would not be able to provide detailed scientific data if more detailed marine species observation reports were to be required. Furthermore, the Navy does not currently maintain a record management system to collect, archive, analyze, and report marine species observation or vessel speed data for every training and testing activity and all vessel movements. For example, the speed of Navy vessels can fluctuate an unlimited number of times during training and testing events. Developing and implementing a record management system of this magnitude would be unduly cost prohibitive and place a significant administrative burden on vessel operators and activity participants. Burdening operational Commanders, vessel operators, and event participations with requirements to complete additional administrative reporting would distract them from preparing a ready force and focusing on mission-essential tasks. Additional reporting requirements would draw event participants' attention away from the complex tactical tasks they are primarily obligated to perform, such as driving a warship or engaging in a gunnery event, which would adversely impact personnel safety, public health and safety, and the effectiveness of training or testing.

5.6 Mitigation Summary

Table 5.6-1 summarizes the procedural mitigation measures that the Navy will implement under Alternative 1 or Alternative 2 of the Proposed Action. For specific requirements, additional information, and clarifications to the table summaries, see Section 5.3 (Procedural Mitigation to be Implemented). For a summary of mitigation areas that the Navy considered for this Draft Supplemental, see Appendix K (Geographic Mitigation Assessment). The final mitigation areas resulting from the MMPA and ESA consultation and permitting processes will be included in this section of the Final Supplemental.

Table 5.6-1: Summary of Procedural Mitigation

Stressor or Activity	*Mitigation Zone Sizes and Other Requirements*	*Protection Focus*
Environmental Awareness and Education	• Afloat Environmental Compliance Training program for applicable personnel	• Marine mammals • Sea turtles • Seabirds
Active Sonar	• 2 Lookouts (hull-mounted sources on platforms without space or manning restrictions while underway) • 1 Lookout (all other sources) • Mitigation zones: – 1,000 yd. power down, 500 yd. power down, and 200 yd. or 100 yd. shut down for low-frequency active sonar ≥200 decibels (dB) and hull-mounted mid-frequency active sonar (with exceptions for pinnipeds hauled out on, or in the water near, man-made structures and vessels) – 200 yd. or 100 yd. shut down for low-frequency active sonar <200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar (with exceptions for pinnipeds hauled out on, or in the water near, man-made structures and vessels)	• Marine mammals • Sea turtles
Weapons Firing Noise	• 1 Lookout • Mitigation zone: 30° on either side of the firing line out to 70 yd. from the muzzle of weapon being fired	• Marine mammals • Sea turtles • Seabirds (marbled murrelets, short-tailed albatross)
Explosive Sonobuoys	• 1 Lookout • Mitigation zone: 600 yd.	• Marine mammals • Sea turtles
Explosive Torpedoes	• 1 Lookout • Mitigation zone: 2,100 yd.	• Marine mammals • Sea turtles
Explosive Medium-Caliber and Large-Caliber Projectiles	• 1 Lookout • Mitigation zones: – 200 yd. (seabirds) and 600 yd. (marine mammals, sea turtles) for medium-caliber projectiles – 1,000 yd. (marine mammals, sea turtles) for large-caliber projectiles	• Marine mammals • Sea turtles • Seabirds (marbled murrelets, short-tailed albatross)
Explosive Missiles	• 1 Lookout • Mitigation zone: 2,000 yd.	• Marine mammals • Sea turtles
Explosive Bombs	• 1 Lookout • Mitigation zone: 2,500 yd.	• Marine mammals • Sea turtles
Explosive Mine Countermeasure and Neutralization Activities	• 1 Lookout (≤ 5 lb. charge) • 2 Lookouts (> 5–60 lb. charge) • Mitigation zones: – 600 yd. (≤ 5 lb. charge) – 2,100 yd. (> 5–60 lb. charge)	• Marine mammals • Sea turtles

Table 5.6-1: Summary of Procedural Mitigation (continued)

Stressor or Activity	*Mitigation Zone Sizes and Other Requirements*	*Protection Focus*
Explosive Mine Neutralization Activities Involving Navy Divers	• 2 Lookouts, including 1 Navy biologist • Mitigation zone: – 100 yd. for < 0.1 lb. charges (seabirds) – 400 yd. for > 0.5–2.5 lb. charges (seabirds) – 500 yd. for > 0.5–2.5 lb. charges (marine mammals) • Special pre- and post-event observations • Use of smallest practicable positive control charges • Requirements for low sea state (Beaufort 2 or less) and good visibility conditions • Permission required from the appropriate designated Command authority prior to explosive activities • At the Hood Canal Explosive Ordnance Disposal Range: no use of > 0.5–2.5 lb. charge during February, March, and April; avoidance of > 0.5–2.5 lb. charges to the maximum extent practicable during August, September, and October • At the Crescent Harbor Explosive Ordnance Disposal Range, no explosive activities at least 1,000 m from the closest point of land • Requirements to submit mitigation summary reports to the USFWS after the completion of each activity	• Marine mammals • Seabirds (marbled murrelets) • Fish (bull trout, salmonids)
Vessel Movement	• 1 Lookout • Mitigation zones: – 500 yd. (for surface ships) around whales – 200 yd. (for surface ships) around other marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – 100 yd. (for small boats, such as range craft) around marine mammals (except bow-riding dolphins and pinnipeds hauled out man-made navigational structures, port structures, and vessels) – Within the vicinity of sea turtles • Special event planning and environmental training measures prior to Small Boat Attack Exercises	• Marine mammals • Sea turtles
Towed In-Water Devices	• 1 Lookout • Mitigation zones: – 250 yd. (for in-water devices towed by aircraft or surface ships) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels) – 100 yd. (for in-water devices towed by small boats, such as range craft) around marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels). – Within the vicinity of sea turtles	• Marine mammals • Sea turtles

Table 5.6-1: Summary of Procedural Mitigation (continued)

Stressor or Activity	*Mitigation Zone Sizes and Other Requirements*	*Protection Focus*
Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions	• 1 Lookout • Mitigation zones: – 200 yd. during small-, medium-, and large-caliber events (marine mammals, sea turtles) and small- and medium-caliber events (seabirds)	• Marine mammals • Sea turtles • Seabirds (marbled murrelets, short-tailed albatross)
Non-Explosive Missiles	• 1 Lookout • Mitigation zone: 900 yd.	• Marine mammals • Sea turtles
Non-Explosive Bombs and Mine Shapes	• 1 Lookout • Mitigation zone: 1,000 yd.	• Marine mammals • Sea turtles

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6 Additional Regulatory Considerations

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6 Additional Regulatory Considerations

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action; consistency with other federal, state, and local plans, policies, and regulations in addition to the ones discussed in Chapter 3 (Affected Environment and Environmental Consequences); the relationship between short-term impacts and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources; and energy conservation.

6.1 Consistency with Other Applicable Federal, State, and Local Plans, Policies, and Regulations

Implementation of the Proposed Action addressed in this Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (Supplemental) would comply with applicable federal, state, and local laws, regulations, and executive orders (EOs). The United States (U.S.) Department of the Navy (Navy) is consulting with and will continue to consult with regulatory agencies, as appropriate, during the NEPA process and prior to implementing the Proposed Action.

Table 6.1-1 summarizes environmental compliance requirements that were considered in preparing this Supplemental (including those that may be secondary considerations in the resource evaluations). Section 3.0.2 (Regulatory Framework) provides brief excerpts of the primary federal statutes, EOs, international standards, and guidance that form the regulatory framework for the resource evaluations. Section 1.6 (The Environmental Planning Process) provides brief excerpts of the primary federal statutes, EOs, and guidance that form the regulatory framework for the resource evaluations in Chapter 3 (Affected Environment and Environmental Consequences). Documentation of consultation and coordination with regulatory agencies is provided in Appendix I (Agency Correspondence).

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Statutes, Regulations, Executive Orders, International Standards, and Guidance	*Status of Compliance*
Statutes and Regulations	
Abandoned Shipwreck Act (43 United States [U.S.] Code [U.S.C.] sections 2101–2106)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Act to Prevent Pollution from Ships (33 U.S.C. sections 1901–1915)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Antiquities Act (16 U.S.C. sections 431–433)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
Statutes and Regulations (continued)	
Bald and Golden Eagle Protection Act (16 U.S.C. 668–668c)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Clean Air Act (42 U.S.C. sections 7401 et seq.) Clean Air Act General Conformity Rule (40 CFR section 93[B]) State Implementation Plan (SIP)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Clean Water Act (33 U.S.C. 1251 et seq.)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Coastal Zone Management Act (16 U.S.C. sections 1451-1464)	The legal description and the definitions for this Act from the 2015 Final NWTT EIS/OEIS have not changed. As described in the 2015 Final NWTT EIS/OEIS, a Consistency Determination or a Negative Determination may be submitted for review of federal agency activities.
Endangered Species Act (ESA) (16 U.S.C. sections 1531 et seq.)	This Supplemental analyzes potential effects to species listed under the ESA and is administered by both the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). In accordance with Section 7 of the ESA (50 CFR section 402), during the preparation of the 2015 MITT Final EIS/OEIS, the Navy prepared a Biological Assessment and submitted it to the USFWS. A Biological Opinion (BO) was issued by USFWS and remains valid. The Navy will continue to adhere to any BO terms and conditions listed therein. The Navy is preparing another Biological Assessment that will be submitted to NMFS as part of formal consultation. A BO may be issued by NMFS and the Navy will adhere to any BO terms and conditions listed therein. In addition, the Navy will apply for a Letter of Authorization (LOA), which is expected to impose terms and conditions that, when implemented, would make ESA Section 9 prohibitions inapplicable to covered Navy activities. The MMPA LOA permit may be issued by NMFS prior to the issuance of the Record of Decision on this Supplemental.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
Historic Sites, Buildings and Antiquities Act, 1935 (54 U.S.C. 320101 et seq.) Antiquities Act (54 U.S.C. sections 320301–320303)	The citations and naming conventions for Historic Sites, Buildings and Antiquities Act have changed slightly since the 2015 NWTT Final EIS/OEIS. However, no substantive changes to the laws have occurred since 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. sections 1801–1882)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Marine Mammal Protection Act (MMPA) (16 U.S.C. sections 1431 et seq.)	This Supplemental EIS/OEIS updates the analysis and will be the basis for a request for a 7-year LOA, which is a change from the 2015 NWTT Final EIS/OEIS per the 2018 National Defense Authorization Act and the MMPA, as the NMFS permitting period has been changed from 5- to 7-year permits, to cover the Navy's proposed activities for the 2020–2027 timeframe.
Migratory Bird Treaty Act (16 U.S.C. sections 703–712)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
National Fishery Enhancement Act (33 U.S.C. section 2101 et seq.)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Statutes and Regulations (continued)	
National Historic Preservation Act (NHPA) (54 U.S.C. section 306108)	The Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. See Section 3.10 (Cultural Resources) for the assessment. Navy activities are currently covered under the completed Section 106 consultation for the 2015 NWTT Final EIS/OEIS. The Navy will engage in consultation under NHPA Section 106 to support the Proposed Action in the Study Area under this Supplemental.
National Marine Sanctuaries Act (16 U.S.C. sections 1431–1445c-1)	The Navy and NMFS will be submitting a joint Sanctuary Resource Statement to Olympic Coast National Marine Sanctuary (OCNMS). OCNMS will have 45 days to respond with conservation recommendations for the agencies to consider.
Resource Conservation and Recovery Act (42 U.S.C. section 6901 et seq.) Military Munitions Rule	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	*Status of Compliance*
Rivers and Harbors Act (33 U.S.C. section 401 et seq.)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
The Sikes Act of 1960 (16 U.S.C. sections 670a-670o, as amended by the Sikes Act Improvement Act of 1997, Public Law No. 105-85), requires military installations with significant natural resources to prepare and implement Integrated Natural Resource Management Plans (INRMPs).	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Submerged Lands Act of 1953 (43 U.S.C. sections 1301–1315)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Sunken Military Craft Act (Public Law 108–375, 10 U.S.C. section 113 Note and 118 Stat. 2094–2098)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
Wilderness Act (Public Law 88–577, 16 U.S.C. 1131–1136)	The Wilderness Act was not included in the 2015 NWTT Final EIS/OEIS. The Proposed Action is consistent with the management policies for the Daniel J. Evans Wilderness unit in Olympic National Park.
Executive Orders (EOs)	
EO 11990, *Protection of Wetlands*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 12962, *Recreational Fisheries*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	***Status of Compliance***
EOs (continued)	
EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13089, *Coral Reef Protection*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13112, *Invasive Species*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13158, *Marine Protected Areas*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13175, *Consultation and Coordination With Indian Tribal Governments*	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.
EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	This EO was revoked and replaced by EO13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*, since the 2015 NWTT Final EIS/OEIS.
EO 13693, *Planning for Federal Sustainability in the Next Decade*	This EO was revoked and replaced by EO 13834, *Efficient Federal Operations* since the 2015 NWTT Final EIS/OEIS.
EO 13783, *Promoting Energy Independence and Economic Growth*	This EO revokes EO 13653, *Preparing the United States for the Impacts of Climate Change*. The Proposed Action is consistent with the policy's goals for the safe, efficient development of domestic energy resources.
EO 13792, *Review of Designations Under the Antiquities Act*	On April 26, 2017, EO 13792 was issued and directed the Secretary of the Interior to review designations of national monuments made since 1996. The Proposed Action is consistent with this EO and considers all national monuments that are still designated as such.
EO 13834, *Efficient Federal Operations*	The Proposed Action is consistent with the federal government's order to prioritize actions that reduce waste, cut costs, enhance the resilience of federal infrastructure and operations, and enable more effective accomplishment of an agency's mission. This Executive Order revokes EO 13693, *Planning for Federal Sustainability in the Next Decade*.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Statutes, Regulations, Executive Orders, International Standards, and Guidance	*Status of Compliance*
EOs (continued)	
EO 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*	The Proposed Action is consistent with the comprehensive national policy for the *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States* (which replaced EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*).
International Standards	
International Convention for the Prevention of Pollution from Ships (MARPOL)	These legal requirements have not changed since the 2015 NWTT Final EIS/OEIS, and the Navy has verified that the updated activity array and stressor quantities do not change its compliance with these requirements.

Notes: CFR = Code of Federal Regulations, U.S. = United States, NMFS = National Marine Fisheries Service, NWTT = Northwest Training and Testing, EIS = Environmental Impact Statement, OEIS = Overseas Environmental Impact Statement, MMPA = Marine Mammal Protection Act, MBTA = Migratory Bird Treaty Act, ESA = Endangered Species Act, INRMP = Integrated Natural Resource Management Plan, OCNMS = Olympic Coast National Marine Sanctuary

6.1.1 Coastal Zone Management Act Compliance

The 2015 Final NWTT EIS/OEIS describes the *Coastal Zone Management Act of 1972* (16 United States Code [U.S.C.] section 1451, et seq.). This description and the definitions from the 2015 Final NWTT EIS/OEIS have not changed. See Section 4.3.5.5 (Shoreline Development) and 4.4.6.3 (Coastal Development) in the 2015 Final NWTT EIS/OEIS for additional information regarding management of the coastal zone within the NWTT Study Area.

As described in the 2015 Final NWTT EIS/OEIS, a Consistency Determination (CD) or a Negative Determination may be submitted for review of federal agency activities.

6.1.1.1 Washington Coastal Zone Management Program

In 1976, the State of Washington’s Coastal Zone Management Program (CZMP) was the first to be accepted and approved by the National Oceanic and Atmospheric Administration, and implemented by the Washington Department of Ecology. Washington’s CZMP is primarily based on their Shoreline Management Act of 1971, as well as other state land use and resource management laws. Any public federal project carried out with a federal agency, or private project licensed or permitted by a federal agency, or carried out with a federal grant, must be determined to have “Federal Consistency,” which means the project is consistent with Washington’s CZMP.

The coastal zone includes all lands and waters from the coastline seaward to 3 NM. The coastline along the inland marine waters is located at the seaward limit of rivers, bays, estuaries, or sound. The inland political boundaries of the counties are used as the Coastal Zone limit because they generally follow drainage divides. The Act specifically excludes from the coastal zone those lands that are subject solely by law to the discretion of or held in trust by the federal government (e.g., military reservations and other defense installations, all lands within National Parks, the Olympic Coast National Marine Sanctuary, Indian lands held in trust by the federal government, and National Forest lands and National

Recreation Areas owned or leased by the federal government) (Washington State Department of Ecology, 2001).

The federal CZMA also gives special funding to assist in making improvements to the state CZMP. Washington State participates in these voluntary Improvement Grants, otherwise known as the Section 309 Program, in order to update and amend the Shoreline Master Program Guidelines under Washington's Shoreline Management Act. Washington conducted a self-assessment of their CZMP that was finalized in 2015 for improvements to the program from 2016 to 2020. The various updates to the program will be considered in the CD process between the Navy and Washington Department of Ecology (Washington Department of Ecology, 2015).

In June 2018, the State of Washington finalized and adopted a new Pacific Coast Marine Spatial Plan. The Marine Spatial Plan includes scientific information on ocean uses and resources, provides a framework for evaluating future ocean use proposals, and establishes protections for sensitive areas and fisheries. The plan was submitted to NOAA to be reviewed and approved for incorporation into Washington State's CZMP. Since there is a history of military presence off the coast of Washington State, the Marine Spatial Plan includes a section about military operations. Under a Federal Consistency determination, the Navy must be compliant with the state's implementation of the Marine Spatial Plan (Washington State Department of Ecology, 2018).

6.1.1.2 Oregon Coastal Management Program

The Oregon Coastal Management Program was described in the 2015 NWTT Final EIS/OEIS and has not changed. The Navy submitted a negative determination to the Oregon Department of Land Conservation and Development for the 2015 NWTT Final EIS/OEIS, and the State of Oregon concurred. No new consultation would be required as a result of the Proposed Action because no training and testing activities are proposed within the Oregon Coastal Zone, and no proposed activities would affect any land or water use of natural resource of Oregon's coastal zone. The Navy intends to send the Oregon Coastal Management Program a letter stating that a revised negative determination is not required as there are still no proposed training or testing activities planned to occur within the Oregon Coastal Zone as concluded in the Navy's Negative Determination that supported the 2015 NWTT EIS/OEIS.

6.1.1.3 California Coastal Management Program

The California Coastal Act was described in the 2015 NWTT Final EIS/OEIS and has not changed. Previously, the Navy submitted a negative determination to the California Coastal Commission for the 2015 NWTT Final EIS/OEIS. The California Coastal Commission concurred with the Navy's negative determination, in which the Commission agreed that it does not appear reasonably foreseeable that the proposed activities would affect California coastal zone resources. In accordance with the Coastal Zone Management Act, the Navy will comply with California's Coastal Management Plan.

6.1.1.4 Alaska Coastal Management Program

The Alaska Coastal Management Program (CMP) ended at 12:01 a.m., Alaska Standard Time on July 1, 2011 per state legislative action (AS 44.66.030). The Legislature adjourned the special legislative session May 14, 2011 without passing legislation required to extend the Alaska CMP. Therefore, Alaska currently does not have an approved CMP, and the Navy has no requirements to prepare and submit a CD.

6.1.2 Marine Protected Areas

The 2015 NWTT Final EIS/OEIS discussed Marine Protected Areas (MPA) that overlapped with the Study Area (U.S. Department of the Navy, 2015). EO 13792, *Review of Designations Under the Antiquities Act*, authorized a review by the Secretary of Interior of certain designated National Monuments under the Antiquities Act. No changes have been made currently to any of the National Monuments in the Study Area. Figure 6-1 and Figure 6-2 show MPAs in the Offshore Area and Inland Waters. These areas include the Olympic Coast National Marine Sanctuary (OCNMS), National Wildlife Refuges, state or local MPAs that are included in the National System of Marine Protected Areas, and the marine component of the Olympic National Park. This Supplemental has been prepared in accordance with requirements for natural or cultural resources protected under the National System of MPAs. While several MPAs are located within the Study Area and are included in the National System of MPAs, it is important to note that through standard operating procedures, the Navy takes every precaution to train or test in these areas sparingly. Table 6.1-2 provides information on the MPAs that are new, have regulations that have changed since the 2015 NWTT Final EIS/OEIS, or have new or different Navy training and testing activities proposed to occur. Further analysis and discussion of Marine Protected Areas can be found in the 2015 NWTT Final EIS/OEIS Chapter 6 (Table 6.1-2). Additionally, the OCNMS within the Study Area receives protection under both EO 13158 and the National Marine Sanctuaries Act and is described in more detail below.

6.1.2.1 Olympic Coast National Marine Sanctuary

Details of the OCNMS are discussed in the 2015 NWTT Final EIS/OEIS, and the dimensions, species, and descriptions of the area have not changed. The offshore portion of the Study Area encompasses the OCNMS. All allowed Department of Defense (DoD) military training and testing activities currently are, and would continue to be, carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources and qualities. Air-to-water bombing, and high explosives are not used in the Sanctuary. Therefore, proposed training and testing activities are consistent with those described in the sanctuary's designation document and in Section 6.4.5 (Department of Defense Activities) of the *Olympic Coast National Marine Sanctuary Final Management Plan and Environmental Assessment* (2011), authored and published by the National Oceanic and Atmospheric Administration, and would continue to be exempt from the prohibitions identified in the Sanctuary's regulations. The mitigation developed for MMPA/ESA impacts (see Chapter 5, Mitigation) would be applied to all activities occurring near or within the Sanctuary. Further, the Navy would continue to regulate which training and testing activities occur within the Sanctuary based on existing requirements, as discussed below.

To ensure compliance with the National Marine Sanctuary Program regulations and the interagency consultation requirements of National Marine Sanctuaries Act section 304(d), the Navy considered all proposed modifications to training and testing activities to determine whether they have the potential to destroy, cause the loss of, or injure sanctuary resources, or result in adverse impacts on sanctuary resources or qualities. The Navy and NMFS will be submitting a joint Sanctuary Resource Statement to OCNMS. OCNMS has 45 days to respond with conservation recommendations for the agencies to consider. The Navy has considered and found some additional mitigation measures as indicated in Appendix K (Geographic Mitigation Assessment). These mitigation measures in the OCNMS are to limit mid-frequency 1 sonar training hours to no more than 32 hours annually; 20 percent of the total annual training authorization of 164 hours. Should national security present a requirement to use mid-frequency 1 sonar or explosive munitions for training in this area during the designated timeframe, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information in its annual activity reports submitted to NMFS.

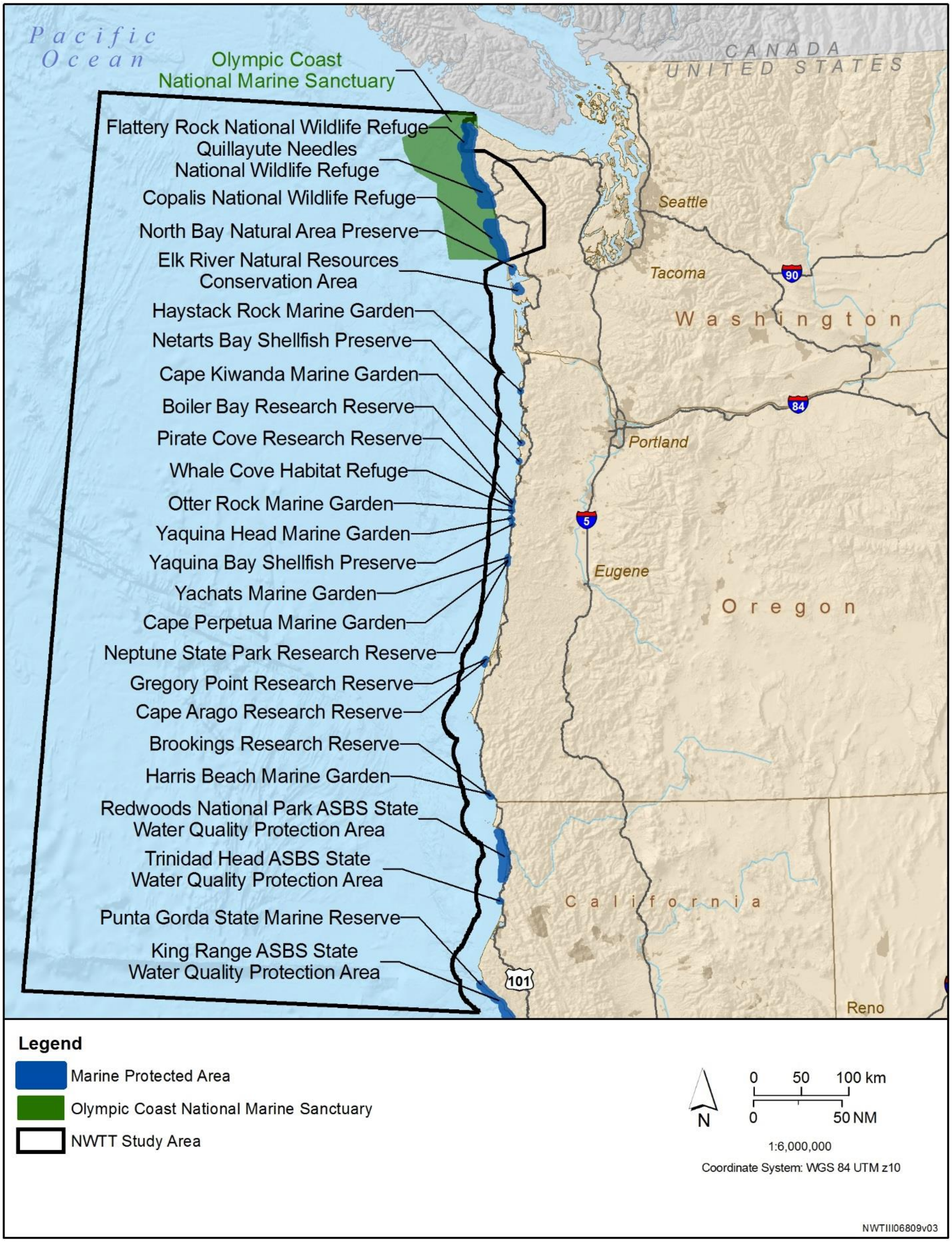

Figure 6-1: Marine Protected Areas in and Near the Offshore Area Portion of the Study Area

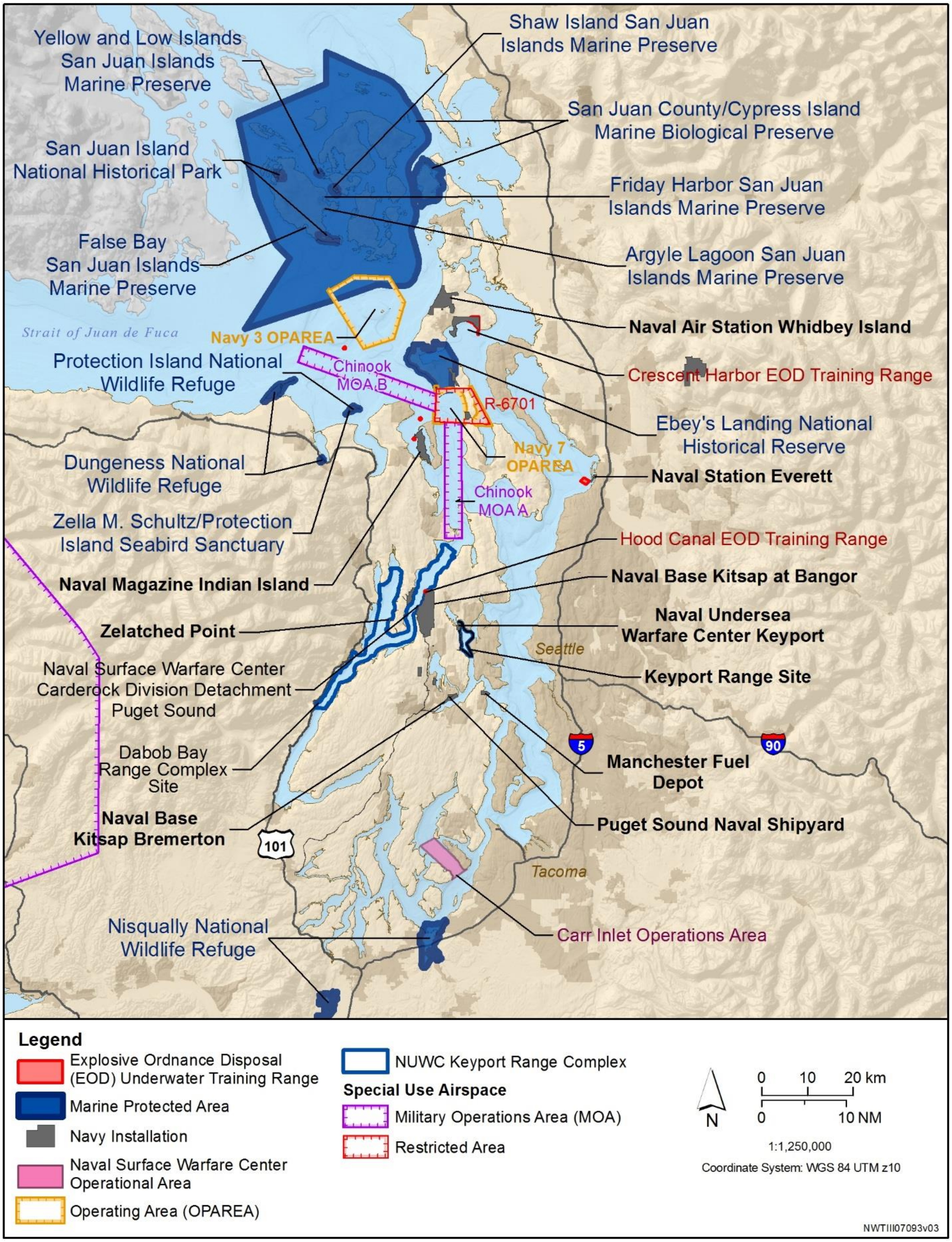

Figure 6-2: Marine Protected Areas in and Near the Inland Waters Area of the Study Area

Table 6.1-2: Marine Protected Areas Located Within the Northwest Training and Testing Study Area

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Training and Testing Activities and Potential Impacts
Copalis National Wildlife Refuge	Washington (Offshore Area)	Ecosystem	The Refuge is closed to visitation to protect wildlife and other natural, cultural, and other resources consistent with the conservation purpose of the Refuge.	The Navy conducts no activities in or near this area, but Navy ships may transit near or through the reserve.
Ebey's Landing National Historical Reserve	Washington (Puget Sound)	Natural Heritage	The Reserve covers the entire central Whidbey Island area, including Penn Cove.	The Navy's proposed activities in the Inland Waters would not occur within the limits of the Reserve and therefore would not violate the spatial boundaries or restrictions of the Reserve.
Flattery Rocks National Wildlife Refuge	Washington (Offshore Area)	Ecosystem	The Refuge is closed to visitors to protect wildlife and other natural, cultural, and other resources consistent with the conservation purpose of the Refuge.	The Navy conducts no activities in or near this area, but Navy ships may transit near or through the Refuge.
Olympic Coast National Marine Sanctuary	Washington (Offshore Area)	Ecosystem	The regulations state that "all Department of Defense (DoD) activities must be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities." If a DoD activity causes any destruction, loss, or injury to a Sanctuary resource, then the "DoD, in coordination with the Director, must promptly prevent and mitigate further damage and must restore or replace the Sanctuary resource or quality in a manner approved by the Director."	The Navy and NMFS will be submitting a joint Sanctuary Resource Statement to the Olympic Coast National Marine Sanctuary (OCNMS). OCNMS will have 45 days to respond with conservation recommendations for the agencies to consider.

Table 6.1-2: Marine Protected Areas Located Within the Northwest Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Training and Testing Activities and Potential Impacts
Olympic National Park	Washington (Offshore Area)	Ecosystem	Vessels are prohibited from creating a wake or exceeding 5 miles per hour, 100 yards from shoreline in undeveloped areas. Permits are required for aircraft and air delivery; delivery/retrieval of a person/object by parachute, helicopter, or other airborne means; or removal of a downed aircraft. As a designated World Heritage Site, the Olympic National Park was analyzed in the 2015 NWTT Final EIS/OEIS in Appendix K (World Heritage Site Analysis).	The Navy does not conduct ship or submarine activities in Olympic National Park but does conduct flight activities in the Olympic Military Operations Areas in national airspace above the Park. The environmental analysis for placement of mobile emitters on U.S. Forest lands outside the Olympic National Park supporting these activities was included in the Navy's Electronic Warfare Range Environmental Assessment. The Navy received special use permits from the U.S. Forest Service for placement of these emitters. Analysis of flight activities over the Olympic National Park within the MOA airspace is included in this Proposed Action. The Navy completed a noise study in Appendix J (Airspace Noise Analysis for the Olympic Military Operations Areas) to support determinations made in Section 3.12 (Socioeconomic Resources) that noise impacts on the Park and its resources would not rise to the level of significance for cultural or biological resources (see Appendix J, Airspace Noise Analysis for the Olympic Military Operations Areas).
Quillayute Needles National Wildlife Refuge	Washington (Offshore Area)	Seabirds/ Wildlife	No discharge/depositing, no dredging or altering the seabed, no motorized aircraft below 2,000 ft. or within 1 NM seaward, and no bombing activities.	The Navy does not discharge/deposit into, dredge, or alter the seabed; fly motorized aircraft below 2,000 ft. or within 1 NM seaward of Quillayute Needles National Wildlife Refuge; or conduct bombing activities in the refuge.

Notes: DoD = Department of Defense, EIS/OEIS = Environmental Impact Statement/Overseas Environmental Impact Statement, Navy = United States Department of the Navy, NM = nautical miles, NMFS = National Marine Fisheries Service, OCNMS = Olympic Coast National Marine Sanctuary, U.S. = United States, MOA = Military Operations Area

6.1.3 Magnuson-Stevens Fishery Conservation and Management Act

The Proposed Action has the potential to impact Essential Fish Habitat (EFH) and managed species within the Study Area. The Navy prepared an EFH Assessment for the 2015 NWTT Final EIS/OEIS. The relevant science has not changed measurably since 2015 and this Supplemental covers similar training and testing activities in the same study area as those analyzed in 2015 (a copy of the EFH Assessment is available at https://www.NWTTEIS.com).

The Navy will continue to coordinate with NMFS to ensure that the best available data is being used for continued compliance with the Magnuson-Stevens Fishery Conservation and Management Act.

6.2 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with the Council on Environmental Quality regulations (Part 1502), this Supplemental analyzes the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. This analysis has not changed since the analysis conducted in the 2015 NWTT Final EIS/OEIS. See Section 6.2 (Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity) of the 2015 NWTT Final EIS/OEIS for more information (U.S. Department of the Navy, 2015).

6.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented” (42 U.S.C. section 4332). This analysis has not changed since it was conducted in the 2015 NWTT Final EIS/OEIS and the Navy’s activities have been ongoing and continuous since then. See Section 6.3 (Irreversible or Irretrievable Commitment of Resources) of the 2015 NWTT Final EIS/OEIS for more information (U.S. Department of the Navy, 2015).

6.4 Energy Requirements and Conservation Potential of Alternatives

Pursuant to the operational strategy report in 2011, the DoD published an implementation plan to integrate operational energy considerations and transformation into existing programs, processes, and institutions (U.S. Department of Defense, 2012). The DoD consumed approximately 1.3 percent of the total U.S. oil and petroleum consumption in Fiscal Year 2013. It is the largest single user in the nation (Burke, 2014). The Navy consumes approximately 26 percent of the total DoD share (U.S. Department of Defense, 2016). In Fiscal Year 2013, the Navy consumed almost 90 million barrels of liquid fuel (Burke, 2014). In 2016, the DoD published a new Operational Energy Strategy to update the 2011 strategy and transform the way energy is consumed in military operations; the strategy sets the overall direction for operational energy security (U.S. Department of Defense, 2016). The 2016 strategy shifts focus towards three objectives: (1) increasing future warfighting capability by including energy throughout future force development; (2) identifying and reducing logistic and operational risks from operational energy vulnerabilities; (3) and enhancing the force’s mission effectiveness through updated equipment and improvements in training, exercises, and operations (U.S. Department of Defense, 2016). These documents provide guidance to the DoD in how to better use energy resources and transform the way we power current and future forces.

Training and testing activities within the Study Area would result in an increase in energy demand over current activities. The energy demand would arise from fuel (e.g., gasoline, diesel) consumption, mainly from aircraft and vessels participating in training and testing. Details of fuel consumption by training and testing activities on an annual basis are set forth in the air quality emissions calculation spreadsheets available on the project website. Aircraft fuel consumption is estimated to decrease by approximately 28 percent and 26 percent per year under Alternative 1 and Alternative 2, respectively, when compared to current rates of aircraft fuel consumption for training and testing activities. Vessel fuel consumption is estimated to increase by 140 percent under Alternative 1 and by 163 percent per year under Alternative 2, when compared to current rates of vessel fuel consumption during training and testing activities. Fuel consumption would result in a net total increase of 7 percent and 13 percent for Alternative 1 and 2, respectively. The alternatives could result in a net cumulative reduction in the global energy (fuel) supply. The significant increase in vessel testing fuel consumption for Alternatives 1 and 2 is due to additional testing operations compared to the baseline, including operations that were previously not analyzed; and updated fuel flow rates for vessels, which are significantly higher for certain vessels, including guided-missile destroyer.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed training and testing activities are identified. The Navy's energy vision given in the Operational Energy Strategy report (2016) is consistent with energy conservation practices and states that the Navy values energy as a strategic resource, understands how energy security is fundamental to executing our mission afloat and ashore, and is resilient to any potential energy future.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supporting the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning. These are improvements to existing shipboard technologies that will both help with fleet readiness and decrease the ships' energy consumption and greenhouse gas emissions.

These initiatives are expected to greatly reduce the consumption of fossil fuels (Section 3.1, Sediments and Water Quality). Furthermore, to offset the impact of its expected near-term increased fuel demands and achieve its goals of reducing fossil fuel consumption and greenhouse gas emissions, the Navy has launched the first vessels of its Great Green Fleet in San Diego (Olson, 2016). The Great Green Fleet was a year-long, Department of the Navy initiative that demonstrated the sea service's efforts to transform its energy use (U.S. Department of the Navy, 2016). The Great Green Fleet's centerpiece was a Carrier Strike Group that deployed on alternative fuels, including nuclear power for the carrier and a blend of advanced biofuel made from beef fat and traditional petroleum for its escort ships (U.S. Department of the Navy, 2016). Throughout 2016, other platforms included ships, aircraft, amphibious and expeditionary forces, and shore installations from the Department of the Navy that participated in the Great Green Fleet by using energy-efficient systems, operational procedures, or alternative fuel during the course of planned mission functions throughout the world (U.S. Department of the Navy, 2016).

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There are no figures in this chapter.

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8 Public Involvement and Distribution

This chapter describes the efforts to involve the public in preparing this Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental) for Northwest Training and Testing (NWTT).

8.1 Project Website

A project website was established to provide the public with information and to accept comments electronically. The project website address is https://www.nwtteis.com and has been active since 2012. The website address was included in the *Federal Register* Notice of Intent to Prepare a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement. It was also included in newspaper advertisements, stakeholder and federally recognized tribes notification letters, press releases, and postcard mailers disseminated for the Notice of Intent. The scoping fact sheet booklet, public notifications, maps, frequently asked questions, technical reports, informational videos, and various other materials are available on the project website and will be updated and made available throughout the course of the project. The website is periodically updated with project announcements, which are emailed to website subscribers.

8.2 Scoping Period

The public scoping period began with issuance of the Notice of Intent in the *Federal Register* on August 22, 2017 (82 FR 39779). At the request of the public and elected officials, the Navy extended the public scoping period to October 6, 2017, and a Notice of Extension of Scoping Period was published in the *Federal Register* on September 20, 2017 (82 FR 43950). Comments on the scope of the analysis were provided by mail and through the project website.

8.2.1 Public Scoping Notification

The Navy made significant efforts to notify the public to ensure maximum public participation during the scoping process. A summary of these efforts follows.

8.2.1.1 Notification Letters

Tribal letters were mailed on August 18, 2017, via priority mail to 56 tribal chairpersons of federally recognized tribes. Stakeholder letters were mailed first-class on August 21, 2017, to 614 federal, state, and local elected officials and government agencies. Entities that received the scoping notification letter can be found in Table 8.2-1, and an example of a stakeholder letter can be found in Figure 8.2-1.

Table 8.2-1: Entities that Received the Scoping Notification Letter

<table>
<tr><th colspan="2">Federally Recognized Tribes and Tribal Groups</th></tr>
<tr><td>Big Lagoon Rancheria, California
Cahto Tribe of the Laytonville Rancheria
Central Council of the Tlingit and Haida Indian Tribes
Cher-Ae Heights Indian Community of the Trinidad Rancheria, California
Confederated Tribes and Bands of the Yakama Nation
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians
Confederated Tribes of Grand Ronde Community of Oregon
Confederated Tribes of the Chehalis Reservation
Confederated Tribes of Siletz Indians of Oregon
Coquille Indian Tribe
Cow Creek Band of Umpqua Tribe of Indians
Cowlitz Indian Tribe
Coyote Valley Band of Pomo Indians of California Elk Valley Rancheria, California
Hoh Indian Tribe
Hopland Band of Pomo Indians, California
Hoopa Valley Tribe, California
InterTribal Sinkyone Wilderness Council
Jamestown S'Klallam Tribe
Karuk Tribe
Ketchikan Indian Corporation
Little River Band of Pomo Indians
Lower Elwha Tribal Community
Lummi Tribe of the Lummi Reservation
Makah Indian Tribe of the Makah Reservation
Metlakatla Indian Community, Annette Island Reserve
Muckleshoot Indian Tribe
Nisqually Indian Tribe
Nooksack Indian Tribe</td>
<td>Organized Village of Saxman Pinoleville Pomo Nation, California
Port Gamble S'Klallam Tribe
Potter Valley Tribe, California
Puyallup Tribe of the Puyallup Reservation
Quileute Tribe of the Quileute Reservation
Quinault Indian Nation
Resighini Rancheria, California
Robinson Rancheria Band of Pomo Indians, California
Round Valley Indian Tribes, Round Valley Reservation, California
Samish Indian Nation
Sauk-Suiattle Indian Tribe
Scotts Valley Band of Pomo Indians of California
Sherwood Valley Rancheria of Pomo Indians of California
Shoalwater Bay Indian Tribe of the Shoalwater Bay Indian Reservation
Skokomish Indian Tribe
Snoqualmie Indian Tribe
Squaxin Island Tribe of the Squaxin Island Reservation
Stillaguamish Tribe of Indians of Washington
Suquamish Indian Tribe of the Port Madison Reservation
Swinomish Indian Tribal Community
Tolowa Dee-ni’ Nation
Tulalip Tribes of Washington
Upper Skagit Indian Tribe
Wiyot Tribe, California
Yurok Tribe of the Yurok Reservation, California</td></tr>
<tr><th colspan="2">Federal Elected Officials and Federal Agencies</th></tr>
<tr><td colspan="2">U.S. Senators (Washington, Oregon, California, Alaska) and Staff
U.S. Representatives (Alaska at large; California Districts 1, 2, 5; Oregon Districts 1, 2, 3, 4, 5; Washington Districts 1, 2, 3, 6, 7, 8, 9); and Staff
Battelle Pacific Northwest Laboratory
Bureau of Indian Affairs
    Northwest Regional Office
Bureau of Land Management
    Coos Bay District Office
    Oregon/Washington State Office
    Spokane District Office
Bureau of Ocean Energy Management
    Pacific Outer Continental Shelf Region
Bureau of Safety and Environmental Enforcement
    Office of Offshore Regulatory Programs</td></tr>
</table>

Federal Aviation Administration
- Western Pacific Region

Fisheries and Oceans Canada Pacific Region
Marine Mammal Commission
National Marine Protected Areas Center
National Park Service
- Olympic National Park

National Oceanic and Atmospheric Administration
- Office of Law Enforcement
- National Marine Fisheries Service
  - Arcata Field Office
  - Office of Protected Resources
    - Endangered Species Act Interagency Cooperation Division
    - Marine Mammal Permitting
    - West Coast Region
  - Washington Coast/Lower Columbia Habitat Branch
  - Northwest Regional Office
  - Northwest Fisheries Science Center
  - Washington Habitat Branch
  - Oregon Office
  - Southwest Oregon Habitat Branch
  - Ukiah Field Office

Olympic Coast National Marine Sanctuary
- Advisory Council

Pacific Fishery Management Council
Puget Sound Federal Caucus
U.S. Army Corps of Engineers
U.S. Army National Guard, Boardman Oregon
U.S. Coast Guard
- District 13
- District 17
- Office of Operating and Environmental Standards

U.S. Department of Agriculture Forest Service
- Olympic National Forest
- Pacific Northwest Region U.S. Department of Commerce

U.S. Environmental Protection Agency Region X
- Environmental Review & Sediment Management Unit
- NEPA Compliance Division

U.S. Geological Survey
- Alaska Science Center
- Northwest Region Office
- Pacific Region Office
- Western Fisheries Research Center

U.S. Fish and Wildlife Service
- Arcata Office
- Pacific Region
- Region 7
- Washington Maritime Wildlife Refuge Complex
- Western Washington Office
  - Consultation & Conservation Planning Division
- Quilcene National Fish Hatchery

State Elected Officials and State Agencies
Office of the Governor (Washington, Oregon, California, Alaska) and Staff
State Senators (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 5, 16, 28, 29; California Districts 1, 2, 4; Alaska Districts A, B, C) and Staff
State Representatives (Washington Districts 1, 2, 7, 10, 19, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32, 35, 38, 39, 44; Oregon Districts 1, 9, 10, 31, 32, 57; California District 1; Alaska Districts 1, 2, 3, 4) and Staff
Alaska Department Natural Resources
Division of Forestry
Alaska Department of Commerce
Community and Economic Development
Alaska Department of Environmental Conservation
Alaska Department of Fish & Game
Commercial Fisheries Division
Division of Wildlife Conservation
Habitat
Sport Fish Division
Sport Fishing
Subsistence
Alaska Department of Military & Veterans Affairs
Alaska Department of Natural Resources
Public Information Center
Division of Forestry
Division of Mining, Land and Water
Division of Parks and Outdoor Recreation
Office of History and Archaeology
Alaska Department of Transportation & Public Facilities
Division of Statewide Aviation
Alaska Marine Highway
Alaska Statement of Cooperation
California Coastal Commission
California Department of Fish and Wildlife
California Environmental Protection Agency
California Resources Agency
Washington Coastal Marine Advisory Council
Department of Commerce
Community & Economic Development
Division of Community and Regional Affairs
Department of Environmental Conservation
Division of Air Quality
Division of Administrative Services
Division of Environmental Health
Division of Spill Prevention and Response
Division of Water
Department of Natural Resources
Division of Mining, Land and Water
Division of Geological & Geophysical Surveys
Division of Oil and Gas
Department of Toxic Substances Control
Department of Transportation & Public Facilities
Division of Ports and Harbors
Oregon Department of Fish and Wildlife
Oregon Department of Forestry

Oregon Department of Land Conservation and Development
Oregon Parks and Recreation Department
Oregon Department of State Lands
Oregon Military Department
Oregon State Department of Environmental Quality
    Water Quality
Oregon Water Resources Department
Oregon Parks and Recreation Department
Pacific States Marine Fisheries Commission
Puget Sound Partnership
Regulatory Commission of Alaska
Scappoose Industrial Air Park
State of Alaska Department of Environmental Conservation
    Division of Water
Washington State Department of Ecology
    Shorelands and Environmental Assistance Program
Washington State Department of Agriculture
    Policy and Communications
Washington State Department of Archaeology & Historic Preservation
Washington State Department of Ecology
    Northwest Regional Office
    Southwest Regional Office
Washington State Department of Fish and Wildlife, Region 6
Washington State Department of Natural Resources
Washington State Fish and Wildlife Commission
Washington State Parks and Recreation Commission

Local Elected Officials and Local Agencies

Washington State
    City of Aberdeen
    City of Bainbridge Island
    City of Everett
    City of Forks
    City of Gig Harbor
    City of Hoquiam
    City of Oak Harbor
    City of Ocean Shores
    City of Port Angeles
    City of Port Orchard
    City of Port Townsend
    City of Poulsbo
    City of Sequim
    City of Shelton
    City of Tacoma
    City of Westport
    Clallam County Board of Commissioners
    Grays Harbor County Board of Commissioners
    Island County Board of Commissioners
    Jefferson County Board of Commissioners
    Kitsap County Board of Commissioners
    Mason County
    Pacific County Board of Commissioners
    Pierce County Council

- San Juan County Council
- Snohomish County Council
- City of Oak Harbor Planning Services Division
- City of Ocean Shores
- Friday Harbor Airport

Oregon State

- City of Astoria
- City of Bandon
- City of Bay City
- City of Brookings
- City of Cannon Beach
- City of Coos Bay
- City of Depoe Bay
- City of Garibaldi
- City of Gearhart
- City of Gold Beach
- City of Lakeside
- City of Lincoln City
- City of Manzanita
- City of Nehalem
- City of Newport
- City of North Bend
- City of Port Orford
- City of Reedsport
- City of Rockaway Beach
- City of Seaside
- City of Tillamook
- City of Warrenton
- City of Wheeler
- City of Yachats
- Clatsop County Board of Commissioners
- Coos County Board of Commissioners
- Curry County Board of Commissioners
- Lane County Board of Commissioners
- Lincoln County
- Tillamook County Board of Commissioners
- Depoe Bay Nearshore Action Team
- Office of Lincoln County
- Port Orford Watershed Council

California State

- City of Arcata
- City of Crescent City
- City of Eureka
- City of Fort Bragg
- City of Point Arena
- City of Trinidad
- Del Norte County Board of Supervisors
- Humboldt County Board of Supervisors
- Mendocino County Board of Supervisors
- Humboldt County Democratic Central Committee

Alaska State

- City of Ketchikan
- Ketchikan Gateway Borough

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/0952
August 21, 2017

Dear Sir or Madam:

SUBJECT: NOTICE OF INTENT TO PREPARE A SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT FOR NORTHWEST TRAINING AND TESTING

This letter is to inform you that the Department of the Navy (Navy) is preparing a supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing"). The Navy is requesting your comments on the scope of the analysis, including potential environmental issues and viable alternatives to be considered during the development of the Draft Supplemental EIS/OEIS.

The Navy previously completed an EIS/OEIS in 2015, for which a Record of Decision was signed in October 2016, for at-sea training and testing activities occurring within the Study Area. The supplement to the 2015 Final EIS/OEIS is being prepared to support ongoing and future activities conducted at sea within the Study Area beyond 2020. Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of activities the Navy has been conducting in the Study Area for decades.

The Supplemental EIS/OEIS will include an analysis of training and testing activities using new information available after the release of the 2015 Final EIS/OEIS. New information includes an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act to support ongoing and future at-sea military readiness activities within the Study Area beyond 2020.

The Study Area remains unchanged since the 2015 Final EIS/OEIS (Enclosure 1). The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations where sonar maintenance and testing occur. In the supplement to the 2015 Final EIS/OEIS, the Navy will only analyze those training and testing activities conducted at sea within the Study Area.

Figure 8.2-1: Stakeholder Scoping Notification Letter

5090
Ser N465/0952
August 21, 2017

The Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sonar and explosives while employing marine species protective mitigation measures. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct at-sea training and testing activities at levels required to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

Public comments will be accepted during the 30-day scoping period beginning August 22, 2017 and extending through September 21, 2017. Comments must be postmarked or received online by **September 21, 2017** for consideration in the development of the Draft Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Avenue, Building 385
Oak Harbor, WA 98278-3500

For more information, please visit the project website at www.NWTTEIS.com or contact Ms. Jackie Queen, NWTT Supplemental EIS/OEIS Project Manager, at 360-257-3852, or email jackie.queen@navy.mil.

Please help the Navy inform the community about the intent to prepare the Supplemental EIS/OEIS for at-sea training and testing in the Pacific Northwest by sharing this information with your staff and interested individuals.

Sincerely,

Larry M. Foster

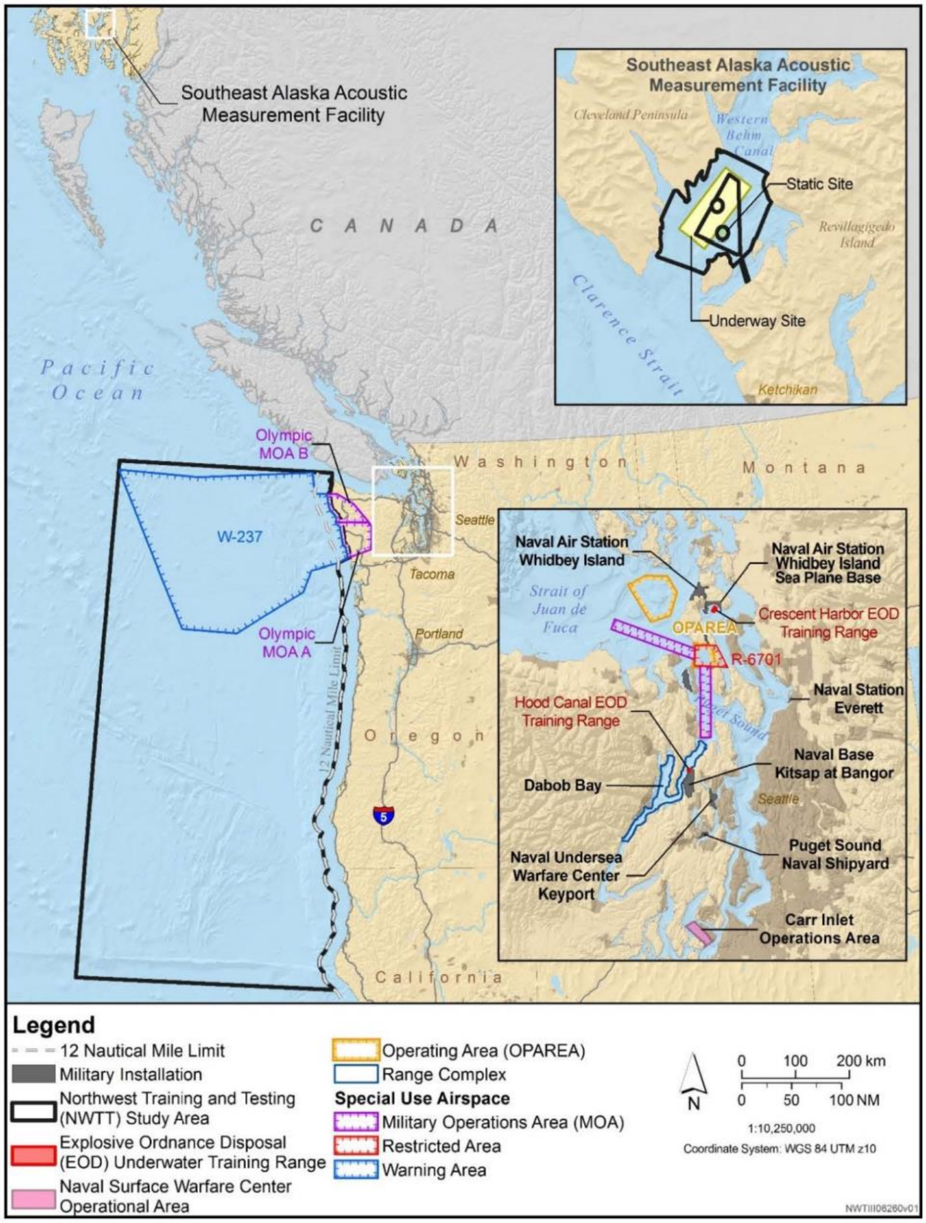
L. M. FOSTER
By direction

Enclosure: 1. Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Study Area

2

Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

Enclosure 1: Northwest Training and Testing Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement Study Area



Enclosure (1)

Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

8.2.1.2 Postcard Mailers

A postcard was mailed first-class to 1,655 individuals, community groups, tribal staff, and nongovernmental organizations on August 21, 2017. The postcard provided information about the Proposed Action, the website address, and how to submit public comments. An example of the postcard is shown in Figure 8.2-2.

Figure 8.2-2: Postcard Mailer for Scoping (Front)

Proposed Action

The Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sonar and explosives while employing marine species protective mitigation measures. Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of activities the Navy has been conducting in the Study Area for decades.

For more information or to submit comments online, visit **www.NWTTEIS.com**.

Naval Facilities Engineering
Command Northwest
Attention: NWTT Supplemental
EIS/OEIS Project Manager
3730 North Charles Porter Ave.
Building 385
Oak Harbor, WA 98278-3500

Figure 8.2-2: Postcard Mailer for Scoping (Back)

8.2.1.3 Newspaper Advertisements

Display advertisements were placed in local newspapers to advertise the public's opportunity to comment on the scope of the analysis. The advertisements included a description of the Proposed Action, the address of the project website, the duration of the comment period, and information on how to provide comments. The newspapers and publication dates are indicated in Table 8.2-2. An example of the advertisement is shown in Figure 8.2-3.

Table 8.2-2: Newspaper Publications

Newspaper	Newspaper Coverage	Publication Dates
Juneau Empire	Juneau, Alaska	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Ketchikan Daily News	Ketchikan, Alaska	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Eureka Times-Standard	Eureka, California	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Fort Bragg Advocate-News	Fort Bragg, California	Thursday, Aug. 24, 2017 Thursday, Aug. 31, 2017 Thursday, Sept. 7, 2017
The Daily Astorian	Astoria, Oregon	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug 24, 2017
Newport News-Times	Newport, Oregon	Wednesday, Aug. 23, 2017 Friday, Aug. 25, 2017 Wednesday, Aug. 30, 2017
The Oregonian	Portland, Oregon	Wednesday, Aug. 23, 2017 Friday, Aug. 25, 2017 Saturday, Aug. 26, 2017
The Daily Herald	Everett, Washington	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
The Daily World	Aberdeen, Washington	Tuesday, Aug. 22, 2017 Thursday, Aug. 24, 2017 Saturday, Aug. 26, 2017
Forks Forum	Forks, Washington	Thursday, Aug. 24, 2017 Thursday, Aug. 31, 2017 Thursday, Sept. 7, 2017
Journal of the San Juan Islands	San Juan Island, Washington	Wednesday, Aug. 23, 2017 Wednesday, Aug. 30, 2017 Wednesday, Sept. 6, 2017

Newspaper	Newspaper Coverage	Publication Dates
The Kitsap Sun	Kitsap, Washington	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Peninsula Daily News	Port Angeles, Washington	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Port Townsend and Jefferson County Leader	Port Townsend, Washington	Wednesday, Aug. 23, 2017 Wednesday, Aug. 30, 2017 Wednesday, Sept. 6, 2017
The Seattle Times	Seattle, Washington	Tuesday, Aug. 22, 2017 Wednesday, Aug. 23, 2017 Thursday, Aug. 24, 2017
Sequim Gazette	Sequim, Washington	Wednesday, Aug. 23, 2017 Wednesday, Aug. 30, 2017 Wednesday, Sept. 6, 2017
Whidbey News-Times	Whidbey Island, Washington	Wednesday, Aug. 23, 2017 Saturday, Aug. 26, 2017 Wednesday, Aug. 30, 2017

The U.S. Navy INVITES YOU TO PARTICIPATE in the Northwest Training and Testing Supplemental EIS/OEIS Process

The U.S. Navy is preparing a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the Northwest Training and Testing (NWTT) EIS/OEIS Study Area beyond 2020.

Public Involvement Opportunity

The Navy is requesting your comments on the scope of the analysis to be considered during the development of the Draft Supplemental EIS/OEIS. Comments will be accepted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

All comments must be postmarked or received online by Sept. 21, 2017 for consideration in the development of the Draft Supplemental EIS/OEIS.

Figure 8.2-3: Newspaper Announcement for Scoping

8.2.1.4 Press Releases

Commander, Navy Region Northwest Public Affairs Office distributed a news release to local and regional media outlets on August 22, 2017. A second news release was distributed to media outlets on September 15, 2017, and that same news release was redistributed on October 2, 2017. The first news release provided information on the Proposed Action and how to submit comments. The second news release provided information on the public scoping comment period extension, the Proposed Action, and how to submit comments. The press releases from the Commander, Navy Region Northwest are shown in Figure 8.2-4 and Figure 8.2-5.

COMMANDER, NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Rd., Silverdale, WA 98315-1100
Phone: 360-396-1630 Fax: 360-396-7127

Aug. 22, 2017

Release # 0823417

U.S. NAVY SEEKS PUBLIC INPUT ON THE NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash — The U.S. Navy is preparing a supplement to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing"). The Navy is requesting public comments on the scope of the analysis, including potential environmental issues and viable alternatives to be considered during the development of the Draft Supplemental EIS/OEIS.

The Navy previously completed an EIS/OEIS in 2015, for which a Record of Decision was signed in October 2016, for at-sea training and testing activities occurring within the Study Area. The supplement to the 2015 Final EIS/OEIS is being prepared to support ongoing and future activities conducted at sea within the Study Area beyond 2020. Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of activities the Navy has been conducting in the Study Area for decades.

The Supplemental EIS/OEIS will include an analysis of training and testing activities using new information available after the release of the 2015 Final EIS/OEIS. New information includes an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act to support ongoing and future at-sea military readiness activities within the Study Area beyond 2020.

Proposed Action:

The Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sound navigation and ranging (sonar) and explosives while employing marine species protective mitigation measures.

The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

-more-

Figure 8.2-4: Commander, Navy Region Northwest Scoping Press Release

NWTT SUPPLEMENTAL EIS/OEIS -2-

- Conduct at-sea training and testing activities at levels required to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged since the 2015 Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations where sonar maintenance and testing occur. In the supplement to the 2015 Final EIS/OEIS, the Navy will only analyze those training and testing activities conducted at sea within the Study Area.

Scoping Comment Period for the Supplemental EIS/OEIS:

The 30-day scoping comment period begins Aug. 22, 2017 through Sept. 21, 2017. Comments must be postmarked or received online by **Sept. 21, 2017** for consideration in the development of the Draft Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Scoping meetings are not being held at this stage of the process because the Proposed Action does not differ substantially from the 2015 Final EIS/OEIS. However, public meetings are planned to occur following the release of the Draft Supplemental EIS/OEIS in early 2019. For additional project information, please visit the project website at **www.NWTTEIS.com.**

Please help inform your community by sharing the information in this press release.

Should you have trouble accessing the project website, please email ProjectManager@nwtteis.com for assistance. For other information about your Navy in the Northwest Region, please visit the Navy Region Northwest website at www.cnic.navy.mil/cnrnw.

-USN-

Figure 8.2-4: Commander, Navy Region Northwest Scoping Press Release (continued)

COMMANDER, NAVY REGION NORTHWEST

Public Affairs Office
1100 Hunley Road, Silverdale, WA 98315-1100
Phone: 360-396-1630 Fax: 360-396-7127

FOR IMMEDIATE RELEASE **Sept. 15, 2017**
Release #17-258

NAVY EXTENDS PUBLIC SCOPING COMMENT PERIOD FOR NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

SILVERDALE, Wash. — The U.S. Navy is extending the public scoping comment period for the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS) through Oct. 6, 2017, to allow the public more time to submit substantive comments. Scoping, which is conducted in accordance with the National Environmental Policy Act, is a process where the public is encouraged to participate in the development of an environmental impact statement by identifying the scope of the analysis, including potential environmental issues and viable alternatives.

The Navy is preparing a supplement to the 2015 NWTT Final EIS/OEIS to assess the potential environmental effects associated with military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter referred to as the "Study Area"). Military readiness activities include training and research, development, testing, and evaluation (hereafter referred to as "training and testing").

Scoping Comment Period Extension for the Supplemental EIS/OEIS:

The Navy is accepting comments throughout the extended public comment period, which began Aug. 22. 2017, and now runs until Oct. 6, 2017. All comments must be postmarked or received online by **Oct. 6, 2017**, for consideration in the development of the Supplemental EIS/OEIS. Comments may be submitted online at **www.NWTTEIS.com**, or by mail to:

Naval Facilities Engineering Command Northwest
Attention: NWTT Supplemental EIS/OEIS Project Manager
3730 North Charles Porter Ave., Building 385
Oak Harbor, WA 98278-3500

Public meetings are planned to occur following the release of the Draft Supplemental EIS/OEIS in early 2019. For additional project information, please visit the project website at **www.NWTTEIS.com**.

Background:

The Navy completed an EIS/OEIS in 2015 for training and testing activities occurring within the same Study Area, for which a Record of Decision was signed in October 2016. The supplement to the 2015 Final EIS/OEIS is being prepared to support future activities conducted at sea and in associated airspace within the same Study Area beyond 2020. As part of this process, the Navy will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and Endangered Species Act. Proposed training and testing activities are generally

-more-

Figure 8.2-5: Commander, Navy Region Northwest Comment Extension Press Release

NWTT Supplemental EIS/OEIS -2-2-2

consistent with those analyzed in the previous EIS/OEIS and approved in the 2016 Record of Decision, and are representative of activities the Navy has been conducting in the Study Area for decades.

Proposed Action:

The Proposed Action is to conduct training and testing activities at sea and in associated airspace within the Study Area. At-sea activities include the use of active sound navigation and ranging (sonar) and explosives while employing marine species protective measures.

The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities at sea and in associated airspace to support military readiness requirements beyond 2020; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area remains unchanged from the 2015 Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and Navy pierside locations.

Visit the project website at **www.NWTTEIS.com** to view a map of the Study Area, learn more about the project, and submit substantive comments online.

Should you have trouble accessing the project website, please email ProjectManager@nwtteis.com for assistance. For other information about your Navy in the Northwest Region, please visit the Navy Region Northwest website at www.cnic.navy.mil/cnrnw.

Please help inform your community by sharing the information in this press release.

-USN-

Figure 8.2-5: Commander, Navy Region Northwest Comment Extension Press Release (continued)

8.2.1.5 Subscriber Email Notifications

Email subscribers from Phase II were carried forward into Phase III to start with 166 initial website subscribers. An email notification was sent to these 166 website subscribers on August 22, 2017, announcing the Navy's Intent to Prepare a Draft Supplemental EIS/OEIS. A second email notification was sent to 181 website subscribers on September 15, 2017. The email informed the subscribers of the public scoping comment period extension dates. As of January 2019, there are 193 website subscribers.

8.2.2 Public Scoping Comments

Scoping comments were submitted in two ways:

- Written letters (received any time during the public comment period)
- Comments submitted directly on the project website (received any time during the public comment period)

The Navy received written and electronic comments from federal agencies, state agencies, federally recognized tribes, nongovernmental organizations, individuals, and community groups. A total of 786 comments were received. Seven hundred forty-five comments were submitted using the electronic comment form on the project website. Forty-one written comments were mailed. A sampling of some of the specific areas of concerns follows.

8.2.2.1 Proposed Action and Alternatives

- Need for clarity on the Navy's Proposed Action
- Overview requested on how the Proposed Action fits within the broader Department of Defense training and testing occurring throughout the Pacific Northwest, western regions and states, marine coastal and oceanic environments, and Alaska
- Concern about expansion
- Opposition to expansion of the use of sonar and explosives
- Concern about the impacts of dipping sonar
- Concern for activities that are perceived as a waste of taxpayer dollars
- Concern about the Navy conducting war games in the Pacific Northwest and creating war zones in the area
- Recommendation to evaluate the efficacy of sonar with computer modeling rather than performing experiments in the ocean
- Consider an alternative that maximizes opportunities to limit sound exposures to marine mammals to a level that would likely result in behavioral harassment only
- Include a range of alternatives that meet the stated purpose and need, goals and objectives, and responds to issues identified during the scoping process
- Encourage selection of alternatives that protect, restore, and enhance the environment
- Provide greater details on whether Navy exercises would expand onto public beaches
- Develop reasonable alternatives that inform decision-makers and the public of how the agencies can, in accordance with Council on Environmental Quality regulations, avoid or minimize adverse impacts or enhance the quality of the human environment
- Evaluate an alternative that would exclude ocean waters off the California coast from all training and testing

- Request for the Navy to broadly define the scope of the project and re-evaluate the spectrum of naval training exercises conducted in the Pacific Northwest

8.2.2.2 National Environmental Policy Act and Public Involvement

- Request for a 60-day comment period extension
- Request the Navy issue revised notices clarifying specific actions the Navy will analyze in this Supplemental to provide clarity on the scope of analysis
- Request the Navy issue a revised Notice of Intent mentioning the Proposed Action's potential effects and proximity to Olympic National Park
- Objection to developing a Supplemental rather than a new EIS/OEIS
- Determination of whether a revised or updated Coastal Zone Management Act compliance document is required
- Request Navy invite U.S. Fish and Wildlife Service, National Park Service, and U.S. Forest Service to be cooperating agencies to more comprehensively evaluate impacts

8.2.2.3 Location of Activities

- Request the Navy research other locations for training and testing
- Request to use other areas where the Navy trains and conducts tests, and not in the marine waters of the Pacific Northwest, Alaska, and California
- Concern about ocean areas off the Northern California coast being used for chemical tests
- Should not test live ammunition or explosions of aerial or underwater ordnance
- Evaluate alternate areas that would have less impact on residents and economy

8.2.2.4 Segmentation

- Request to conduct EISs associated with the geographic area being impacted, rather than by broad resource category
- Concern the Navy is segmenting and limiting its analysis to individual training exercises or actions to characterize its activities as minimal
- Request aircraft training be split into a separate analysis to allow the public to engage in a more meaningful way
- Provide information on impacts of the EA-18G Growlers in the analysis

8.2.2.5 Environmental Impact Analysis

- Evaluate direct and indirect impacts
- Recommend a detailed table identifying the proposed type and frequency of specific potential stressors be developed; provide to the public in advance of the release of this Draft Supplemental
- Monitor depleted uranium in the ocean
- Evaluate impacts of aircraft noise and the use of sonar and live explosives on humans, animals, and marine life
- Request for comparison of baseline activities versus proposed activities

- Concerns that training and testing exercises involving marine vessels and aircraft, explosives, electromagnetic devices, or sonar technology have the potential to negatively impact terrestrial and marine resources and diminish visitor enjoyment of national parks in the Pacific Northwest
- Natural and cultural resources and visitor experience in three units of the National Park System may be impacted by the activities identified in this Supplemental and should be evaluated in detail:
    - Ebey's Landing National Historical Reserve
    - Olympic National Park
    - San Juan Island National Historical Park
- Request for appropriate density estimates for expended training debris, which should be calculated using the footprint area of the specific exercise
- Focus impact discussion on specific resources and locales and avoid basing significance conclusions on averaging impacts over large areas of ocean
- Avoid equating a lack of information with a lack of impact
- Use project-specific thresholds to determine levels of impact to focus analysis on potentially significant environmental impacts
- Concern over aircraft training and expansion of training areas over Olympic National Park
- Disruption to National Park will result in increased noise complaints from the public
- Assess impacts of alternative on the resources and values of Olympic National Park
- Develop and fully analyze alternatives that avoid aviation training over Olympic National Park and that minimize impacts on the Park
- Include Olympic National Park World Heritage Site and the International Biosphere Reserve designation of Olympic National Park in the analysis

8.2.2.6 Cumulative Impacts

- Assess cumulative impacts of naval activities on marine biota
- Assess impacts at sea and throughout the region
- Characterize resources, ecosystems, and communities in terms of their response to change and capacity to withstand stress

8.2.2.7 Sediments and Water Quality Impacts

- Discuss the applicability of national standards under development by the Environmental Protection Agency under Section 312(n) of the Clean Water Act to establish the Uniform National Discharge Standards to control discharges incidental to the normal operation of military vessels
- Include relevant updates to the fate, transport, and bioaccumulation of toxics in expended materials
- Include relevant updates on areas that contain hazardous materials, and evaluate the potential for training and testing to resuspend contaminants
- Evaluate whether the Navy is putting depleted uranium into marine waters
- Concerns for groundwater or other contamination associated with Navy operations on Whidbey Island

8.2.2.8 Air Quality

- Quantify the contribution of carbon pollution from projected military activities
- Concerns about aerosol spraying and resulting impacts on critical habitat and species
- Include in the scope of the analysis the greenhouse gas emissions resulting from the project, and all the effects of those emissions, including ocean acidification, climate change, and loss of species
- Consider in the analysis:
    - Any adverse impact on air-quality-related values in a federal Class I area or state wilderness area
    - Whether there are annual emissions greater than the basic Prevention of Significant Deterioration emission thresholds
    - Any new violation of state or federal ambient air quality standards
    - Interference with the maintenance or attainment of any state or federal ambient air quality standard in the project area
    - Increases in the frequency or severity of existing violations of state or federal ambient air quality standard in the analysis area
    - Exposure of nearby populations to increased levels of diesel particulate matter and other air toxics
    - Delays in the timely attainment of any standard, interim emission reduction, or other air quality milestone
    - Exposure of sensitive receptors to substantial pollutant concentrations

8.2.2.9 Airborne Noise

- Develop on-the-ground noise data instead of a model
- Include health impacts from noise, including effects of post-traumatic stress disorder
- Analyze Growler noise complaints and impacts noise would have on tourism, residents, health, and quality of life
- Recognize predicted noise and actual noise produced by aircraft deviates significantly
- Concerns that models are producing wrong results
- Request the Navy fund the collection of baseline ambient acoustic data in Olympic National Park and include the results in this Supplemental
- Request to continue Navy flight training in Montana and other locations already disrupted by jet noise
- Impact of aircraft and helicopter noise on farm animals and other species found in National Parks, such as the Olympic marmot
- Analyze the impact noise would have on property values
- Analyze effects related to the scenic, aesthetic, and cultural components of the Olympic Peninsula, including impacts on visitors to Olympic National Park who are seeking solitude and/or natural ambient noise levels
- Analyze the impacts on nesting colonies of gulls as a result of aircraft noise over Lopez Island

8.2.2.10 Socioeconomic Resources

- Evaluate economic impacts on tourism, property values, health, and well-being
- Impacts on commercial fishing industry

8.2.2.11 Terrestrial Species and Habitats/Marine Birds

- Concern that the analysis may be limited to just effects at sea, but proposed analysis of impacts on terrestrial environments should be included
- Analyze the impacts on terrestrial species from Navy overflights
- Impacts on wildlife that may experience increased and prolonged stress levels

8.2.2.12 Marine Resources

- Evaluate the pollution from activities in marine waters, and state what pollutants are being added to marine waters from Navy activities
- Concerns about disruption to the marine environment and marine species, especially from the use of active sonar and explosives
- Refrain from measuring impacts on the marine environment according to whether population impacts would occur; harm to smaller areas and groups should be considered
- Analyze how stressors affect habitat, as well as the physiology and behavior of marine life
- Revise thresholds and weighting system for auditory impacts
- Revise behavioral impact thresholds to incorporate best available science

8.2.2.13 Marine Mammal Impacts

- Navy and National Marine Fisheries Service should include information needed to evaluate compliance with the Marine Mammal Protection Act/Endangered Species Act
- Concerns that the Navy lies about marine species takes and mortalities to gain permits from federal agencies
- Concerns on incidental takes and general impacts on marine species
- Analyze the impact of pinniped colonies found near Lopez Island as a result of aircraft noise
- Impacts on the ocean food chain due to the loss of large mammals
- Concern that low-frequency active sonar systems violate the Marine Mammal Protection Act

8.2.2.14 Fish/Marine Habitat

- Impacts on migrating salmon populations, damage to honing mechanisms, and takes of endangered species, including salmon and steelhead
- Analyze impacts of noise on fish and stress hormone production from sound
- Reach out to the Alaska Ocean Observing System for fish population/migration data
- Incorporate latest understanding of important marine habitats reflected in current management documents

8.2.2.15 American Indian and Alaska Native Traditional Resources

- Concerns about the evaluation of impacts on the cultural resources, and areas of importance
- Consider impacts on cultural practices, which have religious and spiritual meaning
- Best available science should include Tribal Traditional Knowledge

- Request the Navy continue to fulfill its obligation for meaningful government-to-government tribal consultation
- Concern about impacts on usual and accustomed treaty rights
- Consider a tribe's human-environmental relationship
- Consider the economic impact on the tribe
- Concern about diminished treaty rights
- Evaluate the possible disruption to tribal cultural practices
- Determine impacts of noise on the cultural landscape
- Impacts on salmon and other fish that provide subsistence to neighboring indigenous populations

8.2.2.16 Public Health and Safety

- Determine public health effects from chaff and other toxins
- Determine impacts from exposure to electromagnetic radiation

8.2.2.17 Mitigation Measures

- Recommendations to establish additional mitigation areas (geographic) and time-area management (temporal) areas
- Provide specific clean up measures that will be taken on the terrestrial and marine environment
- Recommendation to use thermal detection for marine species
- Concerns about inefficiencies and inadequacies of human Lookouts, and requests to analyze the effectiveness of visual monitoring
- Move training and testing activities outside of the annual gray whale migration path, and suspend training activities during gray whale migration
- Recommendation for Navy to engage in direct dialogue with the trawling community and develop a mutually acceptable warning system to alert trawlers when submarines are operating in the area
- Follow current mitigation measures, including but not limited to:
  - Do not operate at night or in specific ocean areas
  - Conduct air flights to search for species
  - Do not operate when a species is within a certain range
  - Do not operate when bow-riding dolphins are present
  - Operate at less than full power
  - Reduce speeds as directed
- Reduce impacts to the lowest possible level
- Provide training to Navy personnel on a tribe's history, culture, and subsistence uses
- Consider habitat-based management and important feeding areas
- Concerns that cultural mitigation measures are inadequate
- Avoid areas of biological and ecological importance
- Include an adaptive management plan, including monitoring the effectiveness of mitigation commitments
- Include more monitoring results in this Supplemental
- Include the public in mitigation planning

8.3 Notification of Availability of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

This Draft Supplemental public review and comment period will begin with issuance of the Notice of Availability and Notice of Public Meetings in the *Federal Register*. The *Federal Register* notices will include notification of the availability of the Draft Supplemental and where it can be accessed; an overview of the Proposed Action and its purpose and need; public commenting information; and the locations, dates, and times of public meetings. The purpose of the public meetings is to inform the public about the Proposed Action and environmental analysis, and to solicit public comments on the environmental issues addressed and analyzed in this Supplemental. Comments will be accepted by mail, through the project website at www.nwtteis.com, and at the public meetings.

8.3.1 Notification of Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement and Public Meetings

The Navy will make significant efforts to facilitate maximum public participation during Draft Supplemental public review and comment period. A summary of these efforts follows.

8.3.1.1 Notification Letters

Tribal notification letters will be distributed three days prior to the release of Draft Supplemental to appropriate federally recognized tribes and tribal groups. Stakeholder letters will be mailed one day prior to the release of Draft Supplemental to interested federal, state, and local government agencies and elected officials, and persons expressing an interest in the Proposed Action and Draft Supplemental.

8.3.1.2 Postcards

Postcards will be mailed to recipients on the project mailing list, including individuals; nongovernmental organizations; tribal groups; community and business groups; fishing, aviation, and recreation groups; and private companies. The postcards will include the dates, locations, and times of the public meetings, as well as the website address for more information, commenting information, and a brief summary of the Proposed Action.

8.3.1.3 Press Releases

Press releases to announce the availability of the Draft Supplemental and public meetings will be distributed to local and regional media. Press releases will provide a description of the Proposed Action, project website, duration of the comment period and commenting methods, information repositories, and location, dates, and times of the public meetings. The press releases will also provide information on the availability of the Navy to meet with the media in advance of the meetings.

8.3.1.4 Newspaper Advertisements

To announce the availability of the Draft Supplemental and public meetings, advertisements will be placed in area newspapers as shown in Table 8.3-1. The advertisements will include a description of the Proposed Action, the project website, the duration of the comment period, and information on how to provide comments.

Table 8.3-1: Newspaper Announcements of the Availability of the Draft Supplemental EIS/OEIS and Public Meetings

Newspaper	Newspaper Coverage
Juneau Empire	Juneau, Alaska
Ketchikan Daily News	Ketchikan, Alaska
Eureka Times-Standard	Eureka, California
Fort Bragg Advocate-News	Fort Bragg, California
The Daily Astorian	Astoria, Oregon
Newport News-Times	Newport, Oregon
The Oregonian	Portland, Oregon
The Daily Herald	Everett, Washington
The Daily World	Aberdeen, Washington
Forks Forum	Forks, Washington
Journal of the San Juan Islands	San Juan Island, Washington
The Kitsap Sun	Kitsap, Washington
Peninsula Daily News	Port Angeles, Washington
Port Townsend and Jefferson County Leader	Port Townsend, Washington
The Seattle Times	Seattle, Washington
Sequim Gazette	Sequim, Washington
Whidbey News-Times	Whidbey Island, Washington

8.3.2 Public Meetings

The Navy will hold open house public meetings to inform the public about the Proposed Action and environmental analysis, and to solicit public comments on the Draft Supplemental. The public meetings will include informational poster stations staffed by Navy representatives. There will not be a presentation or formal oral comment session. A stenographer will be available for the public to facilitate one-on-one oral comments; written comments can be submitted at any time during the meetings. Members of the public may arrive at any time during the public meetings.

8.4 Distribution of the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

All of the parties being notified of the availability of the Draft Supplemental will be directed to access the document electronically on the project website (www.nwtteis.com), or to access hard and CD-ROM copies, as available at the information repositories discussed in Section 8.4.2 (Information Repositories). Chairpersons of federally recognized tribes will receive a CD-ROM copy of the Draft Supplemental.

8.4.1 Federal Agencies

The U.S. Environmental Protection Agency will receive a hard copy and electronic version (CD-ROM) of the Draft Supplemental. Regional offices of the U.S. Environmental Protection Agency will receive electronic versions of the Draft Supplemental. The National Marine Fisheries Service headquarters office, U.S. Fish and Wildlife Service office, and U.S. Coast Guard office will receive hard and electronic copies of the Draft Supplemental.

8.4.2 Information Repositories

The Draft Supplemental will be mailed in hard copy form, along with an electronic CD-ROM, to the information repository locations shown in Table 8.4-1.

Table 8.4-1: Information Repositories

Repository Name	Mailing Address	Phone
Everett Main Library	2702 Hoyt Ave., Everett, WA, 98201	425-257-8010
Gig Harbor Library	4424 Point Fosdick Drive NW, Gig Harbor, WA, 98335	253-548-3305
Jefferson County Library (Port Hadlock)	620 Cedar Ave., Port Hadlock, WA, 98339	360-385-6544
Kitsap Regional Library (Poulsbo)	700 NE Lincoln Road, Poulsbo, WA 98370	360-779-2915
Kitsap Regional Library - Sylvan Way (Bremerton)	1301 Sylvan Way, Bremerton, WA 98310	360-405-9100
North Olympic Library System Forks Branch	171 S. Forks Ave., Forks, WA 98331	360-374-6402
Lopez Island Library	2225 Fisherman Bay Road, Lopez Island, WA 98261	360-468-2265
Oak Harbor Public Library	1000 SE Regatta Drive, Oak Harbor, WA 98277	360-675-5115
Port Angeles Main Library	2210 S. Peabody St., Port Angeles, WA 98362	360-417-8500
Port Townsend Public Library	1220 Lawrence St., Port Townsend, WA 98368	360-385-3181
San Juan Island Library	1010 Guard St., Friday Harbor, WA 98250	360-378-2798
Timberland Regional Library Aberdeen	121 E. Market St., Aberdeen, WA 98520	360-533-2360
Timberland Regional Library Hoquiam	420 Seventh St., Hoquiam, WA 98550	360-532-1710
Astoria Public Library	450 10th St., Astoria, OR 97103	503-325-7323
Driftwood Public Library	801 SW Highway 101 #201, Lincoln City, OR 97367	541-996-2277
Newport Public Library	35 NW Nye St., Newport, OR 97365	541-265-2153
Oregon State University, Guin Library Hatfield Marine Science Center	2030 SE Marine Science Drive, Newport, OR 97365	541-867-0249
Tillamook Main Library	1716 Third St., Tillamook, OR 97141	503-842-4792
Fort Bragg Branch Library	499 Laurel St., Fort Bragg, CA 95437	707-964-2020
Humboldt County Public Library Arcata Branch Library	500 Seventh St., Arcata, CA 95521	707-822-5954
Humboldt County Public Library Eureka Main Library	1313 Third St., Eureka, CA 95501	707-269-1905
Redwood Coast Senior Center	490 N. Harold St., Fort Bragg, CA 95437	707-964-0443
Juneau Public Library Downtown Branch	292 Marine Way, Juneau, AK, 99801	907-586-5249
Ketchikan Public Library	1110 Copper Ridge Lane, Ketchikan, AK 99901	907-225-3331

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APPENDIX A NAVY ACTIVITIES DESCRIPTIONS

A.1 Training Activities

The Navy's training activities are organized generally into eight primary mission areas and a miscellaneous category (Other Training) that includes those activities that do not fall within a primary mission area, but are an essential part of Navy training. In addition, because the Navy conducts a number of activities within larger training exercises, descriptions of those larger exercises are also included here. It is important to note that these larger exercises are comprised entirely of individual activities described in the primary mission areas.

Descriptions of sonar, ordnance/munitions, targets, and other systems were provided in the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) (Section 2.3, Description of Sonar, Ordnance/Munitions, Targets, and Other Systems Employed in Northwest Training and Testing Activities).

A.1.1 Air Warfare Training

Air warfare is the primary mission area that addresses combat operations by air and surface forces against hostile aircraft. Navy ships contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled guns for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft guns. Air warfare training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. Air warfare training includes surface-to-air gunnery, surface-to-air and air-to-air missile exercises, and aircraft force-on-force combat maneuvers.

A.1.1.1 Air Combat Maneuver

<table>
<tr><th colspan="4">Air Warfare</th></tr>
<tr><th colspan="4">Air Combat Maneuver</th></tr>
<tr><td>Short Description</td><td colspan="2">Fixed-wing aircrews aggressively maneuver against threat aircraft to gain tactical advantage.</td><td>Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Basic flight maneuvers in which fixed-wing aircrew engage in offensive and defensive maneuvering against each other. During air combat maneuver engagements, no ordnance is fired, but countermeasures such as chaff and flares may be used. These events typically involve two aircraft; however, based upon the training requirement, events may involve multiple aircraft.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft
Targets: Air targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="2">Typical Locations
Offshore Area
W-237
Olympic Military Operations Areas (MOAs)</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic: Aircraft noise
Physical Disturbance and Strike: Aircraft and aerial targets
Energy: In-air electromagnetic devices
Explosive: None
Ingestion: None
Entanglement: None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality: Criteria air pollutants
Sediments and Water Quality: None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources: None
Socioeconomic Resources: Airborne acoustics
Physical disturbance and strike
Public Health and Safety: None</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Compression pad or plastic piston, endcap – chaff and flare, flare O-ring
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">No munitions fired. Flare and chaff may be used.
For air quality analysis:
- Average 2 fixed-wing fighter aircraft per event
- Average 1 hr. per event</td></tr>
</table>

A.1.1.2 Gunnery Exercise Surface-to-Air

<table>
<tr><th colspan="4">Air Warfare</th></tr>
<tr><th colspan="4">Gunnery Exercise Surface-to-Air</th></tr>
<tr><td rowspan="2">Short Description</td><td rowspan="2" colspan="2">Surface ship crews fire medium- and large-caliber guns at air targets.</td><td>Typical Duration</td></tr>
<tr><td>1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Surface ship crews defend against threat aircraft or missiles with large- and medium-caliber guns to disable or destroy the threat.
An event involves one ship and a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Large- or medium-caliber guns fire non-explosive projectiles to disable or destroy the threat before it reaches the ship. The target is towed by a contract air services jet.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Aircraft carrier, amphibious warfare ship, fixed-wing aircraft, surface combatant
Targets: Air targets
Systems being Trained/Tested: None</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Aircraft safety
Weapons firing safety</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Offshore Area
W-237</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosions

Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions

Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants

Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Large- and medium-caliber projectile fragments
Non-Ingestible Material:
Large- and medium-caliber casings, large-caliber projectiles</td><td>Military Recoverable Material</td><td>Air targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Weapons Firing Noise
Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
</table>

Air Warfare	
Gunnery Exercise Surface-to-Air	
Assumptions Used for Analysis	Explosive rounds are used greater than 50 nautical miles (NM) from shoreline, all large-caliber non-explosive events occur greater than 20 NM from shore, and all other non-explosive rounds are used 12 NM or greater from shore. The target is a fiberglass finned target that is towed approximately 3 NM behind the towing aircraft, at an altitude of 1,000 ft. or greater. Approximately 30 percent of the projectiles are assumed to be high explosive. All projectiles explode well above surface.

A.1.1.3 Missile Exercise Air-to-Air

<table>
<tr><th colspan="4">Air Warfare</th></tr>
<tr><th colspan="4">Missile Exercise Air-to-Air</th></tr>
<tr><td>Short Description</td><td colspan="2">Fixed-wing aircrews fire air-to-air missiles at air targets.</td><td>Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">An event involves two or more fixed-wing aircraft and a target. Missiles are either high-explosive warheads or non-explosive practice munitions. The target is an unmanned aerial target drone, a tactical air-launched decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by small boat or rotary-wing aircraft; tactical air-launched decoys and illumination flares are expended and not recovered. These events typically occur at high altitudes.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft; rotary-wing aircraft; small boat
Targets: Air targets, flares
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
W-237</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Aircraft noise
Vessel noise
Weapons noise
Explosive:
In-air explosions
Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions
Energy:
None
Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives
Metals
Chemicals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Target and missile (explosive) fragments, casing
Non-Ingestible Material:
Large parachutes, medium parachutes, illumination flares, missile (non-explosive)</td><td>Military Recoverable Material</td><td>Targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Air Warfare	
Missile Exercise Air-to-Air	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	4 Training events per year with 4 high explosive (HE) warheads, 4 non-explosive practice munitions (NEPM) warheads. Assume 1 flare per Missile Exercise event. All events occur greater than 50 NM from shore and above 15,000 ft. altitude. All propellant and explosives are consumed.

A.1.1.4 Missile Exercise Surface-to-Air

<table>
<tr><th colspan="4">Air Warfare</th></tr>
<tr><th colspan="4">Missile Exercise Surface-to-Air</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship crews fire surface-to-air missiles at air targets.</td><td>Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Surface ship crews defend against threat missiles and aircraft with ship-launched surface-to-air missiles.
The event involves a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Ship-launched surface-to-air missiles are fired (high-explosive) to disable or destroy the threat. The target typically is a remote-controlled drone. Surface-to-air missiles may also be used to train against land attack missiles.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Aircraft carrier, amphibious warfare ship, surface combatant
Targets: Air targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
W-237</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosions</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
None

Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
Explosives
Metals
Chemicals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Target and missile (explosive) fragments
Non-Ingestible Material:
Large parachutes</td><td>Military Recoverable Material</td><td>Undamaged targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Air Warfare	
Missile Exercise Surface-to-Air	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Assumes that all surface-to-air missiles are high explosive. All events occur greater than 50 NM from shore and missile explosions occur above 500 ft. altitude. All explosive and propellant are consumed.

A.1.2 Anti-Submarine Warfare Training

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, and identify, track, and target submarines. Passive sonar “listens” for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine).

The Navy’s anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts; distinguishing discrete acoustic signatures including those of ships, submarines, and marine life; and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against “enemy” submarine contacts, torpedo employment exercises against the target, and exercising command and control tasks in a multi-dimensional battlespace.

A.1.2.1 Anti-Submarine Warfare Torpedo Exercise – Submarine

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Torpedo Exercise—Submarine</th></tr>
<tr><td>Short Description</td><td colspan="2">Submarine crews search for, track, and detect submarines. Event would include one non-explosive MK-48 torpedo.</td><td>Typical Duration
8 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Submarine crews search for, detect, and track a surface vessel or threat submarine to develop firing position to launch a torpedo. A single submerged submarine operates at slow speeds and various depths while using its hull-mounted or towed array sonar to track a surface vessel or threat submarine. Passive sonar is used almost exclusively. Explosive (only for Alternative 2) or non-explosive exercise torpedoes can be fired and active sonar can be used during this training event.
This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other range complexes depending on training requirements and available assets.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft, small boat, submarines
Targets: Sub-surface targets
Systems being Trained/Tested: Mid-frequency and high-frequency sonar, torpedoes</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
In-water explosions (Alternative 2 only)</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials
Ingestion:
None</td><td>Energy:
None
Entanglement:
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
None</td><td>Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
For Alternative 2 only: heavyweight torpedo (explosive) – fragments, target fragments
Non-Ingestible Material:
Guidance wires, heavyweight torpedo accessories</td><td>Military Recoverable Material</td><td>Anti-Submarine Warfare Training Targets, Exercise Torpedoes</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Mid-Frequency:
MF3
High-Frequency:
HF1</td><td colspan="2">Anti-Submarine Warfare:
ASW4
Torpedoes:
TORP2</td></tr>
</table>

Anti-Submarine Warfare		
Anti-Submarine Warfare Torpedo Exercise—Submarine		
In-Water Explosive Bins	E11 (Alternative 2 only)	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Explosive Stressors:** *(Section 5.3.3)* Explosive torpedoes (Alternative 2 only)	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Exercise non-explosive practice torpedoes are recovered. Guidance wire has a low breaking strength and breaks easily. Weights and flex tubing sink rapidly. All events would occur 50 NM or more from shoreline.	

A.1.2.2 Anti-Submarine Warfare Tracking Exercise – Helicopter

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Exercise - Helicopter	
Short Description	Helicopter crews search for, track, and detect submarines. **Typical Duration** 2–4 hours
Long Description	Helicopters using sonobuoys and dipping sonar search to detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys (both passive and active) are typically employed by a helicopter operating at altitudes below 3,000 ft. Dipping sonar (both passive and active) is employed from an altitude of about 50 ft. after the search area has been narrowed based on the sonobuoy search. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 target, or a live submarine. Unmanned aerial systems, such as the MQ-8 Fire Scout, may also be used. The preferred range for this exercise is an instrumented range, but it may be conducted in other range complexes depending on training requirements and available assets.
Typical Components	**Platforms:** Rotary-wing aircraft, small boat, unmanned aerial system **Targets:** Sub-surface targets **Systems being Trained/Tested:** Dipping sonar systems, sonobuoys
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aircraft system procedures Target deployment and retrieval safety **Typical Locations** **Offshore Area** Offshore Area
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None **Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** None **Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Chemicals Metals Other materials
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike **Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike **Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys, ASW Training Targets, sonobuoy wires **Military Recoverable Material** ASW Training Targets
Sonar and Other Transducer Bins	**Mid-Frequency:** MF4 MF5

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Exercise - Helicopter	
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Submarines may provide service as the target. All events are conducted in water greater than 600 ft. in depth and further than 12 NM from shore. For air quality analysis: - 1 rotary-wing aircraft per event - Average 2 hours per event

A.1.2.3 Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Tracking Exercise—Maritime Patrol Aircraft</th></tr>
<tr><td>Short Description</td><td colspan="2">Maritime patrol aircraft crews search for, track, and detect submarines.</td><td>Typical Duration
2–8 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Fixed-wing maritime patrol aircraft employ sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.
Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare (ASW) Training Target, a MK-30 target, or a live submarine.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft
Targets: Sub-surface targets, submarines
Systems being Trained/Tested: Mid-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Military expended materials
Ingestion:
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices
Entanglement:
Decelerators/parachutes
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
Chemicals
Metals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Sonobuoys, ASW training targets, sonobuoy wires</td><td>Military Recoverable Material</td><td>ASW training targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Mid-Frequency:
MF5</td><td colspan="2">Anti-Submarine Warfare:
ASW2 ASW5</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Exercise—Maritime Patrol Aircraft	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar
Assumptions Used for Analysis	Submarine may provide service as the target. If target is air dropped, one parachute per target. All events are conducted in water greater than 600 ft. in depth and further than 12 NM from shore. For air quality analysis: - 1 fixed-wing patrol aircraft per event - Average 6 hours per event

A.1.2.4 Anti-Submarine Warfare Tracking Exercise – Ship

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Tracking Exercise—Ship</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship crews search for, track, and detect submarines.</td><td>Typical Duration
2–4 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine.
A surface ship operates at slow speeds while employing sonobuoys, hull-mounted sonar, or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is either a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or live submarine.
This exercise may involve a single ship, or involve multiple aircraft, ships, and submarines.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Surface combatant
Targets: Sub-surface targets
Systems being Trained/Tested: Mid-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials
Ingestion:
None</td><td>Energy:
In-water electromagnetic devices
Entanglement:
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
ASW training targets, expendable bathythermograph</td><td>Military Recoverable Material</td><td>ASW training targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Mid-Frequency:
MF1
MF11</td><td colspan="2">Anti-Submarine Warfare:
ASW3</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Exercise—Ship	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	A submarine may provide service as the target. All events are conducted in water greater than 600 ft. in depth and further than 12 NM from shore.

A.1.2.5 Anti-Submarine Warfare Tracking Exercise – Submarine

Anti-Submarine Warfare		
Anti-Submarine Warfare Tracking Exercise—Submarine		
Short Description	Submarine crews search for, track, and detect submarines.	**Typical Duration** 8 hours
Long Description	Submarine crews search for, detect, and track a threat submarine to develop firing position to launch a torpedo. A single submerged submarine operates at slow speeds and various depths while using its hull-mounted or towed array sonar to track a threat submarine. Passive sonar is used almost exclusively. The target for this exercise is either an MK 39 expendable mobile anti-submarine warfare training target, MK 30 recoverable training target, or live submarine.	
Typical Components	**Platforms:** Submarines **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency and high-frequency sonar	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Towed in-water device safety Target deployment and retrieval safety	**Typical Locations** **Offshore Area** Offshore Area
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** None **Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None	**Sediments and Water Quality:** Metals
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Physical disturbance and strike **Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** ASW Training Targets	**Military Recoverable Material** None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3	**High-Frequency:** HF1
In-Water Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Towed in-water devices Vessel movement
Assumptions Used for Analysis	All events are conducted in water greater than 600 ft. in depth and further than 12 NM from shore.	

A.1.3 Electronic Warfare Training

Electronic warfare is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

A.1.3.1 Electronic Warfare Training

<table>
<tr><th colspan="4">Electronic Warfare</th></tr>
<tr><th colspan="4">Electronic Warfare Training</th></tr>
<tr><td>Short Description</td><td colspan="2">Aircraft and ship crews control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy’s ability to take defensive actions.</td><td>Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Aircraft and ship crews control the electromagnetic spectrum used by enemy systems to degrade or deny the enemy’s ability to take defensive actions. Electronic Warfare Operations can be active or passive, offensive or defensive. Fixed-wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface ships detect and evaluate enemy electronic signals from enemy aircraft or missile radars; evaluate courses of action concerning the use of passive or active countermeasures; and then use ship maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft, surface combatant
Targets: Air targets, electronic warfare targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Offshore Area
W-237
Olympic MOA
Inland Waters
Inland Waters</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices

Ingestion:
None</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Chaff (Offshore Area only) – air fibers, compression pad or plastic piston, endcap – chaff and flare, flare O-ring
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
</table>

Electronic Warfare	
Electronic Warfare Training	
Sonar and Other Transducer Bins	None
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	For air quality analysis: - 1 contract air services aircraft - 1 fixed-wing electronic warfare aircraft - 1 fixed-wing strike aircraft - Average 2 hours per event

A.1.4 Mine Warfare Training

Mine warfare is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until they are triggered by the approach of an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. Mine warfare training includes mine countermeasures exercises and mine laying exercises.

A.1.4.1 Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercises</th></tr>
<tr><td>Short Description</td><td colspan="2">Maritime security personnel train to protect civilian ports and harbors against enemy efforts to interfere with access to those ports.</td><td>Typical Duration
Multiple days</td></tr>
<tr><td>Long Description</td><td colspan="3">Naval forces conduct mine warfare training in conjunction with Department of Homeland Security units. The three pillars of mine warfare, airborne (helicopter), surface (surface ships), and undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic U.S. ports remain free of mine threats. Various mine warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional mine warfare techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Marine mammal systems may be used during this exercise.
Event locations and scenarios will vary according to Department of Homeland Security and Department of Defense strategic goals and evolving world events.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platform, rotary-wing aircraft, support craft, surface combatant, unmanned underwater vehicle
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: Mine detection systems, towed mine neutralization systems, airborne mine neutralization system</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Unmanned surface vehicle and unmanned underwater vehicle procedures
Towed in-water device procedures</td><td colspan="2">Typical Locations
Inland Waters
Naval Magazine Indian Island
NS Everett
Naval Base Kitsap (NBK) Bangor
NBK Bremerton
Manchester Fuel Pier
Port Angeles
Port of Seattle</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Seafloor devices

Ingestion:
None</td><td>Energy:
In-water electromagnetic devices
In-air electromagnetic devices

Entanglement:
None</td></tr>
</table>

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercises</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Sediments and Water Quality:</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Mine shapes</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">High-Frequency:
HF4
Synthetic Aperture Sonars:
SAS2</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Active sonar
Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Non-permanent mine shapes will be laid in various places on the bottom and will be retrieved Shapes are varied, from about 1 m circular to about 2.5 m long by 1 m wide. They will be recovered using normal assets, with diver involvement.
While goal is to conduct once per year, alternating East/West Coast, assume that a West Coast event will occur every other year with a total of three per 5-year period.
For air quality analysis:
- 1 rotary-wing aircraft (12 hours)
- 1 Mine Countermeasures-class ship (24 hours)
- 1 Rigid Hull Inflatable Boat (24 hours)</td></tr>
</table>

A.1.4.2 Mine Neutralization – Explosive Ordnance Disposal Training

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Mine Neutralization – Explosive Ordnance Disposal Training</th></tr>
<tr><td rowspan="2">Short Description</td><td rowspan="2" colspan="2">Personnel disable threat mines using explosive charges.</td><td>Typical Duration</td></tr>
<tr><td>Up to 4 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit.
Personnel detect, identify, evaluate, and neutralize non-explosive practice mines in the water with an explosive device and may involve detonation of one or more explosive charges per training event. At each of the two training locations, up to three events per year may occur using 0.1 pound (E0) explosive charges (Limpet Mine Neutralization Tool), and three events per year with up to 2.5 pound (E3) charges. For each event using 0.1 pound charges, a total of up to six charges may be used. For events using charges of 2.5 pounds or less, one charge will be used. Events may also include recovery of the neutralized non-explosive mine to the surface and towing it to shore by small boat. These training events are normally conducted during daylight hours for safety reasons.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Small Boat
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: None</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Underwater detonation safety</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Inland Waters
Crescent Harbor EOD training Range
Hood Canal EOD Training Range</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Vessel Noise

Explosive:
In-water explosions</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials
Seafloor devices

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants</td><td>Sediments and Water Quality:
Explosives Chemicals
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Explosives
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Target fragments, small-caliber projectile casings
Non-Ingestible Material:
Mine-shape (explosive) fragments</td><td>Military Recoverable Material
Training targets (mine shapes)</td></tr>
</table>

Mine Warfare		
Mine Neutralization – Explosive Ordnance Disposal Training		
Sonar and Other Transducer Bins	None	
In-Water Explosive Bins	Up to E3	
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive mine neutralization activities involving Navy divers	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Mine shapes will be recovered. For air quality analysis: - 3 small boats - Average 2 hours per event	

A.1.5 Surface Warfare Training

Surface warfare is a type of naval warfare in which aircraft and surface ships employ weapons and sensors in operations directed against enemy surface ships or small boats. Aircraft-to-surface Surface Warfare is conducted by using precision guided munitions. Surface warfare also is conducted by warships employing naval guns. Training in surface warfare includes surface-to-surface gunnery, air-to-surface gunnery, and bombing exercises. Gunnery and missile training may involve expenditure of ordnance against a towed target.

A.1.5.1 Bombing Exercise Air-to-Surface

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Bombing Exercise Air-to-Surface</th></tr>
<tr><td rowspan="2">Short Description</td><td colspan="2" rowspan="2">Fixed-wing aircrews deliver bombs against surface targets.</td><td>Typical Duration</td></tr>
<tr><td>1 hour</td></tr>
<tr><td>Long Description</td><td colspan="3">Fixed-wing aircraft conduct bombing exercises against stationary floating targets (e.g., MK-58 smoke buoy), towed targets, or maneuvering targets. An aircraft clears the area, deploys a smoke buoy, and then delivers high-explosive or non-explosive practice munitions bombs on the target. A range boat may be used to deploy towed or maneuvering targets for an aircraft to attack.
Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive. The following munitions may be employed by strike fighter aircraft in the course of bombing exercise: Unguided munitions include non-explosive subscale bombs (MK-76 and BDU-45), explosive and non-explosive general purpose bombs (MK-80 series), MK-20 cluster bomb (explosive, non-explosive). Precision-guided munitions include laser-guided bombs (explosive, non-explosive), laser-guided training rounds (non-explosive), Joint Direct Attack Munition (explosive, non-explosive).</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft, support craft
Targets: Surface targets
Systems being Trained/Tested: Aircraft platforms, bombs, non-explosive practice munitions</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Aircraft safety
Laser procedures
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Offshore Area
W-237 (Excluding Olympic MOAs and Olympic Coast National Marine Sanctuary)</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise

Explosive:
In-water explosions</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
Explosives Metals</td></tr>
</table>

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Bombing Exercise Air-to-Surface</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Explosives
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Small decelerators/parachutes, target fragments, bomb fragments
Non-Ingestible Material:
Mark 58 marine marker, bomb (non-explosive)</td><td>Military Recoverable Material</td><td>Recoverable surface targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">E10</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Explosive Stressors: (Section 5.3.3)
Explosive bombs
Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Non-explosive bombs and mine shapes</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Approximately 90 percent of non-explosive bombs are the sub-scale bombs such as the MK-76 and BDU-48. 110 NEPM and 10 HE bombs annually.
All explosive bombing events occur greater than 50 NM from shore. Non-explosive bombing events occur greater than 20 NM from shore. Air-to-surface bombing is not authorized in the Olympic Coast National Marine Sanctuary.
For air quality analysis:
- 2 fixed-wing strike aircraft (1 hour)</td></tr>
</table>

A.1.5.2 Gunnery Exercise Surface-to-Surface – Ship

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Gunnery Exercise Surface-to-Surface – Ship</th></tr>
<tr><td rowspan="2">Short Description</td><td rowspan="2" colspan="2">Surface ship crews fire large-, medium-, and small-caliber guns at surface targets.</td><td>Typical Duration</td></tr>
<tr><td>Up to 3 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">This exercise involves ships' gun crews engaging surface targets at sea with their main battery large-caliber (typically 57 millimeter [mm], 76 mm, and 5-inch), medium-caliber (20 mm, 25 mm, and 40 mm), and small-caliber (.50-caliber and smaller) guns. Targets include the QST-35 seaborne powered target, high speed maneuverable surface target, or a specially configured remote controlled water craft. Some targets are expended during the exercise and are not recovered.
The target may be a 10-foot diameter red balloon (Killer Tomato), a 50-gallon steel drum, or other available target, such as a cardboard box. Some targets are expended during the exercise and are not recovered.
Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance.
During all events, either high-explosive or non-explosive rounds may be used. High-explosive rounds can either be fused for detonation on impact (with water surface or target), or for proximity to the target (in air detonation).
Shipboard protection systems utilizing small-caliber projectiles will train against high-speed mobile targets.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Surface combatant
Targets: Recoverable or expendable floating target (stationary or towed), remote controlled high speed targets
Systems being Trained/Tested: Large-, medium-, and small-caliber gun systems</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Offshore Area
Offshore Area</td></tr>
<tr><td rowspan="2">Stressors to Biological Resources</td><td>Acoustic:
Vessel noise
Weapons noise</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials</td><td>Energy:
In-air electromagnetic devices</td></tr>
<tr><td>Explosive:
In-water explosions
In-air explosions</td><td>Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Explosives
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Gunnery Exercise Surface-to-Surface – Ship</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Target fragments, projectile fragments, small- and medium-caliber casings, small- and medium-caliber (non-explosive) projectiles
Non-Ingestible Material:
Large-caliber projectiles (non-explosive), large-caliber casings, marine marker, canister</td><td>Military Recoverable Material</td><td>Recoverable surface targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">E1 E2 E5</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Weapons firing noise
Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Small-, medium-, and large-caliber non-explosive practice munitions
Explosive Stressors: (Section 5.3.3)
Explosive medium-caliber and large-caliber projectiles</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Small- and medium-caliber NEPM activity always occurs 12 NM or more from the shoreline.
Large-caliber NEPM activity always occurs 20 NM or more from shoreline.
Medium- and large-caliber explosive munitions activity always occur 50 NM or more from shore.
For analytical purposes assume all high explosive rounds are fused to detonate upon impact with water surface or target.
After impacting the water, the high explosive rounds are expected to detonate within three feet of the surface. Non-explosive rounds and fragments from the high explosive rounds will sink to the bottom of the ocean.</td></tr>
</table>

A.1.5.3 Missile Exercise Air-to-Surface

Surface Warfare			
Missile Exercise Air-to-Surface			
Short Description	Fixed-wing aircrews simulate firing precision-guided missiles, using captive air training missiles (CATMs) against surface targets. Some activities include firing a missile with a high-explosive (HE) warhead.	**Typical Duration**	2 hours
Long Description	Fighter, Electronic Attack, maritime patrol aircraft aircrews fire precision-guided missiles against surface targets. Aircraft involved may be unmanned. Fixed-wing aircraft (fighters, Electronic Attack, or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch high-explosive precision guided missiles.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Recoverable floating target (stationary or towed), Remotely operated target **Systems being Trained/Tested:** Air-to-surface missile systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Laser procedures Weapons firing safety Target deployment and retrieval safety	**Typical Locations**	**Offshore Area** W-237
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** In-water explosions	**Physical Disturbance and Strike:** Aircraft and aerial target strike Military expended materials Vessel and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria Air Pollutants Hazardous Air Pollutants	**Sediment and Water Quality:** Explosives Metals Chemicals	
Stressors to Human Resources	**Cultural Resources:** Acoustics Explosives Physical disturbance	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Missile fragments, target fragments **Non-Ingestible Material:** Missiles (non-explosive)	**Military Recoverable Material**	Recoverable surface targets
Sonar and Other Transducer Bins	None		
In-Water Explosive Bins	E10		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-Explosive Missiles	**Explosive Stressors:** *(Section 5.3.3)* Explosive Missiles	

Surface Warfare	
Missile Exercise Air-to-Surface	
Assumptions Used for Analysis	Assume one target per event. Most missiles are non-firing. Some missiles are live missiles with HE warhead (4 HE missiles per year). All events occur greater than 50 NM from shore.

A.1.6 Other Training

A.1.6.1 Intelligence, Surveillance, Reconnaissance

<table>
<tr><th colspan="5">Other Training</th></tr>
<tr><th colspan="5">Intelligence, Surveillance, Reconnaissance</th></tr>
<tr><td>Short Description</td><td colspan="2">Maritime patrol aircraft (MPA), unmanned aerial systems, ships, and submarines use all available sensors to collect data on threat vessels.</td><td colspan="2">Typical Duration
2–8 hours</td></tr>
<tr><td>Long Description</td><td colspan="4">MPA and unmanned aerial systems operators use all available sensors to collect data on threat vessels. Passive sonobuoys are used to collect and analyze acoustic data, and photographic equipment is used to document the vessel with visual information.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Aircraft, unmanned aerial system, ships, submarines
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety
Unmanned aircraft system procedures</td><td colspan="3">Typical Locations
Offshore Area
Offshore Area
Inland Waters
Restricted Area 6701
NAVY 7 OPAREA</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise
Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials
Vessel and in-water devices
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
Entanglement:
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
None</td><td>Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Sonobuoys, sonobuoy wires</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">None</td></tr>
</table>

Other Training	
Intelligence, Surveillance, Reconnaissance	
Assumptions Used for Analysis	ISR training is conducted by Maritime Patrol Aircraft and unmanned aerial systems in W-237 and the Pacific Northwest Operating Area. Activities typically last 6 hours. P-8A aircrews use a variety of intelligence gathering and surveillance methods, including visual, infrared, electronic, radar, and acoustic. EP-3 and EA-18G crews conduct ISR training as well, but to a lesser extent than P-8A crews.

A.1.6.2 Maritime Security Operations

<table>
<tr><th colspan="3">Other Training</th></tr>
<tr><th colspan="3">Maritime Security Operations</th></tr>
<tr><td>Short Description</td><td>Helicopter, surface ship, and small boat crews conduct a suite of maritime security operations events, including maritime security escorts for Navy vessels such as submarines and aircraft carriers; Visit, Board, Search, and Seizure; Maritime Interdiction Operations; Force Protection; and Anti-Piracy Operations.</td><td>Typical Duration
TPS, averaging 10 hours, up to approximately 12–18 hours; 2 hours for other MSO activities</td></tr>
<tr><td>Long Description</td><td colspan="2">Maritime security operations in the NWTT study area are predominantly maritime security escort events, including the Transit Protection Program (TPP) and training of other escort units. The TPP includes up to 9 security vessels that protect SSBNs while moving within Puget Sound and the Strait of Juan de Fuca. U.S. Coast Guard (USCG) personnel and their ancillary equipment and weapons systems are involved in these events. Generally, the escorts establish a moving 1000-yard perimeter (security zone) around the vessel to prevent non-participants from entering that security zone. Non-participant vessels might be ordered to move. Every 2 years, a training event occurs which involves up to 16 vessels, transiting from Hood Canal to Admiralty Inlet. During this biennial event, boat crews train to engage surface targets by firing small-caliber (blank) weapons.
Similar maritime security escort training occurs with Coastal Riverine Group (CRG) boats that conduct force protection for designated vessels and movements. These CRG boat crews train to protect ships while entering and leaving ports. Other missions include ensuring compliance with vessel security zones for ships in port and at anchor, conducting patrols to counter waterborne threats, and conducting harbor approach defense.
The vessels used by TPP and CRG include small unit riverine craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, reaction vessels, blocking vessels, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or nearshore land targets with small-caliber (blank) weapons.</td></tr>
<tr><td>Typical Components</td><td colspan="2">Platforms: Small boats, reaction vessels, blocking vessels, and patrol boats
Targets: High-performance small boats, recoverable or expendable floating target
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Target deployment and retrieval safety</td><td>Typical Locations
Inland Waters
NBK Bremerton
Hood Canal
Dabob Bay
TPS Route (169)
NS Everett
Puget Sound
Strait of Juan de Fuca</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Vessel noise
Weapons noise

Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Energy:
In-air electromagnetic devices

Explosive:
None

Ingestion:
Military expended materials – munitions

Entanglement:
None</td></tr>
</table>

<table>
<tr><th colspan="5">Other Training</th></tr>
<tr><th colspan="5">Maritime Security Operations</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
None
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Shell casings
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Maritime security training events conducted in inland waters do not involve live fire of weapons. All maritime security events involve vessel movement, sometimes at speeds necessary to overtake suspect vessel or small boats (targets). Maritime security training events, particularly maritime security escorts, are conducted proximate to Naval Bases (NAVBASEs) Kitsap Bangor, Bremerton, and Everett, and within the Hood Canal, Dabob Bay, Puget Sound, and Strait of Juan de Fuca.
Maritime Security Escort (SSBN Transit Protection): The Transit Protection Program (TPP) utilizes a mixture of 16 security vessels, up to 9 of which can be utilized at any time for escorting SSBNs transiting between the SSBN homeport of NAVBASE Bangor and the dive/surface point in the Strait of Juan de Fuca or Dabob Bay. TPP vessels include 16 escort security boats home ported at NAVBASE Kitsap Bangor, consisting of 2 Blocking Vessels (250 ft.), 2 Reaction Vessels (87 ft.), and 12 Screening Vessels (small boats and patrol boats – 16–85 ft.).
Depending on the type of vessel escort being conducted and other conditions, the security zone could be from a 100-yard to a 1,000-yard radius around the escorted vessel. Recreational and commercial vessels might be ordered to move.
To the extent practicable, all use of blank ammunition would be near the center of the waterway and no closer than 500 yards to the shoreline.
All shell casings associated with use of blank ammunition shall be captured, to the greatest extent feasible, using either cofferdams around guns, capture bins, or capture on the deck of vessels. Radio broadcasts to mariners will be conducted during exercises to ensure the public is aware and clear of the area.</td></tr>
</table>

Other Training	
Maritime Security Operations	
Assumptions Used for Analysis	Maritime Security Escort (Coastal Riverine Group): Naval Coastal Riverine Units train to provide escort and force protection security to naval vessels. These training events will be conducted within inland waterways in and around Naval Homeports such as Naval Base Kitsap Bangor, Naval Base Kitsap Bremerton, and Naval Station Everett, and within the Hood Canal, Dabob Bay, Puget Sound, and Strait of Juan de Fuca WA. These training events would occur approximately 51 times per year, approximately 60–70 percent originating proximate to Bangor, 20–30 percent proximate to Bremerton, and the remainder (less than 10 percent) proximate to Everett. The average total transit distance associated with maritime security escort training events (Other) can vary between 50 and 180 NM. Maritime Security Escort (Other) is supported with 6 total vessels (i.e., 34' Sea Ark Patrol Craft and 85' Mk VI Riverine Craft), of which 2–4 vessels would be used for a single escort mission. Naval Coastal Riverine Forces would also conduct certification maritime security escort training events once every 6–9 months. These certification events would include 8–10 days underway, operating in common escort areas (with 1–2 days of no-fire events/7 days of blank fire events in the vicinity of Whidbey Island). The typical training day would consist of two shifts, approximately 5 hours each. Nighttime training is not anticipated. Certification training would utilize up to 5 boats (3 as escorts, 1 simulating a Navy vessel to be protected, and 1 simulating Opposition Force [OPFOR]). Expended Brass: Efforts will be made by crews to collect all expended brass (shell casings) captured on the deck; however, brass ejection may result in loss over the side. Use of Pyrotechnics limited to flash, flare, and sound devices, may be utilized. Noise Levels: Loud hailers will be used for hailing contacts if no radio communication can be established. Use of sirens in support of mission or training will be minimized and period of use limited to late-morning through early evening. Water Depth: Patrol boats will not typically be operating in shoal water. Unless in an emergency and during launch and recovery, patrol boats will only operate in waters in which the charted depth is greater than 6 ft. Speed: Patrol boats are not expected to exceed 15 knots unless involved in a drill that requires them to quickly move from one zone to another to provide force protection. For air quality analysis: - 1 fixed-wing strike aircraft - 1 rotary-wing aircraft - 3–9 small boats - Average 2 hours per event

A.1.6.3 Personnel Insertion/Extraction – Non-Submersible

Other Training		
Personnel Insertion/Extraction Training—Non-Submersible		
Short Description	Military personnel train for insertion and extraction into target areas using rotary wing aircraft, fixed-wing aircraft (insertion only), or small boats.	**Typical Duration** Up to 12 hours
Long Description	Personnel train to approach or depart an objective area using various transportation methods and tactics. These operations train forces to insert and extract personnel and equipment day or night. Tactics and techniques employed include insertion from aircraft by parachute, by rope, or from low, slow-flying helicopters from which personnel jump into the water. Parachute training is required to be conducted on surveyed drop zones to enhance safety. Insertion and extraction methods also employ small inflatable boats. Activity may include Navy personnel learning advanced self-contained underwater breathing apparatus (SCUBA) diving, to include tactics, techniques, and procedures and emergency procedures. Small boats are used for safety.	
Typical Components	**Platforms:** Small boats, rotary-wing aircraft, fixed-wing aircraft **Targets:** None **Systems being Trained/Tested:** None	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Inland Waters** Crescent Harbor EOD Range NAVY 7 OPAREA
Stressors to Biological Resources	**Acoustic:** Vessel noise Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Aircraft and aerial target **Ingestion:** None **Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None **Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material** None
Sonar and Other Transducer Bins	None	
In-Water Explosive Bins	None	

Other Training	
Personnel Insertion/Extraction Training—Non-Submersible	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	For air quality analysis: - 1 small boat - Average 8 hours per event

A.1.6.4 Precision Anchoring

<table>
<tr><td colspan="4">Other Training</td></tr>
<tr><td colspan="4">Precision Anchoring</td></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship crews release and retrieve anchors in designated locations.</td><td>Typical Duration
Up to 1 hour</td></tr>
<tr><td>Long Description</td><td colspan="3">Ship crews choose the best available anchoring sites. The ship uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Navy ships
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety</td><td colspan="2">Typical Locations
Inland Waters
Naval Magazine Indian Island
Naval Station Everett
NAVY 3 OPAREA
Eastern Banks Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices

Ingestion:
None</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">None</td></tr>
</table>

A.1.6.5 Search and Rescue

<table>
<tr><th colspan="4">Other Training</th></tr>
<tr><th colspan="4">Search and Rescue</th></tr>
<tr><td>Short Description</td><td colspan="2">Helicopter crews train to rescue military personnel at sea.</td><td>Typical Duration
2–3 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Helicopter crews rescue military personnel at sea.
Helicopters fly below 3,000 ft. and locate personnel to be rescued. Flares are expended during training.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Rotary-wing aircraft, small boats
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Inland Waters
Crescent Harbor EOD Range
Restricted Area 6701</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Aircraft noise
Vessel noise

Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices

Energy:
In-air electromagnetic devices

Explosive:
None

Ingestion:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants

Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
None

Socioeconomic Resources:
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Flares
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">This activity involves a helicopter landing and simulated extraction of a survivor (typically one of the helicopter crewmembers). The search and rescue helicopter, an H-60, approaches the survivor, hovers, recovers the survivor, and then departs the area with the survivor onboard.</td></tr>
</table>

A.1.6.6 Small Boat Attack Exercise

<table>
<tr><th colspan="4">Other Training</th></tr>
<tr><th colspan="4">Small Boat Attack Exercise</th></tr>
<tr><td rowspan="2">Short Description</td><td rowspan="2">Small boat crews engage pierside surface targets with small-caliber weapons. Only blank rounds are fired.</td><td colspan="2">Typical Duration</td></tr>
<tr><td colspan="2">4 hours over 3 days</td></tr>
<tr><td>Long Description</td><td colspan="3">A single activity consists of multiple days of training. For analysis in this SEIS/OEIS, a 3-day scenario is assumed. On the first day, blanks will be fired from a small-caliber machine gun, mounted on a high-speed boat used by Navy security forces. The second day will consist of test firing multiple crew-serve and hand-held small-caliber weapons, all with blank ammunition. Some rounds will be fired from both the high-speed boat and from a Navy surface ship moored at a Navy pier. The third day will be the full training exercise. This consists of a high-speed attack vessel running directly at the Navy pier where the simulated target surface ship is moored.
Duration of firing will be approximately 2 hours with a total of 1,000 rounds fired the first day, and a duration of 1.5 hours with a total of 1,000 rounds fired the second day. The final day will have a duration of approximately 30 minutes, with 1,000 rounds fired. Typical firing patterns are 3–30 round bursts, assess target, and then fire again. Multiple crew members will be given a chance to fire the weapons.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Small boats or watercraft
Targets: High-performance small boats
Systems being Trained/Tested: None</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Weapons firing procedures</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Inland Waters
Naval Station Everett
NBK Bangor
NBK Bremerton</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Vessel noise
Weapons noise

Explosive:
None

Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions

Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants

Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Small-caliber casings
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
</table>

Other Training	
Small Boat Attack Exercise	
Sonar and Other Transducer Bins	None
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	At locations where a security barrier is present, and sea lions may be hauled out on the barrier, the security barrier will be pulled fully open to remove haul out opportunities. During Day 1 training, all firing will occur at least 250 ft. away from the security barrier.

A.1.6.7 Submarine Sonar Maintenance

<table>
<tr><th colspan="4">Other Training</th></tr>
<tr><th colspan="4">Submarine Sonar Maintenance</th></tr>
<tr><td>Short Description</td><td colspan="2">Maintenance of submarine sonar and other system checks are conducted pierside or at sea.</td><td>Typical Duration
Up to 1 hour</td></tr>
<tr><td>Long Description</td><td colspan="3">A submarine performs periodic maintenance on the AN/BQQ-10 (high-frequency and mid-frequency) sonar system while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport; however, sonar maintenance could occur at sea as the system's performance may warrant.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Submarines
Targets: None
Systems being Trained/Tested: Mid-frequency hull mounted sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Pierside testing safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area
Inland Waters
NBK Bremerton
NBK Bangor</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
None</td><td>Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
None</td><td>Public Health and Safety:
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">Low-Frequency:
LF5
Mid-Frequency:
MF3</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td>Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">For biological resources analysis, vessel noise and vessel strike are only analyzed for the periods while the submarines are surfaced, typically brief in nature. Mitigation measures related to vessel movement are also only considered during the period of surfacing.
For human resources stressor analysis, physical disturbance and strike and physical interactions are only analyzed for the periods while the submarines are surfaced, typically brief in nature.</td></tr>
</table>

A.1.6.8 Surface Ship Sonar Maintenance

Other Training			
Surface Ship Sonar Maintenance			
Short Description	Maintenance of surface ship sonar and other system checks are conducted pierside or at sea.	**Typical Duration** Up to 4 hours	
Long Description	This scenario consists of surface ships performing periodic maintenance to the AN/SQS-53 sonar and other ship systems while in port or at sea. This maintenance takes up to 4 hours. Surface ships operate active sonar systems for maintenance while in shallow water near their homeport; however, sonar maintenance could occur anywhere as the system's performance may warrant.		
Typical Components	**Platforms:** Surface combatants **Targets:** None **Systems being Trained/Tested:** Mid-frequency hull mounted sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Offshore Area** Offshore Area	**Inland Waters** Naval Station Everett NBK Bremerton
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1		
In-Water Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.1.6.9 Unmanned Underwater Vehicle Training

<table>
<tr><th colspan="4">Other Training</th></tr>
<tr><th colspan="4">Unmanned Underwater Vehicle Training</th></tr>
<tr><td>Short Description</td><td colspan="2">Unmanned underwater vehicle certification involves training with unmanned platforms to ensure submarine crew proficiency. Tactical development involves training with various payloads for multiple purposes to ensure that the systems can be employed effectively in an operational environment.</td><td>Typical Duration
Up to 24 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Unmanned underwater vehicle certification and tactical development involves training with unmanned platforms on which various payloads are attached and used for different purposes. Payload certification and development training assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions. Training can range from basic remote control and autonomous navigation tests to deployment and activation of onboard systems that may include hydrodynamic instruments, launchers, and recovery capabilities. These vehicles are capable of expanding the communication and surveillance capabilities of submarines, and terrestrial commands.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Support craft, unmanned underwater vehicle
Targets: None
Systems being Trained/Tested: Acoustic modem, high-frequency sonar, synthetic aperture sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Unmanned surface vehicle and unmanned underwater vehicle procedures</td><td colspan="2">Typical Locations
Offshore Area
Quinault Range Site
Inland Waters
Crescent Harbor EOD Range, Dabob Bay Range Complex, NBK Bangor, NBK Bremerton, Keyport Range Site, Manchester Fuel Pier, NAVY 3 OPAREA, NAVY 7 OPAREA</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
None</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
None</td><td>Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
Anchor blocks</td><td>Military Recoverable Material</td><td>None</td></tr>
</table>

Other Training	
Unmanned Underwater Vehicle Training	
Sonar and Other Transducer Bins	**Forward-Looking Sonar:** FLS2 **Acoustic Modems:** M3
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Potential specific locations for this activity include Northwest Training Range Complex Dabob Bay, Hood Canal Sinclair Inlet, NBK Bangor, NBK Keyport, Manchester Fuel Pier. For air quality analysis: - 1 support craft - Average 8 hours per event

A.2 NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES

A.2.1 ANTI-SUBMARINE WARFARE

A.2.1.1 Anti-Submarine Warfare Testing

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Ships and their supporting platforms (rotary-wing aircraft and unmanned aerial systems) detect, localize, and prosecute submarines.</td><td>Typical Duration
1–2 weeks, with 4–8 hours of active sonar use with intervals of non-activity in between.</td></tr>
<tr><td>Long Description</td><td colspan="3">Ships conduct detect-to-engage operations against modern diesel-electric and nuclear submarines using airborne and surface assets (both manned and unmanned). Active and passive acoustic systems are used to detect and track submarine targets, culminating in the deployment of lightweight torpedoes to engage the threat.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Rotary-wing aircraft, submarine, surface combatant
Targets: Sub-surface targets
System being Trained/Tested: Acoustic countermeasures, navigation sonar, sonar systems, sonobuoys, torpedo systems, underwater communications</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Towed in-water device safety
Target deployment and retrieval safety</td><td>Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended material
Vessels and in-water devices
Ingestion:
Military expended materials – other than munitions</td><td>Energy:
None
Entanglement:
Decelerators/parachutes
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td>Sediments and Water Quality:
Chemicals
Metals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-air energy
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Small decelerator/parachute
Non-Ingestible Material:
Acoustic countermeasures, lightweight torpedo accessories, mobile subsurface target, sonobuoy (non-explosive), sonobuoy wires</td><td>Military Recoverable Material</td><td>Lightweight (non-explosive) torpedo</td></tr>
</table>

Anti-Submarine Warfare			
Anti-Submarine Warfare Testing			
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1K MF4 MF10 MF11 MF 5 MF12	**Anti-Submarine Warfare:** ASW1 ASW2 ASW3 ASW5	**Torpedoes:** TORP1
In-Water Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	All sonobuoys have parachutes unless otherwise noted.		

A.2.1.2 At-Sea Sonar Testing

Anti-Submarine Warfare		
At-Sea Sonar Testing		
Short Description	At-sea testing to ensure systems are fully functional in an open ocean environment.	**Typical Duration** From 4 hours to 11 days
Long Description	At-sea sonar testing is required to calibrate or document the functionality of sonar systems while the ship or submarine is in an ocean environment. At-sea sonar testing is conducted to verify the vessel meets design acoustic specifications, define the underwater characteristics of the vessel, determine effects of systems and equipment on ship's acoustic characteristics, and provide technical background necessary to initiate development of design improvements to reduce noise. Tests also consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes.	
Typical Components	**Platforms:** Aircraft carrier, fixed-wing patrol aircraft, rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface targets **System being Trained/Tested:** Acoustic countermeasures, acoustic modems, sonar systems, sonobuoys, underwater communication systems, torpedo systems	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety Target deployment and retrieval safety	**Typical Locations** **Offshore Area**: Offshore Area **Inland Waters**: Dabob Bay Range Complex
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosives:** None **Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials Vessels and in-water devices **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerator/parachutes Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** None **Socioeconomic Resources:** Accessibility	**Public Health and Safety:** Physical interactions In-air energy In-water energy
Military Expended Material	**Ingestible Material:** Small decelerator/parachute **Non-Ingestible Material:** Lightweight torpedo accessories, anti-torpedo torpedo accessories, motorized sub-surface target, sonobuoy (non-explosive), sonobuoy wires	**Military Recoverable Material** Lightweight (non-explosive) torpedo Anti-torpedo torpedo

Anti-Submarine Warfare					
At-Sea Sonar Testing					
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3 MF4 MF5	**High-Frequency** HF1 HF5	**Anti-Submarine Warfare** ASW3	**Torpedoes** TORP1	**Acoustic Modems** M3
In-Water Explosive Bins	None				
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar			**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	Active sonar use is intermittent throughout the duration of the event. Manned aircraft are not used in inland waters.				

A.2.1.3 Countermeasure Testing

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Countermeasure Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Countermeasure testing involves the testing of systems that will detect, localize, and track incoming weapons, including marine vessel targets. Countermeasures may be systems to obscure the vessel’s location or systems to rapidly detect, track, and counter incoming threats. Testing includes surface ship torpedo defense systems and marine vessel stopping payloads.</td><td>Typical Duration
From 4 hours to 6 days, depending on the countermeasure being tested</td></tr>
<tr><td>Long Description</td><td colspan="3">Countermeasure testing evaluates the deployment, operation, and effectiveness of components or fully integrated systems used to defend a vessel from an incoming threat. Countermeasures may be mechanical, chemical, or electronic devices that are released from a vessel to obscure the vessel’s location or provide a false target. Countermeasures may also be threat-intervention systems operated from within the vessel to detect, localize, track, and respond to incoming threats. Threat detection range may be extended by towing a sensor array. Test scenarios vary widely, ranging from measuring the operation of a deployment mechanism to validating the ability of an integrated system to detect, track, localize, and destroy an incoming torpedo.
Torpedo defense systems are an array of integrated systems that detect, localize, track, and respond to incoming weapons. At-sea testing of torpedo defense systems addresses all components, including towed acoustic systems, torpedo warning systems, and countermeasure anti-torpedo subsystems. Some torpedo defense system scenarios employ non-explosive torpedoes against targets released by secondary platforms (e.g., helicopter or submarine). While surface vessels are in transit, countermeasure systems may be used to identify false alert rates.
Marine vessel stopping payloads are systems designed to deliver the appropriate measure(s) to affect a vessel's propulsion and associated control surfaces to significantly slow and potentially stop the advance of the vessel. Marine vessel-stopping proposed activities include the use of biodegradable polymers. The biodegradable polymers that the Navy uses are designed to temporarily interact with the propeller(s) of a target craft, rendering the craft ineffective.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: All Navy ships and boats, moored platforms, support craft
Targets: Mine warfare targets, sub-surface targets, surface targets
System being Trained/Tested: Acoustic countermeasures, sonar systems, underwater communications, torpedo systems</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Towed in-water device safety
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
Quinault Range Site
Western Behm Canal
SEAFAC
Inland Waters
Dabob Bay Range Complex
Keyport Range Site</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Military expended material
Vessels and in-water devices
Ingestion:
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices
Entanglement:
Biodegradable polymer
Wires and cables</td></tr>
</table>

Anti-Submarine Warfare	
Countermeasure Testing	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material **Sediments and Water Quality:** Metals Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike **Socioeconomic Resources:** Accessibility Physical disturbance and strike **Public Health and Safety:** Physical interactions In-air energy In-water energy
Military Expended Material	**Ingestible Material:** Biodegradable polymer **Non-Ingestible Material:** Acoustic countermeasures, guidance wire, heavyweight torpedo accessories, mobile sub-surface target **Military Recoverable Material** Mine shape (non-explosive), heavyweight (non-explosive) torpedo, acoustic countermeasures
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 **High-Frequency:** HF8 **Anti-Submarine Warfare:** ASW3 ASW4 **Torpedoes:** TORP2
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Not all events will include the use of sonar and other transducers. Use of expendable materials is minimized in Inland Waters, and most components of countermeasures are recovered (some components are consumed in use and dissipate in the environment). Obscuring devices deployed in the water may have a self-inflating balloon and tether that helps them to operate at the ideal depth. The balloon allows test units to be recovered in calm conditions, but has a slow leak enabling the empty container to sink to the floor. The tether is a very thin wire or monofilament type material and is an entanglement hazard. No marine vessel stopping testing will occur at Southeast Alaska Acoustic Measurement Facility (SEAFAC). All materials used at SEAFAC would be recovered.

A.2.1.4 Pierside Sonar Testing

Anti-Submarine Warfare			
Pierside Sonar Testing			
Short Description	Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities.	**Typical Duration** Up to 3 weeks total per ship, with each source run independently and not continuously during this time	
Long Description	Ships and submarines will activate mid- and high-frequency tactical sonars, underwater communications systems, and navigational devices to ensure they are fully functional prior to at-sea test events. Testing may also include the firing of inert torpedo shapes. Event duration varies, with average durations of 3 weeks with active sonar used intermittently over 2 days during the total event duration. This also includes pierside sonar testing during surface combatant sea trials.		
Typical Components	**Platforms:** Submarine, surface combatant **Targets:** None **System being Trained/Tested:** Sonar systems, underwater communications		
Standard Operating Procedures *(Section 2.3.3)*	Pierside testing safety	**Typical Locations** **Inland Waters** NBK Bangor NBK Bremerton Naval Station Everett	
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosives:** None	**Physical Disturbance and Strike:** None **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF2 MF3 MF9 MF10 MF12	**High-Frequency:** HF3	**Anti-Submarine Warfare:** ASW3
In-Water Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		
Assumptions Used for Analysis	None		

A.2.1.5 Submarine Sonar Testing/Maintenance

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Submarine Sonar Testing/Maintenance</th></tr>
<tr><td>Short Description</td><td colspan="2">Pierside, moored, and underway testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.</td><td>Typical Duration
Up to 3 weeks, with intermittent use of active sonar</td></tr>
<tr><td>Long Description</td><td colspan="3">Following major and routine maintenance periods, system operations are evaluated in both stationary and underway tests. Multiple systems with active and passive acoustic sources such as navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, will be tested.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platform, submarines, surface ships
Targets: None
System being Trained/Tested: Sonar systems, underwater communications</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Pierside testing safety</td><td colspan="2">Typical Locations
Western Behm Canal
SEAFAC</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
None
Habitats:
None</td><td>Sediment and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="2">Mid-Frequency:
MF9</td><td>High Frequency:
HF6</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td>Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">None</td></tr>
</table>

A.2.1.6 Torpedo (Explosive) Testing

Anti-Submarine Warfare		
Torpedo (explosive) Testing		
Short Description	Air, surface, or submarine crews employ explosive and non-explosive torpedoes against artificial targets.	**Typical Duration** 1–2 days during daylight hours
Long Description	Non-explosive and explosive torpedoes (carrying a warhead) will be launched at a suspended target by a submarine and fixed- or rotary-winged aircraft or surface combatants. Event duration is 1–2 days during daylight hours.	
Typical Components	**Platforms:** Fixed-wing aircraft, moored platform, rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface targets, surface targets **System being Trained/Tested:** Acoustic countermeasures, sonar systems, sonobuoys, underwater communications, torpedo systems	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety Weapons firing safety Target deployment and retrieval safety	**Typical Locations** **Offshore Area** Offshore Area
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosives:** In-water explosions	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials Vessels and in-water devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions **Energy:** In-air electromagnetic devices **Entanglement:** Decelerator/Parachutes Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material In-water explosions	**Sediment and Water Quality:** Explosives Chemicals Metals Other materials
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike **Public Health and Safety:** Physical interactions In-air energy In-water energy

Anti-Submarine Warfare			
Torpedo (explosive) Testing			
Military Expended Material	**Ingestible Material:** Lightweight torpedo (explosive) - fragments, heavyweight torpedo (explosive) – fragments, small decelerator/parachute, target fragments **Non-Ingestible Material:** Buoy (non-explosive), guidance wire, heavyweight torpedo accessories, lightweight torpedo accessories, sonobuoy (non-explosive), sonobuoy wires, stationary surface target	**Military Recoverable Material**	Heavyweight (non-explosive) torpedo, lightweight (non-explosive) torpedo
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF3 MF4 MF5 MF6 **High-Frequency:** HF1 HF6	**Anti-Submarine Warfare:** ASW3	**Torpedoes:** TORP1 TORP2
In-Water Explosive Bins	E8 E11		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Explosive Stressors:** *(Section 5.3.3)* Explosive torpedoes	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	All sonobuoys have parachutes unless otherwise noted. Only one heavyweight torpedo test could occur in 1 day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day. All non-explosive torpedoes are recovered. Explosive torpedo testing occurs at least 50 NM from shore and does not occur within the boundaries of the Olympic Coast National Marine Sanctuary.		

A.2.1.7 Torpedo (Non-Explosive) Testing

Anti-Submarine Warfare			
Torpedo (non-explosive) Testing			
Short Description	Air, surface, or submarine crews employ non-explosive torpedoes against targets, submarines, or surface vessels.	**Typical Duration**	Up to 2 weeks
Long Description	Aerial, surface, and subsurface assets fire exercise torpedoes against surface or subsurface targets, or at no target and programmed with a particular run geometry. Torpedo testing evaluates the performance and the effectiveness of hardware and software upgrades of heavyweight or lightweight torpedoes. It also includes testing of experimental torpedoes. Not all torpedo tests involve acoustics. Exercise torpedoes are recovered, typically from surface ships and helicopters that are specifically crewed and outfitted for torpedo recovery. Event duration is dependent on number of torpedoes fired.		
Typical Components	**Platforms:** Aircraft carrier, autonomous underwater vehicle, fixed-wing aircraft, moored platform, rotary-wing aircraft, remotely operated vehicle, submarines, support craft, surface combatant, unmanned underwater vehicle **Targets:** Sub-surface targets, surface targets **System being Trained/Tested:** Acoustic countermeasures, sonar systems, sonobuoys, underwater communications, torpedo systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety Unmanned surface vehicle and unmanned underwater vehicle procedures Weapons firing safety Target deployment and retrieval safety	**Typical Locations** **Offshore Area** Offshore Area	**Inland Waters** Dabob Bay Range Complex
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosives:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials Vessels and in-water devices **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/Parachutes, Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended materials	**Sediment and Water Quality:** Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy In-water energy

Anti-Submarine Warfare				
Torpedo (non-explosive) Testing				
Military Expended Material	**Ingestible Material:** Small decelerator/parachute **Non-Ingestible Material:** Acoustic countermeasures, buoy (non-explosive), heavyweight torpedo accessories, lightweight torpedo accessories, mobile sub-surface target, sonobuoy (non-explosive), sonobuoy wires, guidance wire, anti-torpedo torpedo accessories		**Military Recoverable Material**	Anchors, heavyweight (non-explosive) torpedo, lightweight (non-explosive) torpedo, anti-torpedo torpedo, stationary sub-surface target
Sonar and Other Transducer Bins	**Low-Frequency:** LF4	**Mid-Frequency:** MF1 MF3 MF4 MF5 MF6 MF9 MF10	**High-Frequency:** HF1 HF5 HF6	**Anti-Submarine Warfare:** ASW3 ASW4 **Torpedoes:** TORP1 TORP2 TORP3
In-Water Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	All exercise torpedoes are recovered. Typically, no more than 8 torpedoes are fired per day during daylight hours.			

A.2.2 Mine Warfare

A.2.2.1 Mine Countermeasure and Neutralization Testing

Mine Warfare			
Mine Countermeasure and Neutralization Testing			
Short Description	Air, surface, and subsurface vessels neutralize threat mines and mine-like objects.	**Typical Duration**	1–10 days, with intermittent use of countermeasure/neutralization systems during this period
Long Description	Mine countermeasure-neutralization and mine system testing is required to ensure systems can effectively neutralize threat (live or inert) mines that will otherwise restrict passage through an area and to ensure U.S. Navy mines remain effective against enemy ships. These systems may be deployed with a variety of ships, aircraft, submarines, or unmanned autonomous vehicles and operate in water depths up to 6,000 ft. Mines are neutralized by cutting mooring cables of buoyant mines, producing acoustic energy that fires acoustic-influence mines, by employing radar or laser fields, detonating mines using remotely-operated vehicles, or using explosive charges to destroy threat mines. There will be no explosive testing in the Inland Waters. Testing in Inland Waters would involve non-explosive aspects of mine countermeasure and neutralization testing, including the placement of non-explosive targets, the operation of unmanned underwater vehicles and associated sensors, and the operation of laser systems.		
Typical Components	**Platforms:** Amphibious warfare ship, mine warfare ship, rotary-wing aircraft, rotary-wing unmanned aerial system, surface combatant, unmanned underwater vehicle **Targets:** Mine shapes **System being Trained/Tested:** Electromagnetic devices, minehunting sonar, low powered lasers, radar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Laser procedures Unmanned aircraft system procedures Unmanned surface vehicle and unmanned underwater vehicle procedures Towed in-water device safety Target deployment and retrieval safety	**Typical Locations** **Offshore Area** Offshore Area	**Inland Waters** Only non-explosive aspects of this testing activity would occur at the following areas: NBK Bremerton Carr Inlet Operations Area Crescent Harbor EOD Range Dabob Bay Range Complex Hood Canal EOD Range Naval Station Everett Keyport Range Site Naval Magazine Indian Island NAVY 3 OPAREA
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosives:** In-water explosions (Offshore Area only)	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials Vessels and in-water devices Seafloor devices **Ingestion:** Military expended materials - munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables

Mine Warfare			
Mine Countermeasure and Neutralization Testing			
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices In-water explosions (Offshore Area only)	**Sediment and Water Quality:** Explosives Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy In-water energy
Military Expended Material	**Ingestible Material:** Neutralizer (explosive) – fragments, mine (explosive) – fragments **Non-Ingestible Material:** Fiber optic cable, fiber optic can, anchors	**Military Recoverable Material**	Mine shape (non-explosive)
Sonar and Other Transducer Bins	**High-Frequency:** HF4		
In-Water Explosive Bins	E4 E7		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	**Explosive Stressors:** *(Section 5.3.3)* Explosive mine countermeasure and neutralization activities **Acoustic Stressors** *(Section 5.3.2)* Active sonar	
Assumptions Used for Analysis	Explosives are not used in the Inland Waters or in the Olympic Coast National Marine Sanctuary. Manned aircraft are not used in the Inland Waters except at the designated aircraft-use area Navy 3 OPAREA.		

A.2.2.2 Mine Detection and Classification Testing

<table>
<tr><th colspan="2">Mine Warfare</th></tr>
<tr><th colspan="2">Mine Detection and Classification Testing</th></tr>
<tr><td>Short Description</td><td>Air, surface, and subsurface vessels and systems detect and classify mines and mine-like objects. Vessels also assess their potential susceptibility to mines and mine-like objects.
Typical Duration
Up to 24 days, with up to 12 hours of acoustic activity each day</td></tr>
<tr><td>Long Description</td><td>Mine detection and classification systems require testing to evaluate the capability of generating underwater magnetic and acoustic signature fields as well as sonar systems that can detect and classify a wide range of threat mines at tactically different water depths. Surface craft may deploy an underwater sensor system that uses ship signature to develop a susceptibility profile against mine-like objects. This testing encompasses evaluating the operation and effectiveness of the components and integrated systems for mine detection and classification, as well as assessing vessel vulnerability to mines and development of new mine-like targets. Detection systems may use acoustic, electro-optic, or laser sensors, and may be deployed from surface or subsurface vessels, or unmanned platforms. Mine detection and classification sonar may also be used for mapping, as well as detection, classification, and localization of items on the seafloor. In order to develop better and safer methods of minesweeping, the Navy is currently testing new systems to detect locate, identify, and avoid mines including a laser airborne mine detection system that uses laser illumination coupled with sensitive electro-optic receivers to find mines in the upper part of the water column.</td></tr>
<tr><td>Typical Components</td><td>Platforms: Moored platform, support craft, surface combatant, remotely operated vehicles, unmanned aerial vehicle, unmanned underwater vehicle
Targets: Mine shapes
System being Trained/Tested: Minehunting sonar, electro-magnetic or laser sensors</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Laser procedures
Unmanned aircraft system procedures
Unmanned surface vehicle and unmanned underwater vehicle procedures
Towed in-water device safety
Target deployment and retrieval safety
Typical Locations
Offshore Area
Quinault Range Site
Inland Waters
Dabob Bay Range Complex
Keyport Range Site</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None
Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Seafloor devices
Ingestion:
None
Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – seafloor devices
Sediments and Water Quality:
Metals</td></tr>
</table>

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Mine Detection and Classification Testing</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics</td><td>Public Health and Safety:
Physical interactions
In-air energy
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">Anchors, mine shape (non-explosive)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Low-Frequency:
LF4</td><td colspan="2">High-Frequency:
HF4</td><td colspan="2">Broadband
BB1 BB2</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="5">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="5">Mine-like targets and temporary anchored devices may be deployed for the duration of a single test event or may be left in place for up to 12 months to support multiple events; all devices and their anchors are recovered. Bottom anchors are not deployed in known sensitive shallow water benthic habitats such as eelgrass beds.</td></tr>
</table>

A.2.3 SURFACE WARFARE

A.2.3.1 Kinetic Energy Weapon Testing

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Kinetic Energy Weapon Testing</th></tr>
<tr><td>Short Description</td><td>A kinetic energy weapon uses stored energy released in a burst to accelerate a projectile.</td><td colspan="2">Typical Duration
1 day</td></tr>
<tr><td>Long Description</td><td colspan="3">A kinetic energy weapon uses stored energy released in a burst to accelerate a projectile to more than 7 times the speed of sound to a range of up to 200 miles.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Surface combatants
Targets: Air Targets, surface targets
System being Trained/Tested: Kinetic energy weapon</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Weapons firing safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Weapons noise
Vessel noise
Explosives:
In-air explosions
Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended materials
Vessels and in-water devices
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions
Energy:
In-air electromagnetic devices
Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
Physical interactions
In-air energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Large-caliber (explosive) projectile fragments, target fragments
Non-Ingestible Material:
Expendable aerial drone, kinetic energy round, large-caliber projectile (non-explosive), large-caliber projectile casings, sabot - kinetic energy round, stationary surface target</td><td>Military Recoverable Material</td><td>None</td></tr>
</table>

Surface Warfare	
Kinetic Energy Weapon Testing	
Sonar and Other Transducer Bins	None
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Assume one target is expended per event. Explosive rounds are designed to detonate above the surface target. Activity takes place at least 50 NM from shore.

A.2.4 Unmanned Systems

A.2.4.1 Unmanned Aerial System Testing

<table>
<tr><th colspan="4">Unmanned Systems</th></tr>
<tr><th colspan="4">Unmanned Aerial System Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Unmanned aerial systems (UASs) are remotely piloted or self-piloted (i.e., preprogrammed flight pattern) aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. They can carry cameras, sensors, communications equipment, or other payloads.</td><td>Typical Duration
1–12 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">UASs are remotely piloted or self-piloted (i.e., preprogrammed flight pattern) aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. They can carry cameras, sensors, communications equipment, or other payloads. UASs can vary in size up to approximately 10 ft. in length, with gross vehicle weights of a couple hundred pounds. Propulsion types can range from traditional turbofans, turboprops, and piston engine-driven propellers, to electric motor-driven propellers powered by rechargeable batteries (lead-acid, nickel-cadmium, and lithium ion), photovoltaic cells, or hydrogen fuel cells.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing unmanned aerial system, rotary-wing unmanned aerial system, support craft
Targets: None
System being Trained/Tested: Unmanned aerial vehicle</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Unmanned aircraft system procedures</td><td colspan="2">Typical Locations
Offshore Area
Quinault Range Site
Inland Waters
Dabob Bay Range Complex
Keyport Range Site
Restricted Area 6701</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
None</td><td>Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
</table>

Unmanned Systems	
Unmanned Aerial System Testing	
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	UASs work in compliance with the Federal Aviation Administration (FAA) regulations UASs can vary in size up to approximately 10 ft. in length, with gross vehicle weights of a couple hundred pounds.

A.2.4.2 Unmanned Surface Vehicle System Testing

Unmanned Systems			
Unmanned Surface Vehicle System Testing			
Short Description	Unmanned surface vehicles are primarily autonomous systems designed to augment current and future platforms to help deter maritime threats. They employ a variety of sensors designed to extend the reach of manned ships.	**Typical Duration**	Up to 10 days. Some propulsion systems (gliders) could operate continuously for multiple months.
Long Description	Unmanned surface vehicles (USV) can include remotely operated craft (semisubmersible, plane hull, semi-plane hull, etc.) and test vehicles. During testing, they can operate autonomously, semi-autonomously, or non-autonomously. Non-autonomous or remotely controlled vehicles may be tethered like remotely operated vehicles (ROVs) or remotely controlled via radio link. USVs may have multiple test objectives or payloads (such as cameras and sonar) onboard so that numerous tests can be executed during a single testing activity. USVs may be used in conjunction with unmanned underwater vehicles and unmanned aerial systems to meet test objectives. USV launch and retrieval methods are highly variable because of the differences in vehicle type and size. USV test vehicle launch methods include lowering onto the water from a support craft or pier, deploying from another craft, or launching from a boat ramp. The vehicle will propel itself through the water to complete the test objectives, which could include deployment or recovery of a payload, sonar or other sensor use, or completion of a propulsion test.		
Typical Components	**Platforms:** Unmanned surface vehicle; support craft **Targets:** Surface targets **System being Trained/Tested:** Unmanned surface vehicle		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned surface vehicle and unmanned underwater vehicle procedures Target deployment and retrieval safety	**Typical Locations** **Offshore Area** Quinault Range Site	**Inland Waters** Dabob Bay Range Complex Keyport Range Site
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosives:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Stationary Surface Targets, anchors
Sonar and Other Transducer Bins	None		

Unmanned Systems	
Unmanned Surface Vehicle System Testing	
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	None

A.2.4.3 Unmanned Underwater Vehicle Testing

<table>
<tr><th colspan="4">Unmanned Systems</th></tr>
<tr><th colspan="4">Unmanned Underwater Vehicle Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Testing involves the production or upgrade of unmanned underwater vehicles. This may include testing of mission capabilities (e.g., mine detection), evaluating the basic functions of individual platforms, or conducting complex events with multiple vehicles.</td><td>Typical Duration
Typically 1–2 days, but endurance testing may last up to 35 days. Some propulsion systems (e.g., gliders) could operate continuously for multiple months.</td></tr>
<tr><td>Long Description</td><td colspan="3">Unmanned underwater vehicle (UUV) testing covers a broad range of activity in support of the development of UUV performance capabilities (propulsion, navigation, control, durability, and reliability) and mission capabilities (launch and recovery systems, development of various payloads and the capability to deliver the payload as needed, data collection and communication). UUVs may operate singly, in groups, or in coordination with unmanned aircraft or unmanned surface vehicles. Most UUV operations include a launch, transit, mission profile execution, and recovery operations. UUVs may be developed to carry out warfare missions (e.g., mine detection) or scientific missions (e.g., bottom mapping), while others are developed to support other testing objectives (e.g., performing as a target for anti-submarine warfare). UUVs may be launched from unmanned aerial vehicles, surface craft, submarines, piers, or land. Once launched, the vehicles are either towed or self-propelled to the test area. Unmanned underwater vehicles may also deploy, tow, operate, or recover remote sensors and payload systems. Systems on or towed by the UUV may be acoustically active, produce radio-frequency transmissions, or use lasers.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing unmanned aerial systems, patrol boats, remote operated vehicle, shore-based facility, small boat, special mission ship, submarines, support craft, surface combatant, unmanned surface vehicle, unmanned underwater vehicle
Targets: Mine warfare targets, sub-surface targets, surface targets
System being Trained/Tested: Sonar systems, acoustic modem, underwater communications systems, torpedo systems, unmanned underwater vehicle</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Towed in-water device safety
Unmanned aircraft system procedures
Unmanned surface vehicle and unmanned underwater vehicle procedures
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
Quinault Range Site
Inland Waters
Carr Inlet Operations Area
Dabob Bay Range Complex
Keyport Range Site</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended materials
Vessels and in-water devices
Seafloor devices
Ingestion:
Military Expended Materials – Other Than Munitions</td><td>Energy:
In-air electromagnetic devices
Entanglement:
Decelerators/ parachutes</td></tr>
</table>

Unmanned Systems						
Unmanned Underwater Vehicle Testing						
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices			**Sediments and Water Quality:** Chemical Other materials		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike		**Socioeconomic Resources:** Accessibility Physical disturbance and strike		**Public Health and Safety:** Physical interactions In-air energy In-water energy	
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Lightweight torpedo accessories, anti-torpedo torpedo accessories, mobile sub-surface target			**Military Recoverable Material**	Anchor, mine shape (non-explosive), lightweight (non-explosive) torpedo, anti-torpedo torpedo, stationary surface target, stationary sub-surface target	
Sonar and Other Transducer Bins	**High-Frequency:** HF5 HF9	**Very High Frequency:** VHF1	**Torpedoes:** TORP1	**Forward-Looking Sonar:** FLS2	**Acoustic Modems:** M3	**Synthetic Aperture Sonars:** SAS2
In-Water Explosive Bins	None					
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar			**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices		
Assumptions Used for Analysis	Mine shapes and other temporary anchored targets may be deployed for the duration of a single test event or may be left in place for up to 12 months to support multiple events; all devices and their anchors are recovered. Bottom anchors are not deployed in known sensitive shallow water benthic habitats such as eelgrass beds. Multiple vehicles may operate simultaneously in one or multiple areas.					

A.2.5 Vessel Evaluation

A.2.5.1 Propulsion Testing

<table>
<tr><th colspan="5">Vessel Evaluation</th></tr>
<tr><th colspan="5">Propulsion Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Ship is run at high speeds in various formations and at various depths.</td><td colspan="2">Typical Duration
Up to 5 days</td></tr>
<tr><td>Long Description</td><td colspan="4">Propulsion testing is one part of the total sea trial activity. During this activity, the ship is tested for maneuverability, including full power and endurance runs.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Surface ships
Targets: None
System being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Vessel noise
Explosives:
None
Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None
Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria Air Pollutants
Habitats:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
None
Socioeconomic Resources:
Accessibility
Physical disturbance and strike
Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Physical Disturbance and Strike (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Surface ships will not be conducting test constantly for the entire duration.
Surface ships may not be traveling in a straight line.
Surface ships will operate at least 3 NM from shore, across the full spectrum of capable speeds.</td></tr>
</table>

A.2.5.2 Undersea Warfare Testing

<table>
<tr><th colspan="3">Vessel Evaluation</th></tr>
<tr><th colspan="3">Undersea Warfare Testing</th></tr>
<tr><td>Short Description</td><td>Ships demonstrate capability of countermeasure systems and underwater surveillance, weapons engagement, and communications systems. This tests ships’ ability to detect, track, and engage undersea targets.</td><td>Typical Duration
Up to 10 days</td></tr>
<tr><td>Long Description</td><td colspan="2">Undersea warfare events may be comprised of tracking and firing events or tests of hull-mounted sonar system capabilities to detect and avoid torpedo type targets. Tracking and firing events ensure the operability of the undersea warfare suite and its interface with the rotary-wing helicopter. Tests include demonstrating the ability of the ship to search, detect, and track a target and conduct attacks with exercise torpedoes. Detection and avoidance events may use surface craft and underwater platforms to test the capability of mid- and high-frequency acoustic sources. Subsurface moving targets, rocket and air-dropped weapons, sonobuoys, towed arrays, and sub-surface torpedo-like devices may be used. Approximately 1 week of in-port training may precede the event.</td></tr>
<tr><td>Typical Components</td><td colspan="2">Platforms: Rotary-wing aircraft, submarines, support craft, surface combatant
Targets: Sub-surface targets
System being Trained/Tested: Acoustic countermeasures, underwater communications systems, sonar systems, sonobuoys, torpedo systems</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Target deployment and retrieval safety</td><td>Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Explosives:
None
Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended materials
Vessels and in-water devices
Ingestion:
Military expended materials – other than munitions
Energy:
None
Entanglement:
Decelerator/Parachute, Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Metals
Chemicals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
Physical interactions
In-air energy
In-water energy</td></tr>
</table>

<table>
<tr><th colspan="4">Vessel Evaluation</th></tr>
<tr><th colspan="4">Undersea Warfare Testing</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Small decelerator/parachute
Non-Ingestible Material:
Acoustic countermeasures, buoy (non-explosive), expended bathythermograph, expended bathythermograph wire, heavyweight torpedo accessories, lightweight torpedo accessories, mobile subsurface target, sonobuoy (non-explosive), sonobuoy wires, guidance wire</td><td>Military Recoverable Material</td><td>Lightweight (non-explosive) torpedo, heavyweight (non-explosive) torpedo</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">Mid-Frequency: MF1 MF4 MF5 MF6 MF9
High-Frequency: HF4
Anti-Submarine Warfare: ASW3 ASW4
Torpedoes: TORP1 TORP2</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Active sonar
Physical Disturbance and Strike (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Not all sonobuoys used in this activity would include a decelerator/parachute.
Ships will not be conducting test constantly during the duration of the allotted time.</td></tr>
</table>

A.2.5.3 Vessel Signature Evaluation

<table>
<tr><th colspan="4">Vessel Evaluation</th></tr>
<tr><th colspan="4">Vessel Signature Evaluation</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship, submarine, and auxiliary system signature assessments. This may include electronic, radar, acoustic, infrared and magnetic signatures.</td><td>Typical Duration
Typically 1–5 days, up to 20 days depending on the test being conducted</td></tr>
<tr><td>Long Description</td><td colspan="3">Signature testing is passive monitoring of surface ships and submarines, conducted on new ships and periodically throughout a vessel's life cycle, to assess the vessel's vulnerability to various types of detection systems when operating in different profiles (e.g., with or without a communication buoy deployed). Signature testing may include the subject vessel's own safety and navigation systems, tracking devices and range safety systems, radar systems, and underwater or in-air communications equipment. Submarines move through the test site, but in-water devices may be towed. Data may be collected by passive acoustic hydrophones, by passive electro-magnetic or infrared sensors, or by radar. Also included in this activity is the Shipboard Electronic Systems Evaluation Facility, which conducts measurements of antenna emission patterns, Federal Aviation Administration identification of Friend or Foe systems, and Tactical Air Navigation Systems.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platforms, submarines, support craft, surface combatant
Targets: None
System being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety</td><td colspan="2">Typical Locations
Western Behm Canal
SEAFAC
Inland Waters
Dabob Bay Range Complex</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Vessel noise
Explosives:
None
Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None
Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Physical disturbance and strike
Public Health and Safety:
Physical interactions
In-air energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Physical Disturbance and Strike (Section 5.3.4)
Vessel movement</td></tr>
</table>

Vessel Evaluation	
Vessel Signature Evaluation	
Assumptions Used for Analysis	None

A.2.6 OTHER TESTING

A.2.6.1 Acoustic and Oceanographic Research

<table>
<tr><th colspan="4">Acoustic and Oceanographic Science and Technology</th></tr>
<tr><th colspan="4">Acoustic and Oceanographic Research</th></tr>
<tr><td>Short Description</td><td colspan="2">Research using active transmissions from sources deployed from ships, aircraft, and unmanned underwater vehicles. Research sources can be used as proxies for current and future Navy systems.</td><td>Typical Duration
Up to 14 days</td></tr>
<tr><td>Long Description</td><td colspan="3">Active acoustic transmissions used for engineering tests of acoustic sources, validation of ocean acoustic models, tests of signal processing algorithms, and characterization of acoustic interactions with the ocean bottom, fish and ocean surface. Standard oceanographic research sensing (acoustic Doppler current profiler, fathometer-like systems) also to be employed.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Support craft, unmanned underwater vehicle
Targets: None
System being Trained/Tested: Sonar systems</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Unmanned surface vehicle and unmanned underwater vehicle procedures</td><td colspan="2">Typical Locations
Offshore Area
Quinault Range Site
Inland Waters
Dabob Bay Range Complex
Keyport Range Site</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – seafloor devices</td><td>Sediments and Water Quality:
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-air energy
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Anchors</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Low Frequency:
LF4</td><td colspan="2">Mid Frequency:
MF9</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Acoustic and Oceanographic Science and Technology		
Acoustic and Oceanographic Research		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	None	

A.2.6.2 Acoustic Component Testing

<table>
<tr><th colspan="2">Other Testing</th></tr>
<tr><th colspan="2">Acoustic Component Testing</th></tr>
<tr><td>Short Description</td><td>Various surface vessels, moored equipment, and materials are tested to evaluate performance in the marine environment.
Typical Duration
1 day to multiple months</td></tr>
<tr><td>Long Description</td><td>Acoustic component testing includes various activities utilizing the marine environment for testing and evaluation, including troubleshooting components of all installed systems, including acoustic systems. Components may be tested in-situ or removed and tested independently. Test may involve radar, environmental sensors, magnetic, passive acoustic, optical, or air quality instrumentation to measure, record, and analyze system effectiveness, dependability, operational parameters, and durability. Surface operations utilize a variety of vessels for deployment of test equipment and for the monitoring of the air, surface, and subsurface.</td></tr>
<tr><td>Typical Components</td><td>Platforms: Moored platform, submarines, support craft, surface combatants, unmanned underwater vehicles, unmanned aerial vehicle, unmanned surface vessel
Targets: None
System being Trained/Tested: Acoustic modems, sonar systems, underwater communication systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Unmanned aircraft system procedures
Unmanned surface vehicle and unmanned underwater vehicle procedures
Typical Locations
Western Behm Canal
SEAFAC
Inland Waters
NBK Bangor
NBK Bremerton
Naval Station Everett
Naval Magazine Indian Island</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None
Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Ingestion:
None
Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants
Habitats:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Physical disturbance and strike
Public Health and Safety:
Physical interactions
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None
Military Recoverable Material
None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Low Frequency: LF5
Mid Frequency: MF9
High Frequency: HF3 HF6</td></tr>
<tr><td>In-Water Explosive Bins</td><td>None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td>Acoustic Stressors (Section 5.3.2)
Active sonar
Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
</table>

Other Testing	
Acoustic Component Testing	
Assumptions Used for Analysis	Subject vessel being tested is moored at the Navy piers in Washington, but may be moving or static if the test is conducted at SEAFAC. ROVs may be used to deploy sensors below the water line at the Washington piers, but are unlikely to be used at SEAFAC.

A.2.6.3 Cold Water Support

Other Testing		
Cold Water Support		
Short Description	Fleet training for divers in a cold water environment, and other diver training related to Navy divers supporting range/test site operations and maintenance.	**Typical Duration** Assume 8 hours for all events, though they may continue for up to 40 hours, and infrequently some may operate intermittently for multiple consecutive months
Long Description	Fleet training for divers in a cold water environment, and other diver training related to Navy divers supporting range/test facility operations and maintenance. Hand-held acoustic systems and underwater communication devices may be used in diver training, as well as a variety of in-water devices for transporting divers or cargo, and various dive targets such as mine-like shapes.	
Typical Components	**Platforms:** Moored platform, submarines, surface combatant **Targets:** Mine warfare targets **System being Trained/Tested:** Sonar systems, underwater communications	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Target deployment and retrieval safety	**Typical Locations** **Western Behm Canal** SEAFAC **Inland Waters** Carr Inlet Operations Area Dabob Bay Range Complex Keyport Range Site
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosives:** None **Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – seafloor devices	**Sediments and Water Quality:** None
Stressors to Human Resources	**Cultural resources:** Physical disturbance and strike **Socioeconomic Resources:** Accessibility	**Public Health and Safety:** Physical interactions In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material** Mine shape (non-explosive), anchors
Sonar and Other Transducer Bins	**High-Frequency** HF6	
In-Water Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	If a submarine is used as part of the event (SEAFAC, Carr Inlet), submarine acoustic systems may be activated.	

A.2.6.4 Hydrodynamic and Maneuverability Testing

Other Testing		
Hydrodynamic and Maneuverability Testing		
Short Description	Submarines maneuver in the submerged operating environment.	**Typical Duration** 10 days
Long Description	Hydrodynamic testing is required to validate the control and maneuverability of a submarine in a submerged testing environment.	
Typical Components	**Platforms:** Moored platform, submarines, support craft **Targets:** None **System being Trained/Tested:** None	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Western Behm Canal** SEAFAC
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosives:** None **Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None
Stressors to Human Resources	**Cultural resources:** None **Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material** None
Sonar and Other Transducer Bins	None	
In-Water Explosive Bins	None	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	For biological resource analysis, vessel noise and vessel strike are only analyzed for the periods while the submarines are surfaced, typically brief in nature. Mitigation measures related to vessel movement are only considered using the period of surfacing as well. For human resource stressor analysis, physical disturbance and strike and physical interactions are only analyzed for the periods (typically brief in nature) while the submarine is surfaced. Underwater communications are used for range and vessel safety purposes.	

A.2.6.5 Non-Acoustic Component Testing

<table>
<tr><th colspan="4">Other Testing</th></tr>
<tr><th colspan="4">Non-Acoustic Component Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">These tests involve non-acoustic sensors and communication systems. Non-acoustic sensors may also gather other forms of environmental data.</td><td>Typical Duration
3 days (4 hours per day for 3 days)</td></tr>
<tr><td>Long Description</td><td colspan="3">Radio communication with submarines typically includes systems using tethered, untethered, or towed buoyant in-water devices to raise an antenna package to the surface to broadcast the signal. Some communication buoys are intended for single-use applications while the rest are multi-use packages. The component hardware of these systems needs to be tested to ensure that it will reliably support communication without interfering with non-communication vessel operations. Components may be tested while integrated with the platform or removed and tested independently. Test may involve radar, environmental sensors, magnetic, passive acoustic, or optical instrumentation to measure, record, and analyze component effectiveness, dependability, operational parameters, and durability. Optical communications tests may include communication between helicopter or fixed-wing aircraft and manned or unmanned underwater systems, and may also include ground truth sensors mounted on surface craft.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: All navy ships and boats, in-water structures, moored platform, remote operated vehicle, support craft, unmanned aerial vehicle, unmanned underwater vehicle
Targets: None
System being Trained/Tested: Communications systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Unmanned aircraft system procedures
Unmanned surface vehicle and unmanned underwater vehicle procedures</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area
Inland Waters
Dabob Bay Range Complex
Keyport Range Site
Keyport Pier
NBK Bangor
Zelatched Point Pier</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – seafloor devices</td><td>Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-air energy</td></tr>
</table>

Other Testing			
Non-Acoustic Component Testing			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Bottom placed instruments
Sonar and Other Transducer Bins	None		
In-Water Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel Movement		
Assumptions Used for Analysis	Manned aircraft are not used in Dabob Bay Range Complex or Keyport Range Site. Underwater communications are used for range and vessel safety purposes. Unmanned aerial vehicles used in the inland waters areas would be small (e.g., Phantom quadcopter).		

A.2.6.6 Post Refit Sea Trial

<table>
<tr><th colspan="4">Other Testing</th></tr>
<tr><th colspan="4">Post Refit Sea Trial</th></tr>
<tr><td>Short Description</td><td colspan="2">Following periodic maintenance periods or repairs, sea trials are conducted to evaluate submarine propulsion, sonar systems, and other mechanical tests.</td><td>Typical Duration
Typically 8 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Testing activities are conducted throughout the life of a Navy submarine to verify performance and mission capabilities. Sea trials are conducted following periodic maintenance or repairs. A typical test may include a submarine operating at full power and subjected to high-speed runs, steering tests, and other mechanical tests.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed facility, submarines
Targets: None
System being Trained/Tested: Acoustic modem, underwater communications</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety</td><td colspan="2">Typical Locations
Inland Waters
Dabob Bay Range Complex</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Explosives:
None</td><td>Physical Disturbance and Strike:
None
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
None
Habitats:
None</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Mid-Frequency:
MF10</td><td>High-Frequency:
HF9</td><td>Acoustic Modems:
M3</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td>Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">None</td></tr>
</table>

A.2.6.7 Radar and Other System Testing

<table>
<tr><th colspan="4">Other Testing</th></tr>
<tr><th colspan="4">Radar and other System Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Testing may include use of military or commercial radar, communication systems (or simulators), or high-energy lasers. Testing may occur aboard a ship or a helicopter against drones, small boats, or other targets.</td><td>Typical Duration
12 hours per day over a 7-day period</td></tr>
<tr><td>Long Description</td><td colspan="3">At-sea testing may include use of military or commercial radar, communication systems (or simulators), or high-energy lasers. No subsurface transmission will occur during this testing. Testing of various air and surface targets may include unmanned aerial vehicles or small craft (e.g., floating cardboard triwalls, towed, anchored, or self-propelled vessels). High-energy laser testing may include tracking, scoring, and neutralization runs with single or multiple targets.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Surface ships, rotary-wing aircraft
Targets: Aerial targets, surface targets
System being Trained/Tested: Radar, high-energy lasers</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety
Aircraft safety
High-energy laser safety
Towed in-water device safety
Target deployment and retrieval safety</td><td colspan="2">Typical Locations
Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended materials
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
High-energy lasers
Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td>Sediments and Water Quality:
Metals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics</td><td>Public Health and Safety:
Physical interactions
In-air energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
Air targets – expended drone, mobile surface target</td><td>Military Recoverable Material</td><td>Stationary surface target</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Other Testing	
Radar and other System Testing	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	None

A.2.6.8 Semi-Stationary Equipment Testing

<table>
<tr><th colspan="4">Other Testing</th></tr>
<tr><th colspan="4">Semi-Stationary Equipment Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Semi-stationary equipment (e.g., hydrophones) is deployed to determine functionality.</td><td>Typical Duration
From 10 minutes to multiple days</td></tr>
<tr><td>Long Description</td><td colspan="3">Semi-stationary equipment calibration and testing is performed from a fixed site, suspended over the side of a boat, moored to the bottom, suspended in the water column, or on the surface. Examples of semi-stationary equipment include moored hydrophones (i.e., devices to listen to underwater sound), line arrays (i.e., multiple hydrophones) deployed on the ocean bottom, acoustic countermeasures, a moored oceanographic sensor that moves vertically through the water column, sonobuoys, and transducers. Some units produce sound in the water (e.g., acoustic countermeasures), while others only listen (e.g., passive sonobuoys, vector sensors that measure particle motion). Some tests could require deployment in an area that provides opportunistic data collection (e.g., placing a hydrophone near a shipping lane to collect shipping noise data), or with specific geographic or oceanographic requirements.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platform, shore based facility, submarines, support craft
Targets: None
System being Trained/Tested: Acoustic modems, sonar systems, underwater communications systems</td></tr>
<tr><td>Standard Operating Procedures
(Section 2.3.3)</td><td>Vessel safety</td><td colspan="2">Typical Locations
Western Behm Canal
SEAFAC
Inland Waters
Dabob Bay Range Complex
Keyport Range Site</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosives:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td>Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="2">Sediments and Water Quality:
Metals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions
In-water energy</td></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Anchors, canister</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Low-Frequency:
LF4
Mid-Frequency:
MF9</td><td>High-Frequency:
HF6 HF9</td><td>Very High Frequency:
VHF2</td></tr>
<tr><td>In-Water Explosive Bins</td><td colspan="3">None</td></tr>
</table>

Other Testing		
Semi-Stationary Equipment Testing		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Anchored equipment and temporary mooring buoys may be deployed for the duration of a single test event or may be left in place for up to 12 months to support multiple events; all devices and their anchors are recovered. Bottom anchors are not deployed in known sensitive shallow water benthic habitats such as eelgrass beds. Acoustic test facility testing would occur at the Keyport Pier.	

A.2.6.9 Simulant Testing

Other Testing		
Simulant Testing		
Short Description	The capability of surface ship defense systems to detect and protect against chemical and biological attacks are tested.	**Typical Duration** 3 days
Long Description	The capabilities of surface ship defense systems to detect and protect in the event of chemical and biological attacks are tested. Testing involves the deployment of harmless compounds (i.e., simulants) as substitutes for chemical and biological warfare agents. Because chemical and biological warfare agents remain a security threat, the Department of Defense uses relatively harmless compounds (simulants) as substitutes for chemical and biological warfare agents to test equipment intended to detect their presence. Chemical and biological agent detectors monitor for the presence of chemical and biological warfare agents and protect military personnel and civilians from the threat of exposure to these agents. The simulants trigger a response by sensors in the detection equipment without irritating or injuring personnel involved in testing detectors. Navy Chemical Agent Simulant 82 (commonly referred to as NCAS-82), glacial acetic acid, triethyl phosphate, sulfur hexafluoride, 1,1,1,2 tetrafluoroethane (a refrigerant commonly known as R134), and 1,1-difluoroethane (a refrigerant commonly known as R-152a) are also referred to as gaseous simulants and can be released in smaller quantities in conjunction with glacial acetic acid or triethyl phosphate releases. The types of biological simulants that may be used include spore-forming bacteria, non-spore-forming bacteria, ovalbumin, bacteriophage MS2, and Aspergillus niger. The simulants are generally dispersed by hand at the detector or by aircraft as a fine mist or aerosol.	
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, surface combatant **Targets:** None **System being Trained/Tested:** None	
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Offshore Area** Offshore Area
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosives:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices **Ingestion:** None **Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike **Public Health and Safety:** Physical interactions In-air energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material** None

Other Testing	
Simulant Testing	
Sonar and Other Transducer Bins	None
In-Water Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	All chemical simulants have low toxicity to humans and the environment. Examples of chemical simulants include glacial acetic acid and triethyl phosphate. All biological simulants are considered to be Biosafety Level 1 organisms. Examples of biological simulants are spore-forming bacteria, non-spore-forming bacteria, the protein ovalbumin, MS2 bacteriophages, and the fungus *Aspergillus niger*. Simulant testing will occur at least 3 NM from shore.

A.3 Naval Air Systems Command Testing Activities

A.3.1 Anti-Submarine Warfare

A.3.1.1 Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft</th></tr>
<tr><td rowspan="2">Short Description</td><td rowspan="2">The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.</td><td colspan="2">Typical Duration</td></tr>
<tr><td colspan="2">4–8 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="3">Similar to an anti-submarine warfare (ASW) tracking exercise-maritime patrol aircraft, an anti-submarine warfare tracking test—maritime patrol aircraft evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8 fixed-wing aircraft conduct anti-submarine warfare testing using non-impulsive sonobuoys (e.g., AN/SSQ-62 DICASS, AN/AQS-125 MAC, AN/AQS-125 HDC, MK-84 ESUS) and passive sonobuoys (e.g., AN/SSQ-53 DIFAR). If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in deep (typically beyond 100 ft.) waters. Some anti-submarine warfare maritime patrol aircraft tracking tests could be conducted as part of a coordinated event with fleet training activities.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft
Targets: Submarine
Systems being Trained/Tested: Sonobuoys/sonobuoy launching systems, data transmission systems</td></tr>
<tr><td rowspan="2">Standard Operating Procedures (Section 2.3.3)</td><td rowspan="2">Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations</td></tr>
<tr><td colspan="2">Offshore Area
Offshore Area</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise

Explosives:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Military expended materials

Ingestion:
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Habitats:
Physical disturbance and strike – military expended material</td><td>Air Quality:
Criteria Air Pollutants
Sediment and Water Quality:
Metals Other Materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
</table>

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys, sonobuoy wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF5 MF6	**Anti-Submarine Warfare:** ASW2 ASW5	
In-Water Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active Sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Assume one decelerator/parachute per sonobuoy For air quality analysis: - 1 fixed-wing patrol aircraft - Average 8 hours per event		

A.3.1.2 Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft (SUS)

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft (SUS)			
Short Description	This test evaluates the sensors and systems used by maritime patrol aircraft to communicate with submarines using any of the family of signal underwater sound (SUS) sonobuoy systems.	**Typical Duration** 8 flight hours per event	
Long Description	Similar to an ASW tracking exercise-maritime patrol aircraft, an anti-submarine warfare tracking test—maritime patrol aircraft (SUS) evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8 fixed-wing aircraft conduct anti-submarine warfare testing using explosive (SUS) sonobuoys (i.e., MK-61 SUS, MK-64 SUS, and MK-82 SUS) and passive sonobuoys (e.g., AN/SSQ-53 DIFAR). If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in deep (typically beyond 100 ft.) waters. Some anti-submarine warfare maritime patrol aircraft tracking tests could be conducted as part of a coordinated event with fleet training activities.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Submarine **Systems being Trained/Tested:** Sonobuoys/sonobuoy launching systems, data transmission systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Offshore Area** Offshore Area	
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** In-water explosions	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria Air Pollutants	**Sediment and Water Quality:** Explosives Chemicals Metals Other Materials	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical Interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, sonobuoy fragments **Non-Ingestible Material:** Sonobuoys, sonobuoy wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft (SUS)	
In-Water Explosive Bins	E1 E3
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive Sonobuoys **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Assume one decelerator/parachute per sonobuoy Explosive sonobuoy testing occurs at least 50 NM from shore and does not occur within the boundaries of the Olympic Coast National Marine Sanctuary. For air quality analysis: - 1 fixed-wing patrol aircraft - Average 8 hours per event

A.3.2 OTHER TESTING

A.3.2.1 Intelligence, Surveillance, Reconnaissance/Electronic Warfare Triton Testing

Electronic Warfare (EW)			
ISR/EW Triton Testing			
Short Description	ISR/EW Triton Testing will evaluate the sensors and communication systems on board the MQ-4C Triton unmanned aerial system.	**Typical Duration**	Up to 30 flight hours per event
Long Description	The MQ-4C Triton unmanned aerial system will fill a complementary role to the P-8A fixed-wing aircraft, providing maritime intelligence, surveillance and reconnaissance (ISR) and Electronic Warfare (EW) support to the Navy. This MQ-4C Triton will be equipped with electro-optical and infrared sensors that allow it to conduct high-altitude surveillance operations. ISR/EW Triton Testing will evaluate the sensors and communication systems on board the MQ-4C Triton unmanned aerial system at a high altitude (50,000 feet above sea level) within the NWTT Study Area.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** None **Systems being Trained/Tested:** Unmanned aerial systems, data transmission systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aircraft system procedures	**Typical Locations** **Offshore Area** Offshore Area	**Inland Waters** EW Range
Stressors to Biological Resources	**Acoustic/Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None	**Sediment and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
In-Water Explosive Bins	None		
Procedural Mitigation Measures	None		

Electronic Warfare (EW)	
ISR/EW Triton Testing	
Assumptions Used for Analysis	Triton is at approximately 50,000 feet above ground level for duration of test events within the NWTT Study Area.

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Supplemental Environmental Impact Statement/

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Northwest Training and Testing

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APPENDIX B Activity Stressor Matrices

This appendix contains three matrices. The first two matrices in this appendix list the training and testing activities that occur in the Northwest Training and Testing Study Area and their associated stressors. The third matrix lists the resources analyzed in this Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement and the stressors they are potentially affected by.

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Table B-1: Stressors by Training Activity

Northwest Training Activity	Biological Resources																		Physical Resources[1]					Human Resources[2]							
	Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Vessel Noise	Aircraft Noise	Weapons Noise	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Devices	Aircraft & Aerial Targets	Military Expended Material	Seafloor Devices	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer[3]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials[4]	Explosives[5]	Physical Disturbance & Strike[6]	Accessibility[7]	Airborne Acoustics[8]	Physical Disturbance & Strike[6]	In-Water Energy[9]	In-Air Energy[10]	Physical Interactions[11]
AIR WARFARE																															
Air Combat Maneuver			✓				✓				✓	✓							✓		✓			✓			✓	✓			
Gunnery Exercise (Surface-to-Air)		✓	✓	✓	✓		✓			✓	✓	✓					✓		✓	✓	✓				✓	✓	✓	✓			✓
Missile Exercise (Air-to-Air)			✓		✓		✓				✓	✓			✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
Missile Exercise (Surface-to-Air)		✓	✓	✓	✓		✓			✓	✓	✓					✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
ANTI-SUBMARINE WARFARE																															
Torpedo Exercise – Submarine	✓	✓								✓		✓		✓							✓				✓			✓	✓		✓
Tracking Exercise – Helicopter	✓	✓	✓				✓			✓	✓	✓			✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Tracking Exercise – Maritime Patrol Aircraft	✓	✓	✓				✓			✓	✓	✓			✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Tracking Exercise – Ship	✓	✓					✓			✓		✓							✓						✓	✓	✓	✓	✓		✓
Tracking Exercise – Submarine	✓	✓								✓		✓									✓				✓			✓	✓		✓
ELECTRONIC WARFARE																															
Electronic Warfare Training – Aircraft			✓				✓				✓								✓							✓	✓	✓			✓
Electronic Warfare Training - Ship		✓					✓			✓									✓							✓		✓			✓
MINE WARFARE																															
Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	✓	✓	✓			✓	✓	✓		✓	✓		✓						✓	✓				✓	✓	✓	✓	✓	✓		✓
Mine Neutralization – Explosive Ordnance Disposal Training		✓				✓				✓		✓	✓				✓	✓	✓	✓				✓	✓	✓	✓	✓	✓		✓
SURFACE WARFARE																															
Bombing Exercise Air-to-Surface			✓			✓	✓				✓	✓					✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
Gunnery Exercise Surface-to-Surface – Ship		✓		✓		✓	✓			✓		✓					✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓

Table B-1: Stressors by Training Activity (continued)

Northwest Training Activity	Biological Resources																		Physical Resources[1]					Human Resources [2]						
	Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors		Public Health & Safety Stressors		
	Sonar & Other Transducers	Vessel Noise	Aircraft Noise	Weapons Noise	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Devices	Aircraft & Aerial Targets	Military Expended Material	Seafloor Devices	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [3]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [4]	Explosives [5]	Physical Disturbance & Strike [6]	Accessibility [7]	Airborne Acoustics [8]	Physical Disturbance & Strike [6]	In-Water Energy [9]	In-Air Energy [10]	Physical Interactions [11]
SURFACE WARFARE (Continued)																														
Missile Exercise Air-to-Surface			✓	✓		✓	✓			✓	✓	✓					✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
OTHER TRAINING																														
Intelligence, Surveillance, Reconnaissance			✓				✓				✓	✓		✓	✓				✓												
Maritime Security Operations		✓		✓			✓			✓		✓							✓		✓					✓	✓	✓			✓
Personnel Insertion/ Extraction – Non-Submersible		✓								✓									✓												
Precision Anchoring		✓					✓			✓		✓	✓						✓						✓	✓					✓
Search and Rescue		✓	✓				✓			✓	✓								✓								✓	✓			✓
Small Boat Attack Exercise		✓		✓						✓		✓					✓		✓		✓				✓	✓	✓	✓			✓
Submarine Sonar Maintenance	✓								✓																		✓				
Surface Ship Sonar Maintenance	✓	✓				✓			✓																		✓				
Unmanned Underwater Vehicle Training	✓	✓								✓		✓																			

[1] Habitat stressors are included under Biological Resources
[2] Area of interest is U.S. Territorial Waters (seaward of the mean high water line to 12 nautical miles and any inshore waters)
[3] Testing activities only
[4] Other Materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects
[5] Vibration and shock waves from underwater explosions
[6] Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, and vibration from sonic booms in U.S. territorial waters (seaward of the mean high water line to 12 nautical miles)
[7] Availability of access on the ocean and in the air
[8] Loud noises from weapons firing, in-air explosions, and sonic booms
[9] Active sonar, underwater explosions, vessel movements, mine warfare training devices, and unmanned underwater systems
[10] Sources or electromagnetic energy and lasers
[11] Interaction of Navy aircraft, vessels, and equipment with general public
Note: A check indicates events that take place for Alternative 1 and Alternative 2.

Table B-2: Stressors by Testing Activity

Northwest Testing Activity	Biological Resources																		Physical Resources[1]					Human Resources [2]							
	Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Vessel Noise	Aircraft Noise	Weapons Noise	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Devices	Aircraft & Aerial Targets	Military Expended Material	Seafloor Devices	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [3]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [4]	Explosives [5]	Physical Disturbance & Strike [6]	Accessibility [7]	Airborne Acoustics [8]	Physical Disturbance & Strike [6]	In-Water Energy [9]	In-Air Energy [10]	Physical Interactions [11]
NAVAL SEA SYSTEMS COMMAND																															
ANTI-SUBMARINE WARFARE																															
Anti-Submarine Warfare Testing	✓	✓	✓							✓	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
At-Sea Sonar Testing	✓	✓	✓				✓			✓	✓	✓		✓	✓			✓	✓		✓	✓	✓			✓		✓	✓	✓	✓
Countermeasure Testing	✓	✓					✓			✓		✓		✓		✓		✓	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓
Pierside-Sonar Testing	✓																												✓		
Submarine Sonar Testing/Maintenance	✓	✓								✓																		✓	✓		✓
Torpedo (Explosive) Testing	✓	✓	✓			✓	✓			✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Torpedo (Non-explosive) Testing	✓	✓	✓				✓			✓	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
MINE WARFARE																															
Mine Countermeasure and Neutralization Testing	✓	✓	✓			✓	✓				✓	✓	✓	✓			✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Mine Detection and Classification Testing	✓	✓								✓	✓		✓						✓		✓				✓	✓	✓		✓	✓	✓
SURFACE WARFARE																															
Kinetic Energy Weapon Testing		✓		✓	✓		✓			✓	✓	✓			✓		✓	✓	✓		✓				✓	✓	✓	✓		✓	✓
UNMANNED SYSTEMS																															
Unmanned Aerial System Testing		✓								✓	✓								✓						✓	✓	✓	✓			✓
Unmanned Surface Vehicle System Testing		✓								✓									✓						✓	✓		✓		✓	✓
Unmanned Underwater Vehicle Testing	✓	✓					✓			✓	✓	✓	✓		✓			✓	✓			✓	✓		✓	✓		✓	✓	✓	✓
VESSEL EVALUATION																															
Propulsion Testing		✓								✓									✓							✓		✓			✓
Undersea Warfare Testing	✓	✓	✓							✓	✓	✓		✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

Table B-2: Stressors by Testing Activity (continued)

Northwest Testing Activity	Biological Resources																		Physical Resources[1]					Human Resources [2]							
	Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors			Public Health & Safety Stressors	
	Sonar & Other Transducers	Vessel Noise	Aircraft Noise	Weapons Noise	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Devices	Aircraft & Aerial Targets	Military Expended Material	Seafloor Devices	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [3]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [4]	Explosives [5]	Physical Disturbance & Strike [6]	Accessibility [7]	Airborne Acoustics [8]	Physical Disturbance & Strike [6]	In-Water Energy [9]	In-Air Energy [10]	Physical Interactions [11]
VESSEL EVALUATION (CONTINUED)																															
Vessel Signature Evaluation		✓					✓			✓									✓						✓	✓		✓		✓	✓
OTHER TESTING																															
Acoustic and Oceanographic Research	✓	✓					✓			✓			✓						✓				✓		✓	✓		✓	✓	✓	✓
Acoustic Component Testing	✓	✓								✓	✓								✓						✓	✓		✓	✓		✓
Cold Water Support	✓	✓								✓			✓						✓						✓	✓				✓	✓
Hydrodynamic and Maneuverability Testing		✓								✓																✓		✓			✓
Non-Acoustic Component Testing		✓					✓			✓			✓						✓						✓	✓	✓	✓		✓	✓
Post-Refit Sea Trial	✓																									✓		✓	✓		✓
Radar and Other System Testing		✓	✓				✓		✓	✓	✓	✓			✓				✓		✓		✓			✓	✓			✓	✓
Semi-Stationary Equipment Testing	✓	✓								✓									✓		✓		✓			✓		✓	✓		✓
Simulant Testing		✓	✓				✓			✓	✓								✓			✓	✓			✓	✓	✓		✓	✓
NAVAL AIR SYSTEMS COMMAND																															
ANTI-SUBMARINE WARFARE																															
Tracking Test – Maritime Patrol Aircraft	✓		✓				✓				✓	✓		✓	✓			✓	✓		✓		✓		✓	✓	✓	✓	✓		✓
Tracking Test – Maritime Patrol Aircraft (SUS)			✓			✓	✓				✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

Table B-2: Stressors by Testing Activity (continued)

Northwest Testing Activity	Biological Resources																		Physical Resources[1]					Human Resources [2]							
	Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Vessel Noise	Aircraft Noise	Weapons Noise	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Devices	Aircraft & Aerial Targets	Military Expended Material	Seafloor Devices	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [3]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [4]	Explosives [5]	Physical Disturbance & Strike [6]	Accessibility [7]	Airborne Acoustics [8]	Physical Disturbance & Strike [6]	In-Water Energy [9]	In-Air Energy [10]	Physical Interactions [11]
OTHER TESTING																															
Intelligence, Surveillance, Reconnaissance (ISR)/Electronic Warfare (EW) Triton Testing							✓				✓																				

[1] Habitat stressors are included under Biological Resources
[2] Area of interest is U.S. Territorial Waters (seaward of the mean high water line to 12 nautical miles and any inshore waters)
[3] Testing activities only
[4] Other Materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects
[5] Vibration and shock waves from underwater explosions
[6] Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, and vibration from sonic booms in U.S. territorial waters (seaward of the mean high water line to 12 nautical miles)
[7] Availability of access on the ocean and in the air
[8] Loud noises from weapons firing, in-air explosions, and sonic booms
[9] Active sonar, underwater explosions, vessel movements, mine warfare training devices, and unmanned underwater systems
[10] Sources or electromagnetic energy and lasers
[11] Interaction of Navy aircraft, vessels, and equipment with general public
Note: A check indicates events that take place for Alternative 1 and Alternative 2.

Table B-3: Stressors by Resource

Stressors vs. Resources		Biological Resources																		Physical Resources[1]					Human Resources [2]							
		Acoustic Stressors				Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors				Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resources Stressors		Socioeconomic Resources Stressors			Public Health & Safety Stressors		
		Sonar & Other Transducers	*Vessel Noise*	*Aircraft Noise*	*Weapons Noise*	*In-Air Explosions*	*In-Water Explosions*	*In-Air Electromagnetic Devices*	*In-Water Electromagnetic Devices*	*High-Energy Lasers*	*Vessels & In-water Devices*	*Aircraft & Aerial Targets*	*Military Expended Material*	*Seafloor Devices*	*Wires & Cables*	*Decelerators/Parachutes*	*Biodegradable Polymer* [3]	*Military Expended Materials – Munitions*	*Military Expended Materials – Other than Munitions*	*Criteria Air Pollutants*	*Explosives*	*Metals*	*Chemicals*	*Other Materials* [4]	*Explosives* [5]	*Physical Disturbance & Strike* [6]	*Accessibility* [7]	*Airborne Acoustics* [8]	*Physical Disturbance & Strike* [6]	*In-Water Energy* [9]	*In-Air Energy* [10]	*Physical Interactions* [11]
Physical	Sediments and Water Quality						✓														✓	✓	✓	✓								
	Air Quality					✓													✓	✓												
Biological	Marine Habitats						✓				✓		✓	✓																		
	Marine Mammals	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Sea Turtles	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Birds	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓				✓	✓	✓	✓												
	Marine Vegetation						✓				✓		✓	✓							✓	✓	✓	✓								
	Marine Invertebrates	✓					✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Fishes	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓								
Human	Cultural Resources			✓			✓						✓	✓											✓	✓						
	American Indian and Alaskan Traditional Resources																															
	Socioeconomic Resources	✓	✓	✓	✓		✓				✓	✓	✓		✓						✓	✓	✓	✓			✓	✓	✓			
	Public Health and Safety	✓			✓		✓			✓	✓	✓	✓	✓																✓	✓	✓

[1] Habitat stressors are included under Biological Resources
[2] Area of interest is U.S. Territorial Waters (seaward of the mean high water line to 12 nautical miles and any inshore waters)
[3] Testing activities only
[4] Other Materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects
[5] Vibration and shock waves from underwater explosions
[6] Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, and vibration from sonic booms in U.S. territorial waters (seaward of the mean high water line to 12 nautical miles)
[7] Availability of access on the ocean and in the air
[8] Loud noises from weapons firing, in-air explosions, and sonic booms
[9] Active sonar, underwater explosions, vessel movements, mine warfare training devices, and unmanned underwater systems
[10] Sources or electromagnetic energy and lasers
[11] Interaction of Navy aircraft, vessels, and equipment with general public
Note: A check indicates stressors analyzed for each resource.

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Appendix C Air Quality Example Calculations

This appendix discusses emission factor development, calculations, and assumptions used in the air quality analyses presented in Section 3.2 (Air Quality) of the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (Supplemental).

C.1 Surface Operations Emissions

Surface operations are activities associated with vessel movements. Fleet training activities use a variety of marine vessels, including cruisers, destroyers, frigates, carriers, submarines, amphibious vessels, and small boats. Testing activities use a variety of marine vessels, including various testing support vessels, work boats, torpedo recovery vessels, unmanned surface vehicles, and small boats. These vessels use diverse propulsion methods, including marine outboard engines, diesel engines, and gas turbines.

C.1.1 Marine Outboard Engines

The United States (U.S.) Environmental Protection Agency (USEPA) has published emissions factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. Representative emission factors for two-stroke and four-stroke engines of various horsepower are presented in Table C-1.

Table C-1: United States Environmental Protection Agency Emission Factors for Outboard Engines

Engine		*Emissions Factor (grams/hp-hr.)*			
Type	*Rating (horsepower)*	*NO_x*	*CO*	*VOC*	*PM*
2-Stroke	16–25	4.32	79.32	18.69	0.26
	50–100	4.32	79.32	15.55	0.22
4-Stroke	16–25	5.82	166.46	4.65	0.06
	60–100	5.82	127.94	3.53	0.06

Notes: CO = carbon monoxide, hp = horsepower, hr. = hour, NOx = nitrogen oxides, VOC = volatile organic compounds, PM = Particulate Matter
Source: U.S. Environmental Protection Agency, 2010, Exhaust Emissions Factors for Non-Road Engine Modeling-Spark Ignition. Report No. NR-010f; Office of Mobile Sources, Assessment and Modeling Division, EPA-420-R-10-019.

Emissions for surface craft using outboard engines were calculated using USEPA AP-42 factors, multiplied by the engine horsepower and hours of operation.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = annual surface craft emissions

HP = horsepower (reflective of a particular load factor/engine power setting)

HR/YR = hours per year

EF = air pollutant emission factor for specific engine type

ENG = number of engines per vessel

To obtain the total criteria pollutant emissions for the Proposed Action, emissions were calculated for each training or testing activity, type of surface vessel, and criteria pollutant. These individual estimates of emissions, in units of tons per year, were then summed by criteria pollutant to obtain the aggregate emissions for surface vessel emissions activities.

C.1.2 Diesel Engines

Limited data were available for large marine diesel engines. Therefore, USEPA AP-42 emissions factors for industrial reciprocating engines were used to calculate diesel engine emissions. Other sources of vessel emissions factors included data presented in John J. McMullen Associates, as referenced in previous U.S. Department of the Navy (Navy) EIS/OEIS documentation. Diesel was assumed to be the primary fuel to ensure a conservative estimate. Calculation methods similar to those described for marine outboard engines were used to obtain emissions estimates for diesel engines.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = annual surface craft emissions

HP = horsepower (reflective of a particular load factor/engine power setting)

HR/YR = hours per year

EF = air pollutant emission factor for specific engine type

ENG = number of engines per vessel

Diesel engine emission factors were multiplied by the engine horsepower and annual hours of operation to calculate the pollutant emissions per year.

C.2 Air Operations Emissions

Fleet training and Naval Air Systems Command testing use various aircraft, including the E/A-18G, P-8, SH-60B, MH-60S, and Lear Jet. Aircraft operations of concern are those that occur from ground level up to 3,000 feet (ft.) above ground level (AGL). The 3,000 ft. AGL altitude was assumed to be the ceiling of the mixing zone (known as the atmospheric mixing height) above which any pollutant generated would not contribute to increased pollutant concentrations at ground level. Pollutants emitted by aircraft above 3,000 ft. AGL are excluded from the analysis of compliance with National Ambient Air Quality Standards. The pollutant emission rate is a function of the aircraft engine's fuel flow rate and efficiency. Emissions for one complete training activity for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

For this Supplemental, emission factors for most military engines were obtained from the Navy's Aircraft Environmental Support Office memoranda and the Federal Aviation Administration's Emissions and Dispersion Modeling System model). For those aircraft for which engine data were unavailable, an applicable surrogate was used. Using these data, as well as number of sorties, pollutant emissions for each aircraft were calculated by applying the equation below.

$$Emissions = T \times N x FF \times EF \times ENG \times CF$$

Where:

Emissions = annual aircraft emissions (pounds [lb.]) (for EF in lb./1,000 gallons [gal.] fuel)

T = time at a specified power setting (hours [hr.]/activity).

N = Number of aircraft operations per year for each type of aircraft

FF = fuel flow at a specified power setting (gal./hr./engine)

EF = pollutant emission factor by engine type and power setting (lb./1,000 gal. of fuel used)

ENG = number of engines per aircraft

CF = conversion factor (0.001)

C.3 Ordnance and Munitions Emissions

Available emissions factors (AP-42, *Compilation of Air Pollutant Emission Factors*) were used. These factors were then multiplied by the net weight of the explosive and the number of items that were used per year. This calculation provides estimates of annual emissions.

$$Emissions = EXP/YR \times EF \times Net\ Wt$$

Where:

Emissions = annual ordnance emissions

EXP/YR = number of explosives, propellants, and pyrotechnics items used per year

EF = air pollutant emissions factor per item

Net Wt = net weight of explosive, propellant, or pyrotechnics per ordnance item

C.4 Emissions Estimates Spreadsheets

The following spreadsheets are examples of the emissions calculations for aircraft, vessels, and ordnance. Tables C-2 through C-10 provide example calculations for the air quality calculations for vessels, aircraft, and ordnance. The examples provided are for baseline training within the NWTT Study Area. These examples are representative of calculation spreadsheets developed for each range or testing area and of the calculations developed for each alternative analyzed in this Supplemental.

C.5 Example Record of Non-Applicability

This appendix provides an example of the documentation that will be prepared for each state potentially impacted by the Proposed Action. The example document includes a Record of Non-Applicability memorandum, a standard form to show Clean Air Act conformity, and sample conformity analyses.

MEMORANDUM FOR THE RECORD

From: _________

Subj: Conformity Analysis for Northwest Training and Testing (NWTT) Environmental Impact Statement/Overseas Environmental Impact Statement – Operations in State of Washington Waters

Ref: (a) 40 CFR, Part 93, Subpart B: Determining Conformity of General Federal Actions to State or Federal Implementation Plans

Encl: (1) Record of Non-Applicability for Northwest Training and Testing in State of Washington Waters

1. Enclosure (1) is a Record of Non-Applicability for those activities associated with Pacific Fleet training and testing activities that are expected to occur annually in State of Washington waters. The Proposed Action would have no new emissions of criteria air pollutants in air quality non-attainment or maintenance areas.

2. If there are any questions or if additional information is needed, please call ________ at ______.

____

Name

Title

Figure C-1: Sample Record of Non-Applicability Memorandum

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The Proposed Action falls under the Record of Non-Applicability (RONA) category and is documented with this RONA.

Proposed Action: Northwest Training and Testing

Action Proponents: Commander, Pacific Fleet

Naval Sea Systems Command

Naval Air Systems Command

Proposed Action Name: Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (SEIS/OEIS)

Proposed Action and Emissions Summary:

The Proposed Action consists of training and testing activities in the waters of the States of Alaska, Washington, Oregon, and California, as well as in federal and international waters. The Proposed Action would result in no increases in emissions of criteria air pollutants in air quality non-attainment or maintenance areas. Accordingly, the Proposed Action is exempt from the provisions of 40 CFR, Part 93, Subpart B.

Affected Air Basins: Northwest Washington Air Quality Control Region, Puget Sound Air Quality Control Region

Date RONA prepared: ____________________

RONA prepared by: Naval Facilities Engineering Command, Northwest

Attainment Area Status and Emissions Evaluation Conclusion:

To the best of my knowledge and belief, the information contained within this General Conformity Applicability Analysis is correct and accurate. By signing this statement, I am in agreement with the finding that the total of all reasonably foreseeable direct and indirect emissions that will result from this action is below the de minimis threshold set forth in 40 CFR 93.153. Accordingly, it is my determination that this action conforms to the applicable State Implementation Plan (SIP).

RONA Approval:

Signature: ____________________

Name/Rank: ____________________ Date: ____________

Position: __________ Commanding Officer: ____________ Activity: ____________

Enclosure 1

Figure C-2: Sample Record of Non-Applicability Form

Table C-2: Greenhouse Gas Emissions Under All Alternatives

Case	Source	TRAINING GHG Emissions (lb/year) CO_2	TRAINING N_2O	TRAINING CH_4	TRAINING $CO_{2\text{-}e}$	TESTING GHG Emissions (lb/year) CO_2	TESTING N_2O	TESTING CH_4	TESTING $CO_{2\text{-}e}$	TOTAL GHG Emissions (lb/year) CO_2	TOTAL N_2O	TOTAL CH_4	TOTAL $CO_{2\text{-}e}$
Baseline (2015 NWTT EIS/OEIS)	Aircraft	264,552,544	8,582	7,476	267,370,027	5,537,775	180	157	5,596,752	270,090,318	8,762	7,633	272,966,779
ALT 1 - Pref. LT	Vessels	64,893,806	2,105	1,834	65,584,925	4,762,766	184	77	4,821,481	69,656,572	2,289	1,911	70,406,406
	Total	**329,446,350**	**10,687**	**9,310**	**332,954,952**	**10,300,540**	**364**	**233**	**10,418,233**	**339,746,890**	**11,051**	**9,544**	**343,373,185**
	kilos	149,748,341	4,858	4,232	151,343,160	4,682,064	165	106	4,735,560	154,430,405	5,023	4,338	156,078,720
	teras	0.149748341	4.85789E-06	4.23E-06	0.15134316	0.00468206	1.654E-07	1.06E-07	0.00473556	0.1544304	5.02E-06	4.34E-06	0.15607872
Alt 1	Aircraft	191,413,129	6,210	5,409	193,451,678	4,114,545	133	116	4,158,365	195,527,674	6,343	5,526	197,610,042
	Vessels	79,879,404	2,591	2,257	80,730,119	87,263,425	2,831	2,466	88,192,780	167,142,829	5,422	4,724	168,922,899
	Total	**271,292,533**	**8,801**	**7,667**	**274,181,797**	**91,377,970**	**2,964**	**2,582**	**92,351,145**	**362,670,502**	**11,765**	**10,249**	**366,532,941**
	kilos	123,314,788	4,000	3,485	124,628,089	41,535,441	1,347	1,174	41,977,793	164,850,228	5,348	4,659	166,605,882
	teras	0.123314788	4.00038E-06	3.48E-06	0.124628089	0.04153544	1.347E-06	1.17E-06	0.04197779	0.16485023	5.35E-06	4.66E-06	0.166605882
Alt 2	Aircraft	196,272,965	6,367	5,547	198,363,271	4,325,991	140	122	4,372,063	200,598,956	6,508	5,669	202,735,333
	Vessels	91,366,349	2,964	2,582	92,339,400	91,750,107	2,976	2,593	92,727,245	183,116,456	5,940	5,175	185,066,645
	Total	**287,639,313**	**9,331**	**8,129**	**290,702,671**	**96,076,098**	**3,117**	**2,715**	**97,099,308**	**383,715,411**	**12,448**	**10,844**	**387,801,978**
	kilos	130,745,142	4,241	3,695	132,137,578	43,670,954	1,417	1,234	44,136,049	174,416,096	5,658	4,929	176,273,627
	teras	0.130745142	4.24142E-06	3.69E-06	0.132137578	0.04367095	1.417E-06	1.23E-06	0.04413605	0.1744161	5.66E-06	4.93E-06	0.176273627

Table C-3: Distribution and Frequency of Training and Testing Activities Under All Alternatives

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
TRAINING														
Air Warfare														
	275	Chaff	W-237 A and B	126	Chaff	W-237 A and B	126	Chaff	W-237 A and B	1	100%	0%	0%	0%
Air Combat Maneuver	275	Flares	Olympic Military Operations Area	574	Flares	Olympic Military Operations Area	574	Flares	Olympic Military Operations Area					
	550		Total	700		Total	700		Total					
Missile Exercise (Air-to-Air)	9.6		W 237	1.6		W 237	9.6		W 237	1.5	0%	0%	100%	0%
	2.4	AIM-7/9/120 (15 explosive warheads, 15 NEPM warheads	OPArea - ORAB	0.4	AIM-7/9/120 (5 explosive warheads, 5 NEPM warheads)	OPArea - ORAB	2.4	AIM-7/9/120 (15 explosive warheads, 15 NEPM warheads	OPArea - ORAB					
	2.4		OPArea - PSAB	0.4		OPArea - PSAB	2.4		OPArea - PSAB					
	2.4		OPArea - NOI	0.4		OPArea - NOI	2.4		OPArea - NOI					
	2.4		OPArea - PI	0.4		OPArea - PI	2.4		OPArea - PI					
	2.4		OPArea - SOI	0.4		OPArea - SOI	2.4		OPArea - SOI					
	2.4		OPArea - NCAB	0.4		OPArea - NCAB	2.4		OPArea - NCAB					
	24		TOTAL	4		TOTAL	24		TOTAL					
Gunnery Exercise (Surface-to-Air)	64		W 237	50		W 237	64		W 237	1.5	0%	0%	100%	50%
	16	Large-caliber rounds (230 explosive, 80 NEPM) Medium-caliber rounds (6,320 explosive, 9,680 NEPM)	OPArea - ORAB	12.5	Large-caliber rounds (60 explosive, 6,670 NEPM) Medium-caliber rounds (300 explosive, 9,680 NEPM)	OPArea - ORAB	16	Large-caliber rounds (230 explosive, 80 NEPM) Medium-caliber rounds (6,320 explosive, 9,680 NEPM)	OPArea - ORAB					
	16		OPArea - PSAB	12.5		OPArea - PSAB	16		OPArea - PSAB					
	16		OPArea - NOI	12.5		OPArea - NOI	16		OPArea - NOI					
	16		OPArea - PI	12.5		OPArea - PI	16		OPArea - PI					
	16		OPArea - SOI	12.5		OPArea - SOI	16		OPArea - SOI					
	16		OPArea - NCAB	12.5		OPArea - NCAB	16		OPArea - NCAB					
	160		TOTAL	125		TOTAL	160		TOTAL					
Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises	1.6	8 HE warheads	W 237	1.6	8 HE warheads	W 237	1.6	8 HE warheads	W 237	4	0%	0%	100%	67%
	0.4		OPArea - ORAB	0.4		OPArea - ORAB	0.4		OPArea - ORAB					
	0.4		OPArea - PSAB	0.4		OPArea - PSAB	0.4		OPArea - PSAB					
	0.4		OPArea - NOI	0.4		OPArea - NOI	0.4		OPArea - NOI					
	0.4		OPArea - PI	0.4		OPArea - PI	0.4		OPArea - PI					
	0.4		OPArea - SOI	0.4		OPArea - SOI	0.4		OPArea - SOI					
	0.4		OPArea - NCAB	0.4		OPArea - NCAB	0.4		OPArea - NCAB					
	4		TOTAL	4		TOTAL	4		TOTAL					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Surface Warfare														
Gunnery Exercise (Surface-to-Surface) Ship	50 30 30 30 30 30 200	Small-caliber rounds (121,200 NEPM) Medium-caliber rounds (48 explosive, 33,492 NEPM) Large-caliber rounds (160 explosive, 2,720 NEPM)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	50 30 30 30 30 30 200	Small-caliber rounds (121,000 NEPM) Medium-caliber rounds (120 explosive, 17,000 NEPM) Large-caliber rounds (112 explosive, 2,720 NEPM)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	50 30 30 30 30 30 200	Small-caliber rounds (121,000 NEPM) Medium-caliber rounds (120 explosive, 17,000 NEPM) Large-caliber rounds (112 explosive, 2,720 NEPM)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	3	0%	0%	100%	100%
Gunnery Exercise (Surface-to-Surface) Boat (not included in DOPAA)	0	None	Crescent Harbor	0	1500 sc blanks	Crescent Harbor	0	1500 sc blanks	Crescent Harbor	0	0%	0%	100%	100%
Missile Exercise (Air –to-Surface)	4	AGM-84 (4 explosive missiles)	W-237	2	AGM-84 (2 explosive missiles)	W-237	4	AGM-84 (4 explosive missiles)	W-237	2	0%	0%	100%	100%
HARM Exercise (included in Electronic Warfare Operations (EW OPS))	0	All non-firing Captive Air Training Missiles	W-237	0	All non-firing Captive Air Training Missiles	W-237	0	All non-firing Captive Air Training Missiles	W-237	2	0%	0%	100%	0%
Bombing Exercise (Air-to-Surface)	7.5 4.5 4.5 4.5 4.5 4.5 30	BDU-45, MK-84 bombs (10 explosive, 110 NEPM)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	7.5 4.5 4.5 4.5 4.5 4.5 30	BDU-45 series bombs (84 NEPM) MK-80 series bombs (2 explosive)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	7.5 4.5 4.5 4.5 4.5 4.5 30	BDU-45 series bombs (84 NEPM) MK-80 series bombs (2 explosive)	OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	1	0%	0%	100%	90%
Sinking Exercise (SINKEX) - no longer conducted	0 0 0 0 0 0 0 0	24 HE Bombs, 1,400 HE Lg-caliber rounds, 22 HE Missiles, 2 MK-48 HE	W 237 OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	0 0 0 0 0 0 0 0	None	W 237 OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	0 0 0 0 0 0 0 0	None	W 237 OPArea - ORAB OPArea - PSAB OPArea - NOI OPArea - PI OPArea - SOI OPArea - NCAB TOTAL	8	0%	0%	100%	10%

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Anti-Submarine Warfare														
Tracking Exercise – Submarine (assumed no air emissions - nuclear vessels)	25	None	OPArea - ORAB	25	None	OPArea - ORAB	25	None	OPArea - ORAB	8	0%	0%	100%	100%
	15		OPArea - PSAB	15		OPArea - PSAB	15		OPArea - PSAB					
	15		OPArea - NOI	15		OPArea - NOI	15		OPArea - NOI					
	15		OPArea - PI	15		OPArea - PI	15		OPArea - PI					
	15		OPArea - SOI	15		OPArea - SOI	15		OPArea - SOI					
	15		OPArea - NCAB	15		OPArea - NCAB	15		OPArea - NCAB					
	100		TOTAL	100		TOTAL	100		TOTAL					
Tracking Exercise-Ship	16.25	None	OPArea - ORAB	16.25	None	OPArea - ORAB	16.25	None	OPArea - ORAB	3	0%	0%	100%	100%
	9.75		OPArea - PSAB	9.75		OPArea - PSAB	9.75		OPArea - PSAB					
	9.75		OPArea - NOI	9.75		OPArea - NOI	9.75		OPArea - NOI					
	9.75		OPArea - PI	9.75		OPArea - PI	9.75		OPArea - PI					
	9.75		OPArea - SOI	9.75		OPArea - SOI	9.75		OPArea - SOI					
	9.75		OPArea - NCAB	9.75		OPArea - NCAB	9.75		OPArea - NCAB					
	65		TOTAL	65		TOTAL	65		TOTAL					
Tracking Exercise-Maritime Patrol Aircraft (MPA) includes Maritime Patrol Aircraft (DICASS), Maritime Patrol Aircraft (MAC), Maritime Patrol Aircraft (HDC)	81	896 DICASS, 720 SSQ-125 MAC sonobuoys, 7,320 passive buoys	OPArea - ORAB	100	896 DICASS, 350 MAC buoys, 50 MAC HDC buoys, 7,650 passive buoys	OPArea - ORAB	100	896 DICASS, 350 MAC buoys, 50 MAC HDC buoys, 7,650 passive buoys	OPArea - ORAB	6	0%	0%	100%	75%
	48.6		OPArea - PSAB	60		OPArea - PSAB	60		OPArea - PSAB					
	48.6		OPArea - NOI	60		OPArea - NOI	60		OPArea - NOI					
	48.6		OPArea - PI	60		OPArea - PI	60		OPArea - PI					
	48.6		OPArea - SOI	60		OPArea - SOI	60		OPArea - SOI					
	48.6		OPArea - NCAB	60		OPArea - NCAB	60		OPArea - NCAB					
	324		TOTAL	400		TOTAL	400		TOTAL					
Tracking Exercise – Helicopter	1.6	None	W-237	0.8	None	W-237	16	None	W-237	2	0%	0%	100%	100%
	0.4		OPArea - ORAB	0.2		OPArea - ORAB	4		OPArea - ORAB					
	0.4		OPArea - PSAB	0.2		OPArea - PSAB	4		OPArea - PSAB					
	0.4		OPArea - NOI	0.2		OPArea - NOI	4		OPArea - NOI					
	0.4		OPArea - PI	0.2		OPArea - PI	4		OPArea - PI					
	0.4		OPArea - SOI	0.2		OPArea - SOI	4		OPArea - SOI					
	0.4		OPArea - NCAB	0.2		OPArea - NCAB	4		OPArea - NCAB					
	4		TOTAL	2		TOTAL	40		TOTAL					
Electronic Warfare														
Electronic Warfare Operations (EW Ops) Aircraft and Ship Combined	1,055	None	W-237	1,044	None	W-237	1,055	None	W-237	1	40%	40%	20%	0%
	1,055		Olympic MOAs	1,044		Olympic MOAs	1,055		Olympic MOAs	1	60%	0%	40%	0%
	527.5		OPArea - ORAB	522		OPArea - ORAB	527.5		OPArea - ORAB					
	527.5		OPArea - PSAB	522		OPArea - PSAB	527.5		OPArea - PSAB					
	527.5		OPArea - NOI	522		OPArea - NOI	527.5		OPArea - NOI	1	0%	0%	100%	0%
	527.5		OPArea - PI	522		OPArea - PI	527.5		OPArea - PI					
	527.5		OPArea - SOI	522		OPArea - SOI	527.5		OPArea - SOI					
	527.5		OPArea - NCAB	522		OPArea - NCAB	527.5		OPArea - NCAB					
	5275		TOTAL	5220		TOTAL	5275		TOTAL					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Mine Warfare														
Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	0.25		NS Everett	0.25		NS Everett	0.25		NS Everett	24	100%	0%	0%	100%
	0.25		NB Kitsap-Bangor	0.25		NB Kitsap-Bangor	0.25		NB Kitsap-Bangor					
	0.25		Indian Island	0.25		Indian Island	0.25		Indian Island					
	0.25		NB Kitsap-Bremerton	0.25		NB Kitsap-Bremerton	0.25		NB Kitsap-Bremerton					
	1		TOTAL	1	3,000 small-caliber rounds (all blanks)	TOTAL	1	3,000 small-caliber rounds (all blanks)	TOTAL					
Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	6	Three, 2.5 lb. charges, 18 LMNT	Crescent Harbor	6	Three, 2.5 lb. charges, 18 LMNT	Crescent Harbor	6	Three, 2.5 lb. charges, 18 LMNT	Crescent Harbor	2	40%	40%	20%	100%
	6		Hood Canal	6		Hood Canal	6		Hood Canal	2	60%	0%	40%	100%
	12		Total	12		Total	12		Total					
Submarine Mine Exercise (discontinued and not considered in the SEIS)	2	N/A	OPArea - ORAB	0	N/A	OPArea - ORAB	0	N/A	OPAREA					
	1.2		OPArea - PSAB	0		OPArea - PSAB	0		OPArea - PSAB					
	1.2		OPArea - NOI	0		OPArea - NOI	0		OPArea - NOI	0	0%	0%	100%	100%
	1.2		OPArea - PI	0		OPArea - PI	0		OPArea - PI					
	1.2		OPArea - SOI	0		OPArea - SOI	0		OPArea - SOI					
	1.2		OPArea - NCAB	0		OPArea - NCAB	0		OPArea - NCAB					
	8		TOTAL	0		TOTAL	0		TOTAL					
Naval Special Warfare														
Personnel Insertion/ Extraction-Submersible	35	None	Crescent Harbor	0	None	Crescent Harbor	0	None	Crescent Harbor	5	100%	0%	0%	100%
Personnel Insertion/ Extraction – Non-Submersible - no aircraft	10	None	Crescent Harbor	6	None	Crescent Harbor	10	None	Crescent Harbor	8	100%	0%	0%	100%
Other														
Maritime Security Operations (Transit Protection System TPS)	54	1,320 small caliber rounds (all blanks)	NB Kitsap-Bangor	42	Small-caliber side arms, 7.62-cal, 50-cal, and 25-mm weapons (all blanks)	NB Kitsap-Bangor	54	Small-caliber side arms, 7.62-cal, 50-cal, and 25-mm weapons (all blanks)	NB Kitsap-Bangor	10	100%	0%	0%	100%
	54		Hood Canal OPAREAs	42	1320	Hood Canal OPAREAs	54	1320	Hood Canal OPAREAs					
	10		Dabob Bay	10	rounds	Dabob Bay	10	rounds	Dabob Bay					
	54		Puget Sound	42		Puget Sound	54		Puget Sound					
	54		Strait of Juan de Fuca	42		Strait of Juan de Fuca	54		Strait of Juan de Fuca					
	226		TOTAL	178		TOTAL	226		TOTAL					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Maritime Security Operations (Non-TPS)	20	None	NB Kitsap-Bangor	14	Small-caliber side arms, 7.62-cal, 50-cal, and 25-mm weapons (all blanks)	NB Kitsap-Bangor	20	Small-caliber side arms, 7.62-cal, 50-cal, and 25-mm weapons (all blanks)	NB Kitsap-Bangor	8	100%	0%	0%	100%
	20		NB Kitsap @ Bremerton	14		NB Kitsap @ Bremerton	20		NB Kitsap @ Bremerton					
	20		NB Everett	14		NB Everett	20		NB Everett					
	60		TOTAL	42		TOTAL	60		TOTAL					
Maritime Security Operations - Certification	2	None	Whidbey Island	2	small arms	Whidbey Island	2	small arms	Whidbey Island	100	100%	0%	0%	100%
Precision Anchoring	5		NS Everett	20		NS Everett	20		NS Everett	1	100%	0%	0%	100%
	5		Indian Island	20		Indian Island	20		Indian Island					
	10	None	TOTAL	40	None	TOTAL	40	None	TOTAL					
Small Boat Attack	0.33		NS Everett	0.33		NS Everett	0.33		NS Everett	4	100%	0%	0%	100%
	0.33		NB Kitsap-Bangor	0.33		NB Kitsap-Bangor	0.33		NB Kitsap-Bangor					
	0.33		NB Kitsap-Bremerton	0.33		NB Kitsap-Bremerton	0.33		NB Kitsap-Bremerton					
	1	3,000 small-caliber rounds (all blanks)	TOTAL	1	3,000 small-caliber rounds (all blanks)	TOTAL	1	3,000 small-caliber rounds (all blanks)	TOTAL					
Intelligence, Surveillance, Reconnaissance (ISR)	50	200 passive sonobuoys	OPArea - ORAB	50	200 passive sonobuoys	OPArea - ORAB	50	200 passive sonobuoys	OPAREA	6	0%	0%	100%	60%
	30		OPArea - PSAB	30		OPArea - PSAB	30		OPArea - PSAB					
	30		OPArea - NOI	30		OPArea - NOI	30		OPArea - NOI					
	30		OPArea - PI	30		OPArea - PI	30		OPArea - PI					
	30		OPArea - SOI	30		OPArea - SOI	30		OPArea - SOI					
	30		OPArea - NCAB	30		OPArea - NCAB	30		OPArea - NCAB					
	200		TOTAL	200		TOTAL	200		TOTAL					
Search and Rescue	25	None	NASWI Survival Area	20	None	NASWI Survival Area	25	None	NASWI Survival Area	2.5	40%	40%	20%	100%
	25		Crescent Harbor	20		Crescent Harbor	25		Crescent Harbor	2.5	60%	0%	40%	100%
	25		Lake Hancock	20		Lake Hancock	25		Lake Hancock					
	25		Olympic MOA	20		Olympic MOA	25		Olympic MOA					
	100		Total	80		Total	100		Total					
Surface Ship Sonar Maintenance	6.5	None	Pierside: NB Kitsap Bremerton	12.5	None	Pierside: Naval Base Kitsap at Bremerton	12.5	None	Pierside: Naval Base Kitsap at Bremerton	4	100%			100
	6.5		Pierside: NS Everett	12.5		Pierside: Naval Station Everett	12.5		Pierside: Naval Station Everett					
	13		Total	25		Total	25		Total					
Submarine Sonar Maintenance (No air quality impact)	11	None	Pierside: NB Kitsap Bangor	11	None	Pierside: NB Kitsap Bangor	11	None	Pierside: NB Kitsap Bangor	1				100
	11		Pierside: NB Kitsap Bremerton	11		Pierside: NB Kitsap Bremerton	11		Pierside: NB Kitsap Bremerton					
	22		Total	22		Total	22		Total					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
TESTING														
Anti-Submarine Warfare														
Anti-Submarine Warfare Testing	13	16 NEPM torpedoes	Quinault Range* Site	4	8 NEPM torpedoes	Quinault Range* Site	4	8 NEPM torpedoes	Quinault Range* Site	6	100%	0%	0%	100%
				12		OPArea - ORAB	12		OPArea - ORAB	6	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	6	0%	0%	100%	100%
				8		OPArea - NOI	8		OPArea - NOI	6	0%	0%	100%	100%
				4		OPArea - PI	4		OPArea - PI	6	0%	0%	100%	100%
				8		OPArea - SOI	8		OPArea - SOI	6	0%	0%	100%	100%
				8		OPArea - NCAB	8		OPArea - NCAB	6	0%	0%	100%	100%
				40		TOTAL -NWTT Offshore	40		TOTAL -NWTT Offshore					
				44		TOTAL	44		TOTAL					
At-Sea Sonar Testing	0	None	Quinault Range* Site	2	None	Quinault Range* Site	2	None	Quinault Range* Site	4	100%	0%	0%	75%
				0.9		OPArea - ORAB	1.5		OPArea - ORAB	4	50%	50%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	4	50%	50%	100%	100%
				0.6		OPArea - NOI	1		OPArea - NOI	4	50%	50%	100%	100%
				0.3		OPArea - PI	0.5		OPArea - PI	4	50%	50%	100%	100%
				0.6		OPArea - SOI	1		OPArea - SOI	4	50%	50%	100%	100%
				0.6		OPArea - NCAB	1		OPArea - NCAB	4	50%	50%	100%	100%
				3		TOTAL -NWTT Offshore	5		TOTAL -NWTT Offshore					
	0	None	DBRC Range Site	7	24 NEPM torpedoes	DBRC Range Site	9	32 NEPM torpedoes	DBRC Range Site	4	100%	0%	0%	75%
Countermeasure Test	14	123 NEPM torpedoes	Quinault Range* Site	14	12 NEPM torpedoes	Quinault Range* Site	14	12 NEPM torpedoes	Quinault Range* Site	3	0%	0%	100%	75%
	37	21 NEPM torpedoes	DBRC Range Site	15	None	DBRC Range Site	15	None	DBRC Range Site	3	100%	0%	0%	75%
	37	None	Keyport Range Sites	14	None	Keyport Range Sites	14	None	Keyport Range Sites	3	100%	0%	0%	75%
	4	None	SEAFAC Restricted Areas 1-5	1	None	SEAFAC Restricted Areas 1-5	1	None	SEAFAC Restricted Areas 1-5					
	92		Total	44		Total	44		Total					
Torpedo Non-Explosive Testing	23	119 NEPM torpedoes	Quinault Range* Site	18	146 NEPM torpedoes	Quinault Range* Site	18	146 NEPM torpedoes	Quinault Range* Site	4	0%	0%	100%	75%
				1.2		OPArea - ORAB	1.2		OPArea - ORAB		0%	0%	100%	75%
				0		OPArea - PSAB	0		OPArea - PSAB	4	0%	0%	100%	75%
				0.8		OPArea - NOI	0.8		OPArea - NOI	4	0%	0%	100%	75%
				0.4		OPArea - PI	0.4		OPArea - PI	4	0%	0%	100%	75%
				0.8		OPArea - SOI	0.8		OPArea - SOI	4	0%	0%	100%	75%
				0.8		OPArea - NCAB	0.8		OPArea - NCAB	4	0%	0%	100%	75%
				4		TOTAL -NWTT Offshore	4		TOTAL -NWTT Offshore					
	41	189 NEPM torpedoes	DBRC Range Site	61	358 NEPM torpedoes	DBRC Range Site	61	358 NEPM torpedoes	DBRC Range Site	1.5	100%	0%	0%	75%

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2				HORZ Dist (%)			<3,000 FT (%)
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	0-3	3-12	12+	
Torpedo (Explosive) Testing	0.75	6 HE torpedoes 6 NEPM torpedoes	OPArea - ORAB	0.8	8 HE Torpedoes	OPArea - ORAB	1	8 HE Torpedoes	OPArea - ORAB	4	0%	0%	100%	75%
	0.45		OPArea - PSAB	0	16 NE Torpedoes	OPArea - PSAB	0	16 NE Torpedoes	OPArea - PSAB	4	0%	0%	100%	75%
	0.45		OPArea - NOI	0.8		OPArea - NOI	0.8		OPArea - NOI	4	0%	0%	100%	75%
	0.45		OPArea - PI	0.4		OPArea - PI	0.4		OPArea - PI	4	0%	0%	100%	75%
	0.45		OPArea - SOI	0.8		OPArea - SOI	0.8		OPArea - SOI	4	0%	0%	100%	75%
	0.45		OPArea - NCAB	0.8		OPArea - NCAB	0.8		OPArea - NCAB	4	0%	0%	100%	75%
	3		TOTAL	4		TOTAL	4		TOTAL					
Mine Warfare														
Mine Detection and Classification Testing	0	None	Quinault Range[*] Site	1	None	Quinault Range[*] Site	1	None	Quinault Range[*] Site	12	0%	0%	100%	100%
	27	None	DBRC Range Sites	25	None	DBRC Range Sites	25	None	DBRC Range Sites	12	100%	0%	0%	100%
	27	None	Keyport Range Sites	17	None	Keyport Range Sites	17	None	Keyport Range Sites	16	100%	0%	0%	100%
	54		Total	43		Total	43		Total					
Mine Countermeasure and Neutralization	0	None	Quinault Range[*] Site	1.5	Mine HE – 5 Mine Neutralizer – 36	Quinault Range[*] Site	1.5	Mine HE – 5 Mine Neutralizer – 36	Quinault Range[*] Site	40	0%	0%	100%	100%
				0.45		OPArea - ORAB	0.45		OPArea - ORAB	40	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	40	0%	0%	100%	100%
				0.3		OPArea - NOI	0.3		OPArea - NOI	40	0%	0%	100%	100%
				0.15		OPArea - PI	0.15		OPArea - PI	40	0%	0%	100%	100%
				0.3		OPArea - SOI	0.3		OPArea - SOI	40	0%	0%	100%	100%
				0.3		OPArea - NCAB	0.3		OPArea - NCAB	40	0%	0%	100%	100%
				1.5		TOTAL -NWTT Offshore	1.5		TOTAL -NWTT Offshore					
	0	None	DBRC Range Sites	0.3	None	DBRC Range Sites	0.3	None	DBRC Range Sites	20	100%	0%	0%	100%
	0		Keyport Range Sites	0.3		Keyport Range Sites	0.3		Keyport Range Sites	20	100%	0%	0%	100%
				0.3		Carr Inlet	0.3		Carr Inlet	20	100%	0%	0%	100%
				0.3		Crescent Harbor EOD Range	0.3		Crescent Harbor EOD Range	20	100%	0%	0%	100%
				0.3		Hood Canal EOD Range	0.3		Hood Canal EOD Range	20	100%	0%	0%	100%
				0.3		Naval Magazine Indian Island	0.3		Naval Magazine Indian Island	20	100%	0%	0%	100%
				0.3		NS Everett	0.3		NS Everett	20	100%	0%	0%	100%
				0.3		NB Kitsap-Bremerton	0.3		NB Kitsap-Bremerton	20	100%	0%	0%	100%
				0.3		Navy 3 OPAREA	0.3		Navy 3 OPAREA	20	100%	0%	0%	100%
	0		Total	3		Total - Inland	3		Total - Inland					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2				HORZ Dist (%)			<3,000 FT
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	0-3	3-12	12+	(%)
Surface Warfare														
Kinetic Energy Weapon Testing (Railgun)				1.2	Kinetic energy HE – 80	OPArea - ORAB	1.2	Kinetic energy HE – 80	OPArea - ORAB	8	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	8	0%	0%	100%	100%
				0.8		OPArea - NOI	0.8		OPArea - NOI	8	0%	0%	100%	100%
				0.4		OPArea - PI	0.4		OPArea - PI	8	0%	0%	100%	100%
				0.8		OPArea - SOI	0.8		OPArea - SOI	8	0%	0%	100%	100%
				0.8		OPArea - NCAB	0.8		OPArea - NCAB	8	0%	0%	100%	100%
				4		TOTAL	4		TOTAL					
Unmanned Systems														
Unmanned Underwater Vehicle Testing	140	67 NEPM torpedoes	Keyport Range Site	58	24 NEPM torpedoes	Keyport Range Site	58	36 NEPM torpedoes	Keyport Range Site	1	100%	0%	0%	100%
	141	67 NEPM torpedoes	DBRC Range Site	322	24 NEPM torpedoes	DBRC Range Site	322	36 NEPM torpedoes	DBRC Range Site	1	100%	0%	0%	100%
	0	None	Quinault Range* Site	38	24 NEPM torpedoes	Quinault Range* Site	39	24 NEPM torpedoes	Quinault Range* Site	1	0%	0%	100%	100%
Unmanned Aerial System Testing	20	None	Quinault Range* Site	2	None	Quinault Range* Site	2	None	Quinault Range* Site	6	0%	0%	100%	100%
				6.7	None	R6701	6.7	None	R6701	2	100%	0%	0%	100%
				6.7	None	Keyport Range Site	6.7	None	Keyport Range Site	2	100%	0%	0%	100%
	20	None	DBRC Range Sites	6.7	None	DBRC Range Sites	6.7	None	DBRC Range Sites	2	100%	0%	0%	100%
Unmanned Surface Vehicle System Testing	20	None	Quinault Range* Site	4	None	Quinault Range* Site	4	None	Quinault Range* Site	8	0%	0%	100%	100%
	10	None	Keyport Range Site	10	None	Keyport Range Site	10	None	Keyport Range Site	8	0%	0%	100%	100%
	10	None	DBRC Range Sites	10	None	DBRC Range Sites	10	None	DBRC Range Sites	8	0%	0%	100%	100%
Vessel Evaluation														
Propulsion Testing				3	None	OPArea - ORAB	3.9	None	OPArea - ORAB	3	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	3	0%	0%	100%	100%
				2		OPArea - NOI	2.6		OPArea - NOI	3	0%	0%	100%	100%
				1		OPArea - PI	1.3		OPArea - PI	3	0%	0%	100%	100%
				2		OPArea - SOI	2.6		OPArea - SOI	3	0%	0%	100%	100%
				2		OPArea - NCAB	2.6		OPArea - NCAB	3	0%	0%	100%	100%
				10		TOTAL	13		TOTAL					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Undersea Warfare Testing	0	None	Quinault Range* Site	4	23-55 NEPM torpedoes	Quinault Range* Site	7	78 NEPM torpedoes	Quinault Range* Site	8	33%	33%	33%	100%
				2.4	None	OPArea - ORAB	3.3	None	OPArea - ORAB	8	33%	33%	33%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	8	33%	33%	33%	100%
				1.6		OPArea - NOI	2.2		OPArea - NOI	8	33%	33%	33%	100%
				0.8		OPArea - PI	1.1		OPArea - PI	8	33%	33%	33%	100%
				1.6		OPArea - SOI	2.2		OPArea - SOI	8	33%	33%	33%	100%
				1.6		OPArea - NCAB	2.2		OPArea - NCAB	8	33%	33%	33%	100%
				8		TOTAL -NWTT Offshore	11		TOTAL -NWTT Offshore					
Vessel Signature Evaluation	0	None	DBRC Range Sites	1	None	DBRC Range Sites	1	None	DBRC Range Sites	2	100%	0%	0%	100%
	43	None	SEAFAC Restricted Areas 1-5	37	None	SEAFAC Restricted Areas 1-5	48	None	SEAFAC Restricted Areas 1-5	2	100%	0%	0%	100%
Other Testing														
Cold Water Support	20		Quinault Range* Site	0		Quinault Range* Site	0		Quinault Range* Site	2	0%	0%	100%	100%
	32.5	None	DBRC Range Sites	1	None	DBRC Range Sites	2	None	DBRC Range Sites	2	100%	0%	0%	100%
	32.5	None	Keyport Range Sites	3	None	Keyport Range Sites	3	None	Keyport Range Sites	2	100%	0%	0%	100%
	65		Total	4		Total	5		Total					
	1	None	SEAFAC Restricted Areas 1-5	1	None	SEAFAC Restricted Areas 1-5	1	None	SEAFAC Restricted Areas 1-5	8	100%	0%	0%	100%
Post-Refit Sea Trial	32	None	DBRC Range Sites	30	None	DBRC Range Sites	39	None	DBRC Range Sites	No Air quality impact				
Radar and Other System Testing	0	None	Quinault Range* Site	0	None	Quinault Range* Site	0	None	Quinault Range* Site	0	0%	0%	100%	100%
				16.2	None	OPArea - ORAB	16.2	None	OPArea - ORAB	2	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	2	0%	0%	100%	100%
				10.8		OPArea - NOI	10.8		OPArea - NOI	2	0%	0%	100%	100%
				5.4		OPArea - PI	5.4		OPArea - PI	2	0%	0%	100%	100%
				10.8		OPArea - SOI	10.8		OPArea - SOI	2	0%	0%	100%	100%
				10.8		OPArea - NCAB	10.8		OPArea - NCAB	2	0%	0%	100%	100%
				54		TOTAL	54		TOTAL					

Range Activity	2015 NWTT EIS/OEIS Ongoing Activities			Alternative 1			Alternative 2							
	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	Annual events	Annual Ordnance	Location	HR/OP	HORZ Dist (%) 0-3	3-12	12+	<3,000 FT (%)
Acoustic and Oceanographic Research	0	None	Keyport Range Sites	1.5	None	Keyport Range Sites	1.5	None	Keyport Range Sites	28	100%	0%	0%	100%
	0	None	DBRC Range Sites	1.5	None	DBRC Range Sites	1.5		DBRC Range Sites	28	100%	0%	0%	100%
	0	None	Quinault Range* Site	1	None	Quinault Range* Site	1	None	Quinault Range* Site	28	0%	0%	100%	100%
Non Acoustic Component Testing	5	None	Quinault Range* Site	6	None	Quinault Range* Site	6	None	Quinault Range* Site	2	0%	0%	100%	100%
				0.3	None	OPArea - ORAB	0.6	None	OPArea - ORAB	6	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	6	0%	0%	100%	100%
				0.2		OPArea - NOI	0.4		OPArea - NOI	6	0%	0%	100%	100%
				0.1		OPArea - PI	0.2		OPArea - PI	6	0%	0%	100%	100%
				0.2		OPArea - SOI	0.4		OPArea - SOI	6	0%	0%	100%	100%
				0.2		OPArea - NCAB	0.4		OPArea - NCAB	6	0%	0%	100%	100%
				1		TOTAL -NWTT Offshore	2		TOTAL -NWTT Offshore					
			NB Kitsap-Bangor	13		NB Kitsap-Bangor	13		NB Kitsap-Bangor	1	100%	0%	0%	100%
	37	None	DBRC Range Sites	46	None	DBRC Range Sites	46	None	DBRC Range Sites	1	100%	0%	0%	100%
	37		Keyport Range Sites	16		Keyport Range Sites	16		Keyport Range Sites	1	100%	0%	0%	100%
	74		Total	82		Total	83		Total					
Semi-Stationary Equipment Testing	88	None	DBRC Range Sites	60	None	DBRC Range Sites	60	None	DBRC Range Sites	1	100%	0%	0%	100%
	88	None	Keyport Range Sites	60	None	Keyport Range Sites	60	None	Keyport Range Sites	1	100%	0%	0%	100%
	176		Total	120		Total	120		Total					
	2	None	SEAFAC Restricted Areas 1-5	3	None	SEAFAC Restricted Areas 1-5	3	None	SEAFAC Restricted Areas 1-5	1	100%	0%	0%	100%
Simulant Testing	0	None	Quinault Range* Site	0	None	Quinault Range* Site	0	None	Quinault Range* Site	6	0%	0%	100%	100%
				15	None	OPArea - ORAB	15	None	OPArea - ORAB	2	0%	0%	100%	100%
				0		OPArea - PSAB	0		OPArea - PSAB	6	0%	0%	100%	100%
				10		OPArea - NOI	10		OPArea - NOI	3	0%	0%	100%	100%
				5		OPArea - PI	5		OPArea - PI	5	0%	0%	100%	100%
				10		OPArea - SOI	10		OPArea - SOI	3	0%	0%	100%	100%
				10		OPArea - NCAB	10		OPArea - NCAB	3	0%	0%	100%	100%
				50		TOTAL	50		TOTAL					
Acoustic Component Testing	15	None	NS Everett	5.0	None	NS Everett	5.0	None	NS Everett	1	100%	0%	0%	100%
	15		NB Kitsap-Bangor	30.0		NB Kitsap-Bangor	30.0		NB Kitsap-Bangor	1	100%	0%	0%	100%
	15		Indian Island	5.0		Indian Island	5.0		Indian Island	1	100%	0%	0%	100%
	15		NB Kitsap-Bremerton	5.0		NB Kitsap-Bremerton	5.0		NB Kitsap-Bremerton	1	100%	0%	0%	100%
	60		TOTAL	45		TOTAL -Inland	45		TOTAL - Inland					
	4	None	SEAFAC Restricted Areas 1-5	13	None	SEAFAC Restricted Areas 1-5	18		SEAFAC Restricted Areas 1-5	8	100%	0%	0%	100%
Non-Acoustic Component Testing (accounted for in the above)	0	None	NB Kitsap Bangor	0	None	NB Kitsap Bangor	0	None	NB Kitsap Bangor	12	0%	0%	100%	100%

Table C-4: Aircraft Engine Emissions Indices/Factors and Sources

General information						Emission Indices, lb/1,000 lb fuel						Emissions Factors (lb/hr)					References
Aircraft	Engine Model	Engines (#)	Fuel Flow (lb/hr) /Engine	Fuel Flow (gal/hr)	Mode	CO	NOx	HC	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Source of Emissions Indices Information
C-130 F/R/T	T56-A-16 Turboprop	4	2068	1182	Intermediate Military	2.51	11.19	na	0.28	2.06	1.22	20.76	92.56	2.32	17.04	10.09	USAF 2003 Draft Mobile AEI Guide Updated
E-2C	T56-A-425, -427	2	1100	314	circle	2.16	8.06	0.49	0.56	2.06	3.97	4.75	17.73	1.24	4.53	8.73	AESO Memorandum Report No. 9943C, February 2010.
EA-18G	F414-GE-400	2	5169	1477	circle	0.72	14.75	0.12	0.14	2.06	6.56	7.44	152.49	1.43	21.30	67.82	AESO Memorandum Report No. 9933, Revision D, March 2011.
EA-6B	J52-P-408A	2	3195	913	circle	7.99	5.71	1.09	1.25	2.06	12.12	51.06	36.49	8.01	13.16	77.45	AESO Memorandum Report No. 9941, Revision B, December 2009.
F-15	F100-PW-220	2	9679	2765	military	0.86	29.32	na	1.79	2.06	1.33	16.65	567.58	34.65	39.88	25.75	USAF 2003 Draft Mobile AEI Guide Updated
FA-18E/F	F414-GE-400	2	5169	1477	circle	0.72	14.75	0.12	0.14	2.06	6.56	7.44	152.49	1.43	21.30	67.82	AESO Memorandum Report No. 9933, Revision D, March 2011.
Learjet	TFE731-2-2B	2	532	152		22.38	5.90	4.26	4.90	2.06	1.27	23.81	6.28	5.21	2.19	1.35	USAF Institute for Environment, Safety and Occupational Health Risk Analysis, October 2002.
P-3C	T56-A-14	4	1200	686	ASUW	1.82	8.43	0.41	0.47	2.06	3.97	8.74	40.46	2.26	9.89	19.06	AESO Memorandum Report No. 9948, Revision C, March 2010.
P-8 MMA	Boeing 737-800 Series CFM56-7B26	2	1631	466	climbout	1.24	9.26	0.28	0.32	2.06	0.56	4.05	30.21	1.05	6.72	1.83	ICAO, 2007, Cited in DoN 2008 (EIS for Introduction of the P-8A).
S-3B	TF34-GE-400	2	1145	327		14.10	4.07	1.86	2.14	2.06	3.62	32.29	9.32	4.90	4.72	8.29	AESO Memorandum Report No. 9915A, March 2000.
H-60	T700-GE-401C	2	634	181	circle	5.66	6.56	0.55	0.63	2.06	4.20	7.18	8.32	0.80	2.61	5.33	AESO Memorandum Report No. 9953, January 2014.

Table C-5: Vessel Emission Factors

		VESSEL SPECIFICATIONS						VESSEL OPERATIONAL PARAMETERS					EMISSIONS FACTORS (LB/HR)						
Vessel		Propulsion	Output (HP)	No.	Max Power (HP)	Generator	No.	Speed	Load	Op HP	Gen No.	GEN (kW)	CO	NOx	HC	SOx	PM10	PM2.5	Fuel Consumption at Speed (gal/hr)
Cruiser	CG-3	GE LM 2500	21,500	4	86,000			12	12.2%	10,492	2	2@1625kW ea	61.51	79.58	4.32	77.63	2.79	2.79	1,339
Destroyer	DDG-3	GE LM 2500	21,500	4	86,000			12	4.9%		2	2@1300kW ea	60.16	114.52	4.01	88.53	3.64	3.640	1640.65
Frigate	FFG-3	GE LM 2500	21,500	2	43,000			12	4.8%	2,064	2	650	120	78.11	11.64	16.08	4.30	4.30	203
Torpedo Retrieval Boat	TRB-3							12	90%		2	1@ 38kW	6.47	56.22	1.55	7.40	1.18	1.18	3.00
	AOE-2							15	50%		2	NA	109.76	311.31	10.60	119.99	10.41	10.41	1630.37
USCG Cutter WHEC715, 378 feet - Hamilton Class	USCG	Fairbanks Morse T88-1-8, 3,600 hp		2		GM 8-645, 550 kW	2	10	40%		2 Diesels	1@ 358kW	5.74	57.91	0.88	11.55	0.21	0.21	79
Amphibious Assault Ship - Tarawa	LHA-1	Steam Combustion Engineering		3		NA - No separate emissions	0	12	30%		2	NA	7.96	47.09	5.67	133.29	28.11	28.11	2226.13
Landing Helicopter Dock	LHD-2	Two marine gas turbines			70,000			12	30%		2	NA	8.08	47.83	5.77	135.50	28.58	28.58	2226.13
Amphibious Transport Dock	LPD-2	turbocharged marine Colt-Pielstick Diesels			41,600			12	35%		2	NA	3.48	21.00	2.58	60.82	12.85	12.85	756.25
	MCM												25.62	30.81	6.09	5.13	0.56	0.56	33.00
	CVN												0.68	9.23	0.17	1.09	0.08	0.08	148.50
Landing Craft Air Cushion	LCAC	Avco Lycoming TF-40B 3,955 hp each		4	15,820	APU T-62-T-40-7 Sunstrand 60 kW each	2	35	80%	12,656	2	10	25.41	55.32	0.72	43.30	3.89	3.77	676
Landing Craft Utility	LCU	GM Detroit, V12-71N 460bhp		2	92	3-71 GM Detroit, 40 kW	2	10	2,000 rpm (97%)	89	2	7	36.21	44.95	0.52	3.11	1.57	1.52	259
	AAV-2	400 hp						6	2,400		1	NA	0.76	6.22	0.82	1.25	0.26	0.25	67
Advanced Amphibious Assault Vehicle	AAAV	MTU MT 883 Ka-523 2,016 kW, 2,740 hp, 3,300 rpm		1	2,740	NA - No separate emissions	0	20	TBD		1	NA						0.00	66
	PC-2	3,350 hp each						12	30% 666 rpm		2	11.6 gph (95%)	17.21	38.14	2.94	8.23	0.92	0.89	8
	MK V-2	2,285 hp						12	30%		2	10 kW	3.86	29.49	0.99	4.73	0.40	0.39	14
	RIB-4							25	2,300		2	NA	0.34	9.14	0.06	1.44	0.15	0.15	14.00
	CRRC-5							12-18	4,500		1	NA		0.15	12.90			0.00	3
	AE-2							10	95% 1,650 rpm		2	NA	20.17	20.93	0.99	5.97	1.57	1.57	
	BW-3							15	3,500		2	NA		0.26	26.30			0.00	

Source: HSST, 03/28/2017

Notes:
1. AOE-1 assumed 2 boilers operating and heavy displacement.
2. AOE, LHA, LHD, and LPD class ships - Steam ship emissions are calculated based on ship's fuel consumption.
3. Steam ship emission factors were calculated using U.S. Environmental Protection Agency AP-42 Steam Ship Emission Factors for Distillate Oil.
4. All SO_X emission factors were based upon 0.5% sulfur content of the fuel.
5. PM_{10} is based on 95% of total PM based on information provided by the EPA.

								EMISSIONS FACTORS (lb/hp-hr)[a]					EMISSIONS FACTORS (lb/hr)						Fuel Flow (gph)
VESSEL	ENGINE	MODEL	HP	NO.	MAX HP	LOAD	OP HP	CO	NO_x	VOC	SO_2	PM	CO	NO_x	VOC	SO_2	PM	PM2.5	
BV	Main	CAT3516	3000	2	6000														
	Bow Thruster	Brunvol	950	2	1900														
	Stern Thruster	Brunvol	950	1	950														
	generator	CAT C18	340	3	1020														
	Total				9870	0.5	4935	0.0082	0.00286	0.0004	0.00083	0.00007	40.47	14.11	1.97	4.10	0.35	0.34	286
RV	Main	MTU 8V 396	751	2	1502	0.5	751	0.0082	0.00286	0.0004	0.00083	0.00007	6.16	2.15	0.30	0.62	0.05	0.05	43
	Generator	Man DO 824																	
SVL	Main	MTU 10V2000 M92	1,360	2	2,720	0.5	1360	0.0082	0.00286	0.0004	0.00083	0.00007	11.15	3.89	0.54	1.13	0.10	0.09	79
	Generator	Northern Lights M20CRW2.2	32	1	32	0.5	16	0.0082	0.0117	0.0022	0.00083	0.00048	0.13	0.19	0.04	0.01	0.01	0.01	1
	Total												11.28	4.08	0.58	1.14	0.10	0.10	80
SVS	Main	Mercury Verado	275	3	825	0.5	412.5	0.0082	0.0088	0.0015	0.00083	0.00018	3.38	3.63	0.62	0.34	0.07	0.07	24
Sea Ark	Main	Cummings QSB-9	380	2	760	0.53	402.8	0.0082	0.0088	0.0015	0.00083	0.00018	3.30	3.54	0.60	0.33	0.07	0.07	23
Mark VI	Main	MTU 12V396 TE94	2,285	2	4570	0.53	2422.1	0.0082	0.00286	0.0004	0.00083	0.00007	19.86	6.93	0.97	2.01	0.17	0.16	140

(a) SOURCE: Technical Support Document, Rulemaking to Consider the Adoption of Proposed Regulations to Reduce Emissions from Diesel Engines on Commercial Harbor Craft Operated Within California Waters and 24 Nautical Miles of the California Baseline; Appendix B: Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. 2007. California Air Resources Board.

Table C-6: Aircraft Training Emissions Under Alternative 1

AQCR	Range / Location	Activity	Aircraft	Annual Hours	Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
TRAINING																														
SEAI, AK	SEAFAC																													
NWAB, WA	NAS WI Survival Area	Other																												
		Search and Rescue	SH-60B	50	359	416	40	131	266	359	416	40	131	266	144	166	16	52	107	144	166	16	52	107	72	83	8	26	53	9,057
	Crescent Harbor	Mine Warfare																												
		Mine Neutralization – Explosive Ordnance Disp	SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		NSW																												
		Personnel I&E	SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			C-130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other																												
		Search and Rescue	SH-60B	50	359	416	40	131	266	359	416	40	131	266	215	250	24	78	160	0	0	0	0	0	144	166	16	52	107	9,057
ORAB, WA	W-237	Air Warfare																												
		Air Combat Maneuver	EA-6B	126	6,433	4,597	1,009	1,659	9,758	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115,020
			EA-18G	126	938	19,213	180	2,683	8,545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	348,444
		Missile Exercise (Air-to-Air)	EA-6B	10	490	350	77	126	743	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8,763
		Gunnery Exercise (Surface-to-Air)	EA-6B	75	3,829	2,737	601	987	5,809	1,915	1,368	300	494	2,904	0	0	0	0	0	0	0	0	0	0	1914.604	1368.259	300.3699	493.6275	2904.255	68,464
		Surface Warfare																												
		Missile Exercise (Air –to-Surface)	P-8	3	10	77	3	17	5	10	77	3	17	5	0	0	0	0	0	0	0	0	0	0	10	77	3	17	5	1,193
			SH-60B	5	33	38	4	12	24	33	38	4	12	24	0	0	0	0	0	0	0	0	0	0	33	38	4	12	24	826
			S-3B	1	27	8	4	4	7	27	8	4	4	7	0	0	0	0	0	0	0	0	0	0	27	8	4	4	7	275
		HARM Exercise (included in Electronic Warfare Operations (EW OPS))	EA-18G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise – Helicopter	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	1.6	11	13	1	4	9	11	13	1	4	9	0	0	0	0	0	0	0	0	0	0	11	13	1	4	9	290
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	960	49,038	35,045	7,693	12,643	74,386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876,781
			P-8	84	338	2,523	88	561	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38,927
	Olympic MOA	Air Warfare																												
		Air Combat Maneuver	EA-6B	574	29,306	20,943	4,598	7,556	44,454	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	523,980
			EA-18G	574	4272	87527	819	12224	38927	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,587,356
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	960	49,038	35,045	7,693	12,643	74,386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876,781
			P-8	84	338	2,523	88	561	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38,927
		Other																												
		Search and Rescue	SH-60B	50	359	416	40	131	266	359	416	40	131	266	144	166	16	52	107	144	166	16	52	107	72	83	8	26	53	9,057
	NUWC OPAREA	Air Warfare																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	478.6509	342.0647	75.09248	123.4069	726.0638	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	15	61	453	16	101	27	55	408	14	91	25	0	0	0	0	0	0	0	0	0	0	55	408	14	91	25	6,991
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MPA) includes Maritime Patrol Aircraft (DICASS), Maritime Patrol Aircraft (MAC), Maritime Patrol Aircraft (HDC)	P-8	600	2,427	18,127	630	4,033	1,096	1,821	13,595	473	3,024	822	0	0	0	0	0	0	0	0	0	0	1,821	13,595	473	3,024	822	279,651
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	300	1,214	9,064	315	2,016	548	728	5,438	189	1,210	329	0	0	0	0	0	0	0	0	0	0	728	5,438	189	1,210	329	139,826
	Hood Canal	Mine Warfare																												
		Mine Neutralization – Explosive Ordnance Disp	SH-60B	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AQCR	Range / Location	Activity	Aircraft	Annual Hours	Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
PSAB	Hood Canal	**Mine Warfare**																												
		Mine Neutralization – Explosive Ordnance Disp	SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NUWC OPAREA	**Air Warfare**																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	479	342	75	123	726	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	9	36	272	9	60	16	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	4,195
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MP	P-8	360	1,456	10,876	378	2,420	658	1,092	8,157	284	1,815	493	0	0	0	0	0	0	0	0	0	0	1,092	8,157	284	1,815	493	167,791
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	180	728	5,438	189	1,210	329	437	3,263	113	726	197	0	0	0	0	0	0	0	0	0	0	437	3,263	113	726	197	83,895
	Lake Hancock	**Other**																												
		Search and Rescue	SH-60B	50	359	416	40	131	266	359	416	40	131	266	144	166	16	52	107	144	166	16	52	107	72	83	8	26	53	9,057
NOI, OR	NUWC OPAREA	**Air Warfare**																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	479	342	75	123	726	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	9	36	272	9	60	16	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	4,195
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MP	P-8	360	1,456	10,876	378	2,420	658	1,092	8,157	284	1,815	493	0	0	0	0	0	0	0	0	0	0	1,092	8,157	284	1,815	493	167,791
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	180	728	5,438	189	1,210	329	437	3,263	113	726	197	0	0	0	0	0	0	0	0	0	0	437	3,263	113	726	197	83,895
PI, OR	NUWC OPAREA	**Air Warfare**																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	479	342	75	123	726	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	9	36	272	9	60	16	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	4,195
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MPA) includes Maritime Patrol Aircraft (DICASS), Maritime Patrol Aircraft (MAC), Maritime Patrol Aircraft (HDC)	P-8	360	1,456	10,876	378	2,420	658	1,092	8,157	284	1,815	493	0	0	0	0	0	0	0	0	0	0	1,092	8,157	284	1,815	493	167,791
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	180	728	5,438	189	1,210	329	437	3,263	113	726	197	0	0	0	0	0	0	0	0	0	0	437	3,263	113	726	197	83,895

AQCR	Range / Location	Activity	Aircraft	Annual Hours	Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
SOI, OR	NUWC OPAREA	**Air Warfare**																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	479	342	75	123	726	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	9	36	272	9	60	16	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	4,195
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MP	P-8	360	1,456	10,876	378	2,420	658	1,092	8,157	284	1,815	493	0	0	0	0	0	0	0	0	0	0	1,092	8,157	284	1,815	493	167,791
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	180	728	5,438	189	1,210	329	437	3,263	113	726	197	0	0	0	0	0	0	0	0	0	0	437	3,263	113	726	197	83,895
NCAB, CA	NUWC OPAREA	**Air Warfare**																												
		Missile Exercise (Air-to-Air)	EA-6B	2	123	88	19	32	186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,191
		Gunnery Exercise (Surface-to-Air)	EA-6B	19	957	684	150	247	1,452	479	342	75	123	726	0	0	0	0	0	0	0	0	0	0	479	342	75	123	726	17,116
		Surface Warfare																												
		Bombing Exercise (Air-to-Surface)	P-8	9	36	272	9	60	16	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	4,195
		Sinking Exercise (SINKEX) - no longer conducte	F/A-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			P-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			E-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			SH-60B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Anti-Submarine Warfare																												
		Tracking Exercise- Maritime Patrol Aircraft (MPA) includes Maritime Patrol Aircraft (DICASS), Maritime Patrol Aircraft (MAC), Maritime Patrol Aircraft (HDC)	P-8	360	1,456	10,876	378	2,420	658	1,092	8,157	284	1,815	493	0	0	0	0	0	0	0	0	0	0	1,092	8,157	284	1,815	493	167,791
		Tracking Exercise – Helicopter	SH-60B	0.4	3	3	0	1	2	3	3	0	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0	1	2	72
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	EA-6B	480	24,519	17,522	3,847	6,322	37,193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	438,391
			P-8	42	169	1,262	44	281	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,464
		Other																												
		Intelligence, Surveillance, Reconnaissance (ISR	P-8	180	728	5,438	189	1,210	329	437	3,263	113	726	197	0	0	0	0	0	0	0	0	0	0	437	3,263	113	726	197	83,895
															CO	NOx	VOC	SOx	PM10											
		NWAB, WA													0.2	0.2	0.0	0.1	0.1											
		ORAB, WA													0.1	0.1	0.0	0.0	0.1											
		ONW													0.3	0.3	0.0	0.1	0.2											
		PSAB													0.1	0.1	0.0	0.0	0.1											
		NOI, OR													0.0	0.0	0.0	0.0	0.0											
		PI, OR													0.0	0.0	0.0	0.0	0.0											
		SOI, OR													0.0	0.0	0.0	0.0	0.0											
		NCAB, CA													0.0	0.0	0.0	0.0	0.0											
					Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	
		TRAINING SUBTOTAL (pounds)		10,703	######	440,233	51,224	118,093	498,568	16,734	83,005	3,629	19,100	13,086	646	749	72	235	479	431	499	48	157	320	15,658	81,758	3,509	18,708	12,287	9,091,533
		TRAINING SUBTOTAL (tons)			**157.5**	**220.1**	**25.6**	**59.0**	**249.3**	**8.4**	**41.5**	**1.8**	**9.5**	**6.5**	**0.3**	**0.4**	**0.0**	**0.1**	**0.2**	**0.2**	**0.2**	**0.0**	**0.1**	**0.2**	**7.8**	**40.9**	**1.8**	**9.4**	**6.1**	
		TRAINING SUBTOTAL (metric tons)			143	200	23	54	227	8	38	2	9	6	0	0	0	0	0	0	0	0	0	0	7	37	2	9	6	

Table C-7: Aircraft Testing Emissions Under Alternative 1

AQCR	Range / Location	Activity	Aircraft	Annual Hours	Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
TEST ACTIVITIES																														
ORAB, WA																														
	Quinault Range Site	Anti-Submarine Warfare Testing																												
			SH-60B	264	1,895	2,196	212	690	1,406	1,895	2,196	212	690	1,406	0	0	0	0	0	0	0	0	0	0	1,895	2,196	212	690	1,406	47,822
	Quinault Range Site	At-Sea Sonar Testing																												
			P-8	20	81	604	21	134	37	61	453	16	101	27	0	0	0	0	0	0	0	0	0	0	61	453	16	101	27	9,322
			SH-60B	20	144	166	16	52	107	108	125	12	39	80	0	0	0	0	0	0	0	0	0	0	108	125	12	39	80	3,623
	DBRC Range Site	At-Sea Sonar Testing																												
			P-8	28	113	846	29	188	51	85	634	22	141	38	0	0	0	0	0	0	0	0	0	0	85	634	22	141	38	13,050
			SH-60B	28	201	233	22	73	149	151	175	17	55	112	0	0	0	0	0	0	0	0	0	0	151	175	17	55	112	5,072
	Quinault Range Site	Torpedo Test - Explosive																												
			P-8	8	32	242	8	54	15	24	181	6	40	11	0	0	0	0	0	0	0	0	0	0	24	181	6	40	11	3,729
			SH-60B	8	57	67	6	21	43	43	50	5	16	32	0	0	0	0	0	0	0	0	0	0	43	50	5	16	32	1,449
	Quinault Range Site	Torpedo Test - Non-Explosive																												
			P-8	352	1,424	10,635	370	2,366	643	1,068	7,976	277	1,774	482	0	0	0	0	0	0	0	0	0	0	1,068	7,976	277	1,774	482	164,062
			SH-60B	352	2,526	2,928	282	919	1,875	1,895	2,196	212	690	1,406	0	0	0	0	0	0	0	0	0	0	1,895	2,196	212	690	1,406	63,762
	DBRC Range Site	Torpedo Test - Non-Explosive																												
			P-8	976	3,949	29,487	1,025	6,560	1,783	2,961	22,115	769	4,920	1,337	1,481	11,057	385	2,460	669	0	0	0	0	0	1,481	11,057	385	2,460	669	454,900
			SH-60B	976	7,005	8,118	783	2,549	5,198	5,253	6,089	587	1,912	3,898	2,627	3,044	294	956	1,949	0	0	0	0	0	2,627	3,044	294	956	1,949	176,795
	Quinault Range Site	Mine Countermeasure and																												
			SH-60B	120	861	998	96	313	639	861	998	96	313	639	0	0	0	0	0	0	0	0	0	0	861	998	96	313	639	21,737
	DBRC Range Site	Mine Countermeasure and																												
			SH-60B	60	431	499	48	157	320	431	499	48	157	320	215	250	24	78	160	0	0	0	0	0	215	250	24	78	160	10,869
	Quinault Range Site	Undersea Warfare Testing																												
			SH-60B	72	517	599	58	188	383	517	599	58	188	383	0	0	0	0	0	0	0	0	0	0	517	599	58	188	383	13,042
	Quinault Range Site	Radar and Other System Testing																												
			SH-60B	1296	9,301	10,780	1,039	3,385	6,902	9,301	10,780	1,039	3,385	6,902	0	0	0	0	0	0	0	0	0	0	9,301	10,780	1,039	3,385	6,902	234,761
	Quinault Range Site	Simulant Testing																												
			P-8	300	1,214	9,064	315	2,016	548	1,214	9,064	315	2,016	548	0	0	0	0	0	0	0	0	0	0	1,214	9,064	315	2,016	548	139,826
			SH-60B	300	2,153	2,495	241	784	1,598	2,153	2,495	241	784	1,598	0	0	0	0	0	0	0	0	0	0	2,153	2,495	241	784	1,598	54,343
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	18	73	544	19	121	33	55	408	14	91	25	0	0	0	0	0	0	0	0	0	0	55	408	14	91	25	8,390
	OPArea - PSAB																													
		Torpedo Test - Explosive																												
			P-8	4.8	19	145	5	32	9	15	109	4	24	7	0	0	0	0	0	0	0	0	0	0	15	109	4	24	7	2,237
			SH-60B	4.8	34	40	4	13	26	26	30	3	9	19	0	0	0	0	0	0	0	0	0	0	26	30	3	9	19	869
		Mine Countermeasure and																												
			SH-60B	60	431	499	48	157	320	431	499	48	157	320	215	250	24	78	160	0	0	0	0	0	215	250	24	78	160	10,869
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	10.8	44	326	11	73	20	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	5,034
	OPArea - NIO																													
		Torpedo Test - Explosive																												
			P-8	4.8	19	145	5	32	9	15	109	4	24	7	0	0	0	0	0	0	0	0	0	0	15	109	4	24	7	2,237
			SH-60B	4.8	34	40	4	13	26	26	30	3	9	19	0	0	0	0	0	0	0	0	0	0	26	30	3	9	19	869
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	10.8	44	326	11	73	20	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	5,034
	OPArea - PI																													
		Torpedo Test - Explosive																												
			P-8	4.8	19	145	5	32	9	15	109	4	24	7	0	0	0	0	0	0	0	0	0	0	15	109	4	24	7	2,237
			SH-60B	4.8	34	40	4	13	26	26	30	3	9	19	0	0	0	0	0	0	0	0	0	0	26	30	3	9	19	869
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	10.8	44	326	11	73	20	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	5,034
	OPArea - SOI																													
		Torpedo Test - Explosive																												
			P-8	4.8	19	145	5	32	9	15	109	4	24	7	0	0	0	0	0	0	0	0	0	0	15	109	4	24	7	2,237
			SH-60B	4.8	34	40	4	13	26	26	30	3	9	19	0	0	0	0	0	0	0	0	0	0	26	30	3	9	19	869
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	10.8	44	326	11	73	20	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	5,034
	OPArea - NCAB																													
		Torpedo Test - Explosive																												
			P-8	4.8	19	145	5	32	9	15	109	4	24	7	0	0	0	0	0	0	0	0	0	0	15	109	4	24	7	2,237
			SH-60B	4.8	34	40	4	13	26	26	30	3	9	19	0	0	0	0	0	0	0	0	0	0	26	30	3	9	19	869
		ASW Mission Package Test																												
		ASW TRACKEX Test MAP																												
			P-8	10.8	44	326	11	73	20	33	245	9	54	15	0	0	0	0	0	0	0	0	0	0	33	245	9	54	15	5,034
					Criteria Air Pollutants					Criteria Air Pollutants <3,000 ft					Criteria Air Pollutants <3,000 ft State					Criteria Air Pollutants <3,000 ft Federal					Criteria Air Pollutants <3,000 ft International					Fuel Use (gal)
					CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	CO	NOx	VOC	SOx	PM10	
		Total (pounds)		5,360	32,894	83,556	4,741	21,315	22,318	28,871	69,449	4,070	17,908	19,767	4,538	14,601	726	3,573	2,937	0	0	0	0	0	24,333	54,848	3,344	14,336	16,830	1,478,124
		Total (tons)			16.4	41.8	2.4	10.7	11.2	14.4	34.7	2.0	9.0	9.9	2.3	7.3	0.4	1.8	1.5	0.0	0.0	0.0	0.0	0.0	12.2	27.4	1.7	7.2	8.4	
			ORAB		16.0	40.3	2.3	10.3	10.9	14.0	33.5	2.0	8.7	9.6	2.2	7.2	0.4	1.7	1.4	0	0	0	0	0	11.9	26.3	1.6	6.9	8.2	
			PSAB		15.0	39.2	2.2	9.9	10.2	13.1	32.4	1.9	8.3	8.9	0.1	0.1	0.0	0.0	0.1	0	0	0	0	0	10.9	25.2	1.5	6.6	7.5	
			NOI		15.0	39.2	2.2	9.9	10.2	13.1	32.4	1.9	8.3	8.9	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	10.9	25.2	1.5	6.6	7.5	
			PI		15.0	38.9	2.2	9.9	10.1	13.1	32.2	1.9	8.3	8.9	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	10.9	25.1	1.5	6.5	7.5	
			SOI		15.0	38.9	2.2	9.9	10.1	13.0	32.2	1.9	8.3	8.9	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	10.9	25.0	1.5	6.5	7.5	
			NCAB		15.0	38.9	2.2	9.9	10.1	13.0	32.2	1.9	8.3	8.9	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	10.9	25.0	1.5	6.5	7.5	

Table C-8: Vessel Training Emissions Under Alternative 1

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl State CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl Federal CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl International CO	NO_x	VOC	SO_x	PM_{10}	Fuel Use (gal)
TRAINING ACTIVITIES																														
NWAB, WA	Crescent Harbor	**Surface Warfare**																												
		Gunnery Exercise (Surface-to-Surface) Boat (not included in DOPAA)	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mine Warfare																												
		Mine Neutralization – Explosive Ordnance Disposal (EOD) - no	RHIB	36	12	329	2	52	5	12	329	2	52	5	5	132	1	21	2	5	132	1	21	2	2	66	0	10	1	504
		Naval Special Warfare																												
		Personnel Insertion/ Extraction-Submersible	RHIB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Personnel Insertion/ Extraction – Non-Submersible - no aircraft	RHIB	48	16	439	3	69	7	16	439	3	69	7	16	439	3	69	7	0	0	0	0	0	0	0	0	0	0	672
	Puget Sound	**Other**																												
		Maritime Security Operations-TPS	BV	277	11,217	3,912	547	1,135	96	11,217	3,912	547	1,135	96	11,217	3,912	547	1,135	96	0	0	0	0	0	0	0	0	0	0	79,203
			RV	139	854	298	42	86	7	854	298	42	86	7	854	298	42	86	7	0	0	0	0	0	0	0	0	0	0	6,027
			SVL	416	4,637	1,617	226	469	40	4,637	1,617	226	469	40	4,637	1,617	226	469	40	0	0	0	0	0	0	0	0	0	0	32,741
			SVS	416	1,406	1,509	257	142	31	1,406	1,509	257	142	31	1,406	1,509	257	142	31	0	0	0	0	0	0	0	0	0	0	9,931
	Strait of SJF	**Other**																												
		Maritime Security Operations-TPS	BV	420	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	0	0	0	0	0	0	0	0	0	0	120,005
			RV	210	1,293	451	63	131	11	1,293	451	63	131	11	1,293	451	63	131	11	0	0	0	0	0	0	0	0	0	0	9,131
			SVL	630	7,026	2,450	343	711	60	7,026	2,450	343	711	60	7,026	2,450	343	711	60	0	0	0	0	0	0	0	0	0	0	49,607
			SVS	630	2,131	2,287	390	216	47	2,131	2,287	390	216	47	2,131	2,287	390	216	47	0	0	0	0	0	0	0	0	0	0	15,046
	Whidbey Island	**Other**																												
		Maritime Security Operations-Certification	S_A	800	2,642	2,836	483	267	58	2,642	2,836	483	267	58	2,642	2,836	483	267	58	0	0	0	0	0	0	0	0	0	0	18,657
			MK-VI	200	3,972	1,385	194	402	34	3,972	1,385	194	402	34	3,972	1,385	194	402	34	0	0	0	0	0	0	0	0	0	0	28,047
ORAB, WA	Hood Canal	**Other**																												
		Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	RHIB	18	6	165	1	26	3	6	165	1	26	3	4	99	1	16	2	0	0	0	0	0	2	66	0	10	1	252
		Maritime Security Operations-TPS	BV	420	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	0	0	0	0	0	0	0	0	0	0	120,005
			RV	210	1,293	451	63	131	11	1,293	451	63	131	11	1,293	451	63	131	11	0	0	0	0	0	0	0	0	0	0	9,131
			SVL	630	7,026	2,450	343	711	60	7,026	2,450	343	711	60	7,026	2,450	343	711	60	0	0	0	0	0	0	0	0	0	0	49,607
			SVS	630	2,131	2,287	390	216	47	2,131	2,287	390	216	47	2,131	2,287	390	216	47	0	0	0	0	0	0	0	0	0	0	15,046
	Dabob Bay	**Other**																												
		Maritime Security Operations-TPS	BV	200	8,093	2,823	395	819	69	8,093	2,823	395	819	69	8,093	2,823	395	819	69	0	0	0	0	0	0	0	0	0	0	57,145
			RV	100	616	215	30	62	5	616	215	30	62	5	616	215	30	62	5	0	0	0	0	0	0	0	0	0	0	4,348
			SVL	300	3,346	1,167	163	339	29	3,346	1,167	163	339	29	3,346	1,167	163	339	29	0	0	0	0	0	0	0	0	0	0	23,622
			SVS	300	1,015	1,089	186	103	22	1,015	1,089	186	103	22	1,015	1,089	186	103	22	0	0	0	0	0	0	0	0	0	0	7,165
	Puget Sound	**Other**																												
		Maritime Security Operations-TPS	BV	277	11,217	3,912	547	1,135	96	11,217	3,912	547	1,135	96	11,217	3,912	547	1,135	96	0	0	0	0	0	0	0	0	0	0	79,203
			RV	139	854	298	42	86	7	854	298	42	86	7	854	298	42	86	7	0	0	0	0	0	0	0	0	0	0	6,027
			SVL	416	4,637	1,617	226	469	40	4,637	1,617	226	469	40	4,637	1,617	226	469	40	0	0	0	0	0	0	0	0	0	0	32,741
			SVS	416	1,406	1,509	257	142	31	1,406	1,509	257	142	31	1,406	1,509	257	142	31	0	0	0	0	0	0	0	0	0	0	9,931
	Strait of SJF	**Other**																												
		Maritime Security Operations-TPS	BV	420	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	0	0	0	0	0	0	0	0	0	0	120,005
			RV	210	1,293	451	63	131	11	1,293	451	63	131	11	1,293	451	63	131	11	0	0	0	0	0	0	0	0	0	0	9,131
			SVL	630	7,026	2,450	343	711	60	7,026	2,450	343	711	60	7,026	2,450	343	711	60	0	0	0	0	0	0	0	0	0	0	49,607
			SVS	630	2,131	2,287	390	216	47	2,131	2,287	390	216	47	2,131	2,287	390	216	47	0	0	0	0	0	0	0	0	0	0	15,046
	Indian Island	**Mine Warfare**																												
		Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	RHIB	6	2	55	0	9	1	2.0	54.8	0.4	8.6	0.9	2.0	54.8	0.4	8.6	0.9	0	0	0	0	0	0	0	0	0	0	84
			DDG	6	361	687	24	531	22	361	687	24	531	22	360.9	687.1	24.0	531.2	21.8	0	0	0	0	0	0	0	0	0	0	9,844
		Other																												
		Precision Anchoring	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NOₓ	VOC	SOₓ	PM₁₀	Criteria Pollutants < 3,000 ft agl CO	NOₓ	VOC	SOₓ	PM₁₀	Criteria Pollutants < 3,000 ft agl State CO	NOₓ	VOC	SOₓ	PM₁₀	Criteria Pollutants < 3,000 ft agl Federal CO	NOₓ	VOC	SOₓ	PM₁₀	Criteria Pollutants < 3,000 ft agl International CO	NOₓ	VOC	SOₓ	PM₁₀	Fuel Use (gal)
	W-237	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	71	4,241	8,073	282	6,242	256	4,241	8,073	282	6,242	256	0	0	0	0	0	0	0	0	0	0	4,241	8,073	282	6,242	256	115,666
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	5	494	1,401	48	540	47	494	1,401	48	540	47	0	0	0	0	0	0	0	0	0	0	494	1,401	48	540	47	7,337
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	31	1,884	3,587	125	2,773	114	1,884	3,587	125	2,773	114	754	1,435	50	1,109	46	754	1,435	50	1,109	46	377	717	25	555	23	51,385
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	5	573	1,625	55	626	54	573	1,625	55	626	54	229	650	22	251	22	229	650	22	251	22	115	325	11	125	11	8,511
			SSGN	5																										
			SSBN	5																										
	Olympic MOA	Electronic Warfare Operations (EW Ops) -	DDG	31	1,884	3,587	125	2,773	114	1,884	3,587	125	2,773	114	1,130	2,152	75	1,664	68	0	0	0	0	0	754	1,435	50	1,109	46	51,385
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	5	573	1,625	55	626	54	573	1,625	55	626	54	344	975	33	376	33	0	0	0	0	0	229	650	22	251	22	8,511
			SSGN	5																										
			SSBN	5																										
	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	139.5	8,392	15,975	559	12,350	507	8,392	15,975	559	12,350	507	0	0	0	0	0	0	0	0	0	0	8,392	15,975	559	12,350	507	228,871
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	329	934	32	360	31	329	934	32	360	31	0	0	0	0	0	0	0	0	0	0	329	934	32	360	31	4,891
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	48.75	2,933	5,583	195	4,316	177	2,933	5,583	195	4,316	177	0	0	0	0	0	0	0	0	0	0	2,933	5,583	195	4,316	177	79,982
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	377	717	25	555	23	377	717	25	555	23	188	359	13	277	11	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	115	325	11	125	11	115	325	11	125	11	57	163	6	63	5	4,255
			SSGN	3																										
			SSBN	3																										
PSAB	Hood Canal	**Mine Warfare**																												
		Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	RHIB	18	6	165	1	26	3	6	165	1	26	3	4	99	1	16	2	0	0	0	0	0	2	66	0	10	1	252
		Other																												
		Maritime Security Operations-TPS	BV	420	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	16,996	5,928	829	1,720	145	0	0	0	0	0	0	0	0	0	0	120,005
			RV	210	1,293	451	63	131	11	1,293	451	63	131	11	1,293	451	63	131	11	0	0	0	0	0	0	0	0	0	0	9,131
			SVL	630	7,026	2,450	343	711	60	7,026	2,450	343	711	60	7,026	2,450	343	711	60	0	0	0	0	0	0	0	0	0	0	49,607
			SVS	630	2,131	2,287	390	216	47	2,131	2,287	390	216	47	2,131	2,287	390	216	47	0	0	0	0	0	0	0	0	0	0	15,046
	Puget Sound	**Other**																												
		Maritime Security Operations-TPS	BV	286	11,557	4,031	564	1,170	99	11,557	4,031	564	1,170	99	11,557	4,031	564	1,170	99	0	0	0	0	0	0	0	0	0	0	81,604
			RV	143	879	307	43	89	8	879	307	43	89	8	879	307	43	89	8	0	0	0	0	0	0	0	0	0	0	6,209
			SVL	428	4,778	1,666	233	484	41	4,778	1,666	233	484	41	4,778	1,666	233	484	41	0	0	0	0	0	0	0	0	0	0	33,733
			SVS	428	1,449	1,555	265	147	32	1,449	1,555	265	147	32	1,449	1,555	265	147	32	0	0	0	0	0	0	0	0	0	0	10,231
	NS Everett	**Mine Warfare**																												
		Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	RHIB	6	2	55	0	9	1	2.0	54.8	0.4	8.6	0.9	2.0	54.8	0.4	8.6	0.9	0	0	0	0	0	0	0	0	0	0	84
			DDG	6	361	687	24	531	22	361	687	24	531	22	360.9	687.1	24.0	531.2	21.8	0	0	0	0	0	0	0	0	0	0	9,844
		Other																												
		Maritime Security Operations, Non-TPS	S_A	268.8	888	953	162	90	19	888	953	162	90	19	888	953	162	90	19	0	0	0	0	0	0	0	0	0	0	6,269
			MK-VI	67.2	1,335	466	65	135	11	1,335	466	65	135	11	1,335	466	65	135	11	0	0	0	0	0	0	0	0	0	0	9,424
		Precision Anchoring	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Small Boat Attack	RHIB	1.3	0	12	0	2	0	0.5	12.2	0.1	1.9	0.2	0.5	12.2	0.1	1.9	0.2	0	0	0	0	0	0	0	0	0	0	19
		Surface Ship Sonar Maintenance	DDG	50	3,008	5,726	200	4,427	182	3,008	5,726	200	4,427	182	3,007.8	5,725.8	200.3	4,426.6	181.9	0	0	0	0	0	0	0	0	0	0	82,033

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
	NB Kipsat-Bangor	**Mine Warfare**																												
		Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	RHIB	6	2	55	0	9	1	2.0	54.8	0.4	8.6	0.9	2.0	54.8	0.4	8.6	0.9	0	0	0	0	0	0	0	0	0	0	84
			DDG	6	361	687	24	531	22	361	687	24	531	22	360.9	687.1	24.0	531.2	21.8	0	0	0	0	0	0	0	0	0	0	9,844
		Other																												
		Maritime Security Operations-TPS	BV	840	33,992	11,856	1,658	3,441	290	33,992	11,856	1,658	3,441	290	33,992	11,856	1,658	3,441	290	0	0	0	0	0	0	0	0	0	0	240,011
			RV	420	2,586	902	126	262	22	2,586	902	126	262	22	2,586	902	126	262	22	0	0	0	0	0	0	0	0	0	0	18,262
			SVL	1260	14,052	4,901	685	1,422	120	14,052	4,901	685	1,422	120	14,052	4,901	685	1,422	120	0	0	0	0	0	0	0	0	0	0	99,214
			SVS	1260	4,262	4,574	780	431	94	4,262	4,574	780	431	94	4,262	4,574	780	431	94	0	0	0	0	0	0	0	0	0	0	30,093
		Maritime Security Operations, Non-TPS	S_A	268.8	888	953	162	90	19	888	953	162	90	19	888	953	162	90	19	0	0	0	0	0	0	0	0	0	0	6,269
			MK-VI	67.2	1,335	466	65	135	11	1,335	466	65	135	11	1,335	466	65	135	11	0	0	0	0	0	0	0	0	0	0	9,424
		Small Boat Attack	RHIB	1.3	0.5	12	0.1	2	0.2	0	12	0	2	0	0	12	0	2	0	0	0	0	0	0	0	0	0	0	0	19
		Surface Ship Sonar Maintenance	DDG	50	3,008	5,726	200	4,427	182	3,008	5,726	200	4,427	182	3,007.8	5,725.8	200.3	4,426.6	181.9	0.0	0	0	0	0	0	0	0	0	0	82,033
	Kitsap-Bremerton	**Mine Warfare**																												
		Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises	RHIB	6	2	55	0	9	1	2.0	54.8	0.4	8.6	0.9	2.0	54.8	0.4	8.6	0.9	0	0	0	0	0	0	0	0	0	0	84
			DDG	6	361	687	24	531	22	361	687	24	531	22	360.9	687.1	24.0	531.2	21.8	0	0	0	0	0	0	0	0	0	0	18
		Other																												
		Maritime Security Operations, Non-TPS	S_A	268.8	888	953	162	90	19	888	953	162	90	19	888	953	162	90	19	0	0	0	0	0	0	0	0	0	0	6,269
			MK-VI	67.2	1,335	466	65	135	11	1,335	466	65	135	11	1,335	466	65	135	11	0	0	0	0	0	0	0	0	0	0	9,424
		Small Boat Attack	RHIB	1.3	0.45	0.154	0.052	0.018	0.006	0.45	0.15	0.05	0.02	0.01	0.45	0.15	0.05	0.02	0.01	0	0	0	0	0	0	0	0	0	0	19
	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	84	5,035	9,585	335	7,410	304	5,035	9,585	335	7,410	304	0	0	0	0	0	0	0	0	0	0	5,035	9,585	335	7,410	304	137,322
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	2	198	560	19	216	19	198	560	19	216	19	0	0	0	0	0	0	0	0	0	0	198	560	19	216	19	2,935
		Sinking Exercise (SINKEX) - no longer conducted	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSN	0																										
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	29	1,760	3,350	117	2,590	106	1,760	3,350	117	2,590	106	0	0	0	0	0	0	0	0	0	0	1,760	3,350	117	2,590	106	47,989
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	377	717	25	555	23	377	717	25	555	23	188	359	13	277	11	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	115	325	11	125	11	115	325	11	125	11	57	163	6	63	5	4,255
			SSGN	3																										
			SSBN	3																										
NOI, OR	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	84	5,035	9,585	335	7,410	304	5,035	9,585	335	7,410	304	0	0	0	0	0	0	0	0	0	0	5,035	9,585	335	7,410	304	137,322
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	2	198	560	19	216	19	198	560	19	216	19	0	0	0	0	0	0	0	0	0	0	198	560	19	216	19	2,935
		Sinking Exercise (SINKEX) - no longer conducted	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSN	0																										

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl State CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl Federal CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl International CO	NO_x	VOC	SO_x	PM_{10}	Fuel Use (gal)
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	29	1,760	3,350	117	2,590	106	1,760	3,350	117	2,590	106	0	0	0	0	0	0	0	0	0	0	1,760	3,350	117	2,590	106	47,989
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	0	0	0	0	0	0	0	0	0	0	942	1,793	63	1,386	57	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	0	0	0	0	0	0	0	0	0	0	286	813	28	313	27	4,255
			SSGN	3																										
			SSBN	3																										
PI, OR	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	84	5,035	9,585	335	7,410	304	5,035	9,585	335	7,410	304	0	0	0	0	0	0	0	0	0	0	5,035	9,585	335	7,410	304	137,322
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	2	198	560	19	216	19	198	560	19	216	19	0	0	0	0	0	0	0	0	0	0	198	560	19	216	19	2,935
		Sinking Exercise (SINKEX) - no longer conducted	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSN	0																										
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	29	1,760	3,350	117	2,590	106	1,760	3,350	117	2,590	106	0	0	0	0	0	0	0	0	0	0	1,760	3,350	117	2,590	106	47,989
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	0	0	0	0	0	0	0	0	0	0	942	1,793	63	1,386	57	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	0	0	0	0	0	0	0	0	0	0	286	813	28	313	27	4,255
			SSGN	3																										
			SSBN	3																										
SOI, OR	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	84	5,035	9,585	335	7,410	304	5,035	9,585	335	7,410	304	0	0	0	0	0	0	0	0	0	0	5,035	9,585	335	7,410	304	137,322
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	2	198	560	19	216	19	198	560	19	216	19	0	0	0	0	0	0	0	0	0	0	198	560	19	216	19	2,935
		Sinking Exercise (SINKEX) - no longer conducted	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSN	0																										
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	29	1,760	3,350	117	2,590	106	1,760	3,350	117	2,590	106	0	0	0	0	0	0	0	0	0	0	1,760	3,350	117	2,590	106	47,989
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	0	0	0	0	0	0	0	0	0	0	942	1,793	63	1,386	57	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	0	0	0	0	0	0	0	0	0	0	286	813	28	313	27	4,255
			SSGN	3																										
			SSBN	3																										

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
NCAB, CA	NUWC OPAREA	**Air Warfare**																												
		Gunnery Exercise (Surface-to-Air)	DDG	18	1,060	2,018	71	1,560	64	1,060	2,018	71	1,560	64	0	0	0	0	0	0	0	0	0	0	1,060	2,018	71	1,560	64	28,916
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1	123	350	12	135	12	123	350	12	135	12	0	0	0	0	0	0	0	0	0	0	123	350	12	135	12	1,834
		Surface Warfare																												
		Gunnery Exercise (Surface-to-Surface) Ship	DDG	84	5,035	9,585	335	7,410	304	5,035	9,585	335	7,410	304	0	0	0	0	0	0	0	0	0	0	5,035	9,585	335	7,410	304	137,322
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	1.8	198	560	19	216	19	198	560	19	216	19	0	0	0	0	0	0	0	0	0	0	198	560	19	216	19	2,935
		Sinking Exercise (SINKEX) - no longer conducted	CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSN	0																										
		Anti-Submarine Warfare																												
		Tracking Exercise-Ship	DDG	29	1,760	3,350	117	2,590	106	1,760	3,350	117	2,590	106	0	0	0	0	0	0	0	0	0	0	1,760	3,350	117	2,590	106	47,989
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Electronic Warfare Operations (EW Ops) - Aircraft and Ship Combined	DDG	16	942	1,793	63	1,386	57	942	1,793	63	1,386	57	0	0	0	0	0	0	0	0	0	0	942	1,793	63	1,386	57	25,693
			FFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			AOE	3	286	813	28	313	27	286	813	28	313	27	0	0	0	0	0	0	0	0	0	0	286	813	28	313	27	4,255
			SSGN	3																										
			SSBN	3																										
															CO	**NOx**	**VOC**	**SOx**	**PM10**											
		NWAB, WA													26	12	2	3	0											
		ORAB													45	21	3	7	1											
															71	33	4	9	1											
		PSAB													58	30	4	11	1											
		NOI, OR													0	0	0	0	0											
		PI, OR													0	0	0	0	0											
		SOI, OR													0	0	0	0	0											
		NCAB, CA													0	0	0	0	0											
					Total Criteria Air Pollutants					**Criteria Pollutants < 3,000 ft agl**					**Criteria Pollutants < 3,000 ft agl State**					**Criteria Pollutants < 3,000 ft agl Federal**					**Criteria Pollutants < 3,000 ft agl International**					
					CO	**NOx**	**VOC**	**SOx**	**PM10**	**CO**	**NOx**	**VOC**	**SOx**	**PM10**	**CO**	**NOx**	**VOC**	**SOx**	**PM10**	**CO**	**NOx**	**VOC**	**SOx**	**PM10**	**CO**	**NOx**	**VOC**	**SOx**	**PM10**	**Fuel Use (gal)**
		TRAINING SUBTOTAL (pounds)		19,487	324,168	257,951	20,509	138,135	7,349	324,168	257,951	20,509	138,135	7,349	256,858	125,208	15,887	40,788	3,116	1,971	4,301	145	2,740	137	65,340	128,442	4,476	94,607	4,097	3,794,025
		TRAINING SUBTOTAL (tons)			**162**	**129**	**10**	**69**	**4**	**162**	**129**	**10**	**69**	**4**	**128**	**63**	**8**	**20**	**2**	**1**	**2**	**0**	**1**	**0**	**33**	**64**	**2**	**47**	**2**	
		TRAINING SUBTOTAL (metric tons)			147	117	9	63	3	147	117	9	63	3	117	57	7	19	1	1	2	0	1	0	30	58	2	43	2	

Table C-9: Vessel Testing Emissions Under Alternative 1

TEST ACTIVITIES				Annual	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International					Fuel Use
AQCR	Range / Location	Activity	Vessel	Hours	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	(gal)
ORAB, WA																														
	Quinault Range Site	Anti-Submarine Warfare Testing	SSBN	24																										
			DDG	24	1444	2748	96	2125	87	1,444	2,748	96	2,125	87	1,444	2,748	96	2,125	87	0	0	0	0	0	0	0	0	0	0	39376
	Quinault Range Site	At-Sea Sonar Testing	SSBN	8																										
			DDG	8	481	916	32	708	29	361	687	24	531	22	361	687	24	531	22	0	0	0	0	0	0	0	0	0	0	13125
			CVN	8																										
			RHIB	8	3	73	0	12	1	2	55	0	9	1	2	55	0	9	1	0	0	0	0	0	0	0	0	0	0	112
	DBRC Range Site	At-Sea Sonar Testing	SSBN	28																										
			DDG	28	1684	3206	112	2479	102	1,263	2404.83	84.12	1859.18	76.39	1,263	2,405	84	1,859	76	0	0	0	0	0	0	0	0	0	0	45938
			CVN	28																										
			RHIB	28	10	256	2	40	4	7	191.94	1.26	30.24	3.15	7	192	1	30	3	0	0	0	0	0	0	0	0	0	0	392
	Quinault Range Site	Countermeasure Test	DDG	42	2,527	4,810	168	3,718	153	1,895	3,607	126	2,789	115	0	0	0	0	0	0	0	0	0	0	1,895	3,607	126	2,789	115	68907
			RHIB	42	14	384	3	60	6	11	287.91	1.89	45.36	4.73	0	0	0	0	0	0	0	0	0	0	11	288	2	45	5	588
	DBRC Range Site	Countermeasure Test	DDG	45	2,707	5,153	180	3,984	164	2,030	3,865	135	2,988	123	2,030	3,865	135	2,988	123	0	0	0	0	0	0	0	0	0	0	73829
			RHIB	45	15	411	3	65	7	11	308.48	2.03	48.60	5.06	11	308	2	49	5	0	0	0	0	0	0	0	0	0	0	630
		Torpedo Test - Explosive	SSBN	3.2																										
			DDG	3.2	193	366	13	283	12	144	274.84	9.61	212.48	8.73	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			RHIB	3.2	1	29	0	5	0	0.82	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
	Quinault Range Site	Torpedo Test - Non-Explosive	DDG	72	4,331	8,245	288	6,374	262	3,248	6,184	216	4,781	196	0	0	0	0	0	0	0	0	0	0	3,248	6,184	216	4,781	196	118127
			RHIB	72	24	658	4	104	11	18	493.56	3.24	77.76	8.10	0	0	0	0	0	0	0	0	0	0	18	494	3	78	8	1008
	DBRC Range Site	Torpedo Test - Non-Explosive	DDG	91.5	5,504	10,478	367	8,101	333	4,128	7,859	275	6,076	250	4,128	7,859	275	6,076	250	0	0	0	0	0	0	0	0	0	0	150119
			RHIB	91.5	31	836	5	132	14	23	627.23	4.12	98.82	10.29	23	627	4	99	10	0	0	0	0	0	0	0	0	0	0	1281
	Quinault Range Site	Mine Detection and Classification Testing	DDG	12	722	1,374	48	1,062	44	722	1,374	48	1,062	44	0	0	0	0	0	0	0	0	0	0	722	1,374	48	1,062	44	19688
			RHIB	12	4	110	1	17	2	4	109.68	0.72	17.28	1.80	0	0	0	0	0	0	0	0	0	0	4	110	1	17	2	168
	DBRC Range Site	Mine Detection and Classification Testing	DDG	300	18,047	34,355	1,202	26,560	1,091	18,047	34,355	1,202	26,560	1,091	18,047	34,355	1,202	26,560	1,091	0	0	0	0	0	0	0	0	0	0	492195
			RHIB	300	102	2742	18	432	45	102	2742.00	18.00	432.00	45.00	102	2,742	18	432	45	0	0	0	0	0	0	0	0	0	0	4200
	Quinault Range Site	Mine Countermeasure and Neutralization	MCM	60	1,537	1,848	366	308	34	1,537	1,848	366	308	34	0	0	0	0	0	0	0	0	0	0	1,537	1,848	366	308	34	1980
			LHD	60	485	2870	346	8130	1715	485	2869.99	346.03	8129.82	#####	0	0	0	0	0	0	0	0	0	0	485	2,870	346	8,130	1,715	133568
			DDG	60	3609	6871	240	5312	218	3,609	6870.94	240.35	5311.94	#####	0	0	0	0	0	0	0	0	0	0	3,609	6,871	240	5,312	218	98439
	DBRC Range Site	Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	318.89	38.45	903.31	#####	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763.44	26.71	590.22	24.25	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	Quinault Range Site	Unmanned Underwater Vehicle Testing	DDG	38	2,286	4,352	152	3,364	138	2,286	4,352	152	3,364	138	0	0	0	0	0	0	0	0	0	0	2,286	4,352	152	3,364	138	62345
			RHIB	38	13	347	2	55	6	13	347.32	2.28	54.72	5.70	0	0	0	0	0	0	0	0	0	0	13	347	2	55	6	532
			SSBN	38																										
	DBRC Range Site	Unmanned Underwater Vehicle Testing	DDG	322	19,371	36,874	1,290	28,507	1,171	19,371	36,874	1,290	28,507	1,171	19,371	36,874	1,290	28,507	1,171	0	0	0	0	0	0	0	0	0	0	528289
			RHIB	322	109	2943	19	464	48	109	2943.08	19.32	463.68	48.30	109	2,943	19	464	48	0	0	0	0	0	0	0	0	0	0	4508
			SSBN																											
	Quinault Range Site	Unmanned Aerial System Testing	RHIB	12	4	110	1	17	2	4	110	1	17	2	0	0	0	0	0	0	0	0	0	0	4	110	1	17	2	168
	DBRC Range Site	Unmanned Aerial System Testing	RHIB	13.33	5	122	1	19	2	5	122	1	19	2	5	122	1	19	2	0	0	0	0	0	0	0	0	0	0	187
	Quinault Range Site	Unmanned Surface Vehicle System Testing	RHIB	32	11	292	2	46	5	11	292	2	46	5	0	0	0	0	0	0	0	0	0	0	11	292	2	46	5	448
	DBRC Range Site	Unmanned Surface Vehicle System Testing	RHIB	80	27	731	5	115	12	27	731	5	115	12	0	0	0	0	0	0	0	0	0	0	27	731	5	115	12	1120
	Quinault Range Site	Undersea Warfare Testing	DDG	32	1,925	3,665	128	2,833	116	1,925	3,665	128	2,833	116	635	1,209	42	935	38	635	1,209	42	935	38	635	1,209	42	935	38	52501
			RHIB	32	11	292	2	46	5	11	292.48	1.92	46.08	4.80	4	97	1	15	2	4	97	1	15	2	4	97	1	15	2	448
			SSBN	32																										
	DBRC Range Site	Vessel Signature Evaluation	DDG	2	120	229	8	177	7	120	229	8	177	7	120	229	8	177	7	0	0	0	0	0	0	0	0	0	0	3281
			RHIB	2	1	18	0	3	0	1	18.28	0.12	2.88	0.30	1	18	0	3	0	0	0	0	0	0	0	0	0	0	0	28
			SSBN	2																										

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
	DBRC Range Site	Cold Water Support	DDG	2	120	229	8	177	7	120	229	8	177	7	120	229	8	177	7	0	0	0	0	0	0	0	0	0	0	3281
			SSBN																											
	Quinault Range Site	Radar and Other System Testing	RHIB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Quinault Range Site	Acoustic and Oceanographic Research	RHIB	28	10	256	2	40	4	10	256	2	40	4	0	0	0	0	0	0	0	0	0	0	10	256	2	40	4	392
	DBRC Range Site	Acoustic and Oceanographic Research	RHIB	42	14	384	3	60	6	14	384	3	60	6	14	384	3	60	6	0	0	0	0	0	0	0	0	0	0	588
	Quinault Range Site	Non Acoustic Component Testing	RHIB	12	4	110	1	17	2	4	110	1	17	2	0	0	0	0	0	0	0	0	0	0	4	110	1	17	2	168
			DDG	12	722	1,374	48	1,062	44	722	1,374	48	1,062	44	0	0	0	0	0	0	0	0	0	0	722	1,374	48	1,062	44	19688
			LHD	12	97	574	69	1626	343	97	574.00	69.21	1626	343	0	0	0	0	0	0	0	0	0	0	97	574	69	1,626	343	26714
	DBRC Range Site	Non Acoustic Component Testing	RHIB	46	16	420	3	66	7	16	420	3	66	7	16	420	3	66	7	0	0	0	0	0	0	0	0	0	0	644
			DDG	46	2,767	5,268	184	4,072	167	2,767	5,268	184	4,072	167	2,767	5,268	184	4,072	167	0	0	0	0	0	0	0	0	0	0	75470
			LHD	46	372	2200	265	6233	1314	372	2200.33	265.29	6233	#####	372	2,200	265	6,233	1,314	0	0	0	0	0	0	0	0	0	0	102402
	DBRC Range Site	Semi-Stationary Equipment Testing	RHIB	60	20	548	4	86	9	20	548	4	86	9	20	548	4	86	9	0	0	0	0	0	0	0	0	0	0	840
	Quinault Range Site	Simulant Testing	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Indian Island	Acoustic Component Testing	SSBN	5																										
			DDG	5	301	573	20	443	18	301	573	20	443	18	301	573	20	443	18	0	0	0	0	0	0	0	0	0	0	8203
			RHIB	5	2	46	0	7	1	2	46	0	7	1	2	46	0	7	1	0	0	0	0	0	0	0	0	0	0	70
		Mine Countermeasure and Neutralization	MCM	6.7	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.7	54	319	38	903	191	54	318.89	38.45	903.31	#####	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.7	401	763	27	590	24	401	763.44	26.71	590.22	24.25	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	NUWC OPAREA	Anti-Submarine Warfare Testing	DDG	72	4331	8245	288	6374	262	4,331	8,245	288	6,374	262	0	0	0	0	0	0	0	0	0	0	4,331	8,245	288	6,374	262	118127
		At-Sea Sonar Testing	DDG	3.6	217	412	14	319	13	217	412	14	319	13	108	206	7	159	7	108	206	7	159	7	217	412	14	319	13	5906
			CVN	3.6																										
			RHIB	3.6	1	33	0	5	1	1	33	0	5	1	1	16	0	3	0	1	16	0	3	0	1	33	0	5	1	50
		Torpedo Non-Explosive Testing	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			RHIB	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Torpedo Test - Explosive	SSBN	3.2																										
			DDG	3.2	193	366	13	283	12	144	274.84	9.61	212.48	8.73	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			RHIB	3.2	1	29	0	5	0	0.82	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Mine Countermeasure and Neutralization	MCM	18	461	555	110	92	10	461	555	110	92	10	0	0	0	0	0	0	0	0	0	0	461	555	110	92	10	594
			LHD	18	145	861	104	2439	514	145	861.00	103.81	2438.94	#####	0	0	0	0	0	0	0	0	0	0	145	861	104	2,439	514	40070
			DDG	18	1083	2061	72	1594	65	1,083	2061.28	72.10	1593.58	65.48	0	0	0	0	0	0	0	0	0	0	1,083	2,061	72	1,594	65	29532
		Kinetic Energy Weapon Testing (Railgun)	DDG	9.6	578	1099	38	850	35	578	1099.35	38.46	849.91	34.92	0	0	0	0	0	0	0	0	0	0	578	1,099	38	850	35	15750
		Propulsion Testing	DDG	9	541	1031	36	797	33	541	1030.64	36.05	796.79	32.74	0	0	0	0	0	0	0	0	0	0	541	1,031	36	797	33	14766
		Undersea Warfare Testing	DDG	19.2	1,155	2,199	77	1,700	70	1,155	2,199	77	1,700	70	381	726	25	561	23	381	726	25	561	23	381	726	25	561	23	31500
			RHIB	19.2	7	175	1	28	3	7	175.49	1.15	27.65	2.88	2	58	0	9	1	2	58	0	9	1	2	58	0	9	1	269
		Radar and Other System Testing	DDG	32.4	1,949	3,710	130	2,868	118	1,949	3,710	130	2,868	118	0	0	0	0	0	0	0	0	0	0	1,949	3,710	130	2,868	118	53157
		Non Acoustic Component Testing	RHIB	1.8	1	16	0	3	0	1	16	0	3	0	0	0	0	0	0	0	0	0	0	0	1	16	0	3	0	25
			DDG	1.8	108	206	7	159	7	108	206	7	159	7	0	0	0	0	0	0	0	0	0	0	108	206	7	159	7	2953
			LHD	1.8	15	86	10	244	51	15	86.10	10.38	243.89	51.44	0	0	0	0	0	0	0	0	0	0	15	86	10	244	51	4007
		Simulant Testing	DDG	30	1,805	3,435	120	2,656	109	1,805	3,435	120	2,656	109	0	0	0	0	0	0	0	0	0	0	1,805	3,435	120	2,656	109	49220

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl State CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl Federal CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl International CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Fuel Use (gal)
NWAB, WA	Hood Canal EOD Range	Mine Countermeasure and Neutralization	MCM	3.33	85	103	20	17	2	85	103	20	17	2	85	103	20	17	2	0	0	0	0	0	0	0	0	0	0	110
			LHD	3.33	27	159	19	452	95	27	159	19	452	95	27	159	19	452	95	0	0	0	0	0	0	0	0	0	0	7420
			DDG	3.33	201	382	13	295	12	201	382	13	295	12	201	382	13	295	12	0	0	0	0	0	0	0	0	0	0	5469
	Crescent Harbor EOD Range	Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763	27	590	24	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	OPAREA 3	Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763	27	590	24	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	R6701	Unmanned Aerial System Testing	RHIB	13.33	5	122	1	19	2	5	122	1	19	2	5	122	1	19	2	0	0	0	0	0	0	0	0	0	0	187
OPArea - PSAB	Keyport Range Sites	Countermeasure Test	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			RHIB	42	14	384	3	60	6	11	288	2	45	5	11	288	2	45	5	0	0	0	0	0	0	0	0	0	0	588
		Mine Detection and Classification Testing	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			RHIB	272	92	2486	16	392	41	92	2486	16	392	41	92	2,486	16	392	41	0	0	0	0	0	0	0	0	0	0	3808
		Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Unmanned Underwater Vehicle Testing	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			RHIB	58	20	530	3	84	9	20	530	3	84	9	20	530	3	84	9	0	0	0	0	0	0	0	0	0	0	812
			SSBN																											
		Unmanned Aerial System Testing	RHIB	13.33	5	122	1	19	2	5	122	1	19	2	5	122	1	19	2	0	0	0	0	0	0	0	0	0	0	187
		Unmanned Surface Vehicle System Testing	RHIB	80	27	731	5	115	12	27	731	5	115	12	0	0	0	0	0	0	0	0	0	0	27	731	5	115	12	1120
		Cold Water Support	DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			SSBN																											
		Acoustic and Oceanographic Research	RHIB	42	14	384	3	60	6	14	384	3	60	6	14	384	3	60	6	0	0	0	0	0	0	0	0	0	0	588
		Non Acoustic Component Testing	RHIB	16	5	146	1	23	2	5	146	1	23	2	5	146	1	23	2	0	0	0	0	0	0	0	0	0	0	224
			DDG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			LHD	16.0	129	765	92	2168	457	129	765.33	92.28	2167.95	#####	129	765	92	2,168	457	0	0	0	0	0	0	0	0	0	0	35618
		Semi-Stationary Equipment Testing	RHIB	60	20	548	4	86	9	20	548	4	86	9	20	548	4	86	9	0	0	0	0	0	0	0	0	0	0	840
		Torpedo (Explosive) Testing	SSBN	0																										
			DDG	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			CVN	0																										
			RHIB	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Carr Inlet	Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763	27	590	24	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	Hood Canal EOD Range	Mine Countermeasure and Neutralization	MCM	3.33	85	103	20	17	2	85	103	20	17	2	85	103	20	17	2	0	0	0	0	0	0	0	0	0	0	110
			LHD	3.33	27	159	19	452	95	27	159	19	452	95	27	159	19	452	95	0	0	0	0	0	0	0	0	0	0	7420
			DDG	3.33	201	382	13	295	12	201	382	13	295	12	201	382	13	295	12	0	0	0	0	0	0	0	0	0	0	5469
	NS Everett	Acoustic Component Testing	SSBN	5																										
			DDG	5	301	573	20	443	18	301	573	20	443	18	301	573	20	443	18	0	0	0	0	0	0	0	0	0	0	8203
			RHIB	5	2	46	0	7	1	2	46	0	7	1	2	46	0	7	1	0	0	0	0	0	0	0	0	0	0	70
		Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763	27	590	24	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl State CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl Federal CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl International CO	NO_x	VOC	SO_x	PM_{10}	Fuel Use (gal)
	NB Kipsat-Bangor	Acoustic Component Testing	SSBN	30																										
			DDG	30	1805	3435	120	2656	109	1,805	3,435	120	2,656	109	1,805	3,435	120	2,656	109	0	0	0	0	0	0	0	0	0	0	49220
			RHIB	30	10	274	2	43	5	10	274	2	43	5	10	274	2	43	5	0	0	0	0	0	0	0	0	0	0	420
	NB Kipsat-Bremerton	Acoustic Component Testing	SSBN	5																										
			DDG	5	301	573	20	443	18	301	573	20	443	18	301	573	20	443	18	0	0	0	0	0	0	0	0	0	0	8203
			RHIB	5	2	46	0	7	1	2	46	0	7	1	2	46	0	7	1	0	0	0	0	0	0	0	0	0	0	70
		Mine Countermeasure and Neutralization	MCM	6.67	171	205	41	34	4	171	205	41	34	4	171	205	41	34	4	0	0	0	0	0	0	0	0	0	0	220
			LHD	6.67	54	319	38	903	191	54	319	38	903	191	54	319	38	903	191	0	0	0	0	0	0	0	0	0	0	14841
			DDG	6.67	401	763	27	590	24	401	763	27	590	24	401	763	27	590	24	0	0	0	0	0	0	0	0	0	0	10938
	OPArea - NOI																													
		Anti-Submarine Warfare Testing	DDG	48	2888	5497	192	4250	175	2,888	5,497	192	4,250	175	0	0	0	0	0	0	0	0	0	0	2,888	5,497	192	4,250	175	78751
		At-Sea Sonar Testing	DDG	2.4	144	275	10	212	9	144	275	10	212	9	72	137	5	106	4	72	137	5	106	4	144	275	10	212	9	3938
			CVN	2.4																										
			RHIB	2.4	1	22	0	3	0	1	22	0	3	0	0	11	0	2	0	0	11	0	2	0	1	22	0	3	0	34
		Torpedo Test - Non-Explosive	DDG	3.2	193	366	13	283	12	144	275	10	212	9	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			RHIB	3.2	1	29	0	5	0	1	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Torpedo Test - Explosive	SSBN	3.2																										
			DDG	3.2	193	366	13	283	12	144	274.84	9.61	212.48	8.73	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			CVN	1.6																										
			RHIB	3.2	1	29	0	5	0	0.82	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Mine Countermeasure and Neutralization	MCM	12	307	370	73	62	7	307	370	73	62	7	0	0	0	0	0	0	0	0	0	0	307	370	73	62	7	396
			LHD	12	97	574	69	1626	343	97	574.00	69.21	1625.96	#####	0	0	0	0	0	0	0	0	0	0	97	574	69	1,626	343	26714
			DDG	12	722	1374	48	1062	44	722	1374.19	48.07	1062.39	43.65	0	0	0	0	0	0	0	0	0	0	722	1,374	48	1,062	44	19688
		Kinetic Energy Weapon Testing (Railgun)	DDG	6.4	385	733	26	567	23	385	732.90	25.64	566.61	23.28	0	0	0	0	0	0	0	0	0	0	385	733	26	567	23	10500
		Propulsion Testing	DDG	6	361	687	24	531	22	361	687.09	24.03	531.19	21.83	0	0	0	0	0	0	0	0	0	0	361	687	24	531	22	9844
		Undersea Warfare Testing	DDG	12.8	770	1,466	51	1,133	47	770	1,466	51	1,133	47	254	484	17	374	15	254	484	17	374	15	254	484	17	374	15	21000
			RHIB	12.8	4	117	1	18	2	4	116.99	0.77	18.43	1.92	1	39	0	6	1	1	39	0	6	1	1	39	0	6	1	179
		Radar and Other System Testing	DDG	21.6	1,299	2,474	87	1,912	79	1,299	2,474	87	1,912	79	0	0	0	0	0	0	0	0	0	0	1,299	2,474	87	1,912	79	35438
		Non Acoustic Component Testing	RHIB	1.2	0	11	0	2	0	0	11	0	2	0	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	17
			DDG	1.2	72	137	5	106	4	72	137	5	106	4	0	0	0	0	0	0	0	0	0	0	72	137	5	106	4	1969
			LHD	1.2	10	57	7	163	34	10	57.40	6.92	162.60	34.29	0	0	0	0	0	0	0	0	0	0	10	57	7	163	34	2671
		Simulant Testing	DDG	30	1,805	3,435	120	2,656	109	1,805	3,435	120	2,656	109	0	0	0	0	0	0	0	0	0	0	1,805	3,435	120	2,656	109	49220
	OPArea - PI																													
		Anti-Submarine Warfare Testing	DDG	24	1444	2748	96	2125	87	1,444	2,748	96	2,125	87	0	0	0	0	0	0	0	0	0	0	1,444	2,748	96	2,125	87	39376
		At-Sea Sonar Testing	DDG	1.2	72	137	5	106	4	72	137	5	106	4	36	69	2	53	2	36	69	2	53	2	72	137	5	106	4	1969
			CVN	1.2																										
			RHIB	1.2	0	11	0	2	0	0	11	0	2	0	0	5	0	1	0	0	5	0	1	0	0	11	0	2	0	17
		Torpedo Test - Non-Explosive	DDG	1.6	96	183	6	142	6	72	137	5	106	4	0	0	0	0	0	0	0	0	0	0	72	137	5	106	4	2625
			RHIB	1.6	1	15	0	2	0	0	10.97	0.07	1.73	0.18	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	22
		Torpedo Test - Explosive	SSBN	1.6																										
			DDG	1.6	96	183	6	142	6	72	137.42	4.81	106.24	4.37	0	0	0	0	0	0	0	0	0	0	72	137	5	106	4	2625
			CVN	1.6																										
			RHIB	1.6	1	15	0	2	0	0.41	10.97	0.07	1.73	0.18	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	22
		Mine Countermeasure and Neutralization	MCM	6	154	185	37	31	3	154	185	37	31	3	0	0	0	0	0	0	0	0	0	0	154	185	37	31	3	198
			LHD	6	48	287	35	813	171	48	287.00	34.60	812.98	#####	0	0	0	0	0	0	0	0	0	0	48	287	35	813	171	13357
			DDG	6	361	687	24	531	22	361	687.09	24.03	531.19	21.83	0	0	0	0	0	0	0	0	0	0	361	687	24	531	22	9844
		Kinetic Energy Weapon Testing (Railgun)	DDG	3.2	193	366	13	283	12	193	366.45	12.82	283.30	11.64	0	0	0	0	0	0	0	0	0	0	193	366	13	283	12	5250
		Propulsion Testing	DDG	3	180	344	12	266	11	180	343.55	12.02	265.60	10.91	0	0	0	0	0	0	0	0	0	0	180	344	12	266	11	4922
		Undersea Warfare Testing	DDG	6.4	385	733	26	567	23	385	733	26	567	23	127	242	8	187	8	127	242	8	187	8	127	242	8	187	8	10500
			RHIB	6.4	2	58	0	9	1	2	58.50	0.38	9.22	0.96	1	19	0	3	0	1	19	0	3	0	1	19	0	3	0	90

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International					Fuel Use (gal)
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	
		Radar and Other System Testing	DDG	10.8	650	1,237	43	956	39	650	1,237	43	956	39	0	0	0	0	0	0	0	0	0	0	650	1,237	43	956	39	17719
		Non Acoustic Component Testing	RHIB	0.6	0	5	0	1	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	8
			DDG	0.6	36	69	2	53	2	36	69	2	53	2	0	0	0	0	0	0	0	0	0	0	36	69	2	53	2	984
			LHD	0.6	5	29	3	81	17	5	28.70	3.46	81.30	17.15	0	0	0	0	0	0	0	0	0	0	5	29	3	81	17	1336
		Simulant Testing	DDG	25	1,504	2,863	100	2,213	91	1,504	2,863	100	2,213	91	0	0	0	0	0	0	0	0	0	0	1,504	2,863	100	2,213	91	41016
	OPArea - SOI																													
		Anti-Submarine Warfare Testing	DDG	48	2888	5497	192	4250	175	2,888	5,497	192	4,250	175	0	0	0	0	0	0	0	0	0	0	2,888	5,497	192	4,250	175	78751
		At-Sea Sonar Testing																												
			DDG	2.4	144	275	10	212	9	144	275	10	212	9	72	137	5	106	4	72	137	5	106	4	144	275	10	212	9	3938
			CVN	2.4																										
			RHIB	2.4	1	22	0	3	0	1	22	0	3	0	0	11	0	2	0	0	11	0	2	0	1	22	0	3	0	34
		Torpedo Test - Non-Explosive	DDG	3.2	193	366	13	283	12	144	275	10	212	9	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			RHIB	3.2	1	29	0	5	0	1	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Torpedo Test - Explosive	SSBN	3.2																										
			DDG	3.2	193	366	13	283	12	144	274.84	9.61	212.48	8.73	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			CVN	3.2																										
			RHIB	3.2	1	29	0	5	0	0.82	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Mine Countermeasure and Neutralization	MCM	12	307	370	73	62	7	307	370	73	62	7	0	0	0	0	0	0	0	0	0	0	307	370	73	62	7	396
			LHD	12	97	574	69	1626	343	97	574.00	69.21	1625.96	#####	0	0	0	0	0	0	0	0	0	0	97	574	69	1,626	343	26714
			DDG	12	722	1374	48	1062	44	722	1374.19	48.07	1062.39	43.65	0	0	0	0	0	0	0	0	0	0	722	1,374	48	1,062	44	19688
		Kinetic Energy Weapon Testing (Railgun)	DDG	6.4	385	733	26	567	23	385	732.90	25.64	566.61	23.28	0	0	0	0	0	0	0	0	0	0	385	733	26	567	23	10500
		Propulsion Testing	DDG	6	361	687	24	531	22	361	687.09	24.03	531.19	21.83	0	0	0	0	0	0	0	0	0	0	361	687	24	531	22	9844
		Undersea Warfare Testing	DDG	12.8	770	1,466	51	1,133	47	770	1,466	51	1,133	47	254	484	17	374	15	254	484	17	374	15	254	484	17	374	15	21000
			RHIB	12.8	4	117	1	18	2	4	116.99	0.77	18.43	1.92	1	39	0	6	1	1	39	0	6	1	1	39	0	6	1	179
		Radar and Other System Testing	DDG	21.6	1,299	2,474	87	1,912	79	1,299	2,474	87	1,912	79	0	0	0	0	0	0	0	0	0	0	1,299	2,474	87	1,912	79	35438
		Non Acoustic Component Testing	RHIB	1.2	0	11	0	2	0	0	11	0	2	0	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	17
			DDG	1.2	72	137	5	106	4	72	137	5	106	4	0	0	0	0	0	0	0	0	0	0	72	137	5	106	4	1969
			LHD	1.2	10	57	7	163	34	10	57.40	6.92	162.60	34.29	0	0	0	0	0	0	0	0	0	0	10	57	7	163	34	2671
		Simulant Testing	DDG	30	1,805	3,435	120	2,656	109	1,805	3,435	120	2,656	109	0	0	0	0	0	0	0	0	0	0	1,805	3,435	120	2,656	109	49220

AQCR	Range / Location	Activity	Vessel	Annual Hours	Total Criteria Air Pollutants CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl State CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl Federal CO	NO_x	VOC	SO_x	PM_{10}	Criteria Pollutants < 3,000 ft agl International CO	NO_x	VOC	SO_x	PM_{10}	Fuel Use (gal)
	OPArea - NCAB																													
		Anti-Submarine Warfare Testing	DDG	48	2888	5497	192	4250	175	2,888	5,497	192	4,250	175	0	0	0	0	0	0	0	0	0	0	2,888	5,497	192	4,250	175	78751
		At-Sea Sonar Testing	DDG	2.4	144	275	10	212	9	144	275	10	212	9	72	137	5	106	4	72	137	5	106	4	144	275	10	212	9	3938
			CVN	2.4																										
			RHIB	2.4	1	22	0	3	0	1	22	0	3	0	0	11	0	2	0	0	11	0	2	0	1	22	0	3	0	34
		Torpedo Test - Non-Explosive	DDG	3.2	193	366	13	283	12	144	275	10	212	9	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			RHIB	3.2	1	29	0	5	0	1	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Torpedo Test - Explosive	SSBN	3.2																										
			DDG	3.2	193	366	13	283	12	144	274.84	9.61	212.48	8.73	0	0	0	0	0	0	0	0	0	0	144	275	10	212	9	5250
			CVN	3.2																										
			RHIB	3.2	1	29	0	5	0	0.82	21.94	0.14	3.46	0.36	0	0	0	0	0	0	0	0	0	0	1	22	0	3	0	45
		Mine Countermeasure and Neutralization	MCM	12	307	370	73	62	7	307	370	73	62	7	0	0	0	0	0	0	0	0	0	0	307	370	73	62	7	396
			LHD	12	97	574	69	1626	343	97	574.00	69.21	1625.96	#####	0	0	0	0	0	0	0	0	0	0	97	574	69	1,626	343	26714
			DDG	12	722	1374	48	1062	44	722	1374.19	48.07	1062.39	43.65	0	0	0	0	0	0	0	0	0	0	722	1,374	48	1,062	44	19688
		Kinetic Energy Weapon Testing (Railgun)	DDG	6.4	385	733	26	567	23	385	732.90	25.64	566.61	23.28	0	0	0	0	0	0	0	0	0	0	385	733	26	567	23	10500
		Propulsion Testing	DDG	6	361	687	24	531	22	361	687.09	24.03	531.19	21.83	0	0	0	0	0	0	0	0	0	0	361	687	24	531	22	9844
		Undersea Warfare Testing	DDG	12.8	770	1,466	51	1,133	47	770	1,466	51	1,133	47	254	484	17	374	15	254	484	17	374	15	254	484	17	374	15	21000
			RHIB	12.8	4	117	1	18	2	4	116.99	0.77	18.43	1.92	1	39	0	6	1	1	39	0	6	1	1	39	0	6	1	179
		Radar and Other System Testing	DDG	21.6	1,299	2,474	87	1,912	79	1,299	2,474	87	1,912	79	0	0	0	0	0	0	0	0	0	0	1,299	2,474	87	1,912	79	35438
		Non Acoustic Component Testing	RHIB	1.2	0	11	0	2	0	0	11	0	2	0	0	0	0	0	0	0	0	0	0	0	0	11	0	2	0	17
			DDG	1.2	72	137	5	106	4	72	137	5	106	4	0	0	0	0	0	0	0	0	0	0	72	137	5	106	4	1969
			LHD	1.2	10	57	7	163	34	10	57.40	6.92	162.60	34.29	0	0	0	0	0	0	0	0	0	0	10	57	7	163	34	2671
		Simulant Testing	DDG	30	1,805	3,435	120	2,656	109	1,805	3,435	120	2,656	109	0	0	0	0	0	0	0	0	0	0	1,805	3,435	120	2,656	109	49220
SEAI, AK	SEAFAC	Vessel Signature Evaluation	SSBN	74																										
			DDG	74	4452	8474	296	6551	269	4,452	8,474	296	6,551	269	4,452	8,474	296	6,551	269	0	0	0	0	0	0	0	0	0	0	121408
			RHIB	74	25	676	4	107	11	25	676	4	107	11	25	676	4	107	11	0	0	0	0	0	0	0	0	0	0	1036
		Cold Water Support	SSBN																											
			DDG	8	481	916	32	708	29	481	916	32	708	29	481	916	32	708	29	0	0	0	0	0	0	0	0	0	0	13125
		Acoustic Component Testing	SSBN	104																										
			DDG	104	6256	11910	417	9207	378	6,256	11,910	417	9,207	378	6,256	11,910	417	9,207	378	0	0	0	0	0	0	0	0	0	0	170628
			RHIB	104	35	951	6	150	16	35	951	6	150	16	35	951	6	150	16	0	0	0	0	0	0	0	0	0	0	1456
		Countermeasure testing	DDG	4	241	458	16	354	15	180	344	12	266	11	180	344	12	266	11	0	0	0	0	0	0	0	0	0	0	6563
			RHIB	4	1	37	0	6	1	1	27	0	4	0	1	27	0	4	0	0	0	0	0	0	0	0	0	0	0	56
		Semi-Stationary Equipment Testing	RHIB	3	1	27	0	4	0	1	27	0	4	0	1	27	0	4	0	0	0	0	0	0	0	0	0	0	0	42

NWAB, WA					
ORAB	27.29	56.96	2.10	44.82	2.76
PSAB	2.57	7.62	0.37	6.38	0.82
NOI, OR	4.58	8.91	0.37	7.37	0.46
PI, OR	2.59	5.03	0.20	4.13	0.25
SOI, OR	4.58	8.91	0.37	7.37	0.46
NCAB, CA	4.58	8.91	0.37	7.37	0.46

		Total Criteria Air Pollutants CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl State CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl Federal CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl International CO	NOx	VOC	SOx	PM10
SEAI, AK	pounds	11,493	23,449	772	17,088	719	11,432	23,325	768	16,998	715	11,432	23,325	768	16,998	715	0	0	0	0	0	0	0	0	0	0
	tons	5.7	11.7	0.4	8.5	0.4	5.7	11.7	0.4	8.5	0.4	5.7	11.7	0.4	8.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

11.72

		Total Criteria Air Pollutants CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl State CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl Federal CO	NOx	VOC	SOx	PM10	Criteria Pollutants < 3,000 ft agl International CO	NOx	VOC	SOx	PM10	Fuel Use (gal)
TESTING SUBTOTAL (pounds)	5,276	136,856	284,877	11,347	######	####	132,023	274,910	11,021	222,604	#####	72,301	154,846	5,779	121,115	7,958	2,280	4,659	153	3,390	143	58,111	116,770	5,134	99,092	7,330	4,144,743
TESTING SUBTOTAL (tons)		68	142	6	115	8	66	137	6	111	8	36.2	77.4	2.9	60.6	4.0	1.1	2.3	0.1	1.7	0.1	29	58	3	50	4	
TESTING SUBTOTAL (metric tons)		62	129	5	104	7	60	125	5	101	7	33	70	3	55	4	1	2	0	2	0	26	53	2	45	3	

Table C-10: Ordnance Training Emissions Under Alternative 1

AQCR	Range / Location	Activity	Ordnance Item	Annual Amount	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International				
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}
NWAB, WA																													
	Crescent Harbor	**Surface Warfare**																											
		(Surface-to-Surface) Boat (not included in	5.56 blank	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mine Warfare																											
		Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	2.5# charge	7.5	0.16	0.05	0.00	0.00	0.16	0.1575	0.05	0.00	0.00	0.16	0.063	0.02	0.00	0.00	0.06	0.063	0.02	0.00	0.00	0.06	0.03	0.01	0.00	0.00	0.03
	Puget Sound	**Other**																											
		Maritime Security Operations	5.56 blank	40	0.01	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	40	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Strait of SJF	**Other**																											
		Maritime Security Operations	5.56 blank	61	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	61	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Whidbey Island	**Other**																											
		Maritime Security Operations-Certification	5.56 blank	1320	0.37	0.03	0.00	0.00	0.01	0.37	0.03	0.00	0.00	0.01	0.37	0.03	0.00	0.00	0.01	0	0	0	0	0	0	0	0	0	0
			0.5 cal	1320	14.52	1.58	0.00	0.00	0.41	14.52	1.58	0.00	0.00	0.41	14.52	1.58	0.00	0.00	0.41	0	0	0	0	0	0	0	0	0	0
			smoke grenade	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0
			shotgun	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0
ORAB, WA																													
	W-237	**Air Warfare**																											
		Gunnery Exercise (Surface-to-Air)																											
			LC Proj	945	166.28	54.42	0.00	0.00	324.99	83.14	27.21	0.00	0.00	162.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.14	27.21	0.00	0.00	162.50
			MC Proj	5000	420.25	7.38	0.00	0.00	16.40	210.13	3.69	0.00	0.00	8.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	210.13	3.69	0.00	0.00	8.20
		Missile Exercise (Surface-to-Air) - ship																											
			AIM-116 (SS)	3.2	166.05	4.57	0.00	0.03	18.21	111.25	3.06	0.00	0.02	12.20	0.00	0.00	0.00	0.00	0.00	0.00	3.06	0.00	0.00	0.00	111.25	3.06	0.00	0.02	12.20
		Surface Warfare																											
		Missile Exercise (Air –to-Surface)																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	2	20.50	6.15	0.00	0.12	20.50	20.50	6.15	0.00	0.12	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.50	6.15	0.00	0.12	20.50
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NUWC OPAREA	**Anti-Air Warfare**																											
		Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		(Surface-to-Air) - ship emissions are included																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare																											
		Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	680	119.68	39.17	0.00	0.00	233.92	119.68	39.17	0.00	0.00	233.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	119.68	39.17	0.00	0.00	233.92
			MC Proj	8373	703.75	12.36	0.00	0.00	27.46	703.75	12.36	0.00	0.00	27.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	703.75	12.36	0.00	0.00	27.46
			SC Proj	30250	69.58	2.93	0.00	0.00	1.54	69.58	2.93	0.00	0.00	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.58	2.93	0.00	0.00	1.54
		Bombing Exercise (Air-to-Surface)																											
			MK-82	2.5	152.83	0.00	0.00	0.00	0.00	152.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	152.83	0.00	0.00	0.00	0.00
			BDU-45	27.5	7.01	0.00	0.00	0.00	0.00	7.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.01	0.00	0.00	0.00	0.00
		Sinking Exercise (SINKEX) - no longer conducted																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AQCR	Range / Location	Activity	Ordnance Item	Annual Amount	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International				
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}
	Hood Canal																												
		Mine Warfare Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	2.5# charge	3.75	0.08	0.00	0.00	0.00	0.00	0.07875	0.00	0.00	0.00	0.00	0.0315	0.00	0.00	0.00	0.00	0.0315	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
		Other Maritime Security Operations	5.56 blank	61	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	61	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Dabob Bay	**Other**																											
		Maritime Security Operations	5.56 blank	29	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	29	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Puget Sound	**Other**																											
		Maritime Security Operations	5.56 blank	40	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	40	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Strait of SJF	**Other**																											
		Maritime Security Operations	5.56 blank	61	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	61	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
PSAB																													
	NUWC OPAREA	**Air Warfare**																											
		Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	408	71.81	23.50	0.00	0.00	140.35	71.81	23.50	0.00	0.00	140.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.81	23.50	0.00	0.00	140.35
			MC Proj	5023.8	422.25	7.42	0.00	0.00	16.48	422.25	7.42	0.00	0.00	16.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	422.25	7.42	0.00	0.00	16.48
			SC Proj	18150	41.75	1.76	0.00	0.00	0.93	41.75	1.76	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.75	1.76	0.00	0.00	0.93
		Bombing Exercise (Air-to-Surface)																											
			MK-82	1.5	91.70	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00
			BDU-45	16.5	4.21	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00
		Sinking Exercise (SINKEX) - no longer																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Hood Canal	**Mine Warfare**																											
		Mine Neutralization – Explosive Ordnance Disposal (EOD) - no aircraft	2.5# charge	3.75	0.08	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.0315	0.00	0.00	0.00	0.00	0.0315	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
		Other Maritime Security Operations	5.56 blank	61	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	61	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
	Kitsap-Bremerton	**Other**																											
		Small Boat Attack	5.56 blank	333.33	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AQCR	Range / Location	Activity	Ordnance Item	Annual Amount	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International				
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}
	Kitsap-Bangor	**Other**																											
		Maritime Security Operations	5.56 blank	123	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	123	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
		Small Boat Attack	5.56 blank	333.33	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	NS Everett	**Other**																											
		Small Boat Attack	5.56 blank	333.33	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Puget Sound	**Other**																											
		Maritime Security Operations	5.56 blank	40	0.01	0.00	0.00	0.00	0.00	0.011	0.001	0.000	0.000	0.000	0.011	0.001	0.000	0.000	0.000	0	0	0	0	0	0	0	0	0	0
			0.5-cal blank	40	0.45	0.05	0.00	0.00	0.01	0.445	0.049	0.000	0.000	0.013	0.445	0.049	0.000	0.000	0.013	0	0	0	0	0	0	0	0	0	0
NOI, OR																													
	NUWC OPAREA																												
		Air Warfare Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	408	71.81	23.50	0.00	0.00	140.35	71.81	23.50	0.00	0.00	140.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.81	23.50	0.00	0.00	140.35
			MC Proj	5023.8	422.25	7.42	0.00	0.00	16.48	422.25	7.42	0.00	0.00	16.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	422.25	7.42	0.00	0.00	16.48
			SC Proj	18150	41.75	1.76	0.00	0.00	0.93	41.75	1.76	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.75	1.76	0.00	0.00	0.93
		Bombing Exercise (Air-to-Surface)																											
			MK-82	1.5	91.70	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00
			BDU-45	16.5	4.21	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00
		Sinking Exercise (SINKEX) - no longer conducted																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PI, OR																													
	NUWC OPAREA																												
		Air Warfare Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	408	71.81	23.50	0.00	0.00	140.35	71.81	23.50	0.00	0.00	140.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.81	23.50	0.00	0.00	140.35
			MC Proj	5023.8	422.25	7.42	0.00	0.00	16.48	422.25	7.42	0.00	0.00	16.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	422.25	7.42	0.00	0.00	16.48
			SC Proj	18150	41.75	1.76	0.00	0.00	0.93	41.75	1.76	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.75	1.76	0.00	0.00	0.93
		Bombing Exercise (Air-to-Surface)																											
			MK-82	1.5	91.70	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00
			BDU-45	16.5	4.21	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00

AQCR	Range / Location	Activity	Ordnance Item	Annual Amount	Total Criteria Air Pollutants CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl State CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl Federal CO	NO$_x$	VOC	SO$_x$	PM$_{10}$	Criteria Pollutants < 3,000 ft agl International CO	NO$_x$	VOC	SO$_x$	PM$_{10}$
		Sinking Exercise (SINKEX) - no longer conducted																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOI, OR																													
	NUWC OPAREA																												
		Air Warfare Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	408	71.81	23.50	0.00	0.00	140.35	71.81	23.50	0.00	0.00	140.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.81	23.50	0.00	0.00	140.35
			MC Proj	5023.8	422.25	7.42	0.00	0.00	16.48	422.25	7.42	0.00	0.00	16.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	422.25	7.42	0.00	0.00	16.48
			SC Proj	18150	41.75	1.76	0.00	0.00	0.93	41.75	1.76	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.75	1.76	0.00	0.00	0.93
		Bombing Exercise (Air-to-Surface)																											
			MK-82	1.5	91.70	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00
			BDU-45	16.5	4.21	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00
		Sinking Exercise (SINKEX) - no longer conducted																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NCAB, CA																													
	NUWC OPAREA																												
		Air Warfare Gunnery Exercise (Surface-to-Air)																											
			LC Proj	236	41.57	13.60	0.00	0.00	81.25	20.78	6.80	0.00	0.00	40.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.78	6.80	0.00	0.00	40.62
			MC Proj	1250	105.06	1.85		0.00	4.10	52.53	0.92	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.53	0.92	0.00	0.00	2.05
		Missile Exercise (Surface-to-Air) - ship emissions are included in Gunnery exercises																											
			AIM-116 (SS)	0.8	41.51	1.14	0.00	0.01	4.55	27.81	0.76	0.00	0.01	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.81	0.76	0.00	0.01	3.05
		Surface Warfare Gunnery Exercise (Surface-to-Surface) Ship																											
			LC Proj	408	71.81	23.50	0.00	0.00	140.35	71.81	23.50	0.00	0.00	140.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.81	23.50	0.00	0.00	140.35
			MC Proj	5023.8	422.25	7.42	0.00	0.00	16.48	422.25	7.42	0.00	0.00	16.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	422.25	7.42	0.00	0.00	16.48
			SC Proj	18150	41.75	1.76	0.00	0.00	0.93	41.75	1.76	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.75	1.76	0.00	0.00	0.93
		Bombing Exercise (Air-to-Surface)																											
			MK-82	1.5	91.70	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.70	0.00	0.00	0.00	0.00
			BDU-45	16.5	4.21	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00

AQCR	Range / Location	Activity	Ordnance Item	Annual Amount	Total Criteria Air Pollutants					Criteria Pollutants < 3,000 ft agl					Criteria Pollutants < 3,000 ft agl State					Criteria Pollutants < 3,000 ft agl Federal					Criteria Pollutants < 3,000 ft agl International				
					CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}	CO	NO_x	VOC	SO_x	PM_{10}
		Sinking Exercise (SINKEX) - no longer conducted																											
			HARM	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-114	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-65	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			AGM-84	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			SLAM ER	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		TRAINING SUBTOTAL (pounds)			6132.92	392.03	0.00	0.21	1971.90	5262.78	311.01	0.00	0.18	1530.14	19.40	2.09	0.00	0.00	0.60	0.13	3.84	0.00	0.00	0.06	5243.25	308.90	0.00	0.18	1529.47
		TRAINING SUBTOTAL (tons)			3.1	0.2	0.0	0.0	1.0	2.6	0.2	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.2	0.0	0.0	0.8
		TRAINING SUBTOTAL (metric tons)																											
		NWAB, WA			0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		ORAB, WA			1.01	0.07	0.00	0.00	0.37	0.79	0.05	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.05	0.00	0.00	0.26
		PSAB, WA			0.41	0.02	0.00	0.00	0.12	0.37	0.02	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.02	0.00	0.00	0.10
		Noi, OR			0.41	0.02	0.00	0.00	0.12	0.37	0.02	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.02	0.00	0.00	0.10
		PI, OR			0.41	0.02	0.00	0.00	0.12	0.37	0.02	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.02	0.00	0.00	0.10
		SOI, OR			0.41	0.02	0.00	0.00	0.12	0.37	0.02	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.02	0.00	0.00	0.10
		NCAB, CA			0.41	0.02	0.00	0.00	0.12	0.37	0.02	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.02	0.00	0.00	0.10
		Total			3.07	0.20	0.00	0.00	0.99	2.63	0.16	0.00	0.00	0.77	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.62	0.15	0.00	0.00	0.76

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APPENDIX D ACOUSTIC AND EXPLOSIVE CONCEPTS

This appendix is an update to the 2015 Northwest Training and Testing (NWTT) Final Environmental Impact Statement (EIS)/Overseas EIS (OEIS) Appendix F (Acoustic and Explosives Primer) and introduces basic principles and terminology for acoustics and explosives to help the reader understand the analyses presented in this Environmental Impact Statement. This appendix briefly explains the transmission of sound and explosive energy; introduces some of the basic mathematical formulas used to describe propagation; and defines acoustical terms, abbreviations, and units of measurement. The difference between transmission of sound in water and in air is also discussed. Finally, it discusses methods used to analyze what animals may hear.

A number of other sources provide a more extensive background on acoustics and explosives than presented in this overview and are recommended for further inquiry. These include, but are not limited to:

- *Marine Mammals and Noise* (Richardson et al., 1995) for a general overview
- *Principles of Underwater Sound* (Urick, 1983), *Fundamentals of Acoustical Oceanography* (Medwin & Clay, 1998), and *Principles of Marine Bioacoustics* (Au & Hastings, 2008) for comprehensive explanations of underwater acoustics

D.1 Terminology

The following terms are used in this document when discussing sound and the attributes of a sound source.

D.1.1 Sound

Sound is produced when an elastic medium (such as air or water) is set into motion, typically by a vibrating object within the medium. As the object vibrates, its motion is transmitted to adjacent "particles" of the medium. The motion of these particles is transmitted to adjacent particles, and so on. The result is a mechanical disturbance (the "sound wave") that moves away from the source and propagates at a medium-dependent speed (the "sound speed"). As the sound wave travels through the medium, the individual particles of the medium oscillate about their original positions but do not actually move with the sound wave. As the particles of the medium move back and forth they create small changes about the original values of the medium density, pressure, and temperature.

Sound may be described by both physical and subjective attributes. Physical attributes, such as sound amplitude and frequency, may be directly measured. Subjective (or sensory) attributes like loudness depend on an animal's perception of sound. Physical attributes of a sound at a particular point are usually obtained by measuring pressure changes as sound waves pass.

D.1.2 Signal Versus Noise

When sound is purposely created to convey information, communicate, or obtain information about the environment, it is often referred to as a signal. Examples of sounds that could be considered signals are sonar pings, marine mammal vocalizations and echolocation clicks, tones used in hearing experiments, and small sonobuoy explosions used for submarine detection.

Noise is undesired sound (American National Standards Institute, 1994). Sounds produced by naval aircraft and vessel propulsion are considered noise because they represent possible inefficiencies and increased detectability. Whether a sound is perceived as noise often depends on the receiver (i.e., the animal or system that detects the sound). For example, small explosives and sonar used to generate sounds that can locate an enemy submarine produce signals that are useful to sailors engaged in anti-submarine warfare, but are assumed to be noise when detected by marine mammals.

The combination of all sounds at a particular location, whether these sources are located near or far, is ambient noise (American National Standards Institute, 1994). Ambient noise includes natural sources, such as sound from crashing waves, rain, and animals (e.g., snapping shrimp), and anthropogenic sources, such as seismic surveys and vessel noise.

D.1.3 Frequency and Wavelength

Frequency is the physical attribute most closely associated with the subjective attribute "pitch"; the higher the frequency, the higher the pitch. Frequency is defined by the number of oscillations in the sound pressure or particle motion per second. One hertz (Hz) is equal to one oscillation per second, and one kilohertz (kHz) is equal to 1,000 oscillations per second. Human hearing generally spans the frequency range from 20 Hz to 20 kHz. The frequency range of a sound is called its bandwidth.

Pure tones have energy at a constant, single frequency. Complex tones contain energy at multiple, discrete frequencies, rather than a single frequency. A harmonic of a sound at a particular frequency is a multiple of that frequency (e.g., harmonic frequencies of a 2 kHz tone are 4 kHz, 6 kHz, 8 kHz, etc.). A source operating at a nominal frequency may emit several harmonic frequencies, but at lower amplitudes. Some sources may also emit subharmonics; however, these are typically many orders of magnitude less powerful than at the center frequency. Sounds with large bandwidth ("broadband" sounds) have energy spread across many frequencies.

In this document, sounds are generally described as either low- (less than 1 kHz), mid- (1 kHz–10 kHz), high- (10 kHz–100 kHz), or very high- (greater than 100 kHz) frequency. Hearing ranges of marine animals (e.g., fish, birds, sea turtles, and marine mammals) are quite varied and are species-dependent. For example, some fish can hear sounds below 100 Hz and some species of marine mammals have hearing capabilities that extend above 100 kHz. Acoustic impact analyses must therefore focus not only on the sound amplitude (i.e., pressure or particle motion, see Section D.1.4), but on the sound frequency and the hearing capabilities of the species being considered.

The wavelength of a sound is the distance between wave peaks. Wavelength decreases as frequency increases. The frequency multiplied by the wavelength equals the speed of sound in a medium, as shown in this equation:

$$\text{Frequency } (s^{-1}) \times \text{wavelength (m)} = \text{sound speed (m/s)}$$

The approximate speed of sound in sea water is 1500 m/s and in air is 340 m/s, although speed varies depending on environmental conditions [e.g., pressure, temperature, and, in the case of sea water, salinity; see Section D.3.1, Speed of Sound].

D.1.4 Sound Amplitude

Sound amplitude is the physical attribute most closely associated with the subjective attribute loudness. Amplitude is related to the amount that the medium particles oscillate about their original positions and can be thought of as the "strength" of a sound (as the amplitude increases, the loudness also increases). As the sound wave travels, the particles of the medium oscillate but do not actually travel with the wave. The result is a mechanical disturbance (i.e., the sound wave) that propagates away from the sound source.

Sound amplitude is typically characterized by measuring the acoustic pressure or particle motion (see Section D.2, Sound Metrics).

D.1.5 Impulsive Versus Non-Impulsive Sounds

Although no standard definitions exist, sounds may be broadly categorized as impulsive or non-impulsive. Impulsive sounds have short durations, rapid rise-times, broad frequency content, and high peak sound pressures. Impulsive sounds are often produced by processes involving a rapid release of energy or mechanical impacts (Hamernik & Hsueh, 1991). Explosions, air guns, weapon firing, and impact pile driving are examples of impulsive sound sources analyzed in this document. In contrast, sonars, vessel operation, vibratory pile driving, and underwater transducers lack the characteristics of impulsive sources and are thus examples of non-impulsive sound sources. Non-impulsive sounds can be essentially continuous, such as machinery noise, or intermittent, such as sonar pings.

D.1.6 Acoustic Impedance

Acoustic impedance is a property of the propagation medium (air, water, or tissue) that can be simply described as the opposition to flow of a pressure wave. Acoustic impedance is a function of the density and speed of sound in a medium. Sound transmits more readily through materials of similar acoustic impedance, such as water and animal tissue. When sound waves encounter a medium with different acoustic impedance (for example, an air-water interface), they reflect and refract (see Sections D.3.3.3, Refraction; and D.3.3.4, Reflection and Multipath Propagation), creating more complex propagation conditions. For example, sound traveling in air (low impedance) encountering the water surface (high impedance) will be largely reflected, preventing most sound energy in the air from being transmitted into the water. The impedance difference at the tissue-air interface in animals with gas-containing organs also makes these areas susceptible to damage when exposed to the shock wave near an explosion, since the transmission from high-impedance to low-impedance can result in large motion at the boundary.

D.1.7 Duty Cycle

Duty cycle describes the portion of time that a sound source actually generates sound. It is defined as the percentage of time during which a sound is generated over a total operational time period. For example, if a sonar source produces a one-second ping once every 10 seconds, the duty cycle is 10 percent. Duty cycles vary among different acoustic sources; in general, a low duty cycle could be considered 20 percent or less and a high duty cycle 80 percent or higher.

D.1.8 Resonance

Resonance occurs when an object is vibrated at a frequency near its "natural frequency" or resonant frequency. The resonant frequency can be considered the preferred frequency at which an object will oscillate at a greater magnitude than when exposed to other frequencies. In this document, resonance is considered in relation to the size of an air bubble or air cavity in an animal that is exposed to high pressure waves and the potential for injury. The natural frequencies of dolphin and beluga lungs near the surface are about 36 Hz and 30 Hz, respectively (Finneran, 2003), the natural frequency of lungs of a large whale would be lower, while the natural frequency of small air bubbles would be much higher. Resonant frequencies would tend to increase as an animal dives, since the increased water pressure would compress an air-filled structure and reduce its size.

D.2 Sound Metrics

The sound metrics described here are used in this document to quantify exposure to a sound or explosion.

D.2.1 Pressure

Sound pressure is the incremental variation in a medium's static pressure as a sound wave travels through it. Sound pressure is typically expressed in units of pascals (Pa) (1 Pa = 1 N/m^2 = 10 µbar = 1.45×10^{-4} psi), although explosive overpressure may also be described in pounds per square inch (psi).

Various sound pressure metrics are illustrated in Figure D-1 for (a) a non-impulsive sound (a pure tone in this illustration) and (b) an impulsive sound. As shown in Figure D-1, the non-impulsive sound has a relatively gradual rise in pressure from static pressure (the ambient pressure without the added sound), while the impulsive sound has a near-instantaneous rise to a high peak pressure. The peak pressure shown on both illustrations is the maximum absolute value of the instantaneous sound pressure during a specified time interval ("zero-to-peak" or "peak"), which accounts for the values of peak pressures below the static (ambient) pressure (American National Standards Institute, 2013). "Peak-to-peak" pressure is the difference between the maximum and minimum sound pressures. The root-mean-square (rms) value is often used to describe the average sound pressure level of sounds, and sound pressure levels provided in this EIS/OEIS are root-mean-square values unless otherwise specified. As the name suggests, this method takes the square root of the average squared sound pressure values over a time interval. The duration of this time interval can have a strong effect on the measured rms sound pressure for a given sound, especially where pressure levels vary significantly, as during an impulsive sound exposure. If the analysis duration includes a significant portion of the waveform after the sound pressure has returned to zero, the rms pressure would be relatively low. If the analysis duration includes only the highest pressures of the impulsive exposure, the rms value would be comparatively high. For this reason, it is important to specify the duration used to calculate the rms pressure for impulsive sounds.

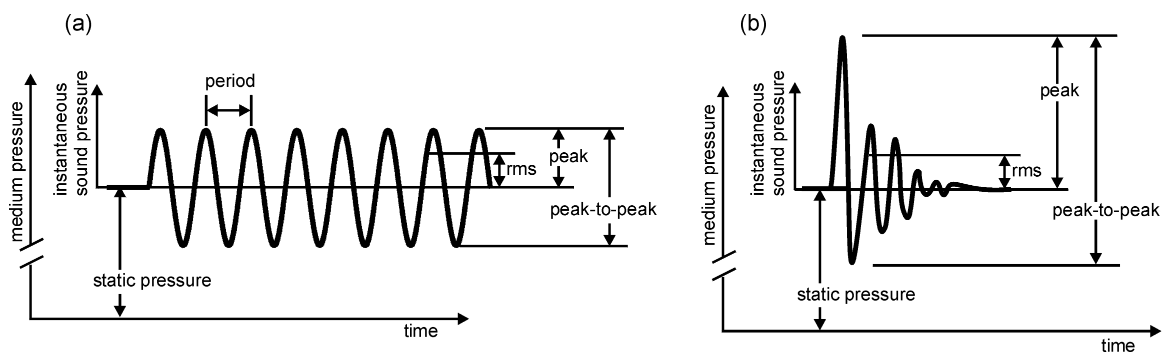


Figure D-1: Various Sound Pressure Metrics for a Hypothetical (a) Pure Tone (Non-Impulsive) and (b) Impulsive Sound

D.2.2 Sound Pressure Level

The most common sound level metric is sound pressure level (SPL). Because many animals can detect very large pressure ranges and judge the relative loudness of sounds by the ratio of the sound pressures (a logarithmic behavior), SPL is described by taking the logarithm of the ratio of the sound pressure to a reference pressure. Use of a logarithmic scale compresses the wide range of measured pressure values into a more useful scale.

Sound pressure levels are normally expressed in decibels. A decibel is 1/10 of a bel, a unit of level when the logarithm is to the base ten and the quantities concerned are proportional to power (American National Standards Institute, 2013). Sound pressure level in decibels is calculated as follows:

$$SPL = 20\log_{10}\left(\frac{P}{P_{ref}}\right)$$

where P is the sound pressure and P_{ref} is the reference pressure. Unless stated otherwise, the pressure P is the rms value of the pressure (American National Standards Institute, 2013). In some situations, SPL is calculated for the peak pressure rather than the rms pressure. On the occasions when rms pressure is not used, the pressure metric will be stated (e.g., peak SPL means an SPL calculated using the peak pressure rather than the rms pressure).

When a value is presented in decibels, it is important to also specify the value and units of the reference quantity. Normally the numeric value is given, followed by the text “re,” meaning “with reference to,” and the numeric value and unit of the reference quantity. For example, a pressure of 1 Pa, expressed in decibels with a reference of 1 micropascal (µPa), is written 120 dB re 1 µPa. The standard reference pressures are 1 µPa for water and 20 µPa for air. The reference pressure for air, 20 µPa, is the approximate lowest threshold of human hearing. It is important to note that because of the differences in reference units, the same sound pressures would result in different SPL values for each medium (the same sound pressure measured in water and in air would result in a higher SPL in water than in air, since the in-air reference is larger). Therefore, sound pressure levels in air and in water should never be directly compared.

D.2.3 Sound Exposure Level

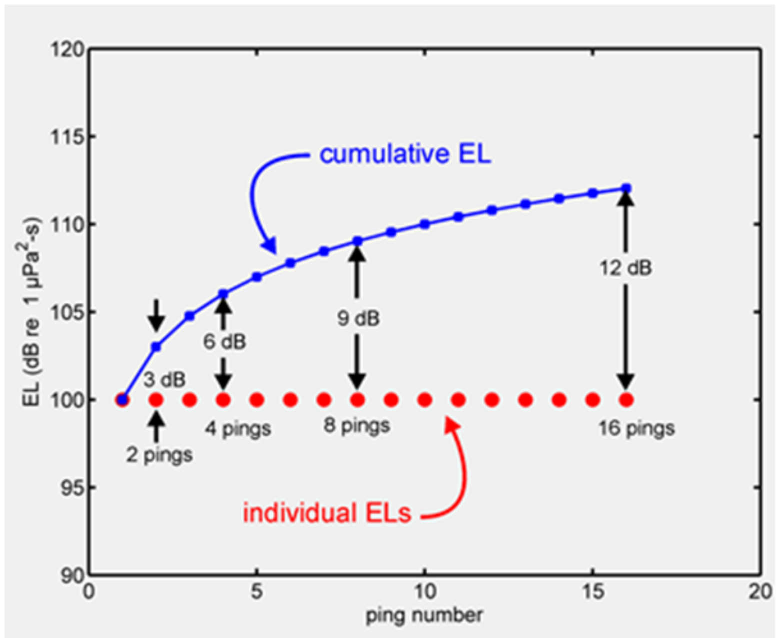
Sound exposure level (SEL) can be thought of as a composite metric that represents both the SPL of a sound and its duration. Individual time-varying noise events (e.g., a series of sonar pings or an impulsive sound) have two main characteristics: (1) a sound pressure that changes throughout the event and (2) a period of time during which the source is exposed to the sound. SEL can be provided for a single exposure (i.e., a single sonar ping or single explosive detonation) or for an entire acoustic event (i.e., multiple sonar pings or multiple explosive detonations). Cumulative SEL provides a measure of the net exposure of the entire acoustic event, but it does not directly represent the sound level heard at any given time. SEL is determined by calculating the decibel level of the cumulative sum-of-squared pressures over the duration of a sound, with units of dB re 1 micropascal squared seconds (re 1 μPa^2-s) for sounds in water and dB re (20 micropascal) squared seconds [dB re (20 $\mu Pa)^2$-s] for sounds in air.

Some rules of thumb for SEL are as follows:

- The numeric value of SEL is equal to the SPL of a one-second sound that has the same total energy as the exposure event. If the sound duration is one second, SPL and SEL have the same numeric value (but not the same reference quantities). For example, a one-second sound with an SPL of 100 dB re 1 µPa has a SEL of 100 dB re 1 μPa^2-s.
- If the sound duration is constant but the SPL changes, SEL will change by the same number of decibels as the SPL.
- If the SPL is held constant and the duration (T) changes, SEL will change as a function of $10\log_{10}(T)$:
    - $10 \log_{10}(10) = 10$, so increasing duration by a factor of 10 raises SEL by 10 dB.

- $10 \log_{10}(0.1) = -10$, so decreasing duration by a factor of 10 lowers SEL by 10 dB.
- Since $10 \log_{10}(2) \approx 3$, so doubling the duration increases SEL by 3 dB.
- $10 \log_{10}(1/2) \approx -3$, so halving the duration lowers SEL by 3 dB.

Figure D-2 illustrates the summation of energy for a succession of sonar pings. In this hypothetical case, each ping has the same duration and SPL. The SEL at a particular location from each individual ping is 100 dB re 1 μPa^2-s (red circles). The upper, blue curve shows the running total or cumulative SEL.

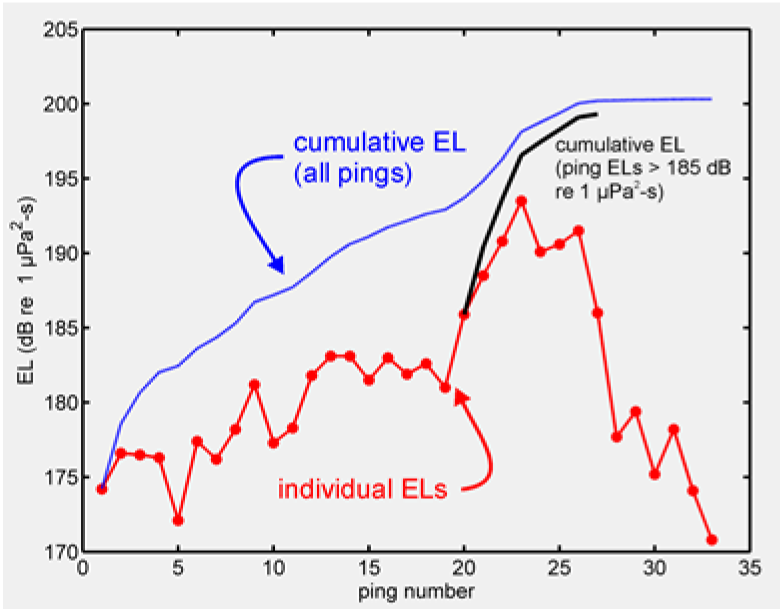


Note: EL = Exposure Level (i.e., Sound Exposure Level)

Figure D-2: Summation of Acoustic Energy from a Hypothetical, Intermittently Pinging, Stationary Sound Source

After the first ping, the cumulative SEL is 100 dB re 1 μPa^2-s. Since each ping has the same duration and SPL, receiving two pings is the same as receiving a single ping with twice the duration. The cumulative SEL from two pings is therefore 103 dB re 1 μPa^2-s. The cumulative SEL from four pings is 3 dB higher than the cumulative SEL from two pings, or 106 dB re 1 μPa^2-s. Each doubling of the number of pings increases the cumulative SEL by 3 dB.

Figure D-3 shows a more realistic example where the individual pings do not have the same SPL or SEL. These data were recorded from a stationary hydrophone as a sound source approached, passed, and moved away from the hydrophone. As the source approached the hydrophone, the received SPL from each ping increased, causing the SEL of each ping to increase. After the source passed the hydrophone, the received SPL and SEL from each ping decreased as the source moved farther away (downward trend of red line), although the cumulative SEL increased with each additional ping received (slight upward trend of blue line). The main contributions are from those pings with the highest individual SELs. Individual pings with SELs 10 dB or more below the ping with the highest level contribute little (less than 0.5 dB) to the total cumulative SEL. This is shown in Figure D-3, where only a small error is introduced by summing the energy from the eight individual pings with SEL greater than 185 dB re 1 μPa^2-s (black line), as opposed to including all pings (blue line).



Note: EL = Exposure Level (i.e., Sound Exposure Level)

Figure D-3: Cumulative Sound Exposure Level Under Realistic Conditions with a Moving, Intermittently Pinging Sound Source

D.2.4 Particle motion

The particles of a medium (e.g., water or air) oscillate around their original position as a sound wave passes. This motion is quantified using average displacement (m or dB re 1pm), velocity (m/s or dB re 1 nm/s^2), and acceleration (m/s^2 or dB re 1 μm/s^2) of the particles (Nedelec et al., 2016). Note that particle velocity is not the same as sound speed, which is how fast a sound wave moves through a medium. Particle motion is directional, whereas pressure measurement is not (Nedelec et al., 2016).

Far from a sound source and without any boundaries that could cause wave interference, particle velocity is directly proportional to sound pressure. Closer to a sound source, particle velocity begins to increase relative to sound pressure. Because this phenomenon is related to wavelength, it may be relevant only when very close to sound sources with extremely low frequencies.

D.2.5 Impulse

Impulse is a metric used to describe the pressure and time component of a pressure wave. Impulse is typically only considered for high energy exposures to impulsive sources, such as exposures close to explosives. Specifically, positive impulse is the time integral of the initial peak positive pressure with units of Pascal-seconds (Pa-s). Impulse is a measured quantity that is distinct from the term “impulsive,” which is not a measurement term, but rather describes a type of sound (see Section D.1.5, Impulsive Versus Non-Impulsive Sounds).

D.3 Predicting How Sound Travels

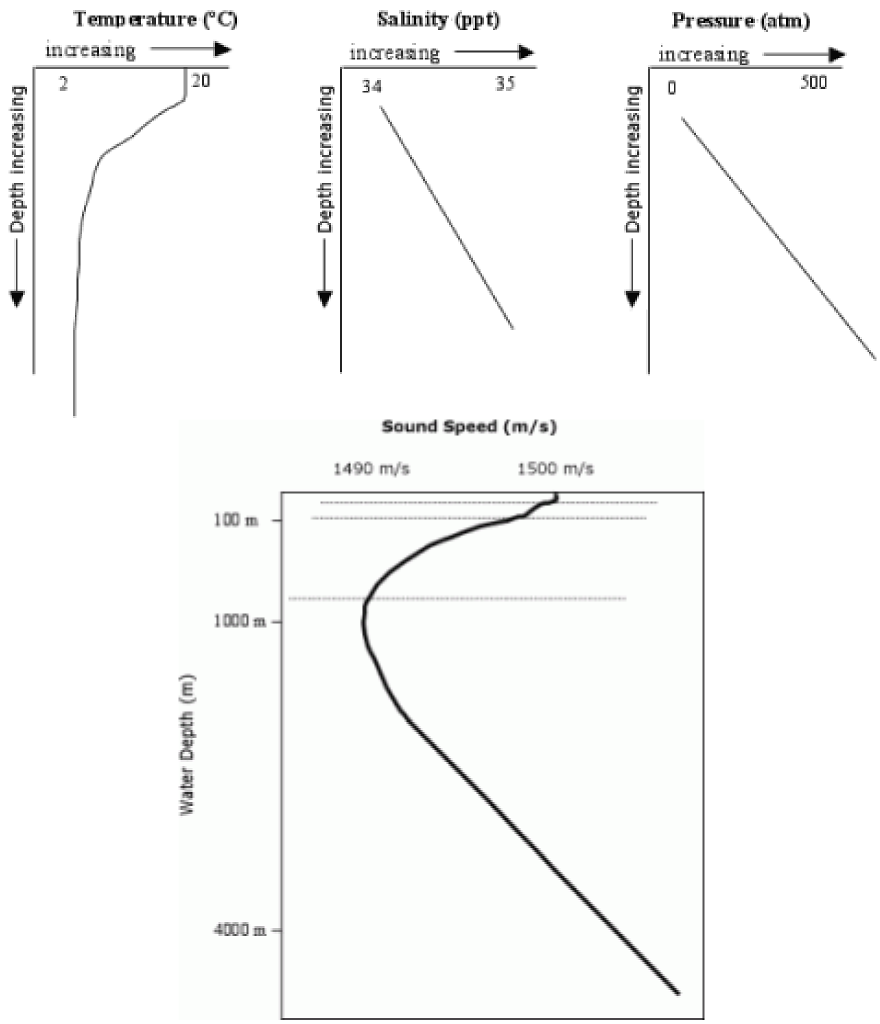
While the concept of a sound wave traveling from its source to a receptor is relatively simple, sound propagation is quite complex because of the simultaneous presence of numerous sound waves of different frequencies and source levels, and other phenomena such as reflections of sound waves and subsequent constructive (additive) or destructive (cancelling) interferences between reflected and incident waves. Other factors such as refraction, diffraction, bottom types, and surface conditions also affect sound propagation. While simple examples are provided here for illustration, the Navy Acoustic Effects Model used to quantify acoustic exposures to marine mammals and sea turtles takes into account the influence of multiple factors to predict acoustic propagation [see technical report *Quantitative Analysis for Estimating Acoustic and Explosive Impacts to Marine Mammals and Sea Turtles* (U.S. Department of the Navy, 2017a)].

D.3.1 Speed of Sound

The speed of sound is not affected by the SPL or frequency of the sound, but rather depends wholly on characteristics of the medium through which it is passing (e.g., the density and the compressibility). Sound travels faster through a medium that is harder to compress. For example, water is more difficult to compress than air, and sound travels approximately 340 m/s in air and 1,500 m/s in seawater.

The speed of sound in air is primarily influenced by temperature, relative humidity, and pressure, because these factors affect the density and compressibility of air. Generally, the speed of sound in air increases as air temperature increases.

The speed of sound in seawater also increases with increasing temperature and, to a lesser degree, with increasing hydrostatic pressure and salinity. Figure D-4 shows an example of how these attributes can change with depth. In seawater, temperature has the most important effect on sound speed for depths less than about 300 m. Below 1,500 m, the increasing hydrostatic pressure is the dominant factor because the water temperature is relatively constant. The variation of sound speed with depth in the ocean is called a sound velocity profile.



Source: Diogou (2014)

Figure D-4: Sound Velocity Profile (Sound Speed) Is Related to Temperature, Salinity, and Hydrostatic Pressure of Seawater

D.3.2 Source Directivity

Most sonar and other active acoustic sources do not radiate sound in all directions. Rather, they emit sounds over a limited range of angles, in order to focus sound energy on a specific area or object of interest. The specific angles are sometimes given as horizontal or vertical beam width. Some sources can be described qualitatively as “forward-looking,” when sound energy is radiated in a limited direction in front of the source, or “downward-looking,” when sound energy is directed toward the bottom.

D.3.3 Transmission Loss

As a sound wave passes through a medium, the sound level decreases with distance from the sound source. This phenomenon is known as transmission loss (TL). The transmission loss is used to relate the source SPL (SL), defined as the SPL produced by a sound source at a distance of one meter, and the received SPL (RL) at a particular location, as follows:

$$RL = SL – TL$$

The main contributors to transmission loss are as follows (Urick, 1983):

- Geometric spreading of the sound wave as it propagates away from the source
- Sound absorption (conversion of sound energy into heat)
- Scattering, diffraction, multipath interference, and boundary effects

D.3.3.1 Geometrical Spreading Loss

Spreading loss is a geometric effect representing regular weakening of a sound wave as it spreads out from a source. Spreading describes the reduction in sound pressure caused by the increase in surface area as the distance from a sound source increases. Spherical and cylindrical spreading are common types of spreading loss.

In the simple case of sound propagating from a point source without obstruction or reflection, the sound waves take on the shape of an expanding sphere. An example of spherical spreading loss is shown in Figure D-5. As spherical propagation continues, the sound energy is distributed over an ever-larger area following the inverse square law: the pressure of a sound wave decreases inversely with the square of the distance between the source and the receptor. For example, doubling the distance between the receptor and a sound source results in a reduction in the pressure of the sound to one-fourth of its initial value; tripling the distance results in one-ninth of the original pressure, and so on. Since the surface area of a sphere is $4\pi r^2$, where r is the sphere radius, the change in SPL with distance r from the source is proportional to the radius squared. This relationship is known as the spherical spreading law. The transmission loss for spherical spreading between two locations is:

$$TL = 20 \log_{10}(r_2/r_1)$$

where r_1 and r_2 are distances from the source. Spherical spreading results in a 6 dB reduction in SPL for each doubling of distance from the sound source. For example, calculated transmission loss for spherical spreading is 40 dB at 100 m and 46 dB at 200 m.

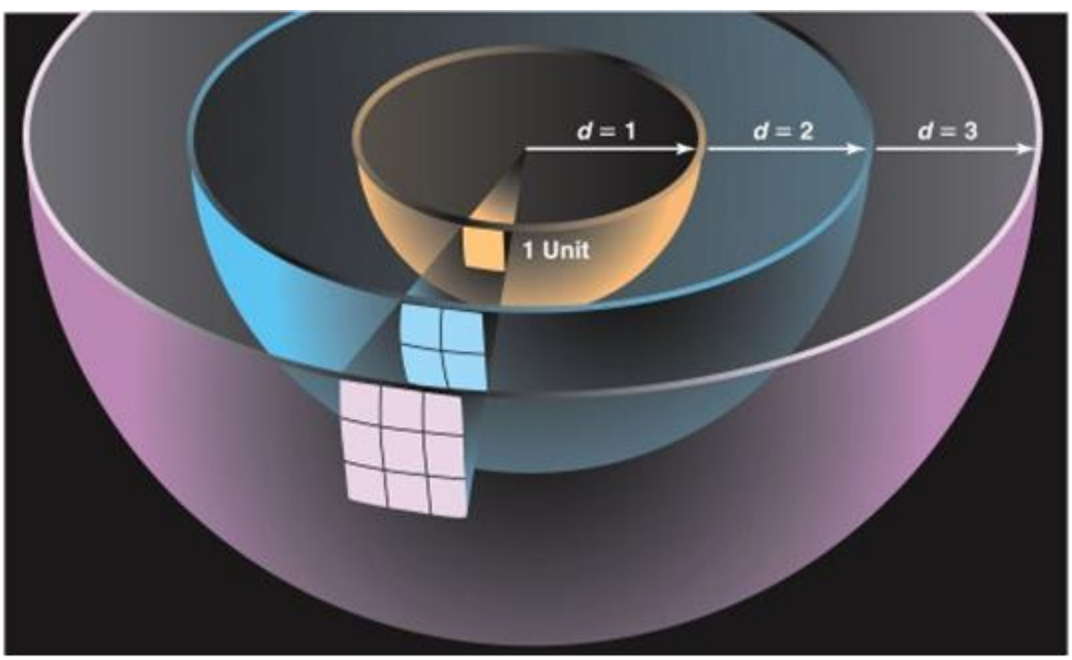


Figure D-5: Graphical Representation of the Inverse Square Relationship in Spherical Spreading

In cylindrical spreading, spherical waves expanding from the source are constrained by the water surface and the seafloor and take on a cylindrical shape. In this case the sound wave expands in the shape of a cylinder rather than a sphere, and the transmission loss is:

$$TL = 10\log_{10}(r_2/r_1)$$

Cylindrical spreading is an approximation of sound propagation in a water-filled channel with horizontal dimensions much larger than the depth. Cylindrical spreading predicts a 3 dB reduction in SPL for each doubling of distance from the source. For example, calculated transmission loss for cylindrical spreading is 30 dB at 1,000 m and 33 dB at 2,000 m.

The cylindrical and spherical spreading equations above represent two simple hypothetical cases. In reality, geometric spreading loss is more spherical near a source and more cylindrical with distance, and is better predicted using more complex models that account for environmental variables, such as the Navy Acoustic Effects Model [see technical report *Modeling and Quantitative Analysis of Acoustic and Explosive Impacts to Marine Species due to Navy Training and Testing Activities* (DON 2017)].

However, when conducting simple spreading loss calculations in near shore environments, "practical spreading loss" can be applied, where:

$$TL = 15\log_{10}(r_2/r_1)$$

Practical spreading loss accounts for other realistic losses in the environment, such as absorption and scattering, which are not accounted for in geometrical spreading.

D.3.3.2 Absorption

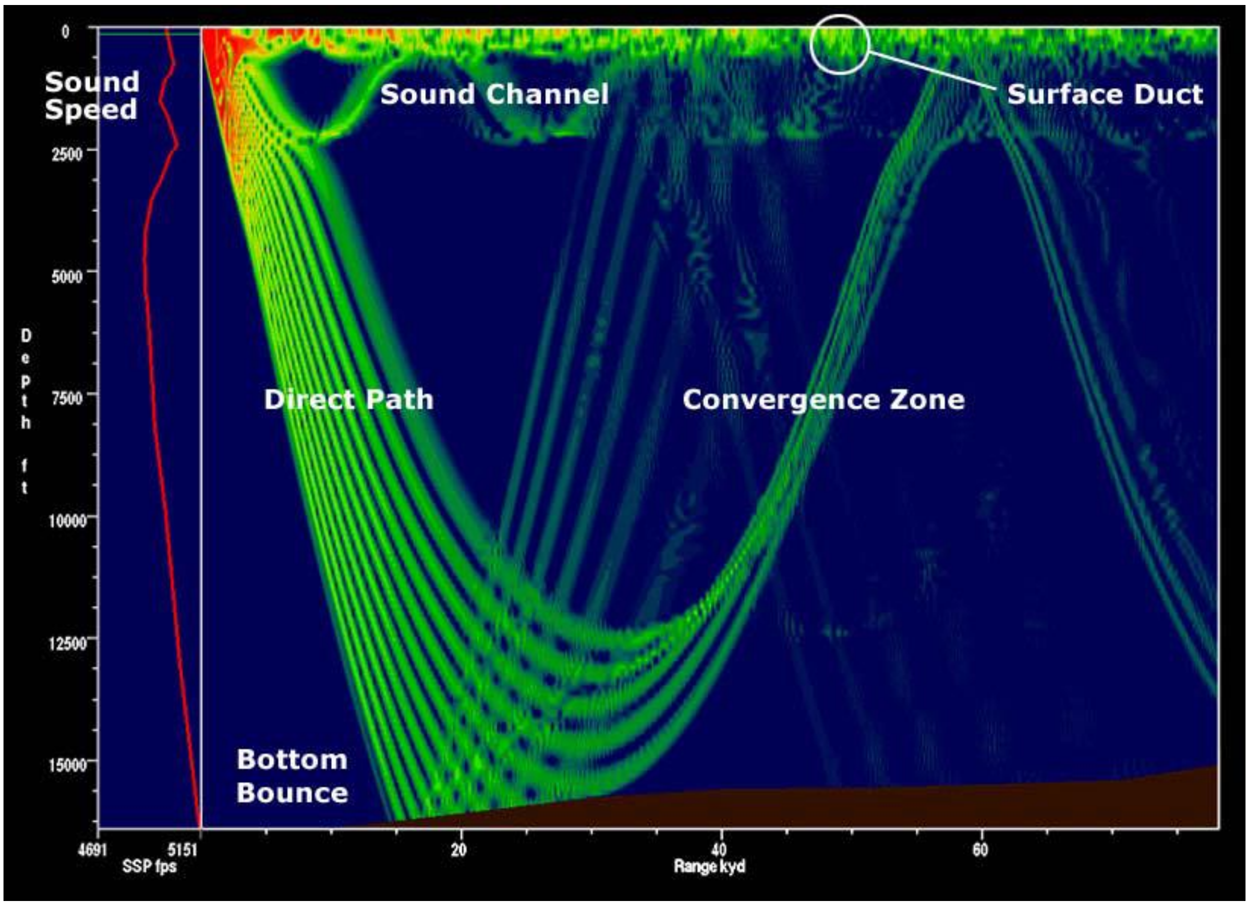
Absorption is the conversion of acoustic energy to kinetic energy in the particles of the propagation medium (Urick, 1983). Absorption is directly related to sound frequency, with higher frequencies having higher rates of absorption. Absorption rates range from 0.07 dB/km for a 1 kHz sound to about 30 dB/km for a 100 kHz sound. Therefore, absorption is the cause of a significant amount of attenuation for high and very high frequency sound sources, reducing the distance over which these sources may be perceived compared to mid- and low-frequency sound sources with the same source level.

D.3.3.3 Refraction

When a sound wave propagating in a medium encounters a second medium with a different density (e.g., the air-water boundary), part of the incident sound will be reflected back into the first medium and part will be transmitted into the second medium (Kinsler et al., 1982). The propagation direction will change as the sound wave enters the second medium; this phenomenon is called refraction. Refraction may also occur within a single medium if the properties of the medium change enough to cause a variation in the sound speed. Refraction of sound resulting from spatial variations in the sound speed is one of the most important phenomena that affect sound propagation in water (Urick, 1983).

As discussed in Section D.3.1 (Speed of Sound), the sound speed in the ocean primarily depends on hydrostatic pressure (i.e., depth) and temperature. Although the actual variations in sound speed are small, the existence of sound speed gradients in the ocean has an enormous effect on the propagation of sound in the ocean. If one pictures sound as rays emanating from an underwater source, the propagation of these rays changes as a function of the sound speed profile in the water column. Specifically, the directions of the rays bend toward regions of slower sound speed. This phenomenon creates ducts in which sound becomes "trapped," allowing it to propagate with high efficiency for large distances within certain depth boundaries. During winter months, the reduced sound speed at the surface due to cooling can create a surface duct that efficiently propagates sound such as commercial shipping noise (Figure D-6). Sources located within this surface duct can have their sounds trapped, but sources located below this layer would have their sounds refracted downward. The deep sound channel, or sound frequency and ranging (SOFAR) channel, is another duct that exists where sound speeds are slowest deeper in the water column (600–1,200 m depth at the mid-latitudes).

Similarly, the path of sound will bend toward regions of lower sound speed in air. Air temperature typically decreases with altitude, meaning sounds produced in air tend to bend skyward. When an atmospheric temperature inversion is present, air is cooler near the earth's surface. In inversion conditions, sound waves near the earth's surface will tend to refract downward.



Note: 1 kiloyard (kyd) = 0.9 km

Figure D-6: Sound Propagation Showing Multipath Propagation and Conditions for Surface Duct

D.3.3.4 Reflection and Multipath Propagation

In multipath propagation, sound may not only travel a direct path (with no reflection) from a source to a receiver, but also be reflected from the surface or bottom multiple times before reaching the receiver (Urick, 1983). Reflection is shown in Figure D-6 at the seafloor (bottom bounce) and at the water surface. At some distances, the reflected wave will be in phase with the direct wave (their waveforms add together) and at other distances the two waves will be out of phase (their waveforms cancel). The existence of multiple sound paths, or rays, arriving at a single point can result in multipath interference, a condition that permits the addition and cancellation between sound waves, resulting in the fluctuation of sound levels over short distances.

Reflection plays an important role in the pressures observed at different locations in the water column. Near the bottom, the direct path pressure wave may sum with the bottom-reflected pressure wave, increasing the exposure. Near the surface, however, the surface-reflected pressure wave may destructively interfere with the direct path pressure wave, "cutting off" the wave and reducing exposure (called the Lloyd mirror effect). This can cause the sound level to decrease dramatically within the top few meters of the water column.

D.3.3.5 Diffraction, Scattering, and Reverberation

Diffraction, scattering, and reverberation are examples of what happens when sound waves interact with obstacles in the propagation path.

Diffraction may be thought of as the change of direction of a sound wave as it passes around an obstacle. Diffraction depends on the size of the obstacle and the sound frequency. The wavelength of the sound must be larger than the obstacle for notable diffraction to occur. If the obstacle is larger than the wavelength of sound, an acoustic shadow zone will exist behind the obstacle where the sound is unlikely to be detected. Common examples of diffraction include sound heard from a source around the corner of a building and sound propagating through a small gap in an otherwise closed door or window.

An obstacle or inhomogeneity (e.g., smoke, suspended particles, gas bubbles due to waves, and marine life) in the path of a sound wave causes scattering as these inhomogeneities reradiate incident sound in a variety of directions (Urick, 1983). Reverberation refers to the prolongation of a sound, after the source has stopped emitting, caused by multiple reflections at water boundaries (surface and bottom) and scattering.

D.3.3.6 Surface and Bottom Effects

Because the sea surface reflects and scatters sound, it has a major effect on the propagation of underwater sound in applications where either the source or receiver is at a shallow depth (Urick, 1983). If the sea surface is smooth, the reflected sound pressure is nearly equal to the incident sound pressure; however, if the sea surface is rough, the amplitude of the reflected sound wave will be reduced. Sound waves reflected from the sea surface experience a phase reversal. When the surface-reflected waves interact with the direct path waves near the surface, a destructive interference pattern is created in which the received pressure approaches zero.

The sea bottom is also a reflecting and scattering surface, similar to the sea surface. Sound interaction with the sea bottom is more complex, however, primarily because the acoustic properties of the sea bottom are more variable and the bottom is often layered into regions of differing density. As sound travels into the seafloor it reflects off of these different density layers in complex ways. For sources in contact with the bottom, such as during pile driving or bottom-placed explosives, a ground wave is produced that travels through the bottom sediment and may refract back into the water column.

For a hard bottom such as rock, the reflected wave will be approximately in phase with the incident wave. Thus, near the ocean bottom, the incident and reflected sound pressures may add together (constructive interference), resulting in an increased sound pressure near the sea bottom. Soft bottoms such as mud or sediment absorb sound waves and reduce the level in the water column overall.

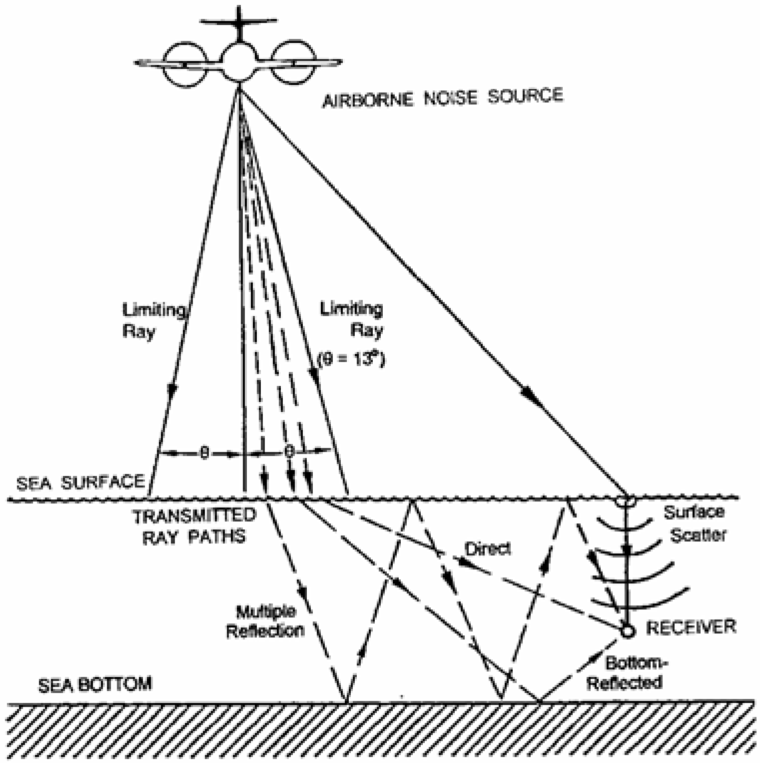
D.3.3.7 Air-Water Interface

Sound from aerial sources such as aircraft and weapons firing may be transmitted into the water under certain conditions. The most studied of these sources are fixed-wing aircraft and helicopters, which create noise with most energy below 500 Hz. Noise levels in water are highest at the surface and are highly dependent on the altitude of the aircraft and the angle at which the aerial sound encounters the ocean surface. Transmission of the sound once it is in the water is identical to any other sound as described in the sections above.

Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been addressed by Young (1973), Urick (1983), Richardson et al. (1995), Eller and Cavanagh (2000), Laney and Cavanagh (2000), and others. Sound is transmitted from an airborne source to a receptor underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) evanescent transmission in which sound travels laterally close to the water surface; and (4) scattering from interface roughness due to wave motion.

When sound waves in air meet the water surface, the sound can either be transmitted across the air-water boundary or reflected off the water surface. When sound waves meet the water at a perpendicular angle (e.g., straight down from an in-air source to a flat water surface), the sound waves are both transmitted directly across the water surface in the same direction of travel and reflected 180° back toward the original direction of travel. This can create a localized condition at the water surface where the incident and reflected waves sum, doubling the in-air overpressure (+ 6 dB). As the incident angle of the in-air sound wave changes from perpendicular, this phenomenon is reduced, ultimately reaching the angle where sound waves are parallel to the water surface and there is no surface reflection.

The sound that enters the water is refracted due to the difference in sound velocity between air and water, as shown in Figure D-7. As the angle of the in-air incident wave moves away from perpendicular, the direction of travel of the underwater refracted waves becomes closer to parallel to the water surface. When the incident angle is reached where the underwater refracted sound wave is parallel to the water surface, all of the sound is reflected back into the air and no sound enters the water. This occurs at an angle of about 13-14°. As a result, most of the acoustic energy transmitted into the water through a relatively narrow cone extending vertically downward from the in-air source. The width of the footprint would be a function of the source altitude. Lesser amounts of sound may enter the water outside of this cone due to surface scattering (e.g., from water surface waves that can vary the angle of incidence over an area) and as evanescent waves that are only present very near the surface.



Source: Richardson et al. 1995

Figure D-7: Characteristics of Sound Transmission Through the Air-Water Interface

If a sound wave is ideally transmitted into water (that is, with no surface transmission loss, such as due to foamy, wave conditions that could decrease sound entering the water), the sound pressure level underwater is calculated by changing the pressure reference unit from 20 µPa in air to 1 µPa in water. For a sound with the same pressure in air and water, this calculation results in a +26 dB sound pressure level in water compared to air. For this reason, sound pressure levels in water and sound pressure levels in air should never be directly compared.

D.4 Auditory Perception

Animals with an eardrum or similar structure, including mammals, birds, and reptiles, directly detect the pressure component of sound. Some marine fish also have specializations to detect pressure changes, although most invertebrates and many marine fish do not have anatomical structures that enable them to detect the pressure component of sound and are only sensitive to the particle motion component of sound. This difference in acoustic energy sensing mechanisms limits the range at which these animals can detect most sound sources analyzed in this document. This is because far from a sound source (i.e., in the far field), particle velocity and sound pressure are directly proportional. But close to a source (i.e., in the near field), particle velocity increases relative to sound pressure and may become more detectable to certain animals. As sound frequency increases, the wavelength becomes shorter, resulting in a smaller near field.

Because mammalian ears can detect large pressure ranges and humans judge the relative loudness of sounds by the ratio of the sound pressures (a logarithmic behavior), sound amplitude is described by the SPL, calculated by taking the logarithm of the ratio of the sound pressure to a reference pressure (see

Section D.2.2, Sound Pressure Level). Use of a logarithmic scale compresses the wide range of pressure values into a more usable numerical scale. On the decibel scale, the smallest audible sound in air (near total silence) to a human is 0 dB re 20 µPa. If the sound intensity increases by a factor of 10, the SPL would increase to 10 dB re 20 µPa. If the sound intensity increases by a factor of 100, the SPL would increase to 20 dB re 20 µPa, and if the sound intensity increases by a factor of 1000, the SPL would be 30 dB re 20 µPa. A quiet conversation has an SPL of about 50 dB re 20 µPa, while the threshold of pain is around 120–140 dB re 20 µPa.

As described in Section D.2.2 (Sound Pressure Level), SPLs under water differ from those in air because they rely on different reference pressures in their calculation; therefore, the two should never be directly compared.

While sound pressure and frequency are physical measure of the sound, loudness is a subjective attribute that varies with not only sound pressure but also other attributes of the sound, such as frequency. For example, a human listener would perceive a 60 dB re 20 µPa sound at 2 kHz to be louder than a 60 dB re 20 µPa sound at 50 Hz, even though the SPLs are identical. This effect is most noticeable at lower sound pressure levels; however, at very high sound pressure levels, the difference in perceived loudness at different frequencies becomes smaller.

To account for differences in hearing sensitivity at various frequencies, acoustic risk analyses commonly use auditory weighting functions—mathematical functions that adjust (or “weight”) received sound levels across sound frequency based on how the listener’s sensitivity or susceptibility to sound changes at different frequencies. For humans, the most common weighting function is called “A-weighting” (see Figure D-8). A-weighted sound levels are specified in units of “dBA” (A-weighted decibels). For example, if the unweighted received level of a 500 Hz tone at a human receiver was 90 dB re 20 µPa, the A-weighted sound level would be 90 dB – 3 dB = 87 dBA because the A-weighting function amplitude at 500 Hz is -3 dB. Many measurements of sound in air appear as A-weighted decibels in the literature because the intent of the authors is to assess noise impacts on humans.

The auditory weighting concept can be applied to other species. When used in analyzing the impacts of sound on an animal, auditory weighting functions adjust received sound levels to emphasize ranges of best hearing and de-emphasize ranges of less or no sensitivity. Auditory weighting functions were developed for marine mammals and sea turtles and are used to assess acoustic impacts. For more information on weighting functions and their derivation for this analysis see technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis* (U.S. Department of the Navy, 2017b).

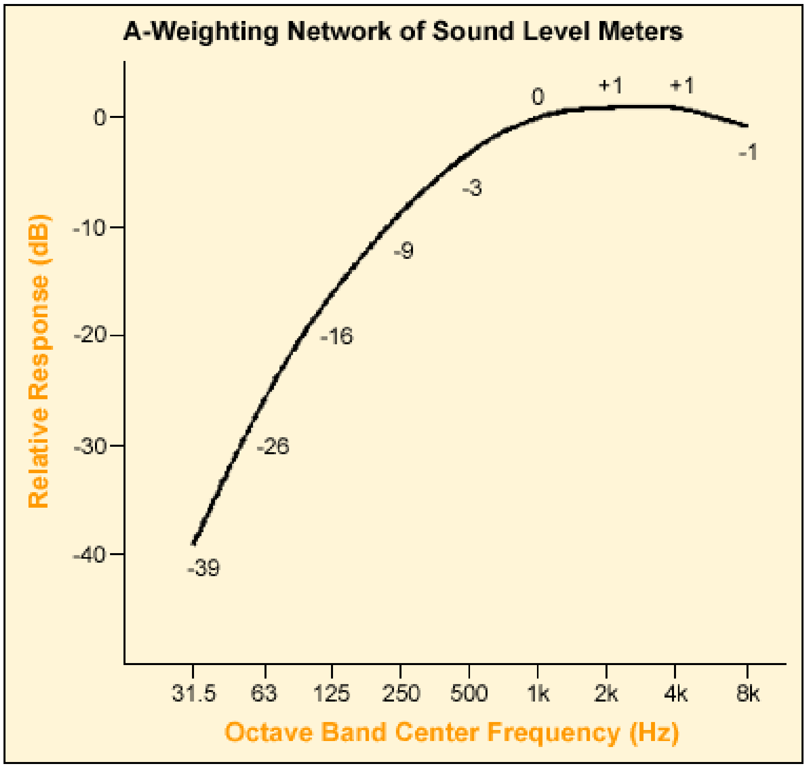


Figure D-8: A-weighting for Human Hearing of Sounds in Air (OSHA). The Numbers Along the Curve Indicate How a Received Sound Level Would Be Adjusted at that Frequency.

D.5 Explosives

Explosive materials used in Navy testing and training activities are either (1) "high explosives," sometimes referred to as HE, which means that the explosive material has a very fast rate of detonation (exceeding the speed of sound), or (2) low explosives, which exhibit a relatively slow burn, or deflagration, such as black powder. Because low explosives are typically used in small quantities and have less destructive power, the below discussion focuses on high explosives.

This rate of detonation of a high explosive is highly supersonic, producing a high pressure, steep instantaneous shock wave front travelling through the explosive material. This shock front is produced by the supersonic expansion of the explosive products, but as the shock front travels away from the immediate area of the detonation, it begins to behave as an acoustic wave front travelling at the speed of sound.

The near-instantaneous rise from ambient to an extremely high peak pressure is what makes the explosive shock wave potentially damaging. The area under this positive pressure duration is calculated as the positive impulse.

The positive pressure produced by an explosion is also referred to as the overpressure. As the shock front passes a location, the positive pressure exponentially decays, as shown in Figure D-9. As the shock front travels away from the detonation, the waveform is stretched—the peak pressure decreases while the positive duration increases. The reduction in peak pressure reduces the rate at which the positive impulse is received. Both the reduction in peak pressure and stretching of the positive impulse reduce the potential for injury. In addition, absorption losses of higher frequencies over distance results in a softening of the shock front, such that the rise to peak pressure is no longer near-instantaneous.

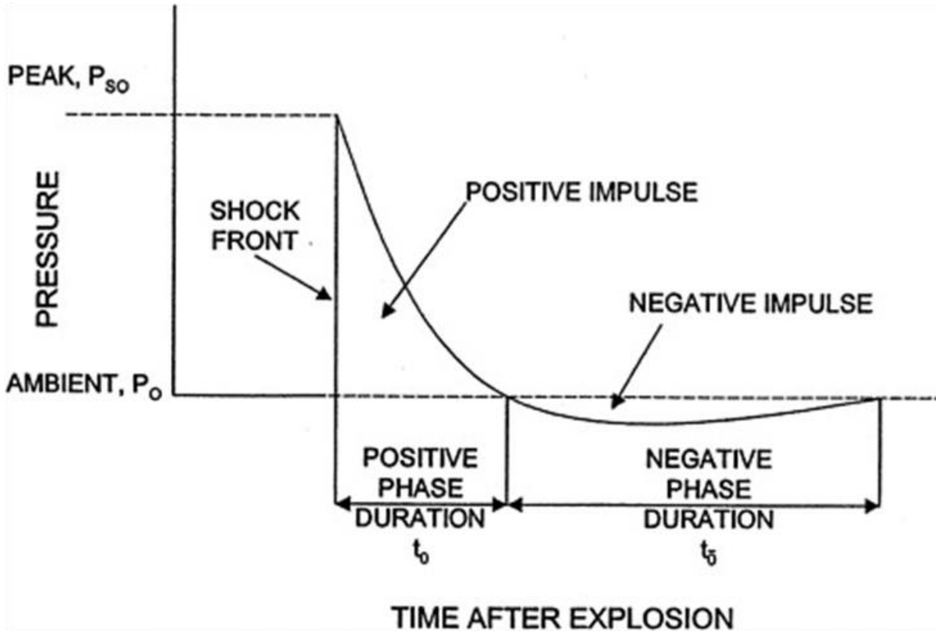


Figure D-9: Impulse Shown as a Function of Pressure over Duration at a Specific Location

The peak pressure experienced by a receptor (i.e., an animal) is a function of the explosive material, the net explosive weight, and the distance from the charge. Net explosive weight (NEW) is a way to classify and compare quantities of different explosive compounds. The net explosive weight for a charge is the energetic equivalent weight of trinitrotoluene (TNT). In general, shock wave effects near an explosive charge increase in proportion to the cube root of the explosive weight (Young, 1991). For example, shock wave impacts will double when the explosive charge weight is increased by a factor of eight (i.e., cube root of eight equals two). This relationship is known as the similarity principle, and the corresponding similitude equations allow for prediction of various explosive metrics for a given charge weight and material.

The similitude equations allow for a simple prediction of peak pressure in a uniform free field environment, and sources are provided below for using these equations for estimating explosive effects in air and in water. However, at longer distances or in more complex environments with boundaries and variations in the propagation medium, explosive propagation modeling is preferred.

D.5.1 Explosions in Air

Explosions in air produce an initial blast front that propagates away from the detonation. When pressure waves from an explosion in air meet the water surface, the pressure wave can be transmitted across the air-water boundary and reflected off the water surface. When pressure waves in air meet the water at a perpendicular angle (e.g., straight down from an in-air source to a flat water surface), the sound waves are both transmitted directly across the water surface in the same direction of travel and reflected 180° back toward the original direction of travel. For acoustic waves, this can create a localized condition at the water surface where the incident and reflected waves sum, doubling the in-air overpressure (+ 6 dB). For shock waves with high incident pressures travelling at supersonic speeds, the reflection from the water surface depends on the angle of incidence and the speed of the shock wave, and the reflected shock wave pressure can be greater than the incident shock wave pressure (Kinney & Graham, 1985; U.S. Department of the Navy, 1975).

In certain explosive geometries, depending on the size of the explosive and its height of detonation, a combined shock wave, called a Mach stem, can be created by the summing of the direct and reflected shock waves at larger angles of incidence (Kinney & Graham, 1985). In instances where this specific geometry does not occur, only the direct path wave is experienced because there is no surface reflection (waves are parallel to or angled away from the water surface, such as would occur when an explosive is detonated at the water surface), or separate direct and reflected pressure waves may be experienced.

D.5.1.1 Fragmentation

Missiles, rockets, projectiles, and other cased weapons will produce casing fragments upon detonation. These fragments may be of variable size and are ejected at supersonic speed from the detonation. The casing fragments will be ejected at velocities much greater than debris from any target due to the proximity of the casing to the explosive material. Unlike detonations on land targets, detonations during Navy training and testing would not result in other propelled materials such as crater debris.

Fragment density can be simply assumed to follow an inverse-square law with distance, in which the possibility of fragment strike is reduced by the square of the distance from the original detonation point. The forces of gravity and drag will further reduce the likelihood of strike with increasing distance than is accounted for in the inverse-square relationship (Zaker, 1975). The possible area of strike risk at any given distance from the detonation point is limited to the surface area of produced fragments, with drag and gravity reducing the number of produced fragments that travel to greater distances.

D.5.2 Explosions in Water

At the instant of explosion underwater, gas byproducts are generated at high pressure and temperature, creating a bubble. The heat causes a certain amount of water to vaporize, adding to the volume of the bubble. This action immediately begins to force the water in contact with the blast front in an outward direction, creating an intense, supersonic pressure shock wave. As the high-pressure wave travels away from the source, it slows to the speed of sound and acts like an acoustic wave similar to other impulsive sources that lack a strong shock wave (e.g., air guns). Explosions have the greatest amount of energy in lower frequencies below 500 Hz, although energy is present in frequencies exceeding 10 kHz (Urick, 1983). The higher frequency components exhibit more attenuation with distance due to absorption (see Section D.3.3.2, Absorption).

The shock wave caused by an explosion in deeper water may be followed by several bubble pulses in which the explosive byproduct gases expand and contract, with correlated high and low pressure oscillations. These bubble pulses lack the steep pressure front of the initial explosive pulse, but the first bubble pulse may still contribute to the total energy released at frequencies below 100 Hz (Urick, 1983). Subsequent bubble pulses contribute little to the total energy released during the explosion (Urick, 1983). If the detonation occurs at or just below the surface, a portion of the explosive power is released into the air and a pulsating gas bubble is not formed.

The pressure waves from an explosive can constructively add or destructively cancel each other in ocean environments with multi-path propagation, as described for acoustic waves in Section D.3.3.3 (Refraction) and Section D.3.3.4 (Reflection and Multipath Propagation). The received impulse is affected by the depth of the charge and the depth of the receiving animal. Pressure waves from the detonation may travel directly to the receiver or be reflected off the water surface before arriving at the receiver. If a charge is detonated closer to the surface or if an animal is closer to the surface, the time between the initial direct path arrival and the following surface-reflected tension wave arrival is reduced, resulting in a steep negative pressure cut-off of the initial direct path positive impulse exposure. Two animals at similar distances from a charge, therefore, may experience the same peak pressure but different levels of impulse at different depths.

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Appendix E Estimated Marine Mammal and Sea Turtle Impacts from Exposure to Acoustic and Explosive Stressors Under Navy Training and Testing Activities

Navy training and testing activities would result in the incidental takes of marine mammals and sea turtles within the Study Area. The following appendix provides the estimated number of marine mammal and sea turtle impacts. Specifically, estimated impacts are derived from the quantitative analysis for activities under Alternatives 1 and 2 that involve the use of acoustic or explosive stressors. The quantitative analysis takes into account Navy activities, marine species density layers, acoustic modeling, and other environmental parameters. A detailed explanation of the quantitative analysis is provided in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2017). It is important to note that *impacts*, as discussed in this appendix, represent the estimated instances of take of marine mammals or sea turtles, not necessarily the number of individuals impacted (i.e., some marine mammals or sea turtles could be impacted several times, while others would not experience any impact). The take tables below represent the minimum and maximum impacts under Alternative 1, and the maximum impacts under Alternative 2 for any given year and across a consecutive 7-year period. because the level of certain activities may vary annually as described in Chapter 2 (Description of Proposed Action and Alternatives), estimated impacts under Alternative 1 will also vary between nominal and maximum years. The variation in activity level under Alternative 2 is negligible therefore the difference in impacts are not presented. In addition, across training and testing activities, the 7-year total impacts in each table may be more or less than seven times the maximum impact in any year. Estimated impacts are provided over the duration of the Marine Mammal Protection Act (MMPA) Regulations and Letters of Authorization, which would be valid for a 7-year period.

E.1 Estimated Marine Mammal Impacts from Sonar and Other Transducers Under Navy Training Activities

Table E-1 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy training activities under Alternatives 1 and 2 over the course of a year.

Table E-1: Estimated Marine Mammals Impacts per Year from Sonar Training Activities

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Order Cetacea										
Suborder Mysticeti (baleen whales)										
Family Balaenopteridae (rorquals)										
Blue whale*	Eastern North Pacific	2	0	0	2	0	0	2	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	41	13	0	41	13	0	42	13	0
Sei whale*	Eastern North Pacific	16	14	0	16	14	0	16	14	0
Minke whale	Alaska	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	51	58	0	52	58	0	54	58	0
Humpback* whale	Central North Pacific	3	2	0	3	2	0	3	2	0
	California, Oregon, & Washington	3	2	0	3	2	0	3	2	0
Family Eschrichtiidae (gray whale)										
Gray whale	Eastern North Pacific	1	0	0	2	0	0	2	0	0
	Western North Pacific†	0	0	0	0	0	0	0	0	0

Table E-1: Estimated Marine Mammals Impacts per Year from Sonar Training Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Suborder Odontoceti (toothed whales)										
Family Delphinidae (dolphins)										
Bottlenose dolphin	California, Oregon, & Washington, Offshore	5	0	0	5	0	0	5	0	0
Killer whale	Alaska Resident	0	0	0	0	0	0	0	0	0
	Eastern North Pacific Offshore	67	1	0	67	1	0	69	1	0
	Northern Resident	0	0	0	0	0	0	0	0	0
	West Coast Transient	73	2	0	76	2	0	79	2	0
	Southern Resident†	2	0	0	2	0	0	3	0	0
Northern right whale dolphin	California, Oregon, & Washington	7,765	156	0	7,785	156	0	7,985	156	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	5,149	85	0	5,198	86	0	5,311	87	0
Risso's dolphin	California, Oregon, & Washington	2,234	46	0	2,240	46	0	2,301	46	0
Short-beaked common dolphin	California, Oregon, & Washington	1,133	25	0	1,140	25	0	1,152	25	0

Table E-1: Estimated Marine Mammals Impacts per Year from Sonar Training Activities (continued)

Species	Stock	*Alternative 1 – Minimum*			*Alternative 1 – Maximum*			*Alternative 2 – Maximum*		
		Behavioral Response	*TTS*	*PTS*	*Behavioral Response*	*TTS*	*PTS*	*Behavioral Response*	*TTS*	*PTS*
Short-finned pilot whale	California, Oregon, & Washington	57	0	0	57	0	0	58	0	0
Striped dolphin	California, Oregon, & Washington	424	13	0	426	13	0	432	13	0
Family Kogiidae (Kogia spp.)										
Pygmy sperm whale	California, Oregon, & Washington	182	160	0	183	160	0	188	161	0
Dwarf sperm whale	California, Oregon, & Washington	20	18	0	20	18	0	21	18	0
Family Phocoenidae (porpoises)										
Dall's porpoise	Alaska	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	6,871	6,346	5	6,911	6,368	6	7,088	6,419	6
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	212	87	0	212	87	0	273	99	0
	Northern California/ Southern Oregon	21	0	0	21	0	0	21	0	0
	Washington Inland Waters	6,607	3,409	12	8,010	4,244	16	9,977	5,196	19

Table E-1: Estimated Marine Mammals Impacts per Year from Sonar Training Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Family Physeteridae (sperm whale)										
Sperm whale*	California, Oregon, & Washington	508	2	0	510	2	0	519	2	0
Family Ziphiidae (beaked whales)										
Baird's beaked whale	California, Oregon, & Washington	553	0	0	556	0	0	559	0	0
Cuvier's beaked whale	California, Oregon, & Washington	1,456	1	0	1,461	1	0	1,497	1	0
Mesoplodon spp	California, Oregon, & Washington	648	1	0	651	1	0	666	1	0
Suborder Pinnipedia										
Family Otariidae (sea lions and fur seals)										
California sea lion	U.S. Stock	3,578	9	0	3,615	9	0	3,698	9	0
Steller sea lion	Eastern U.S.	103	1	0	107	1	0	114	1	0
Guadalupe fur seal*	Mexico	603	3	0	605	3	0	617	3	0
Northern fur seal	Eastern Pacific	2,125	4	0	2,130	4	0	2,162	4	0
	California	43	0	0	43	0	0	44	0	0

Table E-1: Estimated Marine Mammals Impacts per Year from Sonar Training Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Family Phocidae (true seals)										
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0	0
	Oregon/ Washington Coastal	0	0	0	0	0	0	1	0	0
	Washington Northern Inland Waters	262	112	0	436	203	0	509	227	0
	Hood Canal	2,298	332	0	2,334	348	0	2,881	417	0
	Southern Puget Sound	464	279	1	730	360	1	822	398	1
Northern elephant seal	California	1,691	209	0	1,698	209	0	1,735	209	0

* ESA-listed species (all stocks) within the NWTT Study Area. †Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.2 Estimated Marine Mammal Impacts per 7-Year Period from Sonar and Other Transducers Under Navy Training Activities

Table E-2 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy training activities under Alternatives 1 and 2 over the course of seven years.

Table E-2: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Training Activities

Species	*Stock*	*Alternative 1 – 7-year*			*Alternative 2 – 7-year*		
		Behavioral Response	*TTS*	*PTS*	*Behavioral Response*	*TTS*	*PTS*
Order Cetacea							
Suborder Mysticeti (baleen whales)							
Family Balaenopteridae (rorquals)							
Blue whale*	Eastern North Pacific	11	0	0	11	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0
	California, Oregon, & Washington	285	92	0	291	92	0
Sei whale*	Eastern North Pacific	111	95	0	114	95	0
Minke whale	Alaska	0	0	0	0	0	0
	California, Oregon, & Washington	360	407	0	376	407	0
Humpback whale*	Central North Pacific	18	13	0	20	13	0
	California, Oregon, & Washington	23	11	0	24	11	0
Family Eschrichtiidae (gray whale)							
Gray whale	Eastern North Pacific	10	0	0	14	0	0
	Western North Pacific†	0	0	0	0	0	0
Suborder Odontoceti (toothed whales)							
Family Delphinidae (dolphins)							
Bottlenose dolphin	California, Oregon, & Washington, Offshore	33	0	0	33	0	0

Table E-2: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Training Activities (continued)

Species	Stock	Alternative 1 – 7-year			Alternative 2 – 7-year		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Killer whale	Alaska Resident	0	0	0	0	0	0
	Eastern North Pacific Offshore	470	8	0	481	8	0
	Northern Resident	0	0	0	0	0	0
	West Coast Transient	525	13	0	554	15	0
	Southern Resident†	15	0	0	20	0	0
Northern right whale dolphin	California, Oregon, & Washington	54,399	1,094	0	55,894	1,095	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0
	California, Oregon, & Washington	36,187	601	0	37,180	606	0
Risso's dolphin	California, Oregon, & Washington	15,649	323	0	16,110	323	0
Short-beaked common dolphin	California, Oregon, & Washington	7,947	177	0	8,062	177	0
Short-finned pilot whale	California, Oregon, & Washington	398	0	0	403	0	0
Striped dolphin	California, Oregon, & Washington	2,970	89	0	3,026	89	0
Family Kogiidae (Kogia spp.)							
Pygmy sperm whale	California, Oregon, & Washington	1,278	1,120	0	1,316	1,124	0
Dwarf sperm whale	California, Oregon, & Washington	142	124	0	146	125	0

Table E-2: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Training Activities (continued)

Species	*Stock*	*Alternative 1 – 7-year*			*Alternative 2 – 7-year*		
		Behavioral Response	*TTS*	*PTS*	*Behavioral Response*	*TTS*	*PTS*
Family Phocoenidae (porpoises)							
Dall's porpoise	Alaska	0	0	0	0	0	0
	California, Oregon, & Washington	48,192	44,506	39	49,614	44,930	39
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	1,485	607	0	1,910	692	0
	Northern California/ Southern Oregon	145	0	0	145	0	0
	Washington Inland Waters	52,137	27,369	103	69,828	36,364	134
Family Physeteridae (sperm whale)							
Sperm whale*	California, Oregon, & Washington	3,562	12	0	3,636	12	0
Family Ziphiidae (beaked whales)							
Baird's beaked whale	California, Oregon, & Washington	3,875	0	0	3,913	0	0
Cuvier's beaked whale	California, Oregon, & Washington	10,202	7	0	10,480	7	0
Mesoplodon spp	California, Oregon, & Washington	4,544	5	0	4,662	5	0
Suborder Pinnipedia							
Family Otariidae (sea lions and fur seals)							
California sea lion	U.S. Stock	25,179	64	0	25,884	64	0
Steller sea lion	Eastern U.S.	738	5	0	799	5	0
Guadalupe fur seal*	Mexico	4,226	21	0	4,322	21	0
Northern fur seal	Eastern Pacific	14,885	26	0	15,137	26	0
	California	300	0	0	305	0	0

Table E-2: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Training Activities (continued)

Species	Stock	Alternative 1 – 7-year			Alternative 2 – 7-year		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Family Phocidae (true seals)							
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0
	California	0	0	0	0	0	0
	Oregon/ Washington Coastal	0	0	0	5	0	0
	Washington Northern Inland Waters	2,564	1,165	0	3,561	1,591	0
	Hood Canal	16,238	2,394	0	20,167	2,916	0
	Southern Puget Sound	4,364	2,293	6	5,749	2,788	6
Northern elephant seal	California	11,851	1,462	0	12,142	1,464	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.3 Estimated Marine Mammal Impacts from Sonar and Other Transducers Under Navy Testing Activities

Table E-3 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy testing activities under Alternatives 1 and 2 over the course of a year.

Table E-3: Estimated Marine Mammals Impacts per Year from Sonar Testing Activities

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Order Cetacea										
Suborder Mysticeti (baleen whales)										
Family Balaenopteridae (rorquals)										
Blue whale*	Eastern North Pacific	2	3	0	3	4	0	4	4	0
Fin whale*	Northeast Pacific	1	1	0	1	1	0	1	1	0
	California, Oregon, & Washington	24	17	0	44	29	0	58	36	0
Sei whale*	Eastern North Pacific	10	21	0	17	36	0	22	46	0
Minke whale	Alaska	0	1	0	1	1	0	1	1	0
	California, Oregon, & Washington	34	75	0	56	133	0	71	170	0
Humpback whale*	Central North Pacific	32	44	0	46	71	0	58	93	0
	California, Oregon, & Washington	26	33	0	38	56	0	48	72	0

Table E-3: Estimated Marine Mammals Impacts per Year from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Family Eschrichtiidae (gray whale)										
Gray whale	Eastern North Pacific	30	9	0	65	85	0	85	140	0
	Western North Pacific†	0	0	0	1	1	0	1	1	0
Suborder Odontoceti (toothed whales)										
Family Delphinidae (dolphins)										
Bottlenose dolphin	California, Oregon, & Washington, Offshore	2	0	0	3	0	0	5	0	0
Killer whale	Alaska Resident	27	0	0	34	0	0	40	0	0
	Eastern North Pacific Offshore	47	3	0	86	4	0	112	5	0
	Northern Resident	0	0	0	0	0	0	0	0	0
	West Coast Transient	91	18	0	136	20	0	168	22	0
	Southern Resident†	0	0	0	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	7,584	711	1	12,018	847	1	15,176	933	1

Table E-3: Estimated Marine Mammals Impacts per Year from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Pacific white-sided dolphin	North Pacific	80	0	0	101	0	0	117	0	0
	California, Oregon, & Washington	8,714	1,088	1	13,809	1,278	1	17,532	1,403	1
Risso's dolphin	California, Oregon, & Washington	2,358	181	0	3,920	248	0	5,071	290	0
Short-beaked common dolphin	California, Oregon, & Washington	329	3	0	963	21	0	1,317	24	0
Short-finned pilot whale	California, Oregon, & Washington	14	0	0	31	1	0	42	1	0
Striped dolphin	California, Oregon, & Washington	125	3	0	336	7	0	465	9	0
Family Kogiidae (Kogia spp.)										
Pygmy sperm whale	California, Oregon, & Washington	101	162	0	145	306	0	178	407	1
Dwarf sperm whale	California, Oregon, & Washington	11	18	0	16	34	0	20	45	0
Family Phocoenidae (porpoises)										
Dall's porpoise	Alaska	140	341	0	179	459	0	204	574	0
	California, Oregon, & Washington	4,672	7,507	17	6,530	13,837	25	7,843	18,206	31

Table E-3: Estimated Marine Mammals Impacts per Year from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Harbor porpoise	Southeast Alaska	79	28	0	92	38	0	102	47	0
	Northern Oregon/ Washington Coast	25,360	13,812	15	39,304	24,976	34	49,607	33,824	48
	Northern California/ Southern Oregon	1,545	134	0	1,579	134	0	1,582	134	0
	Washington Inland Waters	7,061	9,747	131	7,353	10,284	137	8,428	10,890	147
Family Physeteridae (sperm whale)										
Sperm whale*	California, Oregon, & Washington	164	3	0	319	3	0	418	4	0
Family Ziphiidae (beaked whales)										
Baird's beaked whale	California, Oregon, & Washington	188	0	0	420	0	0	578	1	0
Cuvier's beaked whale	California, Oregon, & Washington	592	3	0	1,072	3	0	1,391	4	0
Mesoplodon spp	California, Oregon, & Washington	258	1	0	467	2	0	606	2	0
Suborder Pinnipedia										
Family Otariidae (sea lions and fur seals)										
California sea lion	U.S. Stock	12,072	314	0	23,653	337	0	32,475	352	0
Steller sea lion	Eastern U.S.	1,557	3	0	3,027	6	0	4,151	8	0

Table E-3: Estimated Marine Mammals Impacts per Year from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum			Alternative 1 – Maximum			Alternative 2 – Maximum		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Guadalupe fur seal*	Mexico	487	9	0	892	10	0	1,168	10	0
Northern fur seal	Eastern Pacific	5,628	122	0	8,424	125	0	10,485	126	0
	California	114	1	0	169	1	0	209	1	0
Family Phocidae (true seals)										
Harbor seal	Southeast Alaska - Clarence Strait	1,497	238	0	2,077	275	0	2,513	312	0
	California	38	0	0	38	0	0	38	0	0
	Oregon/ Washington Coastal	683	424	0	1,350	1,766	0	1,760	2,777	0
	Washington Northern Inland Waters	434	144	0	434	144	0	434	144	0
	Hood Canal	34,158	22,109	0	36,927	23,667	0	38,645	26,574	0
	Southern Puget Sound	2,505	3,196	3	2,544	3,204	3	2,565	3,204	3
Northern elephant seal	California	1,458	294	0	2,437	578	0	3,137	762	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.4 Estimated Marine Mammal Impacts per 7-Year Period from Sonar and Other Transducers Under Navy Testing Activities

Table E-4 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy testing activities under Alternatives 1 and 2 over the course of seven years.

Table E-4: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Testing Activities

Species	Stock	*Alternative 1 – 7-year*			*Alternative 2 – 7-year*		
		Behavioral Response	*TTS*	*PTS*	*Behavioral Response*	*TTS*	*PTS*
Order Cetacea							
Suborder Mysticeti (baleen whales)							
Family Balaenopteridae (rorquals)							
Blue whale*	Eastern North Pacific	15	21	0	21	25	0
Fin whale*	Northeast Pacific	5	5	0	7	6	0
	California, Oregon, & Washington	201	140	0	306	191	0
Sei whale*	Eastern North Pacific	80	171	0	118	239	0
Minke whale	Alaska	4	5	0	5	6	0
	California, Oregon, & Washington	272	622	0	389	875	0
Humpback whale*	Central North Pacific	243	351	0	332	497	0
	California, Oregon, & Washington	198	266	0	266	374	0
Family Eschrichtiidae (gray whale)							
Gray whale	Eastern North Pacific	272	184	0	447	530	0
	Western North Pacific†	2	2	0	4	5	0
Suborder Odontoceti (toothed whales)							
Family Delphinidae (dolphins)							
Bottlenose dolphin	California, Oregon, & Washington, Offshore	14	0	0	22	0	0

Table E-4: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – 7-year			Alternative 2 – 7-year		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Killer whale	Alaska Resident	202	0	0	279	0	0
	Eastern North Pacific Offshore	391	24	0	586	27	0
	Northern Resident	0	0	0	0	0	0
	West Coast Transient	713	133	0	968	152	0
	Southern Resident†	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	59,792	5,201	7	81,951	5,805	7
Pacific white-sided dolphin	North Pacific	603	0	0	817	0	0
	California, Oregon, & Washington	68,415	7,908	8	94,235	8,782	8
Risso's dolphin	California, Oregon, & Washington	18,726	1,374	0	26,633	1,674	0
Short-beaked common dolphin	California, Oregon, & Washington	3,384	58	0	6,427	126	0
Short-finned pilot whale	California, Oregon, & Washington	128	2	0	213	4	0
Striped dolphin	California, Oregon, & Washington	1,264	29	0	2,262	43	0
Family Kogiidae (Kogia spp.)							
Pygmy sperm whale	California, Oregon, & Washington	767	1,370	0	1,023	2,061	3
Dwarf sperm whale	California, Oregon, & Washington	85	152	0	114	229	0

Table E-4: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Testing Activities (continued)

Species	Stock	*Alternative 1 – 7-year*			*Alternative 2 – 7-year*		
		Behavioral Response	***TTS***	***PTS***	***Behavioral Response***	***TTS***	***PTS***
Family Phocoenidae (porpoises)							
Dall's porpoise	Alaska	1,047	2,664	0	1,417	4,015	0
	California, Oregon, & Washington	35,244	62,827	128	45,614	92,834	169
Harbor porpoise	Southeast Alaska	576	218	0	708	332	0
	Northern Oregon/ Washington Coast	193,333	113,581	130	276,511	168,232	224
	Northern California/ Southern Oregon	9,930	671	0	10,078	673	0
	Washington Inland Waters	49,240	68,574	930	57,998	74,967	1,022
Family Physeteridae (sperm whale)							
Sperm whale*	California, Oregon, & Washington	1,416	19	0	2,200	23	0
Family Ziphiidae (beaked whales)							
Baird's beaked whale	California, Oregon, & Washington	1,738	0	0	2,947	2	0
Cuvier's beaked whale	California, Oregon, & Washington	4,971	20	0	7,367	23	0
Mesoplodon spp	California, Oregon, & Washington	2,167	11	0	3,203	14	0
Suborder Pinnipedia							
Family Otariidae (sea lions and fur seals)							
California sea lion	U.S. Stock	101,038	2,236	0	159,932	2,338	0
Steller sea lion	Eastern U.S.	12,963	29	0	21,072	41	0
Guadalupe fur seal*	Mexico	4,027	64	0	6,020	68	0
Northern fur seal	Eastern Pacific	43,420	858	0	57,641	870	0
	California	879	9	0	1,154	9	0

Table E-4: Estimated Marine Mammals Impacts per 7-Year Period from Sonar Testing Activities (continued)

Species	Stock	Alternative 1 – 7-year			Alternative 2 – 7-year		
		Behavioral Response	TTS	PTS	Behavioral Response	TTS	PTS
Family Phocidae (true seals)							
Harbor seal	Southeast Alaska - Clarence Strait	11,630	1,754	0	17,511	2,181	0
	California	191	0	0	191	0	0
	Oregon/ Washington Coastal	5,830	5,043	0	9,363	11,267	0
	Washington Northern Inland Waters	2,221	1,006	0	2,221	1,006	0
	Hood Canal	246,497	159,440	0	269,602	186,016	0
	Southern Puget Sound	17,124	22,387	24	17,506	22,431	24
Northern elephant seal	California	11,772	2,538	0	17,567	3,847	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.5 Estimated Marine Mammal Impacts from Explosives Under Navy Training Activities

Table E-5 provides a summary of the estimated number of marine mammal impacts from exposure to explosives used during Navy training activities under Alternatives 1 and 2 over the course of a year.

Table E-5: Estimated Marine Mammals Impacts per Year from Explosive Training Activities

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Order Cetacea													
Suborder Mysticeti (baleen whales)													
Family Balaenopteridae (rorquals)													
Blue whale*	Eastern North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Sei whale*	Eastern North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
Minke whale	Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Humpback whale*	Central North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Eschrichtiidae (gray whale)													
Gray whale	Eastern North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	Western North Pacific†	0	0	0	0	0	0	0	0	0	0	0	0

Table E-5: Estimated Marine Mammals Impacts per Year from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Suborder Odontoceti (toothed whales)													
Family Delphinidae (dolphins)													
Bottlenose dolphin	California, Oregon, & Washington, Offshore	0	0	0	0	0	0	0	0	0	0	0	0
Killer whale	Alaska Resident	0	0	0	0	0	0	0	0	0	0	0	0
	Eastern North Pacific Offshore	0	0	0	0	0	0	0	0	0	0	0	0
	Northern Resident	0	0	0	0	0	0	0	0	0	0	0	0
	West Coast Transient	0	0	0	0	0	0	0	0	0	0	0	0
	Southern Resident†	0	0	0	0	0	0	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	1	0	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	1	0	0
Risso's dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Short-beaked common dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0

Table E-5: Estimated Marine Mammals Impacts per Year from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Short-finned pilot whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Striped dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Kogiidae (Kogia spp.)													
Pygmy sperm whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	1	0	0
Dwarf sperm whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Phocoenidae (porpoises)													
Dall's porpoise	Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	2	6	1	0	4	16	2	0	4	39	6	0
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	0	0	0	0	0	0	0	0	0	0	0	0
	Northern California/ Southern Oregon	0	0	0	0	0	0	0	0	0	0	0	0
	Washington Inland Waters	0	61	27	0	0	61	27	0	0	102	45	0

Table E-5: Estimated Marine Mammals Impacts per Year from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Family Physeteridae (sperm whale)													
Sperm whale*	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Ziphiidae (beaked whales)													
Baird's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Cuvier's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Mesoplodon spp	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Suborder Pinnipedia													
Family Otariidae (sea lions and fur seals)													
California sea lion	U.S. Stock	0	0	0	0	0	0	0	0	0	0	0	0
Steller sea lion	Eastern U.S.	0	0	0	0	0	0	0	0	0	0	0	0
Guadalupe fur seal*	Mexico	0	0	0	0	0	0	0	0	0	0	0	0
Northern fur seal	Eastern Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0	0	0	0	0

Table E-5: Estimated Marine Mammals Impacts per Year from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Family Phocidae (true seals)													
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0	0	0	0	0
	Oregon/ Washington Coastal	0	0	0	0	0	0	0	0	0	0	0	0
	Washington Northern Inland Waters	0	30	5	0	0	30	5	0	0	50	8	0
	Hood Canal	0	4	1	0	0	4	1	0	0	7	1	0
	Southern Puget Sound	0	0	0	0	0	0	0	0	0	0	0	0
Northern elephant seal	California	0	1	0	0	0	2	1	0	0	5	2	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.6 Estimated Marine Mammal Impacts per 7-Year Period from Explosives Under Navy Training Activities

Table E-6 provides a summary of the estimated number of marine mammal impacts from exposure to explosives used during Navy training activities under Alternatives 1 and 2 over the course of seven years.

Table E-6: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Training Activities

Species	Stock	Alternative 1 – 7-year				Alternative 2 – 7-year			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Order Cetacea									
Suborder Mysticeti (baleen whales)									
Family Balaenopteridae (rorquals)									
Blue whale*	Eastern North Pacific	0	0	0	0	0	0	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Sei whale*	Eastern North Pacific	0	0	0	0	0	0	0	0
Minke whale	Alaska	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Humpback whale*	Central North Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Family Eschrichtiidae (gray whale)									
Gray whale	Eastern North Pacific	0	0	0	0	0	0	0	0
	Western North Pacific†	0	0	0	0	0	0	0	0
Suborder Odontoceti (toothed whales)									
Family Delphinidae (dolphins)									
Bottlenose dolphin	California, Oregon, & Washington, Offshore	0	0	0	0	0	0	0	0

Table E-6: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – 7-year				Alternative 2 – 7-year			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Killer whale	Alaska Resident	0	0	0	0	0	0	0	0
	Eastern North Pacific Offshore	0	0	0	0	0	0	0	0
	Northern Resident	0	0	0	0	0	0	0	0
	West Coast Transient	0	0	0	0	0	0	0	0
	Southern Resident†	0	0	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	0	0	0	0	0	4	0	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	0	0	0	0	0	5	0	0
Risso's dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Short-beaked common dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Short-finned pilot whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Striped dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Family Kogiidae (Kogia spp.)									
Pygmy sperm whale	California, Oregon, & Washington	0	0	0	0	0	8	0	0
Dwarf sperm whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0

Table E-6: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Training Activities (continued)

Species	*Stock*	*Alternative 1 – 7-year*				*Alternative 2 – 7-year*			
		Behavioral Response	*TTS*	*PTS*	*Injury*	*Behavioral Response*	*TTS*	*PTS*	*Injury*
Family Phocoenidae (porpoises)									
Dall's porpoise	Alaska	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	20	75	9	0	25	276	45	0
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	0	0	0	0	0	0	0	0
	Northern California/ Southern Oregon	0	0	0	0	0	0	0	0
	Washington Inland Waters	0	428	188	0	0	713	313	0
Family Physeteridae (sperm whale)									
Sperm whale*	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Family Ziphiidae (beaked whales)									
Baird's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Cuvier's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Mesoplodon spp	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Suborder Pinnipedia									
Family Otariidae (sea lions and fur seals)									
California sea lion	U.S. Stock	0	0	0	0	0	0	0	0
Steller sea lion	Eastern U.S.	0	0	0	0	0	0	0	0
Guadalupe fur seal*	Mexico	0	0	0	0	0	0	0	0
Northern fur seal	Eastern Pacific	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0

Table E-6: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Training Activities (continued)

Species	Stock	Alternative 1 – 7-year				Alternative 2 – 7-year			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Family Phocidae (true seals)									
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0
	Oregon/ Washington Coastal	0	0	0	0	0	0	0	0
	Washington Northern Inland Waters	0	209	35	0	0	348	59	0
	Hood Canal	0	30	5	0	0	50	8	0
	Southern Puget Sound	0	0	0	0	0	0	0	0
Northern elephant seal	California	0	11	1	0	0	32	12	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.7 Estimated Marine Mammal Impacts from Explosives Under Navy Testing Activities

Table E-7 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy testing activities under Alternatives 1 and 2 over the course of a year.

Table E-7: Estimated Marine Mammals Impacts per Year from Explosive Testing Activities

Species	*Stock*	*Alternative 1 – Minimum*				*Alternative 1 – Maximum*				*Alternative 2 – Maximum*			
		Behavioral Response	*TTS*	*PTS*	*Injury*	*Behavioral Response*	*TTS*	*PTS*	*Injury*	*Behavioral Response*	*TTS*	*PTS*	*Injury*
Order Cetacea													
Suborder Mysticeti (baleen whales)													
Family Balaenopteridae (rorquals)													
Blue whale*	Eastern North Pacific	1	0	0	0	1	0	0	0	1	0	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	6	2	0	0	6	2	0	0	6	2	0	0
Sei whale*	Eastern North Pacific	1	1	0	0	1	1	0	0	1	1	0	0
Minke whale	Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	4	2	0	0	4	2	0	0	4	2	0	0
Humpback whale*	Central North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	1	2	0	0	1	2	0	0	1	2	0	0

Table E-7: Estimated Marine Mammals Impacts per Year from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Family Eschrichtiidae (gray whale)													
Gray whale	Eastern North Pacific	1	2	0	0	1	2	0	0	1	2	0	0
	Western North Pacific†	0	0	0	0	0	0	0	0	0	0	0	0
Suborder Odontoceti (toothed whales)													
Family Delphinidae (dolphins)													
Bottlenose dolphin	California, Oregon, & Washington, Offshore	0	0	0	0	0	0	0	0	0	0	0	0
Killer whale	Alaska Resident	0	0	0	0	0	0	0	0	0	0	0	0
	Eastern North Pacific Offshore	0	0	0	0	0	0	0	0	0	0	0	0
	Northern Resident	0	0	0	0	0	0	0	0	0	0	0	0
	West Coast Transient	0	0	0	0	0	0	0	0	0	0	0	0
	Southern Resident†	0	0	0	0	0	0	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	1	1	0	0	1	1	0	0	1	1	0	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	1	1	0	0	1	1	0	0	1	1	0	0

Table E-7: Estimated Marine Mammals Impacts per Year from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Risso's dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Short-beaked common dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Short-finned pilot whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Striped dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Kogiidae (Kogia spp.)													
Pygmy sperm whale	California, Oregon, & Washington	1	3	1	0	1	3	1	0	1	3	1	0
Dwarf sperm whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Phocoenidae (porpoises)													
Dall's porpoise	Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	52	175	66	0	52	175	66	0	52	175	66	0

Table E-7: Estimated Marine Mammals Impacts per Year from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	52	178	79	0	52	178	79	0	52	178	79	0
	Northern California/ Southern Oregon	91	214	86	0	91	214	86	0	91	214	86	0
	Washington Inland Waters	0	0	0	0	0	0	0	0	0	0	0	0
Family Physeteridae (sperm whale)													
Sperm whale*	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Family Ziphiidae (beaked whales)													
Baird's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Cuvier's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Mesoplodon spp	California, Oregon, & Washington	0	0	0	0	0	0	0	0	0	0	0	0
Suborder Pinnipedia													
Family Otariidae (sea lions and fur seals)													
California sea lion	U.S. Stock	1	3	1	0	1	3	1	0	1	3	1	0

Table E-7: Estimated Marine Mammals Impacts per Year from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – Minimum				Alternative 1 – Maximum				Alternative 2 – Maximum			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Steller sea lion	Eastern U.S.	0	1	0	0	0	1	0	0	0	1	0	0
Guadalupe fur seal*	Mexico	0	0	0	0	0	0	0	0	0	0	0	0
Northern fur seal	Eastern Pacific	0	0	0	0	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0	0	0	0	0
Family Phocidae (true seals)													
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0	0	0	0	0	0	0
	California	5	6	1	0	5	6	1	0	5	6	1	0
	Oregon/ Washington Coastal	3	3	0	0	3	3	0	0	3	3	0	0
	Washington Northern Inland Waters	0	0	0	0	0	0	0	0	0	0	0	0
	Hood Canal	0	0	0	0	0	0	0	0	0	0	0	0
	Southern Puget Sound	0	0	0	0	0	0	0	0	0	0	0	0
Northern elephant seal	California	7	8	3	0	7	8	3	0	7	8	3	0

* ESA-listed species (all stocks) within the NWTT Study Area. † Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.8 Estimated Marine Mammal Impacts per 7-Year Period from Explosives Under Navy Testing Activities

Table E-8 provides a summary of the estimated number of marine mammal impacts from exposure to sonar and other transducers used during Navy testing activities under Alternatives 1 and 2 over the course of seven years.

Table E-8: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Testing Activities

Species	*Stock*	*Alternative 1 – 7-year*				*Alternative 2 – 7-year*			
		Behavioral Response	*TTS*	*PTS*	*Injury*	*Behavioral Response*	*TTS*	*PTS*	*Injury*
Order Cetacea									
Suborder Mysticeti (baleen whales)									
Family Balaenopteridae (rorquals)									
Blue whale*	Eastern North Pacific	3	0	0	0	3	0	0	0
Fin whale*	Northeast Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	39	11	0	0	39	11	0	0
Sei whale*	Eastern North Pacific	8	4	0	0	8	4	0	0
Minke whale	Alaska	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	26	10	0	0	26	10	0	0
Humpback whale*	Central North Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	8	8	0	0	8	8	0	0
Family Eschrichtiidae (gray whale)									
Gray whale	Eastern North Pacific	4	9	0	0	4	9	0	0
	Western North Pacific†	0	0	0	0	0	0	0	0
Suborder Odontoceti (toothed whales)									
Family Delphinidae (dolphins)									
Bottlenose dolphin	California, Oregon, & Washington, Offshore	0	0	0	0	0	0	0	0

Table E-8: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Testing Activities (continued)

Species	*Stock*	*Alternative 1 – 7-year*				*Alternative 2 – 7-year*			
		Behavioral Response	*TTS*	*PTS*	*Injury*	*Behavioral Response*	*TTS*	*PTS*	*Injury*
Killer whale	Alaska Resident	0	0	0	0	0	0	0	0
	Eastern North Pacific Offshore	0	0	0	0	0	0	0	0
	Northern Resident	0	0	0	0	0	0	0	0
	West Coast Transient	0	0	0	0	0	0	0	0
	Southern Resident†	0	0	0	0	0	0	0	0
Northern right whale dolphin	California, Oregon, & Washington	8	5	0	0	8	5	0	0
Pacific white-sided dolphin	North Pacific	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	7	4	0	0	7	4	0	0
Risso's dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Short-beaked common dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Short-finned pilot whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Striped dolphin	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Family Kogiidae (Kogia spp.)									
Pygmy sperm whale	California, Oregon, & Washington	6	19	10	0	6	19	10	0
Dwarf sperm whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0

Table E-8: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – 7-year				Alternative 2 – 7-year			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Family Phocoenidae (porpoises)									
Dall's porpoise	Alaska	0	0	0	0	0	0	0	0
	California, Oregon, & Washington	301	1,065	395	0	301	1,065	395	0
Harbor porpoise	Southeast Alaska	0	0	0	0	0	0	0	0
	Northern Oregon/ Washington Coast	259	894	397	0	259	894	397	0
	Northern California/ Southern Oregon	459	1,071	432	0	459	1,071	432	0
	Washington Inland Waters	0	0	0	0	0	0	0	0
Family Physeteridae (sperm whale)									
Sperm whale*	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Family Ziphiidae (beaked whales)									
Baird's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Cuvier's beaked whale	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Mesoplodon spp	California, Oregon, & Washington	0	0	0	0	0	0	0	0
Suborder Pinnipedia									
Family Otariidae (sea lions and fur seals)									
California sea lion	U.S. Stock	5	15	5	0	5	15	5	0
Steller sea lion	Eastern U.S.	0	3	0	0	0	3	0	0
Guadalupe fur seal*	Mexico	0	0	0	0	0	0	0	0

Table E-8: Estimated Marine Mammals Impacts per 7-Year Period from Explosive Testing Activities (continued)

Species	Stock	Alternative 1 – 7-year				Alternative 2 – 7-year			
		Behavioral Response	TTS	PTS	Injury	Behavioral Response	TTS	PTS	Injury
Northern fur seal	Eastern Pacific	0	0	0	0	0	0	0	0
	California	0	0	0	0	0	0	0	0
Family Phocidae (true seals)									
Harbor seal	Southeast Alaska - Clarence Strait	0	0	0	0	0	0	0	0
	California	26	29	7	0	26	29	7	0
	Oregon/ Washington Coastal	15	15	0	0	15	15	0	0
	Washington Northern Inland Waters	0	0	0	0	0	0	0	0
	Hood Canal	0	0	0	0	0	0	0	0
	Southern Puget Sound	0	0	0	0	0	0	0	0
Northern elephant seal	California	43	49	18	0	43	49	18	0

* ESA-listed species (all stocks) within the NWTT Study Area. †Only designated stocks are ESA-listed.
Notes: PTS = permanent threshold shift, TTS = temporary threshold shift

E.9 Estimated Sea Turtle Impacts from Sonar and Other Transducers Under Navy Training and Testing Activities

Based on the quantitative analysis, no sea turtle impacts are anticipated from exposure to sonar and other transducers used during Navy training and testing activities under Alternatives 1 and 2 over the course of a year or seven years.

E.10 Estimated Sea Turtle Impacts from Explosives Under Navy Training and Testing Activities

Based on the quantitative analysis, no sea turtle impacts are anticipated from exposure to explosives used during Navy training and testing activities under Alternatives 1 and 2 over the course of a year or seven years.

REFERENCES

U.S. Department of the Navy. (2017). *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (Technical Report prepared by Space and Naval Warfare Systems Center Pacific). San Diego, CA: Naval Undersea Warfare Center.

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APPENDIX F MILITARY EXPENDED MATERIAL AND DIRECT STRIKE IMPACT ANALYSES

F.1 ESTIMATING THE IMPACT OF MILITARY EXPENDED MATERIALS AND UNDERWATER EXPLOSIONS ON ABIOTIC SUBSTRATES AS A HABITAT FOR BIOLOGICAL RESOURCES

This section describes the calculation of the disturbance footprint (i.e., military expended material footprint or explosive crater footprint) of an instantaneous impact of military expended materials or explosions on the substrate. The actual instantaneous impact on the bottom will depend on the number and location of military expended materials expended and not recovered, which is likely much lower and more concentrated than either scenario being analyzed. Longer-term impacts on the bottom are far more difficult to quantify—refer to the Marine Habitats section (3.3) of Chapter 3 (Affected Environment and Environmental Consequences) for qualitative discussion. The approach described in this appendix is consistent with the approach taken in the 2015 NWTT Final EIS/OEIS (see Appendix H, Statistical Probability Analysis for Estimating Direct Air Strike Impact and Number of Potential Exposures).

The analysis requires a tabular summary of the military expended material or crater (underwater explosions) footprints expected in training and testing areas. The data comes from the Northwest Training and Testing (NWTT) action proponents and represents the most locational flexibility with regard to expenditure of military expended materials and underwater explosions. The data for both expended and recovered material are reported in Table F-1 below. Appendix A (Navy Activities Descriptions) of the 2015 NWTT Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) provides basic descriptions of military expended materials, and Chapter 3 (Section 3.0.3.2, Explosive Stressors) provides basic descriptions of explosive categories. The data for number of military expended materials and underwater explosions are then multiplied by an estimate of the footprint size documented in Table F-1.

To determine the potential level of disturbance of military expended materials on marine substrates, it was assumed that the impact area (footprint) of the expended material on the seafloor is twice the size of its physical size (unless specified otherwise in Appendix F notes). By doubling the footprint, the results should more accurately reflect the potential disturbance to soft bottom habitats (i.e., to account for sediment plumes), but should overestimate disturbance to hard bottom habitats (i.e., because sediment plumes are not expected). These calculations do not consider the Navy's mitigation measures for seafloor resources, which are detailed in Appendix K (Geographic Mitigation Assessment). Items with casings (e.g., small-, medium-, and large-caliber munitions; flares; sonobuoys) have their impact footprints further doubled to account for both the item and its casing. To be conservative (i.e., worst case), items and their casings were assumed to be the same size, although in reality the items are a smaller size in order to fit in their casing.

Additionally, highly explosive munitions that explode either at the surface or in the water column were treated in the same manner as non-explosive practice munitions, although in reality, the explosions would result in smaller fragments reaching the substrate than expected by the fully intact non-explosive practice munitions.

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions

Material Group	*Material Category*	*Bottom Frequency[1]*	*Crater Footprint[2] (ft.^{2})*	*MEM Size (ft.^{2})*	*MEM Footprint (ft.^{2})*	*Material Specific Notes*
Bomb	Bombs (Explosive)	NA	NA	8.1203	112.9048	The MEM footprint was calculated using the bomb with the largest footprint in terms of material fragments.
	Bombs (Non-explosive)	NA	NA	8.1203	112.9048	
Countermeasure	Acoustic Countermeasures	NA	NA	0.31107	1.2432	Includes all type of non-recoverable Acoustic Countermeasures
	Chaff-Air Cartridge	NA	NA	0.0012	0.0022	Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff-Air is fired from an aircraft using a small cartridge.
	Chaff-Ship Cartridge	NA	NA	2.000	4.000	Chaff-ship serves the same purpose of chaff-air. It is fired from a ship in cartridges.
	Anti-torpedo Torpedo	NA	NA	4.5424	9.0847	The Countermeasure Anti-torpedo consists of an anti-torpedo torpedo enclosed within All Up Round Equipment canister. The anti-torpedo torpedo is a 6.75-inch diameter high-maneuverability hard-kill torpedo designed to rapidly intercept and engage an incoming threat torpedo. The All Up Round Equipment consists of a nose sabot, ram plate, launch tube, muzzle cover, and breech mechanism to encapsulate, protect, and ultimately launch the anti-torpedo torpedo. Anti-torpedo torpedoes are frequently recovered; assume all are non-recoverable for worst-case.
Missiles	Missiles (Explosive)	NA	NA	37.3669	74.7338	MEM size based on SM-6
	Missile (Non-explosive)	NA	NA	31.0011	62.0023	MEM size based on Tomahawk

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency*[1]	*Crater Footprint*[2] *(ft.^{2})*	*MEM Size (ft.^{2})*	*MEM Footprint (ft.^{2})*	*Material Specific Notes*
Other	Air-launched Lightweight (Explosive) Torpedo	NA	NA	19.1199	38.2399	MEM size based on MK50/MK54
	Air-launched Lightweight (Non-explosive) Torpedo	NA	NA	19.1199	38.2399	MEM size based on MK50/MK54. Typically recovered
	AMNS/EMNS Neutralizer (Explosive)	50%	430.5564	1.6286	3.2572	AMNS is air deployed whereas EMNS is ship deployed
	AMNS Neutralizer (Non-explosive)	NA	NA	0.1513	0.3026	The neutralizer itself is recovered, but the associated fiber optic cable and the can that holds the fiber optic cable is not.
	Anchor (Expendable)	NA	NA	6.2495	12.5001	Associated primarily with mine shapes.
	Anchor (Recoverable)	NA	NA	6.2495	12.5001	Associated primarily with mine shapes and ships.
	Biodegradable Polymer	NA	NA	NA	NA	A substance composed of molecules that degrade as a result of microorganisms and/or enzymes. Footprint is not applicable because the material breaks up within a couple of hours, depending on the material composition of the polymer. Reference: Karlsson and Albertsson (1998).
	Bottom Placed Instruments	NA	NA	2.0000	4.000	Usually a moored tracking beacon, typically weighing around 50 pounds covering approximately 2 ft.^{2} of seafloor.
	Buoy (Explosive)	NA	NA	0.9752	3.8987	Explosive buoys including mini-sound source and SUS. MEM-size based on Marine Marker.

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency*[1]	*Crater Footprint*[2] *(ft.^{2})*	*MEM Size (ft.^{2})*	*MEM Footprint (ft.^{2})*	*Material Specific Notes*
Other (continued)	Buoy (Non-explosive)	NA	NA	0.9752	3.8987	These buoys are separate from sonobuoys, and are included for DWADS (expendable). MEM size based on Marine Marker. Can be expended or recovered.
	Concrete Slugs	NA	NA	0.0011	0.0022	Assume similar in dimensions to a chaff cartridge
	Endcaps & Pistons – Non Chaff & Flare	NA	NA	0.0043	0.0086	Applies only to where it cannot be associated to another object (e.g., endcaps and pistons associated with chaff would be covered by 'chaff'). Used for testing.
	Endcaps – Chaff & Flare	NA	NA	0.00215	0.0043	Applies only to Chaff-Air and Flares. 1 Endcap is expended per chaff-air or flare.
	Flare O-Ring	NA	NA	0.0043	0.0086	Assumed similar 2-dimensional footprint as endcaps and pistons. Associated with flares. Assumed 1 Flare O-Ring per flare.
	Fiber Optic Can	NA	NA	0.0011	0.0022	Assumed similar 2-dimensional footprint as chaff-air cartridge. Associated with AMNS Neutralizer fiber optic cable. Can that holds fiber optic cable is expended.
	Bathythermograph – Expended	NA	NA	0.0258	0.0516	An instrument that is deployed from a ship to record temperature and depth measurements. Small wires transmit the temperature data from the probe to the ship. This item is fairly standard in terms of footprint; these are off the shelf Commercial products. Reference: NOAA 2015. http://www.aoml.noaa.gov/goos/uot/xbt-what-is.php. Accessed November 3, 2015.
	Fiber Optic Cables	NA	NA	NA	NA	Associated with some rockets and AMNS neutralizers
	Guidance Wires	NA	NA	0	0	Fragments created for relatively small portion associated with explosive devices (associated with heavyweight torpedoes).

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency[1]*	*Crater Footprint[2] (ft.^{2})*	*MEM Size (ft.^{2})*	*MEM Footprint (ft.^{2})*	*Material Specific Notes*
Other (continued)	Bathythermograph – Expended Wire	NA	NA	NA	NA	Single vertical wire
	Heavyweight (Explosive) Torpedo	NA	NA	39.6155	79.2299	MEM size based on MK-48
	Heavyweight Torpedo Accessories	NA	NA	0.1615	3.2367	MEM includes ballast weights, flex tubing
	Heavyweight (Non-explosive) Torpedo	NA	NA	NA	NA	Typically recovered
	Illumination Flares	NA	NA	1.2196	4.8782	Flares that have a large parachute; MEM size based on half the surface area of an 18 ft. diameter parachute used with an LUU-2 illumination flare.
	Lightweight Torpedo Accessories	NA	NA	1.0107	2.0215	MEM includes ballast weights, flex tubing (parachute size not included)
	Marine Marker	NA	NA	0.9752	3.8987	MEM footprint based on two Navy marine markers (MK25 and MK58
	Parachute (Large)	NA	NA	353.4289	706.8578	MEM size based on diameter of drone main parachute (30 ft. diameter).
	Parachute (Medium)	NA	NA	283.9961	567.9932	Associated with Illumination flares (18 ft. diameter)
	Small Decelerator/ Parachute	NA	NA	2.8438	5.6876	Associated with launched sonobuoys, lightweight torpedoes, and drones (drag parachute)
	Sabot	NA	NA	1.2195	4.8782	An accessory used during projectile firing. Footprint similar in size to the projectile.

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency[1]*	*Crater Footprint[2] (ft.²)*	*MEM Size (ft.²)*	*MEM Footprint (ft.²)*	*Material Specific Notes*
Other (continued)	Sonobuoys (Non-explosive)	NA	NA	1.2206	2.4413	Sonobuoys have an extra item footprint (half the dimensions of the sonobuoy) added in addition to the actual sonobuoy and casing to account for the items that are discarded from the sonobuoy following its release. MEM size does not include the associated Small Decelerator/Parachute (noted in table above)
	Sonobuoys (Explosive)	0%	NA	1.2206	2.4413	
	Sonobuoy Wires	NA	NA	NA	NA	One wire is associated with each sonobuoy
	Surface-Launched Lightweight (Explosive) Torpedo	0%	NA	10.0782	20.1576	MEM size based on MK50/MK54
	Surface-Launched Lightweight (Non-Explosive) Torpedo	NA	NA	10.0782	20.1576	Typically recovered
Projectile	Grenades (Explosive)	0	NA	0.1044	0.2088	None
	Large Caliber (Explosive)	NA	NA	1.0097	4.0386	Item assumed to have a projectile and casing
	Large Caliber (Non-explosive)	NA	NA	1.0097	4.0386	Item assumed to have a projectile and casing
	Large caliber (Casing Only)	NA	NA	0.5048	1.0097	Used when the target is on land; no MEM from projectile
	Medium Caliber (Explosive)	NA	NA	0.0560	0.2239	Item assumed to have a projectile and casing
	Medium Caliber (Non-explosive)	NA	NA	0.0560	0.2239	Item assumed to have a projectile and casing
	Small Caliber (Non-explosive)	NA	NA	0.0301	0.1216	Item assumed to have a projectile and casing

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency[1]*	*Crater Footprint[2] (ft.^{2})*	*MEM Size (ft.^{2})*	*MEM Footprint (ft.^{2})*	*Material Specific Notes*
Projectile	Small Caliber (Casing Only)	NA	NA	0.0151	0.0301	Used only for small caliber 'blanks'. All other small caliber rounds are included under NEPM
	Kinetic Energy Round	NA	NA	0.5048	1.0097	Item assumed to only have a projectile (no casing) - size of Large Caliber round.
Target	Aerial Drones – Expendable	NA	NA	294.6082	589.2164	MEM when specifically known it is an aerial drone; MEM size based on Firebee
	Aerial Drones – Recovered	NA	NA	294.6082	589.2164	MEM when specifically known it is an aerial drone; MEM size based on Firebee. Typically recovered.
	Air Target – Expended (Non-Drone)	NA	NA	42.1622	84.3244	MEM when specifically known it is an air launched decoy. MEM size based on dimensions of Tactical Air Launched Decoy or Miniature Air-Launched Decoy.
	Metal Plates	NA	NA	2.7782	5.5563	Charges are secured to a 20" X 20" X 1/2" ferrous metal plate The target unit (concrete blocks, metal plate, and any debris) is brought to the surface and analyzed.
	Surface Target - Expended	NA	NA	5.7522	11.5034	Includes remote controlled or towed targets
	Surface Target - Recovered	NA	NA	NA	NA	Reported as recovered.
	Surface Target (Mobile) - Expended	NA	NA	5.7522	11.5034	Includes remote controlled or towed targets
	Surface Target (Stationary) - Expended	NA	NA	96.8752	193.7504	MEM when specifically known it is a stationary surface target. MEM size based on Killer Tomato.
	Subsurface Target (Mobile) - Expended	NA	NA	1.2206	2.4412	MEM when specifically known it is a sub-surface Motorized Autonomous Target

Table F-1: Categories and Footprints for Various Materials and Underwater Explosions (continued)

Material Group	*Material Category*	*Bottom Frequency[1]*	*Crater Footprint[2] (ft.²)*	*MEM Size (ft.²)*	*MEM Footprint (ft.²)*	*Material Specific Notes*
Target	Surface Target (Stationary) - Expended	NA	NA	96.8752	193.7504	MEM when specifically known it is a stationary surface target. MEM size based on Killer Tomato.
	Subsurface Target (Mobile) - Expended	NA	NA	1.2206	2.4412	MEM when specifically known it is a sub-surface Motorized Autonomous Target
	Mine Shape - Expended	NA	NA	25.7903	51.5807	Mine shapes that were specifically identified as non-recoverable; footprint based on size of explosive mine; size not including anchor
	Mine Shape - Expended	NA	NA	25.7903	51.5807	Mine shape and associated anchor block that are recovered. The vast majority of practice mines have built-in anchors for placing on the bottom; relatively few are moored/floating, and none are drifting.

[1]Bottom frequencies (%) are only listed for underwater explosions;
[2]Crater footprints are only listed for material that may be detonated on the bottom.
Notes: MEM = Military Expended Materials; AMNS/EMNS = Airborne Mine Neutralization System/Expendable Mine Neutralization System; NA = Not Applicable; DWADS = Deep Water Active Distributed System; NEPM = Non-explosive Practice Munitions

F.1.1 Military Expended and Recovered Material – Training Activities

Table F-2 shows military expended and recovered materials and impact footprints within the NWTT Study Area for a single year.

Table F-2: Number and Impacts[1] of Military Expended Materials Proposed for Use During Training Activities in a Single Year Under Alternatives 1 and 2

Military Expended Materials	*Size (ft.^{2})*	*Impact Footprint (ft.^{2})*	*Offshore Area*				*Inland Waters*			
			Alternative 1		*Alternative 2*		*Alternative 1*		*Alternative 2*	
			Number	*Impact (Acre)*	*Number*	*Impact (Acre)*	*Number*	*Impact (Acre)*	*Number*	*Impact (Acre)*
Bombs										
Bombs (Explosive)	8.1203	112.9048	2	0.00518	2	0.00518	0	0	0	0
Bombs (Non-Explosive)	8.1203	112.9048	84	0.21772	90	0.23327	0	0	0	0
Grenade (Explosive)	0.1044	0.2088	130	0.00062	130	0.00062	0	0	0	0
Projectiles										
Small-Caliber (Non-Explosive)	0.0301	0.1216	121,000	0.33778	121,000	0.33778	0	0	0	0
Small-Caliber (Casing Only)	0.0151	0.0301	121,000	0.08361	121,000	0.08361	432	0.00030	432	0.00030
Medium-Caliber (Explosive)	0.056	0.2239	420	0.00216	6,360	0.03269	0	0	0	0
Medium-Caliber (Non-Explosive)	0.056	0.2239	26,660	0.13703	43,112	0.22160	0	0	0	0
Large-Caliber (Explosive)	1.0097	4.0386	172	0.01595	390	0.03656	0	0	0	0
Large-Caliber (Non-Explosive)	1.0097	4.0386	9,390	0.87058	9,520	0.88263	0	0	0	0
Large-Caliber (Casing only)	0.5048	1.0097	9,562	0.22164	9,910	0.22971	0	0	0	0
Missiles (Explosive)	37.6691	74.7338	14	0.02402	27	0.04632	0	0	0	0
Missiles (Non-Explosive)	37.6691	74.7338	4	0.00686	15	0.02573	0	0	0	0
Countermeasures										
Chaff- Air Cartridge	0.0011	0.0022	5,000	0.00025	5000	0.00025	0	0	0	0
Flares	1.2196	4.8782	700	0.07839	700	0.07839	0	0	0	0
Targets										
Air Target- Expended Decoy	42.1622	84.3245	35	0.06775	43	0.08324	0	0	0	0
Air Targets- Recovered Drone	NA	NA	98	0	145	0	0	0	0	0
Sub-Surface Targets (Mobile) - Expended	1.2206	2.4412	49	0.01294	60	0.01584	0	0	0	0
Sub-Surface Targets (Mobile) - Recovered	NA	NA	420	0	420	0	0	0	0	0
Surface Targets (Stationary) - Expended	96.8752	193.7504	374	0.09877	370	0.09771	0	0	0	0

Table F-2: Number and Impacts[1] of Military Expended Materials Proposed for Use During Training Activities in a Single Year Under Alternatives 1 and 2 (continued)

Military Expended Materials	Size (ft.^{2})	Impact Footprint (ft.^{2})	Offshore Area				Inland Waters			
			Alternative 1		Alternative 2		Alternative 1		Alternative 2	
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Targets (continued)										
Mine Shapes - Recovered	NA	NA	0	0	0	0	112	0	120	0
Mine Shapes - Expended	25.7903	51.5807	0	0	0	0	0	0	0	0
Other										
Anchor - Recovered	6.2495	12.5001	10	0.00287	10	0.00287	30	0.00861	30	0.00861
Sonobuoys (Non-Explosive)	1.2207	2.4413	9,338	0.52334	9,378	0.52559	15	0.00084	15	0.00084
Endcaps	0.0021	0.0043	5,700	0.00056	5,700	0.00057	0	0	0	0
Compression Pad/Piston	0.0043	0.0086	700	0.00014	700	0.00014	0	0	0	0
Fiber Optic Can	0.0011	0.0022	170	0.00001	164	0.00001	0	0	0	0
Flare O-Ring	0.0043	0.0086	704	0.00014	724	0.00014	0	0	0	0
Illumination Flare	1.2196	4.8782	4	0.00045	24	0.00269	0	0	0	0
Heavyweight Torpedo (Non-Explosive)	39.6155	79.2299	2	0.00364	0	0	0	0	0	0
Heavyweight Torpedo (Explosive)	39.6155	79.2299	0	0	2	0.00364	0	0	0	0
Heavyweight Torpedo Accessories	0.1615	3.2367	2	0.00015	2	0.00015	0	0	0	0
Lightweight Torpedo (Non-Explosive)	19.1199	38.2398	16	0.01405	16	0.01405	0	0	0	0
Lightweight Torpedo Accessories	1.1011	2.0215	16	0.00074	16	0.00074	0	0	0	0
Marine Marker	0.9752	3.8987	230	0.02059	232	0.02076	0	0	0	0
Small Decelerator/Parachute	2.8438	5.6876	9,338	1.21926	9,378	1.22448	15	0.00196	15	0.00196
Parachutes - Medium	9.0417	18.0834	16	0.00664	16	0.00664	0	0	0	0
Parachutes - Large	283.9961	567.9932	4	0.05216	24	0.31294	0	0	0	0
Total			**321,364**	**5.58055**	**344,680**	**6.06168**	**589**	**0.01087**	**597**	**0.01087**

[1]Calculations for “Impact (Acre) Column = [(Impact Footprint) x (Number)]/43560 sq. ft. per acre; Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 & 2

F.1.2 Military Expended and Recovered Materials – Testing Activities

Table F-3 shows military expended and recovered materials and impact footprints within the NWTT Study Area for a single year.

Table F-3: Number and Impacts[1] of Military Expended Materials Proposed for Use During Testing Activities in a Single Year Under Alternatives 1 and 2

Military Expended Materials	Size (ft.²)	Impact Footprint (ft.²)	Offshore Area				Inland Waters			
			Alternative 1		Alternative 2		Alternative 1		Alternative 2	
			Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)	Number	Impact (Acre)
Projectiles										
Kinetic Energy Round	0.5048	1.0097	80	0.00185	80	0.00185	0	0	0	0
Large-Caliber (Non-Explosive)	1.0097	4.0386	160	0.01483	160	0.01483	0	0	0	0
Large-Caliber (Casing only)	0.5048	1.0097	160	0.00371	160	0.00371	0	0	0	0
Sabot – Kinetic Energy Round	1.2196	4.8782	80	0.00896	80	0.00896	0	0	0	0
Countermeasures										
Acoustic Countermeasures	0.3311	1.2432	751	0.02143	791	0.02258	720	0.02055	720	0.02055
Anti-Torpedo Torpedo	4.524	9.0847	58	0.01210	58	0.01210	176	0.03671	184	0.03837
Targets										
Air Targets - Expended Drone	294.6082	589.2164	162	0.31360	162	0.31360	0	0	0	0
Mine Shapes (Non-Explosive) – Expended	25.7903	51.5807	280	0.33156	280	0.33156	336	0.39787	336	0.39787
Mine Shapes (Non-Explosive) – Recovered	25.7903	51.5807	181	0.21433	181	0.21433	3,776	4.47127	5,266	6.23563
Sub-Surface Target (Mobile) – Recovered	NA	NA	185	0	188	0	1,127	0	1,159	0
Sub-Surface Target (Stationary) – Expended	96.8752	193.7504	4	0.01779	4	0.01779	0	0	0	0
Sub-Surface Target (Stationary) – Recovered	NA	NA	3,331	0	3,331	0	7,317	0	7,317	0
Surface Target (Mobile) – Expended	5.7522	11.5034	162	0.04278	162	0.04278	0	0	0	0
Surface Target (Stationary) – Expended	96.8752	193.7504	172	0.76504	172	0.76504				
Surface Target (Stationary) – Recovered	NA	NA	81	0	81	0	542	0	542	0
Other										
Air-Launched Lightweight Torpedo (Explosive)	19.1199	38.2399	3	0.00263	3	0.00263	0	0	0	0
Air-Launched Lightweight Torpedo (Non-Explosive)	19.1199	38.2399	42	0.03687	42	0.03687	0	0	0	0
AMNS Neutralizer (Explosive)	1.6286	3.2572	36	0.00269	36	0.00269	0	0	0	0
Anchor – Expended	6.2495	12.5001	445	0.12770	445	0.12770	720	0.20661	720	0.20661
Anchor – Recovered	6.2495	12.5001	0	0	0	0	2,527	0.72516	3,107	0.89159
Bathythermograph - Expended	0.2771	0.5554	604	0.00770	1,130	0.01441	0	0	0	0
Bottom Placed Instruments	2.0000	4.0000	0	0.00000	0	0.00000	19	0.00174	19	0.00174
Buoy (Explosive)	0.9752	3.8987	80	0.00716	80	0.00716	0	0	0	0
Buoy (Non-Explosive)	0.9752	3.8987	232	0.02076	392	0.03508	0	0	0	0

Table F-3: Number and Impacts[1] of Military Expended Materials Proposed for Use During Testing Activities in a Single Year Under Alternatives 1 and 2 (continued)

Military Expended Materials	*Size (ft.^{2})*	*Impact Footprint (ft.^{2})*	*Offshore Area*				*Inland Waters*			
			Alternative 1		*Alternative 2*		*Alternative 1*		*Alternative 2*	
			Number	*Impact (Acre)*	*Number*	*Impact (Acre)*	*Number*	*Impact (Acre)*	*Number*	*Impact (Acre)*
Other (Continued)										
Fiber Optic Can	0.0011	0.0022	36	0.00000	36	0.00000	0	0	0	0
Guidance Wire	0.0000	0.0000	0	0	0	0	230	0	230	0
Heavyweight Torpedo (Explosive)	39.6155	79.2299	4	0.00728	4	0.00728	0	0	0	0
Heavyweight Torpedo (Non-Explosive)	39.6155	79.2299	148	0.26919	188	0.34195	230	0.41834	230	0.41834
Heavyweight Torpedo Accessories	0.1615	3.2367	152	0.01129	192	0.01427	230	0.01709	230	0.01709
Lightweight Torpedo Accessories	1.1011	2.0215	82	0.00381	85	0.00394	48	0.00223	48	0.00223
Parachutes (Medium)	9.0417	18.0834	102	0.04234	102	0.04234	176	0.07306	184	0.07639
Decelerator/Parachute (Small)	2.8438	5.6876	1,657	0.21635	1,657	0.21635	48	0.00627	48	0.00627
Sonobuoy (Non-Explosive)	1.2207	2.4413	3,445	0.19307	5,125	0.28723	48	0.00269	48	0.00269
Surface-Launched Lightweight Torpedo (Explosive)	10.0782	20.1576	2	0.00093	2	0.00093	0	0	0	0
Surface-Launched Lightweight Torpedo (Non-Explosive)	10.0782	20.1576	37	0.01712	40	0.01851	48	0.02221	48	0.02221
Total			**12,954**	**2.71489**	**15,449**	**2.90847**	**18,318**	**6.40180**	**20,436**	**8.33758**

[1]Calculations for "Impact (Acre) Column = [(Impact Footprint) x (Number)]/43560; Blue shading indicates numbers and impacts of MEM that differ between Alternatives 1 and 2

F.2 Statistical Probability Analysis for Estimating Direct Strike Impact and Number of Potential Exposures from Military Expended Materials

This section discusses the methods and results for calculating the probability of a direct strike of an animal from any military items from the proposed training and testing activities falling toward (or directed at) the sea surface. For the purposes of this section, military items include non-explosive practice munitions, sonobuoys, acoustic countermeasures, targets, and high-energy lasers. Only marine mammals and sea turtles will be analyzed using these methods because animal densities are necessary to complete the calculations, and density estimates are currently available only for marine mammals and sea turtles within the Study Area. The analysis conducted here does not account for explosive munitions because impacts from explosives are analyzed within the Navy Acoustic Effects Model as described in the Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing (U.S. Department of the Navy, 2018).

F.2.1 Direct Impact Analysis

A probability was calculated to estimate the impact probability (P) and number of exposures (T) associated with direct impact of military items on marine animals on the sea surface within the specified training or testing area (R) in which the activities are occurring. The statistical probability analysis is based on probability theory and modified Venn diagrams with rectangular "footprint" areas for the individual animal (A) and total impact (I) inscribed inside the training or testing area (R). The analysis is over-predictive and conservative, in that it assumes: (1) that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend the majority of their time underwater, and (2) that the animals are stationary, which does not account for any movement or any potential avoidance of the training or testing activity.

- A = length*width, where the individual animal's width (breadth) is assumed to be 20 percent of its length for marine mammals and 112 percent of its length for sea turtles. This product for A is multiplied by the number of animals N_a in the specified training or testing area (i.e., product of the highest average month animal density [D] and training or testing area [R]: $N_a = D*R$) to obtain the total animal footprint area ($A*N_a = A*D*R$) in the training or testing area. As a conservative scenario, the total animal footprint area is calculated for the species with the highest average month density in the training or testing area with the highest use of military items within the entire Study Area.
- I = N_{mun}*length*diameter, where N_{mun} = total annual number of military items for each type, and "length" and "diameter" refer to the individual military equipment dimensions. For each type, the individual impact footprint area is multiplied by the total annual number of military items to obtain the type-specific impact footprint area (I = N_{mun}*length*diameter). Each training or testing activity uses one or more different types of military items, each with a specific number and dimensions, and several training and testing activities occur in a given year. When integrating over the number of military items types for the given activity (and then over the number of activities in a year), these calculations are repeated (accounting for differences in dimensions and numbers) for all military items types used, to obtain the type-specific impact footprint area (I). These impact footprint areas are summed over all military items types for the given activity, and then summed (integrated) over all

activities to obtain the total impact footprint area resulting from all activities occurring in the training or testing area in a given year. As a conservative scenario, the total impact footprint area is calculated for the training or testing area with the highest use of military items within the entire Study Area.

Though marine mammals and sea turtles are not randomly distributed in the environment, a random point calculation was chosen due to the intensive data needs that would be required for a calculation that incorporated more detailed information on an animal's or military item's spatial occurrence.

The analysis is expected to provide an overestimation of the probability of a strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest seasonal density, (2) it does not take into account the possibility that an animal may avoid military activities, (3) it does not take into account the possibility that an animal may not be at the water surface, (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets, and so only a very small portion of those projectiles that miss the target would hit the water with their maximum velocity and force, and (5) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures.

The likelihood of an impact is calculated as the probability (P) that the animal footprint (A) and the impact footprint (I) will intersect within the training or testing area (R). This is calculated as the area ratio A/R or I/R, respectively. Note that A (referring to an **individual** animal footprint) and I (referring to the impact footprint resulting from the **total** number of military items N_{mun}) are the relevant quantities used in the following calculations of single-animal impact probability [P], which is then multiplied by the number of animals to obtain the number of exposures (T). The probability that the random point in the training or testing area is within both types of footprints (i.e., A and I) depends on the degree of overlap of A and I. The probability that I overlaps A is calculated by adding a buffer distance around A based on one-half of the impact area (i.e., 0.5*I), such that an impact (center) occurring anywhere within the combined (overlapping) area would impact the animal. Thus, if L_i and W_i are the length and width of the impact footprint such that $L_i*W_i = 0.5*I$ and $W_i/L_i = L_a/W_a$ (i.e., similar geometry between the animal footprint and impact footprint), and if L_a and W_a are the length and width (breadth) of the individual animal such that $L_a*W_a = A$ (= individual animal footprint area), then, assuming a purely static, rectangular scenario (Scenario 1), the total area $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$, and the buffer area $A_{buffer} = A_{tot} – L_a*W_a$.

Four scenarios were examined with respect to defining and setting up the overlapping combined areas of A and I. The results of the following four scenarios were averaged to determine the probability:

1. **Scenario 1**: Purely static, rectangular scenario. Impact is assumed to be static (i.e., direct impact effects only; non-dynamic; no explosions or scattering of military items after the initial impact). Hence the impact footprint area (I) is assumed to be rectangular and given by the product of military items length and width (multiplied by the number of military items).
$A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.
2. **Scenario 2**: Dynamic scenario with end-on collision, in which the length of the impact footprint (Li) is enhanced by Rn = 5 military items lengths to reflect forward momentum.
$A_{tot} = (L_a + (1 + R_n)*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.
3. **Scenario 3**: Dynamic scenario with broadside collision, in which the width of the impact footprint (W_i) is enhanced by R_n = 5 military items lengths to reflect forward momentum.
$A_{tot} = (L_a + 2*W_i)*(W_a + (1 + R_n)*L_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.

4. **Scenario 4**: Purely static, radial scenario, in which the rectangular animal and impact footprints are replaced with circular footprints while conserving area. Define the radius (R_a) of the circular individual animal footprint such that $\pi*R_a^2 = L_a*W_a$, and define the radius (R_i) of the circular impact footprint such that $\pi *R_i^2 = 0.5*L_i*W_i = 0.5*I$. Then $A_{tot} = \pi *(R_a + R_i)^2$ and $A_{buffer} = A_{tot} - \pi *R_a^2$ (where $\pi = 3.1415927$).

Static impacts (Scenarios 1 and 4) assume no additional aerial coverage effects of scattered military items beyond the initial impact. For dynamic impacts (Scenarios 2 and 3), the distance of any scattered military items must be considered by increasing the length (Scenario 2) or width (Scenario 3), depending on orientation (broadside versus end-on collision), of the impact footprint to account for the forward horizontal momentum of the falling object. Forward momentum typically accounts for five object lengths, resulting in a corresponding increase in impact area. Significantly different values may result from the static and dynamic orientation. Both of these types of collision conditions can be calculated each with 50 percent likelihood (i.e., equal weighting between Scenarios 2 and 3, to average these potentially different values).

Impact probability P is the probability of impacting one animal with the given number, type, and dimensions of all military items used in training or testing activities occurring in the area per year, and is given by the ratio of total area (A_{tot}) to training or testing area (R): $P = A_{tot}/R$. Number of exposures is $T = N*P = N*A_{tot}/R$, where N = number of animals in the training or testing area per year (given as the product of the animal density [D] and range size [R]). Thus, $N = D*R$ and hence $T = N*P = N*A_{tot}/R = D*A_{tot}$. Using this procedure, P and T were calculated for each of the four scenarios, for Endangered Species Act (ESA)-listed marine mammals and the marine mammal and sea turtle species with the highest average month density (used as the annual density value) and for each military item type. The scenario-specific P and T values were averaged over the four scenarios (using equal weighting) to obtain a single scenario -averaged annual estimate of P and T. The potential number of exposures (t) are reported in Table F-4, Table F-5, and Table F-6.

F.2.2 Parameters for Analysis

Impact probabilities (P) and number of exposures (T) were estimated by the analysis for the following parameters:

1. Two action alternatives: Alternative 1 and Alternative 2. Animal densities, animal dimensions, and military item dimensions are the same for the two action alternatives.
2. One training and testing area: The NWTT Offshore Area.
3. The following types of non-explosive items:
    - Small-caliber projectiles: up to and including .50 caliber rounds
    - Medium-caliber projectiles: larger than .50 caliber rounds but smaller than 57 millimeters (mm) projectiles
    - Large-caliber projectiles: includes projectiles greater than or equal to a 57 mm projectile
    - Missiles: includes rockets and jet-propelled munitions
    - Bombs: non-explosive practice bombs and mine shapes, ranging from 10 to 2,000 lb.
    - Torpedoes: includes all aircraft-released lightweight torpedoes
    - Sonobuoys: includes all sonobuoys
    - Targets: includes expended, airborne and surface targets, as well as mine shapes
    - Lightweight torpedo accessories: includes all accessories that are dropped along with the torpedo (nose cap, air stabilizer, etc.)

- Expended bathythermographs: small sensors deployed from ships

4. High-energy lasers: includes high-energy laser weapons that are directed at a surface target.
5. Animal species of interest: the eight species of ESA-listed marine mammals and the non-ESA listed marine mammal species with the highest average month density in the training and testing area of interest (harbor porpoise and California sea lion), and the only sea turtle species with a possible occurrence in the training and testing area of interest.

F.2.3 Input Data

Input data for the direct strike analysis include animal species likely to be in the area and military items proposed for use under each of the two action alternatives. Animal species data include: (1) species identification and status (i.e., threatened, endangered, or neither), (2) highest average month density estimate for the species of interest, and (3) adult animal dimensions (length and width) for the species with the highest density. The animal's dimensions are used to calculate individual animal footprint areas (A = length*width), and animal densities are used to calculate the number of exposures (T) from the impact probability (P): T = N*P. Military items data include: (1) military items category (e.g., projectile, bomb, rocket, target), (2) military items dimensions (length and width), and (3) total number of military items used annually.

Military items input data, specifically the quantity (e.g., numbers of bombs and rockets), are different in magnitude between the two action alternatives. All animal species input data, the military items' identification and category, and the military items' dimensions are the same for the two alternatives; only the quantities (i.e., total number of military items) are different.

F.2.4 Output Data

Estimates of impact probability (P) and number of exposures (T) for a given species of interest were made for the specified training or testing area with the highest annual number of military items used for each of the two action alternatives. The calculations derived P and T from the highest annual number of military items used in the Study Area for the given alternative. Differences in P and T between the alternatives arise from different numbers of events (and therefore military items) for the two alternatives.

Results for marine mammals and sea turtles are presented in Tables F-4 through F-6.

Table F-4: Estimated Exposures from Direct Strike of a High-Energy Laser by Area and Alternative in a Single Year

NWTT Offshore Area				
Species	Training		Testing	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2
All Marine Mammals Species	0.000000	0.000000	0.000619	0.000619
Leatherback Sea Turtle	0.000000	0.000000	0.000000	0.000000

Table F-5: Estimated Representative Marine Mammal Exposures from Direct Strike of Military Expended Materials by Area and Alternative in a Single Year

NWTT Offshore Area				
Species	Training		Testing	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Humpback Whale	0.000463	0.000534	0.000353	0.000372
Sei Whale	0.000006	0.000007	0.000004	0.000005
Fin Whale	0.000230	0.000265	0.000177	0.000186
Blue Whale	0.000064	0.000073	0.000049	0.000052
Sperm Whale	0.000054	0.000062	0.000041	0.000043
Killer Whale (Southern Resident)	0.000012	0.000014	0.000009	0.000010
Gray Whale	0.000215	0.000249	0.000164	0.000173
Harbor porpoise	0.010810	0.012568	0.008129	0.008576
California sea lion	0.004216	0.004902	0.003170	0.003345
Guadalupe Fur Seal	0.000216	0.000251	0.000162	0.000171

Table F-6: Estimated Leatherback Sea Turtle Exposures from Direct Strike of Military Expended Materials by Area and Alternative in a Single Year

NWTT Offshore Area				
Species	Training		Testing	
	Alternative 1	Alternative 2	Alternative 1	Alternative 2
Leatherback Sea Turtle	0.000001	0.000002	0.000001	0.000001

REFERENCES

Karlsson, S., and A. C. Albertsson. (1998). Biodegradable polymers and environmental interaction. *Polymer Engineering and Science, 38*(8), 1251–1253.

U.S. Department of the Navy. (2018). *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (Technical Report prepared by NUWC Division Newport, Space and Naval Warfare Systems Center Pacific, G2 Software Systems, and the National Marine Mammal Foundation). Newport, RI: Naval Undersea Warfare Center.

Supplemental Environmental Impact Statement/

Overseas Environmental Impact Statement

Northwest Training and Testing

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Appendix G Federal Register Notices

Appendix G contains the following Federal Register Notices:

1. Notice of Intent to Prepare a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for Northwest Training and Testing
2. Notice of Extension of Scoping Period for the Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for Northwest Training and Testing

Federal Register / Vol. 82, No. 161 / Tuesday, August 22, 2017 / Notices 39779

Any associated form(s) for this collection may be located within this same electronic docket and downloaded for review/testing. Follow the instructions at *http://www.regulations.gov* for submitting comments. Please submit comments on any given form identified by docket number, form number, and title.

FOR FURTHER INFORMATION CONTACT: To request more information on this proposed information collection or to obtain a copy of the proposal and associated collection instruments, please write to the DSS Office of Information Management, Russell Knox Building, 27130 Telegraph Rd., Quantico, VA 22134 or email *dss.niss@mail.mil.*

SUPPLEMENTARY INFORMATION:

Title; Associated Form; and OMB Number: National Industrial Security System (NISS); OMB Control Number 0704–XXXX.

Needs and Uses: The information collection requirement is necessary for DSS to oversee the National Industrial Security Program (NISP) pursuant to Executive Order 12829. The National Industrial Security System (NISS) will become the repository of records related to the maintenance of information pertaining to contractor facility security clearances (FCL) and contractor capabilities to protect classified information in its possession.

Affected Public: Cleared contractor companies participating in the NISP.

Annual Burden Hours: 11,671.

Number of Respondents: 11,671.

Responses per Respondent: 1.

Annual Responses: 11,671.

Average Burden per Response: 60 minutes.

Frequency: On occasion.

Respondents are security professionals who provide information to DSS in order to process facility security clearances (FCL), report changes of the facility that may affect the FCL, and managing incident response. In addition to this standard processing, NISS will enable security staff to communicate with their DSS representative pursuant to requirement DoD 5220.22–M, National Industrial Security Program Operating Manual. The NISS will be an integrated automated solution that will facilitate efficient execution of the Agency's core mission. NISS will allow users to manage large amounts of information through increased automated workflows to ensure accuracy, create linkages in data, and close the gap of missing data elements.

Dated: August 16, 2017.

Aaron Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2017–17686 Filed 8–21–17; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for Northwest Training and Testing

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality, the Department of the Navy (DoN) announces its intent to prepare a supplement to the 2015 Final Northwest Training and Testing (NWTT) Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS).

DATES: Public comments will be accepted during the 30-day scoping period from August 22, 2017 to September 21, 2017. Public scoping meetings will not be held. However, public meetings are planned to occur following the release of the Draft Supplemental EIS/OEIS in early 2019.

ADDRESSES: The DoN invites scoping comments on the NWTT Supplemental EIS/OEIS from all interested parties. Substantive comments may be provided by mail to the address below and through the project Web site at *http://nwtteis.com/*. Comments must be postmarked or received online by September 21, 2017 for consideration during the development of the Draft Supplemental EIS/OEIS.

FOR FURTHER INFORMATION CONTACT: John Mosher, (360) 257–3234, *john.g.mosher@navy.mil.* Naval Facilities Engineering Command Northwest, Attention: NWTT Supplemental EIS/OEIS Project Manager, 3730 North Charles Porter Avenue, Building 385, Oak Harbor, Washington 98278–3500.

SUPPLEMENTARY INFORMATION: The DoN will assess the potential environmental effects associated with ongoing and future at-sea military readiness activities conducted within the NWTT EIS/OEIS Study Area (hereafter known as the "Study Area") beyond 2020. Military readiness activities include training and research, development, testing, and evaluation (hereafter known as "testing"). The Supplemental EIS/OEIS will include an analysis of training and testing activities using new information available after the release of the 2015 Final EIS/OEIS. New information includes an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science. Proposed activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS and are representative of training and testing activities the DoN has been conducting in the Study Area for decades.

The Study Area remains unchanged since the 2015 Final EIS/OEIS. The Study Area is comprised of established maritime operating areas and warning areas in the northeastern Pacific Ocean, including areas within the Strait of Juan de Fuca, Puget Sound, and the Western Behm Canal in southeastern Alaska. The Study Area includes air and water space within and outside Washington state waters, air and water space outside state waters of Oregon and Northern California, and DoN pierside locations where sound navigation and ranging (sonar) maintenance and testing occur. In the supplement to the 2015 Final EIS/OEIS, the DoN will only analyze those training and testing activities conducted at sea within the Study Area.

As part of this process, the DoN will seek the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and Endangered Species Act to support on-going and future at-sea military readiness activities within the Study Area beyond 2020.

Pursuant to 40 CFR 1501.6, the DoN will invite the National Marine Fisheries Service and the U.S. Coast Guard to be cooperating agencies in preparation of the Supplemental EIS/OEIS.

The DoN's lead action proponent is Commander, U.S. Pacific Fleet. Additional action proponents include Naval Sea Systems Command and Naval Air Systems Command.

The DoN's Proposed Action is to conduct at-sea training and testing activities within the Study Area. Activities include the use of active sonar and explosives while employing marine species protective mitigation measures. The Proposed Action does not alter the DoN's original purpose and need as discussed in the 2015 Final EIS/OEIS.

The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the DoN can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in section 5062 of Title 10 of the U.S. Code. A Supplemental EIS/OEIS is considered the appropriate document, as there is recent scientific information including revised acoustic criteria to consider, in furtherance of NEPA, relevant to the environmental effects of the DoN's Proposed Action. The analysis will support Marine Mammal Protection Act authorization requests.

Proposed training and testing activities are generally consistent with those analyzed in the 2015 Final EIS/OEIS. In the Supplemental EIS/OEIS, the DoN will analyze the proposed changes to the tempo and types of training and testing activities, accounting for the introduction of new technologies, the evolving nature of international events, advances in warfighting doctrine and procedures, and changes in the organization of vessels, aircraft, weapons systems, and DoN personnel. In the NWTT Supplemental EIS/OEIS, the DoN will reflect the compilation of training and testing activities required to fulfill the DoN's military readiness requirements beyond 2020, and therefore includes the analysis of newly proposed activities and changes to previously analyzed activities.

In the Supplemental EIS/OEIS, the DoN will evaluate the potential environmental effects of a no action alternative and action alternatives. Resources to be evaluated include, but are not limited to, marine mammals, sea turtles, essential fish habitat, threatened and endangered species, and American Indian and Alaska Native Traditional Resources.

The scoping process is used to identify public concerns and local issues to be considered during the development of the Draft Supplemental EIS/OEIS. Federal agencies, state agencies, local agencies, the public, and interested persons are encouraged to provide substantive comments to the DoN on environmental resources and issue areas of concern the commenter believes the DoN should consider.

Comments must be postmarked or received online by September 21, 2017 for consideration during the development of the Draft Supplemental EIS/OEIS. Comments can be mailed to: Naval Facilities Engineering Command Northwest, Attention: NWTT Supplemental EIS/OEIS Project Manager, 3730 North Charles Porter Avenue, Building 385, Oak Harbor, Washington 98278–3500. Comments can be submitted online via the project Web site at *http://www.nwtteis.com/*. Also at this Web site, those interested in receiving electronic project updates can subscribe to receive notifications via email for key milestones throughout the environmental planning process.

Dated: August 16, 2017.

A.M. Nichols,

Lieutenant Commander, Judge Advocate General's Corps, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2017–17618 Filed 8–21–17; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Free Application for Federal Student Aid (FAFSA®) Information To Be Verified for the 2018–2019 Award Year

Correction

In notice document 2017–09167, appearing on pages 21204 through 21208, in the issue of Friday, May 5, 2017, make the following corrections:

1. On page 21207, in the second column, on the second line, the entry that reads "I certify that I ___", should read:

"I certify that I ___ am".

2. On the same page, in the same column, on the nineteenth line, the entry that reads "I certify that I ___", should read:

"I certify that I ___ am".

[FR Doc. C1–2017–09167 Filed 8–21–17; 8:45 am]

BILLING CODE 1301–00–D

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

[EERE–2017–BT–CRT–0054]

Proposed Agency Information Collection Extension

AGENCY: Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy.

ACTION: Information collection extension, with changes; notice and request for comment.

SUMMARY: The U.S. Department of Energy (DOE) intends to extend with changes for three years with the Office of Management and Budget (OMB), the Certification Reports, Compliance Statements, Application for a Test Procedure Waiver, and Recordkeeping for Consumer Products and Commercial/Industrial Equipment subject to Energy or Water Conservation Standards Package under OMB No. 1910–1400. Comments are invited on: (a) Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information shall have practical utility; (b) the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used; (c) ways to enhance the quality, utility, and clarity of the information to be collected; and (d) ways to minimize the burden of the collection of information on respondents, including through the use of automated collection techniques or other forms of information technology.

DATES: Written comments and information are requested and will be accepted on or before October 23, 2017.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2017–BT–CRT–0054, by any of the following methods:

1. *Federal eRulemaking Portal: http://www.regulations.gov*. Follow the instructions for submitting comments.
2. *Email:* to *InfoCollection2017CRT0054@ee.doe.gov*. Include docket number EERE–2017–BT–CRT–0054 in the subject line of the message.
3. *Postal Mail:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a compact disc ("CD"), in which case it is not necessary to include printed copies.
4. *Hand Delivery/Courier:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza SW., Suite 600, Washington, DC 20024. Telephone: (202) 287–1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted.

Docket: The docket for this activity, which includes Federal Register notices, comments, and other supporting documents/materials, is available for review at *http://www.regulations.gov*. All documents in the docket are listed in the *http://www.regulations.gov* index. However, some documents listed in the index,

43950 Federal Register / Vol. 82, No. 181 / Wednesday, September 20, 2017 / Notices

Responses to Disturbance and Climate Variability on DoD Lands (FY18 New Start)—Dr. Scott Ferrenberg, United States Geological Survey; 2:00 p.m. RC18–C2–1021 (RC18–1021): Using Unmanned Aerial Systems to Model Spatially-Mediated Heterogeneity in 3D Microclimate Landscapes (FY18 New Start)—Dr. Anna Carter, Iowa State University; 2:45 p.m. Break; 3:00 p.m. RC18–C2–1108 (RC18–1108): Aquatic Ecosystem Vulnerability to Fire and Climate Change in Alaskan Boreal Forests (FY18 New Start)—Dr. Jeffrey Falke, United States Geological Survey; 3:45 p.m. Resource Conservation and Resiliency Overview—Dr. Kurt Preston, Resource Conservation and Resiliency Program Manager; 3:55 p.m. RC18–C1–1358 (RC18–1358): Using Remotely-sensed Data and Light-level Geolocator Technology to Inform Off-Post Landscape-Scale Conservation Planning for a Migratory Species (FY18 New Start)—Dr. Ashley Long, Texas A&M AgriLife Research; 4:40 p.m. Public Discussion/Adjourn for the day.

Thursday, October 19, 2017: 8:30 a.m.: Convene—Dr. Joseph Hughes, Chair; 8:40 a.m. Weapons Systems and Platforms Overview—Dr. Robin Nissan, WP Program Manager; 8:50 a.m. WP18–C4–1047 (WP18–1047): Development of an Agile, Novel Expeditionary Battlefield Manufacturing Plant using Recycled and Reclaimed Thermoplastic Materials (FY18 New Start)—Dr. Prabhat Krishnaswamy, Engineering Mechanics Corporation of Columbus; 9:35 a.m. WP18–C4–1323 (WP18–1323): Recycling and Reuse of Metal Alloys by a Single Solid-State Additive Manufacturing and Repair Process (FY18 New Start)—Dr. Paul Allison, University of Alabama; 10:20 a.m. Break; 10:35 a.m. Weapons Systems and Platforms Overview—Dr. Robin Nissan, WP Program Manager; 10:45 a.m. WP18–C1–1114 (WP18–1114): Emulsion Characterization Study for Improved Bilgewater Treatment and Management (FY18 New Start)—Ms. Danielle Paynter, Naval Surface Warfare Center; 11:30 a.m. Weapons Systems and Platforms Overview—Dr. Robin Nissan, WP Program Manager; 11:40 a.m. WP18–C3–1193 (WP18–1193): An Integral Hypergolic Hybrid-Solid Fuel Ramjet Concept for AP-Free High Performance Tactical Rocket Motors (FY18 New Start)—Dr. Mark Pfeil, U.S. Army Aviation & Missile Research, Development, and Engineering Center; 12:25 p.m. Lunch; 1:25 p.m. Weapons Systems and Platforms Overview—Dr. Robin Nissan, WP Program Manager; 1:35 p.m. WP18–F2–1439 (WP18–1439) Development and Evaluation of Non-Chromate LHE ZnNi Passivations for DoD Electrical Connectors (Follow-on to FY15 SEED Project)—Dr. Matthew O'Keefe, Missouri S&T; 2:20 p.m. Munitions Response Overview—Dr. Herbert Nelson, Munitions Response Program Manager; 2:30 p.m. MR18–C1–1233 (MR18–1233): Improved Penetrometer Performance in Stratified Sediment for Cost-Effective Characterization, Monitoring and Management of Submerged Munitions Sites (FY18 New Start)—Dr. Nina Stark, Virginia Tech; 3:15 p.m. Break; 3:30 p.m. Environmental Restoration Overview—Dr. Andrea Leeson, ER Program Manager; 3:40 p.m. ER–2531: Role of Acidophilic Methanotrophs in Long Term Natural Attenuation of VOCs in Low pH Aquifers (Follow On to FY15 Limited Scope Project)—Dr. Paul Hatzinger, Aptim Federal Services; 4:25 p.m. Strategy Session—Dr. Herb Nelson, Acting Executive Director; 4:55 p.m. Public Discussion/Adjourn.

Meeting Accessibility: The meeting location has proper and working facilities for those with disabilities. Please contact the Designated Federal Officer (DFO) if there are any issues.

Written Statements: Pursuant to 41 CFR 102–3.140, and section 10(a)(3) of the Federal Advisory Committee Act of 1972, the public or interested organizations may submit written statements to the Strategic Environmental Research and Development Program, Scientific Advisory Board. Written statements may be submitted to the committee at any time or in response to an approved meeting agenda. All written statements shall be submitted to the DFO for the Strategic Environmental Research and Development Program, Scientific Advisory Board. The DFO will ensure that the written statements are provided to the membership for their consideration. Time is allotted at the close of each meeting day for the public to make comments.

Dated: September 15, 2017.

Aaron Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2017–20011 Filed 9–19–17; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Extension of Scoping Period for the Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement for Northwest Training and Testing

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: A notice of intent was published by the U.S. Environmental Protection Agency in the **Federal Register** (82 FR 39779) on August 22, 2017 for the supplement to the 2015 Final Northwest Training and Testing (NWTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). The 30-day scoping period ends on September 21, 2017. This notice announces a 15-day extension of the scoping period until October 6, 2017.

DATES: Public comments will be accepted during the 45-day scoping period from August 22, 2017 to October 6, 2017.

ADDRESSES: Comments may be provided via mail to the address provided below or through the project Web site at *http://nwtteis.com/*. Comments must be postmarked or received online by October 6, 2017 for consideration during the development of the Supplemental EIS/OEIS. Anyone interested in receiving electronic project updates can subscribe on the project Web site to receive notifications via email for key milestones throughout the environmental planning process.

FOR FURTHER INFORMATION CONTACT: Mr. John Mosher, 360–257–3234, *john.g.mosher@navy.mil.* U.S. Pacific Fleet, Attention: NWTT Supplemental EIS/OEIS Project Manager, 3730 North Charles Porter Avenue, Building 385, Oak Harbor, Washington 98278–3500.

Dated: September 14, 2017.

S.E. Milewski,

Deputy Division Director, Administrative Law Division, Judge Advocate General's Corps, U.S. Navy, Alternate Federal Register Liaison Officer.

[FR Doc. 2017–20013 Filed 9–19–17; 8:45 am]

BILLING CODE 3810–FF–P

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Sunshine Act Notice

TIME AND DATE: 12:00 p.m.–3:00 p.m., September 26, 2017.

PLACE: Defense Nuclear Facilities Safety Board Headquarters, 625 Indiana

Appendix H: Public Comment Responses

This appendix to appear in the Final Supplemental EIS/OEIS.

Supplemental Environmental Impact Statement/

Overseas Environmental Impact Statement

Northwest Training and Testing

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List of Figures

There are no figures in this appendix.

List of Tables

There are no tables in this appendix.

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Appendix I Agency Correspondence

This appendix contains correspondence sent between the Navy and relevant government agency status.

I.1 Cooperating Agency Status

I.1.1 Navy Request to National Marine Fisheries Service

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON DC 20350-2000

5090
Ser N45/17U132423
September 27, 2017

Ms. Donna S. Wieting
Director, Office of Protected Resources
National Marine Fisheries Service
1315 East West Highway
Silver Spring, MD 20910

SUBJECT: NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT - COOPERATING AGENCY REQUEST

Dear Ms. Wieting:

In accordance with the National Environmental Policy Act (NEPA) of 1969 and Executive Order (EO) 12114, the United States (U.S.) Department of the Navy (Navy) is preparing a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with the continuation of military readiness activities, which consist of training as well as research, development, testing, and evaluation (RDT&E, hereinafter referred to as "testing") activities that include the use of active sonar and explosives in the Northwest Training and Testing (NWTT) Study Area. The proposed training and testing activities within the NWTT Study Area support the Navy's Title 10 of the U.S. Code requirements to achieve and maintain military readiness by ensuring the Navy can provide trained and equipped combat-ready forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.

This NWTT Supplemental EIS/OEIS represents the third phase (Phase III) of ongoing NEPA and EO 12114 compliance for continuation of at-sea training and testing. It will evaluate the conduct of military readiness activities from 2020 into the reasonably foreseeable future and accommodate evolving mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft, and weapon systems) into the Fleet.

The Phase III NWTT Study Area remains consistent with the area studied in the Phase II NWTT EIS/OEIS completed in 2015 and consists of established maritime operating and warning areas in the eastern North Pacific Ocean region, located adjacent to the northwest coast of the United States, and areas within the Strait of Juan de Fuca, Puget Sound, and the Behm Canal. The Study Area includes four existing range complexes and facilities: the Northwest Training Range Complex, the Naval Undersea Warfare Center Keyport Range Complex, the Carr Inlet Operations Area, and the Southeast Alaska Acoustic Measurement Facility. In addition to these range complexes, the Study Area also includes select Navy pierside locations and inland waters that are outside the range complexes.

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The Phase III NWTT Supplemental EIS/OEIS is intended to serve as a basis for the renewal of current regulatory permits and authorizations and the analysis of emerging and future force structure changes and training and testing requirements. An important aspect of the Phase III NWTT Supplemental EIS/OEIS will be the analysis of the potential effects to marine species protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) and habitats protected under the Magnuson-Stevens Fishery Conservation and Management Act. The existing MMPA Final Rule and Letters of Authorization for NWTT Phase II activities will expire in November 2020.

To complete the analysis required by the permitting and consultation process pursuant to MMPA and ESA in an efficient and effective way, the Navy believes that participation by the National Marine Fisheries Service (NMFS) is needed. Therefore, in accordance with the Council on Environmental Quality's (CEQ) regulations implementing NEPA (specifically 40 CFR Part 1501) and CEQ's 2002 guidance on cooperating agencies, the Navy requests that NMFS serve as a cooperating agency for the development of the Phase III NWTT Supplemental EIS/OEIS.

Consistent with 40 CFR 1501.6, the Navy is requesting NMFS' participation as early in the planning process as possible. As the lead agency, the Navy will:

a. Gather all necessary background information and prepare the Supplemental EIS/OEIS and all necessary permit applications associated with acoustic issues within the Study Area;

b. Work with NMFS personnel to determine the method of estimating potential effects to protected marine species, including threatened and endangered species;

c. Determine the scope of the NWTT Supplemental EIS/OEIS, including the alternatives evaluated;

d. Circulate the NEPA document to the general public and any other interested parties;

e. Schedule and supervise meetings held in support of the NEPA process and compile comments received; and

f. Maintain an administrative record and respond to Freedom of Information Act (FOIA) requests relating to the Phase III Supplemental EIS/OEIS.

The Navy respectfully requests that NMFS, in its role as a cooperating agency, provide the following support:

a. Participate in the NEPA process, to include public participation efforts pertaining to the Phase III Supplemental EIS/OEIS, and fund such support through its own sources to the maximum extent possible;

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b. Provide timely comments on working drafts of the Phase III Supplemental EIS/OEIS in accordance with the approved project schedule and commenting protocols, and provide minutes of any agency information meetings that have been adjudicated within the agency;

c. Adhere to the overall schedule as set forth by the Navy in coordination with NMFS;

d. Respond to Navy requests for information, in particular, those related to review of the acoustic effects analysis and evaluation of the effectiveness of protection and mitigation measures;

e. Coordinate, to the maximum extent practicable, any public comment periods that are necessary in the MMPA permitting process with the Navy's NEPA public comment periods;

f. Make available staff support at Navy's request to enhance the Navy's interdisciplinary capability;

g. Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the Phase III Supplemental EIS/OEIS;

h. Utilize NMFS resources, including funding where appropriate, in support of executing its cooperating agency responsibilities.

i. Prepare any NMFS-specific documents required to support the NMFS decision-making process;

j. Maintain an administrative record and respond to FOIA requests relating to the Phase III Supplemental EIS/OEIS; and

k. Provide a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the Phase III NWTT Supplemental EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. NMFS assistance is invaluable to this endeavor.

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September 27, 2017

We appreciate your consideration of our request and look forward to your response. The point of contact for this action is Ms. Dawn Schroeder, (703) 695-5219, email: dawn.schroeder@navy.mil.

Sincerely,

C. A. LAHTI
Director, Energy and Environmental
Readiness Division

Copy to:
OPNAV (N9I, N83)
Commander, U.S. Fleet Forces Command (N46)
Commander, U.S. Pacific Fleet (N465)
Commander, Navy Installations Command (N45)
Commander, Naval Sea Systems Command
Commander, Naval Air Systems Command
Commander, Navy Region Northwest
Commander, Naval Facilities Engineering Command, (N45)

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I.1.2 Navy Request to U.S. Coast Guard

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N46/1250
October 12, 2017

Vice Admiral Fred M. Midgette
Commander, U.S. Coast Guard Pacific Area
Coast Guard Defense Force West
Coast Guard Island, Bldg. 51-6
Alameda, CA, 94501-5100

Dear Admiral Midgette:

Subj: NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT - COOPERATING AGENCY REQUEST

In accordance with the National Environmental Policy Act (NEPA) of 1969 and Executive Order (EO) 12114, the United States (U.S.) Department of the Navy (Navy) is preparing a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with training and testing activities in the Northwest Training and Testing (NWTT) Study Area. The proposed training and testing activities within the NWTT Study Area supports the Navy's Title 10 of the U.S. Code requirements to achieve and maintain military readiness by ensuring the Navy can provide trained and equipped combat-ready forces.

The NWTT Supplemental EIS/OEIS represents the third phase (Phase III) of ongoing NEPA and EO 12114 compliance for continuation of at-sea training and testing. It will evaluate the conduct of military readiness activities from 2020 into the reasonably foreseeable future and accommodate evolving mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft, and weapon systems) into the Fleet.

The Phase III NWTT Study Area remains consistent with the area studied in the Phase II NWTT EIS/OEIS completed in 2015 and consists of established maritime operating and warning areas in the eastern North Pacific Ocean region, located adjacent to the northwest coast of the United States, and areas within the Strait of Juan de Fuca, Puget Sound, and the Behm Canal in southeastern Alaska.

The Phase III NWTT Supplemental EIS/OEIS is intended to serve as a basis for the renewal of current regulatory permits and authorizations and the analysis of emerging and future force structure changes and training and testing requirements. An important aspect of the Phase III NWTT Supplemental EIS/OEIS will be the analysis of the potential effects to marine species protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) and habitats protected under the Magnuson-Stevens Fishery Conservation and

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Ser N46/1250
October 12, 2017

Management Act. The existing MMPA Final Rule and Letters of Authorization for Phase II NWTT activities will expire in November 2020.

As with the 2015 Phase II NWTT EIS/OEIS, certain U.S. Coast Guard units and personnel are proposed to continue to support Navy Maritime Security Operation activities within the NWTT Study Area, and are appropriate to incorporate within this study. Therefore, in accordance with the Council on Environmental Quality's (CEQ) regulations implementing NEPA (specifically 40 CFR Part 1501) and CEQ's 2002 guidance on cooperating agencies, the Navy requests that the U.S. Coast Guard serve as a cooperating agency for the development of the Phase III NWTT Supplemental EIS/OEIS.

Consistent with 40 CFR Part 1501.6, the Navy is the lead agency for the Phase III NWTT Supplemental EIS/OEIS. As the lead agency, the Navy will:

- Use U.S. Coast Guard environmental analysis and proposals to the maximum extent possible consistent with its responsibility as lead agency.
- Meet with the U.S. Coast Guard to discuss the Supplemental EIS/OEIS process, as requested.
- Circulate the appropriate NEPA documentation to the general public and any other interested parties.
- Schedule and supervise meetings held in support of the NEPA process and compile comments received.
- Maintain an administrative record and respond to Freedom of Information Act (FOIA) requests relating to the SEIS/OEIS.

Navy respectfully requests the U.S. Coast Guard, in its role as a cooperating agency, provide the following support:

- Participate in the NEPA process.
- Provide a representative during the public outreach process within the USCG Area of Responsibility.
- Provide data to the Navy on Coast Guard activities that take place in the NWTT Supplemental EIS/OEIS study area.
- Assume, on request of the Navy, responsibility for developing information and preparing environmental analyses, for which the Coast Guard has special expertise.

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Ser N46/1250
October 12, 2017

- Make available staff support at the Navy's request to enhance the Navy's interdisciplinary capability for the study.

- Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the Supplemental EIS/OEIS.

- Utilize Coast Guard resources, including funding where appropriate, to support the cooperating agency role.

- Adhere to the overall schedule, as set forth by the Navy.

- Provide a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the Phase III NWTT Supplemental EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The Coast Guard's assistance is invaluable in this endeavor.

We appreciate your consideration of our request and look forward to your response. The point of contact for this action is Mr. John Mosher, COMPACFLT N465JM at (360) 257 - 3234, email: john.g.mosher@navy.mil.

Very respectfully,

J. W. KORKA
Fleet Civil Engineer

Copy to:
CNO WASHINGTON DC (N45)
COMNAVSEASYSCOM WASHINGTON DC
COMNAVAIRSYSCOM PATUXENT RIVER MD
COMNAVREG NW SILVERDALE WA

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I.1.3 Navy Request to U.S. Fish and Wildlife Service

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON DC 20350-2000

5090
Ser N45/17U132427
October 4, 2017

Mr. Greg Sheehan
Director
U.S. Fish and Wildlife Service
1849 C Street, NW
Washington, D.C. 20240

SUBJECT: NORTHWEST TRAINING AND TESTING SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT - COOPERATING AGENCY

Dear Mr. Sheehan:

In accordance with the National Environmental Policy Act (NEPA) of 1969 and Executive Order (EO)12114, the United States (U.S.) Department of the Navy (Navy) is preparing a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to assess the potential environmental impacts associated with the continuation of military readiness activities, which consist of training as well as research, development, testing, and evaluation (RDT&E, hereinafter referred to as "testing") activities that include the use of active sonar and explosives in the Northwest Training and Testing (NWTT) Study Area. The proposed training and testing activities within the NWTT Study Area supports the Navy's Title 10 of the U.S. Code requirements to achieve and maintain military readiness by ensuring the Navy can provide trained and equipped combat-ready forces capable of winning wars, deterring aggression, and maintaining freedom of the seas.

This NWTT Supplemental EIS/OEIS represents the third phase (Phase III) of ongoing NEPA and EO 12114 compliance for continuation of at-sea training and testing. It will evaluate the conduct of military readiness activities from 2020 into the reasonably foreseeable future and accommodate evolving mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft, and weapon systems) into the Fleet.

The Phase III NWTT Study Area remains consistent with the area studied in the Phase II NWTT EIS/OEIS completed in 2015 and consists of established maritime operating and warning areas in the eastern North Pacific Ocean region, located adjacent to the northwest coast of the United States, and areas within the Strait of Juan de Fuca, Puget Sound, and the Behm Canal in southeastern Alaska. The Study Area includes four existing range complexes and facilities: the Northwest Training Range Complex, the Naval Undersea Warfare Center Keyport Range Complex, the Carr Inlet Operations Area, and the Southeast Alaska Acoustic Measurement Facility. In addition to these range complexes, the Study Area also includes select Navy pierside locations and inland waters that are outside the range complexes.

An important aspect of the Phase III NWTT Supplemental EIS/OEIS will be the analysis of the potential effects to species protected under the Endangered Species Act (ESA) and habitats protected under the Magnuson-Stevens Fishery Conservation and Management Act. The

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programmatic Biological Opinion for NWTT will expire in July 21, 2036. The NWTT Supplemental EIS/OEIS is intended to serve as a basis for a review of and potential amendment to the Biological Opinion and the analysis of emerging and future force structure changes and training and testing requirements.

To complete the analysis required by the permitting and consultation process pursuant to ESA in an efficient and effective way, the Navy believes that participation by U.S. Fish and Wildlife Service (USFWS) is needed. Therefore, in accordance with the Council on Environmental Quality's (CEQ) regulations implementing NEPA (specifically 40 CFR Part 1501) and CEQ's 2002 guidance on cooperating agencies, the Navy requests that the USFWS serve as a cooperating agency for the development of the Phase III NWTT Supplemental EIS/OEIS.

Consistent with 40 CFR 1501.6, the Navy is requesting USFWS' participation as early in the planning process as possible. As the lead agency, the Navy will:

a. Gather all necessary background information and prepare the Supplemental EIS/OEIS and all necessary permit applications associated with acoustic issues within the Study Area.

b. Work with USFWS personnel to determine the method of estimating potential effects to threatened and endangered species.

c. Determine the scope of the NWTT Supplemental EIS/OEIS, including the alternatives evaluated.

d. Circulate the appropriate NEPA documentation to the general public and any other interested parties.

e. Schedule and supervise meetings held in support of the NEPA process and compile comments received.

f. Maintain an administrative record and respond to Freedom of Information Act (FOIA) requests relating to the Phase III Supplemental EIS/OEIS.

The Navy respectfully requests the USFWS, in its role as a cooperating agency, provide support as follows:

a. Participate in the NEPA process, to include public participation efforts pertaining to the Phase III Supplemental EIS/OEIS, and fund such support through its own sources to maximum extent possible.

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b. Provide timely comments on working drafts of the Phase III Supplemental EIS/OEIS and minutes of any agency information meetings that have been adjudicated within the agency.

c. The Navy requests that comments on draft documents be provided in accordance with approved project schedules and commenting protocols.

d. Respond to Navy requests for information, in particular, those related to review of the acoustic effects analysis and evaluation of the effectiveness of protection and mitigation measures.

e. Make available staff support at Navy's request to enhance the Navy's interdisciplinary capability.

f. Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the Phase III Supplemental EIS/OEIS.

g. Utilize USFWS resources, including funding where appropriate, to support the cooperating agency role.

j. Prepare any USFWS-specific documents required to support the USFWS decision-making process.

k. Provide a formal, written response to this request.

The Navy views this agreement as important to the successful completion of the environmental planning process for the Phase III NWTT Supplemental EIS/OEIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. USFWS assistance is invaluable to this endeavor.

We appreciate your consideration of our request and look forward to your response. The point of contact for this action is Ms. Dawn Schroeder, (703) 695 - 5219, email: dawn.schroeder@navy.mil.

Sincerely,

C. A. LAHTI
Director, Energy and Environmental
Readiness Division

Copy to: (see next page)

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October 4, 2017

Copy to:
OPNAV (N9I, N83)
Commander, U.S. Fleet Forces Command (N46)
Commander, U.S. Pacific Fleet (N465)
Commander, Navy Installations Command (N45)
Commander, Naval Sea Systems Command
Commander, Naval Air Systems Command
Commander, Navy Region Northwest
Commander, Naval Facilities Engineering Command, (N45)
Mr. Eric Rickerson, State Supervisor, Washington Fish and Wildlife Office, U.S. Fish and Wildlife Service, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503

4

I.1.4 National Marine Fisheries Service Response to Navy

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Captain C.A. Lahti
Director, Energy and
Environmental and Readiness Division
Department of the Navy
2000 Navy Pentagon
Washington, DC 20350-2000

Dear Captain Lahti:

Thank you for your letter requesting the National Marine Fisheries Service (NOAA Fisheries) be a cooperating agency in the preparation of a Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate potential environmental effects in the Department of the Navy's (Navy) Northwest Training and Testing (NWTT) Study Area. Activities conducted in the NWTT Study Area will achieve and maintain military readiness and include current, emerging, and future training activities and research, development, test and evaluation events (Phase III). We support the Navy's decision to prepare a Supplemental EIS/OEIS on this activity and agree to be a cooperating agency, due, in part, to our responsibilities under section 101(a)(5)(A) of the Marine Mammal Protection Act and under section 7 of the Endangered Species Act. NOAA Fisheries will make every effort to support the Navy in the development of a Supplemental EIS/OEIS, including:

- Participating, as necessary, in meetings hosted by the Navy for the discussion of issues related to the Phase III Supplemental EIS/OEIS;
- Providing timely comments on working drafts of the Phase III Supplemental EIS/OEIS in accordance with the approved project schedule and commenting protocols;
- Responding to Navy requests for information, in particular, those related to review of the acoustic effects analysis and evaluation of the effectiveness of protection and mitigation measures; and
- Adhering to the overall schedule as set forth by the Navy in coordination with NMFS.

If you need any additional information, please contact Jolie Harrison at (301) 427-8420.

Sincerely,

Samuel D. Rauch III
Deputy Assistant Administrator for
Regulatory Programs
National Marine Fisheries Service

cc: Barry Thom, NMFS WCRO
Vicki Wedell, NMFS HQ NMS
Steve Leathery, NMFS HQ NEPA
Dawn Schroeder, Navy

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I.1.5 U.S. Coast Guard Response to Navy

U.S. Department of Homeland Security
United States Coast Guard

Commander
Coast Guard Pacific Area

Coast Guard Island, Bldg. 51-6
Alameda, CA 94501-5100
Staff Symbol: PAC-00
Phone: (510) 437-3908
Fax: (510) 437-3774

16475
29 Dec 2017

MEMORANDUM

From: F.M. Midgette, VADM
PACAREA (PAC-00)

To: J. W. Korka, RDML
Fleet Civil Engineer
Unites States Pacific Fleet

Subj: NORTHWEST TRAINING AND TESTING EIS COOPERATING AGENCY REQUEST

Ref: (a) Your letter 5090 of 12 Oct 2017

1. The Coast Guard is pleased to accept the offer, as per reference (a), to participate as a cooperating agency in the subject EIS/OEIS. Doing so will materially further the Coast Guard's interest in the use of Navy range complexes for necessary Coast Guard weapons and military readiness training. The Coast Guard's participation will also assist in mutual efforts associated with the operation of the Range Complex and establishment of safety zones in accordance with 33 Code of Federal Regulations (CFR) Part 165. As the Coast Guard is a military service and a branch of the Armed Forces, we believe that this action is, and will remain, in full compliance with 40 CFR Part 1501 and the council on Environmental Quality Cooperating Agency guidance issued on 30 January 2002.

2. The Coast Guard agrees with the Navy's statements on pages 2 and 3 of reference (a) concerning the Navy's actions as the lead agency in the EIS/OEIS. As a cooperating agency, the Coast Guard will, to the extent allowed by available resources and fiscal constraints:

• Participate in the NEPA process;

• Provide data to the Navy on Coast Guard activities and operations that take place in the NWTT EIS/OEIS study areas;

• Assume, on request of the Navy, responsibility for developing information and preparing environmental analyses, for which the Coast Guard has special expertise;

• Make staff support available at the lead agency's request to enhance the Navy's interdisciplinary capability, consistent with operational requirements;

• Participate, as necessary, in meetings hosted by the Navy for discussion of issues related to the EIS/OEIS;

• Utilize available Coast Guard resources, including funding where appropriate and available, to support our role as a cooperating agency; and

Subj: NORTHWEST TRAINING & TESTING EIS COOPERATING AGENCY REQUEST 5090

• Adhere to the overall schedule as set forth by the Navy.

3. As a cooperating agency, I request that the U.S. Coast Guard, as an armed force of the United States within the Department of Homeland Security, be expressly mentioned and described in the NWTT EIS/OEIS, and our operations and activities that take place in the study area be analyzed for environmental effects. To assist the Navy, the Coast Guard is providing operational data to the Navy on Coast Guard operations and activities that take place in the NWTT EIS/OEIS study areas, and we will continue to do so as necessary and appropriate.

4. This memo constitutes the formal written response requested by your letter. I request that the Navy supply the Coast Guard with two preliminary copies of all draft and final NWTT EISs/OEISs for our review of these documents, with a minimum 14 day response period in each instance. This action is important to the successful completion of the environmental planning process for the NWTT EIS/OEIS. We look forward to working with the Navy to facilitate mission accomplishment through productive use of the Northwest Training and Testing Range Complex.

5. The Coast Guard point of contact for all correspondence and exchanges of information with the Navy concerning the NWTT EIS/OEIS is Mr. Brad McKitrick, CG-OES-4 at (202) 372-1443, Bradley.K.McKitrick@uscg.mil.

#

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CG-7
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CGDELEVEN
CGD THIRTEEN
CGD SEVENTEEN

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Appendix J: Airspace Noise Analysis for the Olympic Military Operations Areas

Supplemental Environmental Impact Statement/
Overseas Environmental Impact Statement
Northwest Training and Testing

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APPENDIX J AIRSPACE NOISE ANALYSIS FOR THE OLYMPIC MILITARY OPERATIONS AREAS

J.1 INTRODUCTION

This noise study is a component of the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (Supplemental). This study models the noise from aircraft while conducting training activities within the Olympic Military Operations Area (MOAs) and Warning Areas W-237A and W-237B. The transit of aircraft to and from these areas is discussed in the body of this Supplemental in Section 2.3.3.2 (Sea Space and Airspace Deconfliction), Section 3.0.3.1.3.1 (Navigation and Safety), and Section 3.12.3.2.1.1 (Impacts on Airborne Acoustics Under Alternative 1 for Training Activities). The noise model utilizes a database of measured aircraft noise levels under different flyover conditions. The results of this study were used throughout the body of this Supplemental to support the analysis and effects determinations for resources such as birds, cultural resources, American Indian and Alaska Native Traditional Resources, and socioeconomic resources.

J.2 PURPOSE

The purpose of this noise study is to document potential changes to the noise environment within the special use airspace (SUA) of the Olympic A MOA, Olympic B MOA, W-237A, and W-237B for operations of the EA-18G Growler, P-3C Orion, P-8A Poseidon, and F-15 Eagle. This noise analysis is an update to the 2015 NWTT Final EIS/OEIS published in October of 2015. Therefore, this analysis serves to update the modeled noise environment between reference training activities based on historical data and a future proposed state. The reference activities for the EA-18G, the P-3C, the P-8, and the F-15 were derived from a three-year average of actual aircraft flight information derived from 2015–2017 Sierra Hotel Aviation Reporting Program (SHARP) and Data Collection and Scheduling Tool (DCAST) data. SHARP enables aircrew to capture after flight information for fleet training as well as combat readiness data for calculating aircrew and squadron combat readiness levels for operational missions. DCAST is a web-based range complex scheduling system developed for use across all Commander Pacific Fleet's training areas and ranges. DCAST provides the ability to schedule all training resources and Commander Pacific Fleet range complex use in a safe and efficient manner, while collecting data for the purpose of range sustainment (i.e., environmental stewardship and training area and range administration). The proposed future year activities entail updates to both Navy training and testing requirements into the foreseeable future.

J.3 DESCRIPTION OF THE SPECIAL USE AIR SPACE

The SUA analyzed in this study includes the Olympic MOAs and the Warning Areas W-237A and W-237B.[1] The Federal Aviation Administration established the Olympic MOAs, W-237A, and W-237B in 1977 as components of the National Airspace System. The Olympic MOAs begin approximately 53 nautical miles (NM) west of Seattle and extend 3 NM off the coast of Washington State. Although the Olympic MOAs are comprised of A and B sections, normal training activities utilize both sections as one unified block of airspace. W-237A and W-237B begin on the western edge of the Olympic MOAs, and

[1] Warning Area W-237 has several other sections. However, all of these are located farther off shore, away from acoustically sensitive receptors on land, and thus were not considered in this noise analysis.

they extend to the west offshore for approximately 50 NM. As with the Olympic MOAs, these two sections are normally used as a single block of airspace. For modeling purposes, these two units are identified as W-237. All four airspace units are shown in Figure J-1.

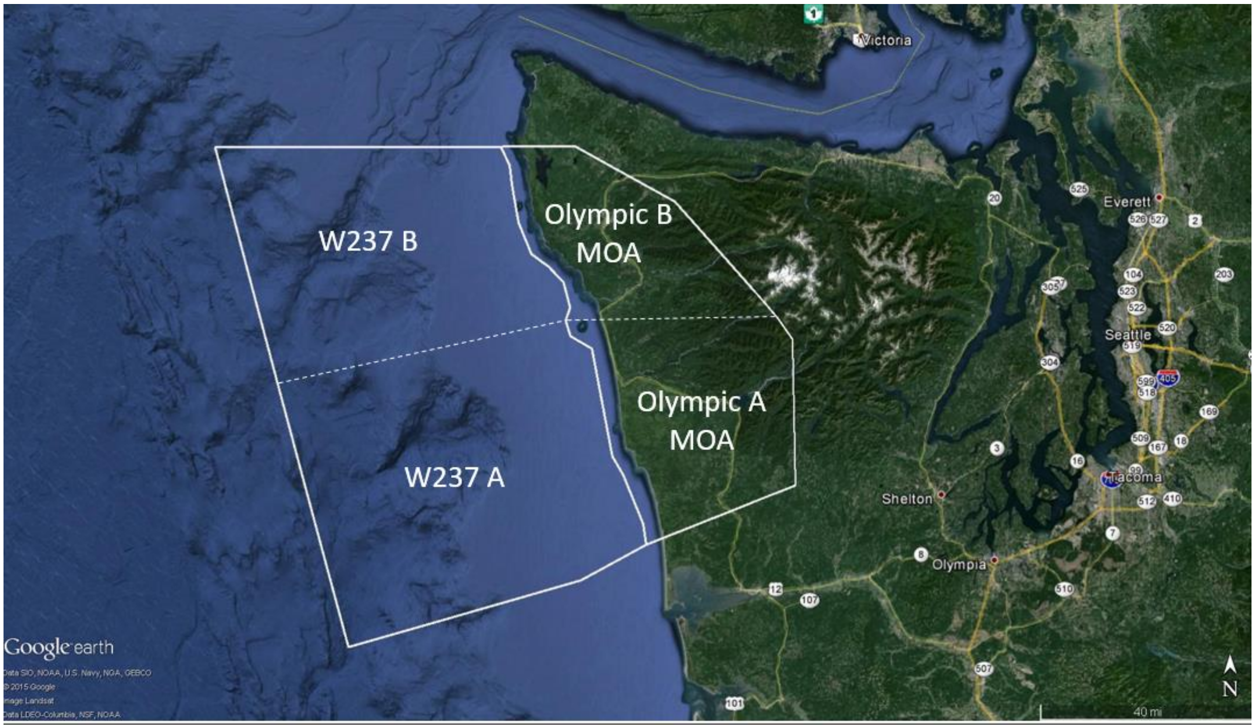

Figure J-1: SUA W-237 and the Olympic MOAs, with the A and B Sections Identified. The A and B Sections Were Combined into a Single Airspace for this Study.

The altitude range for the Olympic MOA airspace begins at 6,000 ft. above mean sea level (MSL) and extends to an upper limit of 18,000 ft. MSL. The 6,000 ft. MSL floor of the airspace is straightforward for the majority of the MOAs, but in the eastern part of the MOAs the terrain can rise several thousand feet above sea level, approaching the floor of the airspace. To account for this, a further restriction requires that aircraft operating over land in the Olympic MOAs maintain an altitude of at least 1,200 ft. above ground level. This 1,200 ft. restriction would only affect terrain located at the eastern edge of the MOAs, where elevations could exceed 4,800 ft. MSL, which is less than 1 percent of the area beneath the MOAs (see Figure J-2). Above the Olympic MOAs, the Olympic Air Traffic Control Assigned Airspace (ATCAA) extends the upper altitude limit of the combined airspace to 35,000 ft. MSL. The altitude range for W-237A and W-237B begins at sea level and extends to 50,000 ft. MSL (Naval Air Station Whidbey Island, 2016). While W-237A and W-237B are not over land, they are included in this study to address noise from activities in these areas.

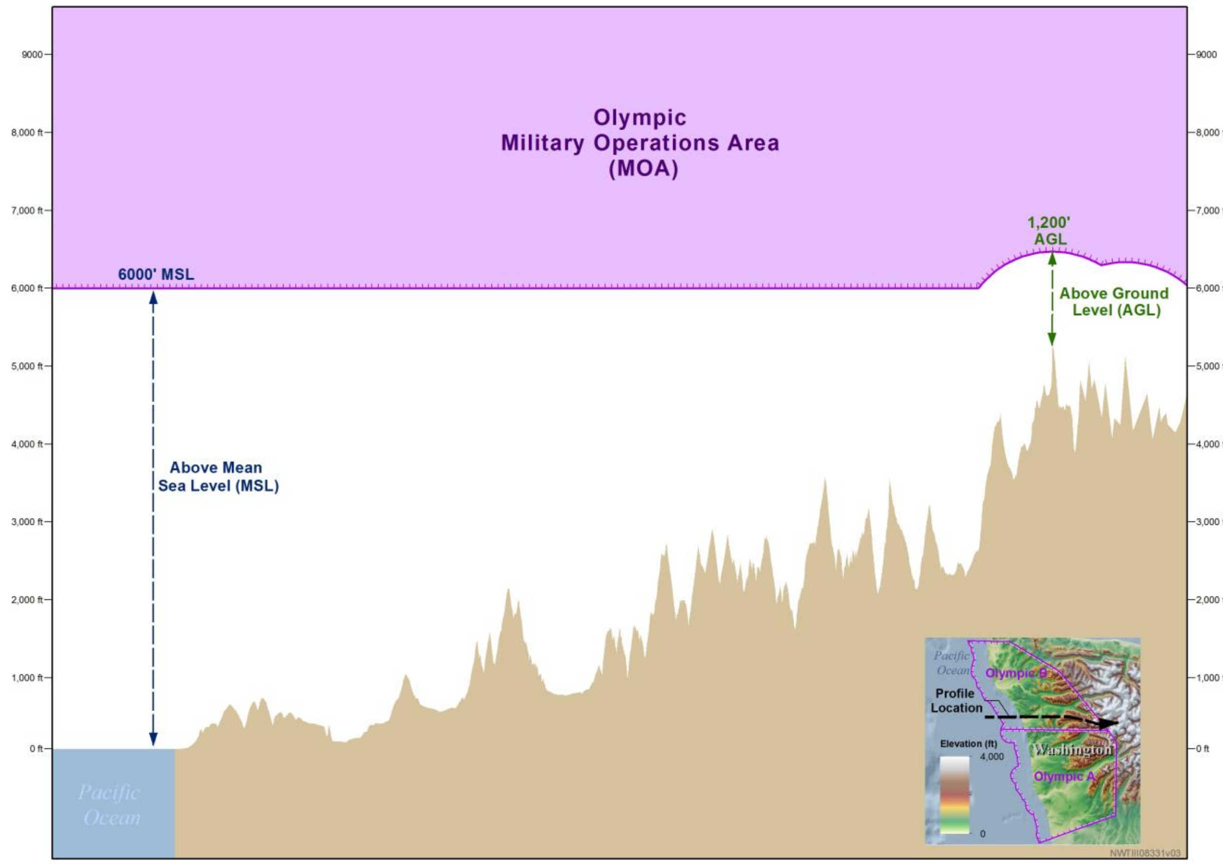

Figure J-2: Floor of the Olympic MOA Airspace

To reduce the likelihood of exceeding the limits of these designated airspaces, aircrews specifically plan their flight maneuvers to avoid inadvertently flying outside of the airspace boundaries. For modeling purposes, a 3 NM offset was applied to the Warning Areas and to the north, south, and east borders of the Olympic MOAs A and B, effectively restricting the modeled aircraft from flying within 3 NM of the edges of the airspace. This offset is used to represent how the aircraft actually fly within the MOA. No offset was applied to the west portion of the Olympic MOA since aircraft often enter the warning areas from the MOA. The result for the acoustic modeling is to concentrate the noise into the interior of the MOA.

J.4 NOISE METRICS

Noise is one of the most prominent environmental issues associated with military training activities. The noise environment at military bases and training areas can include various types of noise sources that can either be classified as intermittent time varying noise (e.g., on-base vehicular traffic and aircraft training activities), or impulsive noise (e.g., weapons firing or detonation of explosives). Not all of these noise sources are directly associated with military training, such as civilian vehicular traffic or building heating, ventilation, and air conditioning system noise. However, military training activities may dominate the noise environment around military bases and training areas. For this study, the standard noise metric, Day-Night Average Sound Level (DNL), is utilized as well as supplement metrics (e.g., maximum noise level [L_{max}]), to provide more information on noise events that would occur within the Olympic National Park.

J.4.1 DAY-NIGHT AVERAGE SOUND LEVEL

In 1979, the Federal Interagency Committee on Urban Noise (FICUN) was established, and they published "Guidelines for Considering Noise in Land-Use Planning and Control" (FICUN, 1980). These guidelines complement federal agency criteria by providing for the consideration of noise in all land-use planning and interagency/intergovernmental processes. The FICUN established DNL as the most appropriate descriptor for all noise sources in land-use planning. In 1982, the Environmental Protection Agency (EPA) published "Guidelines for Noise Impact Analysis" to provide all types of decision-makers with analytic procedures to uniformly express and quantify noise impacts (EPA, 1982). The American National Standards Institute (ANSI) endorsed DNL in 1990 as the "acoustical measure to be used in assessing compatibility between various land uses and outdoor noise environment" (ANSI, 2003). In 1992, the Federal Interagency Committee on Noise (FICON) reaffirmed the use of DNL as the principal aircraft noise descriptor in the document entitled "Federal Agency Review of Selected Airport Noise Analysis Issues" (FICON, 1992). For aviation noise analyses, the Federal Aviation Administration (FAA) has determined that the cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of yearly DNL, the FAA's primary noise metric (FAA, 2015). In general, scientific studies and social surveys have found a high correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL (Schultz, 1974; Fidell et al., 1991; Finegold et al., 1994).

The DNL is a noise measure used for assessing cumulative sound levels. This measure accounts for the exposure of all noise events in an average 24-hour period. DNL (which is also denoted as L_{dn}) is an average sound level, expressed in decibels (dB), which is commonly used to assess aircraft noise exposures in communities in the vicinity of airfields and under SUA (FICUN, 1980; EPA, 1982; ANSI, 2005). DNL values are related to compatible/incompatible land uses and do not directly relate to any singular sound event a person may hear. DNL includes a 10 dB adjustment for acoustical nighttime noise events. Acoustical daytime is defined as the period from 0700 to 2200 hours local, and acoustical nighttime is the period from 2200 to 0700 hours the following morning. The 10 dB penalty accounts for the generally lower background sound levels and greater community sensitivity to noise during nighttime hours.

To assess accurately the impacts on humans from different types of noise events, the DNL metric is used along with weighting factors that emphasize certain parts of the audio frequency spectrum. The normal human ear detects sounds in the range from 20 hertz (Hz) to 20,000 Hz, but our ears are most sensitive to sounds in the 1,000 to 4,000 Hz range. Community noise is therefore assessed using a filter that approximates the frequency response of the human ear, adjusting low and high frequencies to match the sensitivity of the ear. This "A-weighting" filter is used to assess most community noise sources. Noise defined with the "A-weighting" filter uses the decibel designation dBA. See Table J-1 for sound levels of common noise sources.

Table J-1: Examples of Various Sound Levels

dBA	Example	Home & Yard Appliances	Workshop and Construction
0	Healthy hearing threshold	n/a	n/a
10	A pin dropping	n/a	n/a
20	Rustling leaves	n/a	n/a
30	Whisper	n/a	n/a
40	Babbling brook	Computer	n/a
50	Light traffic	Refrigerator	n/a
60	Conversational speech	Air conditioner	n/a
70	Shower	Dishwasher	n/a
75	Toilet flushing	Vacuum cleaner	n/a
80	Alarm clock	Garbage disposal	n/a
85	Passing diesel truck	Snow blower	n/a
90	Squeeze toy	Lawn mower	Arc welder
95	Inside subway car	Food processor	Belt sander
100	Motorcycle (riding)	n/a	Handheld drill
105	Sporting event	n/a	Table saw
110	Rock band	n/a	Jackhammer

Notes: n/a =not applicable
Source: Berger et al., 2015

In the late 1980s, Congress directed the Department of Interior to investigate public concerns on aircraft noise within national parks and wilderness areas. One of the results of the Park Service's investigation was the introduction of audibility as a way of assessing the impact of transportation noise on natural quiet. The prediction of audibility estimates the ability of a human to hear a noise within the ambient soundscape. However, no uniform criteria nor threshold on percent time audible has been established to determine a potential noise impact within these SUA. In Section J.7 (Acoustic Monitoring Report), a 2010 National Park Service acoustic monitoring study, in which percent time audible data are provided, will be discussed.

Aircraft noise generated in SUA is somewhat different from that associated with airfield activities. As opposed to patterned or routine overflight over a specific area associated with airfields, overflights within SUA can be highly variable in occurrence and location. Individual military overflight events also differ from typical airfield noise events in that noise from a low-altitude, high-airspeed flyover can have a sudden onset (i.e., exhibiting a rate of increase in sound level [onset rate] of up to 15 to 150 dB per second). To represent these differences, the conventional DNL metric is adjusted to account for the "surprise" effect of the sudden onset of aircraft noise events on humans. This adjustment is applied by adding a noise penalty of up to 11 dB above the normal Sound Exposure Level (Stusnick et al., 1993, ANSI, 2005). Onset rates between 15 to 150 dB per second require an adjustment penalty of 0 to 11 dB, while onset rates below 15 dB per second require no adjustment. The adjusted DNL is designated as the onset-rate adjusted day-night average sound level (DNL_r or L_{dnr}).

Because DNL takes into account both the amount of noise from each aircraft operation as well as the total number of operations flying throughout the day, there are many ways in which aircraft noise can add up to a specific DNL. Small numbers of relatively loud operations can result in the same DNL as large numbers of relatively quiet operations.

J.4.2 Maximum Noise Level

Another noise metric that can provide additional supplemental information about the noise environment is the maximum noise level (L_{max}). For SUA noise analysis, the L_{max} metric provides the maximum noise level from the single loudest event potentially occurring within the SUA. Moreover, the L_{max} is unaltered by the number of training activities. However, an observer might not necessarily experience that event depending on where the observer was located in relation to the aircraft overflight. Because the flight activities within SUA are dispersed throughout the airspace, this means an observer would need to be directly below an aircraft as it flew at the lowest possible altitude to experience the maximum level of noise.

In this analysis, noise from aircraft training activities within the Olympic MOA was assessed using noise metrics recommended by the Department of Defense (DoD), the Federal Interagency Committee on Aviation Noise (FICAN),[2] ANSI, and the FAA. Aircraft flight noise was assessed using the A-weighted L_{dn} and the L_{dnr}. Table J-2 provides the noise level limits associated with land use planning (DoD, 2011; Navy, 2008). In general, most land uses are considered compatible within Noise Zone 1. For Noise Zone 2, some land uses are incompatible with the noise. Within Noise Zone 3, most land uses are incompatible. In addition, the analysis provides L_{max} levels from the EA-18G (Table J-13) to aid in the assessment of noise intrusions into the natural soundscape areas underneath and adjacent to the SUA.

Table J-2: Noise Zone Definitions

Noise Zone	Noise Limit L_{dn} (dBA)	Potential Impacts
1	<65	Lesser
2	65 - 75	Moderate
3	75 +	Highest

Notes: L_{dn} = Day-Night Average Sound Level, dBA = A-Weighted Sound Pressure Level

J.4.3 Computerized Noise Exposure Models

Analyses of aircraft noise exposures and compatible land uses around and underneath SUA are normally accomplished using MOA and Route NoiseMap Model (MRNMap) (Ikelheimer & Downing, 2013). The United States Air Force developed this general-purpose computer model for calculating noise exposures occurring away from airbases, since aircraft noise is also an issue within MOAs and ranges, as well as along Military Training Routes (MTRs). This model expands the calculation of noise exposures away from airbases by using algorithms from both NoiseMap (Moulton, 1992; Czech & Plotkin, 1998) and ROUTEMAP (Bradley, 1996). NoiseMap is the DoD noise model to assess aircraft noise in and around airfields, and ROUTEMAP is a legacy DoD prediction model for cumulative noise underneath and near MTRs. MRNMap leverages the algorithms in these DoD noise models to predict cumulative noise levels underneath and near SUA. MRNMap uses two primary noise models to calculate the noise exposure:

[2] FICAN was established in 1993 as the successor to Federal Interagency Committee on Noise (FICON).

track and area operations. Track operations are for training activities that have a well-defined flight track, such as MTRs, aerial refueling, and strafing tracks. Area operations are for training activities that do not have well defined tracks, but occur within a defined area, such as basic fighter maneuvers within a MOA. The Navy used MRNMap – area operations for this noise study as it is ideally suited to analyze aircraft noise in MOAs.

For area operations, the model allows flexibility. If little is known about the airspace utilization within a MOA, then the MOA boundaries can simply be used, and the training activities are uniformly distributed within the defined area. However, if more is known about how and where the aircraft fly within the MOA, subareas can be defined within the MOA to refine the modeled noise exposure.

Once the airspace is defined, the user must describe the different types of missions occurring within each airspace segment. Individual aircraft missions include the altitude distribution, airspeed, and engine power settings. These individual profiles are coupled with airspace components and annual operational rates.

The noise model MRNMap uses the airspace and operational parameters defined to calculate the desired noise metrics. The model calculates these noise metrics either for a user-defined grid or at user-defined specific points. The specific point calculation, used for this analysis in order to consider the changing elevation, generates a table that provides the noise exposure, as well as the top contributors to the noise exposure. The noise model MRNMap is the FAA-approved model for conducting a detailed noise analysis in MOAs and other SUA, such as the airspace over the Olympic Peninsula.

J.5 Airspace Training and Testing Activities

Flight training activities conducted within the Olympic MOAs and Warning Area W-237 include a range of aircraft and mission types. Specific mission types and associated aircraft for these missions are defined in the Tables J-3 through J-10 below. Mission definitions are broken out into the reference training missions, based on historical data, and the proposed training missions projected to occur in the foreseeable future. Additional details on the modeled activities can be found in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activities Descriptions) of the Supplemental. The numbers reflected in the following tables are based on the number of aircraft sorties, while the numbers in the 2015 NWTT Final EIS/OEIS are the number of activity events; therefore, a comparison between the two sets of data is not easily made. One aircraft sortie could result in the completion of multiple training events, as a sortie is simply a single operational flight by one aircraft. Similarly, in some cases, one event could include multiple aircraft sorties. Naval Air Systems Command would conduct comparatively few testing events that involve only P-8A and Triton aircraft. For the purposes of this analysis, the events would be conducted in the same manner and locations as Fleet training events.

Aircraft modeled include the primary user of the airspace units, EA-18G, along with other users: P-3C, P-8A, and F-15. The F-15 activities were modeled with the Pratt and Whitney F100-PW-229 engines. For the P-8A (a modified Boeing 737), the Boeing 737-700 with a CFM56-7B-24 engine was selected for the reference noise database within MRNMap. These engine selections were made to provide the loudest available variants of these aircraft for the noise modeling.

The noise model relies on performance parameters (airspeed, altitude, and power settings) provided by the aircrews, who fly these missions. Because the actual locations of any given event are unpredictable due to variables such as specific mission requirements and weather, the model assumes that the aircraft events are uniformly distributed throughout the SUA within the 3 NM offset with a diminishing distribution from the offset to the SUA boundary.

J.5.1 Reference Missions

Table J-3: Reference Training Mission Descriptions for the EA-18G

<table>
<tr><th></th><th colspan="8">EA-18G - Reference</th></tr>
<tr><th></th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th></tr>
<tr><td>Name/Identifier</td><td colspan="2">Entry/Exit: Ingress & Egress Routes[3]</td><td colspan="2">Suppress Enemy Air Defenses[1]</td><td colspan="2">Electronic Warfare Close Air Support[1]</td><td colspan="2">Air to Air Counter Tactics[2]</td></tr>
<tr><td># Aircraft/Year</td><td>4448</td><td>0</td><td>1194</td><td>187</td><td>318</td><td>92</td><td>712</td><td>132</td></tr>
<tr><td>% Day (0700L-2159L)</td><td>94%</td><td>0%</td><td>99%</td><td>98%</td><td>99%</td><td>99%</td><td>96%</td><td>100%</td></tr>
<tr><td>% Night (2200L-0659L)</td><td>6%</td><td>0%</td><td>1%</td><td>2%</td><td>1%</td><td>1%</td><td>4%</td><td>0%</td></tr>
<tr><td>Avg Minutes in Airspace/Aircraft</td><td>NA</td><td>NA</td><td>90</td><td>90</td><td>90</td><td>90</td><td>60</td><td>60</td></tr>
<tr><td>Avg Power Setting in % NC</td><td>75</td><td>NA</td><td>80</td><td>80</td><td>82</td><td>82</td><td>89</td><td>89</td></tr>
<tr><td>Avg Speed (Knots indicated)</td><td>250</td><td>NA</td><td>265</td><td>265</td><td>298</td><td>298</td><td>342</td><td>342</td></tr>
<tr><td>Altitude MSL</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td></tr>
<tr><td>FLR - 2,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td></td></tr>
<tr><td>2,000 - 4,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td></td></tr>
<tr><td>4,000 - 6,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td>2.3%</td></tr>
<tr><td>6,000 - 8,000 ft</td><td></td><td>2.0%</td><td>2.0%</td><td rowspan="2">5.0%</td><td>2.0%</td><td rowspan="2">5.0%</td><td>3.2%</td><td rowspan="3">7.5%</td></tr>
<tr><td>8,000 - 10,000 ft</td><td></td><td rowspan="2">5.0%</td><td rowspan="2">5.0%</td><td rowspan="2">5.0%</td><td rowspan="2">6.6%</td></tr>
<tr><td>10,000 - 12,000 ft</td><td></td><td rowspan="4">16.0%</td><td rowspan="4">16.0%</td></tr>
<tr><td>12,000 - 14,000 ft</td><td></td><td rowspan="4">24.0%</td><td rowspan="4">24.0%</td><td rowspan="4">24.0%</td><td rowspan="4">55.2%</td><td rowspan="4">55.2%</td></tr>
<tr><td>14,000 - 16,000 ft</td><td>100.0%</td></tr>
<tr><td>16,000 - 18,000 ft</td><td></td></tr>
<tr><td>18,000 - 20,000 ft</td><td></td><td>4.2%</td><td>4.2%</td></tr>
<tr><td>20,000 - 23,000 ft</td><td></td><td rowspan="2">64.0%</td><td rowspan="2">64.0%</td><td rowspan="2">65.0%</td><td rowspan="2">64.0%</td><td rowspan="2">65.0%</td><td rowspan="2">35.0%</td><td rowspan="2">35.0%</td></tr>
<tr><td>23,000 - 30,000 ft</td><td></td></tr>
<tr><td>30,000 - 40,000 ft *</td><td></td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td></td><td></td></tr>
<tr><td>Total % Time</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td></tr>
</table>

*Olympic MOA activities are all at or below 35,000 feet MSL, with over 95% of activities at or above 10,000 feet MSL.

[1] Suppress Enemy Air Defenses and Electronic Warfare Close Air Support are two types of Electronic Warfare activities.

[2] Electronic Warfare (EW) and Advanced Air to Air Combat Tactics (AACT) 3-year average of data was 68% EW and 32% AACT – this ratio of events was used for this study.

[3] Entry/Exit number is 2x 1 for entry 1 for exit. W-237 entry/exit are zero because the EA-18G enters the warning area from the MOA.

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, NC = Compressor Stage Rotations Per Minute (a measure of jet engine power setting), FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-4: Reference Training Mission Descriptions for the P-3C

	P-3C/EP-3 - Reference			
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier	Entry/Exit		Intelligence, Surveillance and Reconnaissance	
# Aircraft/Year Avg FY 15-17 (SHARP)	0	155	0	155
% Day (0700L-2159L)	90%	90%	90%	90%
% Night (2200L-0659L)	10%	10%	10%	10%
Avg Minutes in Airspace/Aircraft	NA	NA	180	180
Avg Power Setting in ESHP	2500	2500	2000	2000
Avg Speed (Knots indicated)	260	260	220	220
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft				5%
2,000 - 4,000 ft				
4,000 - 6,000 ft				
6,000 - 8,000 ft				
8,000 - 10,000 ft				5%
10,000 - 12,000 ft	100%	100%	10%	10%
12,000 - 14,000 ft				
14,000 - 16,000 ft				10%
16,000 - 18,000 ft				
18,000 - 20,000 ft			90%	70%
Total % Time	100.0%	100.0%	100.0%	100.0%

Notes: ATCAA = Air Traffic Control Assigned Airspace, SHARP = Sierra Hotel Aviation Reporting Program, Avg = Average, ESHP = Equivalent Shaft Horsepower, FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-5: Reference Training Mission Descriptions for the P-8A

	P-8A - Reference			
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier	Entry/Exit		Intelligence, Surveillance and Reconnaissance	
# Aircraft/Year Avg FY 15-17 (SHARP)	0	64	0	32
% Day (0700L-2159L)	90%	90%	90%	90%
% Night (2200L-0659L)	10%	10%	10%	10%
Avg Minutes in Airspace/Aircraft	NA	NA	180	180
Avg Power Setting in ESHP	6000	6000	5500	5500
Avg Speed (Knots indicated)	260	260	240	240
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft				5%
2,000 - 4,000 ft				
4,000 - 6,000 ft				
6,000 - 8,000 ft				
8,000 - 10,000 ft				5%
10,000 - 12,000 ft	100%	100%	10%	10%
12,000 - 14,000 ft				
14,000 - 16,000 ft				10%
16,000 - 18,000 ft				
18,000 - 20,000 ft			90%	70%
Total % Time	100.0%	100.0%	100.0%	100.0%

Notes: ATCAA = Air Traffic Control Assigned Airspace, SHARP = Sierra Hotel Aviation Reporting Program, Avg = Average, ESHP = Equivalent Shaft Horsepower, FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-6: Reference Training Mission Descriptions for the F-15

	F-15 - Reference					
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier FY Avg FY15-17	Entry/Exit		Basic Fighter Maneuvers		Air Combat Maneuvers	
# Aircraft/Year	24	42	6	10	6	11
% Day (0700L-2159L)	100%	100%	100%	100%	100%	100%
% Night (2200L-0659L)	0%	0%	0%	0%	0%	0%
Avg Minutes in Airspace/Aircraft	NA	NA	25	25	30	25
Avg Power Setting in % NC	75	75	88	88	88	88
Avg Speed (Knots indicated)	250	250	375	375	375	375
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft						
2,000 - 4,000 ft						
4,000 - 6,000 ft						
6,000 - 8,000 ft		10%	10%	10%	10%	10%
8,000 - 10,000 ft		10%	10%	10%	10%	10%
10,000 - 12,000 ft		10%	10%	10%	10%	10%
12,000 - 14,000 ft		20%	20%	20%	20%	20%
14,000 - 16,000 ft	100%	20%	20%	20%	20%	20%
16,000 - 18,000 ft		20%	20%	20%	20%	20%
18,000 - 20,000 ft		10%	10%	10%	10%	10%
Total % Time	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* F-15 Eagle is a U.S. Air Force aircraft that may occasionally use Olympic MOAs and W-237 for training. For an inclusive analysis of military aircraft noise they were included in this study

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, NC = Compressor Stage Rotations Per Minute (a measure of jet engine power setting), FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

J.5.2 PROPOSED MISSIONS

Table J-7: Proposed Training Missions for the EA-18G

<table>
<tr><th></th><th colspan="8">EA-18G - Proposed</th></tr>
<tr><th></th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th><th>Olympic A & B (including ATCAA)</th><th>W-237 A & B</th></tr>
<tr><td>Name/Identifier</td><td colspan="2">Entry/Exit:Ingress & Egress Routes[3]</td><td colspan="2">Suppress Enemy Air Defenses[1]</td><td colspan="2">Electronic Warfare Close Air Support[1]</td><td colspan="2">Air to Air Counter Tactics[2]</td></tr>
<tr><td># Aircraft/Year</td><td>5048</td><td>0</td><td>1201</td><td>319</td><td>515</td><td>137</td><td>808</td><td>214</td></tr>
<tr><td>% Day (0700L-2159L)</td><td>94%</td><td>0%</td><td>99%</td><td>98%</td><td>99%</td><td>99%</td><td>96%</td><td>100%</td></tr>
<tr><td>% Night (2200L-0659L)</td><td>6%</td><td>0%</td><td>1%</td><td>2%</td><td>1%</td><td>1%</td><td>4%</td><td>0%</td></tr>
<tr><td>Avg Minutes in Airspace/Aircraft</td><td>NA</td><td>NA</td><td>90</td><td>90</td><td>90</td><td>90</td><td>60</td><td>60</td></tr>
<tr><td>Avg Power Setting in % NC</td><td>75</td><td>NA</td><td>80</td><td>80</td><td>82</td><td>82</td><td>89</td><td>89</td></tr>
<tr><td>Avg Speed (Knots indicated)</td><td>250</td><td>NA</td><td>265</td><td>265</td><td>298</td><td>298</td><td>342</td><td>342</td></tr>
<tr><td>Altitude MSL</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td><td colspan="2">Percent of total time spent at these altitudes.</td></tr>
<tr><td>FLR - 2,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td></td></tr>
<tr><td>2,000 - 4,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td></td></tr>
<tr><td>4,000 - 6,000 ft</td><td></td><td></td><td></td><td>1.6%</td><td></td><td>1.6%</td><td></td><td>2.3%</td></tr>
<tr><td>6,000 - 8,000 ft</td><td></td><td>2.0%</td><td>2.0%</td><td rowspan="2">5.0%</td><td>2.0%</td><td rowspan="2">5.0%</td><td>3.2%</td><td rowspan="3">7.5%</td></tr>
<tr><td>8,000 - 10,000 ft</td><td></td><td rowspan="2">5.0%</td><td rowspan="2">5.0%</td><td rowspan="2">5.0%</td><td rowspan="2">6.6%</td></tr>
<tr><td>10,000 - 12,000 ft</td><td></td><td rowspan="4">16.0%</td><td rowspan="4">16.0%</td></tr>
<tr><td>12,000 - 14,000 ft</td><td></td><td rowspan="4">24.0%</td><td rowspan="4">24.0%</td><td rowspan="4">24.0%</td><td rowspan="4">55.2%</td><td rowspan="4">55.2%</td></tr>
<tr><td>14,000 - 16,000 ft</td><td>100.0%</td></tr>
<tr><td>16,000 - 18,000 ft</td><td></td></tr>
<tr><td>18,000 - 20,000 ft</td><td></td><td>4.2%</td><td>4.2%</td></tr>
<tr><td>20,000 - 23,000 ft</td><td></td><td rowspan="2">64.0%</td><td rowspan="2">64.0%</td><td rowspan="2">65.0%</td><td rowspan="2">64.0%</td><td rowspan="2">65.0%</td><td rowspan="2">35.0%</td><td rowspan="2">35.0%</td></tr>
<tr><td>23,000 - 30,000 ft</td><td></td></tr>
<tr><td>30,000 - 40,000 ft *</td><td></td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td>5.0%</td><td></td><td></td></tr>
<tr><td>Total % Time</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td><td>100.0%</td></tr>
</table>

*Olympic MOA activities are all at or below 35,000 feet MSL, with over 95% of activities at or above 10,000 feet MSL.

[1] Suppress Enemy Air Defenses and Electronic Warfare Close Air Support are two types of Electronic Warfare activities.

[2] Electronic Warfare (EW) and Advanced Air to Air Combat Tactics (AACT) 3-year average of data was 68% EW and 32% AACT – this ratio of events was used for this study.

[3] Entry/Exit number is 2x 1 for entry 1 for exit. W-237 entry/exit are zero because the EA-18G enters the warning area from the MOA.

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, NC = Compressor Stage Rotations Per Minute (a measure of jet engine power setting), FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-8: Proposed Training Missions for the P-3C

	P3/EP-3 - Proposed 2020-2025			
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier	Entry/Exit		Intelligence, Surveillance and Reconnaissance	
# Aircraft/Year	4	94	2	47
% Day (0700L-2159L)	90%	90%	90%	90%
% Night (2200L-0659L)	10%	10%	10%	10%
Avg Minutes in Airspace/Aircraft	NA	NA	180	180
Avg Power Setting in ESHP	2500	2500	2000	2000
Avg Speed (Knots indicated)	260	260	220	220
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft				5%
2,000 - 4,000 ft				
4,000 - 6,000 ft				
6,000 - 8,000 ft				
8,000 - 10,000 ft				5%
10,000 - 12,000 ft	100%	100%	10%	10%
12,000 - 14,000 ft				
14,000 - 16,000 ft				10%
16,000 - 18,000 ft				
18,000 - 20,000 ft			90%	70%
Total % Time	100.0%	100.0%	100.0%	100.0%

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, ESHP = Equivalent Shaft Horsepower, FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-9: Proposed Training Missions for the P-8A

	P-8A - Proposed 2020-2025			
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier	Entry/Exit		Intelligence, Surveillance and Reconnaissance	
# Aircraft/Year	4	778	2	389
% Day (0700L-2159L)	90%	90%	90%	90%
% Night (2200L-0659L)	10%	10%	10%	10%
Avg Minutes in Airspace/Aircraft	NA	NA	180	180
Avg Power Setting in ESHP	6000	6000	5500	5500
Avg Speed (Knots indicated)	260	260	240	240
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft				5%
2,000 - 4,000 ft				
4,000 - 6,000 ft				
6,000 - 8,000 ft				
8,000 - 10,000 ft				5%
10,000 - 12,000 ft	100%	100%	10%	10%
12,000 - 14,000 ft				
14,000 - 16,000 ft				10%
16,000 - 18,000 ft				
18,000 - 20,000 ft			90%	70%
Total % Time	100.0%	100.0%	100.0%	100.0%

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, ESHP = Equivalent Shaft Horsepower, FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

Table J-10: Proposed Training Missions for the F-15

	F-15 - Proposed					
	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B	Olympic A & B (including ATCAA)	W-237 A & B
Name/Identifier	Entry/Exit		Air Combat Maneuvers		Basic Fighter Maneuvers	
# Aircraft/Year	24	48	6	12	6	12
% Day (0700L-2159L)	100%	100%	100%	100%	100%	100%
% Night (2200L-0659L)	0%	0%	0%	0%	0%	0%
Avg Minutes in Airspace/Aircraft	10	10	30	25	25	25
Avg Power Setting in % NC	75	75	88	88	88	88
Avg Speed (Knots indicated)	250	250	375	375	375	375
Altitude MSL	Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.		Percent of total time spent at these altitudes.	
FLR - 2,000 ft						
2,000 - 4,000 ft						
4,000 - 6,000 ft						
6,000 - 8,000 ft		10%	10%	10%	10%	10%
8,000 - 10,000 ft		10%	10%	10%	10%	10%
10,000 - 12,000 ft		10%	10%	10%	10%	10%
12,000 - 14,000 ft		20%	20%	20%	20%	20%
14,000 - 16,000 ft	100%	20%	20%	20%	20%	20%
16,000 - 18,000 ft		20%	20%	20%	20%	20%
18,000 - 20,000 ft		10%	10%	10%	10%	10%
Total % Time	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* F-15 Eagle is a U.S. Air Force aircraft that may occasionally use Olympic MOAs and W-237 for training. For an inclusive analysis of military aircraft noise they were included in this study

Notes: ATCAA = Air Traffic Control Assigned Airspace, Avg = Average, NC = Compressor Stage Rotations Per Minute (a measure of jet engine power setting), FLR = Floor, MSL = Mean Sea Level, NA = Not Applicable

J.6 PROJECTED AIRCRAFT NOISE EXPOSURE

The operational parameters described in Section J.5 (Airspace Training and Testing Activities) were used as inputs to MRNMap to calculate the noise exposures within the Olympic MOAs and the Warning Area W-237.

J.6.1 TERRAIN

The area beneath the Olympic MOAs includes mountainous terrain. The Olympic MOAs have a 3 NM boundary offset, which was applied to the north, south, and east boundaries. The offset was not applied to the west boundary as aircraft often cross the boundary when traversing between the MOA and warning area. The elevation distributions were calculated in both the area inside of the 3 NM boundary offset (where most of the operations will take place), and the area between the MOA boundary and the 3 NM boundary offset (fewer operations occur in this area).

Area inside of the 3 NM boundary offset:

- 14.47 percent of the MOA's area lies above terrain with an elevation range between 0 and 5 ft. (MSL),
- 46.87 percent between 5 and 500 ft. MSL,
- 18.53 percent between 500 and 1,000 ft. MSL,
- 7.87 percent between 1,000 and 1,500 ft. MSL,
- 5.32 percent between 1,500 and 2,000 ft. MSL,
- 3.86 percent between 2,000 and 2,500 ft. MSL,
- 2.13 percent between 2,500 and 3,000 ft. MSL,
- 0.78 percent between 3,000 and 3,500 ft. MSL,
- 0.15 percent between 3,500 and 4,000 ft. MSL,
- 0.02 percent between 4,000 and 4,500 ft. MSL,
- 0.00 percent between 4,500 and 4,800 ft. MSL, and
- 0.00 percent between 4,800 and 5,000 ft. MSL.

Area between the MOA boundary and the 3 NM boundary offset:

- 5.75 percent of the MOA's area lies above terrain with an elevation range between 0 and 5 ft. (MSL),
- 29.17 percent between 5 and 500 ft. MSL,
- 20.98 percent between 500 and 1,000 ft. MSL,
- 12.30 percent between 1,000 and 1,500 ft. MSL,
- 8.42 percent between 1,500 and 2,000 ft. MSL,
- 7.86 percent between 2,000 and 2,500 ft. MSL,
- 6.81 percent between 2,500 and 3,000 ft. MSL,
- 4.62 percent between 3,000 and 3,500 ft. MSL,
- 2.88 percent between 3,500 and 4,000 ft. MSL,
- 1.01 percent between 4,000 and 4,500 ft. MSL,
- 0.16 percent between 4,500 and 4,800 ft. MSL, and
- 0.04 percent between 4,800 and 5,000 ft. MSL.

More than 82 percent of the total combined Olympic A and Olympic B MOA area is inside of the 3 NM boundary offset, and the other 18 percent of the area is between the combined MOA boundary and the 3 NM boundary offset. The elevation distributions are shown graphically in Figure J-3.

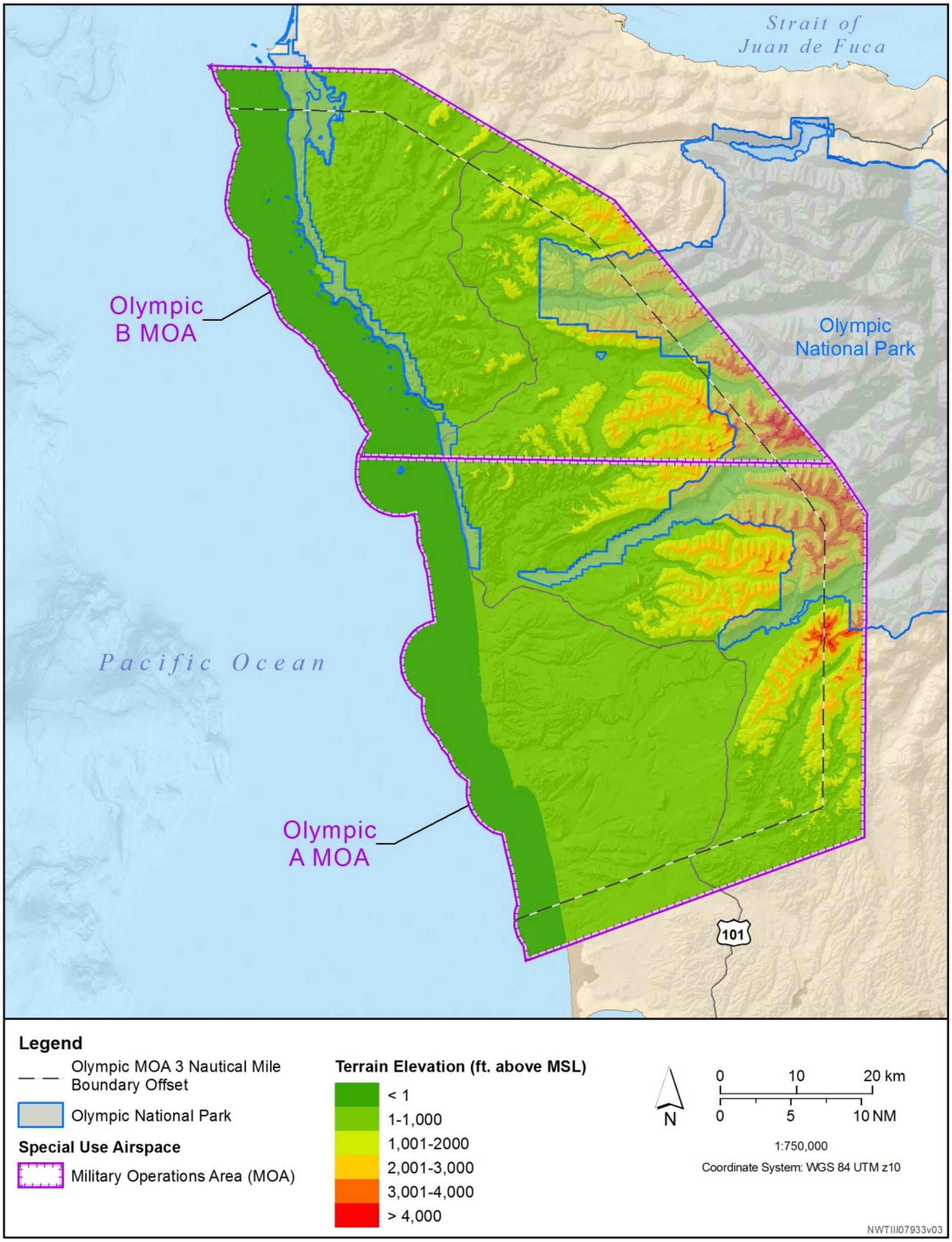

Figure J-3: Elevation Distributions within the Olympic MOAs

To further refine the analysis (since the highest elevations are closer to the MOA boundary than the 3 NM offset), the 3 NM offset area (the area between the 3 NM offset and the MOA boundary) was split in half (at the 1.5 NM offset of the MOA boundary) and the probability of aircraft within each portion of the 3 NM offset and the area inside of the 3 NM offset was calculated.

J.6.2 DAY-NIGHT AVERAGE SOUND LEVEL RESULTS

The current version of MRNMap, which uses the best available science to calculate noise within SUA, does not have the capability to model complex terrain. However, the model can accurately estimate the noise exposure at different elevations by varying the modeled ground elevation. For the Olympic MOA, noise was modeled with different reference ground elevations from 0 ft. MSL to 5,000 ft. MSL to represent the expected noise exposures for the lowest and the highest ground elevations within the MOA. The results are presented in Table J-11. As described above in Section J.4 (Noise Metrics), the results presented from MRNMap consider an average 24-hour period with a 10 dB penalty added for activities occurring at night (L_{dn}) and an additional 11 dB penalty added to adjust for “surprise” effects of the sudden onset of aircraft noise (L_{dnr}).

Table J-11: Cumulative Noise Metrics Values for Baseline and Proposed Aircraft Activities

Terrain Height (feet above MSL)	Baseline L_{dnr} (dBA)	Proposed L_{dnr} (dBA)
0–5	<35	<35
5–500	<35	<35
500–1,000	<35	<35
1,000–1,500	<35	<35
1,500–2,000	<35	<35
2,000–2,500	<35	35.6
2,500–3,000	35.5	36.0
3,000–3,500	36.1	36.7
3,500–4,000	35.7	36.2
4,000–4,500	35.4	36.0

MSL = Mean Sea Level, L_{dn} = Day-Night Average Sound Level,
dBA = A-Weighted Sound Pressure Level

For the cumulative noise metrics (L_{dnr}), the noise modeling results show that the area underneath the Olympic MOAs would experience a cumulative noise exposure of less than 37 dBA for both the reference (current) activities and the proposed activities. The slightly higher values for the proposed activities are a reflection of the 13.5 percent projected increase in sorties over the current level of activities. For the lower ground elevations, the computed noise levels are correspondingly lower, as the distance would increase between the airborne source and the receptor on the ground (see Figure J-2 and Table J-11). For comparison, 35 dBA would be considered the natural ambient noise level of a wilderness area, and 39 dBA the level of a rural residential area. The peak cumulative noise exposures shown in Table J-11 are predicted to occur at 3,000-3,500 ft. terrain height, and not at the highest terrain elevations above 3,500 ft. This reduced cumulative noise exposure is because those higher elevations occur near the boundaries of the MOAs, where aircraft seldom fly and noise events are less likely to occur.

As described above in Section J.4.1 (Day-Night Average Sound Level), there are many ways in which aircraft noise can add up to a specific DNL. Small numbers of relatively loud operations can result in the same DNL as large numbers of relatively quiet operations. Any one location beneath the MOAs could reach a 35 dBA level from several high-noise events, while another location would experience the same average with no high-noise events, but a number of barely audible jet flyovers.

The analysis also considered cumulative noise at locations where air traffic is most common and predictable, beneath specific points that aircraft use to enter or exit the MOAs. These entry points are described in Table J-12 and depicted in Figure J-4.

Table J-12: Entry and Exit Routes to/from Olympic MOAs and W-237

Aircraft	Entry/Exit to Area	Point Number	Fix	Altitude (feet above MSL)	Airspeed (knots)
EA-18G	Navigation Point to Olympic B MOA	1	MCCUL	15,000	250
	Entry to Olympic B MOA	2	NUW 233065	15,000	250
	Exit from Olympic A MOA	1	HQM 360040	14,000	250
	Navigation Point to NASWI	2	YETII	At or above 10,000	250
F-15	Departure Point to Olympic A MOA	1	KPDX	At or above 10,000	250
	Entry to Olympic A MOA	2	HQM001035	14,000–16,000	250
	Exit from Olympic A MOA	1	HQM001035	25,000–27,000	250
	Reporting point returning to KPDX	2	KEIKO	At or above 10,000	250
	Departure Point to Olympic A MOA	1	KPDX	25,000	250
	Reporting Point for Entry to W-237A	2	HQM	25,000	250
	First Navigation Fix after Exit from W-237A	1	HQM	25,000	250
	Reporting Point Returning to KPDX	2	KEIKO	25,000	250
P-3 / P-8	1st Navigation Point to W-237A	1	MCCUL	10,000–12,000	260
	2nd Navigation Point to W-237A	2	HQM	10,000–12,000	260
	Entry to W-237A	3	HQM270030	10,000–12,000	260
	Exit from W-237A	1	HQM270030	10,000–12,000	260
	1st Navigation Point to NASWI	2	HQM	10,000–12,000	260
	Reporting Point Returning to NASWI	3	YETII	10,000–12,000	260
	1st Navigation Point to W-237B	1	MCCUL	10,000–12,000	260
	2nd Navigation Point to W-237B	2	NUW233035	10,000–12,000	260
	3rd Navigation Point to W-237B	3	TOU	10,000–12,000	260

Table J-12: Entry and Exit Routes to/from Olympic MOAs and W-237 (continued)

Aircraft	Entry/Exit to Area	Point Number	Fix	Altitude (feet above MSL)	Airspeed (knots)
	Entry to W-237B	4	TOU210030	10,000–12,000	260
	Exit from W-237B	1	TOU210030	10,000–12,000	260
	1st Navigation Point to NASWI	2	TOU	10,000–12,000	260
	2nd Navigation Point to NASWI	3	NUW233035	10,000–12,000	260
	Reporting Point Returning to NASWI	4	MCCUL	10,000–12,000	260

Notes: MOA = Military Operations Area, MSL = Mean Sea Level, NASWI = Naval Air Station Whidbey Island

Directly under the entry and exit routes to the MOAs and Warning Areas, the highest level of noise exposure was computed to be 36 dBA for both reference activities and proposed activities. These L_{dnr} and L_{dn} noise levels are well below 65 dBA, meaning that the entire area beneath the Olympic MOAs falls within Noise Zone 1.

One of the reasons for these low DNL levels is that the EA-18G spends, on average, more than 95 percent of flight time at or above 10,000 ft. MSL while in the Olympic MOAs. In addition, the P-8A stays at or above 10,000 ft. MSL 100 percent of the flight time. This higher altitude translates into lower cumulative noise levels on the ground. The area beneath W-237 is computed to have cumulative noise levels below 35 dBA.

These calculated noise exposures are based on the average annual operational tempo, as defined in Section J.5 (Airspace Training and Testing Activities). If the training tempo for an active month were twice the annual average, the expected noise exposure would increase by 3 dB. In this situation, the higher elevations within the Olympic MOAs would be exposed to an L_{dn} (and L_{dnr}) of 40 dBA for the proposed activities, which is still within Noise Zone 1 limits.

While these noise zones are applicable to most situations, special consideration needs to be given to the evaluation of significance of noise impacts on noise-sensitive areas such as national parks and historic sites that could include traditional cultural resources (Federal Aviation Administration, 2015). With these noise-sensitive areas in mind, it is notable that the noise exposure for more than 91 percent of the area beneath the Olympic MOAs would be less than 35 dBA, which is considered the natural ambient noise level of a wilderness area. Also, an additional analysis was conducted in which maximum noise levels are considered.

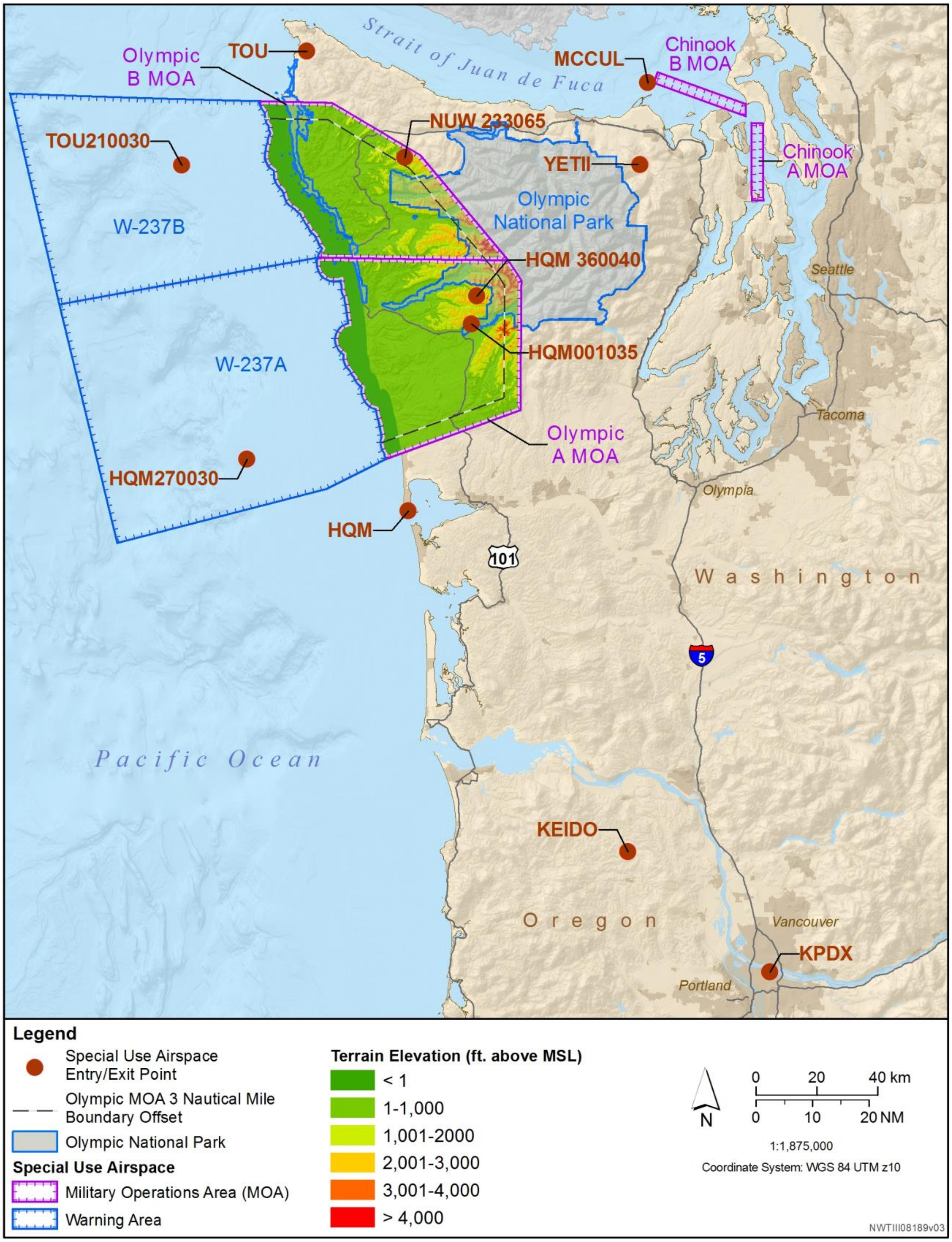

Figure J-4: Entry and Exit Routes to/from Olympic MOAs and W-237

J.6.3 MAXIMUM NOISE LEVEL

Cumulative noise metrics, such as DNL, are well suited for general land use planning, but fall short of providing an understanding of the experience from individual events. In contrast, the L_{max} provides a simple metric to describe single noise events that people may experience while underneath the MOAs. For the modeled missions defined in Section J.5.1 (Reference Missions), the loudest event in terms of L_{max} occurs during the EA-18G Air-to-Air Counter Tactics (see Table J-3 and Table J-7). This situation only occurs when the aircraft is at a relatively high engine power (89 percent NC), flying at the lowest altitudes (6,000 ft. to 8,000 ft. MSL), and flying over the highest elevations. Aircraft performing these training activities only spend 3.2 percent of their flight time at this lowest altitude band across the entire airspace. Combining this operational distribution with the terrain altitude distributions, the noise analysis provides an estimate of the time that areas within the Olympic MOAs will experience noise at a given maximum level. The results for the EA-18G, P-3/P-8, and F-15 are shown in Tables J-13, J-14, and J-15, respectively.

Table J-13: Estimated L_{max} Duration for EA-18G Training Operations Within the Olympic MOAs

Terrain Elevation (MSL)	Probability Distribution within the Combined MOA	Lmax (dBA)	Time at this Lmax (min) per EA-18G SEAD and EWCAS Mission Sortie (1)	Time at this Lmax (min) per EA-18G AACT Mission Sortie (2)	Time at this Lmax (min) per Year for all Combined Missions	
					Baseline	Proposed Action
0 –5	13.67%	81.5	0.246	0.262	558	634
5–500	45.15%	82.9	0.813	0.867	1847	2096
500–1,000	18.77%	84.4	0.338	0.360	767	871
1,000–1,500	8.23%	86.0	0.148	0.158	336	382
1,500–2,000	5.66%	87.8	0.102	0.109	232	263
2,000–2,500	4.28%	89.7	0.077	0.082	175	198
2,500–3,000	2.60%	91.8	0.047	0.050	107	121
3,000–3,500	1.15%	94.2	0.021	0.022	47	54
3,500–4,000	0.40%	97.1	0.007	0.008	16	18
4,000– 4,500	0.09%	100.6	0.002	0.002	4	5

(1) For SEAD and EWCAS missions, 2% of the mission flight time is spent at the lowest altitude that results in this Lmax (6,000–8,000 ft. MSL)
(2) For AACT missions, 3.2% of the mission time is spent at the lowest altitude that results in this Lmax (6,000-8,000 ft. MSL)
Notes: MOA = Military Operations Area, MSL = Mean Sea Level, dBA = A-Weighted Sound Pressure Level, L_{max} = Maximum Received Noise Level, min = minutes, ISR = Intelligence Surveillance Reconnaissance

Table J-14: Estimated L_{max} Duration for P-3 and P-8 Training Operations Within the Olympic MOAs

Terrain Elevation (feet above MSL)	Probability Distribution within the Combined MOA	P-3 Lmax (dBA)	P-8 Lmax (dBA)	Time at this Lmax (min) per ISR Mission Sortie (1)	Time at this Lmax (min) per Year for all Combined Missions	
					Baseline	Proposed Action
0–5	13.67%	51.6	51.2	2.461	0	10
5–500	45.15%	53.0	52.5	8.127	0	33
500–1,000	18.77%	53.7	53.3	3.379	0	14
1,000–1,500	8.23%	54.3	53.9	1.481	0	6
1,500–2,000	5.66%	55.4	55.0	1.019	0	4
2,000–2,500	4.28%	56.4	56.0	0.770	0	3
2,500–3,000	2.60%	57.3	56.9	0.468	0	2
3,000–3,500	1.15%	58.2	57.7	0.207	0	1
3,500–4,000	0.40%	59.2	58.7	0.072	0	<1
4,000–4,500	0.09%	59.8	59.3	0.016	0	<1

(1) For ISR missions, 10% of the mission flight time is spent at the lowest altitude that results in this Lmax (10,000–12,000 ft. MSL)
Notes: MOA = Military Operations Area, MSL = Mean Sea Level, dBA = A-Weighted Sound Pressure Level, Lmax = Maximum Received Noise Level, min = minutes, ISR = Intelligence Surveillance Reconnaissance

Table J-15: Estimated L_{max} Duration for F-15 Training Operations Within the Olympic MOAs

Terrain Elevation (feet above MSL)	Probability Distribution within the Combined MOA	Lmax (dBA)	Time at this Lmax (min) per F-15 ACM Mission Sortie (1)	Time at this Lmax (min) per F-15 BFM Mission Sortie (1)	Time at this Lmax (min) per Year for all Combined Missions	
					Baseline	Proposed Action
0–5	13.67%	80.8	0.410	0.342	5	5
5–500	45.15%	82.3	1.355	1.129	15	15
500–1,000	18.77%	83.6	0.563	0.469	6	6
1,000–1,500	8.23%	85.0	0.247	0.206	3	3
1,500–2,000	5.66%	86.6	0.170	0.142	2	2
2,000–2,500	4.28%	88.3	0.128	0.107	1	1
2,500–3,000	2.60%	90.2	0.078	0.065	1	1
3,000–3,500	1.15%	92.4	0.035	0.029	<1	<1
3,500–4,000	0.40%	95.0	0.012	0.010	<1	<1
4,000–4,500	0.09%	98.1	0.003	0.002	<1	<1

(1) For ACM and BFM missions, 10% of the mission flight time is spent at the lowest altitude that results in this Lmax (6,000–8,000 ft. MSL)
Notes: MOA = Military Operations Area, MSL = Mean Sea Level, dBA = A-Weighted Sound Pressure Level, Lmax = Maximum Received Noise Level, min = minutes, ISR = Intelligence Surveillance Reconnaissance, ACM = Air Combat Maneuver, BFM = Basic Fighter Maneuver

The maximum noise levels (L_{max}) perceived on the ground are dependent on the elevation of the terrain below the aircraft. Because the terrain elevation bands of 4,500–4,800 ft. MSL and 4,800–5,000 ft. MSL occur in the outermost area between the 1.5 NM offset and the MOA boundary, the probability of aircraft flying over these altitudes approaches 0 (less than 0.001 percent). Thus, the time each aircraft spends over these terrain heights is 0.

In W-237A and W-237B, the L_{max} is 88.6 dBA. This is a lower L_{max} than the L_{max} within the MOAs because the warning areas are completely over the ocean (0 ft. MSL elevation) and the distance from the surface of the water to the aircraft flying above is greater than the distance from the higher elevations in the MOAs to the aircraft. The L_{max} is the same for the Proposed Action as the Baseline since the individual mission profiles do not change.

Table J-13 provides the duration that the specified EA-18G L_{max} occurs within the MOAs for an average sortie above the specified terrain height. For areas with ground elevations between 4,000 ft. MSL and 4,500 ft. MSL, for example, the L_{max} values of 100.6 dBA are estimated to occur for 0.12 seconds on average for each EA-18G mission type. Using this average time per sortie provides a cumulative time of five minutes over the course of an entire year for the proposed activities. To clarify this table, it does not suggest that the entire area beneath the MOA will experience noise at these levels for each sortie. Rather, somewhere within the MOAs the noise will reach these levels for brief moments as aircraft fly directly overhead, and these aircraft will not fly over these higher altitude areas for every mission. The total time is the accumulation of all events for the entire area over the course of a year. Thus, the likelihood of someone experiencing these levels is low. Additionally, the L_{max} occurs when the aircraft is flying in the lowest altitude band distribution for that mission. At some locations beneath the MOAs, L_{max} above 81.5 would occur, for a total duration of 4,642 minutes (approximately 77 hours or less than 1 percent of the time) throughout the year. 81.5 dBA equates roughly to a truck driving by at 50 ft.

As an example, suppose a hiker is beneath the Olympic MOAs at a terrain elevation of 300 ft. This is a likely situation, as 45.15 percent of the Olympic MOA is over terrain between 0 and 500 ft. (Table J-13). If an EA-18G Growler aircraft flew directly overhead at full power, at the lowest permissible altitude (the floor of the MOA airspace), the hiker would experience an 82.9 dBA exposure to the jet noise (referred to as L_{max} in Table J-13). That is roughly the sound level the hiker might experience 5 meters from a busy roadway. However, the sound of the jet would be at this level for only an instant, decreasing rapidly as the jet flew away from the hiker. Tables J-14 and J-15 provide similar information for the P-3/P-8 and F-15, respectively, but Table J-13 was chosen as it represents the loudest aircraft of the three.

As the hiker climbs in elevation, the loudest possible noise exposure from an EA-18G would increase as the hiker is moving closer to the floor of the MOA airspace. If the hiker was at 4,500 ft. terrain height, the noise level could potentially be as loud as 100.6 dBA. The likelihood of louder noise exposures grows increasingly unlikely for four reasons:

1. Most of the terrain beneath the Olympic MOAs (more than 77 percent) is 1,000 ft. or lower, thereby creating a buffer of at least 5,000 ft. between the hiker and the jet (when the jet is flying at its lowest permissible altitude). Only 0.09 percent of the area beneath the Olympic MOAs is above 4,000 ft. elevation (Table J-13), where the 100.6 dBA exposure is possible and, for more than 77 percent of the area, the maximum noise level would be 84.4 dBA (Table J-13).
2. The highest terrain beneath the Olympic MOAs is found at the eastern most border of the MOAs, where aircraft presence is unlikely due to the 3 NM offset used by aircrew to avoid accidentally spilling out of the airspace.

3. The highest terrain areas on the Olympic peninsula are extremely remote, where few people are likely to occur (Figure J-3).
4. As shown in Table J-13, the 100.6 dBA noise level would occur somewhere beneath the MOA for only five minutes in any year under the proposed level of activities.

The analysis also considered maximum noise levels at locations where air traffic is most common and predictable, beneath specific points that aircraft use to enter or exit the MOAs. These entry/exit points are described in Table J-12. Table J-16 provides the maximum noise levels of entry and exit routes to/from the MOAs and warning areas. These L_{max} values would occur only at areas directly below each route; noise levels would be lower farther from the route. Maximum noise levels at both the minimum and maximum terrain elevations were provided to show the range of noise levels potentially experienced on the ground. Although the warning areas are over the water, the aircraft must fly over terrain up to 4,500 ft. MSL to reach the warning areas (except for F-15). For terrain between 0 ft. MSL and 4,500 ft. MSL, linear interpolation can be used to estimate the L_{max}. For example, at a location under the EA-18G entry route into Olympic MOAs where the elevation is 2,250 ft. MSL, the L_{max} is estimated to be 53.0 dBA. Table J-12 lists the fixes, altitudes, and airspeeds that each aircraft type utilizes to enter and exit each area.

Table J-16: Maximum Noise Levels for Entry and Exit Routes to/from Olympic MOAs and W-237

Aircraft	Terrain Elevation (feet above MSL)	Entry/Exit to Area	Lmax (dBA)
EA-18G	0	Entry to Olympic MOA	49.8
EA-18G	0	Exit from Olympic MOA	51.1
EA-18G	4,500	Entry to Olympic MOA	56.4
EA-18G	4,500	Exit from Olympic MOA	58.2
P-3 and P-8	0	Entry and Exit to W-237A	52.6
P-3 and P-8	0	Entry and Exit to W-237B	52.6
P-3 and P-8	4,500	Entry and Exit to W-237B	61.2
F-15	0	Entry and Exit to W-237	62.3
F-15	0	Entry and Exit to Olympic MOA	49.5
F-15	4,500	Entry and Exit to Olympic MOA	55.7

Notes: MOA = Military Operations Area, MSL = Mean Sea Level, dBA = A-Weighted Sound Pressure Level, Lmax = Maximum Received Noise Level

Like all aircraft, the EA-18G produces varied sound output under different conditions, as indicated in Table J-17. The distance listed in this table is the total distance to the aircraft, and the Engine Power represents the maximum and minimum power conditions as identified in Table J-3 and Table J-7. This table is useful as a general guide to the maximum noise levels from this aircraft and can be used to estimate maximum noise levels for different activities.

For example, Table J-12 lists the Entry/Exit activity of the EA-18G into the Olympic MOAs with the aircraft flying between 14,000 and 16,000 ft. MSL, at a power level of 75 percent NC. If a ground elevation of 0 ft. MSL is assumed, the closest total distance to an aircraft that flies directly overhead will be approximately 15,000 ft., and Table J-17 can be used to estimate that the Lmax for this activity is 50 dBA. If a ground height of 5,000 ft. MSL is assumed, the total distance to the aircraft becomes 10,000 ft., and the estimate for Lmax is 57 dBA.

Table J-17: Maximum Noise Level from the EA-18G for Different Distances and Engine Powers

	EA-18G Lmax Values (dBA)	
Distance to Aircraft	Engine Power	
	75% NC	89% NC
2,000 ft	81	97
5,000 ft	69	84
10,000 ft	57	73
15,000 ft	50	65
20,000 ft	44	59
30,000 ft	35	50
40,000 ft	<35*	44

* MRNMap does not compute values below 35 dBA

Notes: NC = Compressor Stage Rotations Per Minute (a measure of jet engine power setting),
dBA = A-Weighted Sound Pressure Level,
Lmax = Maximum Received Noise Level

J.7 Acoustic Monitoring Report

In 2010, the National Park Service conducted an acoustic monitoring study within the Olympic National Park (NPS 2016). Of five ground locations where noise sampling took place, three (Hoh River Trail, Third Beach Trail, and Lake Ozette) lie beneath the Olympic MOAs. The purpose of this monitoring effort was to characterize existing sound levels and estimate natural ambient acoustic baselines for these areas, as well as identify audible sound sources. (Two other sites were monitored, but they lie well outside the boundary of the MOAs. While they could be indicative of noise levels received during transit to the MOAs, the results at these two sites were very similar to results seen in the other three sites, and so add no new information.)

The natural daytime ambient acoustic baseline was found to be 34.1 dBA for Hoh River Trail, 35.6 dBA for Third Beach Trail, and 31.4 dBA for Lake Ozette.

Data from the study are summarized below in Tables J-18 and J-19. Table J-18 reports the percent of time that sound levels were above 4 metrics (35, 45, 52, and 60 dBA) at each of the measurement locations for the winter season. The metric of 52 dBA is the Environmental Protection Agency’s speech interference threshold for speaking in a raised voice to an audience at 10 meters; and 60 dBA provides a basis for estimating impacts on normal voice communications at 3 ft. Hikers and visitors viewing scenic vistas in the park would likely be conducting these types of conversations.

Table J-18: Percent Time Above Metrics for Winter Season Beneath the Olympic MOAs

Site Name	% Time above sound level: Daytime (7 am to 7 pm)				% Time above sound level: Nighttime (7 pm to 7 am)			
	35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
Hoh River Trail	41.39	2.29	0.21	0.01	29.88	3.86	0.21	0.00
Third Beach Trail	57.43	19.29	5.79	0.18	58.91	19.46	4.83	0.33
Lake Ozette	40.14	16.67	7.85	1.19	44.36	16.15	5.18	1.40

Notes: MOA = Military Operations Area, dBA = A-Weighted Sound Pressure Level

Table J-19: Summary of Acoustic Observer Log Data for All Sites for the Winter Season

Site Name	% Time Audible: Daytime (7 am to 7 pm)			
	Fixed-Wing Aircraft and Helicopter Sounds	Other Aircraft Sounds	Other Human Sounds	Natural Sounds
Hoh River Trail	0.5	11.2	4.9	83.4
Third Beach Trail	1.3	3.7	4.2	90.8
Lake Ozette	0.8	6.3	0.4	92.5

As noted in the National Park Service study, none of these metrics should be construed as thresholds of impact. The results indicate that, at the Hoh River Trail site where aircraft sounds were audible 11.7 percent of the time, 52 dBA was exceeded less than 0.3 percent of the time. At the other two sites, while the time above 52 dBA was greater, approximately 6–8 percent, fewer of those occurrences appear to be related to aircraft noise. Natural sounds were the predominant sources of sounds measured at all three sites, and were audible between 83 and 93 percent of the time.

The data for this study were collected in 2010 but are considered relevant to current conditions related to Navy aircraft training, as the level of Navy activity in 2010 is generally consistent with the baseline data presented in Section J.5 (Airspace Training and Testing Activities) of this Airspace Noise Analysis.

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APPENDIX K GEOGRAPHIC MITIGATION ASSESSMENT

K.1 INTRODUCTION

As described in Chapter 5 (Mitigation), the United States (U.S.) Department of the Navy (Navy) will implement mitigation measures to avoid or reduce potential impacts from the Northwest Training and Testing (NWTT) Supplemental Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) Proposed Action. Mitigation measures that the Navy will implement under the Proposed Action are organized into two categories: procedural mitigation and mitigation areas. The Navy will implement procedural mitigation measures (e.g., using trained Lookouts to observe for marine mammals and sea turtles prior to, during, and after an activity) whenever and wherever applicable training or testing activities take place within the Study Area. Procedural mitigation measures are discussed in Chapter 5 (Mitigation). Chapter 5 (Mitigation) also presents information about the Navy's mitigation development process, such as a brief history of mitigation development for previous at-sea environmental compliance documents, definitions of mitigation terminology, and details on Navy monitoring, research, and reporting initiatives.

The purpose of this Appendix is to present the Navy's assessment of mitigation areas in the NWTT Study Area. Mitigation areas are geographic locations within the Study Area where the Navy will implement additional mitigation to: (1) avoid or reduce potential impacts on biological or cultural resources for which procedural mitigation cannot be implemented (e.g., seafloor resources), (2) in combination with procedural mitigation, effect the least practicable adverse impact on marine mammal species or stocks and their habitat, or (3) in combination with procedural mitigation, ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat.

As discussed in Chapter 5 (Mitigation), the Navy will coordinate its mitigation with the appropriate regulatory agencies, including the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service, through the consultation and permitting processes. The Final Supplemental, Navy and NMFS Records of Decision, Marine Mammal Protection Act Regulations and Letters of Authorization, and Endangered Species Act (ESA) Biological Opinions will document all mitigation measures the Navy will implement under the Proposed Action.

K.2 MITIGATION AREA DEVELOPMENT PROCESS

The Navy completed an extensive assessment of the Study Area to develop the mitigation areas included in this Appendix to the Draft Supplemental. The Navy reanalyzed existing mitigation areas implemented under the 2015 NWTT Final EIS/OEIS; assessed additional habitat areas suggested by the public, NMFS, other governmental agencies, and non-governmental organizations; and considered other habitats identified internally by the Navy.

In developing mitigation areas, the Navy considered the manner and degree to which a potential mitigation measure was likely to avoid or reduce potential impacts on applicable seafloor and cultural resources and species or stocks of biological resources while still being practical and safe to implement, and not impeding the effectiveness of military readiness activities. The Navy operational community (i.e., leadership from the aviation, surface, subsurface, and special warfare communities; leadership from the research and acquisition community; and training and testing experts), environmental planners, and scientists provided input on the effectiveness and practicality of mitigation implementation. Data inputs for mitigation area assessment and development included the operational information described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, predicted activity impact footprints, and marine species monitoring and density data. A Biological Assessment and operational analysis of the mitigation areas the Navy developed for the NWTT Study Area is provided in Section K.4 (Mitigation Areas to be Implemented). Additional details about the assessment criteria are provided in the sections below.

K.2.1 Biological Effectiveness Assessment Criteria

Mitigation areas are designed to help avoid or reduce potential impacts in key areas of importance. Therefore, the mitigation benefit is discussed qualitatively in terms of the context of impact avoidance or reduction. The Navy considers a mitigation area to be effective if it meets the following criteria:

- **The mitigation area is a key area of biological or ecological importance or contains cultural resources:** The best available science suggests that the mitigation area contains submerged cultural resources (e.g., shipwrecks) or is particularly important to one or more species or resources for a biologically important life process (i.e., foraging, migration, reproduction) or ecological function (e.g., live hard bottom habitat that provides critical ecosystem functions); and
- **The mitigation will result in an avoidance or reduction of impacts:** Implementing the mitigation will likely avoid or reduce potential impacts on: (1) species, stocks, or populations of marine mammals based on data regarding their seasonality, density, and behavior; or (2) other biological or cultural resources based on their distribution and physical properties. Furthermore, implementing the mitigation will not shift or transfer adverse effects from one species to another (e.g., to a more vulnerable or sensitive species).

K.2.2 Operational Assessment Criteria

Mitigation measures are expected to have some degree of impact on the training and testing activities that implement them (e.g., modifying where and when activities occur, ceasing an activity in response to a sighting). The Navy is able to accept a certain level of impact on its military readiness activities because of the benefit that mitigation measures provide for avoiding or reducing impacts on environmental and cultural resources. The Navy's focus during mitigation assessment and development is that mitigation measures must meet the appropriate balance between being effective and practical to implement.

To evaluate practicality, the Navy operational community conducted an extensive and comprehensive assessment to determine how and to what degree potential mitigation measures would be compatible with planning, scheduling, and conducting training and testing activities under the Proposed Action in order to meet the Navy's Title 10 requirements. During its assessment to determine how and to what degree the implementation of mitigation would be compatible with meeting the purpose and need of the Proposed Action, the Navy considered a mitigation measure to be practical to implement if it met all criteria discussed in Section 5.2.3.1 (Assessment Criteria) for safety, sustainability, and mission requirements.

K.3 Resources and Habitats Assessed

The Navy assessed resources and habitats throughout the NWTT Study Area for potential mitigation areas. The assessment included, but was not limited to, the resources and habitats listed below and shown in Figure K-1 that were identified internally by the Navy, suggested by the public during the

National Environmental Policy Act scoping process, identified as biologically important areas by Van Parijs et al. (2015), or designated as a National Marine Sanctuary:

- Seafloor resources (i.e., live hard bottom habitat, artificial reefs, shipwrecks)
- Banks and Canyons
  - Nehalem Bank, Daisy Bank
  - Nitinat Canyon, Juan de Fuca Canyon, Quinault Canyon, Grays Canyon, Guide Canyon, Willapa Canyon, Astoria Canyon, Eel Canyon
- Gray whales
  - Gray whale migration areas in Puget Sound and off the U.S. West Coast (seasonal depending on location)
  - Gray whale feeding area off Northwest Washington (May – November)
  - Gray whale feeding area in Northern Puget Sound (March – May)
- Humpback whales
  - Humpback whale feeding area off Northern Washington (May – November)
  - Humpback whale feeding area at Stonewall and Heceta Bank (May – November)
  - Humpback whale feeding area at Point St. George (July – November)
- Killer whales
  - Transient killer whale habitat
  - Southern Resident killer whale habitat
- Olympic Coast National Marine Sanctuary

Several areas were suggested by public comments during the National Environmental Policy Act scoping process that are located outside of the Study Area; therefore, those habitats are not considered in this Appendix. Information on Marine Protected Areas other than the Olympic Coast National Marine Sanctuary is presented in full in Chapter 6 (Additional Regulatory Considerations) of this Draft Supplemental.

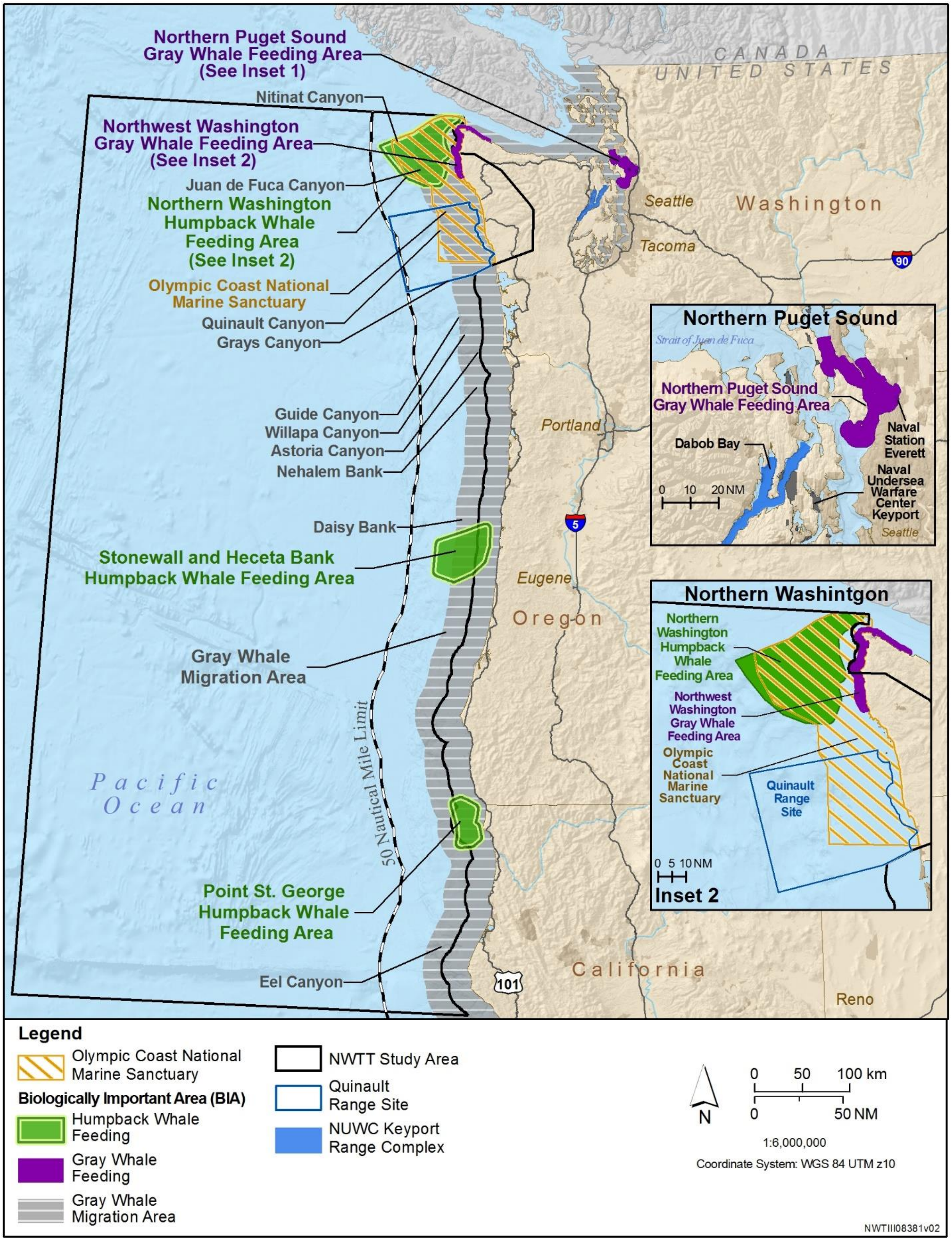

Figure K-1: Resources and Habitats Assessed

K.3.1 Seafloor Resources

Seafloor resources fulfill important ecosystem functions. Live hard bottom habitats and artificial structures (e.g., artificial reefs, shipwrecks) provide attachment substrate for aquatic vegetation and invertebrates, such as corals, seaweed, seagrass, macroalgae, and sponges. These habitats in turn support a community of organisms, such as fish, shrimp, crabs, barnacles, worms, and sea cucumbers.

Dive sites occur throughout nearshore areas of the Study Area where there are shipwrecks and artificial reefs, making these resources highly valuable from a socioeconomic standpoint. Similarly, submerged aquatic vegetation provides important habitat for commercially and recreationally important fish species. Historic shipwrecks are classified as archaeological resources and are an important part of maritime history. For additional information on the biological, cultural, and socioeconomic importance of seafloor resources and their associated ecosystem components, refer to Chapter 3.3 (Marine Habitats), Chapter 3.4 (Marine Mammals), Chapter 3.7 (Marine Vegetation), Chapter 3.8 (Marine Invertebrates), Chapter 3.9 (Fishes), Chapter 3.10 (Cultural Resources), and Chapter 3.11 (Socioeconomic Resources) of this Draft Supplemental.

K.3.2 Banks and Canyons

Nehalem and Daisy Banks are reefs designated by the Environmental Protection Agency as ecologically significant areas. The reefs are known for their high biological diversity and are thought to be particularly important habitat for numerous species, including marine invertebrates, for foraging and reproduction (U.S. Environmental Protection Agency, 2017).

Submarine canyon environments are characterized by high pressure and low oxygen, light, and temperature levels. Many are thought to be particularly important for a wide variety of marine species, including marine mammals, invertebrates, and fishes, due to their association with primary productivity. For example, submarine canyons contribute to the growth and reproduction of important zooplankton and phytoplankton populations (Hickey & Banas, 2003). The Willapa, Nitinat, Juan de Fuca, Grays, Quinault, and Guide submarine canyons are located off the coast of Washington state. The Nitinat, Juan de Fuca, and Quinault canyons exist partially within the boundaries of the Olympic Coast National Marine Sanctuary (National Marine Sanctuaries, 2017). Astoria Canyon is located off the coast of Oregon, and Eel Canyon is located off northern California. The Eel, Astoria, and Grays canyons have each been characterized by the National Oceanic and Atmospheric Administration as essential fish habitats and are listed as Marine Protected Areas (Vander Schaaf et al., 2013).

K.3.3 Gray Whales

Eastern North Pacific gray whales are known to migrate along the U.S. West Coast on both their northward and southward migrations. This species makes the longest annual migration of any mammal: 15,000–20,000 kilometers roundtrip (Jefferson et al., 2008; Jones & Swartz, 2009). The migration connects summer arctic and north Pacific feeding grounds with winter mating and calving regions in temperate and subtropical coastal waters. Winter grounds extend from central California south along Baja California, the Gulf of California, and the mainland coast of Mexico.

Gray whale migration along the U.S. West Coast can be loosely categorized into three phases (Rugh et al., 2001; Rugh et al., 2008). Beginning in the fall, whales start the southward migration from summer feeding areas (which span the coast from the northern Gulf of Alaska to the Study Area) to winter calving areas. The Southbound Phase includes all age classes as they migrate primarily to the nearshore waters and lagoons of Baja, Mexico, mainly following the coast, and occurs from October through

March. During the southbound phase of migration, peak sightings occur in January off the Oregon and Washington coasts (Herzing & Mate, 1984; Rugh et al., 2001). The southbound trip averages two months in length. The northward migration to the feeding grounds occurs in two phases. Northbound Phase A consists mainly of adults and juveniles that lead the beginning of the north-bound migration from late January through July, peaking in April through July. Newly pregnant females go first to maximize feeding time, followed by adult females and males, then juveniles (Jones & Swartz, 2009). The Northbound Phase B consists primarily of cow-calf pairs which begin their northward migration later (February to July), remaining on the reproductive grounds longer to allow calves to strengthen and rapidly increase in size before the northward migration (Herzing & Mate, 1984; Jones & Swartz, 2009). Selected areas of the migrations have recently been identified by NMFS as biologically important areas (Calambokidis et al., 2015).

Most of the eastern North Pacific stock summers in the shallow waters of the northern Bering Sea, Chukchi Sea, and western Beaufort Sea (Rice et al., 1981), but a small proportion (approximately 200 individuals) spend the summer and fall feeding along the Pacific coast from Southeastern Alaska to central California (Calambokidis et al., 1987; Calambokidis et al., 2002; Carretta et al., 2017; Gosho et al., 2011; Sumich, 1984). These whales, collectively known as the “Pacific Coast Feeding Group,” are a trans-boundary population within the United States and Canada and are defined by the International Whaling Commission as a gray whale that is observed between 1 June and 30 November within the region between northern Vancouver Island and Northern California and has been photo-identified within this area during two or more years (Carretta et al., 2017; Punt & Moore, 2013). Information from non-systematic, visual boat-based surveys and tagging data indicate the existence of Pacific Coast Feeding Group aggregation areas in the Pacific Northwest. The occurrence of eastern North Pacific gray whales and members of the Pacific Coast Feeding Group is considered seasonally likely in the offshore portion of the Study Area. Given their small population size and limited number of sightings off the U.S. West Coast, the occurrence of ESA-listed western North Pacific gray whales in the offshore portion of the Study Area is considered rare.

Clear seasonal differences in gray whale distribution were noted based on three distinct time periods: (1) winter (December–January), corresponding to the timing of their southbound migration; (2) spring (February–April), corresponding to the timing of their northbound migration; and (3) summer/fall (May–October), a time when any gray whales present are primarily members of the Pacific Coast Feeding Group. The eastern (shoreward) boundary of the Offshore Area of the Study Area is 12 nautical miles (NM) from the coast of Northern California, Oregon, and southern Washington and therefore does not overlap most of the gray whale migration corridor, which is closer to shore in these areas. Calambokidis et al. (2015) report that migration corridors used by most gray whales are within 10 kilometers of the U.S. West Coast. Data from tags placed on gray whales in Northern California adjacent to the Study Area in 2012 and 2013 confirmed the whales predominantly used the narrow continental shelf area along the Oregon coast, which is outside the Study Area (Mate, 2013; Mate et al., 2013). As shown Figure K-1, the only portion of the Study Area that overlaps the three documented gray whale migration routes is the area off northern Washington in W-237 of the Offshore Area that abuts the coastline (Aquatic Mammals, 2015; Calambokidis et al., 2015). Gray whales tagged in 2012 and 2013 showed a strong preference for shallow, nearshore habitat. These whales did not appear to use any canyons or underwater features preferentially, and were rarely found in the Offshore Area more than 19 kilometers from shore (Mate, 2013; Mate et al., 2013). In aerial surveys conducted in waters off Washington, Oregon, and Northern California covering the approximate nearshore half of the Study Area in the spring, summer, and fall of 2011 and 2012, gray whales were present during all surveys and within

25 kilometers of the coast except for two sightings over deeper water (Adams et al., 2014). In boat surveys between 1984 and 2011 off the Washington coast, gray whales were most commonly observed in very shallow waters with depths ranging from 5 to 15 meters over rocky substrates and often near kelp forests (Scordino et al., 2017).

As gray whales migrate between feeding and breeding grounds, a few may enter the Strait of Juan de Fuca to feed. Gray whales are observed in Washington inland waters in all months of the year (Calambokidis et al., 2010), with peak abundance from March through June (Calambokidis et al., 2010). One stranding occurred at Naval Base Kitsap Bremerton in January 2013. Gray whales have been sighted in Hood Canal south of the Hood Canal Bridge on six occasions since 1999, including a stranded whale at Belfair State Park (Calambokidis, 2013; Scheffer & Slipp, 1948). The most recent report in Hood Canal was of "blows" (air exhaled through the whale's blowhole) characteristic of gray whales in the waters near Lilliwaup in November 2010 (Calambokidis, 2013).

Calambokidis et al. (2010) reported that Puget Sound (mudflats near the Whidbey Island and Camano Island area) is used as a springtime feeding area for a small, regularly occurring group of gray whales. Observed feeding areas are located in Saratoga Passage between Whidbey and Camano Islands including Crescent Harbor, and in Port Susan Bay located between Camano Island and the mainland in Possession Sound. These areas are between Naval Air Station Whidbey Island (Crescent Harbor) and Naval Station Everett. In the Rich Passage to Agate Passage area in the vicinity of Naval Base Kitsap Bremerton and Keyport, 11 opportunistic sightings of gray whales in inland waters were reported to Orca Network between January 2003 and July 2012. NMFS has identified a seasonal, gray whale feeding area located in the vicinity of Everett, Washington and designated the Gray Whale Northern Puget Sound feeding area (Calambokidis et al., 2015). NMFS has identified this area as important for feeding during the March through May season associated with gray whale feeding at that location.

K.3.4 Humpback Whales

In inland waters of Washington including the Strait of Juan de Fuca, Puget Sound, and other parts of the Salish Sea, scientists have noted a trend of increased humpback whale abundance (Cascadia Research, 2017; Cogan, 2015). Located near the inland waters portion of the Study Area (Aquatic Mammals, 2015; Calambokidis et al., 2015), NMFS identified the Northern Washington (May–November) feeding area. This area is primarily used annually during the approximate 6–7 month period when humpback whale feeding occurs at those locations. Shipboard surveys in July 2005 that included both U.S. and Canadian waters found that humpback whale sightings were concentrated around the edge of what appears to be the semi-permanent eddy associated with the outflow from the Strait of Juan de Fuca (Dalla-Rosa et al., 2012). The majority of this semi-permanent eddy and associated feeding area is present to the north of the designated feeding biologically important area's northern boundary (drawn between the U.S. and Canadian Exclusive Economic Zones). The designated biologically important area was bounded to the north by Canadian waters because the identification of biologically important areas was restricted to locations only in U.S. waters (Calambokidis et al., 2015; Ferguson et al., 2015a; Ferguson et al., 2015b).

The two humpback whale feeding areas in and around the offshore portion of the Study Area are (1) Point St. George (feeding July to November), and (2) Stonewall and Heceta Bank (feeding May–November). The Stonewall and Heceta Bank biologically important area begins inside of 12 NM from shore and extends beyond 12 NM in two small portions of the Study Area. Each of these areas is primarily utilized during the approximate 6–7 month period annually when humpback whale feeding occurs at those locations (Aquatic Mammals, 2015; Calambokidis et al., 2015).

Visual surveys and acoustic monitoring studies have detected humpbacks along the Washington coast year-round, with peak occurrence during the summer and fall (Oleson et al., 2009). Consistent with previous recordings from two Navy-funded offshore passive acoustic monitoring devices (Širović et al., 2012a; Širović et al., 2012b), humpback whales were most commonly detected in acoustic recordings between September and December, which is also the peak time for humpback whale singing (Širović et al., 2012a). Lower levels of humpback whale calling were also detected from February through May (Oleson et al., 2009; Širović et al., 2012a; Širović et al., 2012b). Visual and acoustic detections of humpback whales in this area do not fully overlap, as most visual sightings occur during the summer and early fall (Oleson et al., 2009), which is likely the result of the strong seasonal variation in humpback whale singing and other vocal behavior (Širović et al., 2012a; Širović et al., 2012b).

The California, Oregon, and Washington stock of humpback whales uses the waters off the West Coast of the United States as a summer feeding ground. They are present off the Northern California coast mainly between April and December and off the Oregon and Washington coasts mainly from May through November (Calambokidis et al., 2004a; Calambokidis et al., 2010; Dohl et al., 1983; Forney & Barlow, 1998; Green et al., 1992). Photo-identification studies suggest that whales feeding in this region are part of a small sub-population that primarily feeds from central Washington to southern Vancouver Island (Calambokidis et al., 2004a; Calambokidis et al., 2008). Whales appear to range broadly throughout the continental shelf waters, with significant seasonal trends in distribution; however, detailed knowledge of habitat use and individual residency patterns while in this feeding area cannot be determined easily through visual surveys alone (Falcone & Schorr, 2014). In winter and spring (roughly January–March), most whales are south on their breeding grounds and are likely not as abundant in this region of the Study Area during these times.

Off the U.S. West Coast, humpback whales are more abundant in shelf and slope waters (<2,000 meters deep), and are often associated with areas of high productivity (Becker et al., 2010; Becker et al., 2012; Forney et al., 2012). Humpback whales primarily feed along the shelf break and continental slope (Green et al., 1992). Off Washington, higher concentrations have been reported between Juan de Fuca Canyon and the outer edge of the shelf break in a region called “the Prairie,” near Barkley and Nitinat Canyons, and near Swiftsure Bank (Calambokidis et al., 2004b). Five humpback whales were satellite tagged off Washington between May 2010 and May 2013. Although tag durations were short with a median duration of 7 days, tag tracks showed all five whales using both shelf and slope waters as well as some underwater canyons such as the Juan de Fuca Canyon (one of five whales) (Schorr et al., 2009; U.S. Department of the Navy, 2013).

K.3.5 KILLER WHALES

Transient (Bigg’s) killer whales in the Pacific Northwest spend most of their time along the outer coast of British Columbia and Washington, but visit NWTT Inland Waters in search of harbor seals, sea lions, and other prey. Transients may occur in NWTT Inland Waters in any month (Orca Network, 2010) but several studies have shown peaks in occurrences: Morton (1990) found bimodal peaks in spring (March) and fall (September–November) for transients on the northeastern coast of British Columbia. Baird and Dill, (1995) found some transient groups frequenting the vicinity of harbor seal haulout sites around southern Vancouver Island during August and September, which is the peak period for pupping through post-weaning of harbor seal pups. However, not all transient groups were seasonal in these studies, and their movements appear to be unpredictable. Transient killer whale occurrences in inland waters have increased between 1987 and 2010, possibly because the abundance of some prey species (e.g., seals, sea lions, and porpoises) has increased (Houghton, 2014).

The Southern Resident stock of killer whales is a trans-boundary stock including killer whales in inland Washington and southern British Columbia waters as well as waters offshore (Carretta et al., 2018; National Marine Fisheries Service, 2016). The Southern Resident Distinct Population Segment is listed as endangered under the ESA. Photo-identification of individual whales through the years has resulted in a substantial understanding of this stock's structure, behaviors, and movements in inland waters (Wiles, 2016; Wright et al., 2017). In spring and summer months, Southern Resident killer whales are most frequently seen in the San Juan Islands region with intermittent sightings in Puget Sound (Olson & Osborne, 2017; Shields et al., 2018). In the fall and early winter months, the Southern Residents are seen more frequently in Puget Sound, where returning chum and Chinook salmon are concentrated. By winter, they spend progressively less time in the inland marine waters and more time off the coast of Washington, Oregon, and California (Black, 2011; Cogan, 2015; Hanson et al., 2017; National Marine Fisheries Service, 2016; Olson & Osborne, 2017).

While both Southern Resident killer whales and transient (Bigg's) killer whales are frequently sighted in the main basin of Puget Sound, their presence near Navy installations varies from not present to infrequent sightings, depending on the season (Orca Network, 2012). Southern Resident killer whales have not been reported in Hood Canal or Dabob Bay since 1995 (National Marine Fisheries Service, 2008). Southern Resident killer whales (J pod) were historically documented in Hood Canal by sound recordings in 1958 (Ford, 1991), a photograph from 1973, sound recordings in 1995 (Unger, 1997), and also anecdotal accounts of historical use, but these latter sightings may be transient whales (National Marine Fisheries Service, 2008). Transient killer whales were last observed in Hood Canal in 2005 and prior to that in 2003. In the last two weeks of April of 2018, a transient killer whale matriline transited and foraged the entire length of Hood Canal. The Navy captured acoustic recordings at Zelatched Point. Prior to these occurrences, transients were rarely seen. Near Naval Base Kitsap Bremerton and Keyport, the Southern Resident killer whale is also rare, with the last confirmed sighting in Dyes Inlet in 1997. Transient killer whales have been seen infrequently near Naval Base Kitsap Bremerton (e.g., a sighting in 2013 at Dyes Inlet; (Orca Network, 2013)). The Navy assumes Transients will occasionally be present in this area. Both Southern Resident killer whales and transients have been observed in Saratoga Passage and Possession Sound near Naval Air Station Whidbey Island and Naval Station Everett, respectively. Transients and Southern Resident killer whales have also been observed in southern Puget Sound in the Carr Inlet area.

K.3.6 Olympic Coast National Marine Sanctuary

The Olympic Coast National Marine Sanctuary consists of an area of 2,408 square NM of marine waters and the submerged lands off the Olympic Peninsula Coastline of Washington State. The sanctuary extends approximately 38 miles seaward, covering much of the continental shelf and several major submarine canyons.

Due to the Juan de Fuca Eddy ecosystem created from localized currents at the entrance to the Strait of Juan de Fuca, and the diversity of bottom habitats, the Olympic Coast National Marine Sanctuary supports a variety of marine life. See Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), Section 3.6 (Birds), Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fishes) for additional information on these species.

Key habitats within the sanctuary include kelp forest, surfgrass, seafloor (sand and silt, gravel and cobbles), deep-sea coral and sponge gardens, rocky reefs, intertidal zone, nearshore subtidal, deep-water benthic, and water column habitat. The diversity of habitats, and the nutrient-rich upwelling zone (which exhibits the greatest volume of upwelling in North America) that drives high primary productivity in this province, contribute to the high species diversity in the Olympic Coast National Marine Sanctuary, with 309 species of fish, more than 56 species of seabirds and 24 species of shorebirds, occurring in the sanctuary (Office of National Marine Sanctuaries, 2008). The sanctuary is thought to provide important foraging and migration habitat for 29 species of marine mammals, including toothed and baleen whales, seals and sea lions, and sea otters (Office of National Marine Sanctuaries, 2008).

K.4 Mitigation Areas to be Implemented

As a result of the Navy's biological and operational assessments, the Navy will implement mitigation within the mitigation areas detailed in Table K-1 and Table K-2 to avoid or reduce potential impacts on biological or cultural resources under the Proposed Action. Figure K-2 shows the locations of mitigation areas developed for marine species.

Table K-1: Seafloor Resource Mitigation Areas

Mitigation Area Description
<u>**Stressor or Activity**</u> • Explosives • Physical disturbance and strikes
<u>**Mitigation Requirements**</u> • **Seafloor Resource Mitigation Areas (year-round)** – Within the anchor swing circle of live hard bottom, artificial reefs, and shipwrecks, the Navy will not conduct precision anchoring (except in designated anchorages). – Within a 350-yd. radius of live hard bottom, artificial reefs, and shipwrecks, the Navy will not conduct explosive mine countermeasure and neutralization activities or explosive mine neutralization activities involving Navy divers (except in designated locations), and the Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated areas).

Table K-2: Marine Species Mitigation Areas

Mitigation Area Description
Stressor or Activity • Sonar • Explosives • Physical disturbance and strikes
Mitigation Requirements • **Marine Species Coastal Mitigation Area (year-round)** – Within 50 NM from shore in the Marine Species Coastal Mitigation Area, the Navy will not conduct: (1) explosive training activities, (2) explosive testing activities (with the exception of explosive Mine Countermeasure and Neutralization Testing activities), (3) non-explosive missile training activities, and (4) non-explosive torpedo training activities. Should national security present a requirement to conduct these activities in the mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. – Within 20 NM from shore in the Marine Species Coastal Mitigation Area, the Navy will not conduct non-explosive large-caliber gunnery training activities and non-explosive bombing training activities. Should national security present a requirement to conduct these activities in the mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. – Within 12 NM from shore in the Marine Species Coastal Mitigation Area, the Navy will not conduct non-explosive small- and medium-caliber gunnery training activities and Anti-Submarine Warfare Tracking Exercise – Helicopter, Maritime Patrol Aircraft, Ship, or Submarine training activities. Should national security present a requirement to conduct these activities in the mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. • **Olympic Coast National Marine Sanctuary Mitigation Area (year-round)** – Within the Olympic Coast National Marine Sanctuary Mitigation Area, the Navy will not conduct more than 32 hours of MF1 mid-frequency active sonar during training annually and will not conduct non-explosive bombing training activities. Should national security present a requirement to conduct more than 32 hours of MF1 mid-frequency active sonar during training annually or conduct non-explosive bombing training activities in the mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. – Within the Olympic Coast National Marine Sanctuary Mitigation Area, the Navy will not conduct more than 33 hours of MF1 mid-frequency active sonar during testing annually (except within the portion of the mitigation area that overlaps the Quinault Range Site) and will not conduct explosive Mine Countermeasure and Neutralization Testing activities. Should national security present a requirement for the Navy to conduct more than 33 hours of MF1 mid-frequency active sonar during testing annually (except within the portion of the mitigation area that overlaps the Quinault Range Site) or conduct explosive Mine Countermeasure and Neutralization Testing activities in the mitigation area, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. • **Stonewall and Heceta Bank Humpback Whale Mitigation Area (May – November)** – Within the Stonewall and Heceta Bank Humpback Whale Mitigation Area, the Navy will not use MF1 mid-frequency active sonar or explosives during training and testing from May to November. Should national security present a requirement to use MF1 mid-frequency active sonar or explosives during training and testing from May to November, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS.

Table K-2: Marine Species Mitigation Areas (continued)

Mitigation Area Description
• **Point St. George Humpback Whale Mitigation Area (July – November)** – Within the Point St. George Humpback Whale Mitigation Area, the Navy will not use MF1 mid-frequency active sonar or explosives during training and testing from July to November. Should national security present a requirement to use MF1 mid-frequency active sonar or explosives during training and testing from July to November, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS. • **Puget Sound and Strait of Juan de Fuca Mitigation Area (year-round)** – Within the Puget Sound and Strait of Juan de Fuca Mitigation Area, the Navy will require units to obtain approval from the appropriate designated Command authority prior to: (1) the use of hull-mounted mid-frequency active sonar during training while underway, and (2) conducting ship and submarine active sonar pierside maintenance or testing. – Within the Puget Sound and Strait of Juan de Fuca Mitigation Area for Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises, Navy event planners will coordinate with Navy biologists during the event planning process. Navy biologists will work with NMFS to determine the likelihood of gray whale and Southern Resident Killer Whale presence in the planned training location. Navy biologists will notify event planners of the likelihood of species presence as they plan specific details of the event (e.g., timing, location, duration). The Navy will ensure environmental awareness of event participants. Environmental awareness will help alert participating ship and aircraft crews to the possible presence of marine mammals in the training location, such as gray whales and Southern Resident Killer Whales. • **Northern Puget Sound Gray Whale Mitigation Area (March – May)** – Within the Northern Puget Sound Gray Whale Mitigation Area, the Navy will not conduct Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises from March to May. Should national security present a requirement to conduct Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises from March to May, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include information about the event in its annual activity reports to NMFS.

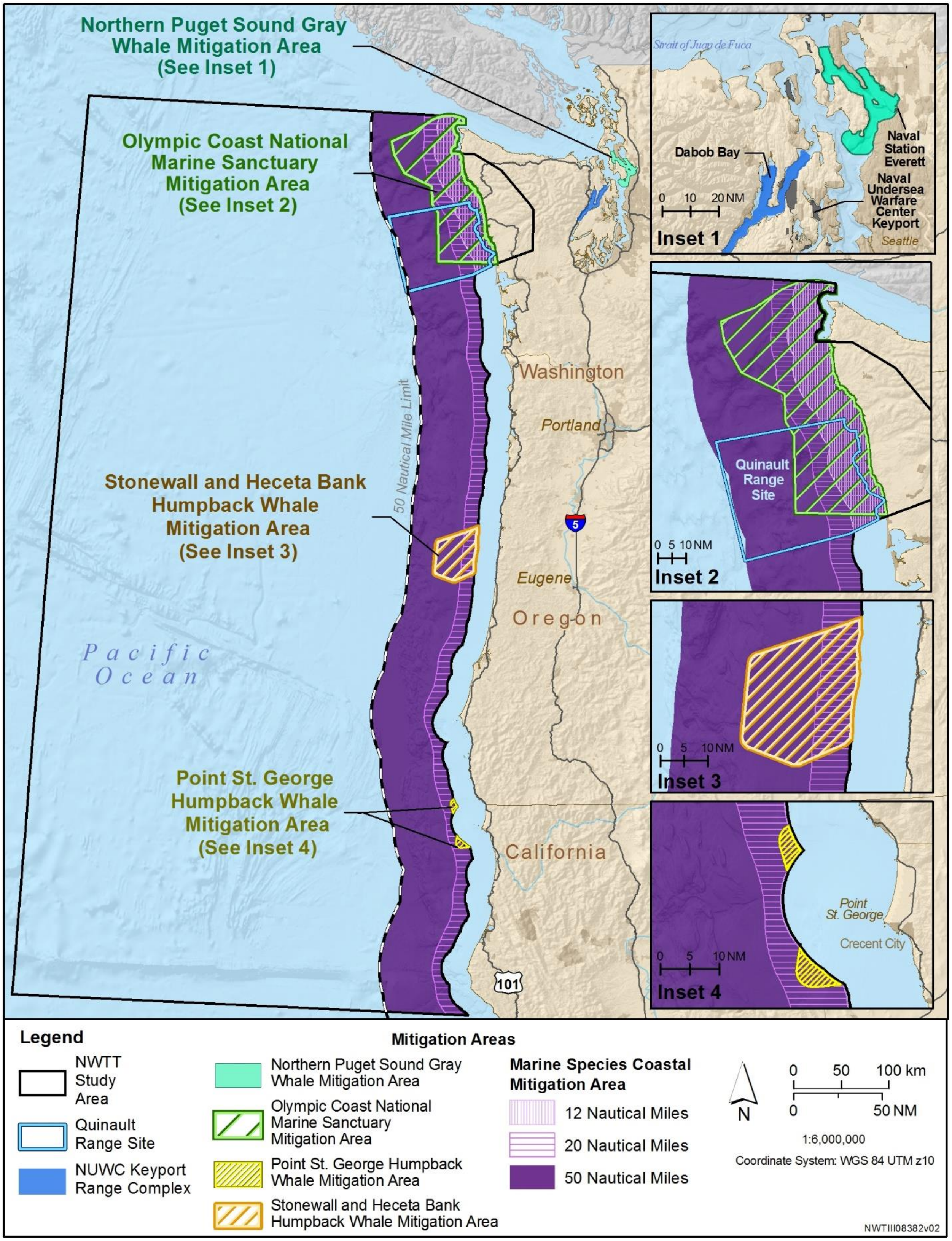

Figure K-2: Marine Species Mitigation Areas

K.4.1 Biological Effectiveness Assessment

Mitigation areas in the NWTT Study Area will avoid or reduce impacts on one or more marine mammal species or stocks and their habitat, as summarized below:

K.4.1.1 Seafloor Resource Mitigation Areas

The seafloor resource mitigation is a continuation from the 2015 NWTT Final EIS/OEIS. Without mitigation, explosives and physical disturbance and strike stressors could potentially impact live hard bottom, artificial reefs, shipwrecks, and their associated ecosystem components during certain training and testing activities in the Study Area. The Navy developed mitigation areas as either the anchor swing circle diameter or a 350-yard (yd.) radius around a seafloor resource, as indicated by the best available georeferenced data. Mitigating within the anchor swing circle will protect seafloor resources during precision anchoring activities when factoring in environmental conditions that could affect anchoring position and swing circle size, such as winds, currents, and water depth.

For other activities that will implement the mitigation, a 350-yd. radius around a seafloor resource is a conservatively sized mitigation area that will provide protection well beyond the maximum expected impact footprint (e.g., crater and expelled material radius) of the explosives and non-explosive practice munitions used in the Study Area. The mitigation zone size extends beyond the military expended material with the largest footprint for all Study Areas where this mitigation measure is implemented. For example, the military expended material with the largest footprint (which is not used in the NWTT Study Area) is an explosive mine with a 650-pound net explosive weight, which has an estimated impact footprint of approximately 14,800 square feet and an associated radius of 22.7 yd. The largest explosive applicable to this mitigation in the NWTT Study Area has a charge size of 60-pound net explosive weight. Therefore, the 350-yd. mitigation zone is well beyond the maximum expected direct impact footprint for the activities that will implement the seafloor resource mitigation in the NWTT Study Area, and further mitigates some level of indirect impact from explosive disturbances. Other applicable explosive activities and non-explosive practice munitions have a smaller impact footprint; therefore, the mitigation area will result in additional protection during those activities.

The seafloor resource mitigation areas will help the Navy avoid or reduce potential impacts from explosives and physical disturbance and strike stressors on sensitive seafloor resources and to any biological or cultural resources that inhabit, shelter, rest, feed, or occur in the mitigation areas. As described in Chapter 3.3 (Marine Habitats) of this Draft Supplemental, other habitats, such as soft bottom, are expected to recover relatively quickly from potential disturbances; therefore, there would be a limited benefit of mitigation for other habitat types. To facilitate mitigation implementation, the Navy will include maps of the best available georeferenced data for artificial reefs, live hard bottom, and shipwrecks in its Protective Measures Assessment Protocol. Mitigation areas apply to georeferenced resources because the Navy requires accurate resource identification and mapping for mitigation to be effective and practical to implement.

K.4.1.2 Marine Species Coastal Mitigation Area

The Marine Species Coastal Mitigation Area is designed to avoid or reduce potential impacts from explosives, non-explosive practice munitions, and active sonar on ESA-listed fish, ESA-listed birds, and marine mammals that inhabit, feed in, or migrate through this area, including killer whales, humpback whales, and gray whales. As shown in Figure K-2, the Navy will implement mitigation for applicable activities within 50 NM, 20 NM, or 12 NM from shore in the at-sea portion of the Study Area (including to the Washington shoreline in the W-237 Offshore Area). Mitigation within 12 NM and 20 NM from shore in the Marine Species Coastal Mitigation Area is a continuation from the 2015 NWTT Final EIS/OEIS. Mitigation within 50 NM from shore in the Marine Species Coastal Mitigation Area is a continuation from the 2015 NWTT Final EIS/OEIS for training activities. Mitigation requirements within 50 NM from shore have been expanded to include explosive testing activities (except explosive Mine Countermeasure and Neutralization Testing activities).

K.4.1.3 Olympic Coast National Marine Sanctuary Mitigation Area

Mitigation within the Olympic Coast National Marine Sanctuary Mitigation Area is a continuation from the 2015 NWTT Final EIS/OEIS. Mitigation within the Olympic Coast National Marine Sanctuary is designed to avoid or reduce potential impacts from mid-frequency active sonar, explosives during Mine Countermeasure and Neutralization Testing activities, and non-explosive practice munitions on marine mammals that inhabit, feed in, or migrate through this area, including killer whales, humpback whales, and gray whales. The mitigation will also help the Navy avoid or reduce potential impacts on a wide assemblage of other resources that inhabit, forage in, and migrate through the sanctuary, such as leatherback sea turtles, invertebrates, birds, and fishes.

Because this mitigation area is located entirely within 50 NM from shore in the Marine Species Coastal Mitigation Area, the Navy’s combined mitigation will ensure that marine mammals and other sanctuary resources are not exposed to explosives in the sanctuary from any training or testing activity under the Proposed Action. Furthermore, mitigation within 20 NM and 12 NM from shore in the Marine Species Coastal Mitigation Area will help the Navy avoid or reduce potential impacts from active sonar and non-explosive practice munitions on sanctuary resources.

K.4.1.4 Stonewall and Heceta Bank Humpback Whale Mitigation Area

The Stonewall and Heceta Bank Humpback Whale Mitigation Area is new for the Draft Supplemental. Mitigation within the Stonewall and Heceta Bank Humpback Whale Mitigation Area is designed to avoid or reduce potential impacts seasonally from mid-frequency active sonar and explosives, including explosive Mine Countermeasure and Neutralization Testing activities, on humpback whales in an important feeding area. The mitigation will also help the Navy avoid or reduce potential impacts on other marine mammals that may inhabit or migrate through this area, including killer whales and gray whales.

The Stonewall and Heceta Bank Humpback Whale Mitigation Area is located within the Marine Species Coastal Mitigation Area; therefore, humpback whales and other marine mammals will also benefit from the mitigation measures implemented for explosives and non-explosive practice munitions in that area.

K.4.1.5 Point St. George Humpback Whale Mitigation Area

The Point St. George Humpback Whale Mitigation Area is new for the Draft Supplemental. Mitigation within the Point St. George Humpback Whale Mitigation Area is designed to avoid or reduce potential impacts seasonally from mid-frequency active sonar and explosives, including explosive Mine Countermeasure and Neutralization Testing activities, on humpback whales in an important feeding area. The mitigation will also help the Navy avoid or reduce potential impacts on other marine mammals that may inhabit or migrate through this area, including killer whales and gray whales.

The Point St. George Humpback Whale Mitigation Area is located within the Marine Species Coastal Mitigation Area; therefore, marine mammals will also benefit from the mitigation measures implemented for explosives and non-explosive practice munitions in that area.

K.4.1.6 Puget Sound and Strait of Juan de Fuca Mitigation Area

Mitigation within the Puget Sound and Strait of Juan de Fuca Mitigation Area is a continuation from the 2015 NWTT Final EIS/OEIS. Although not depicted in Figure K-2, the mitigation area encompasses the full extent of the NWTT Inland Waters portion of the Study Area. Mitigation within the Puget Sound and Strait of Juan de Fuca Mitigation Area is designed to avoid or reduce potential impacts from active sonar on killer whales and gray whales. The mitigation will also help the Navy avoid or reduce potential impacts on other marine mammals that inhabit, feed in, or migrate through this area.

K.4.1.7 Northern Puget Sound Gray Whale Mitigation Area

The Northern Puget Sound Gray Whale Mitigation Area is new for the Draft Supplemental. Mitigation within the Northern Puget Sound Gray Whale Mitigation Area is designed to avoid or reduce potential impacts seasonally from active sonar on gray whales in an important feeding area. The mitigation will also help the Navy avoid or reduce potential impacts on other marine mammals that inhabit or migrate through this area seasonally.

K.4.2 Operational Assessment

The Navy conducts training and testing activities in the NWTT Study Area because this region provides valuable access to sea space and airspace conditions analogous to areas where the Navy operates or may need to operate in the future. Training and testing schedules are based on national tasking, the number and duration of training cycles identified in the Optimized Fleet Response Plan and various training plans, forecasting of future testing requirements, and emerging requirements. When scheduling activities, the Navy considers the need to minimize sea space and airspace conflicts throughout the entire Study Area. For example, the Navy schedules training and testing to minimize conflicts between its own activities and with consideration for public safety (e.g., safe distances from recreational boating activities). Daily fluctuations in training and testing schedules and objectives could mean that, on any given day, vessels may depend on discrete locations of the Study Area for discrete purposes.

The Navy selects training areas in this region to allow for the realistic tactical development of the myriad training scenarios Navy units are required to complete to be mission effective. Certain activities, such as deployment certification exercises that involve integration with multiple warfare components, require large areas of the littorals and open ocean for realistic and safe training. The Navy chooses training locations based on proximity to training ranges, available airspace (e.g., avoiding airspace conflicts with major airports), unobstructed sea space, and aircraft emergency landing fields. The Navy requires flexibility in the timing of its use of active sonar and explosives in order to meet individual training and testing schedules and deployment schedules. Navy vessels, aviation squadrons, and testing programs have a limited amount of time available for training and testing. The Navy must factor in variables such as maintenance and weather when scheduling event locations and timing.

The Navy uses select areas in NWTT Inland Waters for a limited number of training and testing activities. These waters overlap the habitat extent of marine mammal habitat within Puget Sound. It is critical for national security that the Navy's inshore activities, such as Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection exercises, occur in NWTT Inland Waters as planned to provide realism and access to the necessary environmental conditions. The Navy selects the locations and scenarios for Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercises according to Department of Homeland Security strategic goals and evolving world events.

The Navy conducts testing activities in the Study Area because it provides a variety of bathymetric and environmental conditions necessary to ensure functionality and accuracy of systems and platforms in areas analogous to where the military operates. Testing locations are typically located near systems command support facilities, which provide critical safety, platform, and infrastructure support and technical expertise necessary to conduct testing (e.g., proximity to air squadrons). The testing community is required to install and test systems on platforms at the locations where those platforms are stationed. Additionally, the testing community has a need for rapid development to quickly resolve tactical deficiencies. Overall, training and testing schedules can be cyclical and are partially driven by geo-political situations, which precludes the Navy from implementing additional mitigation to reduce or eliminate the use of active sonar or explosives in the Study Area.

Expanding the mitigation areas in the Study Area would encroach upon the primary water space where training and testing activities are scheduled to occur. For example, expanding the mitigation to protect additional seafloor features where marine species are known to occur (e.g., soft bottom, which provides habitat for resources such as seagrass, worms, and clams) would essentially result in the Navy not conducting training and testing activities throughout a significant portion of the Study Area. This would prohibit the Navy from accessing a majority of its ranges and operating areas and conducting the Proposed Action in environments that are analogous to where the military operates, or may need to operate in the future, which would prevent it from meeting its mission requirements.

Further expansions of mitigation areas in the Study Area would require the Navy to relocate its activities to alternative locations, such as farther offshore in the NWTT Offshore Area. Moving activities farther offshore would reduce a unit's training opportunities during its limited available training timeframes (i.e., increased time spent transiting to more distant training areas results in decreased time available for training). This would also result in training and testing activities being conducted in water conditions that do not accurately reflect the types of environments where military missions and combat operations occur. Increasing transit distances would result in additional fuel consumption and expenditures, which could serve as a limiting factor for Navy surface units whose available underway times are constrained by fuel expenses.

Implementing additional mitigation in the Study Area would have a significant impact on the ability of units to meet their individual training and certification requirements (impacting the ability to deploy with the required level of readiness necessary to accomplish their missions), to certify forces to deploy to meet national security tasking (limiting the flexibility of Combatant Commanders and warfighters to project power, engage in multi-national operations, and conduct the full range of naval warfighting capability in support of national security interests), and for program managers and weapons system acquisition programs to meet testing requirements and required acquisition milestones. Based on the Navy's preliminary assessment for this Draft Supplemental, additional mitigation in the Study Area would increase operational costs (due to extending distance offshore, which would increase fuel consumption, maintenance, and time on station to complete required training and testing activities), increase safety risks (associated with conducting training and testing at extended distances offshore and farther away from critical medical and search and rescue capabilities), and accelerate fatigue-life of aircraft and ships (leading to increased safety risk and higher maintenance costs). Furthermore, additional mitigation would significantly impact training and testing realism due to reduced access to necessary environmental or oceanographic conditions that replicate military mission and combat conditions. This would diminish the ability for Navy Sailors to train and become proficient in using sensors and weapon systems as required during military missions and combat operations.

The iterative and cumulative impact of all potential mitigation measures the Navy assessed, including certain mitigation measures suggested through public scoping comments, would deny national command authorities the flexibility to respond to national security challenges and effectively accomplish the training necessary for deployment. For example, additional limitations on the use of active sonar and explosives would require the Navy to shift its training activities to alternative locations farther offshore. This would have significant impacts on safety, sustainability, and the ability to meet mission requirements within limited available timeframes. Likewise, requiring weapons system program managers and research, testing, and development program managers to use alternative areas within limited available timeframes would deny them the necessary flexibility to rapidly field or develop systems to meet testing program requirements and emerging requirements.

In summary, the Navy developed the mitigation areas identified in Table K-1 and Table K-2 to provide further protection for marine mammals and ESA-listed species, and help the Navy avoid or reduce potential impacts on seafloor resources in areas the best available science suggests are key areas of biological or ecological importance, or locations of submerged cultural resources. The mitigation will help the Navy avoid or reduce potential impacts from active sonar, explosives, and physical disturbance and strike stressors on these resources. Further restrictions on the level, number, or timing (seasonal or time of day) of training or testing activities would be impractical due to implications for safety, sustainability, and mission requirements.

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