

NMFS/FHWA Best Management Practices (BMPs) for Transportation Actions in the Greater Atlantic Region

Comparison of transportation project types, and links between project components with resource effects and conservation measures

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Bridge Repair, Demolition, and Replacement: Bridge work may include structural repairs; pile driving and removal; demolition; excavation for and installation of bridge abutments; temporary fills; riprap placement; constructing bridge columns; constructing stormwater facilities; approach widening; paving with asphalt concrete; and complete replacement. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>
	Substructures/footings	Habitat alteration and loss	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized habitat alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Superstructures	Habitat alteration/shading	Behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Beam/deck panel placement	Underwater noise	Temporary behavior modification/ avoidance, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
	Deck pour/paving and painting	Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized habitat alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Stabilization/riprap placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, localized habitat alteration, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Pile installation via vibratory or impact hammer, water jetting	Underwater noise	Physical injury and mortality, temporary behavior modification, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Excavation/drilled-shafts/columns/piers	Underwater noise	Physical injury and mortality; temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Removal via direct pull/clam shell	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Removal via vibratory hammer	Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Pile-cutting	Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Underwater Noise BMPs (Section 6.1)
	Post-piling removal	Habitat alteration/altered bottom habitat	Physical injury and mortality, avoidance	Habitat alteration	See Habitat Alteration BMPs (Section 6.5)
	Fill/disposal	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Vessel interaction	Physical injury, temporary behavior modification, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Culvert Repair and Replacement: Work on culverts may involve vegetation and sediment removal, pavement and roadbed removal, culvert extraction, placing new culverts or outflow pipes, backfilling and patching the pavement, installing armoring and headwalls, planting, and dewatering the work area and establishing a flow bypass prior to initiating work. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, and habitat alteration</p>
	Substructures	Habitat alteration and loss	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized habitat alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Paving	Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized habitat alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Culvert placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, localized habitat alteration, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
Heavy equipment & vehicles		Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
Earthwork		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
Stabilization/riprap placement		Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, localized habitat alteration, affected prey resources	See Turbidity and Sedimentation and Habitation Alteration BMPs (Sections 6.3 and 6.5)
Fill/disposal		Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Vessel interaction	Physical injury, temporary behavior modification, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Docks, Piers, and Waterway Access Projects: Docks, piers, and waterway access projects may be associated with boardwalks, bicycle/pedestrian paths or bridges, other docks and piers, boat ramps, overlooks, viewpoints, and/or historical markers. These activities may include at-grade or elevated trails including boardwalks (piles with decking), fill/ stabilization, and excavation. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>
	Stabilization/riprap placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Substructures	Habitat alteration, turbidity and sedimentation	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Superstructures	Habitat alteration/shading	Behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Pile installation via vibratory or impact hammer, water jetting	Underwater noise	Physical injury and mortality, temporary behavior modification, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
Excavation/drilled- shafts/columns/piers		Underwater noise	Physical injury and mortality; temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
Removal via direct pull/clam shell		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
Removal via vibratory hammer		Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
Pile-cutting		Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Underwater Noise BMPs (Section 6.1)
Post-piling removal		Habitat alteration/altered bottom habitat	Physical injury and mortality, avoidance	Habitat alteration	See Habitat Alteration BMPs (Section 6.5)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Slope Stabilization: Stabilization techniques include placing or resetting riprap, abutment caps, bulkheads, scour countermeasures, concrete mattresses, or other structures to protect and restore eroded slopes or to protect slopes that are vulnerable to erosion. Non-structural shoreline stabilization measures that do not use hard components such as the placement of sand fill, coir logs, and/or native shell may also be incorporated. Stabilization structures can be installed from land, temporary structures, or water via shallow-draft barges. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>
	Removal/excavation of structures & riprap	Turbidity and sedimentation	Physical injury and mortality, temporary behavior modification/avoidance, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Stabilization/riprap placement	Habitat alteration/alterd connectivity, altered sediment deposition	Behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Fill/disposal	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/alterd bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/alterd connectivity, altered sediment deposition	Temporary behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Vessel interaction	Physical injury, temporary behavior modification, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
<p>Water Diversions/Cofferdams: Cofferdams create isolated work areas that can be dewatered to allow work to be done in-the-dry. Cofferdams may consist of sandbags, causeways/ earthen structures, and/or large casings or structures created out of sheet piles. They may be installed with hammers, by crane and excavator, or placed by hand, depending on size. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction
	Cofferdam construction/ installation	Underwater noise	Physical injury and mortality, temporary behavior modification, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Cofferdam in place	Habitat alteration/barriers	Temporary behavior modification, delayed movements	Temporary localized habitat loss	See Habitat Alteration BMPs (Section 6.5)
	Cofferdam removal	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized habitat alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Dewatering, cofferdam pump-out	Impingement/entrainment, turbidity and sedimentation, reduced water quality	Physical injury and mortality, trapping/harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement, Turbidity and Sedimentation, and Reduced Water Quality BMPs (Sections 6.2, 6.3, and 6.4)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & cranes	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Demolition: Demolition occurs by mechanical dismantling of structures from an adjacent structure or barge, or via land or through blasting. Structural components may be removed using a variety of methods such as cutting/sawing, blasting/chemical expansion (bentonite), hydraulic drilling, excavating, or by using a hoe ram, wrecking ball, clamshell dredge, or splitting wedges and hydraulic impact hammer. Demolition debris is typically mechanically removed and demolished structures are typically barged or trucked offsite for disposal. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>
	Mechanical removal or blasting	Underwater noise	Physical injury and mortality, temporary behavior modification, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants and pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
Excavation	Turbidity and sedimentation		Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Impingement and entrainment	Physical injury and mortality, trapping/harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Vessel interaction	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
<p>Pile Driving/Removal: Piles support decking, provide temporary support during construction, serve as fenders and dolphins to protect structures, support navigation markers, and may support cofferdams, breakwaters, and bulkheads. They can be made of steel, concrete, wood, or plastic, and may be in the form of single piles or sheets. Piles can be driven into the substrate by impact or vibratory hammers, water jetting, or drilled/augured in by drilled shafts or rock sockets and may be removed by vibratory hammer, direct pull, clamshell bucket grab, cutting/breaking below the mudline, or mechanical demolition. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction
	Pile installation via vibratory or impact hammer, water jetting	Underwater noise	Physical injury and mortality, temporary behavior modification, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
Excavation/drilled-shafts/columns/piers		Underwater noise	Physical injury and mortality; temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Underwater Noise BMPs (Section 6.1)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices	
		Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)	
	Removal via direct pull/clam shell	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)	
	Removal via vibratory hammer		Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Underwater Noise BMPs (Section 6.1)
			Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, temporary localized habitat alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Pile-cutting		Underwater noise	Physical injury, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Turbidity and Sedimentation BMPs (Section 6.3)
	Post-piling removal		Habitat alteration/altered bottom habitat	Physical injury and mortality, avoidance	Habitat alteration	See Habitat Alteration BMPs (Section 6.5)
	Barges/vessels		Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
			Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Spuds/spudding		Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
<p>Dredging/Excavation: Dredging is typically done with hydraulic or mechanical equipment to remove naturally accreting sediment, deepen or widen a waterway, or to return an area to pre-construction conditions. Dredging or excavation may be associated with the installation of sub-structures, placement of erosion and scour control measures or utility lines or cables, or to remove debris. Excavation is often necessary to key in stabilization materials. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>	

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Dredging/excavation	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Impingement and entrainment	Physical injury and mortality, trapping/harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
		Vessel interaction	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Impingement and entrainment	Physical injury and mortality, trapping/ harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
<p>Fill/Stabilization: Fill and grading may be required prior to stabilization. Construction of temporary access fills and roads may be required to provide a working platform or access for machinery. Scour repair measures including fill and stabilization structures may be necessary. Fill may also be associated with disposal of excavated or dredged material. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction
	Fill/disposal	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Vessel interaction	Physical injury, temporary behavior modification, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Impingement and entrainment	Physical injury and mortality, trapping/ harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
<p>Vessel Activities: Construction and maintenance of transportation projects can increase vessel traffic. Equipment access may be from barges, depending on site characteristics. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>		See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction			

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Vessel traffic/activity	Underwater noise	Physical injury, temporary behavior modification/avoidance, reduced fitness	Temporary localized habitat alteration, affected prey resources	See Vessel Interaction BMPs (Section 6.6)
		Reduced water quality/pollutant materials discharge	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration, turbidity and sedimentation/altered sediment deposition	Temporary behavior modification/avoidance, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
		Impingement and entrainment	Physical injury and mortality, harassment, temporary behavior modification, reduced fitness	Temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
		Vessel interaction	Physical injury, temporary behavior modification, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
<p>Habitat Restoration, Establishment, and Enhancement: Habitat restoration, establishment, or enhancement may be done to restore areas impacted temporarily during the construction of a project, or as compensatory mitigation or to create mitigation banks. This may include excavation, fill, planting, invasive plant removal, channel reconstruction, shell placement, and living shorelines. Habitat restoration may also include demolition of abandoned or obsolete structures, debris removal, and/or sediment remediation. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction
	Stabilization/riprap placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Substructures	Habitat alteration, turbidity and sedimentation	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Superstructures	Habitat alteration/shading	Behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, affected prey resources	See Habitat Alteration BMPs (Section 6.5)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Dredging/excavation	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Impingement and entrainment	Physical injury and mortality, trapping/harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
		Vessel interaction	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)
<p>Scientific Measurement Devices/Survey Activities: The use of scientific measurement devices or survey activities may be necessary to collect data at a project site in advance of project design or construction or as a part of required monitoring. Such devices or survey activities may include staff or current gages, water recording and biological observation devices, soil borings, core sampling, historic resource surveys, and side scan sonar. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction
	Stabilization/riprap placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Substructures	Habitat alteration, turbidity and sedimentation	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Superstructures	Habitat alteration/shading	Behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
	Excavation	Turbidity and sedimentation	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected water quality, localized habitat loss and alteration (burying/covering), affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
		Reduced water quality/resuspended contaminants	Hazardous material exposure, physical injury, and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)
		Habitat alteration/altered bottom habitat	Physical injury and mortality, temporary behavior modification, reduced fitness	Habitat alteration, affected water quality, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
		Habitat alteration/altered connectivity, altered sediment deposition	Temporary behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
		Impingement and entrainment	Physical injury and mortality, trapping/harassment, temporary behavior modification, reduced fitness	Temporarily affected water quality, temporary localized habitat alteration	See Impingement/Entrainment and Entanglement BMPs (Section 6.2)
		Vessel interaction	Physical injury, temporary behavior modification/avoidance, reduced fitness	Affected prey resources, foraging, sheltering and spawning habitat	See Vessel Interaction BMPs (Section 6.6)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
<p>Staging Area Establishment: Staging areas may need to be established for delivery and storage of construction materials and equipment, contractor office and storage trailers, and parking. Staging areas vary in size and may require vegetation clearing, grubbing, grading, or excavation to level the site, and installation of drainage improvements. Refer to the other applicable activities/sub-activities to ensure all aspects of a project are included.</p>					<p>See sections on underwater noise, impingement/entrainment, turbidity and sedimentation, reduced water quality, habitat alteration, and vessel interaction</p>
	Stabilization/riprap placement	Habitat alteration/altered connectivity, turbidity and sedimentation/altered sediment deposition	Behavior modification, reduced fitness	Shoreline habitat loss, affected foraging, sheltering and spawning habitat, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Substructures	Habitat alteration, turbidity and sedimentation	Behavior modification, reduced fitness	Loss of habitat, altered flow dynamics, affected prey resources	See Turbidity and Sedimentation and Habitat Alteration BMPs (Sections 6.3 and 6.5)
	Superstructures	Habitat alteration/shading	Behavior modification, reduced fitness	Reduced light levels/altered ambient light patterns, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Temporary access roads/work areas	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)
	Barges/vessels & crane/timber mats	Habitat alteration/vegetation smothering and sediment compaction, vessel interaction	Temporary behavior modification, reduced fitness	Loss of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration and Vessel Interaction BMPs (Sections 6.5 and 6.6)
		Habitat alteration/shading	Temporary behavior modification, reduced fitness	Reduced light levels/ altered ambient light patterns, limited plant growth/recruitment, altered plant/animal assemblages, altered behavior, affected prey resources	See Habitat Alteration BMPs (Section 6.5)
	Heavy equipment & vehicles	Turbidity and sedimentation	Temporary behavior modification, reduced fitness	Minor localized water quality impacts	See Turbidity and Sedimentation BMPs (Section 6.3)
	Spuds/spudding	Habitat alteration/vegetation smothering and sediment compaction	Temporary behavior modification, reduced fitness	Alteration of bottom habitat, altered sediment transport, affected prey resources, foraging, sheltering and spawning habitat	See Habitat Alteration BMPs (Section 6.5)
	Earthwork	Turbidity and sedimentation	Physical injury, temporary behavior modification, reduced fitness	Affected water quality, affected prey resources	See Turbidity and Sedimentation BMPs (Section 6.3)

Activity/Sub-Activity	Components	Stressors	Species Effects	Habitat Effects	Best Management Practices
		Reduced water quality/ resuspended contaminants	Hazardous material exposure, physical injury and mortality, temporary behavior modification, reduced fitness	Affected water quality, localized alteration, affected prey resources	See Reduced Water Quality BMPs (Section 6.4)