Section 4

Conservation Measures

Conservation measures are best management practices (BMPs) used to ensure that activities avoid and minimize impacts to ESA-listed species and their habitat. This section describes 8 general categories of conservation measures, listed below, that apply to each of the 13 construction methods described in Section 3. Four of these 8 general conservation measures have subcategories outlined below in italics.

4.1 Approved Work Windows, CM 1

4.2 Stormwater Pollution Prevention, CM 2 - 30

- *A. Develop Construction Stormwater & Erosion Control Plan (CSECP),* CM 2
- *B. Ensure Contractor/City Crew has SPCP,* CM 3 & 4
- *C. Minimize Site-Preparation-Related Impacts,* CM 5 - 14
- *D. Avoid Heavy Equipment Fuel/Oil Leakage,* CM 15 - 18
- *E. Minimize Earthmoving-Related Erosion,* CM 19 - 24
- *F. Minimize Stream Crossing Sedimentation,* CM 25 & 26
- *G. General Restoration in Open Waters,* CM 27 - 29
- *H. Temporary Dewatering Plan Requirements,* CM 30

4.3 Work Area Isolation, CM 31

4.4 Fish Handling, CM 32

4.5 Overwater Structure Size, CM 33 - 44

- *A. Floats, Docks, or Piers,* CM 33 - 40
- *B. Floating Breakwaters,* CM 41 & 42
- *C. Anchoring Buoys, Floats and Floating Breakwaters,* CM 43 & 44

4.6 Piling Installation and Noise Abatement, CM 45 - 56

- *A. Piling Installation,* CM 45 - 51
- *B. Piling Installation Noise Abatement,* CM 52 - 56

4.7 Shoreline and Aquatic Habitat Protection, CM 43 - 74

A. All Projects/All Structures, CM 57 - 65

B. Beach Nourishment/Substrate Addition, CM 66 & 67

C. Boat Launch, CM 68 & 69

D. Bulkhead Repair/Replacement, CM 70 - 72

E. Riprap Addition, CM 73 & 74

4.8 Pesticides, CM 75 - 78

Across the 8 general categories, there are a total of 78 specific conservation measures. These are detailed below, sequentially numbered starting at 1, shown just below conservation measure 4.1 (Approved Work Windows) and running through to the end of general category 8.

City of Seattle staff will indicate on the **Specific Project Information Forms** (SPIFs), given in Appendix A, those conservation measures that will be applied to a specific activity or suite of activities. There may be additional conservation measures other than those presented here. If additional conservation measures or BMPs will be used, these must be identified and described in the SPIFs.

4.1 Approved Work Windows

CM 1. All work shall be conducted during the approved work windows/timing restrictions for the protection of ESA-listed species or the species they forage upon in the Seattle action areas. If work cannot be completed during the approved work, a request for modification or an extension to the work window should be made to the Corps and Services. These windows can overlap for various species and locations. The work window for bald eagles, protected under the Bald and Golden Eagle Act, is in Appendix C.

A. Fish Windows

Freshwater Fish Window. Follow the approved freshwater work window for ESA-listed species in the Seattle action areas (Table 4-1).

Table 4-1. Approved Freshwater Work Windows for ESA-Listed Fish Species in the Seattle Action Areas*

Waterbody	Location	Window
Lake Washington Ship Canal	Upstream of Locks to east end of Montlake Cut	Oct 1 – Apr 15
Lake Washington south of I-90	>1 mile from the Cedar River	Jul 16 – Dec 31
	Within 1 mile of the Cedar River	Jul 16 – Jul 31 Nov 16 – Dec 31
Lake Washington	Between I-90 and SR 520	Jul 16 – Apr 30
Lake Washington north of SR 520	Between SR 520 and line due west from Arrowhead Point	Jul 16 – Mar 15
	North of line due west from Arrowhead Point	Jul 16 – Jul 31 Nov 16 – Feb 1
Tributaries to Lake Washington in Seattle		Jul 1 – Aug 31
Duwamish River - mouth to upper turning basin		Oct 1 – Feb 15
Tributaries to the Duwamish River		Jul 1 - Sept 30
Tributaries to Puget Sound		Jul 1 – Sept 30
Source**:** Corps 2010		

*Work window for a stream applies to all its tributaries, unless otherwise indicated

Marine Fish Window. Follow the approved marine and estuarine work window for ESA-listed fish species (Coastal-Puget Sound bull trout, Puget Sound Chinook salmon, steelhead and rockfish) and forage fish in the Seattle action areas. (see Figure 1).

- Have City crew or contractor make use of tide tables to select the lowest tides for work.
- Where a river, stream, or tributary enters marine or estuarine water, work windows listed in Table 4-2 apply to all tidally influenced portions of a river, stream or tributary.
- If forage fish spawning habitat is documented in the project area, then the work window for that species applies. For the Seattle Biological Evaluation, 'forage fish' means surf smelt, Pacific sand lance, and Pacific herring. Chinook salmon are forage fish for bull trout as are other small salmonids.

Table 4-2. Approved Marine/Estuarine Work Windows for Puget Sound Chinook Salmon, Bull Trout, Steelhead, Rockfish, and Forage Fish in Seattle Action Areas

Species	Location	Window
Salmon (Puget Sound Chinook)		Jul 2 – Mar 2
Bull trout (Coastal-Puget Sound bull trout)		Jul 16 – Feb 15
	Duwamish Waterway mouth to upper turning basin (SE ¼ of NW ¼ section 4, T23N, R4E)	Oct 1 – Feb 15
Steelhead		Jul 2 – Mar 2
Rockfish*	Puget Sound – kelp beds, eel grass, large rocks	Oct. 1 – Feb. 15
Forage fish:		
Surf smelt		Apr 1 – Aug 31
Pacific herring		May 1 – Jan 14
Pacific sand lance		Mar 2 – Oct 14
Source**:** Corps 2010		

* This work window is for projects that are in or near kelp, eel grass, or large rocks. Rockfish may be present in the nearshore during the summer portion of the Chinook salmon, bull trout, and steelhead (July 2 – October 1). If a project is not located near kelp, eel grass, or large rocks, then the marine work window for listed salmonids should be followed.

Several Work Windows. If several work windows for different species apply (such as for both Chinook and bald eagles) for a specific project, the work windows must be combined.

> For example, if the project is in north Puget Sound, Pacific sand lance spawning habitat is present and work windows would be:
>
> | | |
> |---|---|
> | Salmon | July 2 – March 2 |
> | Bull trout | July 16 – February 15 |
> | Pacific sand lance | March 2 – October 14 |
>
> Taking the days that the approved work windows have in common, the time the project could be constructed is **July 16 – October 14**.

4.2 Stormwater Pollution Prevention

A. Develop Temporary Erosion and Sediment Control Plan

CM 2. Each project shall have onsite a written a Construction Stormwater Erosion Control Plan (CSECP) that includes all information needed to reduce erosion and sedimentation on the project. All projects will require the contractor/City crew to assign an onsite Erosion Control Lead to oversee the work and ensure compliance with the CSECP.

B. Ensure Contractor/City Crew has SPCP

CM 3. The City crew/contractor shall have onsite a written Spill Prevention and Control Plan (SPCP) that describes materials to be used and measures to prevent or reduce impacts from potential spills (fuel, hydraulic fluid, *etc.*).

CM 4. Maintain a spill kit onsite to respond to accidental spills during construction. Ensure that spill kit is stocked with adequate containment material and other supplies to suit the specific job site and potential containment distances.

C. Minimize Site-Preparation-Related Impacts

CM 5. Confine construction impacts to the minimum area necessary to complete the project and delineate impact areas on project plans. Flag boundaries of clearing limits associated with site access, construction, and staging areas as well as wetland and riparian corridor where work has been authorized.

CM 6. Establish staging and site access areas along existing roadways or other disturbed areas to minimize erosion into or contamination of sensitive areas or their buffers. Confine work to the area noted using flagging or other barriers.

CM 7. Limit clearing and grubbing area to minimum required. Retain vegetation to maximum extent possible. Minimize clearing and grubbing effects by cutting vegetative stems but not removing the root systems, which help to reduce erosion potential and allow native plants to regenerate.

CM 8. Divert run-off from entering the project (disturbed) area.

CM 9. Ensure proper BMPs, such as covering, berming, matting, seeding, or mulching, are implemented to prevent erosion of any excavated material.

CM 10. Stockpile large wood, trees, riparian vegetation, other vegetation, sand, and topsoil removed for establishment of staging area and reuse for site restoration.

CM 11. Salvaged debris such as roots and stumps may be used for habitat. Disposal of debris may include chipping, shredding, or grinding for reintroduction to the site as mulch (Std Specs 1-05.13(3), 1-07.5, 2-01.2, 2-10.3(2) and 8-01).

CM 12. Place sediment barriers (*e.g.*, silt fences, coir logs, wood straw, or other effective erosion control method) around disturbed sites to prevent erosion from sediment deposition from entering a waterbody.

CM 13. Keep a supply of erosion control materials (*e.g.*, silt fence or mulch) on hand to respond to sediment emergencies. For wetland areas with high likelihood of germination, use wood straw.

CM 14. Use curb inlet sediment traps and geotextile filters, along with silt fencing, to capture sediment before it leaves the site.

D. Avoid Heavy Equipment Fuel/Oil Leakage

CM 15. Equipment used for work below the OHW[1] or MHHW[2] or in riparian zones or shoreline areas shall be cleaned of accumulated grease, oil, mud, *etc*, and leaks repaired before arriving at the project.

CM 16. Equipment shall be fueled and serviced in an established staging area. Thereafter, all equipment shall be inspected daily for leaks or accumulation of grease, and any identified problems fixed before equipment enters areas typically covered with water.

CM 17. Two oil-absorbing floating booms appropriate for the size of the work shall be available onsite during all phases of work whenever heavy equipment is used below the OHW or MHHW. The booms shall be placed in a location that facilitates an immediate response to potential petroleum leakage and shall be deployed for all petroleum leaks.

CM 18. Vegetable-based hydraulic fluid should be substituted when machines will operate in sensitive areas or their buffer for more than incidental work.

E. Minimize Earthmoving-Related Erosion

CM 19. Operate machinery from existing roads and paved areas where they exist in proximity to the site. In many cases, wood chippings and timber mats can provide a temporary surface where heavy equipment can access a work site.

CM 20. Use temporary materials such as geotextile barriers, hog fuel or wood pellets to stabilize haul and access routes, staging areas and stockpile areas.

CM 21. Stockpile native streambed or substrate materials above the OHW for later use in project restoration. To prevent contamination from fine soils, these materials shall be kept separate from other stockpiled material not native to streambed or substrate.

CM 22. If equipment wash areas are required, they shall be located where washwater, sediment, and pollutants cannot enter waterbodies, including wetlands.

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[1]Ordinary high water (OHW): A non-tidal (freshwater) visible line on a bank where the presence and action of waters are so common as to leave a mark on soil or vegetation.
[2]Mean higher high water (MHHW): A tidal (marine water) datum that is the average high water height.

CM 23. No sediment shall be tracked onto paved streets or roadways. Sediment shall be removed from trucks and equipment before leaving the site.

CM 24. Remove equipment and excess supplies, clean work storage areas, and remove temporary erosion control materials and temporary fill after construction and when soils have stabilized (Std Spec 1-04.11).

F. Minimize Stream Crossing Sedimentation

CM 25. Minimize stream and riparian crossings. If possible, cross at right angles to the main channel.

CM 26. Where temporary stream crossings are essential, crossings shall be managed to minimize the risk of creating erosion.

G. General Restoration in Open Waters

CM 27. For in-water work at or below OHW or MHHW, appropriate and effective erosion or other water quality control devices will be in place before project work begins. Control devices include sealed sand or gravel bags, silt curtains, silt fencing, or other containment systems. Deploy and maintain curtain at sufficient depth to reach bottom and contain sediment.

CM 28. If mechanized equipment is used within the OHW or MHHW, only an extension arm with bucket or similar attachment shall enter the water. Conduct debris removal and work below OHW or MHHW during low water levels (fresh waters) or at low tide (marine waters). This prevents material from entering the water during construction. It is recommended that a tarp be placed on the substrate of the work area. All debris removed shall be disposed of offsite in an approved upland disposal area.

CM 29. Confine use of equipment operating below OHW or MHHW to designated access corridors.

H. Temporary Dewatering Plan Requirements

CM 30. Develop a Temporary Dewatering Plan (TDP) for any dewatering lasting **more than one day** or requiring the installation of **a trench safety system**. The City crew/contractor shall submit the TDP to the City project manager. The TDP shall contain the following minimum information:

- Contact information for preparer and implementation of TDP
- Location of point of discharge and construction schedule
- Existing site conditions and proposed construction activities
- Water quantity (if applicable) and discharge volume monitoring plan
- Impacts of temporary dewatering activities to adjacent public places or streams, wetlands, or their buffers
- *Dewatering Suspension Plan* to secure site if both water quality and quantity requirements are not met. The plan requires the City/contractor to focus efforts on CSECP and dewatering treatment for the site. For sites discharging subsurface flows, the City shall require that site operations cease under the plan. All discharges from dewatering treatment systems must meet Washington state water quality

requirements. If temporarily dewatering dredged material, the returned water should be cleaned to the level acceptable by regulation.

- Emergency termination of dewatering discharges if any of the water quality and/or quantity treatment requirements are not being met. Routing flows to the sewer system is a last-resort option that must receive Seattle Public Utilities and King County consent prior to instigation. All reasonable treatment options (as determined by Seattle Public Utilities) must be exhausted before this is allowed.
- Other information deemed necessary to temporary dewatering activities during the review of the TDP and/or during construction.

4.3 Work Area Isolation

CM 31. Follow proper work area isolation measures (Table 4-3)

Table 4-3. Work Area Isolation

	Measure
1	Determine if a cofferdam or other waterproof barrier is necessary and install it in the dry, if possible.
2	If water infiltrates into the work site, either through the barrier or groundwater, and must be removed, pump it to a tank or other method of treatment so that it meets water quality standards before introducing it back into the waterbody.
3	Where work will occur completely within the water or where isolating the work area is not practical, install a silt curtain or similar measure to minimize environmental impacts to the surrounding area.
4	Do not remove deployed silt curtains until turbidity within the work area has returned to background levels.
5	The temporary bypass system must consist of non-erosive techniques, such as a pipe or a plastic-lined channel, both of which must be sized large enough to accommodate the predicted flow rates during construction. For projects that last longer than 1 day, a contingency plan must be developed to address unexpected storm flows. If storm flows occur and the diversion is overtopped, equipment shall be removed and the project stopped. After the flows return to normal, fish bypass and removal shall occur again to remove any fish that entered the construction area during the storm event.
6	Dissipate flow at the outfall of the bypass system to diffuse erosive energy of the flow. Size the dissipater for the volume and velocity of the bypassed flow. Place the outflow in an area that minimizes or prevents damage to riparian vegetation.
7	Except for gravity diversions that have gradual and small outfall drops directly into water, all water intake structures must have a fish screen installed, operated, and maintained in accordance with the NMFS Juvenile Fish Screen Criteria and the NMFS Addendum NMFS Pump Intake Screen Guidelines. If the diversion

	inlet is a gravity diversion and is not screened to allow for downstream passage of fish, place diversion outlet in a location that facilitates gradual and safe reentry of fish into the stream channel.
8	All stream diversion devices, equipment, pipe, and conduits will be removed and disturbed soil will be restored after the diversion is no longer needed.

4.4 Fish Handling

CM 32. Follow proper fish capture and handling measures (Tables 4-4 through 4-6).

Table 4-4. Fish Capture and Handling General Procedures

	Measure
1	Fish capture operations will be conducted by a trained individual experienced in this type of work. Key staff working with fish removal must have the necessary knowledge, skills, and abilities to ensure the safe handling of all aquatic species.
2	The applicant must obtain any other federal, state and local permits and authorizations necessary for the conduct of fish capture activities.
3	Before conducting activities that may involve fish handling, individuals shall ensure that hands are free of sunscreen, lotion, or insect repellent.
4	Fish will be handled with extreme care and kept in water to the extent possible during transfer procedures based on Tables 4-5 and 4-6.
5	If water remains within the work area and fish are potentially present after isolation of the work area and stream diversion, electrofish, seine, and dip net the work area until catch rates reach zero fish for 3 consecutive passes.

Table 4-5. Fish Capture Methods

Method	Required or Optional	Details
Minnow traps	Optional	Traps may be left in place overnight and may be used in conjunction with seining. This method has limited success in areas of flowing water (most streams), but may be beneficial in calm waters.
Seining	Required	Use seine with mesh of such a size to ensure entrapment of residing fish and age classes. This method is difficult (if not impractical) in streams with many obstacles (wood, rock or undercut banks and insufficient area to beach nets to collect fish).
Dip nets	Required	Use in conjunction with other methods as area is dewatered.

Electrofishing	Required	Use electrofishing in addition to other means of fish capture to ensure the effective capture of fish. Applicants shall adhere to NMFS Backpack Electrofishing Guidelines or SPU-approved fish electroshocking methods. If fish are observed spawning during the in-water work period (a condition likely to occur only in an emergency situation because permitted work/timing windows do not allow this), electrofishing shall not contact spawning adult fish or active redds. **NFMS Backpack Electrofishing Guidelines** 1. Only Direct Current (DC) or Pulsed Direct Current (PDC) shall be used. 2. For conductivity <100 μΩ/cm, use voltage ranges from 900 to 1100. For conductivity from 100 to 300 μΩ/cm, use voltage ranges from 500 to 800. For conductivity greater than 300 μΩ/cm, use voltage to 400. 3. Begin electrofishing with minimum pulse width. Gradually increase to the point where fish are immobilized and captured. 4. Do not allow fish to come into contact with anode. Do not electrofish an area for an extended period of time. Upon capture, remove fish immediately from water. 5. Dark bands on the fish indicate injury, suggesting a reduction in voltage and longer recovery time. **SPU Backpack Electrofishing Guidelines Using Smith Root Backpack Electroshocker** 1. Program the unit for automatic setup (instructions are with unit). 2. Find an unobstructed section of water where fish can be observed. 3. Herd any fish out of the area before initiating automatic setup. 4. Initiate automatic setup. Within Seattle urban creeks initial settings often fall within the following ranges: • Hertz = 30 • Duty Cycle = > 10 but < 15 • Volts = > 180 but < 210 5. Before initiating first sweep, drop duty cycle by 2 units and voltage by 30V. Lowering these units will ensure larger fish (which conduct more voltage) will not be harmed. 6. Conduct the first sweep at this level to remove larger fish. Smaller fish will not react at this voltage, but it may herd them from the area. 7. On the second sweep reset to the original units from the automatic setup. This should now begin to bring in the smaller

	fish. If smaller fish are still avoiding the electroshocking device, increase voltage in 10-unit increments until they are drawn in to the electrode. Under normal urban creek conditions in Seattle voltage should be effective below 250V.

Table 4-6. Fish Handling Methods

	Method
1	In areas where ESA-listed fish have been recorded, it is recommended that the transfer of fish be conducted using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.
2	If using MS 222 to anesthetize fish, use the minimal amount required. Only anesthetize a few fish at a time to minimize the time fish are in MS 222 solution. Anesthetized fish must be fully recovered before being released into a stream.
3	Release captured fish as soon as possible.
4	If fish are held, provide a healthy environment for the stressed fish and minimize the holding time. Water-to-water transfers, the use of dark-shaded containers, and supplemental oxygen should all be considered in designing fish handling operations.
5	Provide a healthy environment for the stressed fish by using large buckets (5-gallon minimum) to prevent overcrowding and minimal handling of fish.
6	Place large fish in buckets separate from smaller prey-sized fish.
7	Monitor water temperature in buckets and well-being of captured fish.
8	After fish have recovered, it is recommended they be released upstream from the project area in suitable habitat, such as a pool or area that provides cover and flow refuge. Because this action is site specific, apply these principles. Release fish: • As close to point of capture as possible • Based on the life-history stage. Juvenile fish are released downstream of the site to aid migration out of the system. Adult fish are released upstream to aid migration to spawning or resting locations. • Into best available habitat to reduce or decrease predation and aid recovery. Or release where good habitat exists and fish can reoccupy the work area after the project is completed. • At multiple release points. If a large number of fish are caught, release fish at different areas so that fish are not concentrated at one location.

4.5 Overwater Structure Size

A. Floats, Docks, or Piers

CM 33. Overwater structures such as piers and floats should be no larger (length and width) than needed for the specified function (Table 4-7). Minimize/reduce pier and overall footprint of structure to reduce shading impacts. In the SPIF, give rationale for project-specific pier and float size requirements.

Table 4-7. Typical Seattle Parks and Recreation Marine Structure Size

Structure	Size
Swim docks	20-by-40 ft to 32-by-40 ft
Small craft floats	maximum 70 ft long 16 to 20 ft wide for stability
Boat launch floats	maximum 8 ft wide for stability (Must accommodate 20 users at a time)

CM 34. Minimize/reduce piling number and space piling further apart where possible to reduce shading impacts.

CM 35. To reduce shading impacts, grating shall be installed on fixed structure surfaces during replacement to provide light transmission to the maximum extent practicable and meet the American Disabilities Act (ADA) requirements. If grating cannot be installed in pier/float decking, consider using transparent glass blocks, prisms, or floors to obtain more light under pier.

CM 36. Flotation for floats will be fully contained in a durable protective casing to prevent breakup of the flotation material and its release into the waterway.

CM 37. In marine waters, replacement floats shall be at least 4 feet above marine vegetation (*e.g.*, eelgrass) to avoid creating new shade over marine vegetation.

CM 38. Any floatation material used shall be positioned so that they do not block any grating or other surface light treatment (i.e. prisms, blocks) and associated light transmission through the overwater structure.

CM 39. Place new and replacement piers at least two feet above OHW or MHHW.

CM 40. New or replacement skirting will not be installed.

B. Floating Breakwaters

CM 41. Limit overall size, length and width to minimum necessary for wave attenuation and safe public use/navigation.

CM 42. Logs shall be clean and without bark.

C. Anchoring Buoys, Floats and Floating Breakwaters

CM 43. Ensure that anchor lines do not drag on the substrate or in aquatic vegetation during low water levels. Buoy cables or chains will be kept off of the bottom by

the addition of a second float below the surface at the appropriate length and size to perform during all tidal and wind conditions.

CM 44. Use mechanical anchors (*e.g.*, helical screw) in lieu of concrete anchors unless substrate (*e.g.*, bedrock) prevents installation of screw anchors.

4.6 Piling Installation and Noise Abatement

A. Piling Installation

CM 45. Plastic, concrete, or timber piling is preferred over steel piling.

CM 46. Use a containment boom for sawdust and debris work. If in marine water, a containment boom may rest on substrate rather than float at all times due to tidal action. Remove contained debris to prevent it from entering the waterway at construction completion.

CM 47. If treated piling is fully extracted or cut below the mudline, cap the holes or piling with appropriate materials (*e.g.*, clean sand or steel pile caps for cut piling). This practice ensures that chemicals from existing piling do not leach into the adjacent sediments or water column.

CM 48. Do **not** use piling treated with creosote, pentachloraphenol, or coal tar.

CM 49. Do **not** use hydraulic water jets to remove or place piling.

CM 50. Replace piling in same general location. Do **not** extend beyond footprint of existing structure.

CM 51. All treated wood will be contained on land or barge during and after removal to preclude sediments and any contaminated material from re-entering the aquatic environment.

B. Piling Installation Noise Abatement

CM 52. Use a vibratory hammer to the maximum extent possible for setting piling. Geotechnical engineering can determine if this will be sufficient based on the piling material and load capacity.

CM 53. A bubble curtain or other noise attenuation method (*e.g.*, wood blocks, nylon blocks, *etc.*) shall be used during impact installation or proofing of steel piling. For piling with a 10-inch or smaller diameter, the sound attenuation device must include one of the methods listed above. For piling with a diameter greater than 10 inches the sound attenuation device must include both the placement of a sound block between the hammer and the piling during pile driving **and** use of a bubble curtain.

CM 54. Hydroacoustic monitoring shall be used for driving large (>12-inch-diameter) steel piling.

CM 55. All reasonable measures shall be taken for the suppression of noise resulting from the work operations. All work shall be performed consistent with the applicable noise control levels set forth in SMC Chapter 25.08 and comply with Std Spec 1-07.5(4) Noise Pollution.

CM 56. Projects using either a vibratory or an impact pile driver to install or remove piling in marine/estuarine waters must deploy sound attenuation and have a qualified observer(s) onsite during all pile driving to scan open water within a certain radius around the work area for marine mammals or marbled

murrelets. The radius is based on use of the Practical Spreading Loss model and sound pressure levels from broad band sounds that may cause death, injury, or behavioral disturbance to marine mammals or marbled murrelets. The distance is based on the following thresholds:

- Marine mammals
    - 120 dB_{rms} behavioral threshold for continuous sound (e.g. vibrating)
    - 160 dB_{rms} behavioral threshold for impulse sound threshold (e.g. impact driving)
    - 180 dB_{rms} injury threshold for whales
    - 190 dB_{rms} injury threshold for pinnipeds
- Marbled murrelet
    - 183 dB_{SEL} non-injurious threshold shift
    - 202 dB_{SEL} auditory injury threshold
    - 208 dB_{SEL} barotrauma threshold

Should a marine mammal (e.g. killer whale, humpback whale, or Steller sea lion) or marbled murrelet be observed within this radius, then the observer must immediately notify the pile driver operator and the operator must cease all pile driving activities immediately and only resume pile driving when all marine mammals or marbled murrelets have left the radius around the work area.

While no monitoring is required for impacts to listed fish species, the practical spreading model can be used to determine the distance for injury or behavioral impacts. The distance is based on the following thresholds:

- Chinook salmon, steelhead, bull trout, rock fish
    - 150 dB_{rms} behavioral threshold
    - 183 dB_{SEL} injury threshold for fish $\leq$ 2 g
    - 187 dB_{SEL} injury threshold for fish > 2 g
    - 206 dB_{peak} instantaneous injury threshold

4.7 Shoreline and Aquatic Habitat Protection

A. All Projects/All Structures

CM 57. Perform the work in the dry whenever possible (80-90% of the time).

CM 58. Minimize construction impacts by conducting work during minus tides or low water levels.

CM 59. All fill materials will be of clean, washed, and commercially-obtained material.

CM 60. To avoid entraining fish, an excavated trench exposed to open water between tidal cycles should be sloped or filled with sand and gravel to optimize fish habitat.

CM 61. Equipment and materials are mobilized to and from the site via upland access or construction barge. If the project area is not isolated and dewatered, a silt curtain will be installed.

CM 62. If a construction barge is used, it shall not ground or rest on the substrate at anytime or anchor over vegetated shallows.

CM 63. Take care to prevent spread of invasive plant species during their removal.

CM 64. Plant the project shoreline with native riparian vegetation. City crews and or their contractors will ensure 80% survival of the planted material at one, three, and five years after installation. Riparian planting plans will be submitted along with the project permit application.

CM 65. Require City crews and or their contractors to retrieve any debris generated during construction that has entered the water and sunk to dispose of it at an upland facility.

B. Beach Nourishment/Substrate Addition

CM 66. Beach material will typically be washed gravel whenever possible to minimize the amount of fill eroding into the waterbody. Sands may be applied above the OHW or MHHW depending on the project purpose.

CM 67. Use clean gravel (less than 3% fines by weight [material passing a number 200 sieve per U.S. standard sieve size]) to avoid turbidity during gravel placement.

C. Boat Launch

CM 68. Place appropriate habitat gravel mix as needed. The mix shall meet WDFW Hydraulic Permit Application requirements.

CM 69. No wet concrete or epoxy shall be placed in the wetted perimeter. Concrete and epoxy must be cured before they come into contact with the water.

D. Bulkhead Repair/Replacement

CM 70. Move the bulkhead as far back as possible above the OHW mark or the MHHW level.

CM 71. Construct bulkhead to contain habitat complexity, such as coves, where recreational use allows.

CM 72. Plant new bulkhead with native riparian vegetation where not in direct conflict with recreational use.

E. Riprap Addition

CM 73. When installing riprap, include rootwads and/or large woody debris to increase habitat complexity.

CM 74. Cover all newly placed riprap with habitat mix to fill voids and cover the rock to benefit benthic organisms. In locations where habitat mix will wash away rapidly, it may be deemed unnecessary to install.

4.8 Pesticides

CM 75. Pesticides will be applied only under direct supervision (within line of sight) of a licensed applicator. Only pesticides approved by the City Of Seattle may be used. Contact your departmental integrated pest management (IPM) coordinator for information and guidance on pesticide use.

CM 76. When native plants are being restored to a project site, pesticides can be used to control those weeds listed in the King County Noxious Weed List. Plants that are highly invasive and damaging to native riparian habitats include Himalayan blackberry, clematis, morning glory, and Japanese knotweed. These noxious weeds are highly invasive and are particularly damaging to native plant habitat. Increased effort to reduce and/or eradicate these plants should be exercised.

CM 77. Within the shoreline and riparian zone of all waterbodies, pesticide use within 100 feet of the shoreline is regulated under the City of Seattle Environmental Critical Areas Ordinance. Aquatic and emergent noxious weed control is also regulated by the Washington State Department of Ecology (WDOE). A permit from WDOE is required to control aquatic and emergent weeds with herbicides that are approved by WDOE. Contact your departmental IPM Coordinator for information on how to acquire noxious aquatic and emergent weed control permits.

CM 78. Other chemicals, such as foaming agents used to kill roots growing into utility pipes, will be subject to Tier 1 chemical applications exemptions that will require approval from the the Interdepartmental IPM Committee and the Office of Sustainability and Environment. Contact your departmental IPM Coordinator for more information.