

## **21.0 Glossary and Abbreviations**

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Definitions are provided below for regulatory, administrative, and technical terms used in biological assessments and the ESA Section 7 consultation process, followed by a list of [abbreviations](#) used in this manual.

### 21.1 Glossary

**A-weighting** — A frequency-weighting method in which the sound levels are adjusted to approximate the frequency range of human hearing (commonly shown as dBA for A-weighted decibels).

**Act** — the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

**action** (50 CFR 402.02) — Any activity or program of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas. Examples include but are not limited to actions directly or indirectly causing modifications to the land, water, or air; actions intended to conserve listed species or their habitat; and the promulgation of regulations.

**action agency** — The federal agency proposing to undertake a major construction project (action).

**action area** — All areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The limits of the action area are based upon the geographic extent (in both aquatic and terrestrial environments) of the physical, chemical, and biological effects resulting from the proposed action, including direct and indirect effects, as well as effects of interrelated and interdependent activities.

**affect/effect** — To *affect* (a verb) is to bring about a change (example: The proposed action is likely to adversely affect piping plovers nesting on the shoreline). The *effect* (usually a noun) is the result (example: The proposed highway is likely to have the following effects on the Florida scrub jay). *Affect* appears throughout Endangered Species Act Section 7 regulations and documents in the phrases *may affect* and *likely to adversely affect*. *Effect* appears throughout Section 7 regulations and documents in the phrases *adverse effects*, *beneficial effects*, *effects of the action*, and *no effect*.

**air gun** — A device used in underwater seismic surveys that uses air under pressure to produce loud sound levels.

**ambient sound level** — The sound level which is a composite of sound from all non-anthropomorphic sources near and far.

**anticipated** — in incidental take statements (ITS), USFWS/NMFS determines the amount or extent of incidental take “anticipated” (expected) due to the proposed action or an action modified by reasonable and prudent measures (RPM).

**attenuation** — See *transmission loss*.

**audiogram** — A graphical representation of the frequency range and minimum decibel level capable of being heard by different species in units of sound pressure.

**background noise** — The sound that is present whether or not the sound source being analyzed is in operation. For transportation projects, traffic noise contributes to background noise levels in a project area, and is usually higher than ambient sound levels.

**baseline** — The starting point for analysis; ambient or background conditions from which to measure and compare potentially altered conditions caused by project activities.

**batched biological assessment** — A biological assessment that provides collective coverage for groups of similar types of projects or for projects that take place in a similar geographic location.

**batched biological evaluation** — The term used by U.S. Army Corps of Engineers for informal biological assessment.

**beneficial effects** — Contemporaneous positive effects without any adverse effects on the species or habitat. By definition, beneficial effects cannot be considered to have *no effect*.

**best available scientific and commercial data** — To assure the quality of the biological, ecological, and other information used in the implementation of the Act, it is the policy of the USFWS/NMFS to: (1) evaluate all scientific and other information used to ensure that it is reliable, credible, and represents the best scientific and commercial data available; (2) gather and impartially evaluate biological, ecological, and other information disputing official positions, decisions, and actions proposed or taken by the USFWS/NMFS; (3) document their evaluation of comprehensive, technical information regarding the status and habitat requirements for a species throughout its range, whether it supports or does not support a position being proposed as an official agency position; (4) use primary and original sources of information as the basis for recommendations; (5) retain these sources referenced in the official document as part of the administrative record supporting the action; (6) collect, evaluate, and complete all reviews of biological, ecological, and other relevant information within the schedules established by the Act, appropriate regulations, and applicable policies; and (7) require management-level review of documents developed and drafted by Service biologists to verify and assure the quality of the science used to establish official decisions, and actions taken by the USFWS/NMFS during implementation of the Act (59 FR 34271).

**best management practices (BMPs)** — Methods, facilities, built elements, and techniques implemented or installed during project construction to reduce short- and long-term project

impacts on listed and sensitive species and habitat. These measures are included as part of the federal agency’s proposed action. They are not recommendations or suggestions.

**biodiversity** — the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

**biofiltration** — The process of filtering water through biological materials, such as vegetation.

**bioinfiltration** — The process of infiltrating water through biological materials, such as vegetation.

**biological assessment (BA)** — The information prepared by or under the direction of an action agency to determine whether a proposed action (major construction activity) is likely to affect listed and proposed species and designated and proposed critical habitat that may be present in the project action area, including the evaluation of potential effects of the action on such species and habitat. The outcome of the biological assessment (BA) determines whether formal consultation or a conference is necessary.

**biological opinion (BO or BiOp)** — The document prepared by the U.S. Fish and Wildlife Service or National Marine Fisheries Service that states the opinion of the Service as to whether a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

**bioretention** — The process of temporarily retaining water in a natural terrestrial community of plants, microbes, and soil.

**candidate species** — A species for which the Service has on file sufficient information on biological vulnerability and threats to support a proposal to list it as threatened or endangered. Until a proposed rule is issued to list a candidate species, authors of biological assessments are not required to address the species, although it is recommended.

**coalescing plates** — A device with parallel plates to separate oil from water by means of gravity.

**community noise level** — See *environmental noise level*.

**compost** — Organic residue, or a mixture of organic residues and soil, that has undergone biological decomposition until it has become relatively stable humus.

**concurrence** — requested written agreement of the USFWS/NMFS of the action agency’s determination of effects for “*not likely to adversely affect (NLAA)*” or “*beneficial, not likely to adversely affect (B-NLAA)*” determinations of a proposed action or program on listed species and/or their habitat. Written concurrence is requested by the action agency from USFWS/NMFS in which the BA determines either NLAA or B-NLAA determinations.

**conference** — A process of early interagency cooperation involving discussions between an action agency and the Services pursuant to Section 7(a)(4) of the Endangered Species Act regarding the likely impact of the agency’s proposed action on proposed species or critical habitat. Conferences are intended to help identify and resolve potential conflicts between an action and species conservation early in project planning, and to develop recommendations to minimize or avoid adverse effects (50 CFR 402.02, 50 CFR 402.10).

**conservation measure (CM)** — Actions to benefit or promote the recovery of listed species that are included by the federal agency as an integral part of the proposed action. These actions will be taken by the federal agency or applicant, and serve to minimize or compensate for the effects of the action on the species under review. These may include actions taken prior to the initiation of consultation, or actions which the federal agency or applicant have committed to complete in a BA or similar document.

**conservation recommendations** – Conservation recommendations are discretionary agency activities described in a USFWS or NMFS biological opinion that minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

**conservation recommendations (Essential Fish Habitat)** – EFH conservation recommendations are advisory and non-binding to the federal action agency. The federal agency is required to provide a written response to NMFS within 30 days describing the measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response from a federal agency that is inconsistent with NMFS recommendations, the federal agency must explain in writing its reasons for not following the recommendations.

**constituent elements** — see physical and biological features.

**consultation** — The process required of a federal agency under section 7(a)(2) of the ESA when any activity authorized, carried out, or conducted by that agency may affect a listed species or designated critical habitat; consultation is with the USFWS/NMFS.

**critical habitat** — Specific geographical areas that possess physical or biological features that are essential to the conservation of listed species. These designated areas may require special management consideration or protection.

**critical ratio** -- The difference, in dB, between a hearing threshold and a masking noise.

**cumulative effects** — The effects of other, future state or private actions that are reasonably certain to occur within the federal project action area (50 CFR 402.02). (This definition of cumulative effects is different from the one provided under NEPA.)

**cylindrical spreading** — The spreading (of sound) in a cylindrical or tubular form from the source.

**decibel** (dB) — A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 micro pascal ( $\mu\text{Pa}$ ) and air is 20 micro pascals (the threshold of healthy human audibility).

**delayed consequences** - Effects caused by the proposed action later in time but still reasonably certain to occur. Formerly referred to as indirect effects.

**delayed mortality** — When a fish dies more than 1 hour and less than 48 hours after removal from the fish cage.

**delayed mortality zone** — The radius around a pile being driven where the peak sound pressure level and impulse are not great enough to result in immediate death, but result in mortality several hours to several days later.

**delist** — To remove an animal or plant species from the USFWS/NMFS' official list of Threatened and Endangered wildlife and/or plant species.

**detention** — The temporary storage of runoff, which is released at a slower rate than it was collected. Detention facilities are most commonly used for flow control.

**direct effects** — Impacts resulting from the proposed action.

**discountable effects** — Potential effects of a proposed action that are extremely unlikely to occur. Based on best judgment, a person would not expect discountable effects to occur.

**distinct population segment** (DPS) — A designation used by the U.S. Fish and Wildlife Service for a discrete vertebrate stock that is treated as an individual species (e.g., a specified seasonal fish run in a particular river). This is equivalent to the NMFS evolutionarily significant unit (ESU) classification.

**drywell** — A well completed above the water table so that its bottom and sides are typically dry except when receiving fluids. Drywells are designed to disperse water below the land surface and are commonly used for stormwater management in eastern Washington.

**ecology embankment** — A stormwater treatment facility constructed in the pervious shoulder area of a highway, consisting of a vegetation-covered French drain containing filter media.

**effect/affect** — See *affect/effect*.

**effects of the action** — The direct and indirect effects of a federal action on listed species or critical habitat, together with the effects of other interrelated and interdependent activities. Direct effects are those resulting from the proposed action. Indirect effects are those caused by the proposed action later in time, but still reasonably certain to occur. Interrelated actions are part of

a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

***endangered species*** — A species that is in danger of extinction throughout all or a significant portion of its range.

***environmental noise level*** — The normal or existing level of environmental sound at a given location, in the absence of traffic.

***evolutionarily significant unit*** (ESU) — A designation used by NMFS for certain local salmon populations or runs that are treated as individual species. This is equivalent to the U.S. Fish and Wildlife Service distinct population segment (DPS) classification.

***federal action agency*** — The federal agency that proposes a specific action or triggers a federal nexus for a project (by providing permits, funding, etc.). This agency is responsible for formally submitting a biological assessment for the proposed action to the Services for review and informal or formal consultation.

***federal nexus*** — A project with a federal nexus either has federal funding, requires federal permits, or takes place on federal lands.

***filter strip*** — A grassy area with gentle slopes that treats stormwater runoff from adjacent paved areas before it can concentrate into a discrete channel.

***formal consultation*** — The process between the Services and the action agency that commences with the action agency's written request for consultation under Section 7(a)(2) of the Endangered Species Act (ESA) and concludes with the Service's issuance of a biological opinion under Section 7(b)(3) of the ESA.

***frequency*** — The number of times per second that the sine wave of sound repeats itself, or that the sine wave of a vibrating object repeats itself. Now expressed in hertz (Hz), formerly in cycles per second (cps).

***frequency spectrum*** — Distribution of sound pressure versus frequency for a waveform, dimension in root mean square (RMS) pressure and defined frequency bandwidth.

***gas bladder*** — An air-filled sac located between the alimentary canal and the kidneys. It is filled with CO<sub>2</sub>, O<sub>2</sub> and N<sub>2</sub> in different proportions than found in air, also called the swim bladder. It is functionally a hydrostatic organ to help control buoyancy, but also plays an important role in sound reception in some species of fish.

***hair cells*** — Cells within the inner ear of most vertebrates that contain ciliary bundles that respond to sound pressure and create the sensation of hearing.

**harass** (50 CFR Part 17) — An intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying to such an extent as to significantly disrupt normal behavior patterns, which include but are not limited to breeding, feeding, and sheltering.

**hard site conditions** — Areas where there is no excess ground-effect noise attenuation, such as asphalt, concrete, hard-packed soils, and water surfaces.

**harm** (50 CFR Part 17) — In the definition of *take* in the Endangered Species Act. Harm is defined by the USFWS to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, and sheltering (50 CFR 17.3). NMFS' definition of harm includes significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, spawning, migrating, rearing, and sheltering (64 FR 60727, November 8, 1999).

**hertz (Hz)** — Frequency or cycles per second; the number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz, and ultrasonic sounds are above 20,000 Hz.

**hydrophone** — An underwater microphone.

**impervious surface** — A hard surface area that either prevents or retards the entry of water into the soil and from which water runs off at an increased rate of flow.

**impulse** — The time integral of the peak pressure, typically described in units of pounds per square inch per millisecond (psi/msec). It recognizes that a short pulse may do less damage than a longer duration pulse of the same pressure. Sound pressure is equivalent to kilowatts, while impulse is equivalent to kilowatt-hours.

**incidental take** — A *take* of listed species that results from an action but is not the direct purpose or intent of the action, as defined under the Endangered Species Act. Incidental *take* can be authorized through Section 7 consultation or through Section 10 conservation planning, such as a habitat conservation plan (HCP).

**incidental take statement (ITS)** — When a proposed federal action is found to be consistent with section 7(a)(2) of the ESA and that action may incidentally take individuals of listed species, USFWS/NMFS will issue an incidental take statement specifying the impact of any incidental taking of endangered or threatened species.

**indirect effects** — See delayed consequences. Effects caused by the proposed action later in time but still reasonably certain to occur.

**infiltration** — The downward movement of water from the surface to the subsoil.

**infiltration pond** — A facility that contains excess runoff then percolates that runoff into the surrounding soil.

**informal consultation** — There may be two types: 1) an optional process that includes all discussions and correspondence between the Service and the action agency or designated nonfederal representative prior to formal consultation (if determined to be necessary), or 2) the process initiated either to notify the Services of a no-effect determination, or to secure concurrence from the Services for a project that may affect but is not likely to adversely affect listed species or critical habitat.

**insignificant effects** — Effects that should never reach the scale where *take* occurs. Based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.

**interdependent action** — An action having no independent utility apart from the proposed action.

**interrelated action** — An action that is part of a larger action and depends on the larger action for its justification.

**is likely to jeopardize the continued existence of a proposed species or adversely modify proposed critical habitat** — When the action agency or the Services identify conditions where the proposed action has this result, a conference is required.

**jeopardize the continued existence of** — To engage in an action that reasonably would be expected to directly or indirectly reduce the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

**jeopardy** (50 CFR 402.02) — Classification given to an action that reasonably would be expected to directly or indirectly reduce the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

**kilojoule** (kJ) — The basic unit of force moving a body a unit distance in the metric system is 1 newton-meter or 1 joule. One joule is 0.7376 foot-pounds. A thousand joules (or 1 kilojoule) is represented as kJ.

**lagena** — One of three symmetrically paired structures in the inner ear of fishes associated with the bony otolith. In most species, the lagena detects acoustic pressure and acoustical particle motion.

**Leq** — The Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.

**likely to adversely affect** — The appropriate finding in a biological assessment (or conclusion during informal consultation) when effects on listed species are expected to be adverse and not: discountable, insignificant, or completely beneficial.

**line source of noise** — A source of noise spread out into a line, such as the combined traffic on a roadway.

**listed species** — Any species of wildlife, fish, or plant that has been listed as endangered or threatened under Section 4 of the Endangered Species Act. Listed species are found in 50 CFR 17.11–17.12. Under the statute, the two types of species are treated in virtually the same way.

**L<sub>max</sub>** — The maximum sound level, in decibels, that occurs during a single event.

**major construction activity** — A construction project (or other undertaking having similar physical effects) that is a major federal action significantly affecting the quality of the human environment, as referred to in the National Environmental Policy Act (NEPA, 42 USC 4332 (2)(c)).

**masking** -- Interference with the detection of one sound by another (Dooling and Therrien 2012).

**may affect, likely to adversely affect** — The appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect on listed species may directly or indirectly result from the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but is also likely to cause some adverse effects, then the proposed action is *likely to adversely affect* the listed species. If incidental *take* is anticipated to result from the proposed action, a determination of *likely to adversely affect* should be made, requiring initiation of formal Section 7 consultation.

**may affect, not likely to adversely affect** — The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial.

**mean lower low water** — Zero tidal elevation. Minus tides are below MLLW.

**media filter** — A filter that includes one of multiple media for removing pollutants such as compost, gypsum, perlite, zeolite, or activated carbon.

**micro pascal** (μPa) — Most underwater acoustic sound pressure measurements are stated in terms of a pressure relative to 1 micro pascal.

**millisecond** (msec) — One-thousandth of a second.

**minimization measure** — Measures that reduce the impact of the project on listed species. Minimization measures are considered part of the proposed action that will be implemented, and are presented in the project description section of the biological assessment. They are not recommendations or suggestions,

**mortality** (fish) — Cessation of all activity including movements of the operculum, or when all respiration stops and the fish lies motionless.

**National Pollutant Discharge Elimination System (NPDES)** — The provision in the federal Clean Water Act that requires point source dischargers of pollutants to obtain permits, called NPDES permits. In Washington state, NPDES permits are administered by the Department of Ecology.

**no effect** — The appropriate conclusion when the proposed action will not affect a listed species or its critical habitat (i.e., will have no effect whatsoever—neither beneficial effects, nor highly improbable effects, nor insignificant effects).

**not likely to adversely affect** — The appropriate finding in a biological assessment (or conclusion during informal consultation) when effects on listed species are expected to be discountable, insignificant, or completely beneficial.

**occupied critical habitat** — Critical habitat that contains individuals of the species at the time of the project analysis. A species does not have to occupy critical habitat throughout the year for the habitat to be considered occupied (e.g., migratory birds). Subsequent events affecting the species may result in this habitat becoming unoccupied.

**outfall** — The point of water discharge from a stormwater facility.

**overpressure** — A positive pressure above ambient levels.

**pascal (Pa)** — A unit of pressure equal to 1 newton per square meter.

**peak (sound)** — The absolute peak sound level measured during an event.

**peak sound pressure (unweighted), dB re 1  $\mu$ Pa** — The peak sound pressure level based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed here as a decibel (referenced to a pressure of 1  $\mu$ Pa) but can also be expressed in units of pressure, such as  $\mu$ Pa or PSI.

**performance-based biological assessment** — A type of biological assessment usually written early in the design phase of a project. Because detailed information on the project description and design is lacking at that stage, they establish habitat and species safeguards by defining actions that will not be included in the project or impacts that will be avoided.

**performance measure** — An observable or measurable benchmark for a particular performance objective against which a project can be compared. If the standards are met, the related performance objectives are considered to have been fully achieved. It is something quantifiable. Standards should be measures, not actions, and should be: 1) achievable, and 2) capable of being monitored.

**permanent threshold shift (PTS)** — A permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level. The amount of permanent threshold shift is customarily expressed in decibels (ANSI 1995; Yost 2007). Available data from humans and other terrestrial mammals

indicate that a 40 dB threshold shift approximates PTS onset (see Ward et al. 1958, 1959; Ward 1960; Kryter et al. 1966; Miller 1974; Ahroon et al. 1996; Henderson et al. 2008).

***physical and biological features*** – Habitat features within designated critical habitat that a listed species needs for life processes and successful reproduction. These features include: 1) space for individual and population growth and for normal behavior; 2) cover or shelter; 3) food, water, air, light, minerals, or other nutritional or physiological requirements; 4) sites for breeding and rearing offspring, germination, or seed dispersal; and 5) habitats that are protected from disturbances or are representative of the historical geographical and ecological distribution of the species. Replaced the term “primary constituent elements”.

***physoclistous fish species*** — See *physostomous*.

***physostomous fish species*** — A species in which the swim bladder is connected to the esophagus by a thin tube. Air to fill the swim bladder is swallowed by the fish and directed to the swim bladder. Air removal from the swim bladder is by expulsion through this tube to the esophagus. Physoclistous fishes have no such connection. Instead, they add gas to the swim bladder using a highly specialized gas secreting system called the rete mirabile, which lies in the wall of the swim bladder and extracts gas from the blood using a counter-current system, much like that found in the kidney to remove wastes from the blood. Removal of gas from the swim bladder occurs by reabsorption into the blood.

***pile-driving time*** — The number of minutes to drive a second section pile to its predetermined elevation.

***piscivorous animal*** — A fish-eating animal.

***point source noise*** — A noise whose source is more or less concentrated at a single point, such as construction noise or a single vehicle heard from a distance.

***predation*** — The act of preying on another animal.

***primary constituent elements*** – see physical and biological features.

***programmatic biological assessment*** — A biological assessment that establishes conditions allowing specific activities that occur within general programs to proceed without individual concurrence from the Service (or allowing a shortened concurrence timeline).

***programmatic biological evaluation*** — Term used by U.S. Army Corps of Engineers for an informal programmatic biological assessment.

***propagation loss*** — The decrease in sound pressure level due to the spherical spreading of the sound wave. In the far field, the rate of decrease in the sound pressure level is proportional to the distance, or  $1/r$ . In an unbounded, homogeneous medium, propagation loss is on the order of 6 dB for every doubling of the distance.

**proposed critical habitat** — Habitat proposed and published in the Federal Register to be designated as critical habitat, or habitat proposed to be added to an existing critical habitat designation, under section 4 of the Act for any listed or proposed species. The appropriate finding in a biological assessment (or conclusion during informal consultation) when effects on listed species are expected to be discountable, insignificant, or completely beneficial.

**proposed species** — Any species of wildlife, fish, or plant that is proposed in the Federal Register to be listed under Section 4 of the ESA as threatened or endangered.

**range** (of a species) — The area or region over which an organism occurs.

**rate** — Percentage probability of an effect.

**reasonable and prudent measures** — Actions that the Services believe are necessary and appropriate to minimize the impacts (amount or extent) of incidental *take*. These measures are communicated to an action agency in a biological opinion issued by the Service.

**received level** (RL) -- the sound level at the receiver of interest.

**receiving water** — A body of water or a surface water system to which surface runoff is discharged.

**receptor** (noise) — The object or perceiver that receives or responds to a sound.

**recovery** — Action that is necessary to reduce or resolve the threats that caused a species to be listed as threatened or endangered.

**recovery unit** — Management subsets of the listed species that are created to establish recovery goals or carry out management actions. To lessen confusion in the context of section 7 and other ESA activities, a subset of an animal or plant species that needs to be identified for recovery or management purposes will be called a “recovery unit” instead of a “population”.

**retention** — The permanent collection and holding of stormwater runoff. Retention facilities are most commonly used for pollutant removal.

**rise time** — The time interval a signal takes to rise from 10 percent to 90 percent of its highest peak.

**RMS impulse** (root mean square) — Root square of the energy divided by the duration. It is the mean square pressure level of the pulse of sound from a strike of the hammer on a pile. It is described as the average pulse pressure and accepted as the reaction threshold for whales to seismic signals. RMS impulse is expressed in dB re 1 micro pascal. It is the unweighted root mean square sound level (20 Hz to 20 kHz) in dB re 1  $\mu$ Pa averaged over the duration of an impulse of sound.

**root mean square (RMS)** — The average of the squared pressures over the time that comprise that portion of the waveform containing 90 percent of the sound energy for one pile-driving impulse, commonly used in repetitive or relatively continuous measurements such as in speech or highway noise. It is not applicable to transient signals such as explosions. It is used in calculating longer-duration sound pulses such as a pile-driving pulse of sound.

**sacculus** — One of three symmetrically paired structures in the inner ear of fishes associated with the bony otolith. In most species the sacculus detects acoustic pressure and acoustical particle motion. This is where the hair cells are located.

**sand filter** — A manmade depression or basin with a layer of sand that treats (removes pollutants from) stormwater as it percolates through the sand and is discharged via a central collector pipe.

**the Services** — Abbreviated term for the U.S. Fish and Wildlife Service and National Marine Fisheries Service.

**soft site conditions** — Areas such as normal earth or ground with vegetation that are absorptive to sound energy, thereby providing ground-effect attenuation.

**sound exposure level (SEL)** — A common unit of sound energy used in airborne acoustics to describe short-duration events. The time integral of frequency-weighted squared instantaneous sound pressures. It is proportionally equivalent to the time integral of the pressure squared and can be described in terms of  $\mu\text{ Pa}^2\text{ sec}$  over the duration of the impulse. (Source: Fisheries and Hydroacoustic Monitoring Program Compliance Report, San Francisco-Oakland Bay Bridge East Span Seismic Safety Project 6-11.)

**sound flanking** — Noise that reaches an observer by paths around or over an acoustical barrier such as a bubble curtain.

**sound intensity** — The rate at which sound energy flows through a unit area.

**sound pressure level (SPL)** — Sound pressure is the sound force per unit area, usually expressed in micro pascals (or 20 micro newtons per square meter), where 1 pascal is the pressure resulting from a force of 1 newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure (e.g., 20 micro pascals).  $SPL = 20 \log \left\{ \frac{P}{\mu 1} \right\}$ . Sound pressure level is the quantity that is directly measured by a sound level meter.

**source (noise)** — A general term designating the prime sound energy generator.

**species** — Includes any subspecies of fish, wildlife, or plant, or any distinct population segment of any species of vertebrate fish or wildlife, which interbreeds when mature.

**species of concern** — A species, usually thought to be in decline, that may be considered for federal candidate status in the future.

**spectrum level** (SL) -- The amount of sound energy at a particular frequency, in dB.

**spherical spreading** — Spreading of sound pressure in a dome or sphere shape from the source.

**suitable habitat** — The area where an organism, including a plant, animal or fish, naturally or normally lives and grows.

**swale** — A natural depression or shallow drainage conveyance with relatively gentle side slopes, generally less than 1 foot, used to temporarily store, route, or filter runoff.

**swim bladder** — See *gas bladder*.

**take (taking)** — To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (as defined under the Endangered Species Act 16 U.S.C. 1532(19)). USFWS and NMFS have expanded their definitions of harm (see definition for harm above).

**terms and conditions** – Terms and conditions are non-discretionary, reasonable and prudent measures required by the USFWS or NMFS, and described in a biological opinion. Terms and conditions must be implemented by the action agency in order to be exempt from the prohibitions of section 9 of the Endangered Species Act.

**threatened species** — Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**threshold discharge area** — An on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within 1/4-mile downstream (as determined by the shortest flow path).

**threshold shift** (TS) -- Temporary or permanent changes in auditory sensitivity as a result of exposure to noise (Saunders and Dooling 1974, p. 1962).

**time expended** — A field operation term indicating the time to bring up a cage, unload the fish, put a new group in, and drop the cage back to depth.

**total acoustic energy** (dB re 1  $\mu\text{Pa}^2$  sec) — Proportionally equivalent to the time integral of the pressure squared, described here in terms of  $\mu\text{Pa}^2$  sec over the duration of the impulse. Similar to the unweighted sound exposure level (SEL) standardized in airborne acoustics to study noise from single events.

**transducer** — A device used to convert underwater sound into electrical voltage.

**transect** — A marked or measured line or strip at a project site along which environmental samples are collected.

**transmission loss** — The accumulated decrease in acoustic intensity as the acoustic pressure wave propagates outward from the source due to spreading.

**trench** — A long cut in the ground, i.e., a ditch or swale.

**trend line** — In technical analysis, a line or two parallel lines that indicate the direction in which a measurable effect is moving, and the direction in which it will continue to move.

**typical pile driving project** -- Installation of 24”-36” diameter steel piles with a vibratory hammer and impact proofing to determine load-bearing capacity with a two-hour dawn and dusk timing restriction (to avoid impacts to peak murrelet foraging periods).

**underpressure** — Negative pressure spike below ambient levels.

**unoccupied critical habitat** — Critical habitat that is not occupied (i.e., not permanently or seasonally occupied) by the listed species at the time of the project analysis. The habitat may be suitable, but the species has been extirpated from this portion of its range. Conversely, critical habitat may have been designated in areas unsuitable for the species, but restorable to suitability with proper management, if the area is necessary to either stabilize the population or assure eventual recovery of a listed species. As recovery proceeds, this formerly unoccupied habitat may become occupied. Some designated, unoccupied habitat may never be occupied by the species, but was designated since it is essential for conserving the species because it maintains factors constituting the species’ habitat. For example, critical habitat may be designated for an upstream area maintaining the hydrology of the species’ habitat downstream.

**utricle** — One of three paired structures in the inner ear of fishes associated with the bony otolith. In most species the utricle is involved in sound detection.

**vault** — An underground storage facility that collects runoff and either percolates that runoff into the surrounding soil at various rates or permanently pools the runoff.

**warranted but precluded** — a 12-month petition finding by the USFWS (or NMFS) that a petitioned action should be undertaken, but cannot because the resources necessary to do so are being devoted to actions with higher priority.

**waveforms** ( $\mu\text{Pa}$  over time) — A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of  $\mu\text{Pa}$  over time (i.e., seconds).

**wavelength** — The distance between successive peaks or nodes of a wave.

**wet pond** — A facility that contains a permanent pool of water and removes pollutants from highway runoff through sedimentation, biological uptake, and plant filtration.

**wet vault** — An underground storage facility that permanently pools water and acts as a settling basin for fine sediment bound with pollutants.

**zone of influence (ZOI)** ---- ZOI is based on an outward radial distance from the noise source, extending to the limit of a particular threshold level in a 360-degree area. Thus, there are separate

ZOIs for mortality, injury, and harassment. The term is typically used in MMPA Incidental Harassment Authorizations.

## **21.2 Abbreviations**

ABC	air bubble curtain
ACP	asphalt concrete pavement
AKART	all known, available, and reasonable methods of prevention, control, and treatment
BA	biological assessment
BE	biological evaluation
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
BO	biological opinion
CCA	chromated copper arsenate
CE	categorical exclusion
CFR	Code of Federal Regulations
CM	conservation measure
Corps	U.S. Army Corps of Engineers
CR	critical ratio
CWA	Clean Water Act
dba	A-weighted decibel
dbh	diameter at breast height (of a tree)
DPS	distinct population segment
EA	environmental assessment
ECA	equivalent clear-cut area
Ecology	Washington Department of Ecology
ECS	environmental classification summary
EFH	essential fish habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

ESU	evolutionarily significant unit
FEMAT	Forest Ecosystem Management Assessment Team Report (same as NFP)
FHWA	Federal Highway Administration
FMP	fishery management plan
FONSI	finding of no significant impact
FR	Federal Register
GMA	Washington Growth Management Act
HCP	habitat conservation plan
HOV	high-occupancy vehicle
HPA	hydraulic project approval
HRM	WSDOT <i>Highway Runoff Manual</i>
HRM/ESA checklist	<i>Highway Runoff Manual</i> /Endangered Species Act checklist
HUC	hydrologic unit code
Hz	hertz
IL	(WSDOT) Instructional Letter
ITS	intelligent transportation systems
kJ	kilojoule
LTAA	likely to adversely affect
LSOG	late-stage old growth
LWM	large woody material
μPa	micro pascal
MLLW	mean lower low water
MM	minimization measure
MMPA	Marine Mammal Protection Act
MP	milepost
msec	millisecond
NE	no effect
NEPA	National Environmental Policy Act
NFP	Northwest Forest Plan (same as FEMAT)
NIS	new impervious surface

NLTAA	not likely to adversely affect
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service (same as NMFS)
NPDES	National Pollutant Discharge Elimination System
NRF	Spotted owl Nesting, Roosting, Foraging habitat
OHWM	ordinary high water mark
Pa	pascal
PBA	programmatic biological assessment
PBE	programmatic biological evaluation
PBF	physical and biological features (replaces PCE)
PCE	primary constituent element
PFMC	Pacific Fishery Management Council
PHS	priority habitats and species
PM	performance measure
psi	pounds per square inch
RL	received level
RM	river mile
RMS	root mean square
ROD	record of decision
RPA	reasonable and prudent alternative
RPM	reasonable and prudent measure
SEPA	Washington State Environmental Policy Act
SEL	sound exposure level
SL	spectrum level
SPL	sound pressure level
SSP	stormwater site plan
T&E	threatened and endangered species (may also imply any status down to and including species of concern)
TESC	temporary erosion and sedimentation control
TL	transmission loss (sound)

TMDL	total maximum daily load
TS	threshold shift
TSS	total suspended solids
UIC	underground injection control
USC	United States Code
U.S. COE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WCC	Washington Conservation Commission
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WRIA	water resource inventory area
WSDOT	Washington State Department of Transportation