

APPENDIX 2A

SUMMARY OF WDFW REGULATORY REQUIREMENTS FOR STREAM CROSSINGS (version October 23, 2017)

[Hydraulic Code](#) - Construction Projects in State Waters (RCW 77.55)

Washington State law (RCW 77.57) grants Washington Department of Fish and Wildlife (WDFW) authority to regulate the construction of water crossing structures along with other activities that use, obstruct, divert, or change the natural flow or bed of Waters of the State. SPU is required to obtain a Hydraulic Project Approval (HPA) from WDFW for any such work. Typically, but not exclusively, such work would be located below the Ordinary High Water Marks of such Waters and include activities such as bank restoration, installing new or retrofit culverts, and installing new or retrofit outfalls.

[Hydraulic Code Rules –WAC 220-660](#) - In all cases, applicants for the HPA must demonstrate compliance with the State of Washington's Hydraulic Code (Chapter 220-660 WAC), which includes a section on water crossing structures:

- Water Crossing Structures [WAC 220-660-190](#) . This is further supported by WDFW's [Water Crossing Design Guidelines](#) (May 9, 2013).

Excerpts from Water Crossing Structures WAC (full text at end of document)

1. For non-fish bearing creek culverts or bridges
Crossings on non-fish bearing streams must be designed to pass wood and sediment expected in the stream reach to reduce the risk of catastrophic failure of the crossing.
2. For fish-bearing creek streams
 - a. General Requirements
A person must design water crossing structures in fish-bearing streams to allow fish to move freely through them at all flows when fish are expected to move. All water crossings must retain upstream and downstream connection in order to maintain expected channel processes. These processes include the movement and distribution of wood and sediment and shifting channel patterns.

The water crossing design must provide unimpeded passage for all species of adult and juvenile fishes. Passage is assumed when there are no barriers due to behavioral impediments, excessive water slope, drop or velocity, shallow flow, lack of surface flow, uncharacteristically coarse bed material, and other related conditions.
 - b. For Bridges
The bridge must pass water, ice, large wood and associated woody material, and sediment likely to move under the bridge during the 100-year flood flows or the design flood flow approved by the department

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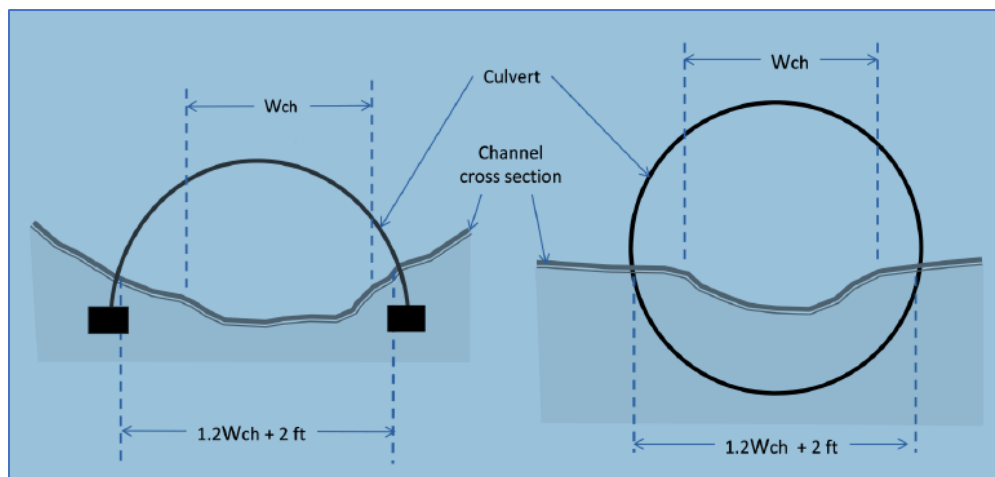
and

The bridge must have at least three feet of clearance between the bottom of the bridge structure and the water surface at the 100-year peak flow.

- c. For Culverts - WDFW endorses two methods for sizing water crossing culverts which are described in WDFW's Water Crossing Design Guidelines.
- No-slope - The no-slope culvert is intended to be installed at 0% slope in small, low gradient streams (< 10 ft bankfull width, < 3% slope). No-slope culverts are countersunk to a minimum depth of 20% of the culvert height and the width of the no-slope culvert at the streambed elevation is at least bankfull width.
 - Stream Simulation – This method is preferred and is the method required by the U.S. Army Corps of Engineers when salmon are present or potentially present. This method is assumed to provide flow and debris conveyance for the 100-year storm event in most situations, but the culvert sizing requirements are defined by stream characteristics not storm event. If a culvert is in a narrowly confined channel, likely to transport large woody material, or downstream of high run-off areas (e.g., urban areas), then the designer should assess the potential impacts of 100-year flood events. **Note prior to November 2014, WAC 220-110-070(3)(d) required culverts to be able to maintain structural integrity during 100-flood flows, but this is no longer a requirement under law. However, the prudent engineer checks to see whether there is adequate clearance for the 100-year flood flow.**

WDFW's Stream Crossing Guidelines have details on this approach (and the no-slope method). Stream simulation is appropriate for moderately confined channels with bankfull width less than 15ft (streams > 15 ft wide bridge is recommended). The intent of this method is to simulate natural stream conditions in a culvert.

Culverts are sized to be $1.2 \times \text{bankfull width} + 2 \text{ ft}$ wide at the streambed and countersunk 30 to 50%. This method is also assumed to provide adequate conveyance for the 100-year peak flow, and therefore, potential impacts of 100-year flood events are typically not an important design consideration.



WAC 220-660-190

Water crossing structures.

Appropriate methods to design water crossing structures are available in the department's *Water Crossing Design Guidelines*, or other published manuals and guidelines. A list of approved manuals and guidelines is on the department's web site.

This section applies only to water crossings over fish-bearing waters. Crossings on nonfish bearing streams must be designed to pass wood and sediment expected in the stream reach to reduce the risk of catastrophic failure of the crossing. Water crossing structures on nonfish bearing streams in the forest environment that are designed to pass the 100-year flood flow and debris likely to be encountered meet this standard.

An HPA is required for all construction or repair/replacement of any structure that crosses a stream, river, or other water body regardless of the location of the proposed work relative to the OHWL of state waters. An HPA is also required for bridge painting and other maintenance where there is potential for paint, sandblasting material, sediments, or bridge parts to fall into the water. An HPA is not required for utility crossings attached to bridge structures.

(1) **Description:** Water crossings are structures constructed to facilitate the movement of people, animals, or materials across or over rivers and other water bodies. These structures include bridges, culverts, fords, and conduits. This section covers bridges, culverts, and fords; WAC [220-660-270](#) covers conduits. Generally, people use bridges to cross over larger streams and rivers, or over unstable channels; they use culverts to cross over smaller streams and they use fords when other stream crossing options would result in a greater impact to fish life and the habitat that supports fish life.

(2) Fish life concerns:

(a) A person must design water crossing structures in fish-bearing streams to allow fish to move freely through them at all flows when fish are expected to move. All water crossings must retain upstream and downstream connection in order to maintain expected channel processes. These processes include the movement and distribution of wood and sediment and shifting channel patterns. Water crossings that are too small in relation to the stream can block or alter these processes, although some encroachment of the flood plain and channel migration zone will be approved when it can be shown that such encroachment has minimal impacts to fish life and habitat that supports fish life.

(b) Fords have a high potential to generate and deliver sediment and may impede fish passage. However, under limited circumstances, fords are appropriate when they provide better protection to fish life and habitat that supports fish life than other water crossing structures.

(3) Permanent water crossing structures – Generally:

(a) The water crossing design must provide unimpeded passage for all species of adult and juvenile fishes. Passage is assumed when there are no barriers due to behavioral impediments, excessive water slope, drop or velocity, shallow flow, lack of surface flow, uncharacteristically coarse bed material, and other related conditions.

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(b) The design of the water crossing structure must follow mitigation sequencing to prevent measurable unmitigated impacts to the expected channel functions and processes found at the site. The department will make an exception where there are human-made features in the flood plain that are outside the control of the applicant and they are unlikely to be removed. By complying with the provisions under subsections (4) and (6) of this section, the applicant is assumed to provide these processes and functions.

(c) If channelization, encroachment, or other human-made changes have degraded the channel in the vicinity of the crossing, the design must have a similar slope and cross section expected under common conditions in the reach.

(i) Similar slope: The slope should be that of a stable channel that would fit within the geomorphic context of the reach.

(ii) Similar cross section: The cross section under or within the water crossing must have a channel bed width, a thalweg, and any overbank area that match the expected stream measurements in order to limit main channel velocity and scour to prevailing conditions.

(d) A person may propose one of the following alternative crossing design methods instead of complying with the provisions under subsections (4) and (6) of this section:

(i) A person can design a water crossing using any design methodology approved by the department if the method specifically addresses fish passage, the protection of the habitat that supports fish life, and the maintenance of expected channel processes defined by the site conditions.

(ii) A **person may use an alternative design for an individual crossing on a case-by-case basis.** To be approved, the alternative plan must include: Project objectives with performance measures, inspection schedule, maintenance triggers, and a contingency plan should the project fail to meet performance measures. Inspection must include compliance monitoring of performance measures after construction with an additional inspection three years after construction. Monitoring reports are required for these two inspections. The contingency plan is activated when the project fails to meet performance measures after the three-year inspection.

(iii) A person can use methods found in WAC [220-660-200](#). Fish passage improvement structures will be approved where extreme and unusual site conditions prevent a person from complying with the provisions in this section provided associated impacts are adequately mitigated.

(e) To determine the average channel bed width for water crossing structure design, a person must use at least three typical widths (bankfull or equivalent), measured in a stream reach that is characteristic of an alluvial or self-forming stream. A person must measure widths that describe prevailing conditions at straight channel sections and outside the influence of any culvert, bridge, or other artificial or unique channel constriction.

(f) When removing an existing crossing in preparation for a new crossing, a person must remove all the existing components (such as approach fill, foundations, stringers, deck, riprap, guide walls, culverts, and aprons) likely to cause impacts to fish life and the habitat that supports fish life. The department may approve the partial removal of certain components when leaving them has been shown to have no measurable, or minor, impact.

(4) Bridge design:

(a) The bridge must pass water, ice, large wood and associated woody material, and sediment likely to move under the bridge during the 100-year flood flows or the design flood flow approved by the department.

(b) The waterward face of all bridge elements that may come in contact with waters of the state including abutments, piers, pilings, sills, foundations, aprons, wing walls, and approach fill must be landward of the OHWL. The requirement excludes midchannel piers and protection required at the toe of embankment in confined channels.

(c) A bridge over a watercourse with an active flood plain must be designed to prevent a significant increase in the main channel average velocity (a measure of encroachment). The bridge is defined as the main bridge span(s) plus flood plain relief structures and approach road overtopping. This velocity must be determined at the 100-year flood flow or the design flood flow approved by the department. The significance threshold should be determined by considering bed coarsening, scour, backwater, flood plain flow, and related biological and geomorphological effects typically evaluated in a reach analysis.

(d) A person must design the bridge to account for the lateral migration expected to occur during the bridge's lifespan. The department will approve encroachment into the expected pathway of lateral migration if the design follows the mitigation sequence to protect fish life and the habitat that supports fish life.

(e) Where there are existing flood control levees at the bridge construction site, or other structures or improvements of value that is not the property of the bridge owner but would constrain the construction of a bridge, the department may approve a shorter bridge span than would otherwise be required to meet the requirements in this section.

(f) The design must have at least three feet of clearance between the bottom of the bridge structure and the water surface at the 100-year peak flow unless engineering justification shows a lower clearance will allow the free passage of anticipated debris.

(g) The bridge design must minimize the need for scour protection. Where midchannel piers are necessary, design them so no additional scour protection is required. If scour protection is unavoidable, the design must minimize the scour protection to the amount needed to protect piers and abutments. The design must specify the size and placement of the scour protection so it withstands expected peak flows.

(5) Bridge construction:

(a) If excavation or other construction activities take place waterward of the OHWL, the work area must be isolated from the stream flow (if present) by using a cofferdam, bypass, or similar structure.

(b) A person must minimize damage to the bed and banks when placing the bridge structure.

(c) Biotechnical slope protection outside the bridge shadow is preferred.

(6) Culvert design:

(a) Stream simulation design:

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(i) A stream simulation culvert must be designed and constructed to comply with the requirements of this subsection.

(ii) The width of the channel-bed inside a stream simulation culvert at the elevation of the stream bed can be determined in one of two ways:

(A) The bed width may be calculated by using any published stream simulation design methodology approved by the department.

(B) The bed width of an individual culvert may be determined on a case-by-case basis with an approved alternative plan that includes project objectives, inspection, maintenance, and contingency components. Inspection must include compliance monitoring after construction, and effectiveness monitoring after three years. Maintenance and contingency are triggered when project fails to meet objectives.

(iii) The stream simulation culvert must be set at the same gradient as the prevailing stream gradient unless engineering justification for an alternative slope is approved by the department.

(iv) The slope of the bed inside a stream-simulation culvert must not exceed the slope of the upstream channel by more than twenty-five percent.

(v) The stream simulation culvert must be countersunk a minimum of thirty percent and a maximum of fifty percent of the culvert rise, but not less than two feet. Alternative depths of culvert fill may be accepted with engineering justification that considers channel degradation and total scour.

(vi) The median particle size of sediment placed inside the stream-simulation culvert must be approximately twenty percent of the median particle size found in a reference reach of the same stream. The department may approve exceptions if the proposed alternative sediment is appropriate for the circumstances.

(b) No-slope design:

(i) The stream channel in which a no-slope culvert will be placed must generally have a channel bed width that is ten feet or less and a gradient less than three percent. However, in some site-specific situations the department may approve no-slope in channels with a gradient up to five percent.

(ii) The length of the culvert must not exceed seventy-five feet.

(iii) A no-slope culvert must be designed and constructed to comply with the following requirements:

(A) The culvert is installed at a zero gradient.

(B) The width of the channel-bed inside a no-slope culvert at the elevation of the stream bed must be equal to or greater than the average channel bed width.

(C) The no-slope culvert is countersunk a minimum of twenty percent of the culvert rise at the culvert outlet downstream and a maximum of forty-percent of the culvert rise at the culvert inlet upstream.

(D) Combining the requirements for culvert width and countersinking, the culvert must meet the following requirements:

(I) For a circular culvert, the minimum culvert diameter must be equal to or greater than the average channel bed width plus twenty-five percent.

(II) For a culvert with an oval cross section (elliptical, pipe arch, or "squashed" pipe) the horizontal width must be equal to or greater than the average channel bed width plus twenty-five percent.

(III) For a box or pipe arch culvert, the span must be equal to or greater than the average channel bed width.

(E) The no-slope culvert must be filled to the depth of the countersink provided in (b)(iii)(C) of this subsection with material similar to what is found in the adjacent channel stream bed, unless either of the following conditions exist:

(I) The culvert is located in a wetland or in an area where the channel-bed is predominately fine sediment and the culvert will be backwatered; or

(II) The culvert will fill quickly because of the high rate of sediment transported through the culvert and will not cause excessive cutting or slumping of the upstream channel.

(7) Temporary culvert design requirements:

(a) The department must determine allowable placement of temporary culvert and time limitations based on the specific fish resources of concern at the proposed water crossing location.

(b) The design of the temporary crossing must maintain structural integrity at the peak flow expected to occur while the crossing is in place.

(c) Temporary culverts must provide unimpeded fish passage in locations where fish passage concerns exist. In site-specific situations, the department may approve a temporary culvert that does not meet all fish passage criteria. These situations may include streams where there is limited fish movement and presence, and where the use of a temporary culvert will result in fewer adverse impacts over the long term.

(d) A person must remove the temporary culvert and block all approaches to vehicular traffic before the HPA expires.

(8) Emergency culvert requirements:

(a) When there is an immediate threat to life, the public, private property, or of environmental degradation, a culvert may be replaced with one that is the same size or larger than the existing one. If the emergency crossing did not have a culvert or the size is not known, the emergency culvert should be large enough to safely pass the 100-year flood event with consideration for debris and sediment. In extreme circumstances, the department may approve the use of any available culvert.

(b) Fish passage must be provided at the times of the year when fish are expected to move. If the culvert design does not provide unimpeded fish passage, a person can use methods found in WAC [220-660-200](#) (fish passage improvement structures) to pass fish until a culvert is constructed.

(9) Culvert construction:

(a) A person must establish the culvert invert elevation with reference point(s) or benchmark(s) created prior to starting work on this project. The reference point(s) must be clearly marked and preserved for post-project compliance. Prior to backfilling, the invert elevation, as stated on the plans, must be confirmed relative to the reference points with at least a construction-grade leveling device (such as an optical auto-level or laser level).

(b) A person must install the culvert in the dry or in isolation from the stream flow by using a bypass channel or culvert, or by pumping the stream flow around the work area. The department may grant exception if installing the culvert in the flowing stream reduces siltation or turbidity.

(c) A person must embed the top of footings of bottomless culverts sufficiently below potential scour depth to prevent exposure of the footing surface and undermining.

(d) The owner(s) must maintain the culvert to ensure it complies with subsection (3) of this section (general design requirement for water crossing structures).

(e) If the culvert becomes a hindrance to fish passage, the owner must obtain an HPA and provide prompt repair.

(10) Permanent ford design:

(a) A person must design and maintain a ford so the ford does not create a channel constriction, impede fish passage, block debris passage, or degrade water quality to the detriment of fish life.

(b) The department will authorize construction of new fords in limited situations when it is the least impacting water crossing option. The following are examples of situations where the department may authorize a ford:

(i) Where there is no maintenance access during winter months or early spring and the crossing has a high risk of failure from rain-on-snow events;

(ii) The road is seasonally inaccessible due to snow pack, weather, or other conditions that seasonally limit access to the water crossing structure;

(iii) The stream has extreme seasonal flow variations and low flows during anticipated ford use;

(iv) The channel has low bank height and low gradient approaches;

(v) The stream has dynamic flood plains, such as alluvial fans; or

(vi) The stream is subject to mass wasting events, debris transport, or extreme peak flows.

(c) Permanent fords must not impede fish passage.

(d) Fords must be located outside of all known or suspected fish spawning areas such as pool tailouts.

(e) Fords must only be used during periods of no or low stream flow (whether dry or frozen) to minimize the delivery of sediment to the stream.

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(f) Vented (grade-separated) fords are preferred over at-grade fords because there is less aquatic disturbance and delivery of sediment and contaminants when traffic is separated from flowing water.

(11) Temporary ford design:

(a) The department may permit temporary fords only during the time of year that avoids high stream flows or expected fish spawning or migration.

(b) If fill is associated with the driving surface of a temporary ford, it must consist of clean washed gravel between one-quarter inch and four inches in diameter.

(c) If the natural stream bed is composed of material smaller than gravel, the temporary ford design must maintain a positive separation between the watercourse bed and all fill associated with the ford to ensure that material used in ford construction is removable.

(12) Ford construction:

(a) Fords must be constructed during periods of low or no stream flow or in isolation from flowing water.

(b) Fords must be constructed perpendicular to the stream flow, or as close to perpendicular as practicable.

(c) Fords must be constructed using material approved by the department.

(d) If the stream bed does not have a firm rock or gravel base, install clean, washed rock or gravel to reduce sedimentation. Broken concrete and pavement or other debris should not be used to construct hardened fords. Placement of material should be limited to the approaches and crossing.

(e) A person must countersink the prism of the ford below the watercourse bed. A person must design the prism to withstand overtopping flood events, and natural debris.

(f) Fill associated with the driving surface of a permanent ford must consist of material that will not attract spawning fish.

(g) A person must protect the driving surface of ford approaches from erosion to ensure that erodible fine silt does not enter waters of the state.

(h) Fords must be regularly inspected and maintained to provide for fish passage and maintain water quality.

(13) Permanent removal of a water crossing (abandonment):

(a) When removing a water crossing without replacing it, a person must comply with the following provisions. In all instances a person must protect the job site from erosion and plant vegetation as necessary to restore the banks and other areas disturbed during construction or removal at the site.

(b) When removing temporary crossings, a person must remove the temporary culvert, bridge, ford, and any imported fill. The site must be restored to a similar width, depth, gradient, and substrate composition as the channel segments upstream and downstream from the crossing. If water-rounded

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granular materials were used for fill, and they are similar to those found in the existing channel bed, the department may allow the materials to remain on the site.

(c) When removing permanent crossings, a person must remove all the components of a bridge or culvert crossing (approach fill, sills, stringers, deck, riprap, guardrails, etc.). The department may approve leaving trees or other vegetation, fill materials when appropriate, or untreated log bridge stringers. The site must be restored to the original contours or a configuration approved by the department.

[Statutory Authority: RCW [77.04.012](#), [77.04.020](#), and [77.12.047](#). WSR 15-02-029 (Order 14-353), § 220-660-190, filed 12/30/14, effective 7/1/15.]