M E M O R A N D U M

To: TFW Policy

Fr: Mary Scurlock, Policy Lead, Forests and Fish Conservation Caucus, Jamie Glasgow (ETG lead) and Chris Mendoza (ETG alternate)

Re: CC unresolved issues related to protocol survey electrofishing based on final Technical Workgroup Report dated June 27, 2016

Dt: July 27, 2016

GENERAL COMMENTS

This memo responds in part to the expectation stated in the above-cited report that TFW Policy Caucuses would bring unresolved issues related to protocol survey electrofishing to Policy for consideration in its Type F stream typing discussions. Overall, our comments express a desire for further clarity and emphasis around the technical rationale for the following conclusions:

- Reliance on fish presence/absence surveys to determine the extent of fish habitat, including recoverable habitats, has inherent risks that such habitat will not be accurately identified that cannot be entirely overcome by training and certification;
- Timing of surveys (both within and outside the sampling window March 1 – July 15) is an important factor in determining whether to use survey data to demonstrate fish absence and therefore, in achieving accurate stream typing.
- There is no sound technical basis for consideration of survey data obtained during high or low stream flows that either reduce the ability to detect fish, or reduce fish distribution.
- E-fishing stream reaches with very low fish densities is likely to negatively impact isolated populations and to produce false negatives.
- Targeting DNR's RMAP inventory of barrier headwater culverts on Type F waters would identify where isolated fish populations likely occur.
- Using e-DNA as a tool for stream typing is less harmful to fish and has a lower error rate than e-fishing.
- Since one of the stream typing system's goals is to protect currently unoccupied and recoverable / restorable habitat, this habitat cannot be determined based on e-fishing surveys for presence.
- The guidance prohibiting the use of e-fishing data to determine stream type upstream of artificial barriers (e.g. culverts) has a strong technical basis.

SPECIFIC COMMENTS

Issue: Seasonality is a consideration for perennial AND seasonal F streams

The executive summary (page 3, para 2) implies that seasonality is only a consideration for perennial streams. It is also an issue for seasonal F streams whose occupied length changes over a year as fish distribution expands and contracts with the upper extent of wetted channel. (See e.g. Wigington et. al., 2006). Our concern is that some seasonal / intermittently flowing Type F channels are misclassified during protocol e-fishing surveys because they are either dry and/or intermittently flowing at the time of the survey when fish do not have access to fish habitat otherwise available at higher flows.

Precaution not enough to render e-fishing appropriate on extremely low populations

It is not adequate to apply "special cautions" or "postponement" of surveys in isolated habitats where few breeding individuals may persist because this is highly likely to have population-level impacts. (Executive Summary, page 3, third paragraph). DNR could use their landowner / manager RMAP inventory database to identify where isolated populations are likely to exist where E-fishing would likely have negative population-level impacts.

eDNA error rate misrepresented

We object to the report's characterization of a statement about the perceived error rate of eDNA as attributable to "*many investigators.*" (page 12, last paragraph). It is our finding that eDNA is substantially more sensitive than traditional e-fishing. *See e.g.* Wilcox et. al. 2015, cited in references). The more notable challenges with using this technique are related to 1) the fact that it still uses a "point in time" to establish fish presence and, 2) establishment of a marker library. See also the report at pages 26-7, characterizing eDNA as being *"prone to false negative results when fish are rare"* without a corresponding recognition that e-fishing is likely to produce MORE false negatives under the same conditions and consequently will fail to identify and protect more fish habitat.

The report does not reflect participant recommendation to consider mandatory submittal of WTMFs in addition to a centralized GIS database of e-fishing information

We have consistently recommended consideration of a policy whereby FPA stream mapping/ typing corrections are required to be submitted as water type modification forms. Doing so will provide optimization and reduce the extent of e-fishing by preventing unnecessary protocol surveys as previously-performed surveys inform downstream water type. Such policy is more consistent with DNR's forest practices water typing website stating that landowners are required to validate all water types within FPA boundaries prior to submission.

Report does not adequately address drought conditions

The text does not focus enough on a key Policy Committee concern: flows below the normal long-term range (drought conditions) (e.g. page 13-14 conclusion about focus of the group on low flows within "normal long term ranges").

We note the lack of agreement around use of surveys in drought years, and the need for further work to consider whether this information should be used to locate the F/N break for an FPA and/or to update water type maps in drought years. (Bullet 9, page 18).

Uncritical reporting of Weyco data under wide stream discussion

We question the uncritical reporting of Weyerhaeuser unpublished high "efficiency" results on page 15, paragraph 1. There is no analysis of the study design's appropriateness to the conclusion offered. E.g. Over what distance? What gradient? Instream and riparian complexity? Fish species and densities? Wild fish *in situ*, or controlled experiment?

Protocol Sufficiency findings – exceptions

The report does not address the protocol's sufficiency where there is not access to ¼ mile above last fish or insufficient pools to meet the protocol survey criterion of 12 pools. (page 16, bullet 4).

Surveys can't demonstrate absence

We continue to object to the characterization of <u>any</u> electrofishing survey as adequate to "demonstrate absence." (page 16, header 5). This contradicts the Executive Summary's correct statement with which we agree that it is "impossible to confirm with absolute certainty that fish are absent from a site." Report at 2, second to last sentence).

Unresolved Issues with exceptions for surveys above some man-made barriers – hard to build exceptions around findings we don't know how to make

The report does not inform the questions of how to determine: 1) that a viable population exists above a man-made barrier to know when e-fishing would not be harmful, or, 2) that population abundance, fitness, and species richness has not been influenced by the barrier. Without answers to these questions, the only logical policy is to establish a presumption against electrofishing above most artificial barriers. It is well-established that barriers can block fish from accessing habitat, can isolate small and susceptible populations of fish, and can reduce abundance (reducing distribution and/or detectability via e-fishing). (See clear policy established by Board Manual, Section 13 Part 2). We concur with the discussion point p. 17, bullet 6. And again, DNR's RMAP culvert inventory database could target where isolated fish populations are likely to exist.

Characterization of Seasonal and Long-Term Distribution Variability of Differences in Last Fish Divorced from Regulatory Implications

The text notes that based on limited fish distribution survey data, some researchers have concluded that seasonal differences in the location of the last fish are not "*biologically significant,"* (page 9, paragraph 1), but fails also to note that this research (Cole and Lemke 2006) was not designed to assess "biological significance", but strictly investigate seasonal and annual fish distribution patterns for CMER. More importantly, the current regulatory scheme that protocol e-fishing serves does not depend on a finding of "biological significance." Rather, there is a presumed direct correlation between the location of the last observed fish and the extent of habitat likely to be used by fish. (i.e. all habitat likely to be used by fish or which may be restored to such use by restoration or management) is presumed to warrant the established level of regulatory protection).

Report is not adequately clear about the risks of not detecting fish

The report could more clearly acknowledge that the *"risk"* of non-detection is not simply that of "not finding fish that are actually present" (and these risks are significant; 16 -

21%). The real risk here is that fish habitat will not be classified and protected as such, which could be included in the discussion at page 20).

Lack of basis for finding current survey window generally appropriate

The report is contradictory in declaring the survey window appropriate in most cases but also finding there is "no specific documentation to answer this question" [of the appropriate window to survey] yet finding in "*most cases*" it's appropriate. (Page 22, bullet 1). Stream flows may vary 10 fold from the beginning to the end of the survey window (March 1 – July 15) rendering some fish habitat inaccessible due to dry / intermittent stream conditions in late spring and early summer.

Role of Physical Criteria

The description of Policy's inquiry into the use of default physical criteria in stream typing as whether they "accurately reflect fish presence" fails to account for the intent of the regulatory scheme to protect habitat that is likely to be used by fish whether or not a fish is actually "present' at the time of a management action or stream typing call (e.g. recoverable habitat). (page 27, bullet b).

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MEMORANDUM

To: **Washington Forest Practices Board**

From: **Mary Scurlock and Chris Mendoza, policy and technical representatives for the Forests and Fish Conservation Caucus**

Date: **May 5, 2017**

Re: **Off-Channel Habitat Identification, Delineation and Protection for Wetlands Connected and Accessible to Fish**

Introduction

After much deliberation, Policy reached agreement on the majority of issues it considered in relation to clarifying how off-channel habitat (OCH) should be identified. A significant recent development is agreement that the extent of non-channelized OCH (associated wetlands accessible to fish) is determined by the Ordinary High Water Line (OHWL) defined in rule rather than bankfull flows. Because field identification of off-channel habitat must rely on site-characteristics that can be assessed any time of the year, including the dry season when wetlands may not contain standing water, and wetland vegetation persists year round, delineation according to OWHL is practical, enforceable and repeatable to implement. This is clearly the intent of both the interim and permanent water typing rules.

Still in dispute is how the transition from wetland to upland vegetation is identified on the ground. The landowner caucuses have questioned whether identification of the vegetation transition is determinative, arguing that OHWL should be limited by bankfull flows using a "laser level." (Personal communication, WFPA and SFLO Representatives). This would not result in protection of the full extent of OCH, which should be determined by vegetation.

We have pressed the remaining disagreement because we believe the edge of Type F associated wetlands is intended to be the edge of OCH under the definition of OHWL (as explained below) and because these areas are ecologically important areas, especially as refugia for juvenile Coho salmon when streams become raging torrents too hostile to inhabit. Off-channel fish habitats are identified as being critical to the optimum survival of fish in the Forests and Fish Report and Forest Practices Habitat Conservation Plan and their implementing rules, and are well-known to have been widely degraded, destroyed and made inaccessible by past land use practices. The Conservation Caucus seeks to ensure that all off-channel habitats intended to be protected as Type F waters are consistently identified and fully protected for the purposes of applying the appropriate Type F riparian protections.

1. Issue Statement and Sources.

This memo summarizes our interpretation of and linkages between current rule and Board Manual language governing the identification and delineation of Type F off-channel habitat (OCH) in non-channelized areas of streams that are not Channel Migration Zones under DNR rules and Board Manual Section 2. Our sources are:

1. Existing rule language found in WAC 222-16-010 under the definitions of

    i. Fish Habitat
    ii. Bankfull Width
    iii. Ordinary High Water Line.

2. Board Manual language in Sections 2 (Channel Migration Zones and Bankfull Width) and Section 8 (Wetlands Delineation).

3. A DNR PowerPoint presentation first presented by Marc Engel during a March 2015 Policy off-channel habitat field trip near Port Townsend.

OCH occurs in both channelized and non-channelized forms, but there is not agreement amongst Policy stakeholders about how to find the edge of OCH in non-channelized, Type F associated wetlands where OHWL governs. We strongly believe that in these situations, the Riparian Management Zone (RMZ) should start at the line of transition from wetland to upland vegetation, which is generally the edge of the wetland (excluding "sloped" forested wetlands that are not fish habitat). We further find that this interpretation is consistent with the current definition of OHWL as it relates to Type F associated wetlands that qualify as off-channel habitats.

2. Identification and Delineation of Type F Associated Wetlands as Off Channel Habitat.

Under WAC 222-16-010 fish habitat "means habitat, which is used by fish at any life stage at any time of the year including potential habitat likely to be used by fish, which could be recovered by restoration or management and includes off-channel habitat."

The non-channelized form of OCH is specifically referenced in the interim rule defining Type 3 waters as follows:

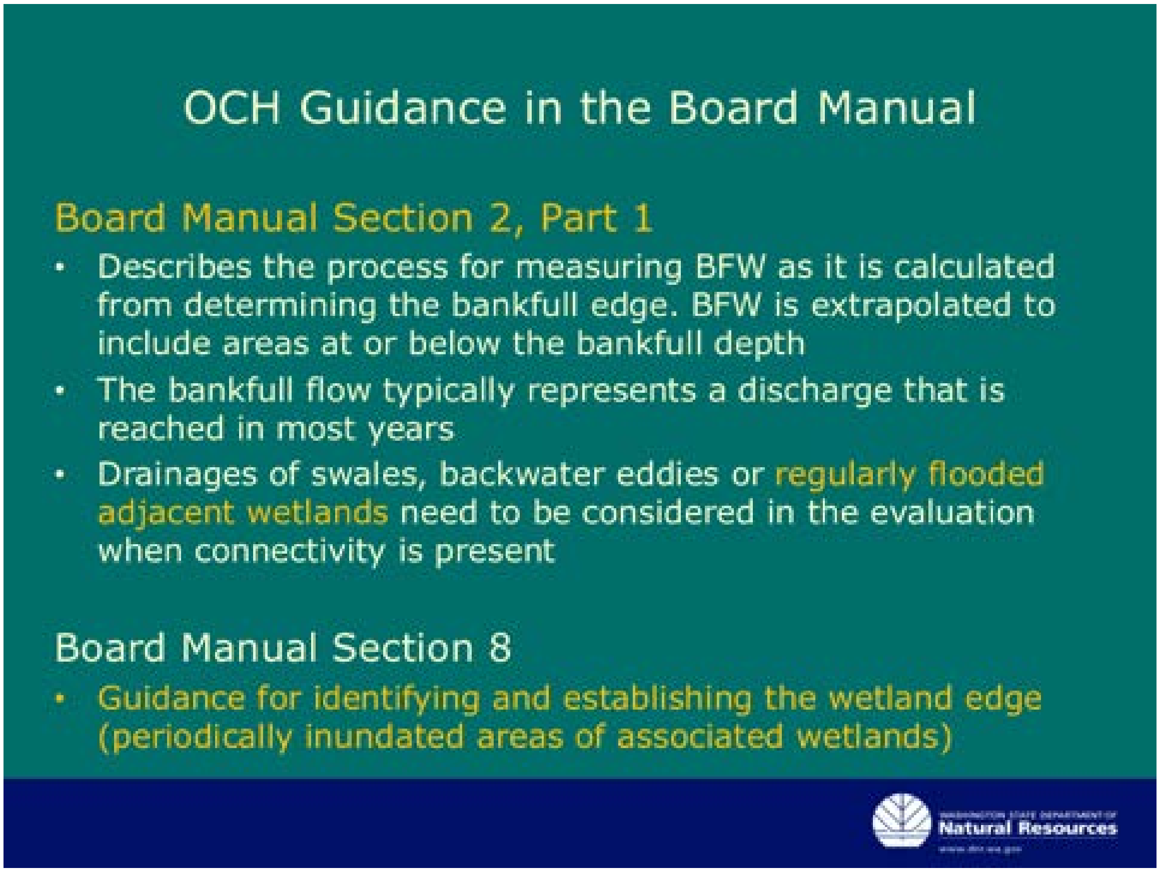
> These are segments of natural waters and <u>periodically inundated areas of their associated wetlands</u> (WAC 222-16-031) (emphasis added).

Policy has agreed that these Type F associated wetlands should be protected using the Ordinary High Water Line defined in rule based on the almost verbatim similarity with the definition of periodically inundated areas of associated wetlands in rule (WAC 222-16-010) and Board Manual Section 2.

> Ordinary High-Water Line:
>
> [m]eans the mark on the shores of all waters, which will be found by examining the beds and banks and ascertaining where the presence and actions of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland; in respect to vegetation: WAC 222-16-010 (emphasis added).
>
> Periodically inundated areas of associated wetlands:
>
> [l]ine of periodic inundation, which will be found by examining the edge of vegetation to ascertain where the presence and actions of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland." WAC 222-16-010 (emphasis added).

In our view, it is not conincidental that the rule defining ordinary high-water line is very much the same as the rule defining periocially inundated areas of associated wetlands. The main difference is that OHWL uses the words "beds and banks" for what we interpret as waters with well defined channels, where by contrast, non-channelized associated wetlands refers to "the edge of vegetation," which means the point at which wetland vegetation transitions to upland vegetation "as to mark upon the soil a character distinct from that of the abutting upland" in respect to vegetation.

This point was also emphasized in a DNR PowerPoint presentation (Marc Engel) to TFW Policy and wetland practitioners on a field trip to Port Townsend in March, 2015 where Policy representatives and their advisers observed how Pope Resources was delineating OCH for channelized and non-channelized associated wetlands in accordance with existing rules and Board Manual guidance. The below slide, copied directly from DNR staff's field trip presentation, supports our rule and Board Manual (section 2) interpretation that Type F periodically inundated areas of associated wetlands recoginized as Type F off-channel habitat must be protectd to "the edge of vegetation," in this case refering to wetland vegetation that transitions to the "abutting uplands, in respect to vegetation."



Note that the DNR slide is entitled "OCH Guidance in the Board Manual" and specifically refers to Board Manual Section 8 for "Guidance for identifying and establishing the wetland edge," (emphasis added) for "periodically inundated areas of associated wetlands." Mr. Engel's talking points listed below this slide given during his presentation to Policy on the OCH field trip states "**Section 8 – establishing the wetland edge is used for associated wetland delineations (indicators for identifying full extent of water lines)**"[i] (see attached DNR PowerPoint presentation).

We fully concur that the wetland edge defines the extent of OCH, and we see no other rational alternatives or interpretations.

3. Arguments against OHWL as equating to the wetland edge.

Based on mulitiple meetings during the dispute resolution process, we attempt to explain the alterantive positions on OCH delineation:

A. OHWL can't go above Bankfull Elevation.

Forest landowners have contended that Type F OCH identifed as periodically inundated areas of associated wetlands does not extend to the "wetland edge" or to the point at which the OCH extends "as to mark upon the soil a character distinct from that of the abutting upland; in respect to vegetation...", as defined in rule (WAC 222-16-010). As we understand it, the argument is that such off-channel habitat need only be recognized for protection if it is below the elevation assoicated with the flow level determining "bankfull width" and "bankfull depth" as defined in rule and board manual guidance, even when such conditions do not encompass the entire area of off-channel habitat defined by where the vegeation changes from wetlands to uplands. (All parties agree that we are not talking about "sloped" wetlands as OCH that fish cannot access.)

This argument fails for three reasons:

i. ***Bankfull is irrelevant in non-channelized Type F waters***. It is simply not possible to accurately characterize bankfull where there is no bank. The technical basis for bankfull flow-related metrics is based on channel-forming events and characteristics that are irrelevant in non-channelized waters.

ii. ***Current Board Manual guidance in Board manual section 2 clearly states that bankful width, depth and flow should NOT be used for periocially inundated areas of associated wetlands***, but only for channelized systems.

Guidance for measuring bankfull width and depth in this manual refers to a measurement of channel dimensions at bankfull flow and not for other parts of the bankfull width definition: b) lakes, ponds, and impoundments; c) tidal water (tidally influenced channels); or d) periodically inundated areas of associated wetlands. See Board Manual Section 8 for guidance. (Emphasis added)

iii. ***Current rule requires that that landowners & practioners find the transition to upland vegetation to locate OHWL:***

[OHWL] means the mark on the shores of all waters, which will be found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation: Provided, That in any area where the ordinary high-water line cannot be found, the ordinary high-water line adjoining saltwater shall be the line of mean high tide and the ordinary high-water line adjoining freshwater shall be the line of mean high-water. (emphasis added).

We interpret this to mean that landowners/practioners may only resort to other means of identifying OHWL if the "mark upon the soil a character distinct from that of the abutting uplands, with respect to vegetation" cannot be found, which would exclude the use of bankfull flow.

And as stated above, Board Manual Section 2 directs the landowner/practitioner to "see Board Manual Section 8 for guidance" on periodically inundated areas of associated wetlands. Board Manual Section 8 is the wetland delination manual that instructs users on how to find the extent/edge of a wetland, as noted by DNR's slide (above).

There is no documentation, including rule or Board Manual guidance, that refutes our interpretation of the rule defining Ordinary High Water Line and Periodically Inundated Areas of Associated Wetlands (WAC 222-16-010). Acceptance of the forest landownes' interpretation by the Board would exclude from Type F protection non-channelized off-channel habitat (associated wetlands) that extend beyond bankfull depth/elevation, and would effectively constitute a change in policy without any rational policy, administrative or scientific basis.

2. "Periodically inundated" equates to the area inundated at bankfull flows.

Landowners also contend that "periodically inundated areas of associated wetlands" implies that only those areas that are inundated (below water) at bankfull flows require protection. Again, we rely on the board manual section 2 admonition that bankfull methods are not relevant to to Type F associated wetlands. Further, even without this direction, to limit "periodically inundated" in this way is inconsistent with the definition of these terms contained within the glossary of Board Manual Section 8 (Wetland Delination):

> Periodically: Used herein, to define detectable regular or irregular saturated soil conditions or inundation, resulting from ponding of ground water, precipitation, overland flow, stream flooding, or tidal influences that occur(s) with hours, days, weeks, months, or even years between events. (emphasis added).

We interpret this to mean that wetlands that serve as OCH may be inundated with water above the surface less frequently than a single year, i.e., "years between events," and, that periodically does not mean the underwater area must be that which exists at bankfull flows. Rather, it is the area delineated by the line of transition from wetland vegetation to a upland vegetation under the OHWL rule.

The frequency of inundation is also defined in Board Manual Section 8 as:

> Frequency (of inundation or soil saturation): The periodicity of coverage of an area by surface water or saturation of the soil; it is usually expressed as the number of years the soil is inundated or saturated during part of the growing season of the prevalent vegetation (e.g. 50 years per 100 years) or as a 1-, 2-, 5-year, etc., inundation frequency. (emphasis added).

We interpret this to mean that the period of inundation may only happen for a short time during the growing season for a relatively short period every few years, but often enough to establish wetland vegetation (used as a surrogate for wetland soils and hydrology), which is exactly why Board Manual Section 8 is referenced in both the rule and Board Manual Section 2 for defining, delinating and protecting off-channel habitat related to Type F periodically inundated areas or associcated wetlands.

Wetland vegetation and soils are the result of inundation that occurs with adequate frequency that emergent vegetation occurs at the edge of the inundated area. Taken together, current rule and guidance do not indicate that identification and protection of OCH should be limited to emergent vegetation that only interfaces with open water at bank full elevation. Because wetland hydrology can be complex, is not generally reliant only on fluvial/surficial flows and varies with local site conditions, where off-channel fish habitats are wetlands meeting rule and Board Manual definitions the most appropriate way to identify the extent of the OCH feature is to find the edge of the wetland—not limited by the area inundated at bankfull flows.

Conclusion

The expert report commissioned by the AMP to review the OCH literature confirmed the importance of OCH even in the smaller streams without CMZs where this discussion is focused. A key role of this habitat is to provide refuge during high flows:

> . . . . OCHs in small to medium sized streams can occur in areas where such habitats are relatively scarce, and thus can be of disproportionately high importance for fish rearing and refuge during certain periods. For example, OCHs provide refuge during high flow periods when water velocities in the main channel become too great for fish to maintain energetically profitable feeding stations (Peterson 1982a; Fausch 1984). Without access to OCH, rearing salmonids and other fishes may volitionally migrate or be physically displaced downstream. Research on Coho salmon in the Oregon Coast Range has demonstrated the importance of OCH to coho production, and how increasing the amount and accessibility of OCH can lead to large increases in parr and smolt production (Nickelson et al. 1992b; Solazzi et al. 2000). Furthermore, the presence of accessible, ecologically complex OCH in small and medium sized streams adds to the overall diversity of habitat types in the drainage system. This in turn facilitates the expression of freshwater life history variation (occupying multiple habitats at different times and places by different individuals in a population) – a "spreading the risk" habitat strategy believed to promote population resilience (Bisson et al. 2009). (Roni et. al. at pages 5-6).

Also relevant is the Quinault case on CMZ delineation pending on appeal (*Quinault v. Esses Daman*, 2013). The portion of this case dealing directly with the identification and protection of OCH as refuge for juvenile Coho was not appealed, and the Pollution Control Hearings Board noted the importance of providing OCH critical to the optimum survival of fish and granted additional riparian protection accordingly.

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[i] Since this presentation we have heard DNR staff back away from their previous position that OCH extends to the wetland edge, which contradicts their previous support of our interpretation as presented in the above slide, that "Periodically inundated areas of associated wetlands" mean the "wetland edge" (Personal communication, Marc Engel Policy Type F Dispute Resolution meetings). We have asked DNR on multiple occassions to provide written documentation with rationale for their reversal on the interpretion of off-channel habitat regarding the protection of OCH to the wetlands edge, but have yet to recieve a response.

Bankfull Flow and Ordinary High Water Mark (OHWM): What's the Difference and Why Does it Matter for Off-Channel Habitat?

Chris Mendoza, Conservation Caucus

*Slide from DNR field trip on OCH (2015)

Off-channel habitat (OCH) defined by WAC (222-16-010) and DNR Board Manual Guidance (Sections 2 and 8).

WAC 222-16-010 General Definitions

Bankfull width:

a) For streams
b) For lakes, ponds, and impoundments – line of mean high water
c) For tidal water – line of mean high tide.

d) For periodically inundated areas of associated wetlands – line of periodic inundation, which will be found by examining the edge of inundation to ascertain where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland.

WAC 222-16-010 General Definitions

Ordinary high-water mark:

“means the mark on the shores of all waters, which shall be found by examining the bed and banks and ascertaining where the presence and actions of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation:”

Provided, That in any area where the OHWM cannot be found…the OHWM adjoining freshwater shall be the line of mean high water.*

*mean high water: the average high water over 19 years.

Board Manual Section 2

Bankfull width and depth (derived from bankfull elevation) should only be used for channel dimensions and should *not* be used when identifying off-channel habitat:

"If a CMZ is not present, measurement of the riparian management zone (RMZ) begins at the outer edge of the bankfull width."

"Guidance for measuring bankfull width and depth in this manual refers to a measurement of channel dimensions at bankfull flow and not for other parts of the bankfull width definition: b) lakes, ponds, and impoundments; c) tidal water (tidally influenced channels); or d) periodically inundated areas of associated wetlands. See Board Manual Section 8 for guidance." (wetland delineation)

Board Manual section 8 defines wetland delineation

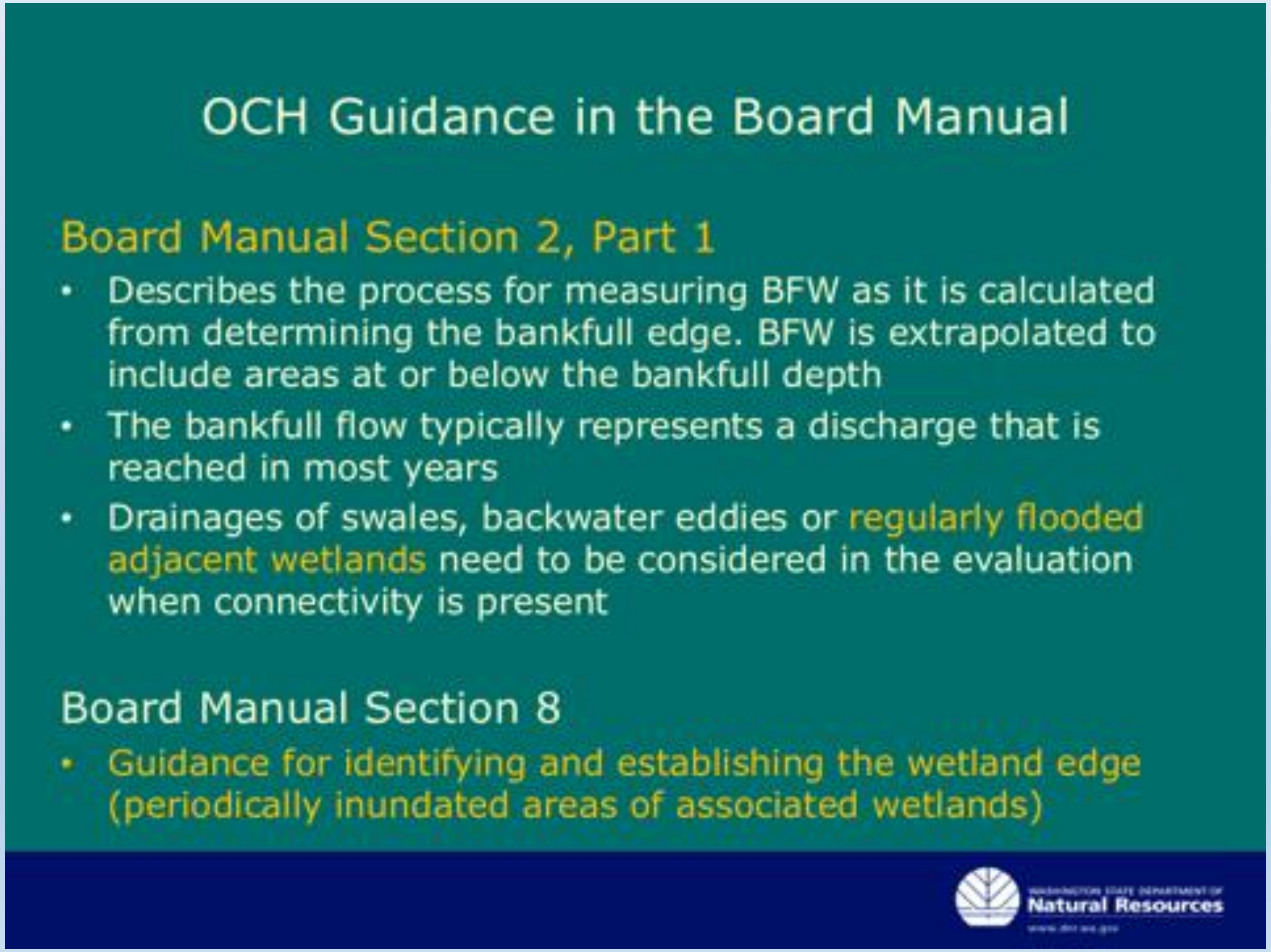
PART 2. TECHNICAL CRITERIA THAT IDENTIFY WETLANDS

“The criteria for wetland hydrology is as follows:

The area is inundated either permanently or periodically to a depth at which emergent vegetation interfaces with open water, or the soil has a frequently occurring high water table that remains within 12 inches of the surface for more than 14 consecutive days during the growing season of the prevalent vegetation.”

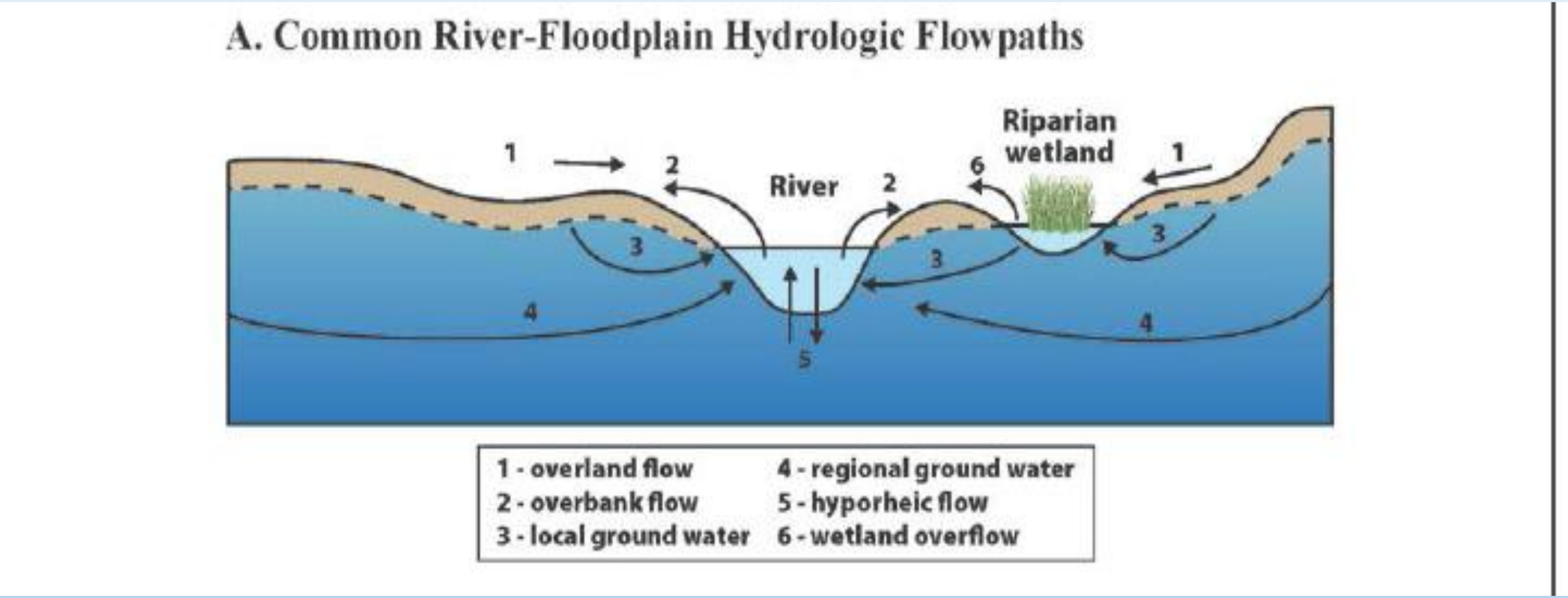
“Section 8 – establishing the wetland edge is used for associated wetland delineations (indicators for identifying full extent of water lines)”

*Slide from DNR field trip on OCH (2015)



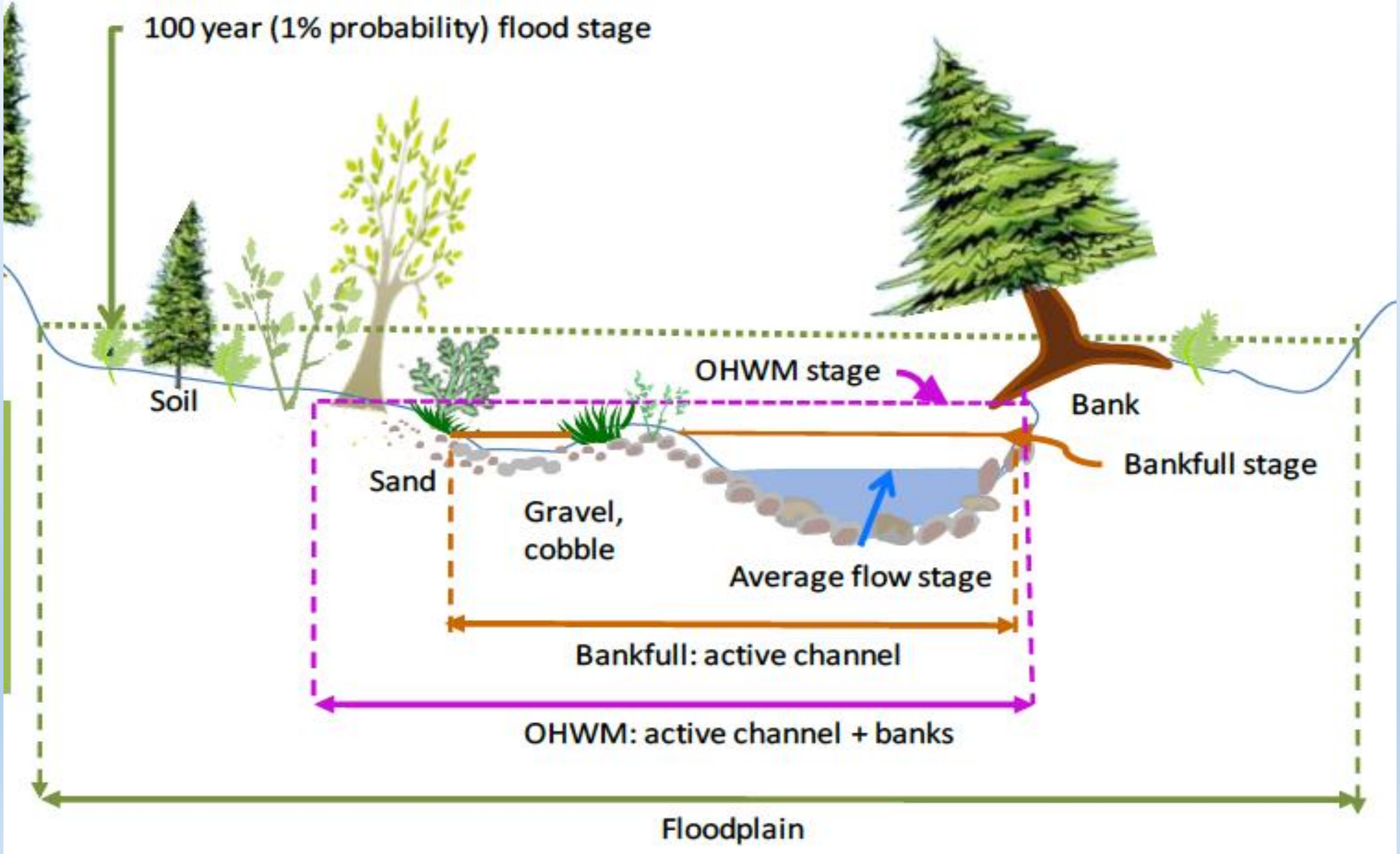
Hydrologic Overland and Subsurface Flowpaths

***** 2015 - Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence. EPA /600/R-14/475F



OHWM compared to Bankfull flow (Ecology 2010, pub # 08-06-001*)

*Determining the Ordinary High Water Mark on Streams in Washington State



(Ecology 2010, pub # 08-06-001*)
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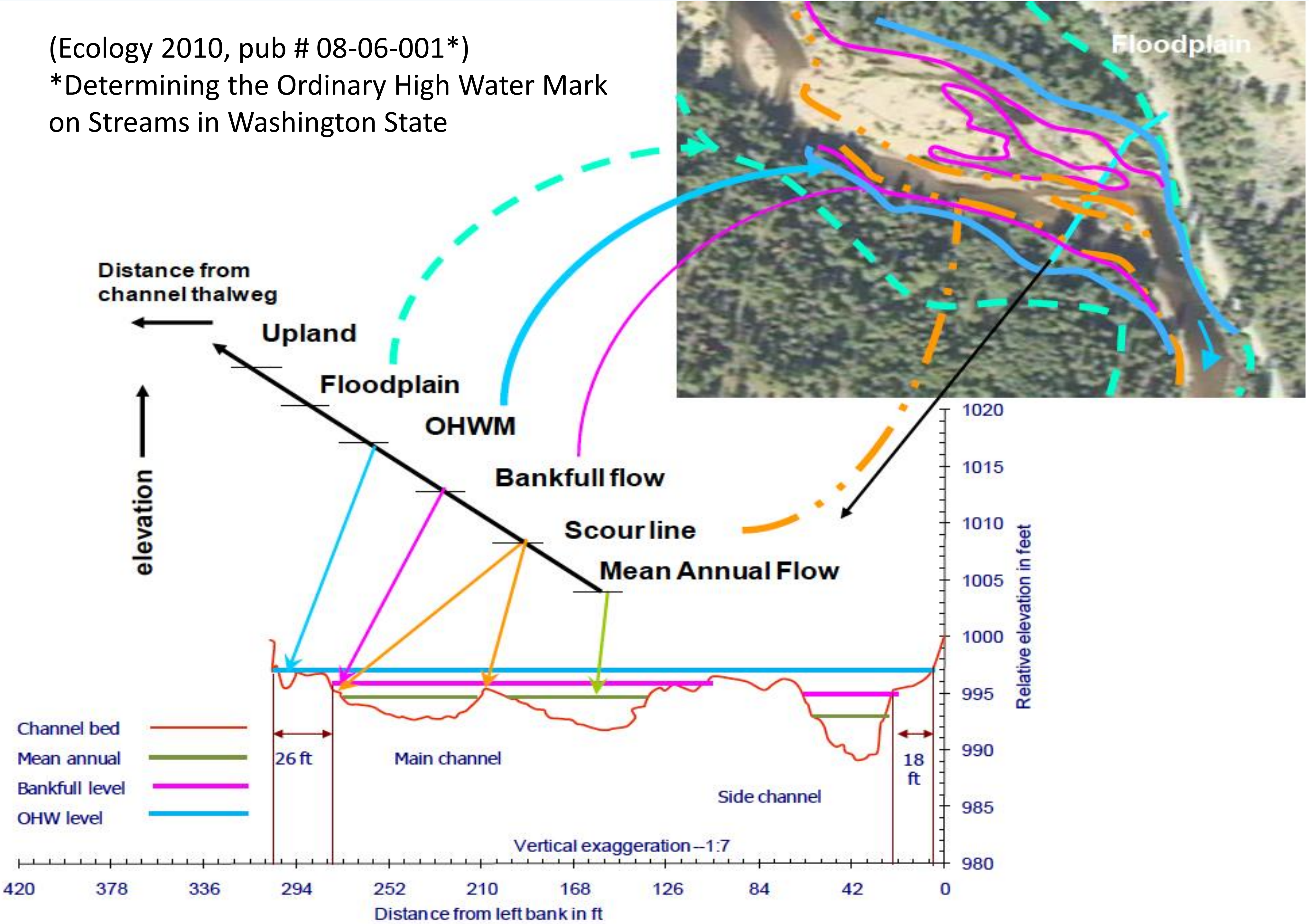
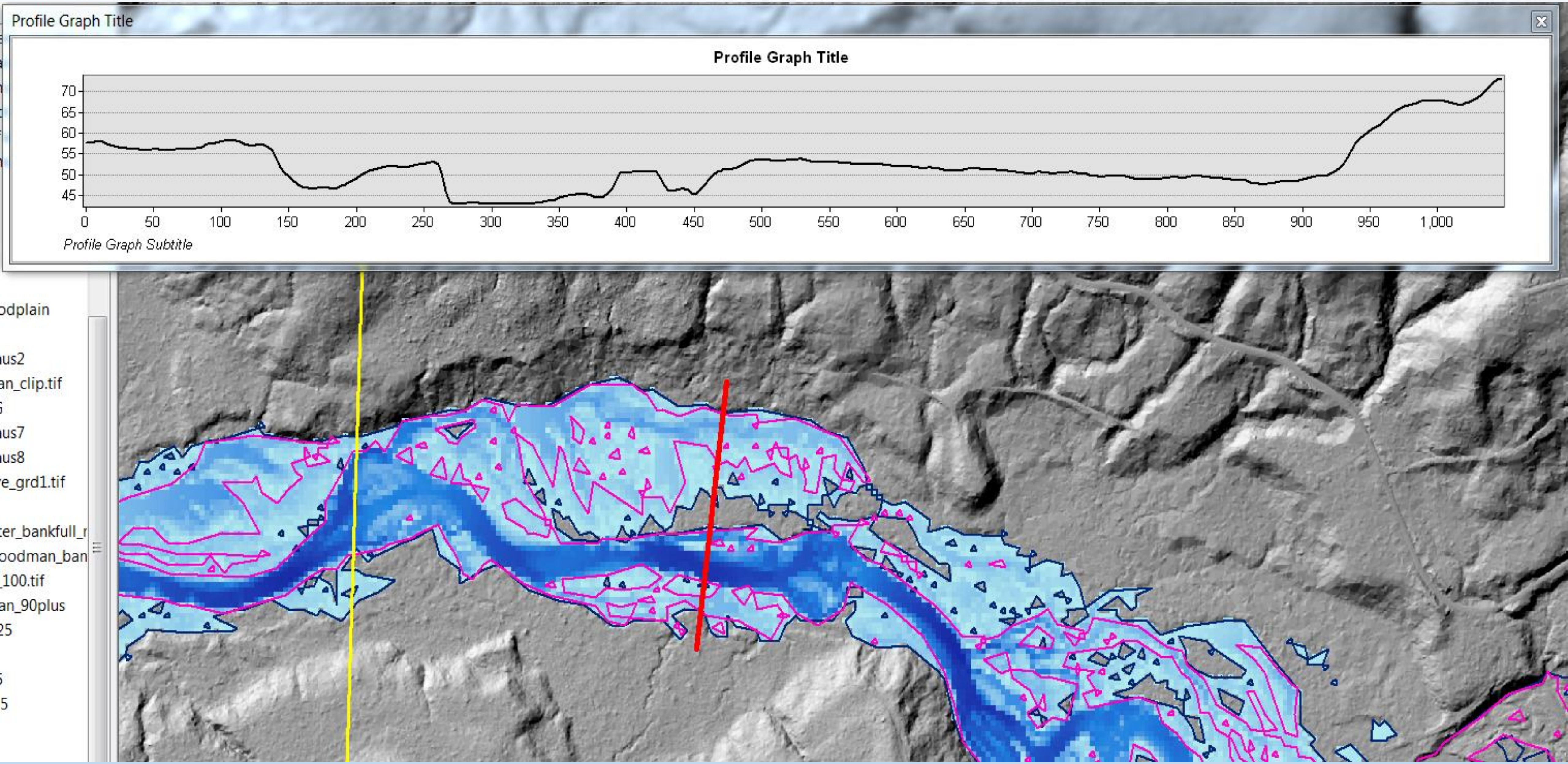
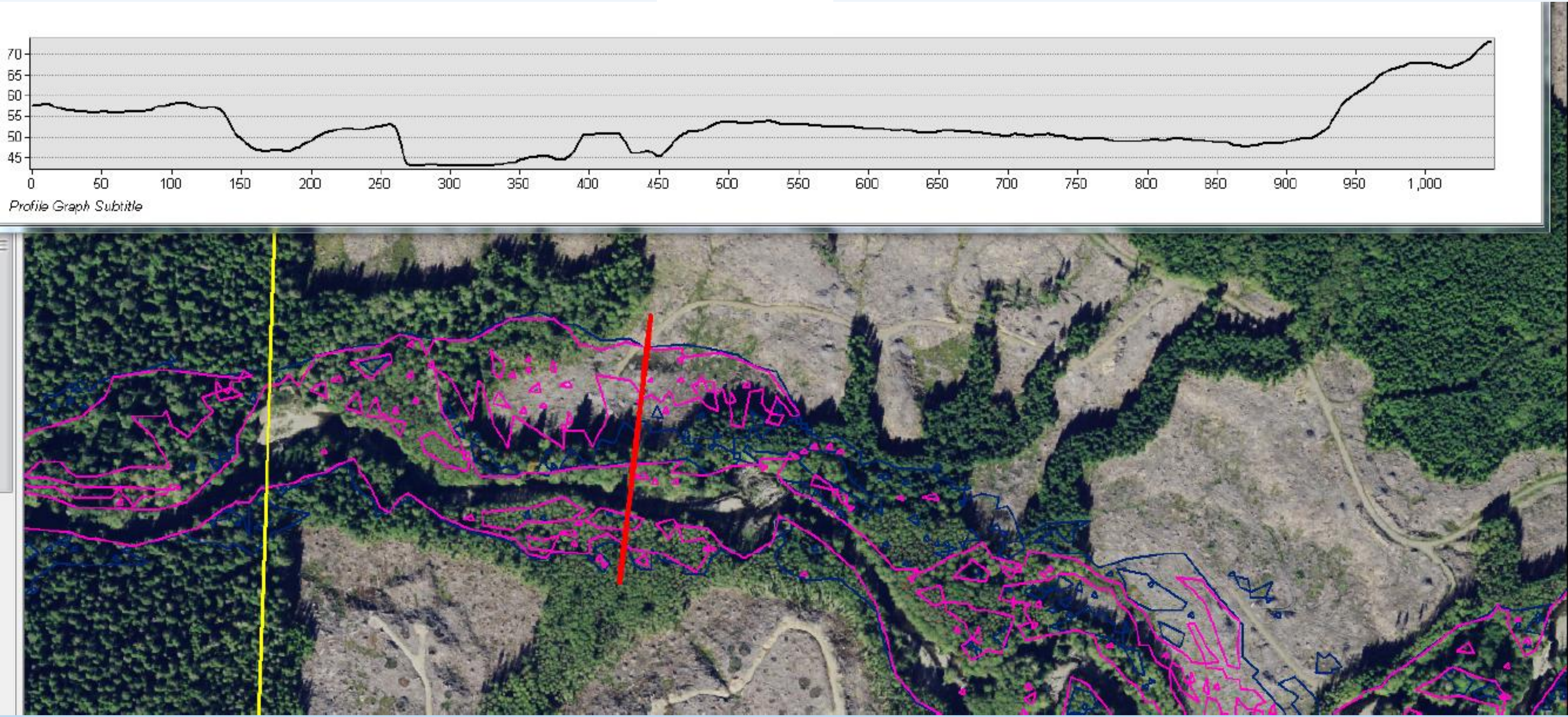


Light Blue Shaded Areas Outlined in Red Indicate a 2 year Flood Frequency



Areas Outlined in Red Indicate a 2 year Flood Frequency




2014/09/10

Common Misunderstandings in Establishing the OHWM on Streams Include: (Ecology 2010, pub # 08-06-001*)

*Determining the Ordinary High Water Mark on Streams in Washington State

- Ignoring side channels in multiple channel systems. Secondary channels may be within the OHWM
- Not including contiguous or associated wetlands within the stream OWHM
- Using the waterward edge or the beginning of the vegetation as the OHWM. Vegetation below or at the OHWM should be considered distinct from that of the abutting upland, not the abutting riparian plant community.

Conclusion

- Limiting Off-Channel Habitat to Bankfull Elevation instead of OHWM, when the later is greater, will significantly reduce the amount of OCH available to fish seeking refuge from inhospitable, high flow/velocity in-channel conditions.
- Doing so goes against both the WAC (222-16-010) and Board Manual guidance (Sections 2 and 8) for protecting periodically inundated areas of associated wetlands that serve as OCH.

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MEMORANDUM

To: **Washington Forest Practices Board**

From: **Mary Scurlock, Jamie Glasgow & Chris Mendoza, for the Forests and Fish Conservation Caucus**

Date: **May 5, 2017**

Re: **Further Recommendations for Fish Habitat Assessment Method**

Our recommendations relate to the TFW Policy Proposed Framework for a Statewide Stream Typing Fish Habitat Assessment Methodology (FHAM) dated April 24, 2017. Our goals are to provide further clarity on key concepts, address areas of disagreement and speak to unaddressed items.

In sum, we urge the Washington Forest Practices Board to:

- Adopt accessibility as the driver of the permanent, habitat-based stream typing method.
- Define potential habitat breaks (PHBs) as permanent natural stream features that have at least an 80% likelihood of preventing upstream fish passage (20% or less likelihood of access).
- Find that the primary metrics for determining PHBs are stream gradient and stream width or their combination.
- Direct the Department of Natural Resources and Washington Department of Fish and Wildlife to lead the Board-directed technical analysis in support of identifying specific metrics for PHBs, considering potential data sources recommended by stakeholder technical advisors.
- Set timelines for implementation of the FHAM that ensures rule implementation by March 1, 2018, (the start of the next field season) and refrain from remanding any stream-typing matters back to Policy.
- Develop and finalize a revised protocol e-fishing survey method with associated training and certification.

1. **Accessibility drives fish habitat-based stream typing.**

The Board should explicitly validate in its proposed rule that the fundamental driver of the stream typing system is the concept that if upstream reaches are "connected and accessible" to presumed fish habitat, then those reaches should be assumed to be fish habitat (Type F waters).

Rationale: An access-based stream typing system limits electrofishing surveys for fish presence/absence to reaches above permanent natural features that are potential barriers likely to block access to fish habitat. A focus on accessibility minimizes the overall extent of electrofishing surveys and their associated risk that currently unoccupied or recoverable fish habitat (F waters) will be erroneously under-protected as non-fish habitat (N waters).

A fish access-driven system is fundamental to the Forests and Fish Report (FFR) and the statewide Forest Practices Habitat Conservation Plan (HCP), both of which envisioned a fish habitat-based stream typing system under which fish presence/absence surveys would only be relied on where there are independent access-related reasons to question fish use.[i]

2. **The FHAM should rely on permanent natural stream features that are likely barriers, i.e., that have at least an 80% likelihood of preventing upstream fish passage (20% or less likelihood of passage).**

The recommended system relies on field-identification of permanent natural stream features that disconnect fish habitat by making it inaccessible. We recommend that these features be called PHBs consistent with the Fish Habitat Technical Group Memo to Policy that was approved by consensus. These features play a key role in the proposed consensus framework: electrofishing surveys are conducted only above PHBs and only until the first fish is found, at which point fish habitat is presumed to extend upstream until the next PHB. If no fish is found above a PHB using the revised protocol e-fishing survey, the proposed Type F/N break is located at that PHB.

But the consensus framework does not specify how much of an impediment to fish movement a habitat break must pose before it qualifies as a PHB. Is it a two-foot tall waterfall that is a 5% barrier to fish passage, or does it take a 14 foot waterfall that is a 100% barrier to fish passage? The greater likelihood of fish access, the greater the method's reliance on electrofishing and present-day fish distribution, and the higher the risk that low fish density, currently unoccupied, or restorable habitat will be erroneously designated as nonfish water. This is a critical gap that determines whether the FHAM is sufficiently "habitat based" to meet the Board's stream typing objectives.

We urge the Board to act now to set a minimum fish access barrier threshold of at least 80% in order to effectively direct and expedite the necessary technical work to specifically define these features, and to meet the Board's objective to reduce electrofishing.

Rationale: The Board has adequate information and authority to establish an 80% threshold for PHBs, and this decision is consistent with the Board's stated policy objectives in prior stream typing resolutions, rule, the FFR, the HCP and other supporting documentation.

A. A method that relies too heavily on present-day fish distribution as determined by a single point-in-time survey is facially inconsistent with the -010 definition that includes potential (recoverable/restorable) habitat that can be used at any time of the year, particularly given the ecological context.

Below an 80% threshold we would still be relying heavily on present-day fish distribution, which imparts substantial risk of under-identification due to false negatives (the presumption that fish absence equates to non-fish habitat). It is simply not logical or consistent with research on seasonal fish distribution in headwater streams (CMER Seasonal Fish Distribution Report to Policy and the Board, 2006), or consistent with a habitat definition that claims to protect unoccupied and restorable habitat, to survey a connected and accessible stream reach on a single day, not find a fish and then claim it is not utilized at any other time of the year. The 80% threshold is also needed to reach the Board's objective of reducing the overall extent of electrofishing. A lower likelihood that a PHB is an access barrier to fish passage equates to more PHBs within a stream reach and hence, more electrofishing above every PHB.

Present-day fish distribution is not a reliable indicator of fish habitat as inclusively defined in -010 in light of the ecological context for private forestland management. This context is defined by: the continuing legacy impacts of past forest management practices,[ii] depressed fish populations,[iii] high variability in headwater fish distribution both annually and seasonally,[iv] widespread barrier culverts yet to be removed by landowners under RMAP,[v] temporary natural barriers,[vi] e-fisher deficiencies,[vii] and potential conflicts of interest.[viii]

B. This is not the appropriate place to consider potential economic impacts from more accurate identification of fish habitat.

At this juncture, it is the Board's duty to move forward with the development of a rule that meets its management objectives.

Setting an appropriate PHB threshold ensures that the proposed fish habitat assessment methodology will honor the rule definition of "fish habitat" by more accurately identifying currently unoccupied and recoverable fish habitat that is connected and accessible to known Type F waters. This should increase the overall stream length receiving Type F buffers because the current system is prone to underestimating the upstream extent of fish habitat.

Further, the proposed method is not likely to over-identify such habitat because the probability of access level we propose still allows fish absence findings from electrofishing to determine Type F/N break locations above permanent natural features that have a substantial likelihood of passing fish (as much as 20%). This method establishes a reasonable allocation of risk to aquatic resources – much more reasonable than does the current "electrofish to the last fish" system which the Board has already recognized is not consistent with FFR and HCP objectives. We note that the proposed PHB target threshold represents a compromise by accepting the use of protocol surveys above potential habitat breaks that have some chance of passing fish; the original intent of the HCP was for surveys to occur only above complete barriers.

C. **A specific access barrier objective is necessary to focus the technical work required for DNR to set the stream gradient and stream width metrics for PHBs in a timely manner.**

Narrowing the range of accessibility for PHBs will substantially reduce the scope of work required to develop specific PHB metrics, because existing data, analysis and reporting can coalesce around a specific threshold – as opposed to a broad range of potential access barriers – posed by various instream features to fish passage.

In short, if we focus on evaluating the metrics associated with features blocking access more than 80% of the time, then we won't waste resources on searching, sourcing, describing and defining a multitude of features that are lesser barriers to fish access.

The stakeholder-driven Fish Habitat Technical Group (FHTG) repeatedly asked the TFW Policy Committee to set this fish access threshold, but they failed to do so during their dispute resolution mediation process. The final vote taken at Policy on May 4, 2017, was six in favor (Ecology, WDFW, DNR, Eastside Tribes, Westside Tribes, Conservation Caucus, Federal Caucus) and three opposed (Large and Small Landowners and Counties). In the absence of a Policy agreement on a fish access threshold, the decision now falls to the Board. An efficient process for follow up technical work cannot begin until this threshold is set.

3. **The primary metrics for determining PHBs are stream gradient and stream width.**

We recommend that the Board explicitly validate, based on the information before it, that channel gradient, stream width (i.e., BFW, a function of basin area), and the interaction between them, are the primary metrics that determine access and should therefore be the primary determinants of the permanent natural features that determine where electrofishing surveys can be conducted.

This finding is well-supported by the Policy caucuses, the FHTG and the literature. Gradient and stream size are the same indicators currently in rule (WAC 222-16-031) used as default physical criteria defining fish habitat. These default physical criteria are used to type streams upstream from manmade barriers to fish passage (e.g., culverts), and where electrofishing protocol surveys are not deployed. All of the habitat assessment methods evaluated during Policy deliberations recognized the significance of channel gradient and stream width in determining habitat accessibility.

Stream geomorphology (e.g., step pool, pool riffle, cascade, bedrock, etc.) should be identified as an important overlay for relevant metrics. All other metrics are secondary for the purposes of setting metrics to ensure simple, consistent, repeatable implementation of the habitat assessment method.

4. **DNR and WDFW should lead Board-directed technical analysis to select specific metrics for PHBs, considering potential data sources recommended by stakeholder technical advisors.**

The Consensus Framework recommends that the Adaptive Management Program Administrator assemble a group of internal and external scientific/technical experts to assist in determining the metrics to identify PHBs. We further recommend that DNR and WDFW experts lead the group and that the first task should be to request that the members of the "offline working group" known as the FHTG provide available data (along with a description of data limitations) that may support this task. WDFW and DNR should also establish a quality assurance/quality control process to ensure that data used for this analysis are appropriate and not biased.

5. **Establish timelines for FHAM finalization that ensures rule implementation by March 1, 2018, (the start of the next field season) and refrain from remanding further stream-typing matters back to Policy.**

The interim stream typing method has been in place far too long, due in no small part to the difficulties associated with resolving complex natural resource regulatory issues in a multi-stakeholder, consensus-based forum. Policy has exhausted its ability to resolve this issue in the last ten years since the DNR fish habitat model-based maps were not adopted as rule (2006), but significant progress has been made over the past five years in narrowing the scope of the issues in disagreement, which have gone through two formal dispute resolution processes. But the costs in terms of resources and time have been high. We urge the Board to formally recognize that Policy's role in the development of the final stream-typing rule and Board Manual guidance is concluded. The requirements of the Adaptive Management Program are satisfied and the Board is free to act. We are confident that the rule and guidance development processes will allow for adequate stakeholder engagement to fulfill public participation needs.

ENDNOTES

[i] The HCP clearly anticipated the implementation of a permanent water typing system designed to identify habitat without reliance on fish presence surveys and specifically does not consider electrofishing a covered activity or use the term "protocol survey." (Final HCP, Riparian Strategy. Section 4.b.1 (Water Typing Systems, 2005)). Fish presence surveys were intended to be used rarely, mostly above permanent natural barriers: the HCP carved out exceptions to reliance on the originally anticipated model-maps where habitat is believed not to be accessible and fish are not found above the blockage. (*Id*. at 186).

[ii] The legacy effects of past forest and other land use practices continue to have negative effects on salmonid abundance and habitat condition; current forest practices impose many of the same effects, but at rates believed to allow for natural recovery. Forest practices have altered riparian and stream habitats by removing canopy shade and large woody debris, sediment entrainment, and splash-damming; effects include increased water temperatures, lower dissolved oxygen levels, and increased fine sediments in channels. Large pieces of wood are essential for creating and maintaining pools for fish habitat and for storing sediment (Bilby et al. 2003, Hicks et al. 1991, Montgomery et al. 1995). Timber harvest from hillsides, or road construction, can accelerate erosion, alter streamflow regimes and habitats, and present physical obstructions to fish movement. Increased fine sediment levels can have a detrimental effect on different salmonid life history stages (Hicks et al. 1991, Meehan 1991). Low streamflow deficits of 50% of baseflow or greater have been documented where more than 50 % of the watershed area was logged, and those water deficits caused by logging and post-logging forest regrowth persist for at least 40-50 years. Reduced summer streamflow in logged headwater basins may limit aquatic habitat and exacerbate stream warming, and may alter water yield and timing in larger basins (Perry and Jones 2016).

[iii] There is substantial evidence of widespread extirpations and that many of the still extant covered fish populations are at risk and depressed. Present-day fish distribution is affected by a 200+ year history of exploitative fishing, agriculture, and development impacts which have resulted in suppressed fish populations. *See e.g.*, the Final Forest Practices HCP, 2005 (Biological Data on and Factors Affecting Covered Species) (citing NRC 1996 findings on salmonid conservation status) and Final Forest Practices HCP Biological Opinion, 2005, findings on specific salmon and steelhead populations. Overall the HCP finds that well-studied fish populations are depressed by the effects of historical land management and habitat loss from diverse land uses, as well as the effects of fishery management. Pacific salmon have disappeared from about 40 % of their historical breeding ranges in Washington, Oregon, Idaho and California over the last century, and many remaining populations are severely depressed in areas where they were formerly abundant (HCP, 2005). Even in intact watersheds absent manmade barriers, depressed fish abundance can result in depressed longitudinal fish distribution (Reeves et. al. 2011). Suppressed fish populations may not fully utilize all the available habitat (*Id*.), and are more difficult to detect via electrofishing (Electrofishing Workgroup Technical Report, 2016).

[iv] Headwater streams are naturally dynamic, and movement of fish therein is critical to their survival (Hoffman and Dunham 2007). Habitat selection – and thus fish distribution – may change temporally and spatially as physical conditions change throughout the stream (Cole and Lempke 2006, Reeves et al. 2011). Coastal cutthroat trout movements at the reach and segment scales typically occur during the winter and spring, while westslope cutthroat trout have been documented to move extensively in all seasons except summer (Hoffman and Dunham 2007). Coastal cutthroat trout comprise the majority (80%) of our headwater fish populations in western Washington (Trotter 2000). These natural fluctuations can occur over short periods of time: four to six-fold differences in fish densities from one year to the next have been reported for populations of resident cutthroat trout in Pacific Northwest streams (Bisson et al. 1994 and House 1995 in Trotter 2000), directly impacting fish detectability. Though largely untested, such swings could impact distribution resulting in upper limits of fish distribution that are moving points (but only rarely exceeding correctly identified Type F habitat thresholds) (Trotter 2000).

[v] There is ample evidence in the record of the HCP and the published literature of widespread man-made barriers which should be presumed to affect fish distribution. For example, the NMFS-FWS HCP Biological Opinion found that: "Statewide, thousands of miles of fish channels have been rendered partially or completely inaccessible to fish, as a result of road culverts and other water crossing structures (WSCC 2000c; 2000d; 2001b; 2002d)." (NMFS & FWS 2006 at 128). Barrier culverts attenuate fish distribution and, in some cases, isolate and fragment small vulnerable populations of resident headwater fish (Hoffman and Dunham 2007). Through its RMAP program, DNR has documented 7,676 fish-barrier culverts on Washington forestlands. As of 2015, over 2,300 of those barriers have yet to be addressed (WDNR 2014), and RMAP fish passage projects are backlogged and not scheduled for completion until 2021. Further, the State estimates that there are 40,000 barriers to fish passage in Washington at present (WA Fish Passage Barrier Removal Board, 2016). Even those barriers downstream from forestland can impact the distribution of fish in forestlands.

[vi] Temporary natural barriers may be caused by natural disturbances including drought and debris torrents that may temporarily compress fish distribution over a period of years. Single-visit survey data cannot account for intra-annual or interannual variation in the upstream extent of fish distribution (Cole and Lempke 2006, Fransen et. al 2013).

[vii] There are numerous unavoidable limitations to the effectiveness of single-pass point-in-time electrofishing surveys at the upper extent of distribution, discussed by the Electrofishing Workgroup (2016), including low fish abundance, reduced e-fisher efficiency due to reduced conductivity and water temperature, complex cover that inhibits surveyor visibility, and cryptic fish behavior.

[viii] Conflict of interest (COI) is "a situation in which a person or organization is involved in multiple interests, financial or otherwise, one of which could possibly corrupt the motivation or decision-making of that individual or organization" (Wikipedia). COI can exist in water typing because landowners or their consultants perform protocol e-fishing surveys where fish detection impacts the area of required stream buffers. When fish are documented further upstream, the landowner is required to leave more trees standing – reducing timber harvest profit. In this context, COI could lead surveyors to intentionally or subconsciously under-represent the upper extent of fish habitat (Type F) waters.

RECOMMENDATIONS OF BEST PRACTICES REGARDING PROTOCOL SURVEY ELECTROFISHING

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RECOMMENDATIONS OF BEST PRACTICES REGARDING PROTOCOL SURVEY ELECTROFISHING

Results of the Electrofishing Technical Workgroup for TFW Policy Committee

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Technical Workgroup Participants with affiliation:
Jamie Glasgow – Conservation Caucus, Wild Fish Conservancy
Etc.
Etc.

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MAY 3, 2016

FOREST PRACTICES ADAPTIVE MANAGEMENT PROGRAM

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MAY 31, 2016

HEWLETT-PACKARD

FOREST PRACTICES ADAPTIVE MANAGEMENT PROGRAM

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EXECUTIVE SUMMARY

This report summarizes the findings of the Electrofishing Technical Group (ETG) regarding the use and effectiveness of protocol electrofishing surveys in detecting fish. The ETG was asked to consider a number of questions related to the efficacy of backpack protocol survey electrofishing and this report addresses each of those questions with a concluding statement followed by a discussion of the evidence supporting the conclusion. This evidence includes published scientific papers as well as the collective experience of members of the ETG who have strong backgrounds in sampling small streams with backpack electrofishers. Where appropriate, specific recommendations are also given. It is important to note that this is not a consensus document. The authors represent a wide range of experience and perspectives. To avoid misrepresentation of individuals not in agreement with all conclusions and/or recommendations, the word "consensus" is only used in cases where ALL stakeholders agreed. Where there was disagreement by one or more stakeholders, "consensus" is not used to describe conclusions and/or recommendations. . Where appropriate, specific recommendations are also given.

Electrofishing is part of implementing a protocol survey that informs the process of stream typing. While this report presents the group's findings about modern electrofishing techniques and survey protocols, it is important to note that it does not address the question of how electrofishing survey results inform where the F/N boundary (division between fish bearing and non-fish bearing segments of the stream) should be located. Electrofishing is an important tool for informing the process of establishing the F/N boundary but it is not the only tool. It is acknowledged that electrofishing surveys can result in 'false negatives' and that fish habitat may not be occupied by fish during an electrofishing survey; other types of data inform the water typing process and should be used for this purpose. Our report is restricted to questions about the protocol electrofishing survey technique itself.

A large number of questions were put to the ETG and there was considerable subject overlap among some of them. Rather than repeat each of the questions in the executive summary, we summarize our findings relative to four general topics: (1) probability of detection, (2) adequacy of single site visits, (3) seasonality of fish occupancy, and (4) harm to individual fish or their populations. More detailed answers to specific questions are found in the body of the report.

1. *Probability of detection*

Electrofishing remains the most common method by forest landowners and managersof choice for establishingdetecting fish presence in headwater streams. Such sites are typically characterized by channels that do not easily lend themselves to other types of fish sampling. Other survey technologies such as environmental DNA (eDNA) are under development and refinement and show great promise, but electrofishing is still the most widely used, effective and efficient method at this time. Site characteristics including water chemistry and clarity,

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stream size, and ~~instream habitat complexities~~the presence of structures in the water that provide escape cover (e.g., undercut banks and log jams) affect capture efficiency, making it impossible to confirm with absolute certainty that fish are absent from a site. However, in the majority of cases electrofishing is the preferred method of detecting fish presence in headwater streams and ~~at present~~ is the technique most likely to provide accurate information.

2. Adequacy of single site visits

In most situations, single site visits performed at the appropriate time when fish are most likely to be present~~Single site visits~~ are believed to be sufficient to establish fish presence, particularly when surveys extend at least one quarter mile ~~upstream of~~above the location of the last sampled fish. ~~The consensus~~ Most members of the ETG believe ~~was~~ that multiple site visits are generally unnecessary~~not necessary~~ provided the survey protocols are followed and conditions for electrofishing are favorable. ~~This includes sites above natural and man-made barriers to fish passage.~~

3. Seasonality of sampling

The current protocol electrofishing survey guidelines provide a sufficient time window for electrofishing when flows are typically low or declining, but not at the lowest point in the hydrologic year. The ETG acknowledges that seasonal fish movements occur, but based on limited~~current~~ evidence the occupied length of perennial headwater streams may~~does~~ not change much over a year (Lemke and Cole 2006) in the absence of ~~extremes in flow or~~ significant channel altering events such as debris flows. Therefore, surveys carried out according to the existing timelines have a high likelihood of detecting fish if they are present at a site provided the survey protocols are followed and conditions for electrofishing are favorable. However, it is important to note that the upper extent of fish use in seasonal channels can be substantially underestimated when such channels are sampled during reduced flows that may occur during the latter half of the sampling season in Western Washington.

~~3.~~4. Harm to fish or fish populations

In most situations, protocol electrofishing surveys are unlikely to result in harmful demographic effects on headwater fish populations as long as appropriate precautions are taken to avoid damage to active redds, damage to instream and riparian habitats, or to cause extensive downstream movement of population members. Special cautions or postponement of electrofishing surveys should be exercised if the survey reach may ~~population is known to~~ contain very few breeding individuals (scientific literature suggests 25 breeding pairs as a lower threshold). The electrofishing technique itself does have the potential to harm fish~~individuals~~ and eggs exposed to electrical fields. ~~Fish spinal~~Spinal injuries are most common ~~and can go undetected at the time of the survey~~. The risk of injury can be minimized by employing modern equipment and using settings that are least harmful to fish. The ETG suggests that training and possible certification of electrofishing crews can also reduce risk ~~to fish populations~~, as well as ensuring that protocol surveys are conducted in a consistent ~~and meaningful~~ manner.

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ACKNOWLEDGMENTS

The following individuals were instrumental in evaluating the technical issues surrounding protocol survey electrofishing. Brandon Austin, Eric Beach, Pete Bisson, Patrick Cooney, Chris Conklin, Doug Couvelier, Jon Drake, Brian Fransen, Jamie Glasgow, Debbie Kay, Kris Knutzen, Ashlie Laydon, Derek Marks, Tim McBride, Chris Mendoza, Blake Murden, Don Nauer, Kris Northcut, Rod Thysell, Jason Walter, and Sarah Zaniewski. Their participation does not imply wholesale endorsement by them or their caucus for each recommendation contained within this document.

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INTRODUCTION

The Type F Permanent Water Typing Rule has been a Forest Practices Board (Board) and Policy priority for the past several years. The issue went through Stages 1 and 2 of the dispute resolution process, ending in the submittal of majority/minority reports to the Board in February 2014. At that time the Board directed Policy to work on two specific issues that are necessary for development of a permanent rule (electrofishing and off-channel habitat). By directing the issue back to Policy with more specific guidance, the Board continued following the adaptive management process for resolving formal disputesdispute according with the adaptive management board manual (Section 22) on those two components.

At its February 2014 meeting, the Board approved a motion associated with development of a permanent water typing rule, and both the Board and Policy work plans were amended to reflect the motion. The identified steps are essential for the Board to consider when making a final determination of the appropriate approach to take in the development of a permanent water typing rule. Policy was directed to complete recommendations for options on a permanent water typing rule, beginning with two tasks: (1) development of "best practices" recommendations regarding protocol survey electrofishing, including an evaluation of published relevant literature, minimizing potential site-specific impacts to Incidental Take Permits covered species, and options for reducing the overall extent of the surveys' use, and (2) an evaluation of the current rule process to identify off-channel habitat under the interim water typing rule, including recommended clarifications in field implementation guidance, or rule language. The evaluation must be based, in part, on field review of approved Forest Practices Applications and water type modification forms.

The motion adopted by the Board directed Policy to evaluate electrofishing best practices in the context of protocol surveys, not electrofishing as a general practice. The Board motion also asked that Policy convene a technical group to help evaluate these best practices. The AMPA convened a technical group that included practitioners and other caucus representatives to identify best practices regarding electrofishing within the context of protocol surveys, including how to reduce site-specific impacts of practices of protocol survey electrofishing and how to reduce the overall extent of the surveys' use. This document is produced by the technical group to meet the intent of a "best practices recommendation".

Policy reviewed a draft work plan for what the technical group would do to meet the Forest Practices Board motion, which included a list of items that the technical group would review/consider. Policy specifically asked the technical group: "What can the technical group identify to inform Policy's recommendations on how to reduce site-specific impacts of electrofishing and the overall extent of the protocol surveys' use?" To assist the technical work group, Policy generated a list of questions and concerns the technical group should consider (including implementation issues and other relevant documents and questions previously raised by Policy including – memo from UCUT to AMPA (Dec 2013), Tech/Op memo, FFR sections, draft water typing Charter documents (2013), comments to the draft electrofishing literature review (May/June 2015), comments to the electrofishing workshop summary (Feb 2015), etc.). The AMPA convened the technical group (ETG) in October 2015.

The technical group was tasked with identifying technical and scientific issues related to the application and use of electrofishing associated with the protocol surveys to determine how it may be possible to maximize the efficient and effective application of all available information including electrofishing to minimize both site specific impacts to Incidental Take Permit relative to Endangered Species Act-listed fishes and the overall use of electrofishing. Members of the technical group were in complete agreement that the final product of their work must be grounded in science. With this in mind their first action was to draft a purpose statement to guide the development of a final product. The resulting purpose statement of this report is:

"Use science and data to develop "best practices" recommendations regarding protocol survey electrofishing, including an evaluation of relevant literature, to minimize potential site-specific impacts to all fishes including Incidental Take Permit covered species, and identify options for optimizing the overall extent of the surveys' use."

The technical group was initially tasked with a set of questions regarding the use of protocol surveys in water typing consistent with their purpose statement, identifying which questions/concerns from the items provided by Policy they considered relevant to the electrofishing topic and which issues they would not address as part of the electrofishing review process. The technical group identified those questions and concerns outside their purview ~~or expertise~~ so Policy would be able to address them through other venues.

This report summarizes the issues identified, topics addressed, and proposed recommendations that resulted from the technical group's work. The ETG notes that there was overlap among some of the questions we were asked to address; therefore, there is some duplication of content in several of the answers.

RESPONSES TO POLICY'S QUESTIONS

Responses were developed to assist members of Policy in responding to the Board's February 2014 Motion. Questions have been separated into five categories: site specific impacts of electrofishing on fish, optimization of the overall extent of survey use, seasonal distribution of fish and timing of surveys, alternatives to electrofishing, and training and/or certification.

SITE SPECIFIC IMPACTS OF ELECTROFISHING ON FISH

1. Do single visit surveys affect fish populations?

Conclusion:

Under most survey conditions, population-scale damages from a single visit protocol electrofishing survey seem improbable. Exceptions can occur where surveys affect very small breeding populations of fish that are isolated above natural or man-made barriers to fish passage.

Discussion:

It is important to recognize the difference between the effects of electrofishing on individual fish and the effects of electrofishing surveys on fish populations. Potential physiological impacts of electrofishing on individual fish and fish eggs are discussed below. Population-level impacts caused by electrofishing can occur if surveys cause significant alterations of Viable Salmonid Population (VSP) parameters – population abundance, population growth rate, population spatial structure, or population diversity – such that the long-term viability of a fish population is compromised (McElhany et al. 2000). To determine potential electrofishing impacts on VSP parameters it is necessary to know the effective population size (number of breeding individuals) in a local population and the possibility for immigration into or emigration from local breeding populations to occur, both of which can influence the true effective population size. Large populations are less vulnerable to harm from single visit surveys than small populations in cases where a site visit affects a relatively small fraction of the overall breeding group. Small, closed populations on the other hand are at greater risk of harm if electrofishing results in impairment of the reproductive success, survival, or distribution of a significant fraction of breeding adults. Nielsen (1998) suggested that an effective population size of 25 or fewer breeding pairs of trout could be vulnerable to potential electrofishing damage. In practice it is very difficult to know the number of potentially breeding adults in a population without sampling the population's entire distribution and being aware of the distribution of natural and man-made barriers to migration.

Most fisheries managers seek to obtain data on the total abundance of fish inhabiting a particular stream system. However, for smaller, high-order, streams, such abundance data may not exist. In the absence of data for the total abundance of a population, effective population size may serve as a surrogate for abundance. Since effective population size focuses solely on the relative genetic contributions of adults, the concept does not account for abundance of egg to fry, and fry to smolt, life stages, nor does effective population size necessarily reflect the carrying capacity of a particular habitat. For ESA-listed populations, VSP criteria may matter more than simple estimates of abundance. This becomes critical where sensitive populations that are important to recovery of ESA-listed stocks inhabit headwaters that do not support large numbers of adults.
In most cases, trout will occur higher in a drainage network than non-salmonid species. The following tables give the species identified in last fish surveys conducted in western (Fransen et al. 2006) and eastern (Cole and Lemke, unpublished) Washington CMER investigations.

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Table 1. Species present within the stream reaches immediately below the terminal upper limits of occurrence among streams in western Washington State. More than one species was identified at some sites.

Species	Sites where present	
	Percent	Number
Cutthroat trout *Oncorhynchus clarkii*	88.9	256
Sculpin *Cottus* spp.	10.4	30
Coho salmon *Oncorhynchus kisutch*	5.2	15
Rainbow trout *Oncorhynchus mykiss*	2.8	8
Brook trout *Salvelinus fontinalis*	2.1	6
Threespine stickleback *Gasterosteus aculeatus*	0.3	1

Table 2. Fish species observed in each watershed during 2002 last fish resurveys in eastern Washington (Cole and Lemke, unpublished data).

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Watershed	Cutthroat trout	Brook trout	Bull trout	Redband trout	Sculpin spp.
Big Sheep		X			
Cabin	X				
Cooper	X	X			
Deer	X	X			
Le Clerc	X	X			
Naneum	X				X
NF Deep	X				
NF Touchet			X	X	
Rattlesnake	X				
Taneum	X	X			

Previously, trout inhabiting small headwater streams were believed to reside in fresh water throughout their life histories and to undertake limited, if any, migrations. Evidence supporting this assumption came largely from marking studies in the UK where the same fish was captured on successive years from the same small stream, often from the same pool (Elliot 1989). If it is assumed that headwater resident fishes do not move, one consequence is that riverine drainage systems contain a mosaic of breeding populations substantially isolated from each other as a result of restricted or absent gene flow. In theory, this can lead to very small effective population sizes in tributaries where trout have access to short segments of the channel and where interbreeding among adjacent tributary populations is absent or minimized.

More recent evidence suggests that movement of adult trout among headwater streams does occur where no natural or unnatural fish passage barriers are present, even though the same fish can occasionally be found at the same place at certain times of the year. Fausch and Young (1995) documented the movement of adult Cutthroat Trout among headwater tributaries in the northern Rocky Mountains and suggested that the ability to move around was an important adaptive mechanism for surviving in seasonally variable and often unpredictable environments. Walter et al. (unpublished CMER study) found that nearly 100% of the fish sampled and tagged immediately below the F/N break in western Washington were absent from the same reach a year later, yet densities often were similar year to year. The development and refinement of PIT-tag (passive integrated transponder) technology has facilitated a better understanding of fish movements in small Pacific Northwest streams, and since PIT-tags have been widely employed most monitoring studies have concluded that movement is widespread and is an important attribute in resident fish life histories. However, large-scale PIT tagging of juvenile fish creates its own set of risks, primarily due to tag burden, sub-lethal tag effects, and delayed mortality.

It is possible that single site visit surveys could directly affect small headwater fish populations, but damaging effects would only occur under specific circumstances. The population inhabiting the stream segment of interest would have to be truly isolated by an impassable barrier from the recruitment of new adults moving up into the stream. That is, fish could leave the segment by moving downstream but new recruits would not be able to enter the population by moving upstream. The location of such specific circumstances in Washington's watersheds has not been fully mapped, but isolated Cutthroat Trout populations upstream from natural and/or anthropogenic barriers are common in the Pacific Northwest (Guy et al. 2008). In these watersheds, a single debris flow or other large disturbance can cause an immediate decrease in intra-population genetic diversity that persists in locations where no subsequent immigration to the population occurs (Guy et al. 2008). Based on available evidence, headwater fish populations upstream from natural and man-made migration barriers are vulnerable to genetic and demographic harm if surveys cause a loss of adult fish that reduce the breeding population size to a level that impairs one or more VSP parameters. In102 protocol site visits in 2015, Weyerhaeuser scientists usually encountered fewer than 4 fish in a population survey (graph below, unpublished data of B. Fransen). Therefore, the breeding population would have to be very small and the site visit would have to result in displacement, reproductive impairment, or mortality of adults in order to result in an impact that could be detected at the~~cause~~ population level~~ impacts~~.

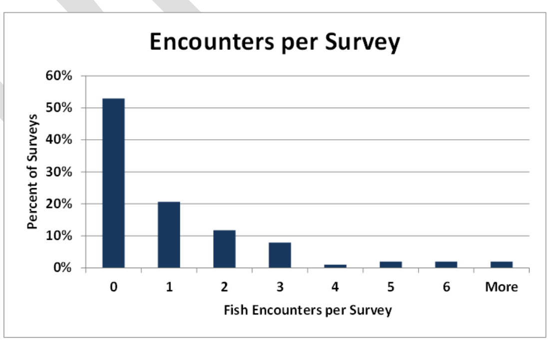

Figure 1. Number of fish encountered per survey at 102 protocol survey sites (B. Fransen, unpublished data).

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Commented [J5]: Interesting to note that >45% of Weyco protocol surveys encounter 1 or more fish…

Based on DNR's RMAP (Road Maintenance and Abandonment Plans) reports, the vast majority of impassible culverts that have been removed and/or replaced are located in the lower portions of watersheds as a result of RMAP's prioritization of anadromous fish passage (DNR annual RMAP reports, DNR / WDFW fish passage database). Impassible culverts historically installed in steep headwater areas are often located underneath deep road fills making them very costly to replace with fish passable culverts. Impassable headwater culverts yet to be replaced can isolate fish populations and form boundaries for areas within watersheds where negative impacts from electrofishing could occur if isolated breeding populations upstream of the barriers are very small.

The barrier effect could be exacerbated if there was significant downstream movement of fish from the sampled reach as a result of volitional avoidance of the electrical field or disturbances related to wading in the stream, or alternatively, if there was drift of stunned fish downstream during the electrofishing procedure itself. To have a significant effect on the population, fish moving downstream out of the sampled reach would need to pass over the barrier that would prevent them from moving back into the site. Finally, a fish population could be negatively impacted if single visit electrofishing led to immediate or delayed mortality of enough shocked individuals or eggs to cause a significant reduction in one or more VSP parameters.

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As outlined above, the potential to reduce the number of breeding adults depends on the geomorphic setting of the stream segment in question and the ability of new colonists to move into the site, thus expanding the effective population size. It is important to note that even in intensively monitored watershed studies where headwater populations (not isolated) have been repeatedly electrofished for a decade or more (Hall et al. 1987; Hartman et al. 1987) there is no direct evidence that long-term harm to salmon and trout populations related to electrofishing has occurred. Given the importance of understanding the effects of protocol single site visits on headwater fishes, additional studies focusing on the demographic and genetic impacts of electrofishing on small populations would be helpful.

<u>Recommendations:</u>

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Careful attention to electrofishing technique minimizes risks to individual fish, prevents both adults and juveniles from being driven downstream out of the site, and blocks egress from shocked areas by stunned fish, thus reducing the likelihood of long-term demographic impacts. Environmental conditions that may compromise the effectiveness of an electrofishing survey include extremes in flow (low or high), turbidity, extremes in conductivity and water temperature (low or high, see NOAA and e-fishing equipment manufacturers guidelines), and dense or impenetrable riparian vegetation. Carrying out effective surveys using techniques that result in low risk to fish populations will require careful adherence to protocols and board manual guidance, particularly NOAA electrofishing guidelines for ESA-listed fish and WDFW Scientific Collection Permit conditions, and in-depth training that provides both proper instruction to electrofisher operation as well as hands-on field experience. It may be helpful to conduct repeat surveys in a small subset of sites for quality control purposes.

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Specific recommendations include:

- Use electrofisher settings appropriate for a stream's conductivity.
- Ensure environmental conditions at time of survey are appropriate and within limits of protocols.
- Follow manufacturer recommendation on when and how to use equipment.
- Avoid electrofishing over active redds.
- Minimize walking in the stream.
- Use block nets at the downstream end of the survey reach to capture more cryptic species (e.g., shorthead sculpin).
-
- Use procedures to minimize egress of fish
- ~~w~~Where small isolated populations are suspected c~~, C~~onsult DNR RMAP reports to help identify where these sites may exist.
- Ensure adequate training of survey leads and crews.
- Evaluate the efficacy of a certification program for electrofisher operators following the USFWS "qualified individual" model used in Section 10 permits.

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2. Is there evidence of direct harm from electrofishing on incubating eggs and gravid females (especially in headwaters where cutthroat spawn)?

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Conclusion:

With proper training, experience, and equipment, direct harm from electrofishing can be minimized. However, the procedure itself has the potential to harm all fish life history stages through lethal and sub-lethal injury and stress.

Discussion:

Electrofishing has been used as a survey tool for more than a half century. Over that time there have been many advances in sampling technology as well as a number of studies on the specific effects of electrofishing on physiological performance. Nielson (1998) provides a useful synthesis of electrofishing impacts on trout populations in the Sierra Nevada Mountains of California. Relative to Question 12, potential harm from protocol surveys goes beyond harm associated directly with electricity effects. A two-person survey team walking carelessly through wadeable channels during a spring survey window can impact eggs and alevins in active redds. Cutthroat Trout typically spawn from late winter to early summer, depending largely on a stream's thermal and discharge regimes, with eggs potentially incubating at spawning locations from March to July. Steelhead or resident Rainbow Trout typically spawn between December and June, with eggs incubating at spawning locations throughout that period or longer. Physical damage to incubating eggs can take place if redds are disrupted by wading when eggs and alevins are crushed or washed from the egg pocket. Owing to their small size, resident Cutthroat or Rainbow Trout inhabiting headwater streams

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do not excavate deep redds and the substrates selected for spawning are composed of smaller gravel than those selected by larger, anadromous salmonids. Eggs may be deposited only a few centimeters below the substrate surface where they may be vulnerable to wading; therefore, it is important for surveyors where possible to avoid wading in stream habitats likely to be used for spawning such as pool tail-outs and low gradient riffles with small to medium diameter gravels. In most cases spawning, gravel incubation, and fry emergence have been completed by early August, and surveys after that time have reduced likelihood of impacting reproductive success.

Evaluating the direct physiological harm from electrofishing to eggs and gravid females is more difficult because electrofishing equipment has been increasingly refined over the years and the published literature on the effects of electrofishing on developmental physiology, based on older technology that is no longer be used, can be outdated. Nevertheless, what literature does exist points to the possibility of some electrofishing-related injury (Sharbor and Carothers 1988; Thompson et al. 1997), although the injury rates have been found by some investigators to be low if proper techniques are followed (Ainslie et al. 1998; McMichael et al. 1998). Spinal injuries, by far, are the most commonly cited injury type and such injuries occur when rapid contraction of muscles during electric shock causes vertebrae to deform or fracture. This can happen at any life history stage.

Visible evidence of electrofishing-related injury does not always reveal the extent of spinal damage. In one study, 40% of fish held in aquaria for a year after exposure to electrofishing showed X-ray evidence of some spinal injury, whereas only 2% exhibited external signs of injury immediately after being shocked (Dalbey et al. 1996). Voltage, wave form, and pulse rate can affect egg development, although some authors believe that the potentially harmful effects of increased voltage are more important than either wave form or pulse rate (Dwyer and Erdahl 1995; Roach 1999). Sharbor and Carothers (1988) found that exponential and square wave pulse patterns were less harmful than quarter-sine waves, and virtually all investigators recommend that surveyors utilize the lowest possible voltage with a wave form that causes the least injury to eggs, juveniles, or adults. However, the ability of electrical currents to effectively stun fish is size-dependent; voltages and wave forms optimized for capturing adult trout are not the most effective for fry, and vice-versa.

The best equipment settings will likely involve a compromise between shocking effectiveness and the potential for injury, a compromise best gained through experience and by adherence to NOAA electrofishing guidelines (http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf), as well as any state permit requirements. The NOAA guidelines state "Electrofishing in the vicinity of adult salmonids in spawning condition and electrofishing near redds are not discussed as there is no justifiable basis for permitting these activities except in very limited situations (e.g., collecting brood stock, fish rescue, etc.)". In addition, because of temperature-related physiological stress associated with warm summer conditions, the greatest risk to ESA-listed fish during surveys may consist of failing to follow stream temperature restrictions on electrofishing during warm survey periods.

Recommendations:

~~The ETG reached consensus that minimizing~~Minimizing harm to individual fish and eggs will require that:

- Surveyors be properly trained and experienced.
- The proportion of the stream exposed to electrofishing be limited.
- Surveyors use modern~~Modern~~ equipment and machine settings that cause the least amount of damage while still effectively detecting fish.
- Available knowledge of potential fish use in and/or upstream of reaches being surveyed (~~previous survey results,~~ species, size, spawn-timing, etc.) be utilized.
- The amount of physical disruption to the channel be minimized.
- Electrofishing surveys are preceded by visual surveys
- Use of alternatives to electrofishing (physical criteria per WAC) is encouraged
- Innovative alternative approaches (ex. eDNA) are developed and refined~~.~~

3. What is currently being done to reduce site-specific impacts *of protocol electrofishing surveys*?

Conclusions:

Landowners currently have several options ~~available~~ to reduce site-specific impacts of single visit surveys. While some of these options are described in Board manual guidance, they are not rules and therefore the extent to which these options are used is currently unknown.

Discussion:

Several options exist to minimize site-specific impacts of single visit surveys, including:

~~(a) WAC 222-16-031 provides physical characteristics of channels that are presumed to have fish use. These 'physicals' can be used to classify streams where fish use has not otherwise been determined, eliminating the need to electrofish over potentially small and/or isolated fish populations. Section 13 of the FPBM, incorporated by reference in the WAC, states that 'above human-made fish blockages, physical criteria are used to determine the presumption of fish use unless otherwise approved by the DNR in consultation with the WDFW, WDOE, and affected Tribes' (Part 2). Section 13 (Part 6) also states "where field surveys for determining fish use have not been done, water type is determined by applying the physical characteristics contained in WAC 222-16-031(3)."~~

~~(b)~~(a) Follow protocol electrofishing survey guidelines using the best available equipment and careful survey procedures. Careful attention to the setting of the stream reach in question (appropriateness of an electrofishing survey, flow regime, presence of passage barriers, suitable fish habitat upstream and downstream), employing electrofisher~~fish~~

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~~shocker~~ settings that result in the least injury while providing for effective capture, avoiding excessive wading in the channel (especially in potential spawning habitats), and taking care to prevent the downstream displacement of fish when performing the survey all contribute to reducing site-specific impacts.

- Conductivity is used to measure the concentration of dissolved solids that have been ionized in a solution such as water. The unit of measurement commonly used is one millionth of a Siemen per centimeter (micro-Siemens per centimeter or µS/cm). Charges (electrons) transfer along these ions between the two electrodes of the electrofisher. Higher conductivity allows for easier transfer of electrons and lower conductivity causes reduced transfer of electrons. ~~One~~The key to successful electrofishing is to minimize the difference between the internal conductivity of a fish and the ambient conductivity of the surrounding water. Fish are generally accepted to have a conductivity of 115 microSiemens/cm (Miranda 2009).

~~(c)~~(b) Use visual observation prior to electrofishing. Visually spotting fish from the stream bank does not injure fish or eggs, and in most cases a visual survey should precede an electrofishing survey. ~~it is possible to identify fish to the species level based on known distributions of species in the drainage~~. However, relying solely on visual observations to determine fish presence is more prone to false negative errors than electrofishing, i.e., concluding that fish are not present when in fact they are. Visually observing fish in very small streams can be especially difficult when the channel is small, the fish species present are small and/or cryptic, ~~the~~ fish abundance is low~~populations are small~~, water is turbulent, and~~/or~~ cover is abundant. For bottom-dwelling species that are occasionally the uppermost stream residents such as sculpins or lampreys, visual observations are virtually impossible. While visual observation is an acceptable method to document fish presence, it is not an acceptable tool for documenting fish absence.

~~(d)~~(c) When appropriate, use an alternative technique for determining presence such as environmental DNA (eDNA). This technique is very benign compared to electrofishing because it simply involves filtering several liters of stream water and assaying it for DNA from species of interest. While this technique is currently gaining traction~~, many investigators still feel that~~ it risks false negative errors when target species are rare and thus contribute a very small fraction of detectable DNA in the sample. Still, false negatives from eDNA are demonstrably less likely than false negatives from e-fishing as eDNA. The difficulty is substantially more sensitive at detecting species presence/absence than electrofishing (Wilcox et al. 2015~~6~~). Further, with the growing use of this innovative tool~~compounded when~~ the library of reference DNA genetic markers~~sequences~~ for species of interest is expanding. A~~incomplete. Nevertheless, a~~ recent study demonstrated that improvements in the technique have the potential to make it a more reliable tool for headwater fish detection (Wilcox et al. ~~2016~~2015), and continued technique refinement and development of reference genetic libraries may make eDNA a viable alternative to electrofishing in the future.

~~(e)~~(d) Survey coordination. Contact WDFW, local Tribes, private landowners, DNR, and/or NGOs to determine what surveys have already been performed in the watershed of

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Probability of detecting 3 fish / 100m is nearly 100%, substantially more sensitive than traditional electrofishing (Wilcox et al 2016).

The eDNA challenges to overcome are the marker library, and the fact that it helps map point-in-time fish distribution, not the distribution of fish habitat

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interest. –Understand the biology and ecology of the fish species that may be present in the survey area, and plan surveys in a manner that increases likelihood of encountering fish if they are present while avoiding harm (i.e. electrofishing over incubating embryos).

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Recommendation:

- Training and/or demonstration of requisite experience is needed for all field crew leaders. Electrofishing can have direct impacts on fish and under specific circumstances can have population-level impacts. Electrofishing protocol surveys are performed by individuals and organizations representing a wide range of backgrounds and experience. To ensure the proper level of consistency, effectiveness, optimization, and accountability, survey leader proficiency should be demonstrated periodically and survey crew members should be instructed in correct techniques, such as: Training as it relates to issue of impacts.
- Type of equipment – proper use including equipment settings.
- Prior investigation of fish presence (pre-mission planning).
- Create a widely available database ~~(central clearinghouse) – look at source for acceptability under Forest Practices for screening and/or decision making.~~ of known fish distributions. If changes to ~~hydrography~~stream location or water types are proposed and accepted for ~~an~~a FPA~~,~~ those changes should be reflected in ~~FPARs or some other central~~a centralized GIS ~~clearinghouse~~database to prevent unnecessary surveys in the future.
- –WTMFs should not be optional..
- Reduce impact by limiting length of stream surveyed.
- ~~Use~~Assess usinge alternative methods for documenting fish presence ~~prior to e-fishing.~~.
- Personnel guidelines (number of staff).
-
- Avoid multiple site visits during appropriate season once fish presence determined.
- Environmental conditions at time of survey – ensure that conditions are appropriate and within limits of protocols.
- Be aware of isolated habitats and existing stressors.
- Encourage use of physical criteria for presumed fish use in lieu of e-fishing as provided in the WAC.

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4. What is the availability of state and/or federal agencies to provide electrofishing and protocol survey assistance to landowners?

State and federal agencies do not currently provide this service. Private consulting firms, NGOs, and tribes have offered electrofishing assistance to landowners.

OPTIMIZATION OF THE OVERALL EXTENT OF SURVEY USE

1. Are surveys ineffective at low flow?

Conclusion:

Based on practitioner experience and site characteristics such as water chemistry, protocol electrofishing surveys are generally effective at ~~detecting fish during~~ low flow conditions when those flows fall within the normal long-term range for a given stream and time of year.

Discussion:

The ETG interpreted ‘low flow’ to represent average flows that fall within the normal long-term range for a given stream and time of year. With that limited interpretation, the ETG found~~There was general agreement that~~:

- Protocol electrofishing surveys are generally effective at low flow.
- Periods of low flow may, in fact, represent the most effective time to survey due to there being more fish per unit channel area, clear water conditions, etc.
- In cases of extreme low flow conditions, electrofishing effectiveness may be compromised when stream depth is too shallow for electrode submersion. The most acute example is when a stream reach dries up completely. In these cases, the loss or lack of flow can reduce or eliminate the opportunity to detect fish and thereby impair survey effectiveness.
-
- Reduced fish distribution resulting from reduced flows must be accounted for in considering protocol survey results and making an F/N determination during low flow. Some small and/or seasonal F streams will be dry, or nearly so, at ‘low flows’ during the survey window.

With regard to isolated habitats and existing stressors, there are no published environmental thresholds for determining when habitats are too physically isolated (presumably, this means situations where flows are intermittent and fish are concentrated in a few pools) or water quality conditions are such that stress on fish associated with electrofishing would be likely to cause injury or death. However, when surveying ESA-listed fish, NOAA electrofishing guidelines contain specific temperature thresholds above which electrofishing is not permitted. Fish that remained stunned for extended periods of time may become easy prey for predators. Protocol experience and training sessions should discourage surveyors from electrofishing in residual pools where inhabitants are likely to be temperature- or food-stressed, and/or exceedingly susceptible to predation. Experience and professional judgment on the part of the surveyors will be needed when deciding whether or not electrofishing is appropriate.

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Commented [J11]: What about when flows fall below the normal long-term range for a given stream and time of year? Do summer 2015 flows (and other drought years) become part of the ‘normal long-term range’ against which future years are considered?

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2. Are surveys ineffective at high flow?

Conclusion:

Based on practitioner experience, protocol electrofishing surveys can be effective at detecting fish during high flow conditions when those flows fall within the normal long-term range for a given stream and time of year.

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Discussion:

The ETG interpreted 'high flow' to represent average flows that fall within the normal long-term range for a given stream and time of year. With that limited interpretation, the ETG found: ~~There was general agreement that:~~

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- Protocol electrofishing surveys are not "ineffective" at high flow, but may be "less effective" than at normal or low flow.

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- High flow conditions may not represent the optimal time to conduct protocol electrofishing surveys. Furthermore, there is a high flow threshold where surveys should not be conducted due to potentially difficult (and unsafe) sampling conditions resulting from increased water volume and depth, higher stream velocity, higher stream turbidity and/or reduced fish response to the electrical field. These conditions may result in reduced likelihood of detecting fish which could result in "false negatives".
- Surveyors tend to avoid sampling in high flow conditions so this may be a non-issue in practice. Unfortunately, in some situations fish distribution is at its greatest extent during high flows, when the upper extents of watersheds can become wetted and accessible.

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3. Are protocol surveys ineffective in streams over 5 feet wide?

Conclusion:

Based on practitioner experience, protocol electrofishing surveys are generally effective ~~at detecting fish~~ in streams greater than 5 feet bankfull width.

Discussion:

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For the purposes of this discussion the ETG interprets the "5 feet wide" criteria to mean channel bankfull width (BFW) because that is the stream metric referenced in Board Manual 13. Some research investigating the relationship between stream channel size and overall electrofisher effectiveness/efficiency has been done, however, results are highly variable. Kruse et al (1998) found that stream width was the most important measured stream variable that influenced capture probability and catch efficiency. Weyerhaeuser Company (unpublished data for CMER) shows a catch efficiency of 84% (16% probability of not capturing fish) for streams that are 1 meter wide, 82% (18% probability of not capturing fish)

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for streams that are 2 meters wide, and 79% (21% probability of not capturing fish) for streams that are 3 meters wide. This report states: “Stream width appears to be a poor predictor of likely catch efficiency within the ranges of stream widths typically encountered during (protocol) electrofishing surveys.”

Protocol electrofishing surveys are not generally ineffective in streams over 5 feet wide, but electrofishing effectiveness can be negatively correlated with stream size. Larger streams may have a higher expectation or presumption of fish use. These larger streams also have a wider cross-sectional area and deeper water column that may require more electrofishing effort (e.g. multiple electrofishers, multiple surveys) in order to increase the probability of detection.

Recommendation:

The metric of “5 feet wide” (BFW) should be revisited, as this does not necessarily represent what practitioners would consider a “larger stream” in the context of protocol electrofishing surveys. ~~–~~Further, an upper limit should be provided as e-fishing effectiveness will diminish as channel width increases past some upper threshold.

4. Is ¼ mile sufficient to demonstrate fish absence?

Conclusion:

Protocol electrofishing surveys conducted over a distance of ¼ mile upstream from the last detected fish are generally sufficient to indicate fish absence with a high probability.

Discussion:

For the purposes of this discussion the “¼ mile” criterion is in reference to the surveyed stream length upstream of the last detected fish. Published data supports the assertion that the ¼ mile survey criteria is generally sufficient to demonstrate~~indicate~~ fish absence. Bliesner and Robison (2007) report that: “In streams with low gradient a minimum of 300 m should be surveyed… In streams where a gradient break of a minimum of 8-12% exists this study has indicated that 60 m is sufficient to indicate the Class I (fish bearing), Class II (aquatic life) break.” ~~There was general agreement among the ETG that if fish have not been detected within ¼ mile survey and there is no potential habitat upstream (including above permanent, temporary or gradient barriers), then absence is implied.~~ However, the need to survey additional distance upstream from the last detected fish may depend on habitat type, stream size, water level, and other stream properties.

5. Are multiple surveys necessary to indicate~~demonstrate~~ absence?

Conclusion:

Multiple protocol electrofishing surveys conducted on a single stream segment are not generally needed to indicate fish absence. However, there may be exceptions where stream

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size, atypical flows, seasonal or annual fish distribution patterns, recent restoration of fish passage, or recent channel disturbances suggest that multiple surveys would be worthwhile.

Discussion:

The single survey criterion is usually sufficient depending on habitat type, stream size, water level, etc. For the purposes of this discussion the term "multiple surveys" means surveys conducted at a single site over multiple days, seasons, and/or years, not multiple survey passes conducted on a single day. Some published data (Cole et al. 2006) supports the assertion that a single protocol electrofishing survey is generally sufficient to indicate fish absence. The authors, however, do acknowledge the fact that: "Longer term studies that include sampling over a wider range of stream flows and that occur after catastrophic environmental events may further characterize variability in the upper limits of fish distribution". There was general agreement within the ETG that in specific instances where seasonality in fish distribution may be expected, where flow conditions at the time of an initial survey are not "normal", or when a survey is conducted in very wide streams channels, additional survey effort may be necessary. In addition, stream segments that ~~ ~~have recently-removed barrier culverts or have been subject to recent channel disturbance events such as debris flows may require additional survey effort (even in subsequent years), particularly if stream conditions have been significantly altered.

6. Are surveys effective above man-made barriers where fish occur above the barrier?

Conclusion:

This does not address the appropriateness of e-fishing above man-made barriers outlined in BM 13. There was non-consensus within the ETG, but based~~Based~~ on some practitioner's~~practitioner~~ experience, protocol electrofishing surveys are ~~generally~~ effective in stream reaches above man-made barriers where viable fish populations exist ~~ ~~if such a determination can be made with confidence, and where the abundance and/or species composition of fish within that reach ~~isdoes~~is not ~~appear to be~~ influenced by the presence of the man-made barrier.

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Commented [J16]: In a sense, the answer is yes – the tool is just as (in)effective below as above a barrier. The issue is what do you do with the information (a 'hang the flag' question).
1)Per Board Manual 13, not finding fish above a barrier can not be used to justify type N.
2)Finding "few" fish above a barrier should necessitate ending e-fishing and force relying on physicals.
3)Given 1 and 2, why allow e-fishing above (most) barriers?
4)Industry could argue for use in situations where 'many' fish are found above the barrier, but this would need to be justified and likely would require add'l e-fishing impacts on isolated headwater pops.

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Discussion:

There is littl~~no~~ evidence to suggest that electrofishing would be less effective above man-made barriers than below them for the purpose of determining fish presence, particularly when habitat conditions and fish composition ~~/~~and abundance are similar between reaches. The appropriateness of using protocol electrofishing surveys for determining fish presence above man-made barriers may be influenced by the characteristics of the fish population in the reach upstream from the barrier relative to the population downstream. In situations where the presence of ~~the~~a man-made barrier may influence~~influences~~ the abundance and/or species composition of fish above the barrier and that this influence could potentially impact the upstream distribution of fish, protocol electrofishing surveys are~~may~~ not ~~be~~ appropriate. Board Manual 13 addresses this situation and recommends using physical criteria provided in rule (WAC 222-16-031) unless otherwise approved by DNR through consultation with WDFW, Department of Ecology, and affected Tribes in these cases.

7. Is detection poor in small headwater streams?

Conclusion:

The probability of detecting fish in headwater streams using protocol electrofishing surveys can be influenced by population density and numerous other factors previously mentioned above, but is generally not poor.

Discussion:

Headwater streams often support lower densities of fish than downstream reaches, and lower densities of fish are more difficult to detect than high densities of fish. Headwaters also often experience high seasonal flow variations affecting fish distribution, are often steep and have complex instream habitat and entrained oxygen that obscures visibility, are generally colder and with lower conductivity than downstream reaches; all of ~~Headwater streams may support low densities of fish,~~ which can result in reduced electrofishing efficiency and detection probability. The probability of detecting fish is directly related to the population size (Weyerhaeuser Company, unpublished CMER data). The draft CMER Preliminary Assessment of Variable Catch Efficiency states, "Likelihood of detection was lower in sites where fish abundance was low and estimated reduced catch efficiency in response to smaller population size". Some research has shown that electrofishing efficiency is negatively correlated with increasing stream size (Kruse et al. 1998, Rosenberger and Dunham 2005), while others have found no significant difference when testing this population abundance and capture efficiency (Foley et al. 2015). There was non-consensus on this issue, however some of ~~However,~~ the ETG believed~~felt~~ that based on the current rule, in the majority of cases electrofishing is ~~the preferred method of detecting fish presence in headwater streams and is the technique most~~ likely to provide accurate information about fish presence, but not necessarily fish absence.

8. Are two shockers [electrofishers] required in larger streams?

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Conclusion:

Based on practitioner experience, multiple electrofishers are not generally required when conducting protocol electrofishing surveys in streams larger than 5 foot bankfull width.

Discussion:

The ETG found no specific documentation or data to support the need for two ~~shockers~~electrofishers in headwater streams wider than 5 ft. BFW. The use of multiple ~~shockers~~electrofishers should be approached with caution as two shockers may increase the potential risk of site-specific survey impacts on fish. ~~ ~~There likely is an upper channel width threshold above which two (or more) electrofishers would result in greater probabilities of detection, but these conditions are generally not encountered during protocol electrofishing stream surveys.

9. Use of protocol surveys during drought years (2015 and future years). Should we be making permanent calls during these years?

Conclusion:

At this time there is a lack of consensus among the ETG on this question. There is agreement, however, that the question may not necessarily be appropriate for this group. This question relates more to if/how drought conditions may impact where to establish the F/N boundary in relation to the last observed fish, and therefore when and where water type maps should be updated.

10. Effectiveness of "single-pass" electrofishing surveys to account for seasonal and long term distribution variability of fish populations within a stream system (snapshot in time).

Conclusion:

By definition a "single pass" or "snapshot in time" sample cannot address seasonal or annual distribution variability. Multiple surveys would be needed at a given site to assess actual variability in fish use between seasons and/or years. The ETG ~~believes~~concluded this is less a question about the effectiveness of the protocol electrofishing survey itself and more about how and where to establish the F/N break point in relation to the location of the last observed upstream fish, in order to account for potential seasonal and/or long term variability in fish distribution.

Discussion:

Studies investigating longitudinal variability in fish distribution have evolved over time. Early research by Shuck (1945) and Miller (1954 and 1957) indicated that resident trout are sedentary, while more recent research has indicated otherwise. Cole et al. (2006) and Cole and

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Lempke (2003) report that changes in the location of the "last upstream fish" were limited in eastern Washington streams during a two-year comparison where surveys were conducted under similar flow conditions and at the same time of year, and the changes that did take place were not biologically significant. Changes in the location of the last upstream fish were more common, and distance of change was greater, however, when the same sites were resurveyed four years later (Cole and Lempke: Final ABR Report 2006). Cole and Lempke (2006) suggested that this increased variability in last fish locations was attributable to both inter- and intra-annual variability, and that surveys captured different flow conditions and sampling seasons. In the same report, however, Cole and Lempke (2006) also reported that: "… these data suggest that the upper limits of fish distribution are not highly variable among seasons, at least when seasonal flow conditions are similar…".

Walter et al. (in review) reported that PIT tagging and recapture data for cutthroat trout sampled at the upstream extent of fish distribution within 6 headwater catchments in western Washington suggests a high rate of mortality within and/or emigration from these small stream reaches from year to year. This, coupled with the fact that fish density in these reaches was relatively consistent through time, suggests that while individual fish in these habitats may be highly mobile, the habitat that the fish population as a whole occupied did not change significantly.

Another study to assess seasonal movement of cutthroat trout in a coastal Oregon stream using both mark-recapture and radio transmitters (Gresswell and Hendricks 2007) reported most fish moved short distances (22-28 meters),, while a few individuals moved significant distances over the course of the 14-month study. Other research on cutthroat trout movement report similar results.

11. What is the risk of not finding fish that are actually present (detectability) when conducting a protocol electrofishing survey?

Conclusion:

The ETG foundagreed that the limited literature on the subject indicates there is an 18% chance of not captureingfinding fish that are actually present, but. The detectability of fish is influenced by site-specific features, experience, and other factors..attributes.

Discussion:

Some investigations speak tohave addressed electrofishing efficiency and/or the probability of detection, anddetecting fish using a backpack electrofisher, while many more examined catch efficiency. For the purposes of this discussion the term catch efficiency is used when fish had to be netted and/or brought to hand in order to be counted, where detection probability applies to situations where fish only had to be observed while electrofishing. When conducting protocol electrofishing surveys, detecting a fish is sufficient to classify a stream segment as Type-F. Fish do not necessarily have to be captured.

Commented [J21]: This is qualitative and subjective.

Commented [J22]: Biological significance is irrelevant to informing the F/N break. Identifying the upper extent of fish use is.

Commented [J23]: Delete unless you provide actual distance variations in the report, which is important relative to length of stream buffers required to be left under rule.

Commented [J24]: You cite distances here, but not from Cole and Lempke (2006) which show last fish distribution of up to 1,500 feet. Biased discussion without including distances from both studies. Also Walter is currently in CMER review. Cole and Lempke was funded and completed by CMER.

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Commented [J26]: Poorly worded. Literally, the risk is that Type F water is misclassed as Type N.

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CMER sponsored research (Cole et al. 2002) evaluated the reliability of a single pass electro-fishing survey to detect the uppermost fish. Detection error surveys were conducted in 28 streams with terminal Type-F/N break points where no permanent natural barrier to upstream fish movement was present at or within 400 meters (m) of the break. After locating the uppermost fish by protocol electrofishing survey, additional electrofishing surveys were conducted in the reach upstream of the uppermost fish. If fish were found upstream from this point, the distance from the new uppermost fish to the original last fish location was

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recorded. Surveys were repeated until no fish were detected above the original location of the uppermost fish in a minimum of 4 consecutive surveys. No fish were found above the uppermost fish location identified during the initial protocol electrofishing in 27 of the 28 sites evaluated. At one site, one fish was found 0.5 m upstream on the second pass and another fish 14 m upstream in the third pass. Average error distance across all sites was 0.5 m. As part of another CMER-sponsored study (Cole and Lempke 2006), detection error was evaluated in both spring and summer. A random sample of 30 streams with fish distribution

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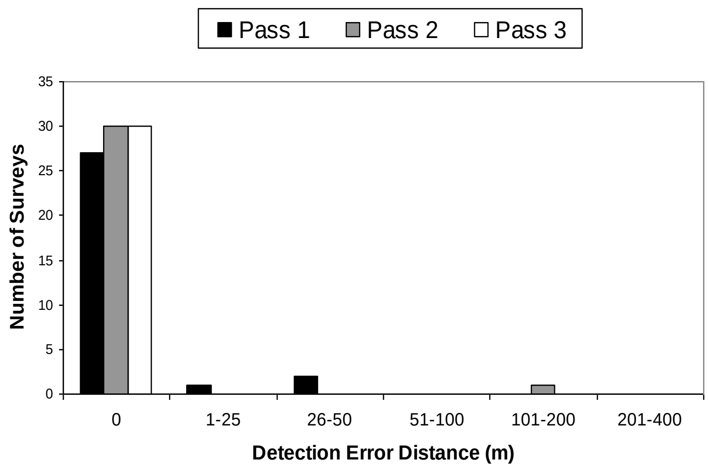
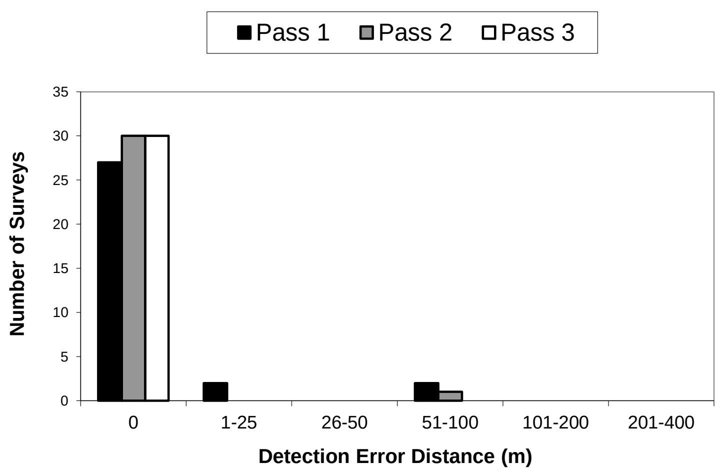
data collected during previously conducted protocol electrofishing surveys, again with terminal F/N break points where no permanent natural barrier to the upstream movement of fish was present at the break point, was selected for each season. The same resurvey protocol was followed as in the Cole et al. (2002) study mentioned above. Cole and Lempke (2006)

Spring Detection Error Distribution



Summer Detection Error Distribution



report that fish were encountered upstream of the original uppermost fish location in only 3 of the 30 sites resurveyed in each season. Average error distance was higher than observed in the 2002 samples, and averaged 47 and 44 meters in spring and summer samples, respectively

Figure 2. Frequency distribution of spring (upper graph) and summer (lower graph) detection error distances of last fish surveys performed in seven eastern Washington watersheds in 2005.

It is important to note that these data likely over-state survey detection error across all sites because sample sites were selected to include only those where not detecting fish that were present was more likely (e.g. terminal streams, and streams with no upstream barrier). "These data are therefore a conservative estimate of survey error across the study area" (Cole and Lemke 2003).

The reported range of catch efficiencies in the literature is somewhat variable., and can be influenced by channel characteristics such as stream width. Catch efficiencies may be lower than detection probabilities in similar habitats as it is possible to detect (observe) a fish without actually capturing it. Kruse et al. (1998) estimated a first pass survey ~~detection probability~~catch efficiency of 82% (18% probability of not capturing fish that are present) in small mountain streams. Similar catch efficiencies of 84% (16% probability of not capturing fish) were reported in forested streams in Washington ~~of 84% (16% probability of not capturing fish) for streams~~ that are 1m wide, 82% (18% probability of not capturing fish) for streams that are 2m wide, and 79% (21% probability of not capturing fish) for streams that are 3m wide (Weyerhaeuser Company, unpublished CMER data).

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SEASONAL DISTRIBUTION OF FISH AND TIMING OF SURVEYS

1. What is the appropriate period to conduct an electrofishing survey?

Conclusion:

Based on practitioner experience, no "perfect window" exists and the current window as defined by Board Manual 13 (March 1-July 15) is appropriate in most cases for western Washington. Surveyors must account for the potential impacts of seasonal and annual flow variability on fish distribution when interpreting fish presence data from a point-in-time protocol survey, especially when conducting surveys near the upper extent of surface flow during the latter half of the survey window.

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Discussion:

The ETG is aware of no specific documentation or data to answer this question, and more research is needed on the subject. Results of research reported by Cole and Lempke (2006), however, do address the issue of changes in the upper distribution of fish between seasons and are included in the responses to other questions.

Commented [J27]: If there's "no specific documentation to answer this question" how can the ETG claim in "most cases" it's appropriate?

Board Manual 13 reads: "Survey information collected to determine fish use or the maximum upstream extent of habitat utilization must be collected during the time window when the fish species in question are likely to be present... In most cases, this period extends from March 1st to July 15th…". For the purposes of this discussion the term "appropriate period" would refer to the time window during which fish species are most likely to be present. The key is knowledge of target species' life histories -and headwater flow conditions in watersheds to be surveyed. It is important to maintain flexibility in potential survey timing on behalf of both surveyors and reviewers. The need for this potential flexibility is supported by Board Manual 13 language (above) in stating "In most cases…". Surveys conducted outside of the Board Manual 13 window to capture potential seasonal fish use can be resolved through consultation with WDFW and affected tribes.

Additional discussion is necessary for appropriate protocol survey windows for eastern Washington.

2. Do differences exist between headwater streams and streams lower in the watershed in relation to fish presence (seasonal use), adult spawner presence, eggs in gravel, juvenile presence, etc.?

Conclusion:

The ETG believesconcluded that differences do exist between headwater streams and streams lower in the watershed in relation to fish presence (seasonal use), fish abundance, adult spawner presence, eggs in gravel, and juvenile presence.

Discussion:

Fish populations in headwater streams typically occur at lower densities, have fewer spawners and eggs in the gravel, and offer less juvenile rearing habitat than downstream reaches. The impact of these differences on protocol electrofishing survey effectiveness have been addressed in a number of other responses in this document.

3. Are there reasons to vary approach when dealing with anadromous vs resident vs all fish use – especially where resident fish are not yet spawning when e-fishing window opens?

Conclusion:

There are reasons to vary survey approaches when with dealing with anadromousencountering different species. and/or life stages. Most important are consideration of timing and abundance of different life stages in the targeted survey reach. The key is knowledge of target species. If unfamiliar with the life history traits of target species, consultation with WDFW and affected tribes prior to conducting surveys is recommended.

Discussion:

For ESA-listed species, adherence to NOAA electrofishing guidelines (http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf), as well as any state permit requirements, should be followed. The NOAA guidelines state "Electrofishing in the vicinity of adult salmonids in spawning condition and electrofishing near redds are not discussed as there is no justifiable basis for permitting these

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Commented [J29]: What are e-fisher detection efficiencies for sculpin?

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4. Any proposed change in the timing of e-fishing window may not fit with and may actually be in opposition to NOAA and ~~DFW~~WDFW guidelines.
~~4.~~

Conclusion:

This will be an important consideration when reviewing the appropriate protocol survey window for a particular site.

Discussion:

This issue should be acknowledged when considering the question, "What is the appropriate period to conduct an electrofishing survey?"

5. When should a protocol survey be used in situations such as:
~~5.~~

a. Streams with disturbance/habitat degradation (e.g. debris flows, fires)?

Conclusion:

Consultation with DNR, Ecology, WDFW and affected tribes is the best way to ensure survey results are accepted.

Discussion:

This is very much a "site specific" question. There is a wide spectrum of disturbance influence on habitat and channel conditions that can influence both fish distribution and the ability to survey effectively. Board Manual 13 requires documentation of how disturbance or habitat degradation may have affected fish distribution. The ETG ~~feels~~concludes that (1) natural events such as debris flows and fires are part of the natural and historic disturbance regime in headwater stream systems, (2) stream segments which have been subject to recent channel disturbance events may require additional survey effort (even in subsequent years), particularly if stream conditions have been significantly altered, (3) the need for survey flexibility is supported by data presented by Cole et al. (2006), and (4) in locations of obvious and recent disturbance events the protocol survey may document presence but is a less reliable indicator of absence.

b. Above man-made barriers (MMBs)?

Conclusion:

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Board Manual 13 addresses this situation ~~(Part 2)~~ and recommends using physical criteria unless otherwise approved ~~through~~by DNR in consultation with~~,~~ WDFW, Department of Ecology, and affected Tribes in these cases.

Discussion:

This topic has been addressed under question 6 "Are surveys effective above man-made barriers where fish occur above the barrier?" in the section on optimization of the overall extent of survey use. Where fish are known with certainty to be absent above a man-made barrier, electrofishing is inappropriate.

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c. Ponds, wetlands, and off-channel habitats?

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Conclusion:

Electrofishing surveys are not the preferred tool for establishing fish presence in ponds and wetlands, especially those that are not wadeable. Protocol electrofishing surveys are not applicable to defining off-channel habitats under current rules.

Discussion:

There are two distinct questions that must be considered here. First, the appropriateness of using protocol electrofishing surveys in ponds and wetlands, and second the appropriateness of using the survey method to define off-channel habitat. Electrofishing surveys can under certain circumstances (small, shallow ponds and wetlands with good water clarity) be appropriate for documenting fish presence in ponds and wetlands, but not usually for documenting absence. The definition of off-channel ~~habitats~~habitat is ~~based on site features relative to bankfull flows and channel migration zones~~currently being reviewed by a TFW Policy technical committee.

Recommendation:

Other methods (minnow trapping, seining, hook and line sampling, etc., or a combination of multiple sampling techniques) are likely to be more appropriate in ponds and wetlands.

d. How soon to shock after removal of man-made barrier or disturbance?

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Conclusion:

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There is no specific documentation or published data to answer this question, and more research is needed on the subject. Data (unpublished) are currently being collected by Weyerhaeuser and the Tulalip Tribe to help answer the question ~~(personal communication with Jason Walter and Derek Marks).~~.

Discussion:

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The ETG believes that timing will largely depend on a number of physical and biological variables including the characteristics of the fish population downstream from the blockage and the characteristics of the stream segment upstream from the blockage. We assumed that the question addresses the issue of time it takes for fish to recolonize stream habitat upstream from natural disturbance or removal of blocking anthropogenic structures.

e. No or insufficient pools meeting protocol "size" are present?

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Conclusion:

Many surveys in headwater and small tributary streams simply cannot meet the qualifying pool criteria, as sufficient numbers of qualifying pools are not present in the surveyed reach. Surveyors should sample and document the pool habitat that is available, and consider sampling at higher flows when minimum pool sizes are present and habitat is more accessible (i.e. sampling early in the survey window)..

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Discussion:

This issue is not a major concern in terms of the effectiveness of protocol electrofishing surveys, unless the absence of minimum pool size is temporary, in which case surveys would need to be conducted at higher flows when fish are most likely to be present (see survey timing).. For the purposes of this discussion we assume that this pool count includes the surveyed stream segment upstream of the last detected fish.

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Recommendation:

Revise the survey protocols related to the number of pools of sufficient size to more accurately reflect conditions in small headwater streams.

f. Larger streams (streams that should naturally be fish habitat); is there a stream size that should automatically be considered fish habitat?

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Conclusion:

~~Scientific~~There is no scientific evidence ~~does not~~to support a single default stream size that should automatically be considered fish habitat.

Discussion:

ETG members ~~felt~~concluded that there are ~~naturally occurring~~some larger streams that do not contain fish, particularly those reaches upstream from permanent natural barriers.

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ALTERNATIVES TO ELECTROFISHING

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1. Are there alternatives that can achieve FFR/HCP precision and accuracy targets while reducing e-fishing?

Conclusion:

There are a number of alternatives to electrofishing and each has its advantages in terms of cost savings or reduction of harm to fish. However, ~~they~~not all have ~~not~~ been evaluated relative to achieving FFR/HCP precision and accuracy targets.

Discussion:

a. eDNA

Environmental Deoxyribonucleic acid (eDNA) sampling is quickly becoming a useful tool in the detection of organismal DNA in water. The emerging information from eDNA researchers on fish detection indicates that legacy DNA can create false positives that still necessitates the need to validate eDNA results with tools like electrofishing. eDNA could be used to identify streams that lack fish, but the technique is prone to false negative results when fish are rare. Whereas, streams with positive eDNA detections could be further explored with electrofishing surveys for occupancy and distribution in the drainage network.

b. Continued use of default physical criteria

WAC 222-16-031 provides physical characteristics of channels that are presumed to have fish use. These 'physicals' can be used to classify streams where fish use has not otherwise been determined, eliminating the need to electrofish over potentially small and/or isolated fish populations. Section 13 of the FPBM, incorporated by reference in the WAC, states that 'above human-made fish blockages, physical criteria are used to determine the presumption of fish use unless otherwise approved by the DNR in consultation with the WDFW, WDOE, and affected Tribes' (Part 2). Section 13 (Part 6) also states "where field surveys for determining fish use have not been done, water type is determined by applying the physical characteristics contained in WAC 222-16-031(3)."

~~Interest exists from some stakeholders for re-examining default physical criteria to see if they accurately reflect fish presence.~~

~~TFW Policy is currently re-examining default physical criteria to see if they accurately reflect fish presence.~~

c. Model

This includes examining models, remote sensing (e.g., LiDAR), and other screening tools that could potentially target field validation efforts resulting in a reduction in the use of electrofishing.

~~e.~~d. Lentic sampling techniques

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For areas (ponds, wetlands, other slow-flowing waters) where electrofishing is not the appropriate approach there are other alternative methods such as minnow traps, seining, and hydroacoustic surveys that can be used. If the water body is large enough and boat access is possible, a boat shocker can be used.

d. Snorkeling
e. Visual Observation

Snorkeling can be used in pools to visually observe fish and can be effective where streams are too deep to be wadeable. Some fish species, because of their habitat preferences, small size, or cryptic coloration, are difficult to observe by snorkeling. Another technique utilizing visual sighting is simply to walk the banks of the stream and watch for fish, but in small channels with considerable instream and riparian cover fish are hard to observe.

e.f. Trapping

Trapping using wire minnow traps is a tool used to sometimes supplement electrofishing in deeper habitats/pools or where electrofishing is not appropriate for specific species. The efficacy of trapping is highly dependent on fish species. Traps in streams may be more useful for capturing invertebrates such as crayfish. Other methods, like snorkeling, are more often used for observing fish. Standardization of trapping currently has not been developed.

Recommendation:

There may be a need to re-examine listed alternatives to determine if they meet FFR/HCP precision and accuracy targets, and understanding advantages and disadvantages of implementing each method.

TRAINING AND/OR CERTIFICATION

Conclusion:

Protocol electrofishing surveys rely on both accuracy in establishing fish presence at a site and consistency of technique when multiple sites are surveyed over a field season. Experience can help ensure that surveys cause a minimum of harm to fish and eggs that might be present at a site, but keeping up with modern equipment and technique is important too. Additionally, leaders of survey crews need to maintain data quality control among crew members and assure that field protocols and other rules are followed. For these reasons, the ETG concluded that there would be value in having a training and/or certification program available to organizations engaging in protocol electrofishing surveys. We note that protocol electrofishing training would involve receiving instruction in both electrofishing theory and field techniques, while protocol certification would add an element of testing and (possibly) prior experience in using electrofishing to determine fish presence in small headwater

Commented [J35]: Add night-time snorkeling, reference (O'Neal?).
David H. Johnson, Brianna M. Shrier, Jennifer S. O'Neal, John A. Knutzen, Xanthippe Augerot, Thomas A. O'Neil, and Todd N. Pearsons, plus 37 contributing authors
478 pages Published by the American Fisheries Society in association with State of the Salmon Publication date: May 2007
ISBN-13: 978-1-888569-92-6
http://www.afsbooks.org/55055p.html

Underwater video?

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streamsand stream classification. We anticipate that field crew leaders would be protocol electrofishing certified.

Discussion of alternatives:

1. Certification Process

a. Would training and/or certification be creating an issue rather than solving one?

Almost every issue tackled by the ETG resulted in a recommendation to improve training / certification of protocol-survey practitioners. Training needs not only to focus on electrofishing, but also on the process of water typing as a whole. This will ensure that current practices are well understood and new individuals entering the field continue with this established process. Certification can be incorporated into the training process by providing a test so that attendees can demonstrate aptitude in the material. Short term, a mandatory training and certification program would put a burden on training all practitioners. Additionally, it would create the need to identify organizations who can develop a training course and subsequently train and certify people. Further, it would require specifying how often this training/certification needs to be renewed and what costs are associated with potential training and certification. Many current practitioners are resistant to needing certification, but do understand the need for future practitioners to be properly trained and certified.

Other potential questions included:

- Would the experience of an operator be considered when establishing requirements for training/certification?
- Would the information needed to secure a Scientific Collection Permits already capture much of the requirements related to experience?
- Would training and/or certification be designed for both surveyors and water type modification (WTM) application reviewers?

The ETG was in non-consensus whethernot sure if both practitioners and WTM reviewers would need to be certified (comparable level of training?). If certification simply focuses on the use and operation of electrofishing equipment, then reviewers may not need to be trained and certified. But, if certification and training includes water typing methodology, then reviewers and users would both find value in training and certification. Is certification/training more a topic item for compliance rather than for refinement of the WTM form? If during review it is discovered that a survey did not follow the protocol, then it should be documented that alternative methods were approved. Certification and training will only resolve this issue if the training includes instruction on how to follow the protocol and prepare a WTM that satisfies reviewers.

Certification programs are currently being offered by USFWS, Smith-Root, and NWETC that cover electrofishing safety, equipment use, and fish handling while electrofishing. There is no formal certification program for the methodology of assessing stream type modification. Therefore, it will be important to determine what information training and certification would

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Commented [J36]: Not what we were discussing.

Commented [J37]: No. Training/cert is necessary to minimize potential site-specific impacts to fish and to optimize the overall extent of the surveys' use.

encompass, at what point the entire training and certification process could be integrated into one course. To be clear, training involves instruction, whereas certification involves a demonstration of proficiency on the training material, often evaluated by passing a test.

Currently, training is left to practitioners training one another. This can create inconsistencies and sometimes spread misinformation. Formalized training minimizes inconsistencies and mitigates against the spread of misinformation. However, certification and maintaining certification records does create an oversight issue of who would be in charge of maintaining the database and informing those who need updated training.

Some members of the ETG expressed concern that the safety aspects of training would cover primarily safety for electrofishing crew members and that there is also a need to include proper training in fish handling, minimizing the risk of spreading invasive species, and other issues relative to protecting aquatic ecosystems. There was the suggestion that practitioners could opt out of certification and/or training if they could establish a history of professional experience, while another suggestion was that prior experience with protocol surveys and WTM forms should not necessarily be required for certification.

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Typical information relative to fish presence or absence submitted with WTM forms is often not standardized. Some ETG members felt water type modifications or proposed changes to the current water type at any given site should follow one standard process. Small landowners seem to be reluctant to use the WTM form. ETG members believed~~were not sure why, but felt~~ that incorporation of WTM instructions could be included in a training/certification program, resulting in increased use ~~and utility~~ of the form.

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b. Scientific Collection Permit

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A Scientific Collection Permit is useful to further demonstrate electrofishing competence. The ETG felt a Collecting Permit should not be used as a surrogate for training and certification, but rather as a supplement. The suggestion was made that the WTM form should~~could~~ include a ~~field~~box where the surveyor's Collection Permit number would~~could~~ be reported if an electrofishing survey was performed~~included~~. If some other survey method was used (e.g., visual observation) the form should indicate that as well.

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24 June 2016

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Re: Request for Restoration of Disclaimer Language to E-Fishing Technical Group Report and Explanation of Reasons

Dear Hans:

This letter follows up on our phone conversation this morning and on my remarks at the June 10 Policy meeting regarding the final report before us based on input from the Electrofishing Technical Subgroup. The title page of the report reads: "*Recommendations of Best Practices Regarding Protocol Survey Electrofishing: Results of the Electrofishing Technical Workgroup for TFW Policy Committee,* Prepared by: Howard, Hammerle, Pete Bisson and Hans Berge, May 31, 2016, Forest Practices Adaptive Management Program."

We appreciate the difficulties inherent in the production of a report based on group input, and recognize the time and effort that went into producing this document. We also recognize that you have consistently represented the report as <u>not</u> being a 'consensus product' of the group. The final draft represent itself as being authored by you, Howard Hammerle and Pete Bisson, but lists the names of technical group members and their alternates.

However, because Jamie Glasgow (and his alternate, Chris Mendoza), have significant substantive disagreements with some of the final text, and because both of their names are listed as being members of the group on what appears as a masthead of sorts, the Conservation Caucus is requesting that disclaimer language be restored to the final report in all subsequent versions. We are not willing to take the risk that at some later date the listing of our technical people on this report will be used to argue that these individuals, our Caucus members, or the Caucus agree with the report word-for-word.

The disclaimer we request be added should appear on the same page as the list of technical group members, and is exactly the same one that appeared in the sub-final draft:

> "Their participation does not imply wholesale endorsement by them or their caucus for each recommendation contained within this document."

The rationale for this request is self-evident: our technical group member and his alternate simply don't endorse some of the content of the document, including some generalizations and value judgments. However, we are nonetheless offering a more detailed rationale for our objections.

The primary reasons are content-based. As a comparison of the sub-final draft with the final version reveals (two comparison versions attached), Jamie Glasgow had 41 separate comments on the sub-final draft. However, numerous comments were not fully addressed by changes to the final draft. The following summary identifies our key concerns:

1. Comments 1 and 2 recommend that material from the Executive Summary be integrated into the Introduction and that executive summary points 1-4 be deleted in their entirety.

2. Comment 3 objects to the executive summary's implication that seasonality is only a consideration for perennial streams because it is an issue for seasonal F streams whose occupied length changes over a year citing (Wigington et. al., 2006). The concern is that some seasonal F channels are misclassified during protocol e-fishing surveys because they are dry at the time of the survey.

3. Comment 4 objects to the following implication that it is ever acceptable to electrofish on extremely low populations: *"Special cautions or postponement of electrofishing surveys should be exercised if the population is known to contain very few breeding individuals (scientific literature suggests 25 breeding pairs as a lower threshold)."* Glasgow's comment 4 states that:
   - This is not helpful. Why would we be e-fishing if we knew this was the case?
   - When we e-fish in reaches we believe don't have fish (generally where we e-fish) but they actually have v. low abundances of fish – we can have population-level impacts.
   - We should cease e-fishing and revert to physicals once one fish is found upstream from a natural barrier when the basin area <XX acres.
   - We cease e-fishing and revert to physicals upstream from manmade barriers, as per Section 13, unless prior approval from DNR, DFW, DOE, and Tribes. Set basin area criteria to address Bonneville Dam (ex)?

4. Comment 8 objects to the report's characterization of a statement about the perceived error rate of eDNA as attributable to "*many investigators*" and states that eDNA is 100% more sensitive than traditional e-fishing, and providing a citation.

5. Comment 9 objects to the document's failure to consider the recommendation that FPA mapping corrections be submitted as water type modification forms (the document goes only so far as to propose a centralized GIS database).

6. Comments 10, 11 and 12 indicate that that the text fails to address a key Policy Committee concern, which is flows <u>below</u> the normal long term range (drought conditions).

7. Comment 15 notes that the question about high flows appears to address only flows within the normal long-term range, failing to address flows higher than this.

8. Comment 16 questions the uncritical reporting of Weyerhaeuser "efficiency" results posing the pertinent questions: "What was the study design? Over what distance? What gradient? Instream and riparian complexity? Densities? Species? Wild fish or controlled experiment? These efficiencies seem high… "

9. Comment 17 notes the unaddressed circumstance where there is not access to ¼ mile above last fish or insufficient pools to meet the protocol survey criterion of 12 pools.

10. Comment 18 objects to the characterization of <u>any</u> electrofishing survey as adequate to "*demonstrate absence*."

11. Comment 19 puts the question of "*effectiveness*" above barriers in the context of stream typing and "where to hang the flag" (place the F/N break) and explains the logic of establishing a presumption against electrofishing above most barriers.

12. Comment 20 states lack of support for the conclusion of general effectiveness of electrofishing above barriers: "This is not my conclusion… Barriers can block fish from accessing habitat, can isolate small and susceptible populations of fish, and can reduce abundance (reducing detectability via e-fishing). [Board Manual] Section 13 Part 2 is unequivocal."

13. Comment 21 points out the lack of reference to any criteria for determining whether viable fish populations exist.

14. Comment 22 points out the lack of reference to any criteria for determining whether the strength of fish populations existing above a man-made barrier have been influenced by the existence of such barriers.

15. Comment 24 characterizes the statement that the location of the last fish in eastern Washington, ostensibly made on the basis of Cole et. al. and Cole and Lemke, as "qualitative and subjective."

16. Comment 25 takes issue with the inclusion of the observation that the seasonal differences in the location of the last fish are not "*biologically significant.*" Not

only does this conclusion lack a basis, but this comment correctly observes that the current regulatory scheme that protocol e-fishing serves does not depend on a finding of "biological significance." Rather, there is a presumed direct correlation between the location of the last observed fish and the extent of habitat likely to be used by fish. (i.e. all habitat likely to be used by fish or which may be restored to such use by restoration or management is presumed to warrant the regulatorily established level of protection).

17. Comment 26 advises against including a quote from Cole and Lemke without also including the absolute values that are being referred to as *"not highly variable."*

18. Comment 27 objects to citation of distances from some studies and not others, thus failing to illustrate the full range of variation between observed last fish distances.

19. Comment 28 asks for actual reference to the *"other research on cutthroat movement"* that is being referred to? (Is the similarity being cited that "most fish moved short distances but a few individuals moved significant distances"? Over the same period of time?)

20. Comment 29 objects to the use of the word "*risk*" as simply being that of "not finding fish that are actually present"; the real risk here is that fish habitat will not be classified as such.

21. Comment 30 notes that: "If there's "no specific documentation to answer this question" [of the appropriate window to survey] how can the ETG claim in "*most cases*" it's appropriate?" (The implication here is that it should be made much clearer that the conclusion is NOT based on empirical research but entirely on practitioner opinion and belief).

22. Comment 33 objects to the report's conflation between detection capability above man-made barriers where fish occur (not a problem) and whether it is "appropriate" under the current guidance and policies (presumed not appropriate, unless okayed by consultation).

23. Comments 35 and 36 object to references to "FFR/HCP precision and accuracy targets" without explicit reference to what this refers to.

24. Comment 37 objects to the characterization of eDNA as being *"prone to false negative results when fish are rare"* without a corresponding recognition that e-fishing is likely to produce MORE false negatives under the same conditions. Notes that "Bigger problem is point-in-time presence vs. identifying fish habitat per 222-16-010."

25. Comments 40 and 41 object to characterization of need for certification and training as a compliance issue, stating that: "Training/cert is necessary to minimize

potential site-specific impacts to fish and to optimize the overall extent of the surveys' use."

Our second set of reasons for demanding restoration of the disclaimer is procedural:

- Our technical people were told from the outset that the group was not being held to consensus and that conflicting language and opinions would not be misrepresented. (*See e.g.* Policy and Work Group notes from September and October). The final report does not fulfill this expectation. We believe that the final report implies that the group was in consensus over the result when in fact it was not. Importantly, technical objections (see above) were tabled due to the inclusion of the disclaimer language that was ultimately excised.

- The finalization of the Technical Group's work was not handled in a way that comports with established past practice -- the basis of reasonable expectations about editorial matters by our group members. In Chris Mendoza's 10 years as our CMER science representative, he can recall no instance in which technical group members were not afforded the opportunity to review the final written product before its transmission to Policy, or in which a single DNR staff member (in this case Howard Hammerle) was given so much license to make last-minute unilateral changes. In this case, an extra day or two would have made all the difference.

I hope this clarifies the Conservation Caucus' concerns about the final content of the Electrofishing Report.

We look forward to working successfully with you and our Policy colleagues on policy recommendations to the Board about this and related subject matter this summer and fall.

Sincerely yours,

Mary Scurlock
Policy Representative