

Technical Memorandum



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To: Tawni Dalziel (City of Sammamish)
From: Courtney Moore & Greg Laird (Otak)
Copies: Electronic Submittal
Date: 10/12/2017
Subject: Response to Permit Comments from Karen Walters of the Muckleshoot Indian Tribe
Project No.: 32794

Karen Walters from the Muckleshoot tribe provided comments on August 19, 2017 for the Zackuse Creek Fish Passage Project after the City of Sammamish applied for a PAUE. This memo documents and provides Otak's response to those comments and questions.

1. Clarification of existing public meeting/stakeholder discussions to date
The public meeting/stakeholder meeting information that shows in a few documents should be clarified. It is stated that the Tribe was involved in a meeting in October 2016 but I know it wasn't me or any else here in MIT Fisheries. Can you revise these documents to show which program at MIT was involved? In these same documents it is noted that King County DNRP was involved which is a sub-group of the larger King County, not just King County. We are similarly structured and it is inappropriate to imply that the entire Tribe participated if it was a specific tribal program or division. I know that MIT Fisheries was not in attendance at any meetings until our meeting in March 2, 2017 in the field.

Also, I think this field coordination meeting should be noted and is not in the list of meetings shown in these public/stakeholder meeting documents.

Project Narrative updated.

2. The Alternative Analysis Report states that there was agreement in the field for this project to not use existing conditions to measure bankfull width. Specifically:

Due to instabilities along the length of Zackuse Creek (such as bank incision, headcuts and upstream slope failure) the identification of a bankfull flow using field indicators is problematic and ultimately not defensible. These constraints were discussed with representatives from local and state agencies, as well as the tribes during a project field meeting on 3/2/2017. Representatives from these agencies agreed with the assessment of a lack of representative reach from which to determine an appropriate bankfull width.

I do not recall agreeing to this statement in the field and have serious doubts that I did so on behalf of MITFD. I do recall we discussing concerns about the accuracy of bankfull widths due to the existing incision and other features but not a wholesale abandonment of using actual bankfull

measurements for this project. Further, I do not have any record of meeting notes from the March 2, 2017 meeting to substantiate these statements.

As we have with other projects, including places where there is channel instability, we would still recommend taking bankfull measurements at the most natural locations and comparing these measurements to the regression equation in WDFW's culvert design manual to see how close they are in a measured vs. estimated bankfull based on precipitation and basin area as a starting point for culvert and stream design. Abandoning actual measurements to determine culvert sizing and stream design may be possible using other tools and rationale but we didn't see these described in detail in the documents reviewed for the PAUE. Further analysis is needed if this approach is to be used.

If there are existing bankfull measurements and a basis for design report, then they should be provided now as part of this submittal. Kevin, if you recall, we asked for it in writing on February 27, 2017. This is important because the replacement culverts should be providing passage for all adult and juvenile salmon, not just kokanee specific using the 10% flow exceedance and a 4 fps velocity. This is too high for juvenile chinook, which should be no more than 2 fps. The demonstration that the new culverts pass all salmon and their life stages is a requirement under the Corps' 404 permit so best to address these issues now.

A preliminary estimate of channel width and associated culvert width was performed using the regional regression analysis information provided in the WDFW Water Crossing Design Guidelines. The results from this regression based calculation for Zackuse Creek suggest a stream bankfull width of 6 feet. This bankfull width would result in a culvert width (using the stream simulation method) of approximately 10 feet.

As a comparison, Otak took bankfull measurements along Zackuse Creek up to the crossing at 206th Ave NE. Although Otak and the City have concluded that the dynamic nature of the system does not lend itself well to establishing a stable bankfull width along a representative reach, these measurements document the bankfull widths used for comparison and context with the proposed culvert.

The proposed channel cross section design has a top/bankfull width of 8 feet along the channel realignment and through the proposed culvert. This bankfull width agrees with top widths in the 6-8 foot range, measured in some locations along Zackuse Creek. An 8 foot channel top width results in a proposed Stream Simulation culvert width of 11.6 feet, leading to the current designed culvert width of 12 feet. Details are also provided in Otak's revised culvert sizing memo (revision included with response submittal).

The project goal of the Zackuse Creek Fish Passage Project is to “improve fish passage and spawning habitat for the native Kokanee salmon” historically present in Zackuse Creek. To achieve this goal the project has been designed with the needs of Kokanee salmon in mind. Chinook salmon do not utilize Zackuse Creek for spawning purposes due to the small size of the stream, stream substrate, and otherwise poor spawning habitat quality for this particular species. Juvenile Chinook that occur in the Lake Sammamish watershed may be present in the nearshore habitat and may make use of Zackuse Creek as a non-natal rearing tributary. However, such use of the Zackuse Creek habitat is likely to be associated with the delta area and low gradient/ lower tributary mouth portion of Zackuse Creek below the proposed culvert replacement sites - and not associated with stream reaches further up in the system. We do not anticipate that juvenile Chinook will move up into the Zackuse Creek system above the proposed culvert replacements, based on known life history and ecological parameters for this species.

The proposed channel was designed in order to maintain the stability of spawning gravel appropriately sized for spawning adult Kokanee salmon. According to the WDFW guidance the velocity criterion is for culverts less than 60 feet in length is 4ft/s (see Table 1). The proposed culvert has been designed to provide appropriate stream flow velocities in accordance with WDFW’s most conservative estimate of the weakest-swimming of the adult salmonids in western Washington: cutthroat trout (see Table 1). Since juvenile Kokanee are an out-migrating species, compliance with swimming velocity criteria are focused on events during the 10% exceedance flows for the month of adult in-migration (identified as November for Kokanee). Juvenile Kokanee will utilize stream flows to out-migrate into the waters of Lake Sammamish in a passive capacity, soon after emerging as alevins from their natal development habitat—allowing the stream flow to carry them down to the lake waters to mature. Based on the life history and ecology of Kokanee, culvert fish passage criteria has therefore been targeted for upstream movement of adult Kokanee rather than juvenile Kokanee as such upstream movement is not expected to occur.

Table 1
Fish Passage Design Criteria for Culvert Installation

Criteria	Trout > 6 in. (150mm)	Adult Pink Salmon	Adult Chinook, Coho, Sockeye, Steelhead
1. Velocity, Maximum (fps)			
Culvert Length (ft)			
a. 10 – 60	4.0	5.0	6.0
b. 60 – 100	4.0	4.0	5.0
c. 100 – 200	3.0	3.0	4.0
d. > 200	2.0	2.0	3.0
2. Flow Depth Minimum (ft)	0.8	0.8	1.0
3. Hydraulic Drop, Maximum (ft)	0.8	0.8	1.0

Table 1. From the WDFW Water Crossing Design Guidelines

3. Is the City of Sammamish replacing three culverts with this project? Some of the documents suggested just ELS Parkway culvert and not the trail and EL Shore Lane culvert. Please clarify.

Otak is designing the East Lake Sammamish Parkway culvert replacement and associated stream realignment project. King County and their consultant Parametrix are designing the culvert replacements for East Lake Sammamish Trail and East Lake Sammamish Shore Lane. The intent is for all three culverts to be replaced within the fish window of summer 2018 before kokanee spawning return in the fall.

4. For the culvert replacement figures in the preliminary plan set, please note that the in-culvert stream design should be modified for all culverts by lessening the in-culvert stream slopes. They are showing as 2:1 where there should be a minimum of 3:1 create better margin conditions for juvenile salmon that also need to pass through these culverts to upstream habitats.

This change in bank side slope will be evaluated as the plans move from 60% to 90% design.

5. I am not sure that the 2 foot clearance above the 100 year flood elevation is sufficient to pass wood that may need to get to downstream areas. A wood transport analysis should be done to help determine the culvert interior height dimension.

In their water crossing documentation WDFW provides the following rational and guidance on freeboard and debris clearances:

Since most wood transported by a stream is bankfull width or less (Flanagan 2004), culverts designed at least as wide as the channel (no-slope and stream simulation) should transport expected debris. [...] the following clearances are suggested.

1. *Small streams less than 8 ft BFW: clearance of 1 ft above the 100-year water surface.*
2. *Medium streams from 8-15 ft BFW: clearance of 2 ft above the 100-year water surface*
3. *Larger stream over 15 ft BFW: clearance of 3 ft above the 100-year water surface (this is*

Since the proposed channel bankfull width is at the threshold of a small and medium stream, Otak chose to incorporate the additional clearance recommended for a medium stream. Two feet of clearance is therefore included in the culvert replacement design height.

6. I didn't see a lot of detail for the wood designs. Please note that the wood in placed in Zackuse Creek should be meeting at least the 75th percentile metrics for Key Piece (sized appropriate for the stream); total # of pieces and wood volumes from Fox and Bolton (2007); attached. The wood is going to be essential to the success and stability for the streambed conditions for all salmon, particularly as the stream appeared to be lacking wood in those areas we looked at in the field. If there needs to be deviations from these metrics, a detailed rationale will be needed for our review.

Details for large woody debris are currently being refined and evaluated as the plans are moved from 60% to 90% design. Wood will be incorporated as appropriate for a small urban catchment in Western WA. Currently four types of wood structures are proposed:

1. Pool habitat feature logs: consists of a passively stable log with a rootwad in contact with the pool
2. Boulder step supplement structures: supplements the grade control boulder band using approximately 3 logs oriented to encourage downstream flow along the thalweg of the channel
3. Bank stability and revetment structure: increases habitat diversity and bank stability on the outside of bends using approximately 5 logs per structure.
4. Floodplain habitat and roughness features: encourages additional woody debris recruitment as well as slows overbank flows and velocities using 4-5 logs per structure.
 - a. This includes two diversion log wood structures will be placed near the upstream tie in point with the existing stream centerline to discourage lateral migration without the use of a hard engineered structure such as a berm.

Where possible, due to size and stability, passive anchoring of wood will be utilized. Where this is not possible, potential options include ballast, notch and chain, or other minimally invasive methods. An additional stability analysis will be considered so that any structures placed will be sized for longevity.

Trees needing to be cleared for construction, if possible, will be left in place for overbank habitat and roughness. Additional woody debris is available on site, stockpiled by the private property owner that will be utilized by the project where appropriate.

References

Flanagan, S. A. (2004). Woody debris transport through low-order stream channels of Northwest California -- implications for road-stream crossing failure. Masters Thesis., Humboldt State University: 66 pages

Barnard, R. J., J. Johnson, P. Brooks, K. M. Bates, B. Heiner, J. P. Klavas, D.C. Ponder, P.D. Smith, and P. D. Powers (2013), Water Crossings Design Guidelines, Washington Department of Fish and Wildlife, Olympia, Washington. <http://wdfw.wa.gov/hab/ahg/culverts.htm>

Tabor et al., 2006. Nearshore Habitat Use by Juvenile Chinook Salmon in Lentic Systems of the Lake Washington Basin Annual Report, 2003 and 2004. Prepared for U.S. Fish and Wildlife Service.

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