Technical Memorandum

11241 willows road ne
suite 200
redmond, wa 98052
phone (425) 822-4446
fax (425) 827-9577

To:	Casey Costello & Channing Syms (WDFW) Tawni Dalziel (City of Sammamish)
From:	Courtney Moore & Greg Laird (Otak)
Copies:	[Electronic Submittal]
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Subject:	Response to WDFW Comments
Project No.:	Zackuse Creek - 32794

Washington Department of Fish and Wildlife (WDFW) provided comments on the Zackuse Creek Water Crossing and Stream Re-alignment Project after a meeting with the City of Sammamish and their project partners on June 28, 2017. This memo documents provides Otak's response to WDFW's comments and questions.

Overall Project:

1. Gradations, specifications, and estimated quantities for the type(s) of substrate material (e.g. streambed mix) to be used in the project as well as the methodology used to determine these needs to be shown in the documents when the project is formally applied for through APPS.

Sediment data collected during previous field visits was used as a reference for stability analysis. In order to understand the downstream change in sediment gradation, a total of four pebble counts were conducted along Zackuse Creek, with at least one pebble count per geomorphic reach to gain an understanding of the existing inputs.

Both the proposed substrate material (WSDOT streambed cobble 4" cobble mix, Standard Spec 9-03.11(2)) and depth (2 feet) was chosen to mimic ideal depth and sediment size conditions for adult kokanee spawning. The WSDOT 4" mix (Table 1) is also similar to the pebble count data from Reach 3 and upstream Reach 2, which may represent future sediment supply contributed from upstream areas in the Zackuse basin based upon the field data collected. Using the Manning and Shields equation an equilibrium bed slope for the run sections that provide the spawning habitat was identified as 1.6%. The D50 particle required for channel stability at this design slope is also similar to the proposed gradation presented below. This suggests that since both the existing gradation and the proposed gradation are similar, when used in the design slope of the re-aligned channel section the reach will trend neither toward aggradation or degradation.

Table 1. WSDOT Streambed Cobbles

	Percent Passing				
Approximate Size[1]	4" Cobbles	6" Cobbles	8" Cobbles	10" Cobbles	12" Cobbles
12"					99-100
10"				99-100	70-90
8"			99-100	70-90	
6"		99-100	70-90		
5"		70-90			30-60
4"	99-100			30-60	
3"	70-90		30-60		
2"		30-60			
1½"	20-50				
¾"	10 max.	10 max.	10 max.	10 max.	10 max.

[1]Approximate Size can be determined by taking the average dimension of the three axes of the rock, Length, Width, and Thickness, by use of the following calculation:

$$\frac{\text{Length + Width + Thickness}}{3} = \text{Approximate Size}$$

Length is the longest axis, width is the second longest axis, and thickness is the shortest axis.

Water Crossings:

1. Stream simulation crossings are required to have a sinuous low flow channel as well as high flow benches. This is not shown in any of the three crossings for this project.

A low flow channel (approximate 0.5ft typical depth) will be included in the proposed channel throughout the entire realignment reach as well as the channel through the new culvert crossing and was been incorporated into the 60% plans submitted to the City of Sammamish. This low flow channel will be located within the main channel and exact horizontal positioning within the channel will be identified by the on-site engineer during installation in the field.

Stream Realignment

1. A monitoring plan will be needed for the boulder grade controls as they are technically classified as a 'constructed fishway.'

A holistic monitoring plan for Zackuse Creek will be submitted prior to construction that will address multiple agency needs. The monitoring plan will cover a 5-year window post construction to document project performance and evaluate project goals.

2. Existing channel is approximately 600 lineal feet within the project site as measured upstream from the inlet of the East Lake Sammamish Parkway Crossing to the top of the new channel. Proposed re-aligned stream is approximately 400 lineal feet. This represents a loss of 200 lineal feet of watercourse. This, coupled with building a fishway, would not meet the no net loss mandate for that section of the project.

The current design of the proposed re-aligned stream remains at approximately 400 linear feet compared with the existing 540 feet. We do not propose to fill the existing channel which receives contributions from seeps/springs and wetlands in addition to the current flow from Zackuse Creek. Maintaining a downstream connection to the existing ditchline and stream will allow continued hydrologic/habitat functioning of a considerable length of the existing channel including as a backwater/high flow velocity refuge.

Additionally, relocation of the channel will accomplish two important goals: increased amount and quality of spawning channel habitat and improved channel stability through the floodplain. Currently the location of the existing alignment

3. Long profiles are needed in order for WDFW to assess the potential for re-grade following project completion. This needs to include the entirety of the project site as well as, at a minimum, downstream from the lakeshore and upstream at least 20 bankfull widths from the top of the stream relocation/realignment.

A long profile is attached, covering both the existing stream centerline from the lake through to approximately 160ft (20 bankfull widths) upstream of the proposed tie in.

4. More cross sections are needed for the realigned channel reach. The channel configuration between pools vs riffles should be different and this is usually shown with cross sections and details.

This comment has been incorporated into the stream restoration sheets included in the 60% plans submitted to the City of Sammamish.

5. More detail is needed regarding the Large Woody Material to be incorporated into the realigned channel. Namely, what percentage of flows will this LWM interact with? How will it be anchored? What are the, at a minimum, approximate numbers and sizes of logs to be used? Will they all have in-tact rootwads?

This comment is being actively examined for further refinement in the 90% plans to be submitted to the City of Sammamish. Currently, the 60% plans submitted to the City of Sammamish show a bank protection 2-log structure at the outside of each constructed bend (accounting for approximately 24 logs).

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 methods include notch and chain, ballast 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.

6. WDFW has concerns over the bed sealing sufficiently given the amount of fill proposed for the riffle sections.
The agent(s) stated that details pertaining to this are in the JARPA materials and will be included in the HPA application materials.

In order to assure that the channel bed seals sufficiently to avoid subsurface flow streambed material will be placed in a gradation from finer to courser material as the channel is constructed. In addition, a special provision has been added to the contractor specifications as shown below:

Placement of stream bed material shall be constructed to ensure that low stream flows are conveyed above the finished channel. During and after placement, the Contractor shall apply water to facilitate filling the interstitial voids of the streambed Cobbles and Boulders with finer gravel and sand streambed Sediment. The voids are satisfactorily filled with Streambed Sediment when water equivalent to the flow rate of the stream does not go subsurface. If water is not present in the stream, the Contractor shall apply water to the stream channel for visual acceptance by the Engineer. The channel shape within the structure should match that outside of the structure so that most flows are contained within the normal bankfull width and flows higher than bankfull engage the floodplains and provide shear stress relief on the channel bed. See sketch below from page 38 of the Water Crossing Design Guidelines.

8. The bankfull width with the pools should be wider than that of the riffles. Please provide sections of each and background data.

This comment has been incorporated into the stream restoration sheets included in the 60% plans submitted to the City of Sammamish. Initial design for maximum pool widths were determined using NRCS guidelines and implemented as 1.2 times the rock step crest width (equations shown below).

Typical Weir Crest Width:	$W_{w,top} = W_{Bankfull} / 0.92$
Maximum Pool Width:	$W_{p,top(max)} = 1.20 * W_{w,top}$

References:

NRCS (Natural Resources Conservation Service). 2007. National Engineering Handbook 654 Technical Supplement 14B. Scour Calculations. 210-VI-NEH. August 2007.