Meeting Purpose and Agenda

Stakeholder Advisory Committee Meeting Purpose:
Discuss progress on the preliminary design including
results of hydrologic and hydraulic modeling efforts and
development of the split channel alternatives.

Introductions and Project Timeline

Project Study Updates

Development of Design Alternatives
Willowmoor - Project Direction

1. Develop the split channel alternative that balances the objectives of flood control, habitat restoration, fish passage, and sustainability.
2. Include variable depth pools.
3. Work with Redmond on city flood control efforts, ground water, and Bear Creek.
4. Conduct a feasibility analysis of a dynamic weir including costs and benefits.
5. Conduct a technical analysis of the split channel alternative for fish mortality and sustainability.
6. Include a beaver mitigation plan.
7. Include a maintenance plan for when project is complete.
8. Pursue grant sources to further evaluate cold water supplementation.
9. Identify funding partners to assume on-going maintenance costs of cold water supplementation.
10. Work with Parks to pursue recreational boater access.
11. Continue existing maintenance during design and permitting phases.

~ Guidance from Flood Control District
Executive Committee Motion 2016-04.1
Recreation Workshop Highlights

• Improve/maintain boat access and portage at weir
• Access to and signage in the project area
• Wildlife viewing in new side channel area
• Reduce sedimentation from dog access points
• Improve access to Marymoor Park
• Reduce concert noise with vegetation
• Create a new lake or riverside dock at Marymoor Park
• Create a bridge across the river at the project site
Hydrologic Modeling – Lake Sammamish Inflow

Red = Observed  
Blue = Simulated
Hydraulic Model Domain and Calibration
Hydraulic Model Calibration - Channel Roughness Representation

Vegetation in TZ

Elodea growth in downstream channel
## Hydraulic Model Calibration

<table>
<thead>
<tr>
<th>Date</th>
<th>TZ Weir</th>
<th>TZ</th>
<th>Downstream of Bear Creek</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simulated Peak Stage (NAVD88)</td>
<td>Difference from Observed</td>
<td></td>
</tr>
<tr>
<td>February 2017</td>
<td>31.6 feet</td>
<td>31.6 feet</td>
<td>31.5 feet</td>
</tr>
<tr>
<td>Q= 1,010 cfs</td>
<td>-0.1 feet</td>
<td>0.4 feet</td>
<td>0.4 feet</td>
</tr>
<tr>
<td>Nov/Dec 2015</td>
<td>32.1 feet</td>
<td>32.1 feet</td>
<td>31.6 feet</td>
</tr>
<tr>
<td>Q= 955 cfs</td>
<td>0.0 feet</td>
<td>0.3 feet</td>
<td>0.1 feet</td>
</tr>
<tr>
<td>Feb/Mar 2014</td>
<td>31.4 feet</td>
<td>31.2 feet</td>
<td>30.6 feet</td>
</tr>
<tr>
<td>Q = 940 cfs</td>
<td>-0.4 feet</td>
<td>-0.2 feet</td>
<td>-0.2 feet</td>
</tr>
</tbody>
</table>
Anticipated Permitting Timeline

Spring 2019 – 30% Design
• Publish SEPA checklist and “mitigated determination of non-significance” (MDNS)
• Initiate US Army Corps section 408 process
• Attend pre-application conference with the US Army Corps, state and local agencies, and tribes

Summer 2020 – 60% Design
• Submit formal application for US Army Corps Section 408 approval letter
• Submit Section 404 (Clean Water Act), 7 (Endangered Species Act), and 106 (cultural resources) permit applications
Permitting: Defining the ESA Action Area

Lake fringe wetlands are high quality rearing habitat for fish including juvenile Chinook, as well as birds and amphibians. Lake fringe wetland boundaries typically coincide with the Ordinary High Water Mark.
Permitting: Defining the ESA Action Area

Lake Sammamish Shoreline
Flooding Elevations and Extents

Lake Elevation (NGVD29)

- 27 Feet
- 28 Feet
- 29 Feet

Shoreline distance between 27-29 feet lake elevation = 33 feet

Shoreline distance between 27-29 feet lake elevation = 1,327 feet
Ordinary High Water Over Time

Estimated 1.25-YR Return Period Lake Level per Evaluation Period

- 1939-1969
- 1966-1999
- 1999-2010
- 2011-2018
- USACE OHW Elevation
- Annual Peaks [1939-2018]
Permitting: Defining the ESA Action Area

Existing Data Sources to be used for 30% design:
• Municipal Shoreline Master Programs (2004)
• Recent wetland delineations around the lake
• Observed high water event data (2019)

Potential New Data Sources may be used for 60% Design:
• New wetland delineations in the project area and Marymoor Park lake-fringe wetlands
• New OHWM delineations for Tosh Creek, and the Sammamish River in the project area
Design Alternatives – In Development

• Two split channel alternatives. Existing, maintained condition is the baseline, “no action” alternative.

• Design criteria were developed to meet all Flood Control District motion requirements, regulatory constraints, and existing maintenance and use agreements.

• Alternatives will be scored using the Evaluation Criteria (handout).

• Both split channel alternatives include a manually-operated dynamic weir in the mainstem channel and a static elevation weir inlet to the side channel.

• Cold water concepts were evaluated and paired with each alternative as a second variation of each one.

• Side channel planform (“birds eye” view) is highly constrained by topography (Tosh Creek alluvial fan), wetlands, and archeological sites.
Design Criteria – No Scoring

Hydrology and Hydraulics
- Do not increase downstream peak flood flows
- Maintain minimum lake level above 25.4 feet NGVD29
- Maintain lake level below elevation 29 feet NGVD29 for 1,500 cfs below Bear Creek

Aquatic Habitat
- Maintain upstream and downstream fish passage
- Avoid or minimize effects to lake fringe wetlands

Recreation
- Maintain navigation through the TZ
Evaluation Criteria – Scored, See Handout
Categories will be scored separately and normalized to 100 points each for ease of evaluation by distinct funding partners.

Hydrology and Hydraulics
• Lake stage
• Redmond stormwater outfalls

Aquatic Habitat
• Salmon
• Wetlands
• Water quality

Construction, Operations, and Maintenance
• Construction impacts
• Maintenance costs
• Permitting risk
## Evaluation Criteria – Hydrology and Hydraulic Performance

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Evaluation Criteria</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-1</td>
<td>Hydrology and hydraulic performance measure</td>
<td>HEC-12 methodology for calculating dry weather flow rates (raw flow)</td>
<td>No change in 100-year peak stage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Greater than 0.5 ft decrease in 100-year peak stage</td>
</tr>
<tr>
<td>H-2</td>
<td>Project impacts on tributary drainage systems along designated reaches</td>
<td>Base flow cuts frequency distribution of mean streamflow rates below the 0.01 percent frequency level and the 0.001 percent frequency level (40-year)</td>
<td>No change in the system</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10% reduction in flow duration above 40-year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10% reduction in peak discharge above 40-year</td>
</tr>
<tr>
<td>H-3</td>
<td>Reduce average water level</td>
<td>Project impacts on designated reaches</td>
<td>No change in average water level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.25 ft reduction in average water level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Greater than 0.25 ft reduction in average water level</td>
</tr>
<tr>
<td>H-4</td>
<td>Reduce frequency and duration of high water and flood levels in designated reaches</td>
<td>Project impacts on designated reaches</td>
<td>No change in average number of days above elevation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10,000 ft (MDEP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10,000 ft (MDEP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10,000 ft (MDEP)</td>
</tr>
</tbody>
</table>

**Weight**

100
## Evaluation Criteria – Aquatic Habitat Performance Measure

<table>
<thead>
<tr>
<th>No.</th>
<th>Aquatic Habitat Performance Measure</th>
<th>Evaluation Criteria</th>
<th>Rating Scale</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH-1</td>
<td>Maintain dredge or diversion of existing stream, fish habitat.</td>
<td>From August 1 to October 1. Maneuverable, Planner or Bridge weir above 30%. Invertebrates present.</td>
<td>No reduction in stream base flow.</td>
<td>0.8</td>
</tr>
<tr>
<td>AH-2</td>
<td>Provide forage fish with appropriate reach.</td>
<td>Carpenter Lake.</td>
<td>Increase stream area by 10%.</td>
<td>2</td>
</tr>
<tr>
<td>AH-3</td>
<td>Reduce temperature within the project reach during critical migration period.</td>
<td>Reduce average index of thermal stress above 21°C.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AH-4</td>
<td>Reduce temperature beyond project reach.</td>
<td>Reduce average index of thermal stress above 15°C.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AH-5</td>
<td>Reduce thermal gradient at the river reach.</td>
<td>Increase surface water flow during the project reach.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>AH-6</td>
<td>Provide side-channel habitats and connectivity.</td>
<td>Install Wildlife Corridor.</td>
<td>Complete corridor with 95% of original generation.</td>
<td>5</td>
</tr>
<tr>
<td>AH-7</td>
<td>Provide suitable aquatic nursery habits.</td>
<td>Provide suitable for food and nursery and regressed aquatic life.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>AH-8</td>
<td>Enhance wetland connectivity.</td>
<td>Increase wetland area by 50%.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>AH-9</td>
<td>Enhance riparian and overland density.</td>
<td>Increase riparian area by 20%.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>AH-10</td>
<td>Protect non-recoverable impacts to sensitive aquatic habitat.</td>
<td>Protect non-recoverable impacts to sensitive aquatic habitat.</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
## Evaluation Criteria – Construction, Operations, and Maintenance Performance Measure

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Evaluation Criteria</th>
<th>Rating Scale</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMA-1</td>
<td>Minimize long-term operation complexity and water volume in channel and CRR facilities</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-2</td>
<td>Minimize construction impacts to ESA/intake species and other riparian habitat</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-3</td>
<td>Minimize construction impacts to ESA/intake species and other riparian habitat</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-4</td>
<td>Minimize the establishment costs of new construction</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-5</td>
<td>Minimize construction impacts to cultural resources</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-6</td>
<td>Minimize construction impacts to cultural resources</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-7</td>
<td>Minimize construction impacts to cultural resources</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-8</td>
<td>Qualitative assessment of neighborhood and public use impacts</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
<tr>
<td>CMA-9</td>
<td>Qualitative assessment of cost</td>
<td>Reliability of the system to maintain low flow, provide minimal maintenance requirements, and operate efficiently</td>
<td>Excellent O&amp;M practice</td>
<td>1</td>
</tr>
</tbody>
</table>

Weight: 100

Score: 1
Evaluation Criteria – Lake Stage
Simulated Lake Sammamish Level, Maintained Condition
(1949 – 2018)
Evaluation Criteria – Lake Stage
Simulated Lake Sammamish Inundation Duration (1949 – 2018)

Exceeds Corps General Design Memo criteria about 10 days over 69 year simulation period.
Evaluation Criteria – Redmond Stormwater Outfalls

The Sammamish River Valley has an extremely flat slope from the valley walls to the river. Historically the entire river valley was a poorly drained wetland complex.

Stormwater outfalls are necessarily low in the river to provide drainage to upland areas. The project cannot impede existing outflow from this drainage infrastructure.
January 16, 2019
Lake Stage:
27 feet (NGVD29, USGS 12122000)

Water stains on the dock indicate the elevation of the ordinary high water mark is higher than the current lake stage (27 feet), so the OHWM would be found landward of this site.
Evaluation Criteria – Operations and Maintenance

TZ maintenance permitting cycles are every five years and require mitigation.

Willow canopy is declining over time.
Design Alternatives – Components
Preliminary Weir Analysis

Manually Operated Dynamic Weir meets H&H and Aquatic Habitat Design Criteria – Selected for Both Split Channel Designs
Cold Water Supplementation Analysis

Cold Water Supplementation Alternatives

• Hypolimnetic Withdrawal
• Hyporheic Exchange
• Deep Pumped Groundwater
• No Cold Water Supplementation
Cold Water: Hypolimnetic

Kokanee habitat quality in summer months

![Lake Volume Graph]
Cold Water: Hyporheic

Hyporheic flow in an alluvial channel

Embedded gravel in Tosh Creek
Cold Water: Deep Pumped Groundwater

- Suitable groundwater found 600 feet below ground surface
- Yield was smaller than expected
Cold Water Supplementation Analysis

Hypolimnetic Withdrawal
- Problematic for Kokanee and nutrient loading.
- Analyzing Concept 8 (lake surface withdrawal and heat exchange) as potential solution.

Hyporheic Exchange
- Promising for local cooling, low volume, concerns with fines from Tosh Creek.

Deep Pumped Groundwater
- Yield lower than expected, requires more wells so not paired with either alternative, could be revisited.

No Cold Water
Alternatives – In Development

**Alternative 1a**
Wide side channel, without lake withdrawal heat exchange unit.

**Alternative 1b**
Wide side channel, paired with “big water” lake withdrawal heat exchange unit.

**Alternative 2a**
Narrow channel, without hyporheic flow exchange.

**Alternative 2b**
Narrow channel, paired with hyporheic flow exchange enhancement/optimization.

**Alternative 3**
Existing weir, no side channel, continued maintenance and mitigation. No cold water supplementation.
Alternative 1: Wide Channel without (1a) or with (1b) Lake Surface Water Heat Exchanger
Alternative 1: Wide Channel without (1a) or with (1b) Lake Surface Water Heat Exchanger
Alternative 2: Narrow Channel without (2a) or with (2b) Hyporheic Exchange in Side Channel
Alternative 2: Narrow Channel without (2a) or with (2b) Hyporheic Exchange in Side Channel

(2b) Optional Hyporheic Exchange in Side Channel
Alternative 3: Existing Condition
Maintenance of TZ

Maintenance includes:
- Permitting (next cycle August 2021)
- Trimming the navigation channel flow path
- Trimming the high flow channel
- Removing all trimmings
- Associated mitigation plantings
Questions?

Kate Akyuz, PMP, Project Manager
(206) 477-4607
kate.akyuz@kingcounty.gov
www.kingcounty.gov/rivers