To: Dan Spear

CC: Chuck Peven

Date: February 21, 2018

Topic: Review of Detroit FSS 30 Percent DDR

In this memo I summarize my major comments on the Detroit FSS 30 Percent DDR. I have also imbedded comments into the attached PDF.

USACE - Thank you for your comments. Responses are in blue.

Major Comments:

1. More rationale is needed for placement of the trashracks downstream of the weir. How would large debris be kept from entering the system and becoming lodged? Looks like the drawings sent out by the Corps on 2/21 may correct this concern by moving trash racks to outside of system.

Concur. Trashracks have been moved upstream.

2. Would like to see a vertical and horizontal water velocity profile at the entrance of the FSS. Would like to confirm that velocity does not change much regardless of entrance opening.

Concur. CFD results are under process. The sides of the weir opening have radiuses to reduce flow separation. Velocity over weir will usually not change significantly over weir regardless of operation. Velocity in downstream dewatering channel downstream will differ as function of inflow and weir depth. Velocities are slower at bottom of channel but reduced or negligent flow, the greater the flow the less the difference. Flow separation does not occur at design flow (4500 cfs)

3. Water velocity decreases downstream of entrance quite substantially. Although fish cannot get out of the system, seems like a high risk of fish holding to exhaustion in the lower velocity areas.

The design intent is to trap the fish at the entrances to the FSS. Flow cannot remain at that velocity going into the screen channel. Therefore, there needs to be a zone of deceleration. The likelihood that fish might hold in this area will vary with the flow rate. At the design flow, the lowest velocity (at the downstream end of the expansion channel) is 3.3 ft/s. Fish are not likely to hold very long under those conditions; in fact, decelerations of this magnitude are typical in surface collectors with trapping velocities halfway through the screen channel and fish do not show extended tendencies to hold in these areas. This minimum velocity reduces with lower operational flow rates, and at the potential minimum flow of 1,000 cfs (if pumping is added to the facility for non-generation periods) the minimum velocity would be 1.5 ft/s. Fish may temporarily hold in this condition, but the increased velocities would begin again when the turbines are started back up.

4. Given all of the moving parts, how tight are the seals around each moving part? Can fish get trapped in these areas?

All openings and moving parts will be sealed. Some seals are shown on the 60% drawings, and they will all be shown on the 90% drawings.

5. Is there an example of a similar design that is working in the Columbia River or elsewhere? Entrance looks similar to RSWs on Columbia River, but those systems I don't think have trashracks in front of them?

There is no precise predecessor of this design in the Columbia. The weir shape is similar to that of John Day Dam Top Spillway weir and the new Foster Fish weir. The addition of the upstream trashrack was a joint decision between A/E and USACE.

6. States that the maximum trashrack velocity is 4fps. Does this means that velocity cannot exceed 4 fps? What velocity can the trashracks withstand if moved to the front of the FSS? Velocities over the weir are at 8fps…implies that trashracks must be located upstream of weir quite a ways?

That is a general guidance based on powerhouse intake trashracks at Bonneville and John Day, which have 4 -5 ft/s approach velocities under maximum conditions. Fish are successfully passing these trashracks. The width of the Detroit FFS trashrack was sized to 24 feet width for each barrel to reduce the average trashack velocity to below 4 ft/s. The trashracks are placed 30-foot upstream so that the surface velocities will usually be less than 4 ft/s.

7. What is the lowest elevation the system can collect fish? 1425?

The lowest reservoir level at which the FSS is operable is 1445. At reservoir levels below that the FSS would need to be shut off and de-ballasted.

8. Not sure that the maximum juvenile migration period will be March to May. Spring Chinook migration in fall could be larger. Report states there could be a large run of steelhead in fall, doesn't seem consistent with data on steelhead migration.

Concur. References to defined maximum migration periods have been removed from the text, and the Design Maximum Water Temperature criterion in Table 2-2 has been removed. The USACE is developing fish migration target numbers and seasons but the information is not yet available at the time of this 60% DDR preparation. All facilities are provided with adequate circulation water to accommodate temperatures up to 70 degrees.

9. Tank size – Does fish storage capacity need to be larger to account for times when roads may be closed (November/December) due to weather? Or is there weather concerns?

Concur. There are weather concerns for trap and haul operations that include wind, ice, lake, and road conditions. The USACE needs to evaluate historic road closures and environmental conditions to determine how much of an impact this may be to operations.

10. Confirm that the system can run at flows exceeding 4,500 cfs. Screens would have to violate NMFS criteria but that can be debated later.

The system can operate up to the potential maximum flow of 5,600 cfs. Screens should remain well balanced with approach velocities of 0.48 to 0.50 ft/s. This information is provided in tables in the 60% DDR text.

11. How much does designing for future pumps add to the costs of the structure? If substantial, could you simply build a floating structure later that sits alongside of the FSS?

Elements to support the future integration of attraction flow pumps included in the current design are as follows: Additional spaces for electrical breakers for each pump motor, a dedicated control cabinet to house eight (8) future starters and electrical feeder lines to pumps, additional i/o and HMI provisions for future integration, conduits for future electrical conductors and control signals, a discharge cone for each pump, and a flap gate for each discharge cone. Future pump installation will require installation of the pump, discharge adapter, rail guide brackets, guide rail, lifting chain assembly, and mini-CAS monitoring relay.
No, the cost to install the additional structure necessary for the potential attraction flow pumps is not substantial. The installation of a floating pump barge would cause additional complications and increase the overall cost.

12. Would the pumps be located on the upper deck?

No, the pumps are submersible and will be located along the aft wall of the FSS plenum.

13. Would like to see figure of depth of FSS opening at various entrance flows. Looks like at maximum design discharge the weirs pull flow from as low as 22 ft? At 5,600 they pull water from 26.8 ft.

A table of estimates weir submergence depths over a range of operating flows has been added to the DDR text.

14. Confirm with NMFS that they will not want to sample fry (<60mm)

It is possible that fry may end up in the sample tank and will be sampled along with the other species. The design expectation at this point is that fry will be transported downstream with the sampled and general population fish held on the FSS.

15. Should sampling occur on FSS or should fish be hauled to a facility near the release site for evaluation? Would fish be trucked and released directly to the river? Or would they be released to stress relief ponds, held 24 hours and released; similar to Cowlitz Falls.

Design will include structure for anesthetization and sampling fish on the FSS. Release strategies are being evaluated by the USACE and may include direct release to the river at various locations, stress relief ponds and/or use of the Minto fish facility.

16. For future versions, there is a large number of kokanee in Detroit…they could overwhelm the system in initial years. Will they be hauled downstream?

Yes. The USACE is providing connectivity in the N. Santiam and kokanee and other species will be hauled downstream as sorting operations for all fish are likely not achievable.