USACE Portland District (NWP) FFDRWG Update Form
October 20, 2016

PROJECT INFORMATION

Project Title	Bonneville Second Powerhouse JBS Orifice Improvements
SCT Reference Number	
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PROJECT DESCRIPTION

An engineering investigation was initiated to provide a recommended design to improve Bonneville Second Powerhouse juvenile fish passage for the downstream migrant (DSM) system from the gatewell to the primary dewatering system. Study goals were focused on improvements to reduce injury and delay to migrating fish species that include:

- Improving the ability for the project operators to detect debris plugs at the orifice;
- Reducing the likelihood of fish impingement due to alignment of orifice flow; and
- Improving gatewell egress times with improved lighting.

Because of its ability to meet all study goals at a reasonable estimated cost the Engineering Documentation Report (EDR) Alternative 4 was selected as the recommended alternative. Alternative 4 would reduce the orifice ring size from 12 5/8 inches to its original design diameter of 12 inches and open additional orifices as needed, to maintain channel design flow and velocities. In addition, both Alternative 11 (minimizes overall tube length) and Alternative 12 (uses lighted orifice ring) would be included.

PROGRESS AND KEY ISSUES

NOAA provided review comments through the FFDRWG process and did not support reducing the orifice ring size. This was due to possible biological risk to adult fish that pass through the orifices. The reduction to a 12 inch orifice ring, with the ability to operate more orifices, was linked to the FGE program and the ongoing investigation to reduce gatewell residence time. Continued discussion through FFDRWG resulted in many members reluctant to reduce orifice ring size. The PDT accepted this concern and the EDR suggests a phased approach for implementing alternative measures, and recommending that a reduction in orifice ring size would be the lowest priority alternative measure for implementation. The phased approach would test the performance of each measure following their implementation before additional measures are considered. The EDR also recommends activities associated with the B2 FGE program that included research and development including:

"*Incorporate observations and conclusions from scheduled testing of the gatewell turbulence reduction device in the B2 FGE program in FY13. Continue to collect information if other alternatives are tested in the B2 FGE program.*"

This project was originally tied to the B2FGE program on a parallel track. Hydraulic and biological testing through the B2FGE program in 2008, 2009, 2013, 2014, and 2015 has provided a better understanding of the mechanisms of mortality in the JBS. The primary sources have been identified and include undesirable gatewell hydraulic conditions and excessive through-screen velocities on the two uppermost panels of the VBS during turbine operations in the upper 1% range. An alternative has been tested with full powerhouse implementation scheduled for fall and winter of 2016/2017.

Based on FGE test data and fish condition data collected through the Smolt Monitoring Program, there appears to be little biological benefit for making adjustments to minimize overall orifice pipe length (Alt. 11) and installation of orifice light rings to improve gatewell egress times (Alt. 12). Given the high cost, substantial O&M and low biological benefit the light ring alternative is not being pursued. However, improving the ability for the project personnel to detect debris plugs at the orifice continues to be a FFDRWG concern. Providing a cohesive jet through re-coring the tube to a larger 18" diameter and minimizing overall pipe length by moving the actuators that have a longer distance to the orifice ring are the highest ranked EDR (CRFM) based alternatives to achieve this objective.

The B2 DSM PLC program operation has a continuous orifice flush cycle for debris removal that takes approximately 3.8 hours to complete for 40 orifices. The cycle then repeats until it is stopped. The other mode of operation is manual, allowing individual control of the slide gate and can be done from a computer touch screen in the control room or at the PLC cabinet in the electrical building on elevation +90 of the intake deck. Another method for manual operation is at the orifice in the DSM channel.

There has been interest expressed to investigate the inspection benefit of installing a local manual control switch to eliminate manually overriding the solenoid valves at the orifice during the inspection. This was included as a recommendation in the EDR. NOAA provided comments during 90% EDR review including – *"Improved orifice inspection could be achieved by improving the view the current light tubes give of the back side of the orifice. We already use these light tubes to view the orifice for plugs but the light fixture is difficult to move out of the way and the light tube lens is difficult to see through. An improved observation system should be combined with an improved air flush system (something easier and more positive to use than the current valves) to allow a better, albeit temporary, orifice jet condition for viewing."*

Maintenance of the orifices and flush system is critical for its optimal operation and performance. Due to the existing frequency of auto flushing, daily system inspections by personnel, very infrequent observations of orifice debris plugging over many years, and the structural crew's ability to maintain removal of debris in gatewells when it is at or near criteria it, is recommended that resources to implement any modifications be conducted through O&M. The COE and FFDRWG members have been in discussion regarding ideas that are expected to help improve the reliability of the system. Two PLC modifications are being investigated:

1. Adding an air burst to the end of the flush cycle after the gate opens providing air support to reinitiate a cohesive jet.
2. Adding another auto flush cycle to the increase the cycling frequency for each orifice to approximately 2 hours.

The COE reported at the December 2015 and June 2016 FFDRWG that other LED light sources with higher luminance values had been investigated by the project through O&M and there were no plans for the PDT to move forward with the EDR recommendations for structural improvements or lighting improvements.

CURRENT SCHEDULE

Schedule for ATR completion will be determined based on ATR participants' availability followed by incorporation of agreed upon changes through the FFDRWG process.

FFDRWG REVIEW NEEDED AT MEETING? (If YES, list discussion topics below)

Updated EDR Recommendation to improve jet quality, inspection capability, align with ranked alternatives, and address FFDRWG concerns:

1. Modified alternative 3: Re-core orifice tube to a larger size (18 inch inside diameter) and maintain existing 12 5/8 inch orifice ring size.

2. Alternative 11: Minimize overall pipe length.

3. Eliminate orifice light ring alternative 12. Conduct lighting improvement on existing system through O&M.

Recommend prototype testing new configuration on poorest performing orifice(s) if necessary following B2FGE program gatewell modifications and O&M program improvements

O&M recommendations:

1. Rehab all orifices and air system for the function in auto and manual.
   ***Update** – BON will be able to overhaul all orifices as time a money allow, starting at the south end of the DSM and working north. This IWW period the Project will rehab orifices 11A-S and 11A-N. This effort will continue each IWW, and includes complete replumbing (fittings, valves, and tubing).*

2. Two air burst cycle PLC modifications to investigate:
    a. Increase the frequency of orifice auto-flush from 4 hour cycle to 2 hour cycle
    b. Add an air burst to the end of the cycle.

    <u>Update</u> - BON is not willing to support this item due to high cost (in labor) and the observation that the orifice jets return to their original state shortly after manually supplying an air burst; BON would rather spend tight O&M dollars on items that have a clear benefit (e.g. orifice rehab).

3. Clean light tubes to improve the view of the base of the jet. The light tubes lose their luminescence due to algae, mold, water deposits on the lenses and spider habitat. The lenses are cleaned or replaced annually but each year the view capability diminishes through the season. The tubes must be cleaned out and have lights which seal tightly against the lens to eliminate spider webs and droppings. A possible solution to the water deposits is to wax the lenses and/or extend the tubes and lights further away from the water. A possible solution to providing long term reflective quality in the tube is to install a PVC white liner.

    <u>Update</u> - A light tube extension was tested on unit 18 in the DSM and did not prevent scum build-up on the glass view lens. Therefore this option is deemed unsuccessful. The project is looking into best options for cleaning the view port tubes.

4. New higher luminance and cooler LED lights to reduce water scale buildup.

    <u>Update</u> – New LED lights have been installed on all orifices.

5. New light hardware to allow unobstructed movement of light for observation of the base of the jet.

    <u>Update</u> – New light shrouds have been installed on all orifices and are movable.

6. Increase frequency of changing out clean lenses. Increase from once per year to twice per year by adding a mid-season change out.

    <u>Update</u> - Cleaning lenses vs. replacement with new being evaluated. BON has a method to clean lenses. BON will add mid season lens change, increasing the frequency of lens cleaning/replacement.