

## MEMORANDUM FOR THE RECORD

22-Sep-2004

**FROM:** Sean Askelson, CENWP-EC-HD

**TITLE:** John Day North Fish Ladder Diffuser 16 (Control Section) Grating Analysis

**DESCRIPTION:** In OCT-2003, John Day Project Biologists requested a brief assessment of narrowing the grating spacing at John Day North Fish Ladder (JD NFL) Diffuser 16, which is the diffuser that feeds the downstream end of the control section. The existing grating (1 inch open spacing) apparently allowed lamprey to crawl through and enter the Auxiliary Water System (AWS). After some limited laboratory experiments at the Smolt Monitoring Facility (SMF), the biologists believed a 3/4 inch open spaced grating would prevent the lamprey from crawling through the grating.

A literature search revealed the JD NFL currently has problems meeting 1.3 ft head requirement at forebay elevations below 262 ft (see attached email Re: Request an assessment related to the diffuser grating's spacing at John Day ladders). We cautioned the project that further reducing the grating spacing size had potential negative impacts on the system. It was possible a tighter grating spacing could decrease the flow capacity of the AWS (in other words, it could take higher forebay elevations to meet the 1.3 ft head requirement). On 17-AUG-2004, the project requested further analysis of the JD NFL control section AWS. The attached Engineering Design Sheet details the steps taken to analyze the JD NFL control section AWS. The goal was to establish the range of forebay elevation where we currently cannot meet criteria (1 ft and/or 1.3 ft head), then simulate a tighter spaced diffuser grating and establish the range when the ladder could not meet criteria.

**CONTROL SECTION LAYOUT:** The JD NFL control section consists of 37 pools connected by a series of slots (some are outfitted with adjustable weirs that swing into place at forebay elevations above 263 ft) arranged in a serpentine fashion and an AWS that consists of an intake, one slide gate, and one diffuser. Weir 248 starts the 1 on 10 ladder section and is directly downstream of the control section in the JD NFL.

**STEPS TAKEN:** The steps taken are explained in detail in the attached ENGINEERING DESIGN SHEET.

**EXISTING CONDITIONS:** From this analysis, in the current configuration (1 inch diffuser grating), the JD NFL AWS can supply 1 ft ladder head for the entire range of normal pool operations (forebay elevations 257 to 268 ft). The JD NFL AWS cannot supply enough water to obtain 1.3 ft ladder head at forebay

elevations below 259.4 ft. The analysis also indicated there might be a small problem meeting the 1.3 ft ladder head at forebay elevations between 263-263.3 ft when the serpentine section moveable sills close portions of the slots.

The Full Calendar Year Forebay Stage Duration Curve for John Day shows the forebay drops below 263.3 ft only 20% of the time, while it drops below 260 ft less than 1% of the time.

**PROPOSED CONDITIONS:** Two conditions were proposed (the first was proposed by the project, the second incorporates the projects proposal with an additional change); 1) the project requested change of the diffuser grating to  $\frac{3}{4}$  inch spacing and 2) the project requested change of the diffuser grating to  $\frac{3}{4}$  inch and changing the trashrack grating to  $\frac{3}{4}$  inch spacing.

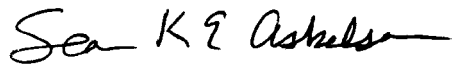
The trashrack open spacing is currently finer than the diffuser grating ( $\frac{7}{8}$  inch and  $\frac{3}{4}$  inch respectively). Theoretically, the debris that passed through the trashrack can also pass through the diffuser; ensuring debris accumulates on the trashrack (which is relatively easy to clean) instead of the diffuser grating. If the diffuser grating alone were changed to  $\frac{3}{4}$  inch, it would be finer than the trashrack. This would allow debris to pass the trashrack that could become lodged on the diffuser grating, which is difficult to clean. For this reason, a  $\frac{3}{4}$  inch trashrack and  $\frac{3}{4}$  inch diffuser grating combination was checked to see what kind of impact this might have on the system.

**RESULTS:** The first proposed condition is ( $\frac{3}{4}$  inch grating spacing) had negligible effects on the ability of the system to meet criteria due to the large area of the diffuser and corresponding low velocities through the diffuser grating. The second proposed condition ( $\frac{3}{4}$  inch diffuser and trashrack grating) shows negligible effects on the system as well.

**CONCLUSION:** In the current configuration, the JD NFL is capable of meeting 1 ft of ladder head throughout the entire range of forebay elevations. It cannot provide enough flow to achieve 1.3 ft ladder head at forebay elevations below 259.4 ft. The stage duration curves indicate the John Day forebay drops below elevation 260 ft less than 1% of the time. This ensures that the forebay is high enough that the JD NFL can meet the 1.3 ft ladder head a majority of the time throughout the calendar year.

Due to the large area and relatively low velocities through Diffuser 16 grating, CENWP-EC-HD does not feel changing the grating to  $\frac{3}{4}$  inch open spacing will have measurable impact on the ladders performance. CENWP-EC-HD would also support changing the trashrack to  $\frac{3}{4}$  inch open spacing if the John Day project feels this is necessary to keep trash from building up on the diffuser grating.

If there are any questions or concerns with this MFR, please contact me via email: [Sean.K.Askelson@USACE.ARMY.MIL](mailto:Sean.K.Askelson@USACE.ARMY.MIL) or telephone at (503) 808-4882.



Sean Askelson, CENWP-EC-HD

Attachments:

Engineering Design Sheet, John Day North Fish Ladder Diffuser Grating

E-Mail: Re: Request an assessment related to the diffuser grating's spacing at John Day ladders

Drawings: JDF-1-5-2/19 - serpentine section layout  
JDN-1-3-20/1 - AWS layout

CC:

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