

Bonneville Washington Shore Minor Modifications: Lamprey orifices

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Fish Biologist

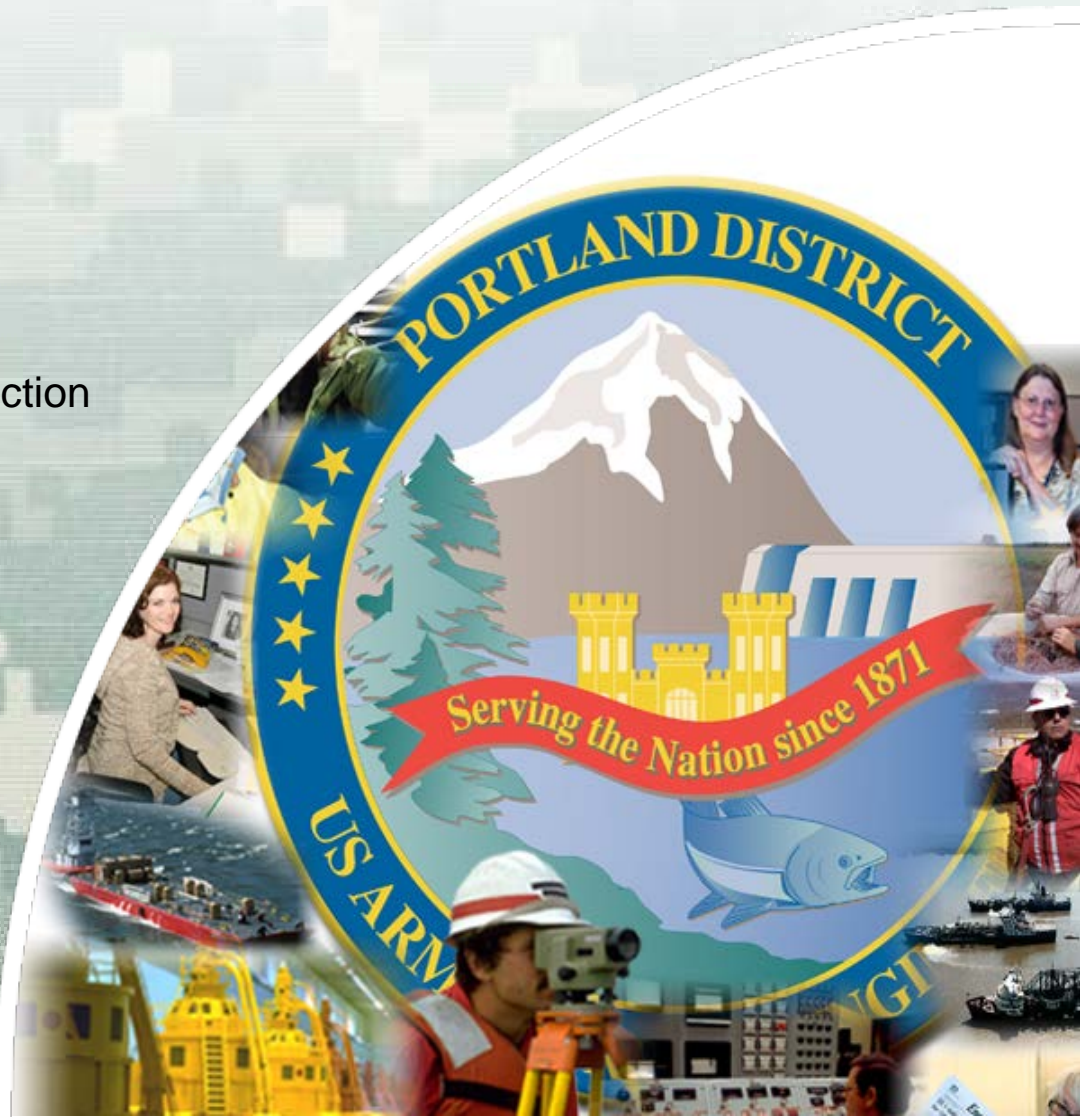
USACE Portland District, Fish Passage Section

FFDRWG

22 May 2018

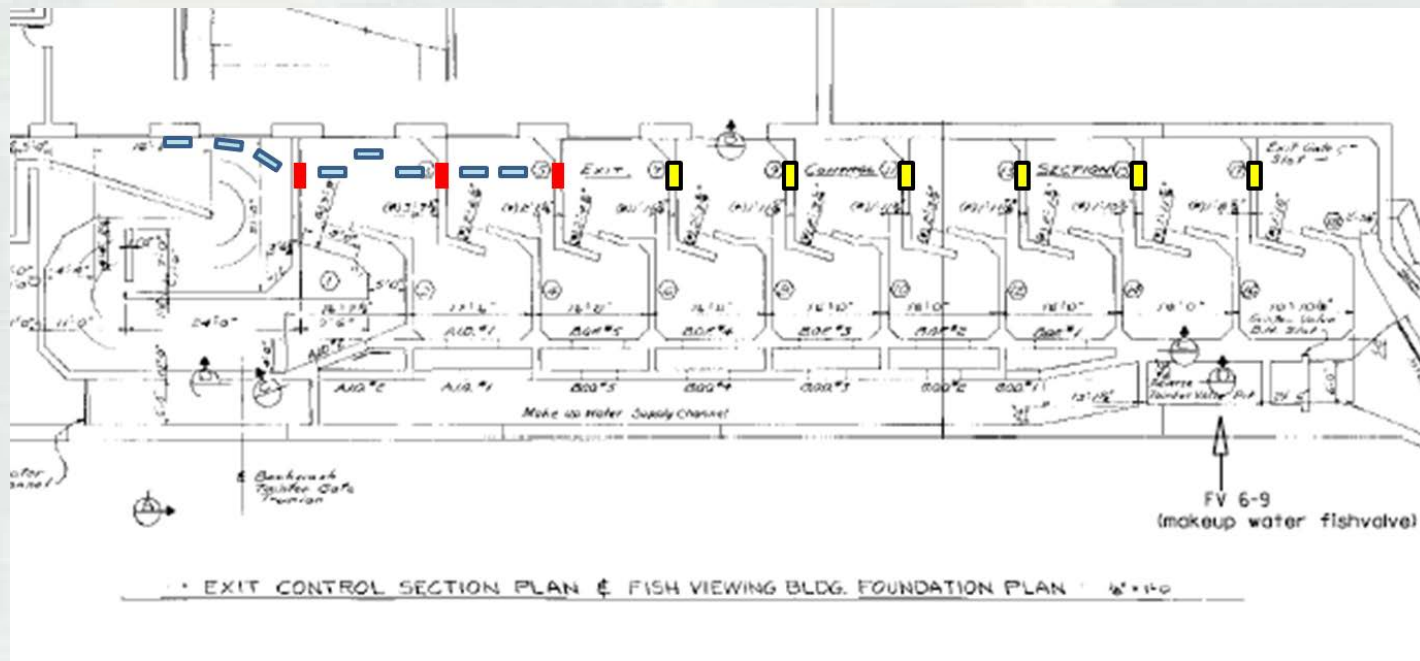


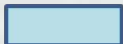
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Proposed locations

- 3 Currently installed at weirs 1, 3, and 5 (red boxes)
- Proposed an additional 6 orifices at weirs 7, 9, 11, 13, 15, and 17 (yellow boxes)
 - No additional monitoring proposed
 - No closure devices to be installed
 - Removal of current closure devices and video rails at weirs 1, 3, and 5.
 - Fill in orifice at weir 1

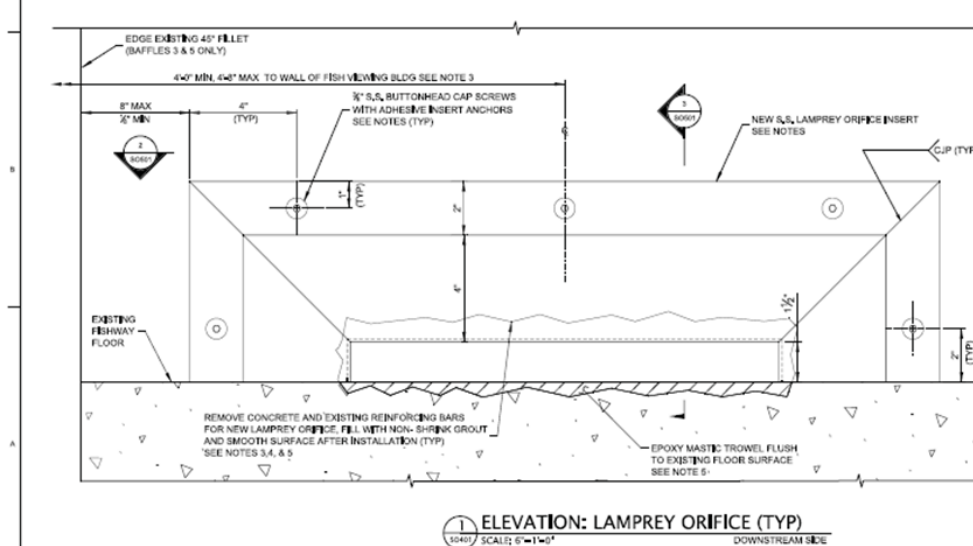
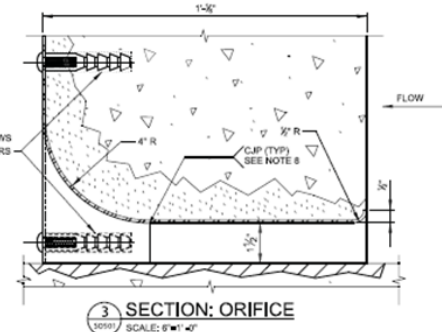
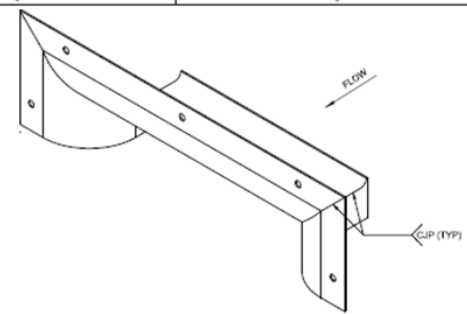
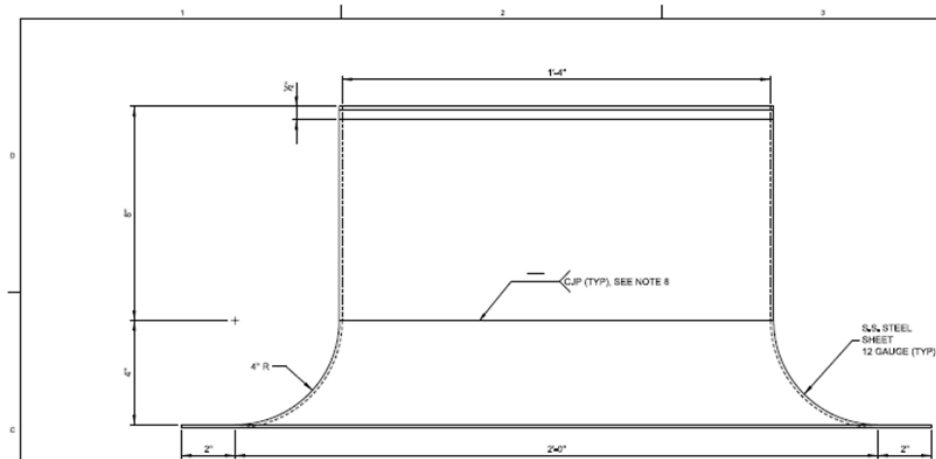


 Refuge box

 Currently installed lamprey orifice

 Proposed lamprey orifice



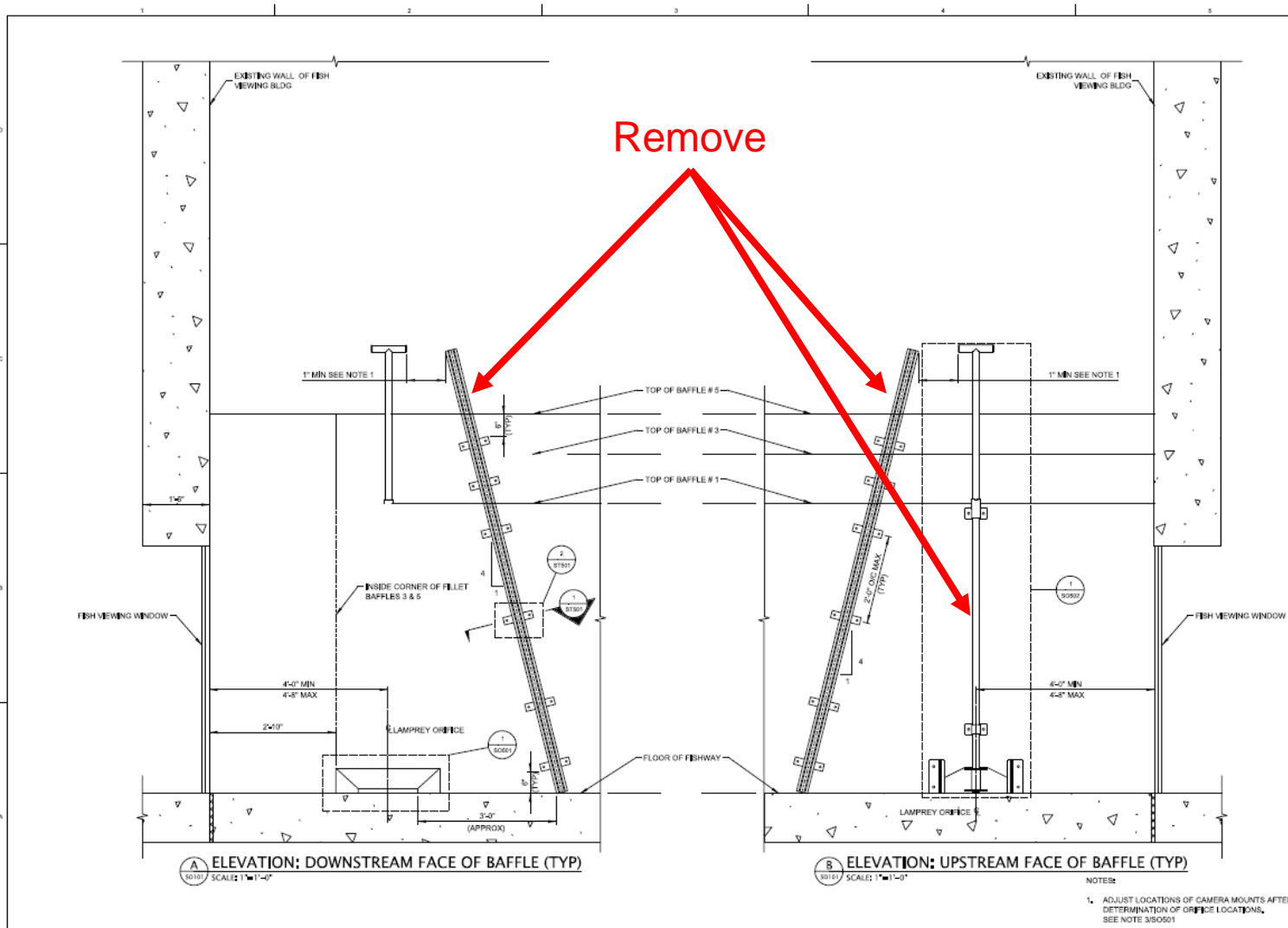


- NOTES:

1. A TOTAL OF THREE ORFICES WITH INSERTS REQUIRED.
2. EXISTING WEIR WALL DIMENSIONS MAY VARY, AND US EDGE OF INSERT AS REQUIRED SO THAT US FACE OF INSERTS DO NOT PROTRUDE BEYOND PLANE OF WALL.
3. BEFORE REMOVING CONCRETE FOR THE NEW LAMPREY ORFICES, FIELD LOCATE NO. 4 & NO. 6 REBARS USING GRID PENETRATING RADAR AND SHIFT THE LOCATION OF THE ORFICE WITHIN THE LIMITS SHOWN IN ORDER TO MINIMIZE THE AMOUNT OF REBAR TO BE CUT. MAINTAIN 2" MINIMUM GROUTED CLEAR COVER FOR REMAINING REBAR.
4. CUT NEW HOLE IN EXISTING WEIR WALL WITH A 3" OVER-CUT FOR GROUT AND PLACE NEW S.S. LAMPREY ORFICE INSERT IN THE CUT HOLE, THEN GROUT BEHIND THE NEW S.S. ORFICE INSERT. TROWEL ALL EXPOSED GROUT SURFACES SMOOTH.
5. FILL OVERCUT AT BOTTOM SURFACE OF ORFICE WITH EPOXY MASTIC AND TROWEL FLUSH TO EXISTING FISHWAY FLOOR AT EL. 65.4. SEE SPECIFICATIONS.
6. S.S. LAMPREY ORFICE INSERTS SHALL BE ANCHORED TO EXISTING WALLS WITH 3/8" Ø A193 B04 S.S. BUTTONHEAD HEX CAP SCREWS AND AQUEOUS INTERNAL-THREADED INSERT ANCHORS. 1/2" Ø SCREWS SHALL BE TACK WELDED TO PREVENT THE SCREWS FROM LOOSENING. EXPANSION-TYPE ANCHORS WILL NOT BE ACCEPTED.
7. ALL SHEET STEEL SHALL BE 12 GAUGE A193 316L STAINLESS STEEL.
8. ALL WELDS SHALL CONFORM TO AWS D1.5, CONTINUOUS FORMED PLATE IS ACCEPTABLE IN LIEU OF WELDS. FILLER METAL SHALL BE LOW CARBON, AND ALL GROOVE WELDS FLUSH AT EXPOSED SURFACES.



Orifice is 1.5 inches by 16 inches long



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PORTLAND DISTRICT

P&S REVIEW 60%

REVISIONS

NO.	DATE	BY	CHKD	DESCRIPTION
1				
2				
3				
4				
5				

PROJECT INFORMATION

PROJECT NO.	PROJECT NAME	PROJECT LOCATION	PROJECT STATUS

DESIGN INFORMATION

DESIGN NO.	DESIGN NAME	DESIGN LOCATION	DESIGN STATUS

REVISIONS

NO.	DATE	BY	CHKD	DESCRIPTION
1				
2				
3				
4				
5				

NOTES

1. ADJUST LOCATIONS OF CAMERA MOUNTS AFTER FINAL DETERMINATION OF ORIFICE LOCATIONS. SEE NOTE 3/SOS01

SHEET IDENTIFICATION
SO401



Hydraulic evaluation

Percent flow diversion

- 1.5 inch orifice uses a maximum of 1% of the total serpentine slot flow.

Evaluation of lamprey orifice jet

- Conservative case is at high forebay 76.5 feet.
 - ▶ Max velocity through any one orifice is 6.24 ft/s
- Theoretical stagnant pool max velocity 13.5 feet away is 2 ft/s
- Current conditions in serpentine pools are velocities ranging from 3 – 7 ft/s perpendicular to the lamprey jet.
 - ▶ The cross velocities result in break up of the orifice jet and pushes it upwards away from the next downstream orifice
 - ▶ High confidence that there will be no accumulating transference of momentum between lamprey orifices



Hydraulic evaluation continued

John Day North exit section physical model evaluation of 18" square orifices (2008)

- Larger head drops and orifice velocities of 7.4 ft/s
- Orifices adjacent to side wall did have dye go through multiple orifices
- Moved away from side wall and jet was diffused between orifices
 - ▶ This design is similar to currant lamprey orifice configuration

