ERDC Spill Pattern Updates

The Dalles Dam

Week of July 17th, 2017

OBJECTIVES: The objective of this modeling trip to ERDC was to develop spill patterns to maximize juvenile fish egress, utilizing the existing 1:80 physical model of The Dalles Dam, while not impeding adult upstream passage. These spill patterns were to be developed looking at higher percentages of spill, up to the “gas cap” as directed by a recent Court Order, while evaluating the potential impacts for erosion, navigation, and structural integrity of Dam features.

ASSUMPTIONS: The current Spill Patterns, which reach a maximum of 40% spill, have provided acceptable downstream egress for juvenile fish and have not significantly impacted upstream passage. Current patterns have also met biological survival metrics. Model runs will be observed at voluntary spill pattern levels closest to the desired change. Differences from the “acceptable” will be noted.

Fish Passage Concerns/Issues

* Will the existing spill pattern provide good juvenile egress at all tailwaters? (Note gas cap will involve higher spill volumes at lower tailwaters.)
* Are shore line velocities too high for good adult passage?
* Will higher spill percentages cause juvenile fish entrainment in “North Eddy” (see pictures at end of report)

Integrity of the Structures (spillway, channel slopes, fish ladder, etc)

* Velocities high enough on the shoreline, or at the end of the spill shelf, to cause erosion?
* Will possible shelf erosion impact the structural integrity of the 8/9 spillwall?

ATTENDANCE:

CENWP –

Jon Rerecich

Steve Schlenker

Jeff Ament

Aaron Litzenberg

ORIGINAL AGENDA:

**July 18th**

8 AM TDA folks - Check in at PAO

8:30 AM Meet to discuss learnings from Bonneville and Strategy for TDA

9:30 AM Go to 1:80 TDA Model

Spill = 65 Kcfs (that was the number in Julies spreadsheet)

Go = 5.6 feet

Total River = 165 Kcfs (39% spill)

TW = 77 feet

Calibrate Eyes, Develop Evaluation Metrics

10:30 AM Reduce TW a foot at a time and eventually get to

Spill = 65 Kcfs

Total River = 120 Kcfs (54% spill)

TW = 71.0 feet

Assume an hour for each change in tailwater - will finish effort on Wednesday (10:30 AM 76 feet, 11:30 AM 75 feet, 12:30 Lunch, 1:30 PM 74 feet, 2:30 PM 73 feet, 3:30 PM 72 feet)

Be sure to take LUNCH

4:00 PM Wrap up – Days Effort

**July 19th**

8:00 AM Meet on TDA Model

Spill = 64 Kcfs

Total River = 120 Kcfs

TW = 71 feet

Anticipate problems at lower TWs. If things don’t look good anticipate that pattern was evaluated with gates 1 and 2 closed to see if that worked.

10:00 AM TDA high river flow

Spill = 164 Kcfs

Total River = 410 Kcfs

TW = 84 feet

This is currently an acceptable condition

10:30 AM Spill = 164 Kcfs

Total River = 440 Kcfs

TW = 85 feet

Egress okay?

11:30 AM Spill = 164 Kcfs

Total River = 440 Kcfs

TW = 84 feet

Egress okay?

12:00 PM LUNCH

1:00 PM Spill = 164 Kcfs

Total River = 440 Kcfs

TW = 83 feet

Egress okay?

2:00 PM Spill = 164 Kcfs

Total River = 440 Kcfs

TW = 82 feet

Egress okay?

**July 20th**

Another Test Day for TDA

Not sure but expect additional modeling is necessary

**July 21st**

Travel Day for TDA Folks

ACTUAL TESTS PERFORMED:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Summary Record of 1:80 Model Dye Tests** | | | | | | | |  |  |  |  |  |  |  |  |
|  |  | Project Operation | | | | | | | Spill Bay Operation | | | | | | |
|  |  |  |  |  |  | Forebay | |  |  |  |  |  |  |  |  |
| Test |  | FLOW RATE (Kcfs) | | | Percent | TDA | Bonn | TW | Type of |  | GO | Q/bay |  | GO | Q/bay |
| No. | Time | Total | PH | Spill | Spill | (ft) | (ft) | (ft) | Pattern | Bays | (ft) | Kcfs | Bays | (ft) | Kcfs |
| **DATE:** | | **7/17/2017** | | **MONDAY** | |  |  |  |  |  |  |  |  |  |  |
| 1 | 800 | 165 | 100 | 65 | 39% | 158.5 | 74.4 | 77.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 2 |  | 165 | 100 | 65 | 39% | 158.5 | 73.2 | 76.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 3 |  | 165 | 100 | 65 | 39% | 158.5 | 70.6 | 74.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 4 |  | **120** | 55 | 65 | 54% | 158.5 | 74.6 | 76.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 5 |  | 120 | 55 | 65 | 54% | 158.5 | 72.3 | 74.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| **DATE:** | | **7/18/2017** | | **TUESDAY** | |  |  |  |  |  |  |  |  |  |  |
| 6 | 800 | 120 | 55 | 65 | 54% | 158.5 | 70.0 | 72.1 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 7 |  | **120** | 55 | 65 | 54% | 158.5 | 74.6 | 76.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 8 |  | 120 | 72 | 48 | 40% | 158.5 | 74.6 | 76.0 | uniform | 1-8 | 4.1 | 6.0 |  |  |  |
| 9 |  | **140** | 75 | 65 | 46% | 158.5 | 74.0 | 76.0 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 10 | 1500 | 140 | 84 | 56 | 40% | 158.5 | 74.0 | 76.0 | uniform | 1-8 | 4.8 | 7.0 |  |  |  |
| **DATE:** | | **7/19/2017** | | **WEDNESDAY** | | |  |  |  |  |  |  |  |  |  |
| 11 | 1000 | **250** | 150 | 100 | 40% | 158.5 | 74.0 | 78.5 | uniform | 1-8 | 8.6 | 12.5 |  |  |  |
| 12 |  | 250 | 81 | 169 | 68% | 158.5 | 74.0 | 78.5 | uniform | 1-8 | 14.7 | 21.1 |  |  |  |
| 13 |  | 250 | 81 | 169 | 68% | 158.5 | 71.1 | 76.5 | uniform | 1-8 | 14.7 | 21.1 |  |  |  |
| 14 |  | **335** | 171 | 164 | 49% | 158.5 | 71.0 | 79.5 | uniform | 1-8 | 14.2 | 20.5 |  |  |  |
| 15 |  | 335 | 171 | 164 | 49% | 158.5 | 74.5 | 81.5 | uniform | 1-8 | 14.2 | 20.5 |  |  |  |
| 16 |  | 335 | 211 | 124 | 37% | 158.5 | 74.5 | 81.5 | uniform | 1-8 | 10.7 | 15.5 |  |  |  |
| 17 | 1630 | 335 | 211 | 124 | 37% | 158.5 | 71.0 | 79.5 | uniform | 1-8 | 10.7 | 15.5 |  |  |  |
| **DATE:** | | **7/20/2017** | | **THURSDAY** | |  |  |  |  |  |  |  |  |  |  |
| 18 | 800 | **120** | 55 | 65 | 54% | 158.5 | 70.0 | 72.1 | uniform | 1-8 | 5.6 | 8.1 |  |  |  |
| 19 | 930 | 120 | 72 | 48 | 40% | 158.5 | 70.0 | 72.1 | uniform | 1-8 | 4.1 | 6.0 |  |  |  |
|  |  | Testing terminated | |  |  |  |  |  |  |  |  |  |  |  |  |

DISCUSSION:

Some of the attendees traveled on Sunday the 16th, so a few operational runs were looked at on Monday the 17th. These runs included low flow conditions (120-165 kcfs) with TW’s in the range of 74 ft – 77 ft. Tailwater elevations were adjusted for a potential range of low to median Bonneville forebay elevations which influence the level of The Dalles tailrace for each given river discharge. This was done to examine the combination of relatively high spill to relatively low tailwater elevation. All spill patterns observed during this modeling trip were uniform patterns, and confined to the spill bays 1 through 8 (inside of the 8/9 spillwall).

During the testing, it was discovered that there was an issue with two of the four pumps that supply water to the model. Once the sump was dewatered to look at the pump intakes, it was found that the foot valves (check valves) on two of the pumps were corroded to the point that little water could flow way into the pumps (see picture below).



ERDC has agreed to refurbish these foot valves, and have them working for the Agency trip in September. Because of the corroded foot valves, the maximum flowrate that was observed the week of July 17th was 335 kcfs, which was performed on Wednesday the 19th.

After the testing was completed on Thursday the 20th, modifications to the device used to drop dye into the model were suggested by NWP and agreed upon by ERDC for the September Agency trip. Also, ERDC was asked to take velocity measurements in the tailrace of the model before the Agency trip.

FINDINGS:

No obvious egress issues were apparent throughout the testing performed on the week of the 17th. The main issue observed was the creation of a large turbulent backroller at the edge of the tailrace shelf, towards the 8/9 spillwall during flow conditions of high spill and low tailwater (see pictures in the section below). Besides the potential issue of entraining juvenile fish in the roller and delaying downstream passage, it appeared to be more of a possible erosion issue at that point. Recommend analyzing future tailwater survey data to see if erosion in that area is progressing up towards the dam. With the 8/9 spillwall helping to redirect the spill flow into the thalweg powerhouse flow, no unexpected egress issues, or adult upstream passage issues, were observed with the tested operations and flowrates on the week of July 17th.

With the combination of relatively high spill and low tailwater, there was somewhat more tendency for dye to plunge deeper off the west end of the spillway shelf. The deeper dye would then be conveyed by secondary currents towards the north eddy area (See Figure 1) off the spillway shelf, but almost always moved out quickly toward the downstream thalweg to the west. No dye was seen moving into the primary areas of egress concern such as the bridge islands, Oregon channel, or spillway shelf south of wall (See Figure 1) regardless of spill percentage for the discharges that were tested.



North Eddy Area

Figure 1 - Egress Destination Zones of High Predator Risk for Juvenile Fish Discharged Through Spillway

PICTURES:







