US Army Corps of Engineers
Portland District (CENWP)

BRADFORD ISLAND
FISHWAY MODIFICATION EDR
FINAL SUBMITTAL

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Tetra Tech INCA

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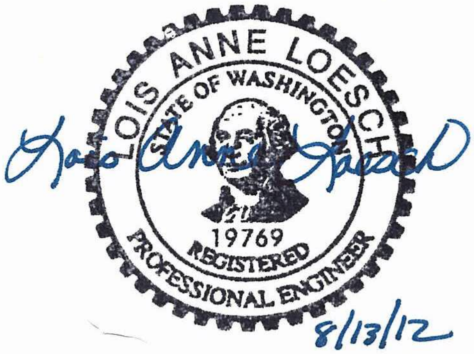
CERTIFICATE OF ENGINEER

The work contained herein was prepared under the supervision and direction of the undersigned.



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Final Submittal
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LIST OF ACRONYMS

AWS	Auxiliary Water Supply
FG	Fish Gate
FMEA	Failure Modes and Effects Analysis
ft/s	feet per second
FV	Fish Valve
HELCRABS	Hydraulic Evaluation of Lower Columbia River Adult Bypass Systems
HMI	Human Machine Interface
HSS	Hydraulic Steel Structures — for more information regarding these components, refer to ER 11W-2-8157, Engineering and Design Responsibility for Hydraulic Steel Structures.
IFR	Individual Failure Rating
I/O	Input / Output
mA	milliamp
MCC	Motor Control Center
N/A	Not Applicable
NEC	National Electrical Code
NMFS	National Marine Fisheries Service
OFR	Overall Failure Rating
OSE	Original Spillway Exit
PH	Powerhouse
PLC	Programmable Logic Controller
psi	pounds per square inch
RPN	Risk Priority Number
SLED	Sea Lion Exclusion Device
SG	Sluice Gate
SW	Submerged Weir
UMT	Upstream Migrant Transport
USACE	US Army Corps of Engineers
WG	Weir Gate

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EXECUTIVE SUMMARY

This Phase II report comprises an assessment of the working components for the two adult fish ladder systems at Bonneville Dam, Bradford Island, A Branch, and B Branch. This is the follow-up to the Phase I Report (2004), which the Portland District prepared in response to the National Marine Fisheries 2000 Biological Opinion Reasonable & Prudent Action (RPA) 126.

Bradford Island A and B Branch fishways began service in 1938 with the original construction of Bonneville Dam and the First Powerhouse. These ladder systems have since undergone several modifications and continue to pass fish effectively. However, due to the age of the fishways, there are concerns of potential problems that could impair future performance.

During the 2003 and 2004 winter shutdowns for maintenance, Project personnel guided the 2004 study team through site inspections of representative samples of components or problem areas in each system. This has been repeated during the Bradford Island 2011 winter shutdown for the Phase II study team.

Following the main report, there are four appendices with supplemental information:

A. Decision Matrix
B. Inspection Reports
C. QC Documentation
D. Correspondence

1.0 INTRODUCTION

1.1 Project Location

The Bonneville Project (Figure 1.1) is located on the Columbia River, 42 miles east of Portland, Oregon on river mile 146. The First Powerhouse at Bonneville began operation in 1938 and the Second Powerhouse in 1982. Both Powerhouses have facilities to enhance adult and juvenile fish passage.

Figure 1.1 Bonneville Project Aerial View from Downstream

1.2 General Facilities

Adult fish passage facilities at Bonneville Dam consist of fishways at Bonneville First and Second Powerhouses (see Figure 1.2). The Bradford Island Fishway, located on the Oregon side of the Project consists of two branches. The A Branch, which serves the first Powerhouse and the B Branch, which serves the south end of the spillway. These two branches join together at Bradford Island and share the counting station and exit section. The Cascades Island Fishway at the north side of the spillway will be the subject of a later task. The Washington Shore Fishway is located on the north side of Powerhouse 2 and is not assessed in this report. More detailed descriptions of the facilities can be found under the specific sections in this report dedicated to the discussion of the individual fishway.

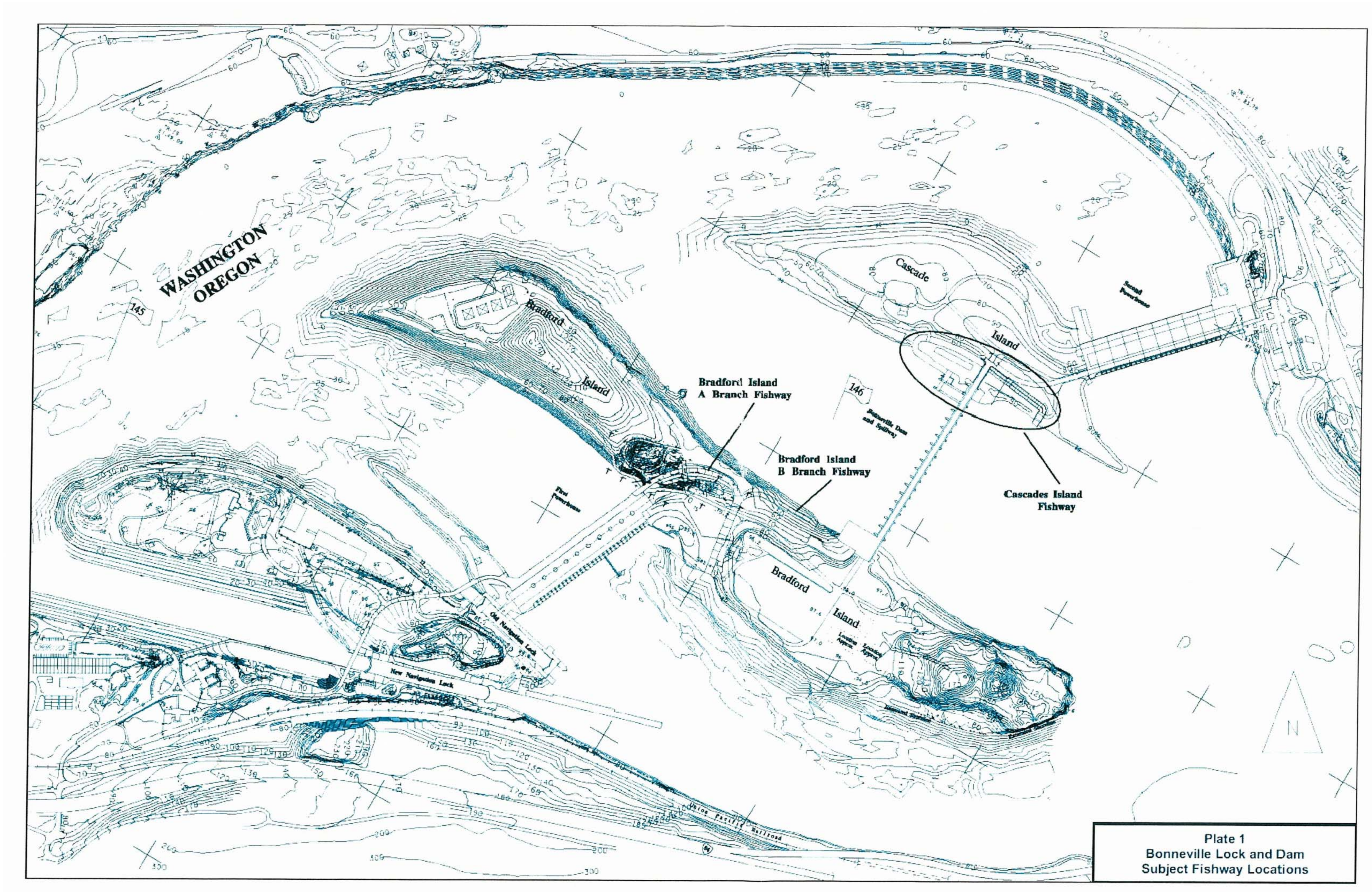

Figure 1.2 **Bonneville Lock and Dam Subject Fishway Locations**

1.3 Authorization

- 1848 - sec 12, Oregon Territorial Act, fish passage on Columbia required for salmon at any man-made blockage
- 1888 - Authority for fish ladders at Corps dams and locks (RHA Aug 1888)
- 1934 - First major salmon fish study - USFWS; first Fish & Wildlife Coordination Act (16 USC 662)
- 1937 - Bonneville Project Act (16 USC 832 - Corps -BPA partnership)
- 1950 - H Doc 531 Columbia River basin master plan; includes Dalles & John Day Dams, plus Hatcheries; large expansion of Willamette Basin flood control project dams (all but Foster)
- 1970s - Boldt fish treaty litigation: treaty rights extended from just fishing site access to 50 percent share of fishery; US v Oregon implements for Columbia River; Zone 6 created (Bonn to McNary dams)
- 1980 - Pacific NW Power Act (16 USC 839); Salmon & Steelhead Act; Magnusson-Stevens Act EFH amendments
- 1988 - CRTFAS Act; CRFM program authorized in appropriations act<------
- 1990s - 2000s - ESA litigation over salmon (16 USC 1536); WRDA Sec 511 authority for CRFM

1.4 Basis for the Report

Ongoing maintenance and repairs have been conducted over the years to continue operations, but additional work is needed to improve and maintain these fishways to meet current hydraulic standards as established in the 2004 HELCRABS report. In addition, National Marine Fisheries Service (NMFS) 2000 Biological Opinion Action 126 states: "The Corps shall initiate an investigation and prepare a report on the Bonneville First Powerhouse Bradford Island and Cascade Island adult fishway auxiliary water system by the end of 2001. In the report, the Corps shall identify measures that will improve or replace aging components, thereby enhancing current and long-term performance and reliability."

In response, the U.S. Army Corps of Engineers (USACE) conducted an initial assessment of the Cascade Island and Bradford Island fishway operating features. The Phase I findings were documented in Bradford Island and Cascades Island Adult Fishways Assessment Phase I Final Report (USACE, July 2004), including a list of concerns regarding the condition of fishway mechanical, structural, and electrical features.

This task order will complete the second phase of a two-phase project to assess the fishway condition and recommend feature repairs/replacement for the Bradford Island and Cascade Island fishways at Bonneville Lock and Dam. The results of the study will be used by CENWP-OD-TF to budget funds for repairs/replacement

1.5 References

- *Bradford Island & Cascades Island Adult Fishways Assessment, Phase I Final Report, (USACE, July 2004).*

- *Hydraulic Evaluation of Lower Columbia River Adult Bypass Systems (HELCRABS) Bradford Island 'B' Branch Adult Fishway Evaluation (USACE, July 2004).*

- *Hydraulic Evaluation of Lower Columbia River Adult Bypass Systems (HELCRABS) Bradford Island 'A' Branch Adult Fishway Evaluation, Interim Evaluation Report (80% DRAFT), (USACE, October 2003).*

2.0 BRADFORD ISLAND A BRANCH

2.1 Existing Operation

The Bonneville A Branch Adult Fishway is one of the four ladder systems at the Bonneville Project that provides bypass routes for the upstream migrating adult salmon, migrating lamprey, and shad. It also comprises one-half of the Bradford Island System, which includes B Branch. The A Branch fishway is situated around the First Powerhouse to the west, north, and east. This system provides fish passage for adults approaching the dam in the Bonneville First Powerhouse tailrace channel.

Fish enter the ladder through two main fishway entrances: south entrance on the south end of the Powerhouse and the north entrance on the north end. (Between the main entrances, there were additional fish entry points along the downstream face of the Powerhouse through telescoping slide gates, or orifice gates. These gates were permanently closed in 2003). Both of the main entrance locations have two sets of telescoping weirs each. The Powerhouse Collection Channel spans the downstream face of the Powerhouse, connecting the south entrance to the north entrance and ultimately leading fish to the overflow ladder section. The fish use the overflow ladder weirs to ascend over the dam, rising from Weir 8 to Weir 53. At this point, the fish enter the junction pool, a joining of the A and B Branches fish conveyance alleys. From there, fish from both branches move up additional weirs to Weir 67, through the counting station and the labyrinth exit section. The fish exit to the forebay on the north side of the First Powerhouse. (See Figure 2.1.)

The flow from the top of the ladder system is supplied from the pool at the exit section, which has a ladder head control system to provide constant flow down the main ladder regardless of forebay fluctuation. Most of the fish attraction water at the entrances is supplied from the auxiliary water system (AWS). Auxiliary water is fed into the collection channel and lower ladder section via floor diffusers. The AWS is comprised of two conduits: the south delivers to the entire collection channel and the north supplies the lower pools of the overflow ladder section. Both conduits are fed from the forebay from each end of the Powerhouse. Fish valves FV1-1 and FV3-7 control the rates of AWS flow into the south and north conduits respectively. Additional flow to the ladder, as needed, is provided by the makeup water supply, which is regulated by Fish Valve FV3-9.

The A Branch was put into service concurrently with the B Branch, Cascades Island Fishways, and the First Powerhouse in 1938. Over the next four decades, modifications were made to the entrances, AWS system, diffusers, fish valves, and exit and forebay head control system. The last major changes occurred in 1970s with the Modifications for Peaking. The exit section was upgraded to the current vertical slot design with a new fish valve (FV3-9) for ladder make-up flow. Underwater orifices were added along with additions to the top elevation of the weirs. In addition, diffuser orifices and ladder weirs were modified. In

1995, the fish entrances were upgraded by replacing a sluice gate at each location with a new telescoping weir.

2.2 Components

The fishway consists of three types of components:

- Fish passage
- Auxiliary water supply
- Control systems

Inspection reports for A branch fish passage and auxiliary water supply are included in Appendix B2; the inspection report for A and B branch control systems is included in Appendix B1.

2.3 Fish Passage Components

2.3.1 Entrances

The fishway entrances are comprised of the south entrance on the south end of the Powerhouse, the north entrance on the north end, and five telescoping slide gates in between the Powerhouse Collection Channel and the tailrace that were permanently closed in 2003. Sea lion exclusion devices (SLEDs) are incorporated at each ladder entrance. The entrances are labeled Weir Gate (WG) -1 (weir gate) and WG-2 at the south end of the powerhouse and WG-64 and WG-65 at the north end.

The entrances provide access to the fish ladder, establishing fish entrance velocity and water level. Loss or failure of the entrance weirs would affect hydraulic performance and limit the openings for fish to enter the ladder.

2.3.2 Powerhouse Collection Channel

The powerhouse Collection Channel runs along the downstream (west) face of the First Powerhouse. This channel conveys fish from the south entrances to the bottom of the A Branch Ladder. The north entrance conveys fish to this location as well. Then the fish move to the junction pool, and ultimately to the fish ladder over the dam. Loss of the collection channel would prevent the passage of fish from the south entrance.

2.3.3 Fish Lock

The fish lock is a defunct fish elevator system that was installed during original fishway construction for the purpose of backing up the fish ladder. The system is comprised of two elevators, each with openings to the equalization chamber and collection channel. The lock elevators are located on the south side of Powerhouse 1, west of FV1-1, and adjacent to the old navigation lock. East of the fish lock, the Ambursen dam sections of the navigation lock were filled with concrete as part of a seismic upgrade; no documented upgrade was done at the fish lock. There have been some undocumented modifications to the fish lock walls (i.e., holes cut) to allow for drainage of leakage water. The fish lock channel is a short arm of the south Powerhouse Collection Channel that extends eastwardly from the south entrance back to the fish lock. This channel is largely rock lined and has no floor diffusers.

Use of the fish lock system was discontinued about 50 years ago. However, use of one of the fish lock units may be reconsidered for sturgeon passage across the dam at some future point.

2.3.4 Ladder Section

The overflow ladder connects the north end of the Powerhouse Collection Channel to the junction pool and exit section. The ladder is approximately 1225 feet long and ranges from 30 to 42 feet wide. The slope is 1:16. The source of ladder flow comes from Bradford Island exit section, the flow evenly split between A and B Branch at the Junction Pool.

2.3.5 Junction Pool

The A Branch and B Branch ladder merge at the junction pool. Weirs 54 to 67, the counting station, and the exit section for Bradford Island are upstream of the junction pool. The downward flow from the exit section is split evenly between each branch. There is a permanently closed diffuser (FG3-13) in the floor of the junction pool.

The junction pool hydraulically connects the upper ladder with the entrances. Loss or failure of the junction pool would prevent fish from entering the upper section of the ladder.

2.3.6 Counting Station

The fish counting station includes an approach pool with the picket lead, counting slot, exit pool, counting slot bypass, and counting room. The counting slot is where the fish are viewed and counted. It is a narrow section that runs adjacent to the counting room with a common viewing window. There is a mechanical crowder that can reduce the slot width to improve viewing access.

The counting station provides the ability to observe fish movement as well as count the number passing through the ladder. The counting station is necessary to assess ladder efficiency and gather overall fish passage statistics. Failure of any part of the counting station would not necessarily affect the passage of fish, unless blockage of the channel occurred.

2.3.7 Exit Section

The exit section is the common passage for fish from both Bradford Island branches to the forebay on the north side of the First Powerhouse. The exit channel provides the transition from the ladder to the forebay. The adjustable weirs provide the ability to regulate flow through the ladder through a range of forebay elevations and maintain ladder weir head criteria. Loss or failure of the exit section channel or the exit weir would prevent fish from entering the forebay. Failure of the exit weir in the closed position would dry up the upper sections of the ladder.

2.3.7.1 Makeup Water Supply System and Channel

The makeup water supply system and channel augments the flow through the exit channel to ensure the ladder head criteria are met at Weir 67. The makeup water supply channel runs adjacent to the exit channel on the west side. This water is (adult) fish free-screened at the forebay by fish screens and by the picket lead on the downstream side of the makeup water supply. Fish valve FV3-9 regulates the flow and adjusts to maintain ladder criteria as the forebay changes. Loss of the makeup water supply system would prevent the exit from operating within criteria.

2.4 Auxiliary Water Supply Components

The auxiliary water system includes two AWS conduits, two systems of diffusers, and three fish valves (FV1-1, FV3-7, and FV3-8). FV1-1 feeds the south conduit of the AWS while FV3-7 feeds the north conduit of the AWS. Fish valve FV3-8 is currently closed and non-operable. The north and south AWS conduits are actually both part of a single conduit, separated by fish valve, FV3-8. This valve is kept closed.

2.4.1 South AWS Conduit

The south AWS conduit supplies auxiliary water to the Powerhouse Collection Channel, the south entrance and partially the north entrance. The conduit runs adjacent (east) and partly below the Powerhouse Collection Channel. It supplies diffusers FG2-1 through FG2-22B along the alignment of Powerhouse Collection Channel. Loss or failure of the AWS conduit would eliminate AWS flow. This would cause the ladder, collection channel, and entrances to be out of criteria, making it difficult for the fish to find the entrances.

2.4.2 North AWS Conduit

The north AWS conduit supplies the lower portion of the A Branch ladder and provides a portion of the flow through the north entrance. The 7.5-feet square conduit runs along the west side of the ladder starting next to the exit section and ending at FV3-8. The conduit feeds FG3-3 through FG3-9 in the floors of ladder pools between Weirs 13 - 31. Loss or failure of the AWS conduit would eliminate AWS flow. This would cause the ladder, collection channel, and entrances to be out of criteria, making it difficult for the fish to find the entrances.

2.4.3 Diffusers

The diffusers are the outlets from the AWS to the fish ladder system. They are designed to dissipate energy and diffuse the flow as it rises through the floor openings. The diffuser gates are 3.5 feet square, open/close leaf gates that go over the downstream face of the AWS diffuser orifices supplying each ladder diffuser with water. All diffuser gates are and have the same configuration. The gates are connected to long gate stems that extend from the top of the ladder walls. The gate leaves are pinned to the stems. Figures 2.1 and 2.2 show the locations of the diffuser gates throughout the fishway. Note that Figure 2.2 is a close up of the gates in the collection channel and the gates between the collection channel and the junction pool.

Project personnel provided the Powerhouse Collection Channel Diffuser Valve Settings shown in Table 2-1 at the inspection for the diffusers that discharge along the Powerhouse Collection Channel.

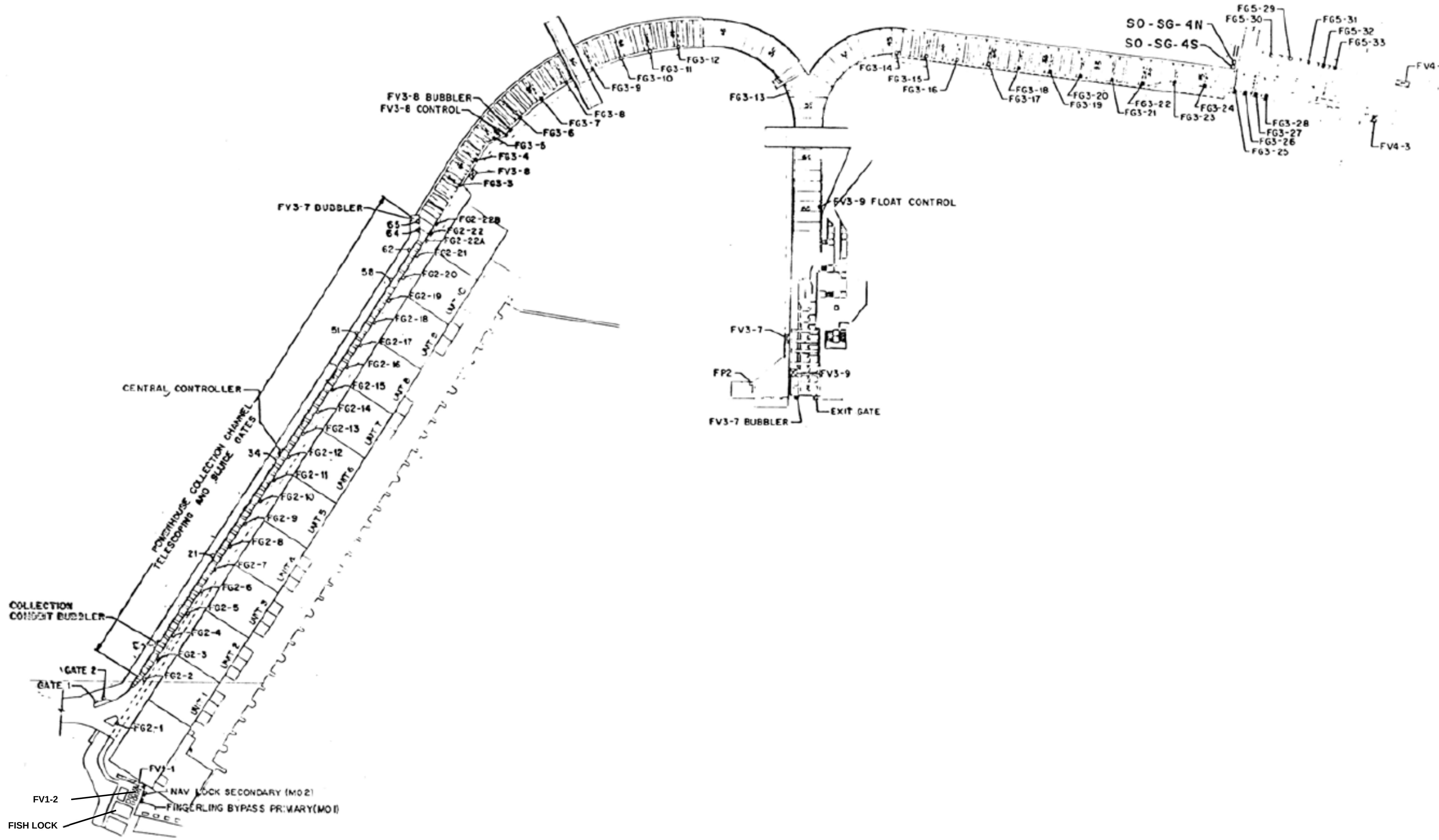

Figure 2.1 **Bradford Island Fishway**

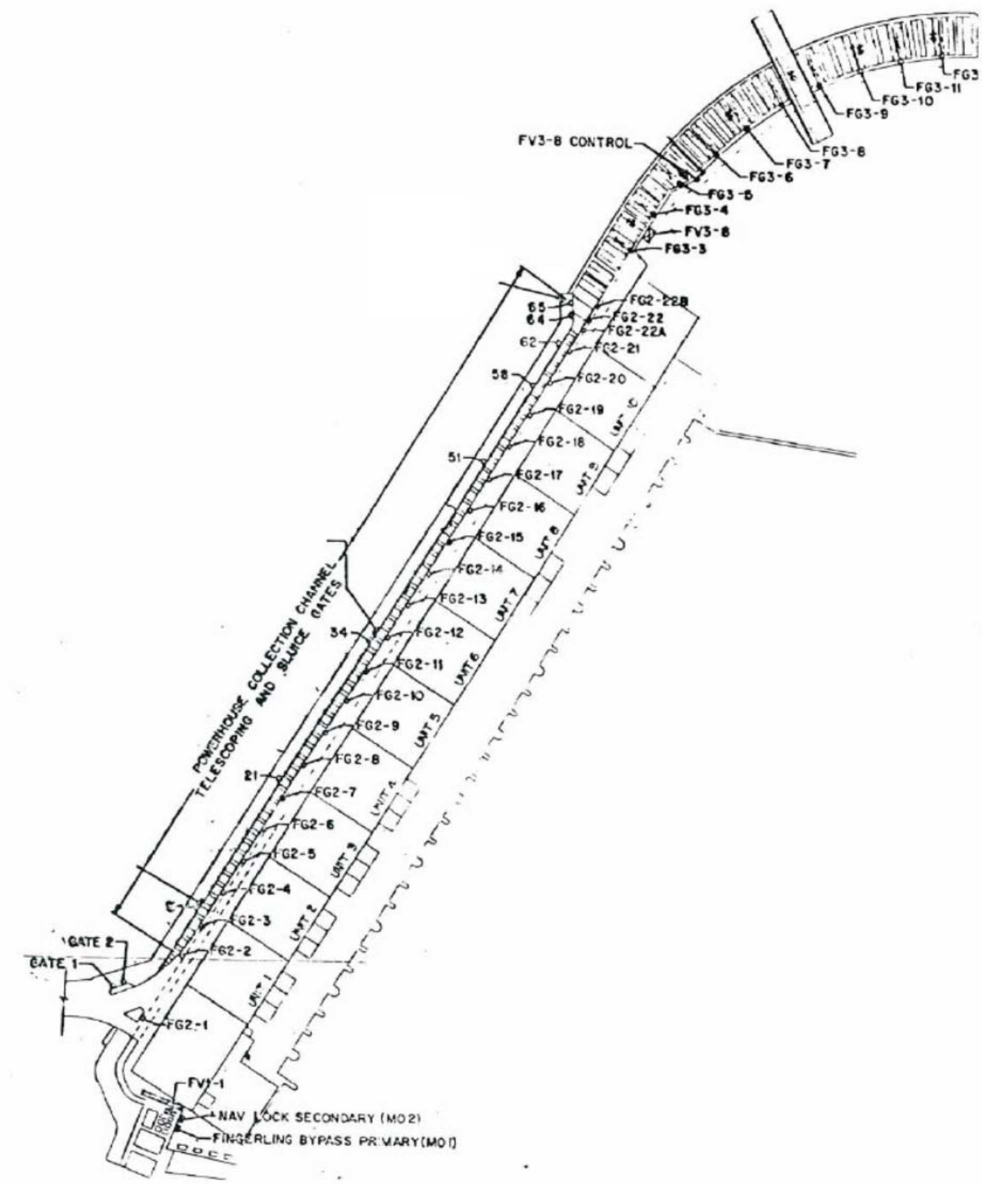

Figure 2.2 Bradford Island A Branch Diffusers

Table 2-1 – Powerhouse Collection Channel Diffuser Valve Settings

(Revised February 25, 2006; As Noted February 1, 2012, see also Drawing BDF-9-G-OA011)

Valve	Setting	Valve	Setting
FG2-1	Closed	FG2-13	Closed
FG2-2	Closed	FG2-14	Closed
FG2-3	Closed	FG2-15	Closed
FG2-4	Open	FG2-16	Closed
FG2-5	Closed	FG2-17	Closed
FG2-6	Closed	FG2-18	Closed
FG2-7	Closed	FG2-19	~~Open~~ Closed - Broken Shaft/yoke
FG2-8	Open	FG2-20	Open
FG2-9	Closed	FG2-21	Open
FG2-10	Closed	FG2-22 Electric	~~Closed~~ Open
FG2-11	Closed	FG2-22A	~~Open~~ Closed has some problems
FG2-12	Open	FG2-22B	Open

Diffusers FG3-3 through FG3-13 are located in the floors of certain pools of the A Branch ladder between the collection channel and the junction pool and are supplied by the north AWS conduit. The four upper diffusers (FG3-10 through FG3-13) have been permanently blocked off.

Loss or failure of diffuser gates in either the open or the closed position could prevent the ladder from operating within criteria.

2.4.4 Fish Valves

The fish valves are the large radius tainter gates that control auxiliary water flow to the two AWS conduits. The valves have a 10.5-foot radius a 7-foot width and a 10.74-foot chord distance.

Loss or failure of the fish valves in either the open or the closed position could prevent the ladder from operating within criteria

2.5 Control Systems

The fishway has monitoring in place for tailwater and entrance water elevations at several locations across the tailrace of PH1. The data from these monitoring devices is utilized by the fishway's PLC program to control its operation. Loss or failure of the control system could prevent the ladder from operating within criteria.

3.0 BRADFORD ISLAND B BRANCH

The Bonneville B Branch Adult Fishway is one of the four ladder systems at the Bonneville Project that provides bypass routes for the upstream migrating adult salmon, shad, and lamprey. It also comprises one-half of the Bradford Island System, which includes A Branch. This ladder is located on the north side of Bradford Island and on the south end of the spillway.

3.1 Existing Operation

Fish enter the ladder through the fishway entrance, comprised of two fixed weirs and two sluice gates located adjacent to Spill Bay 18. Large volumes of attraction water are issued through the entrances to lure the fish from the tailrace into the fishway. Attraction water adjacent to the fish entrance area is provided by a minor opening of the spillway gate at Bay 18. The collection channel connects the entrance to the overflow ladders. The fish use the overflow ladders to ascend over the dam, rising from Weir 8 to Weir 53. At this point, the fish enter the junction pool, a joining of the A and B Branches fish conveyance alleys. From there, fish from both branches proceed up over additional weirs to weir 66, through counting station and the labyrinth exit section. The fish exit to the forebay on the north side of Bonneville First Powerhouse.

The flow from the top of the ladder system is supplied from the pool at the exit section, which has a ladder head control system to provide constant flow down the main ladder regardless of forebay fluctuation. Most of the fish attraction water at the entrances is supplied from the AWS. Auxiliary water is fed into the collection channel and lower ladder section via floor diffusers. The AWS is comprised of two separate conduits: the south delivers to the ladder section and the north supplies the collection channel and fish lock channel. Both conduits are fed from the forebay on the south side of the spillway. Fish valves FV4-3 and FV4-4 control the rates of AWS flow into the south and north conduits respectively. Additional flow to the ladder, if needed, is provided by the makeup water supply, which is regulated by FV3-9.

This fishway was put into service concurrently with the A Branch, Cascades Island Fishways, and the First Powerhouse in 1938. Over the next four decades, modifications were made to the entrances, auxiliary water supply AWS system, diffusers, fish valves, and exit and forebay head control system. The last major changes occurred in 1970's with the *Modifications for Peaking*. The current entrance configurations were installed and the exit section was upgraded to the current vertical slot design with a new fish valve (FV3-9) for ladder make-up flow.

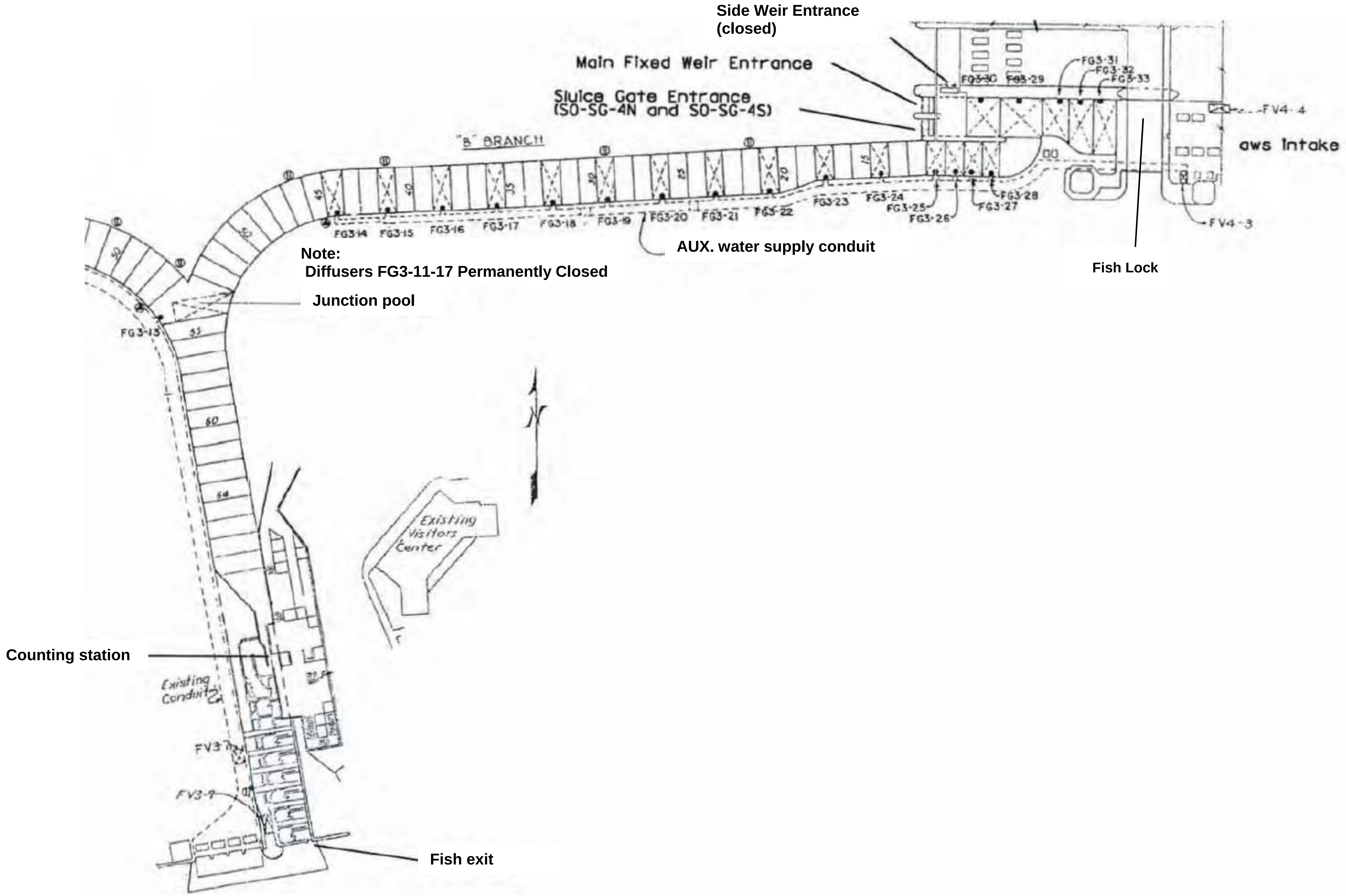

Figure 3.1 Bradford Island B Branch Diffusers and Fish Exit Section.

3.2 Components

The fishway consists of three types of components:

- Fish passage
- Auxiliary water supply
- Control systems

Inspection reports for B branch fish passage and auxiliary water supply are included in Appendix B3; the inspection report for A and B branch control systems is included in Appendix B1.

3.3 Fish Passage Components

3.3.1 Entrances

Fish access to the ladder is through the fishway entrance located next to Spill Bay 18. Between the last pier and the entrance openings, the entrance is divided into two separate and adjacent bays. The north side has two fixed weirs and the south side has two sluice gates.

The entrances provide access to the fish ladder, establishing fish entrance velocity and water level. Loss or failure of the entrance weirs or sluice gates would affect hydraulic performance and limit the openings for fish to enter the ladder.

3.3.2 Collection Channel

The collection channel is the connection between the entrance and the overflow ladder system. The channel is 35 feet wide and bends 180 degrees between the entrance channel and the ladder. There is also a branch that goes to the fish lock.

Loss of the collection channel would prevent the passage of fish from the entrance next to Spill Bay 18.

3.3.3 Fish Lock

The fish lock is a defunct fish elevator system that was installed during original fishway construction for the purpose of backing up the fish ladder. The system is comprised of two elevators, each with openings to the equalization chamber and collection channel. Use of the fish lock system was discontinued about 50 years ago. However, use of one of the fish lock units may be reconsidered for sturgeon passage across the dam at some future point.

3.3.4 Ladder System

The ladder system consists of a series of overflow ladder weirs and orifices, rising from weir 8 to weir 53. The ladder is approximately 720 feet long and 30 - 40 feet wide with a slope of 1:16. The source of ladder flow comes from Bradford Island exit section, the flow evenly split between A and B Branches at the Junction Pool.

3.3.5 Junction Pool

The junction pool is the location where the A and B Branch ladders join into a single channel up to the exit section. This is also where the flow from the upper ladder is split evenly into the A and B branches.

3.4 Auxiliary Water Supply Components

The AWS supplies most of the attraction flow for the entrance-bay openings and also augments flow and velocities in the lower fishway. The AWS flow is supplied from the forebay through two pressurized conduits and is released through diffusion chambers located under the floors of the collection channel and certain lower ladder pools.

Loss or failure of the AWS conduit would eliminate AWS flow. This would make it difficult for the fish to find the entrances and the entrances would not be operating within criteria.

3.4.1 South AWS Conduit

The south AWS conduit supplies the 11 diffusers (FG3-18 - FG3-28) in the ladder system. The conduit starts at the control valve FV4-3 at the equalization chamber and ultimately runs adjacent to the ladder on the south side from weir 8 to weir 45. Four diffusers, FG3-14 through FG3-17, have been permanently closed.

3.4.2 North AWS Conduit

The north AWS conduit supplies the five diffusers (FG3-29 - FG3-33) in the collection channel and fish lock channel. The conduit starts at the control valve FV4-4 and runs entirely within the large wing wall for Spill Bay 18.

3.4.3 Diffusers

The diffusers are the outlets from the AWS to the fish ladder system. They are designed to dissipate energy and diffuse the flow as it rises through the floor openings. The diffuser gates are 3.5 feet square, open/close leaf gates that go over the downstream face of the AWS diffuser orifices supplying each ladder diffuser with water. All diffuser gates are and have the same configuration. The gates are connected to long gate stems that extend from the top of the ladder walls. The gate leaves are pinned to the stems. See Figure 3.1 for diffuser locations.

Loss or failure of diffuser gates in either the open or the closed position could prevent the ladder from operating within criteria.

3.4.4 Fish Valves

The fish valves are the large radius tainter gates that control auxiliary water flow to the two AWS conduits. The valves have a 10.5-foot radius a 7-foot width and a 10.74-foot chord distance.

Loss or failure of the fish valves in either the open or the closed position could prevent the ladder from operating within criteria.

3.5 Control Systems

The fishway has monitoring in place for tailwater, entrance, and ladder water elevations, and head differential between the south AWS conduit and the ladder entrance channel. The data from these monitoring devices is utilized by the fishway's PLC program to control its operation. Loss or failure of the control system could prevent the ladder from operating within criteria.

4.0 CASCADES ISLAND FISHWAY

4.1 LATER – OPTIONAL TASK

5.0 RELIABILITY ASSESSMENT

5.1 Assessment Description

One of the common tools used in reliability engineering is Failure Modes and Effects Analysis (FMEA). FMEA was developed by the U.S. military in 1949. It found application in planning the Apollo space missions in the 1960s and was adopted by the Ford Motor Company in the 1980s to prevent recurrence of problems of the type associated with the Pinto automobile, in which seemingly minor collisions caused the gas tank to explode. Today its use has spread to many industries. It is associated with the respected quality assurance systems QS-9000 and ISO/TS 16949.

One definition of the tool reads as follows: "FMEA is a team-based systematic and proactive approach for identifying the ways that a process or design can fail, why it might fail, the effects of that failure and how it can be made safer." (Source: Institute for Safe Medication Practices Canada) Step 1 is to pick a team consisting of people knowledgeable in the process or design. Based on their knowledge, the team selects, in a brainstorming session, the failure modes to be considered (the "whats"). The team then identifies the causes (the "whys") and the effects of each failure. The failure modes and effects are then listed in a matrix format and evaluated against several criteria using a predetermined scoring system.

In its original form, FMEA uses three criteria to evaluate each specific failure: Severity (S), frequency of occurrence (O), and likelihood of detection (D). Each criterion is assigned a numerical rank based on a predetermined scale. The scales selected will be unique to the application; for example, frequency of occurrence in the case of a mechanical device could relate to number of cycles of operation per failure.

The rankings of the three criteria are multiplied to obtain a Risk Priority Number (RPN) for the specific failure being evaluated (thus, RPN = S x O x D). The RPNs for all failure modes considered are then compared to identify those having the highest risk. Priority for repairs or modifications is determined in order of highest to lowest RPN. In some applications, items with high severity rankings are also given priority regardless of RPN ranking.

For this study, the following procedure was used:

- Individual Failure Rating (IFR) categories were established based on the three FMEA criteria listed above. In this application, the results also needed to reflect the difficulty in accessing the features for inspection and detection. For this reason the original three criteria used in the FMEA model was expanded to seven IFR categories. This allows the detection related factors to have more weight than the severity and frequency of occurrence related factors. (Severity having two IFR's, frequency of occurrence having two IFR's, and likelihood of detection having three IFR's.) This relationship is shown in Table 5-1

- Using information gathered during the Phase II inspections, potential failure modes for the ladder/system features, described previously in this report, were brainstormed, and captured.

- A "Decision Matrix" was then created which a) listed all of the features and potential failure modes and b) scored each one with respect to the seven IFR categories listed and defined in Table 5-1. Each potential failure mode was then assigned a 1-5 rating for each IFR, as defined in Tables 5-2 through 5-8. The Decision Matrix can be found in Appendix A.

- The products of the IFRs determined the Overall Failure Rating (OFR) for that particular failure mode. Sorting the Decision Matrix on the OFR allowed those failure modes with the highest Overall Failure Rating to rise to the top of the Matrix. Additionally, those failures, which could potentially result in a Loss of Life, were also identified, thus allowing these issues to be flagged regardless of OFR.

Table 5-1 - Failure Rating Definitions

Individual Failure Rating	**Definitions**	**Related FMEA Criteria**
Frequency of Operation	The frequency a feature is operated / cycled.	Frequency of Occurrence
Existing Condition	The condition of the feature at the time of inspection.	Likelihood of Detection
Inspection Method	The method used to inspect a feature prior to failure.	Likelihood of Detection
Impact of Failure	The impact to the fishway system, should the feature fail.	Severity
Likelihood of Failure	The likelihood the feature will fail by this Failure mode.	Frequency of Occurrence
Ability to Detect Failure	The likelihood of detecting a failure of the feature.	Likelihood of Detection
Downtime to Repair/ Replace	The amount of time required for repair or replacement of the feature.	Severity
Feature Redundancy	The existence of redundant systems was not assigned a numerical factor, but rather simply noted in the matrix.	N/A

Table 5-2 - Frequency of Operation Factors

Factor (score)	Definition
1	0 Cycles per year
2	0-2 Cycles per year
3	3-10 Cycles per year
4	11-20 Cycles per year
5	>20 Cycles per year

Table 5-3 - Existing Condition Factors

Factor (score)	Definition
1	Good Condition / Well Maintained
2	Operable but in Need of Routine Maintenance
3	Operable but in Need of Repair
4	Inoperable but Repairable
5	Unknown Condition or In Need of Replacement

Table 5-4 - Inspection Method of Feature Factors (Before Failure)

Factor (score)	Definition
1	Remote Monitoring with Alarm
2	Remote Monitoring without Alarm
3	Scheduled Visual Monitoring
4	Readily Apparent to a Casual Observer
5	Not Able to Inspect the Feature

Table 5-5 - Impact of Failure Factors

Factor (score)	Definition
1	Fishway Operation is within Typical Limits
2	Fishway Operation is within Typical Limits with Temporary Adjustment
3	Fishway Operation is Outside Typical Limits, but within Fisheries Criteria
4	Fishway Operation is Outside Fisheries Criteria
5	Fishway is Shutdown

Note: Typical Limits = normal/expected level of operation.

Table 5-6 - Likelihood of Failure Factors

Factor (score)	Definition
1	Failure is Highly Unlikely - Greater than 10 years
2	Failure is Likely - 6 to 10 years
3	Failure is Likely - 4 to 5 years
4	Failure is Likely - 1 to 3 years
5	Failure Likely to Occur at any Time

Table 5-7 - Ability to Detect / Failure of Feature Factors (After Failure)

Factor (score)	Definition
1	Nearly Certain Detection
2	High Chance of Detection
3	Moderate Chance of Detection
4	Low Chance of Detection
5	Remote Chance of Detection

Table 5-8 - Downtime to Repair / Replace Factors

Factor (score)	Definition
1	No effect on Fishway Operation
2	Minor effect on Fishway Operation
3	Can be accomplished during Normally Scheduled Dewatering of Fishway
4	Requires Longer than Normal Dewatering of Fishway
5	Requires Longer than Normal Dewatering of Fishway and/or Immediate Dewatering of Fishway

5.2 Evaluation Example (FV3-8, Failure of a Structural Member)

FV3-8 is located at the junction between the north and south AWS conduit of A Branch. This feature did not make the top five feature list for A Branch but did rank higher than some of the B Branch top five features. Its ranking was established in the following manner.

- FV3-8 is not in use and to the recollection of project personnel has never been operated. Frequency of operation is 0 cycles per year receiving a score of 1.
- At the time of the Phase II inspection A Branch was dewatered to tail water elevation therefore the valve was not inspected. Phase I inspection found FV3-8 seals in bad condition but did not report on the structural members and no photos were taken. Given the age and lack of maintenance it is likely in poor shape, the existing condition is unknown receiving a score of 5.
- FV3-8 can be inspected during regularly scheduled dewatering of the fishway. However, this requires both the north and south AWS conduit of A Branch to be dewatered. Inspection method is by scheduled visual monitoring receiving a score of 3.
- A failure of a structural member on the valve would cause the valve to fail allowing flow instability or surging between the conduits. This would make it difficult to maintain head requirements at the entrances. The impact of failure is "fishway operations are outside of fisheries criteria" resulting in a score of 4.
- Relying on input from project personnel it was established that failure of FV3-8 is likely to occur at any time. The valve receives a likelihood of failure score of 5.

- FV3-8 is not remotely monitored and is not located so that a failure could be observed. However, the head differential between the fishway entrance and the tailwater is monitored. For this reason, one can assume if there is a difficulty in maintaining the entrance head a failure of the valve would be found during troubleshooting of the AWS system. There is a moderate chance to detect a failure, therefore, the valve receives a score of 3.

- If FV3-8 were to fail it is likely that the instability of the AWS system would be cause for an immediate shutdown of the ladder until repairs can be made. With input from Project personnel, the downtime to repair the valve would be longer than a normal ladder dewatering cycle. The downtime to repair or replace IFR receives a score of 5.

- The OFR for FV3-8 would then be: $1 * 5 * 3 * 4 * 5 * 3 * 5 = 4500$.

5.3. Reliability Assessment Results

5.3.1 Bradford Island Fishway Reliability Assessment Results

5.3.1.1 Feature Grouping

Some features have been grouped together in a systematic manner then ranked against each other. The feature groupings were the result of discussions between Project personnel, the Phase II inspection team, and estimating specialists. For example the level of effort required to dewater the collection channel to repair or replace the diffuser gates justified grouping these repairs with repairs needed for the diffuser grating. The highest OFR of a feature in a group established that group's ranking.

5.3.1.2 Top Five OFR Feature Lists

The decision matrix was used to determine the top five features requiring repair, replacement, or inspection in each branch of the fishways based on OFR. The top five lists were for the purpose of providing a cost estimate. The results for the Bradford Island fishway A Branch and B Branch are summarized in Table 5-9 and Table 5-10 below. It should be noted that all of the A Branch top five features ranked higher than all but one of the top five B Branch features.

Table 5-9 - A Branch Top Five OFR Features

Rank	Overall Failure Rating	Feature	Comments
A1	20000	Fish Valve and Bulkhead for FV1-1 and FV1-2	Supplies auxiliary water to the collection channel. Provides the ability to dewater the South AWS.
A2	13500	Fish Valve FV3-7	Supplies auxiliary water to A Branch.
A3	12500	Collection Channel Diffuser Gates and Floor Gratings	Features were grouped together due to the difficulty in dewatering and accessing them.
A4	5625	North AWS Conduit	Supplies auxiliary water to A Branch.
A5	5400	Crane at South AWS Intake	Required for maintenance of the South AWS system.

Table 5-10 - B Branch Top Five OFR Features

Rank	Overall Failure Rating	Feature	Comments
B1	6750	Fish Valve FV4-3 and FV4-4	Supplies auxiliary water to B Branch and B Branch entrance
B2	3375	Floor Grating supplied by the South AWS Conduit	Prevents fish from entering the AWS system
B3	1500	South AWS Conduit	Supplies auxiliary water to B Branch.
B4	1500	Floor grating supplied by the North AWS Conduit	Prevents fish from entering the AWS system
B5	1350	Floor Panels in the Junction Pool	Prevents fish from entering voids under the panels

5.3.1.3 Top Five List Exceptions

In addition to the methods described above, additional factors contributed to the establishment of the top five lists. Features that have established plans and specifications, such as the diffuser gates, were omitted from the top five rankings. Both the Bradford Island A and B branches had diffuser gates with an overall failure rating that would place them in the top five. Features that were not inspected in either the Phase I or Phase II inspections were also omitted. See Table 5-11 for features omitted from the top five list.

Table 5-11 - Features Omitted from the Top Five List

Rank if Included in the Top Five List	Overall Failure Rating	Feature Description	Reason Feature was Omitted from the Top Five List
A4	10800	Diffuser gates FG3-3 to FG3-9	Existing plans and specifications in place, not included in the cost estimate.
B1	10800	Diffuser gates FG3-18 to FG3-25	Existing plans and specifications in place, not included in the cost estimate.
B3	6000	B Branch North AWS Conduit	Condition is unknown and has not been inspected to project's recollection. Not currently showing external signs of distress.
B5	4860	Diffuser gates FG3-29 to FG3-33	Existing plans and specifications in place, not included in the cost estimate.

5.3.1.4 Features Failures Effecting Life Safety

Features whose failure could jeopardize human life were not included in the top five list but are still of great importance. At the conclusion of the Phase II inspection, only one feature was found to have a life safety factor applied. The fingerling bypass, in the south AWS, is no longer used and is in a state of disrepair. Although it scored low for the overall failure rating, a failure of this feature could cause injury or loss of life due to its proximity to pedestrian access. The cause of failure for this feature is due to a seismic event. At the time of the Phase II inspection, a seismic study had been initiated at Monolith 18 but had not been completed due to a lack of funding. According to preliminary findings of this study, local distress is possible at the fingerling bypass walls and local areas of stress concentration. It is recommended that this study be completed to further evaluate the risk associated with the current state of the fingerling bypass.

5.3.1.5 A Branch Top Five OFR Explanation of Rankings

The northern section of A Branch leading to the exit section is in good condition with the exception of the AWS conduit. This is most likely due to the ease in dewatering this section, making regular maintenance and repairs possible. It is apparent that the collection channel and the south AWS are more difficult to dewater and thus maintain and repair. Of the Bradford Island Fishway, this section is in the most need of repairs.

5.3.1.5.1 A1 - Fish Valves FV1-1 and FV1-2 and Bulkheads FV1-1 and FV1-2

Fish valves FV1-1 and FV1-2 were grouped together with the bulkheads for FV1-1 and FV1-2 due to the difficulty in dewatering this area. The Phase II inspection team was not able to directly inspect these features due to the difficulty in dewatering. The assessment is based on viewing the features from above, the Phase I assessment and reports from project personnel. Of the features in this group, the bulkheads establish this group's position in the top five list.

The bulkheads for FV1-1 and FV1-2 isolate the valves from the forebay during maintenance periods and for emergency closures of the fishway. Based on reports from project personnel, these bulkheads frequently get stuck in the bulkhead slots. The bulkhead slots may have shifted over time and are no longer square. This causes the bulkhead to get jammed requiring excessive force to remove it. For this reason, the bulkheads are only used when a complete dewatering of the south AWS conduit is required. This issue is compounded by the aging crane servicing this area, which will be discussed later in this section. The bulkhead slots are not easily inspected. If the bulkheads are not able to be removed, AWS operation cannot be restored. Currently in order to reduce the amount of force required to remove the bulkhead FV1-2 is used to backfill behind the bulkhead for FV1-1, a function the valve was never intended to perform.

The fish valve FV1-1 supplies auxiliary water to the collection channel. To some extent, this valve is also capable of dewatering the south AWS although this is not its primary function. FV1-2 supplied water to the now defunct fingerling bypass and is currently only used to backfill behind the bulkhead for FV1-1. The governing failure mode is a structural failure of the valves. The valves are operable but based on the Phase I assessment and input from project staff they are in need of repair. They can be visually inspected during normally scheduled ladder maintenance periods if the area is dewatered. If one of the valves were to fail, the south entrance to A Branch would be down until repairs can be made. Based on the Phase I assessment and input from project staff it is likely a structural failure of the valve will occur within 4 to 5 years, requiring an immediate dewatering of the fishway to replace the valve.

5.3.1.5.2 A2 - Fish Valve 3-7

Fish valve FV3-7 adjusts frequently to maintain entrance criteria. The governing failure mode is a structural failure of the valve. The valve is operable but some structural members are bent and the valve is in need of repair. The valve can be visually inspected during normally scheduled ladder maintenance periods. If the valve fails, the ladder would be down until repairs can be made. Based on input from project staff it is likely a structural failure will occur within 4 to 5 years. If a structural failure were to occur, an immediate dewatering of the fishway would be required to replace the valve.

5.3.1.5.3 A3 - Collection Channel Gate Valves (FG2-1 - FG2-22B) and Floor Grating

The collection channel diffuser gates and floor grating (FG2-1 - FG2-22B) features were grouped together due to the difficulty in dewatering and accessing them. The preferred open/closed settings for the diffuser gates are included in the recommendations for fishway operation in the 2003 HELCRABS Report. The 2003 report also recommends raising the channel floor; this is not addressed in this document.

The diffuser gates regulate the amount of auxiliary water that enters the fishway. The diffuser gates in the collection channel are manually operated and currently only open or closed. The governing cause of failure for the gates is a broken gate stem. Project personnel stated that a contributing factor in not operating this group of gates is the fear that the gate stem might break if they attempted to open or close the gates. As a result of the difficulty in dewatering this section of the fishway, the gates have not been inspected. If a gate stem were to break, the operator of the gate may not notice the failure. The gates would only be operated to meet the open/closed settings outlined in the 2003 HELCRABS Report. If the gate failed to operate, the ladder would be outside of criteria. A failure would require a longer than normal dewatering of the collection channel to repair.

The floor grating prevents adult fish from entering the AWS conduits. The governing failure mode is a blowout of the grating panel due to the age of the panels and/or fasteners used to anchor them to the floor of the fishway. Many of the anchors are in need of replacement. Gratings can be visually inspected during normally scheduled ladder maintenance periods. A blowout of a grating panel would allow adult fish to enter the AWS system, which would be cause to shut down the fishway until repairs can be made. This failure would be difficult to detect, but once detected the fishway would need to be shut down immediately in order to repair the grating.

5.3.1.5.4 A4 - North AWS Conduit

The North AWS Conduit supplies water to the A Branch. Failure at the expansion joints is the governing failure mode. The conduit is currently operable but in need of repairs. The conduit can be visually inspected during normally scheduled ladder maintenance periods. The failure of a conduit joint may require adjustment of the AWS system to maintain fishway operations. Failure is not likely to occur within the next 3 to 5 years. Joint failure is not likely to be detected outside of scheduled inspections. Repairs to the conduit joints would require a longer than normal dewatering of the fishway.

5.3.1.5.5 A5 - Crane in the Area of the South AWS Intake

The crane at the south AWS intake is used for maintaining the features in that area. This includes maintenance of fish valves FV1-1 and FV1-2 as well as installation and removal of the associated bulkheads. With input from Project personnel the crane is operable but in need of repair and is likely to fail in 1 to 3 years. The crane should be part of a scheduled inspection program as it is required to load test the crane on a regular basis (the last load test being in 2011 at 10,000 lbs.). The governing cause of a crane failure is a failure of the lattice boom. If the crane were to fail while attempting to remove the bulkhead for FV1-1, auxiliary water would not be supplied to the collection channel section of A Branch. A failure of this nature would shut down the collection channel until the bulkhead can be removed by other means or the crane can be repaired to remove the bulkhead.

5.3.1.6 B Branch Top Five OFR Explanation of Results

In general, the B Branch of the Bradford Island fishway is in good condition. Credit should be given to the project staff for maintaining and repairing this branch of the fishway. The following is a summary of the top five features still in need of repair or replacement and the reasons they ranked in the top five list.

5.3.1.6.1 B1 - Fish Valve FV4-3 and FV4-4

Fish valves FV4-3 and FV4-4 adjust frequently to maintain entrance criteria. The governing failure mode is a structural failure of one of the valves. The valves are currently operable but based on the Phase I assessment and input from project staff they are in need of repair. The valves can be visually inspected during normally scheduled ladder maintenance periods. If one of the valves were to fail, the ladder would be down until repairs can be made. Based on the Phase I assessment and input from project staff it is likely a structural failure will occur within the next 5 years. If a structural failure were to occur in one of the valves, an immediate dewatering of the fishway would be required to replace the valve.

5.3.1.6.2 B2 - Floor Grating Supplied by the South AWS Conduit of B Branch

The floor grating prevents adult fish from entering the AWS conduits. The governing failure mode is a blowout of the grating panel due to the age of the panels and/or fasteners used to anchor them to the floor of the fishway. Many of the anchors are in need of replacement. Gratings can be visually inspected during normally scheduled ladder maintenance periods. A blowout of a grating panel would allow adult fish to enter the AWS system, which would be cause to shut down the fishway until repairs can be made. This failure would be difficult to detect, but once detected the fishway would need to be shutdown in order to repair the grating.

5.3.1.6.3 B3 - South AWS Conduit

The south AWS conduit supplies auxiliary water to B Branch fishway. Failure at the expansion joints is the governing failure mode. The existing condition of the conduit is unknown and requires inspection, but due to similarities in construction to the A Branch North AWS conduit it is assumed that repairs are needed. The conduit can be visually inspected during normally scheduled ladder maintenance periods if lighting, ventilation, and other safety equipment are in place. The failure of a conduit joint may require adjustment of the AWS system to maintain fishway operations. Failure is not likely to occur within the next 6 to 10 years. Joint failure is not likely to be detected outside of scheduled inspections. Repairs to the conduit joints would require a longer than normal de-watering of the fishway.

5.3.1.6.4 B4 - Floor Grating Supplied by the North AWS Conduit of B Branch

The floor grating prevents adult fish from entering the AWS conduits. The governing failure mode is a blowout of the grating panel due to the age of the panels and/or fasteners used to anchor them to the floor of the fishway. The anchors and grating are in good condition and are only in need of routine maintenance. Gratings can be visually inspected during normally scheduled ladder maintenance periods. A blowout of a grating panel would allow adult fish to enter the AWS system, which would be cause to shut down the fishway until repairs can be performed. This failure would be difficult to detect, but once detected the fishway would need to be shutdown in order to repair the grating.

5.3.1.6.5 B5 - Floor Grating in the Junction Pool

The floor panels prevent fish from entering the voids under the panels. Panels and fasteners can be visually inspected during normally scheduled ladder maintenance periods. The governing failure mode is a blowout of the panel due to the age of the panels and/or fasteners used to anchor them to the floor of the fishway. Many of the anchors are in need of replacement. As an optional repair to replacing fasteners and panels, the voids in the bottom of the junction pool can be filled to the floor elevation of the fishway. A blowout of a panel would allow adult fish to enter the voids under the floor panels. This failure would be difficult to detect, but once detected it can be repaired during normally scheduled de-watering of the fishway.

5.3.2 Cascade Island Fishway Reliability Assessment Results

LATER – OPTIONAL TASK

6.0 COST ESTIMATE

6.1 General

Reconnaissance level cost estimates have been prepared on ten separate items of the Bradford Island Fishway. The reliability assessment that has been compiled provided the rationale for generating cost estimates for these items. Five of the cost estimates are for items found in the A Branch of the fishway and the other five items are for components of the B Branch. The cost estimates are not total project costs, as they do not include Lands and Damages, Relocations, Planning Engineering and Design, Construction Management or Escalation costs. It is assumed that the items would be repaired or replaced during the scheduled biennial closure of the fishway to minimize operation and dewatering costs; however, certain items will require significant additional dewatering. The biennial closure period occurs between December 4th and the end of February. The cost estimates assume contractor provided cranes and equipment, such that the project cranes are available for on-going operations. It is assumed that floor grating will be replaced in-kind, and if modified grating size or material is necessary for lamprey considerations then a hydraulic analysis will be required and the cost estimates will need to be updated. The following sections discuss the ten items and assumptions used in the estimating process.

6.2 A Branch

6.2.1 A.1 – Fish Valves FV1-1 and FV1-2

This cost estimate is for replacing the bulkheads, electrical, mechanical, and structural component of Fish Valves FV1-1 and FV1-2. These two fish valves are tainter gate structures that control the water into the south end of the AWS and require complete replacement for continued operation. It is assumed that the bulkheads and these two fish valves would be replaced during the scheduled biennial closure of the fishway. It is assumed that the sealing surfaces for these two fish valves are still in good condition and do not need to be replaced. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes bulkheads and fish valves would be replaced one at a time during the scheduled biennial closure of the fishway.
- Assumes all work would be completed within one scheduled fishway closure period.
- Assumes only the fish valve structure is to be removed. The anchor system, bore hubs, and bushings would all remain in place.
- Assumes everything on the fish valves would be replaced (electrical, mechanical, structural and seals) except for the sealing surfaces.

- Assumes everything on the bulkheads will be replaced including the guides.

- Dewatering would require placing the outer stop-logs and dewater the entire intake area south of the powerhouse. This would require pulling the screens out and installing the stop-logs using a carry deck crane and draining through the fish valve. Additionally, minor sandbagging and pumping would be required to dewater the fish valves.

- Assumes a 65-ton crane would be required to place the carry deck crane from the west road below to the fish valve access location.

- Assumes all new metals for the fish valves would be mild steel, prepared and painted at the manufacturer's location, and then shipped to the site.

6.2.2 A.2 – Fish Valve FV3-7

This cost estimate is for replacing the electrical, mechanical, and structural component of Fish Valve FV3-7. This fish valve is a tainter gate structure that controls the water into the north end of the AWS and requires complete replacement for continued operation. It is assumed that this fish valve would be replaced during the scheduled biennial closure of the fishway. It is assumed that the guides for this fish valve are still in good condition and do not need to be replaced. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes fish valve would be replaced during the scheduled biennial closure of the fishway.

- Assumes only the fish valve structure is to be removed. The anchor system, bore hubs, and bushings would all remain in place.

- Assumes everything will be replaced (electrical, mechanical, structural and seals) except for the guides.

- Assumes a 65-ton crane would have full access to replace the fish valve.

- Assumes the area would be dewatered prior to construction, and no costs for dewatering have been included.

- Assumes all new metals for the fish valve would be mild steel, prepared and painted at the manufacturer's location, and then shipped to the site.

6.2.3 A.3 – Collection Channel Diffuser Gates and Floor Grating

This cost estimate is for replacing steel grating found on the floor of the collection channel and diffuser gates that connect the AWS with the collection channel. It is assumed that diffuser gates and floor grating will be replaced in-kind, and the work would occur during the scheduled biennial closure of the fishway. For the purpose of this cost estimate, the costs will be for two units of the collection channel, which can be isolated with transverse bulkheads. The typical dimension of one unit is assumed to be 30-feet wide by 16-feet long. Each unit has 18 grates and two diffuser gates, thus 36 grates and four diffuser gates. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes diffuser gates and floor grating would be replaced during the scheduled biennial closure of the fishway.
- Assumes each steel gate has dimensions of 4-feet wide by 4-feet tall with guide rails on both sides that are 8-feet tall. Assumes all new metals for the guides would be made of stainless steel.
- Assumes each unit has 18-grates. Each grate is assumed to be approximately 6-feet long by 1-foot wide. Assumes each grate has six bolts for attaching to the concrete floor. If modified grating is necessary for lamprey considerations, then a hydraulic analysis will be required and the cost estimate will need to be updated.
- Assumes each unit has two diffuser gates. The replacement of each gate is assumed to include new guide rails and concrete and new slide gate. Assumes a crew of six would require 1-½ weeks to replace each slide gate.
- Assumes three units could be replaced during one construction period. For dewatering it is assumed that the fish valves at both ends of the AWS are closed and that transverse bulkheads, within the collection channel, would be installed to isolate two units. These bulkheads would be placed by 65-ton carry deck crane.
- Dewatering of the two units will require the operation of the in-house pump system along with additional submersible pumps.
- The channel would not be able to be dewatered easily, however this cost estimate assumes the area can be dewatered such that the use of dive crews is not necessary.
- Assumes all new metals (grates and bolts) would be made of galvanized steel and would be powder coated.

6.2.4 A.4 – North AWS Conduit Joints

This cost estimate is for repairing deteriorated joints in the north AWS. It is assumed that joints would be repaired during the scheduled biennial closure of the fishway. This cost estimate includes the preparation costs for repairing joints. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- It is assumed that 15 joints could be repaired during the scheduled biennial closure of the fishway.
- Assumes Fish Valve FV3-7 is closed and several diffuser gates downstream are open to dewater the north AWS where the joints need to be repaired.
- Assumes the 2-foot by 2-foot O&M personnel entrance to the north AWS, near the A Branch/B Branch split, will be open during construction along with some diffuser gates to allow ventilation.
- Assumes temporary walkway, handrails, lighting, ventilation fans, and submersible pumps will be required along the north AWS during construction.
- Assumes all new metals (joint covers and bolts) would be made of stainless steel.

6.2.5 A.5 – Crane in the Area of the South AWS Intake

This cost estimate is for rehabilitating the existing crane at the south AWS intake deck. The crane is on the historical registry therefore it cannot be removed. The crane was constructed in 1936 and was designed to carry 10-ton loads. However, the crane has been derated to a 5-ton capacity. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Costs include rehabilitation of the existing crane.
- Includes costs for transporting the rehabilitated crane components to the site and lifting it into position. Another crane, likely barge mounted, would need to be mobilized in order to remove and lift in the crane components.
- Cost for the crane was based on a discussion with Andrew Lundgren from Coast Crane Company in Portland, Oregon. Mr. Lundgren has worked with the Corps on other crane replacements and mentioned that the costs would range from about one to two million dollars depending on all the crane's specifications.

6.3 B Branch

6.3.1 B.1 – Fish Valves FV4-3 and FV4-4

This cost estimate is for replacing the electrical, mechanical, and structural component of Fish Valves FV4-3 and FV4-4. These two fish valves are tainter gate structures that control the water into the south end of the auxiliary water system (AWS) and require complete replacement for continued operation. It is assumed that these two fish valves would be replaced during the scheduled biennial closure of the fishway. It is assumed that the guides for these two fish valves are still in good condition and do not need to be replaced. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes fish valves would be replaced one at a time during the scheduled biennial closure of the fishway. Both valves could be replaced in one closure period.
- Assumes only the fish valve structure is to be removed. The anchor system, bore hubs, and bushings would all remain in place.
- Assumes everything will be replaced (electrical, mechanical, structural and seals) except for the guides.
- Assumes a 65-ton crane would have full access to replace the fish valves.
- The fish valves would be dewatered at the same time by installing the AWS Intake bulkheads and dewater the whole intake area to allow removal of the valve. Additionally, minor pumping would be required to dewater the fish valves.
- Assumes all new metals for the fish valves would be mild steel, prepared and painted at the manufacturer's location, and then shipped to the site.

6.3.2 B.2 – Floor Grating for Diffusers Supplied by the South AWS Conduit

This cost estimate is for replacing steel grating found on the floor of the fish ladder channel near the junction pool. It is assumed that the floor grating will be replaced in-kind, and the work would occur during the scheduled biennial closure of the fishway. The typical dimension of one unit is assumed to be 40-feet wide by 16-feet long. Each unit has 28 grates. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes each unit has 28 grates. Each grate is assumed to be approximately 6-feet long by 1-foot wide. Assumes each grate has six bolts for attaching to the concrete floor.
- Assumes five units could be replaced during one closure period.

- The AWS and collection channel would be dewatered at the time of the scheduled closure and no other dewatering is assumed.

- Assumes all new metals (grates and bolts) would be made of galvanized steel and would be powder coated.

6.3.3 B.3 – South AWS Conduit Joints

This cost estimate is for repairing deteriorated joints in the south AWS of B Branch; the joints are assumed to have deterioration similar to the joints in the A Branch North AWS. It is assumed that joints would be repaired during the scheduled biennial closure of the fishway. This cost estimate includes the preparation costs for repairing joints, however it only includes the cost for repairing one joint. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- It is assumed that 15 joints could be repaired during the scheduled biennial closure of the fishway.

- Assumes Fish Valve FV4-3 and FV4-4 are closed and the south AWS is dewatered.

- Assumes a new O&M personnel entrance at the end, near the A Branch/B Branch split, of the south AWS will be constructed by excavating to the top of the conduit and pouring a concrete vault access. This new access will be open during construction along with some diffuser gates to allow ventilation.

- Assumes temporary walkway, handrails, lighting, ventilation fans, and submersible pumps will be required along the south AWS during construction.

- Assumes all new metals (joint covers and bolts) would be made of stainless steel.

6.3.4 B.4 – Floor Grating for Diffusers Supplied by the North AWS Conduit of B Branch

This cost estimate is for replacing steel grating found on the floor of the ladder near the spillway. It is assumed that the floor grating will be replaced in-kind and the work would occur during the scheduled biennial closure of the fishway. The typical dimension of one unit is assumed to be 30-feet wide by 16-feet long. Each unit has 18 grates. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes each unit has 18 grates. Each grate is assumed to be approximately 6-feet long by 1-foot wide. Assumes each grate has six bolts for attaching to the concrete floor.

- The AWS and ladder entrance would be dewatered at the time of the scheduled closure. Additionally, minor pumping would be required to dewater next to the spillway.

- Assumes eight units could be replaced during one closure period.

- Assumes all new metals (grates and bolts) would be made of galvanized steel and would be powder coated.

6.3.5 B.5 – Floor Grating for Junction Pool Diffuser

This cost estimate is for replacing steel grating found on the floor of the collection at the junction pool. It is assumed that the floor grating will be replaced in-kind and work would occur during the scheduled biennial closure of the fishway. The junction pool is pentagonal in shape and has 18 grates. Below is a list of assumptions used in developing the quantities and costs for the estimate.

- Assumes junction pool has 18 grates. Each grate is assumed to be approximately 6-feet long by 1-foot wide. Assumes each grate has two bolts for attaching to the concrete floor.

- The AWS and fish ladder would be dewatered at the time of the scheduled closure and no other dewatering is assumed.

- Assumes all new metals (grates and bolts) would be made of galvanized steel and would be powder coated.

7.0 SUMMARY

7.1 Bradford Island Fishway

Bradford Island Fishway reliability assessment and cost estimate is summarized in Table 7.1. The table is organized by the overall failure rating. The rank established is only for the top five features in each branch that were included in the cost estimate. The overall failure rating for some features in A-Branch that were not part of the top five ranked higher than the top five B-branch features with the exception of FV4-3 and FV4-4. Although those features were not included in the cost estimate, they are included in the summary Table 7.2 along with the overall ranking.

Some features were omitted from the top five for various reasons. See paragraph 5.2.1.2 for an explanation of the omitted features. These features are included in the summary Table 7.2 with their overall failure rating.

Table 7-1 - Bradford Island Summary

Overall Ranking	Overall Failure Ratings	Features	Comments	Rank	Cost Estimate Totals
1	20000	Fish Valve and Bulkhead for FV1-1 and FV1-2	Bulkhead slot is not square. Valve seals need replacement and the valve structure is unknown.	A1	$ 633,000
2	13500	Fish Valve FV3-7	Structural members are bent.	A2	$ 227,000
3	12500	Collection Channel Diffuser Gates and Floor Gratings	Features were grouped together due to the difficulty in dewatering and accessing them.	A3	$3,917,000
6	6750	Fish Valve FV4-3 and FV4-4	Failure of structural members.	B1	$ 502,000
9	5625	A-Branch North AWS Conduit	Joints have failed and are in need of repair.	A4	$1,302,000
10	5400	Crane at South AWS Intake	Required for maintenance of the South AWS system.	A5	$3,141,000
14	3375	B-Branch Floor Grating supplied by South AWS Conduit	Primary cause of failure for floor grating is corrosion of both the grating and the anchors attaching the grating to the fishway floor.	B2	$ 795,000

Overall Ranking	Overall Failure Ratings	Features	Comments	Rank	Cost Estimate Totals
16	1500	B-Branch South AWS Conduit	Condition is unknown. Similar in construction to A-Branch North AWS Conduit, so it is assumed that same levels of repairs are needed.	B3	$1,366,000
17	1500	B-Branch Floor Grating supplied by North AWS	See comment regarding floor grating above.	B4	$ 233,000
19	1350	Junction Pool Floor Panels	Primary cause of failure for floor panels is corrosion of both the grating and the anchors attaching the grating to the fishway floor.	B5	$ 48,000

Table 7-2 - Bradford Island Summary Items not Included in the Cost Estimate

Overall Ranking	Overall Failure Ratings	Features	Comments	Reason the Feature was Excluded from the Cost Estimate
4	10800	A-Branch Diffuser Gates FG3-3 to FG3-9	Likely cause of failure is a broken actuator / stem and gate guide failure.	Established Plans and Specifications.
5	10800	B-Branch Diffuser Gates FG3-18 to FG3-25	Likely cause of failure is a broken actuator / stem and gate guide failure.	Established Plans and Specifications.
7	6250	A-Branch South AWS Conduit	Part of the powerhouse structure.	Condition is unknown and needs inspection.
8	6000	B-Branch North AWS Conduit	Part of the spillway structure.	Condition is unknown and needs inspection.

Overall Ranking	Overall Failure Ratings	Features	Comments	Reason the Feature was Excluded from the Cost Estimate
11	4860	B-Branch Diffuser Gates FG3-29 to FG3-33	Likely cause of failure is a broken actuator / stem and gate guide failure.	Established Plans and Specifications.
12	4500	Fish Valve FV3-8	Likely cause of failure is a failure of structural members.	Fell outside of the top 5 features for A-Branch
13	4500	A-Branch Floor Grating supplied by North AWS Conduit.	Primary cause of failure for floor grating is corrosion of both the grating and the anchors attaching the grating to the fishway floor.	Fell outside of the top 5 features for A-Branch
15	3000	Powerhouse Fish Lock	Seismic event could cause a structural failure.	Requires seismic study to be completed.
18	1500	Spillway Fish Lock	Seismic event could cause a structural failure.	Requires seismic study be completed.

7.2 Cascade Island Fishway

LATER – OPTIONAL TASK

APPENDIX A – DECISION MATRIX

Bonneville Dam Bradford Island Fishway Decision Matrix Summary

Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Top 5 Ranking	Overall Failure Rating	Life Safety	Comments
	Date:	June 14, 2012					Individual Failure Ratings - *											
A Branch Fish Passage Components																		
10.6.1.1.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Seismic event	Loss of South AWS	1	5	3	1	5	1	1	No		75	X	Requires seismic report data to complete. In need of replacement.
10.6.1.2.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Age of concrete	Loss of South AWS	1	5	3	1	5	1	1	No		75	X	Requires seismic report data to complete. In need of replacement.
10.2.1.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	4	5	3	3	4	No	A1	10800		Corrosion, wear, and age.
10.2.3.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	4	5	3	2	4	No	A1	7200		Aging Electronics and limits.
10.2.2.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	4	2	5	3	3	No	A1	5400		Wear and age.
10.3.1.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to seal properly	Age of seal	Inability to De-water AWS	2	4	3	5	2	2	5	No	A1	2400		Seal replacement.
10.3.2.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	4	5	5	5	4	5	No	A1	20000		Aging crane. Bulkhead slots may have shifted over time.
10.4.1.2.1	South AWS Conduit	Fish Valve FV1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Operator (stem) failure	Inability to restore AWS operation	2	3	3	5	2	1	5	No	A1	900		Dewatering and access.
10.5.1.1.1	South AWS Conduit	FV1-2 -Bulkhead	Dewater FV1-2	Failure to seal properly	Age of seal	Inability to repair FV1-2 if necessary	1	4	3	1	1	1	1	No	A1	12		
10.4.1.1.1	South AWS Conduit	Fish Valve FV1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Jammed Valve	Inability to restore AWS operation	2	4	5	5	4	4	5	No	A1	16000		Dewatering and access.
11.02.1.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	3	4	5	No	A2	13500		Corrosion. Ability to detect difficult unless dewatered.
11.02.2.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	2	5	5	No	A2	4500		Age.
11.02.3.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	2	2	5	No	A2	4500		Electronics and limits.
10.8.1.1.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken gate stem	Inability to dewater channel	1	5	5	4	5	5	5	Yes	A3	12500		Insufficient downtime-access for repairs. Corrosion and age. Condition unknown.
10.8.1.3.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Jammed gate	Inability to dewater channel	1	5	5	4	5	5	5	Yes	A3	12500		Insufficient downtime for repairs, electronics, corrosion, and age. Condition unknown.
10.8.1.4.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken gate stem	Inability to dewater channel	1	5	5	4	5	5	5	Yes	A3	12500		Insufficient downtime-access for repairs, electronics, corrosion, and age. Condition unknown.
10.8.1.6.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Jammed gate	Inability to dewater channel	1	5	5	4	5	5	5	Yes	A3	12500		Insufficient downtime-access for repairs, electronics, corrosion, and age. Condition unknown.
10.9.1.1.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	5	5	4	2	5	5	No	A3	5000		Corrosion to metal grating. Condition unknown.
10.9.1.2.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No	A3	10000		Corrosion to metal grating. Condition unknown.
10.8.1.2.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken actuator	Inability to dewater channel	1	5	5	4	5	4	4	Yes	A3	8000		Age and Corrosion. Condition unknown.
10.8.1.5.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken actuator	Inability to dewater channel	1	5	5	4	5	4	4	Yes	A3	8000		Age and Corrosion. Condition unknown.
11.01.1.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	A4	5625		Access.

Bonneville Dam Bradford Island Fishway Decision Matrix Summary

	Date:	June 14, 2012					Individual Failure Ratings - *											
Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	**Top 5 Ranking**	Overall Failure Rating	Life Safety	Comments
11.01.1.2.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	**A4**	5625		Access.
11.01.1.3.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	**A4**	5625		Access.
1.3.1.1.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Lattice boom failure	No water in AWS [FV1-1 closed]	2	3	3	5	4	3	5	No	**A5**	5400		
1.3.1.3.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Running components (block, wire rope, sheave, drum)	Unable to dewater [FV1-1 open]	2	3	3	4	4	3	5	No	**A5**	4320		
1.3.1.2.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Age	No water in AWS [FV1-1 closed]	2	3	3	5	4	1	5	No	**A5**	1800		
1.3.1.4.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Electronics	Unable to dewater [FV1-1 open]	2	3	3	4	4	1	5	No	**A5**	1440		
B Branch Fish Passage Components																		
19.02.1.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	3	3	5	No	**B1**	6750		Corrosion, wear, and age.
19.02.3.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	5	2	3	5	No	**B1**	4500		Electronics and limits.
20.2.1.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	3	3	5	No	**B1**	6750		Corrosion, wear, and age.
20.2.2.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	3	5	5	No	**B1**	6750		Wear and age.
19.02.2.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	3	3	5	No	**B1**	4050		Corrosion, wear, and age.
20.2.3.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	5	2	3	5	No	**B1**	4500		Electronics and limits.
19.15.1.1.1	South AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much back pressure	Allow adult fish to enter the AWS	1	3	3	5	2	5	5	No	**B2**	2250		Corrosion of metal grating.
19.15.1.2.1	South AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	3	3	5	3	5	5	No	**B2**	3375		Corrosion of metal grating.
19.01.1.1.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.1.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.2.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.2.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.

Bonneville Dam Bradford Island Fishway Decision Matrix Summary

	Date:	June 14, 2012					Individual Failure Ratings - *											
Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	**Top 5 Ranking**	Overall Failure Rating	Life Safety	Comments
19.01.1.3.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.3.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
20.4.1.2.1	North AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	2	3	5	2	5	5	No	**B4**	1500		Corrosion
20.4.1.1.1	North AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	2	3	5	2	5	5	No	**B4**	1500		Corrosion
6.1.1.1.1	Junction Pool	Junction Pool Floor Panels	Provides no current function	Blowout floor panels	Corrosion or metal fatigue of the fasteners.	Fish enter voids under the floor panels.	1	3	3	5	2	5	3	No	**B5**	1350		

* - Key to Failure Ratings

Frequency of Operation:	1 - 0 Cycles per Year, 2 - 0-2 Cycles per Year , 3 - 3-10 Cycles per Year, 4 - 11-20 Cycles per Year, 5 - > 20 Cycles per Year
Existing Condition:	1 - Good Condition Well Maintained, 2 -Operable but in need of routine maintenance , 3 -Operable but in need of repair , 4 -Inoperable but repairable , 5 - Unknown Condition or In need of replacement
Inspection Method:	1 - Remote Monitoring with Alarm, 2 - Remote Monitoring without Alarm, 3 - Scheduled Visual Monitoring, 4 - Readily Apparent to a Casual Observer, 5 -Not able to Inspect the Feature
Impact of Failure:	1 - Fishway Operation is within Typical Limits, 2 - Fishway Operation is within Typical Limits with Temporary Adjustment, 3 - Fishway Operation is outside Typical Limits, but within Fisheries Criteria, 4 - Fishway Operation is Outside Fisheries Criteria, 5 - Fishway is Shutdown
Likelihood of Failure:	1 - Failure Highly Unlikely/ Greater than 10 years, 2 - 6 to 10 years , 3 - 4 to 5 years- , 4 - 1 to 3 years , 5 - Failure Likely to Occur at any time
Ability to Detect Failure:	1 - Nearly Certain detection, 2 - High Chance of detection, 3 - Moderate Chance of detection, 4 - Low Chance of detection, 5 - Remote Chance of detection
Downtime to Repair/Replace:	1 - No effect on Fishway Operation, 2 - Minor effect on Fishway Operation, 3 - Can be accomplished during Normally Scheduled De-Watering of Fishway, 4 - Requires Longer than Normal De-Watering of Fishway, 5 - Requires Longer than Normal De-Watering of Fishway and/or Immediate De-Watering of Fishway
The Overall Failure Rating is the Product of all of the Individual Failure Ratings	

** - Key to Reference Numbers

X.*.*.*.*:	X = Feature Location
.X..*.*	X = Feature Description
..X.*.*	X = Potential Failure Mode of this Feature
..*.X.*	X = Potential Cause of this Failure Mode
..*.*.X	X = Potential Effect of this Cause of Failure

*** - Key to Colors

Dark Pink	= Rank #1
Blue	= Rank #2
Light Orange	= Rank #3
Light Green	= Rank #4
Purple	= Rank #5
Yellow	= Overall Failure Rating
Red	= Life Safety
	Note: Typical Limits = normal/expected level of operation

Bonneville Dam Bradford Island Fishway Decision Matrix

Date: June 14, 2012

Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Top 5 Ranking	Overall Failure Rating	Life Safety	Comments
							Individual Failure Ratings - *											
A Branch Fish Passage Components																		
1.1.1.1.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	2	1	3	2	4	1	3	Yes		144		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
1.1.1.2.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	2	3	3	Yes		216		
1.1.1.3.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	2	1	3	2	2	1	3	Yes		72		Insufficient Downtime for repairs.
1.1.1.4.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	2	1	3	2	2	2	3	Yes		144		
1.1.1.5.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	2	1	3	2	2	2	3	Yes		144		
1.1.2.1.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes		288		
1.1.2.2.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	3	4	4	Yes		576		
1.1.2.3.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	2	3	3	Yes		216		
1.2.1.1.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	5	1	3	2	4	1	3	Yes		360		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
1.2.1.2.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	5	1	3	3	1	3	4	Yes		540		
1.2.1.3.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	5	1	3	2	2	1	3	Yes		180		
1.2.1.4.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	5	1	3	2	2	2	3	Yes		360		
1.2.1.5.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	5	1	3	2	2	2	3	Yes		360		
1.2.2.1.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	5	1	3	2	4	2	3	Yes		720		Maintenance to clear
1.2.2.2.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	3	4	4	Yes		1440		
1.2.2.3.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	5	1	3	3	1	3	4	Yes		540		
1.3.1.1.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Lattice boom failure	No water in AWS [FV1-1 closed]	2	3	3	5	4	3	5	No	**A5**	5400		
1.3.1.2.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Age	No water in AWS [FV1-1 closed]	2	3	3	5	4	1	5	No	**A5**	1800		
1.3.1.3.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Running components (block, wire rope, sheave, drum)	Unable to dewater [FV1-1 open]	2	3	3	4	4	3	5	No	**A5**	4320		
1.3.1.4.1	South AWS Intake	Crane	Install and remove bulkheads and trash racks; crane service support for FV1-1	Hoist Failure	Electronics	Unable to dewater [FV1-1 open]	2	3	3	4	4	1	5	No	**A5**	1440		
2.1.1.1.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	5	1	3	2	4	1	3	Yes		360		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
2.1.1.2.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	5	1	3	3	1	3	4	Yes		540		
2.1.1.3.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	5	1	3	2	2	1	3	Yes		180		

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Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	**Top 5 Ranking**	Overall Failure Rating	Life Safety	Comments
	Date:	June 14, 2012					Individual Failure Ratings - *											
2.1.1.4.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	5	1	3	2	2	2	3	Yes		360		
2.1.1.5.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	5	1	3	2	2	2	3	Yes		360		
2.1.2.1.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	5	1	3	2	4	2	3	Yes		720		Maintenance to clear
2.1.2.2.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	3	4	4	Yes		1440		
2.1.2.3.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	5	1	3	3	1	3	4	Yes		540		
2.2.1.1.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	2	1	3	2	4	1	3	Yes		144		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
2.2.1.2.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	2	3	3	Yes		216		
2.2.1.3.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	2	1	3	2	2	1	3	Yes		72		Insufficient Downtime for repairs.
2.2.1.4.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	2	1	3	2	2	2	3	Yes		144		
2.2.1.5.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	2	1	3	2	2	2	3	Yes		144		
2.2.2.1.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes		288		
2.2.2.2.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	3	4	4	Yes		576		Common on A & B Branch
2.2.2.3.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	2	3	3	Yes		216		
3.1.1.1.1	Powerhouse Collection Channel	Collection Channel Stop logs	Separates tailwater from Collection Channel	Leaky stop logs	Inadequate sealing	Inability to dewater collection channel	1	5	3	1	5	1	4	No		300		Inadequate sealing of concrete bulkheads. Condition unknown.
4.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	4	5	3	2	5	No		3000		Requires seismic report data to complete. In need of replacement.
4.1.1.2.1	Fish Lock	Bulkhead at FV1-3	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No		400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
4.2.1.1.1	Fish Lock	Bulkhead at FV1-4	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No		400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
4.3.1.1.1	Fish Lock	Bulkhead at South Entrance	Provides separation between defunct Fish Lock and South Entrance	Structural failure	Age	Allow fish into Fish Lock	1	5	5	1	1	5	1	No		125		In need of replacement.
5.1.1.1.1	Ladder System	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes		162		Localized problem
5.2.1.1.1	Ladder System	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes		150		Maintenance to clear
5.3.1.1.1	Ladder System	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes		48		
6.1.1.1.1	Junction Pool	Junction Pool Floor Panels	Provides no current function	Blowout floor panels	Corrosion or metal fatigue of the fasteners.	Fish enter voids under the floor panels.	1	3	3	5	2	5	3	No	**B5**	1350		
7.1.1.1.1	Ladder to Counting Station	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes		162		Localized problem
7.2.1.1.1	Ladder to Counting Station	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes		150		Maintenance to clear
7.3.1.1.1	Ladder to Counting Station	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes		48		
8.1.1.1.1	Counting Station	Fish Crowder	Improves viewing access of fish	Mechanical	Age	Inability to count fish	5	1	2	1	2	1	1	No		20		
9.1.1.1.1	Exit Section	Exit Channel	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes		162		Localized problem
9.2.1.1.1	Exit Section	Pit Tag Antennae	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes		48		

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							Individual Failure Ratings - *											
9.3.1.1.1	Exit Section	Makeup Water Supply System	Provides additional water upstream of Junction Pool	Failure of FV3-9										No		0		Refer to Item 9
9.4.1.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forbay changes	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	1	1	5	No		750		Electronics and limits.
9.4.2.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forbay changes	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	2	3	1	1	5	3	No		450		
9.4.3.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forbay changes	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	5	2	2	5	No		3000		Common on A & B Branch. Electronics and set limits.
9.5.1.1.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forbay	Damaged or stuck adjustable weir	Loss of Power	Prevention of fish entering forbay/loss of exit criteria	5	2	1	5	2	1	2	No		200		Common on A & B Branch
9.5.1.2.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forbay	Damaged or stuck adjustable weir	Jammed weir	Prevention of fish entering forbay/loss of exit criteria	5	2	1	5	2	2	5	No		1000		Common on A & B Branch
A Branch Auxiliary Water Supply (AWS) Components																		
10.1.1.1.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Erosion of surrounding terrain due to leakage	1	5	5	5	2	5	5	No		6250		Condition unknown.
10.1.1.2.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Erosion of surrounding terrain due to leakage	1	5	5	5	2	5	5	No		6250		Condition unknown.
10.1.1.3.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Erosion of surrounding terrain due to leakage	1	5	5	5	2	5	5	No		6250		Condition unknown.
10.2.1.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	4	5	3	3	4	No	**A1**	10800		Corrosion, wear, and age.
10.2.2.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	4	2	5	3	3	No	**A1**	5400		Wear and age.
10.2.3.1.1	South AWS Conduit	Fish Valve FV1-1	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	4	5	3	2	4	No	**A1**	7200		Aging Electronics and limits.
10.3.1.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to seal properly	Age of seal	Inability to De-water AWS	2	4	3	5	2	2	5	No	**A1**	2400		Seal replacement.
10.3.2.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	4	5	5	5	4	5	No	**A1**	20000		Aging crane. Bulkhead slots may have shifted over time.
10.4.1.1.1	South AWS Conduit	Fish Valve FV1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Jammed Valve	Inability to restore AWS operation	2	4	5	5	4	4	5	No	**A1**	16000		Dewatering and access.
10.4.1.2.1	South AWS Conduit	Fish Valve FV1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Operator (stem) failure	Inability to restore AWS operation	2	3	3	5	2	1	5	No	**A1**	900		Dewatering and access.
10.5.1.1.1	South AWS Conduit	FV1-2 -Bulkhead	Dewater FV1-2	Failure to seal properly	Age of seal	Inability to repair FV1-2 if necessary	1	4	3	1	1	1	1	No	**A1**	12		
10.6.1.1.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Seismic event	Loss of South AWS	1	5	3	1	5	1	1	No		75	X	Requires seismic report data to complete. In need of replacement.
10.6.1.2.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Age of concrete	Loss of South AWS	1	5	3	1	5	1	1	No		75	X	Requires seismic report data to complete. In need of replacement.
10.8.1.1.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken gate stem	Inability to dewater channel	1	5	5	4	5	5	5	Yes	**A3**	12500		Insufficient downtime-access for repairs. Corrosion and age. Condition unknown.
10.8.1.2.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken actuator	Inability to dewater channel	1	5	5	4	5	4	4	Yes	**A3**	8000		Age and Corrosion. Condition unknown.
10.8.1.3.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Jammed gate	Inability to dewater channel	1	5	5	4	5	5	5	Yes	**A3**	12500		Insufficient downtime for repairs, electronics, corrosion, and age. Condition unknown.
10.8.1.4.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken gate stem	Inability to dewater channel	1	5	5	4	5	5	5	Yes	**A3**	12500		Insufficient downtime-access for repairs, electronics, corrosion, and age. Condition unknown.

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10.8.1.5.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken actuator	Inability to dewater channel	1	5	5	4	5	4	4	Yes	A3	8000		Age and Corrosion. Condition unknown.
10.8.1.6.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Jammed gate	Inability to dewater channel	1	5	5	4	5	5	5	Yes	A3	12500		Insufficient downtime-access for repairs, electronics, corrosion, and age. Condition unknown.
10.9.1.1.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	5	5	4	2	5	5	No	A3	5000		Corrosion to metal grating. Condition unknown.
10.9.1.2.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No	A3	10000		Corrosion to metal grating. Condition unknown.
11.01.1.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	A4	5625		Access.
11.01.1.2.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	A4	5625		Access.
11.01.1.3.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Erosion of surrounding terrain due to leakage	1	3	5	5	3	5	5	No	A4	5625		Access.
11.02.1.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	3	4	5	No	A2	13500		Corrosion. Ability to detect difficult unless dewatered.
11.02.2.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	2	5	5	No	A2	4500		Age.
11.02.3.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	2	2	5	No	A2	4500		Electronics and limits.
11.03.1.1.1	North AWS Conduit	Fish Valve FV3-8	Separates flow between North and South AWS conduits. Currently closed and non-operable.	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	1	5	3	4	5	3	5	No		4500		Repair requires North and South AWS to be dewatered. Out of service. In need of replacement.
11.03.2.1.1	North AWS Conduit	Fish Valve FV3-8	Separates flow between North and South AWS conduits. Currently closed and non-operable.	Failure to seal properly	Age of seal	More flow than anticipated	1	5	3	2	5	3	5	No		2250		Repair requires North and South AWS to be dewatered. Aging crane. In need of replacement.
11.04.1.1.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Corrosion and age. Condition unknown.
11.04.1.2.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	2	4	Yes		4320		Electronics and limits. Condition unknown.
11.04.1.3.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Electronics, corrosion, and age. Condition Unknown.
11.04.1.4.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Corrosion and age. Condition unknown.
11.05.1.1.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Corrosion and age. Condition unknown.
11.05.1.2.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Electronics and age. Condition unknown.
11.05.1.3.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Electronics, corrosion, and age. Condition Unknown.
11.05.1.4.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	4	Yes		6480		Corrosion and age. Condition unknown.
11.06.1.1.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Corrosion and age. Condition unknown.

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11.06.1.2.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Electronics and age. Condition unknown.
11.06.1.3.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Electronics, corrosion, and age. Condition Unknown.
11.06.1.4.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Corrosion and age. Condition unknown.
11.07.1.1.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	3	Yes		8100		Corrosion and age. Condition unknown.
11.07.1.2.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	3	Yes		8100		Electronics and age. Condition unknown.
11.07.1.3.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	3	Yes		8100		Electronics, corrosion, and age. Condition Unknown.
11.07.1.4.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	3	Yes		8100		Corrosion and age. Condition unknown.
11.08.1.1.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4	3	3	3	Yes		6480		Corrosion and age. Condition unknown.
11.08.1.2.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4	3	3	3	Yes		6480		Electronics and age. Condition unknown.
11.08.1.3.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4	3	3	3	Yes		6480		Electronics, corrosion, and age. Condition Unknown.
11.08.1.4.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4	3	3	3	Yes		6480		Corrosion and age. Condition unknown.
11.09.1.1.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	3	Yes		4860		Corrosion and age. Condition unknown.
11.09.1.2.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	3	Yes		4860		Electronics and age. Condition unknown.
11.09.1.3.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	3	Yes		4860		Electronics, corrosion, and age. Condition Unknown.
11.09.1.4.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4	3	3	3	Yes		4860		Corrosion and age. Condition unknown.
11.10.1.1.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	5	2	2	4	Yes		4800		Corrosion. Condition unknown.
11.10.1.2.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	5	2	2	4	Yes		4800		Corrosion. Condition unknown.
11.10.1.3.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	5	2	2	4	Yes		4800		Electronics and limits. Condition unknown.

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11.10.1.4.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	5	2	2	4	Yes		4800		Corrosion. Condition unknown.
11.11.1.1.1	North AWS Conduit	Floor Grating in A Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	4	3	5	2	5	5	No		3000		Corrosion of steel grating.
11.11.1.2.1	North AWS Conduit	Floor Grating in A Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	4	3	5	3	5	5	No		4500		Corrosion of steel grating.
A Branch Control Systems																		
12.3.1.1.1	South AWS Intakes	Fish Lock Elevators	No current function															N/A - Not Used
13.1.1.1.1	Ladder Entrance	Diffuser Gate Operator	Maintain the flow of the water	Operator fails	Loss of power	Lose control of the flow	5	2	3	4	2	3	2			1440		
13.1.1.2.1	Ladder Entrance	Diffuser Gate Operator	Maintain the flow of the water	Operator fails	Failure of the controller	Lose control of the flow	5	2	3	4	2	3	2			1440		
13.2.1.1.1	Ladder Entrance	Fish Tag System	Counts fish. Not part of this system.															
14.1.1.1.1	Control System	SoftPLC	Controls entire Fishway management system	Shut down due to power loss	Hardware Failure	Shut down Fishway	5	1	1	5	1	1	2	No		50		
14.2.1.1.1	Control System	Human/Machine Interface	Communication link between Operations personnel and Fishway operations.	Loss of communication with PLC	Broken/loose connection	Lose status of Fishway components	5	2	1	2	2	1	2	No		80		Aging components may require replacement/update in the future.
14.3.1.1.1	Control System	Remote Input/Output Rack	Communication link between PLC and Field Monitoring Devices and Operators	Loss of communication with PLC	Loss of power	Loss of control of Fishway components controlled by the particular I/O in question	5	2	1	3	2	2	2	No		240		No longer supported by manufacturer. Spare parts availability beyond on-hand inventory is questionable.
14.4.1.1.1	Control System	Radar Water Level Sensor	Monitor water level	Lack of feedback to the PLC	Loss of power	Lose control of Fishway flow	5	1	2	2	1	3	2	No		120		
14.4.1.2.1	Control System	Radar Water Level Sensor	Monitor water level	Lack of feedback to the PLC	Failure of the instrument	Lose control of the flow	5	1	2	2	1	3	2	No		120		
14.5.1.1.1	Control System	Pressure-type level sensors	Monitor water level	Loss of communication with I/O	Broken wires	Loss of input to PLC	5	1	1	2	1	3	1	No		30		Two types of pressure transducers are in use at the project; one type uses desiccant to protect device from failure due to moisture (preferred), while the other type is more susceptible to moisture induced failure.
14.6.1.1.1	Control System	Circuit Breaker Panel boards	Supply power to the various controllers	Loss of power	Feeder circuit breaker failure	Loss of power to control Fishway components	1	2	2	2	2	2	1	No		32		Fishway components comprise only one aspect of Circuit Breaker Panel board function.
14.6.1.2.1	Control System	Circuit Breaker Panel boards	Supply power to the various controllers	Circuit Breaker trips	Short circuit	Loss of power to control Fishway components	1	2	2	2	2	2	1	No		32		Fishway components comprise only one aspect of Circuit Breaker Panel board function.
B Branch Fish Passage Components																		
15.1.1.1.1	Entrance	South Fixed Entrance Weir SO-SG-2	Provides fixed flow restriction at entrance	None identified	Age	Inability to maintain entrance head and criteria										0		
15.2.1.1.1	Entrance	North Fixed Entrance Weir SO-SG-7	Permanently closed with bulkhead	Bulkhead failure	Age	Inability to maintain entrance head and criteria	1	1	3	2	1	3	3	No		54		
15.2.1.2.1	Entrance	North Fixed Entrance Weir SO-SG-7	Permanently closed with bulkhead	Bulkhead failure	Debris Impact	Inability to maintain entrance head and criteria	1	1	3	2	2	3	3	No		108		
15.3.1.1.1	Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Loss of Power	Inability to maintain entrance head and criteria	5	2	2	2	2	3	1	Yes		240		
15.3.1.2.1	Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2	2	2	2	3	3	Yes		720		
15.3.2.1.1	Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Jammed Gate	Debris	Inability to maintain entrance head and criteria	5	2	2	2	2	3	1	Yes		240		
15.3.2.2.1	Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	2	2	2	2	3	3	Yes		720		
15.4.1.1.1	Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Actuator Failure	Loss of Power	Inability to maintain entrance head and criteria	5	2	2	2	2	3	1	Yes		240		
15.4.1.2.1	Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2	2	2	2	3	3	Yes		720		

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15.4.2.1.1	Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Jammed Gate	Debris	Inability to maintain entrance head and criteria	5	2	2	2	2	3	1	Yes		240		
15.4.2.2.1	Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	2	2	2	2	3	3	Yes		720		
16.1.1.1.1	Collection Channel	Collection Channel														0		Reference B Branch AWS
17.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	3	5	2	2	5	No		1500		Requires seismic report data to complete. In need of replacement.
17.1.1.2.1	Fish Lock	Bulkhead s at Forbay	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	3	1	1	4	5	No		300		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
17.3.1.1.1	Fish Lock	Bulkhead at Entrance	Provides separation between defunct Fish Lock and B Branch Entrance	Structural failure	Age	Allow fish into Fish Lock	1	5	3	1	1	5	5	No		375		
18.1.1.1.1	Ladder System	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Failure to meet ladder criteria for a particular section of ladder	1	2	3	3	1	3	3	No		162		Localized problem
18.2.1.1.1	Ladder System	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes		150		Maintenance to clear
18.3.1.1.1	Ladder System	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Inability to count fish	1	1	4	1	2	2	3	Yes		48		
B Branch Auxiliary Water Supply (AWS) Components																		
19.01.1.1.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.1.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.2.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.2.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.3.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Leakage	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.01.1.3.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Rebar Corrosion	1	5	3	2	2	5	5	No	**B3**	1500		Condition unknown. This feature requires inspection. Similar in construction to A-Branch North AWS conduit. Not currently showing external signs of distress.
19.02.1.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	3	3	5	No	**B1**	6750		Corrosion, wear, and age.
19.02.2.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	3	3	5	No	**B1**	4050		Corrosion, wear, and age.
19.02.3.1.1	South AWS Conduit	Fish Valve FV4-3	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	5	2	3	5	No	**B1**	4500		Electronics and limits.
19.03.1.1.1	South AWS Conduit	FV4-3-Bulkhead	Dewater FV4-3 and AWS Conduit	Failure to seal properly	Age of seal	Inability to De-water AWS	2	2	3	1	5	2	1	No		120		Seal replacement.
19.03.2.2.1	South AWS Conduit	FV4-3-Bulkhead	Dewater FV4-3 and Conduit AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	2	3	5	3	1	5	No		900		
19.04.1.1.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3	2	3	Yes		1620		Corrosion and wear.

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19.04.1.2.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3	2	1	Yes		540		Age and wear.
19.04.1.3.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3	2	3	Yes		1620		Electronics, limits, corrosion, and wear.
19.04.1.4.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3	2	3	Yes		1620		Concrete, corrosion, wear, and age.
19.05.1.1.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Corrosion and wear.
19.05.1.2.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	1	Yes		720		Age and wear.
19.05.1.3.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Electronics, limits, corrosion, and wear.
19.05.1.4.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Concrete, corrosion, wear, and age.
19.06.1.1.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Corrosion and wear.
19.06.1.2.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	1	Yes		720		Age and wear.
19.06.1.3.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Electronics, limits, corrosion, and wear.
19.06.1.4.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	2	3	2	3	Yes		2160		Concrete, corrosion, wear, and age.
19.07.1.1.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Corrosion and wear.
19.07.1.2.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	1	Yes		1350		Age and wear.
19.07.1.3.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Electronics, limits, corrosion, and wear.
19.07.1.4.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Concrete, corrosion, wear, and age.
19.08.1.1.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Corrosion and wear.
19.08.1.2.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	1	Yes		1350		Age and wear.
19.08.1.3.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Electronics, limits, corrosion, and wear.

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19.08.1.4.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Concrete, corrosion, wear, and age.
19.09.1.1.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Corrosion and wear.
19.09.1.2.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	1	Yes		1350		Age and wear.
19.09.1.3.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	3	Yes		4050		Electronics, limits, corrosion, and wear.
19.09.1.4.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3	3	2	5	Yes		6750		Concrete, corrosion, wear, and age.
19.10.1.1.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Corrosion and wear.
19.10.1.2.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	1	Yes		2700		Wear and age.
19.10.1.3.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Electronics, limits, corrosion, and wear.
19.10.1.4.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Concrete, corrosion, wear, and age.
19.11.1.1.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Corrosion and age.
19.11.1.2.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	1	Yes		2700		Wear and age.
19.11.1.3.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Electronics, limits, corrosion, and wear.
19.11.1.4.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4	3	3	4	Yes		10800		Concrete, corrosion, wear, and age.
19.12.1.1.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Corrosion and wear.
19.12.1.2.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	1	Yes		540		
19.12.1.3.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Electronics, limits, corrosion, and wear.
19.12.1.4.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Concrete, corrosion, wear, and age.
19.13.1.1.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Corrosion and wear.

Bonneville Dam Bradford Island Fishway Decision Matrix

Date: June 14, 2012

Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Top 5 Ranking	Overall Failure Rating	Life Safety	Comments
							Individual Failure Ratings - *											
19.13.1.2.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Wear and age.
19.13.1.3.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Electronics, limits, corrosion, and wear.
19.13.1.4.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Concrete, corrosion, wear, and age.
19.14.1.1.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Corrosion and wear.
19.14.1.2.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	1	Yes		540		
19.14.1.3.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Electronics, limits, corrosion, and wear.
19.14.1.4.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4	3	3	4	Yes		2160		Concrete, corrosion, wear, and age.
19.15.1.1.1	South AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much back pressure	Allow adult fish to enter the AWS	1	3	3	5	2	5	5	No	B2	2250		Corrosion of metal grating.
19.15.1.2.1	South AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	3	3	5	3	5	5	No	B2	3375		Corrosion of metal grating.
20.1.1.1.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Leakage	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.1.1.1.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Rebar Corrosion	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.1.1.2.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Leakage	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.1.1.2.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Rebar Corrosion	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.1.1.3.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Leakage	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.1.1.3.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Rebar Corrosion	1	5	3	4	5	4	5	No		6000		Condition unknown. This feature requires inspection. Not currently showing external signs of distress.
20.2.1.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	3	3	5	No	B1	6750		Corrosion, wear, and age.
20.2.2.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	3	5	5	No	B1	6750		Wear and age.
20.2.3.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	5	2	3	5	No	B1	4500		Electronics and limits.
20.3.1.1.1	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	2	2	4	Yes		1440		Age and corrosion.

Bonneville Dam Bradford Island Fishway Decision Matrix																		
	Date:	June 14, 2012					Individual Failure Ratings - *											
Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	**Top 5 Ranking**	Overall Failure Rating	Life Safety	Comments
20.3.1.1.2	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	2	2	1	Yes		360		Age and corrosion.
20.3.1.1.3	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	2	2	4	Yes		1440		Electronics, corrosion, and age.
20.3.1.1.4	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	2	2	4	Yes		1440		Cracking concrete, corrosion, and age.
20.3.1.2.1	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	3	4	3	Yes		3240		
20.3.1.2.2	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	3	2	1	Yes		540		
20.3.1.2.3	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	3	4	3	Yes		3240		
20.3.1.2.4	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5	3	3	3	4	3	Yes		3240		
20.3.1.3.1	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.3.2	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	2	1	Yes		810		
20.3.1.3.3	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.3.4	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.4.1	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.4.2	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	2	1	Yes		810		
20.3.1.4.3	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.4.4	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.5.1	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.3.1.5.2	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	2	1	Yes		810		
20.3.1.5.3	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		

Bonneville Dam Bradford Island Fishway Decision Matrix

	Date:	June 14, 2012					Individual Failure Ratings - *											
Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	**Top 5 Ranking**	Overall Failure Rating	Life Safety	Comments
20.3.1.5.4	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	3	3	4	3	Yes		4860		
20.4.1.1.1	North AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	2	3	5	2	5	5	No	**B4**	1500		Corrosion
20.4.1.2.1	North AWS Conduit	Floor Grating in B Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	2	3	5	2	5	5	No	**B4**	1500		Corrosion

B Branch Control Systems - Note: See A Branch Control System components

* - Key to Failure Ratings

Frequency of Operation:	1 - 0 Cycles per Year, 2 - 0-2 Cycles per Year , 3 - 3-10 Cycles per Year, 4 - 11-20 Cycles per Year, 5 - > 20 Cycles per Year
Existing Condition:	1 - Good Condition Well Maintained, 2 -Operable but in need of routine maintenance , 3 -Operable but in need of repair , 4 -Inoperable but repairable , 5 - Unknown Condition or In need of replacement
Inspection Method:	1 - Remote Monitoring with Alarm, 2 - Remote Monitoring without Alarm, 3 - Scheduled Visual Monitoring, 4 - Readily Apparent to a Casual Observer, 5 -Not able to Inspect the Feature
Impact of Failure:	1 - Fishway Operation is within Typical Limits, 2 - Fishway Operation is within Typical Limits with Temporary Adjustment, 3 - Fishway Operation is outside Typical Limits, but within Fisheries Criteria, 4 - Fishway Operation is Outside Fisheries Criteria, 5 - Fishway is Shutdown
Likelihood of Failure:	1 - Failure Highly Unlikely/ Greater than 10 years, 2 - 6 to 10 years , 3 - 4 to 5 years- , 4 - 1 to 3 years , 5 - Failure Likely to Occur at any time
Ability to Detect Failure:	1 - Nearly Certain detection, 2 - High Chance of detection, 3 - Moderate Chance of detection, 4 - Low Chance of detection, 5 - Remote Chance of detection
Downtime to Repair/Replace:	1 - No effect on Fishway Operation, 2 - Minor effect on Fishway Operation, 3 - Can be accomplished during Normally Scheduled De-Watering of Fishway, 4 - Requires Longer than Normal De-Watering of Fishway, 5 - Requires Longer than Normal De-Watering of Fishway and/or Immediate De-Watering of

The Overall Failure Rating is the Product of all of the Individual Failure Ratings

** - Key to Reference Numbers

X.*.*.*.*:	X = Feature Location
.X..*.*	X = Feature Description
..X.*.*	X = Potential Failure Mode of this Feature
..*.X.*	X = Potential Cause of this Failure Mode
..*.*.X	X = Potential Effect of this Cause of Failure

*** - Key to Colors

Dark Pink	= Rank #1
Blue	= Rank #2
Light Orange	= Rank #3
Light Green	= Rank #4
Purple	= Rank #5
Yellow	= Overall Failure Rating
Red	= Life Safety
	Note: Typical Limits = normal/expected level of operation

APPENDIX B – INSPECTION REPORTS

Appendix B1

Bradford Island Fishway Modifications
Electrical Inspection Report

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Appendix B1

Bradford Island Fishway Modifications
Electrical Inspection Report

Executive Summary

The goal of this report is to address the inspection findings at the Bradford Island Fishway Modifications.

The inspection was completed in accordance with the previously approved Project Hazard Analysis and Safety Plan to meet the safety requirements.

B1.1 Introduction

B1.1.1 Task

The U.S. Army Corps of Engineers (USACE) conducted an initial assessment of the Cascade Island and Bradford Island fishway operating features. The Phase I findings were documented in Bradford Island and Cascades Island Adult Fishways Assessment Phase I Final Report (USACE, July 2004), including a list of concerns regarding the condition of fishway mechanical, structural, and electrical features.

Ongoing maintenance and repairs have been conducted over the years to continue operations, but additional work is needed to improve and maintain these fishways to meet current standards.

On December 20, 2011, an inspection was made of the electrical components for the Bradford Island fishway. This inspection was authorized to complete the second phase of a two phase project to assess the fishway condition and recommend feature repairs/replacement for the Bradford Island fishway at Bonneville Lock and Dam. The results of the study will be used by CENW POD-TF to budget funds for repairs/replacement.

B1.2 Product

This inspection report is the documentation of the inspection tasks. This report will be included as an appendix to the Bradford and Cascade Islands Fishway Modifications Engineering Document Report (EDR).

B1.3 Access Limitations and Considerations

B1.3.1 Planned Access

The plan was to inspect the Auxiliary Water Supply Intake, Ladder Entrance and electrical Control Systems currently in place and compare the phase 1 findings against current observations.

B1.3.2 Actual Access

The fish ladders had been de-watered to permit maintenance and structural inspection. To accommodate these activities, the power to the gate operators had been turned off and lock out/tag out tags had been affixed to the associated circuit breakers. Therefore, operation of the various gates could not be verified.

B1.4 Tools and Support Required

This inspection required limited personnel support from the Project. Project support was arranged through Ms. Liza Roy. The following paragraphs list the equipment and personnel required to perform the gate inspection.

B1.4.1 Equipment and Personnel Provided by the Project

The following USACE personnel and equipment were provided to assist the inspection of the Fishway

B1.4.1.1 USACE Personnel

Bill Fortuny	Electrical	USACE

B1.4.1.2 Equipment

- Extension ladders
- Portable lights

B1.4.2 Equipment and Personnel to be provided by INCA

INCA inspection staff included a Electrical Staff Engineer as the lead. Inspection equipments are listed below.

B1.4.2.1 Tetra Tech INCA Personnel

Dave Stewart	Electrical	Tetra Tech INCA

B1.4.2.2 Inspection Tools

- Metal rulers
- 25 foot extension measuring tape
- Dial calipers
- Personal flashlights

B1.4.2.3 Recording Tools

- Writing instruments (pencil and pen)
- Rite-in-the-rain notebook
- Digital camera
- Rechargeable batteries and battery charger
- Metal scribe
- Paint crayons
- Aluminum clipboards

B1.4.2.4 Safety Equipment

- Hard hat
- Steel toed boots
- Safety glasses
- Gloves (heavy gloves for line handling, light gloves for general use)
- Hearing protection
- Tag lines (to secure ladders and to haul up tool bucket)
- First aid kit

B1.4.2.5 Access Equipment

- Fall protection harnesses
- Fall prevention lanyards (2 per climber)
- Flange clamps (lanyard anchors, one per lanyard)

B1.4.2.6 Communication Tools

- Mobile phone
- Mobile radios

- Portable computer

B1.4.2.7 Specialty Attire

- Rain gear

B1.5 Inspection Procedure

INCA performed inspections at the Entrance, Junction Pool Ladder and Auxiliary Water System Intake locations at the Bradford Island fishway.

The electrical inspection was performed on December 20, 2011.

B1.5.1 Auxiliary Water Supply Intake

B1.5.1.1 Planned Inspection

The inspection of the Auxiliary Water Supply Intake was planned to encompass the electric operators/equipment at the following locations to see if one of the following had occurred: 1) the operators/equipment were functional or still in existence or, 2) had been removed or replaced.

The main features at the AWS intake that were to be inspected were the 7SW-SG-4N-S, the fish lock elevators, the north AWS conduit, Fish Valves 4-3 and 4-4, and the fish lock valves.

The following electrical controls listed in Table B1.5-1 were not included in the 2012 inspection; consequently, an assessment cannot be given on their condition. Table B1.5-1 was furnished by the District. However, as the Soft PLC appears to be a software application there is no physical condition to inspect.

Table B1.5-1 - Bonneville Fish Passage PLC Controls

Bonneville Fish passage PLC controls 4/5/2012
B1 collection channel, A-branch, and B-branch

System	PLC equipment type	In Service date	HMI	PLC component location	Sensors	sensor type
NOTE: FV3-3 & 3-4 auxiliary water supply valves currently have no position indication to PLC, plans to install sensors have not been completed.						
Cascade Island fishway	Soft PLC, MTL I/O	2001?	North Tower-Ifix viewstation	Spillway North Tower	Tailwater level	4-20 ma pressure/level sensor, GE/Druck
			B1 control room- Ifix viewstation (shared with b-banch HMI)		Entrance bay level & Channel level	4-20 ma radar sensors
					Auxiliary water conduit level	4-20 ma pressure/level sensor, GE/Druck
NOTE: FV4-3 & 4-4 auxiliary water supply valves currently have no position indication to PLC, plans to install sensors have not been completed.						
BI visitor center fish view water level FV3-9 control (maybe integrate with B-branch control?)	no PLC	2011	none	NA	Fish View window weir level	4-20 ma radar sensor

NOTE: currently no diffuser gate position indication is provided in any of these PLC systems.

B1.5.1.2 Actual Inspection

The inspection was performed with a representative of the Corps and a Licensed Electrician.

B1.5.2 Ladder Entrance

B1.5.2.1 Planned Inspection

The inspection of the ladder entrance was to include the diffuser gates and the fish ladder orifices for condition and operation.

B1.5.2.2 Actual Inspection

Electrical operators of gates and valves were inspected.

B1.5.3 General Control Systems

B1.5.3.1 Planned Inspection

There are several systems that needed to be reviewed for operation, condition and wiring. These included the control system in general, the control monitoring system, the control system conduits, and the control system inoperable pressure transducer.

B1.5.3.2 Actual Inspection

Components of the control system for the fish ladder, auxiliary water supply, and diffuser gates were inspected.

B1.6 Inspection Findings

The following are the inspection findings for Bradford Island B Branch. All notes regarding condition are from the 2011/2012 inspections unless noted as being from 2004.

Photographs are attached in the observation section for each observation made. All the photographs taken during the inspection are in Appendix B in CD-Rom. General observations are made at the end of each sub section for each respective item.

The following terms are used in this report for the observations made on the site.

Minor corrosion: Corrosion with section loss less than 1/32 inch.

Light corrosion: Corrosion with section loss less than 1/16 inch.

Medium corrosion: Corrosion with section loss ranging from 1/16 inch to 1/8 inch.

Heavy corrosion: Corrosion with section loss more than 1/8 inch.

Metal pop-ups: Conical shaped metal bumps on the surface. These are corrosion concentrations, which have not yet ruptured the surface of the coating.

B1.6.1 Auxiliary Water Supply Intake

B1.6.1.1 SW-SG-4N and 4S

These operators are controlled remotely from a Soft PLC (programmable logic controller) located in the power house control room. Communication for the control operations is through remote I/O (input/output) racks located near the equipment being controlled. The PLC uses level signals from radar type level sensors and from pressure type level transducers for its control function. Control is based upon differential levels between the forebay and tail water levels. The 2004 inspection noted that there was no feedback from the gate operators to confirm gate position. (See paragraph B1.6.2.1.) This is due mainly to the age of the operators and the fact they do not have capability of adding position transducers.

The radar level sensor was inspected from the catwalk area and appears to be in very good condition. It is in operation (see level display in HMS photograph in paragraph B1.6.3.3, Figures B1.6.10 and B1.6.11). Additionally, there was no indication of a feedback to the PLC to indicate gate positions.

Figure B1.6.1 Radar Level Transmitter/Receiver

B1.6.1.2 Pressure Level Tranducers

Pressure transducers measure the water level of the forebay and tail water. Level sensors also measure the AWS level and the fish ladder level. These various level signals are used by the PLC to maintain differential water levels throughout the fish ladder system.

Figure B1.6.2 Pressure Type Level Element in Still-Well

Figure B1.6.3 Level Transducer Converts Pressure Signal to 4-20mA for Input to PLC

Figure B1.6.4 A Second Type Level Transducer, Preferred by the Corps because it has Moisture Preventative with Indication

B1.6.1.3 Fish Lock Elevators

This equipment is very old, probably original, and is not in operation. We were informed that it was possible to operate this equipment but that it had not been used for quite some time.

B1.6.2 Ladder Entrance

B1.6.2.1 Diffuser Gates

Concern was raised during the 2004 inspection regarding the condition of the gate operators and the fact that the gates' operation was controlled by the PLC but there was no feedback to indicate the gate position, or if the controller received the signal from the PLC.

We noted some changes to some of the controllers, mainly the addition of disconnect switches to bring these controllers in line with the National Electrical Code requirements. Entrance gates have Duropot position transmitter to indicate gate position to PLC.

These operators were manufactured Limitorque and, except for normal weathering, were in very good condition.

Figure B1.6.5 Duropot Position Transmitter for Intake Gate

B1.6.2.2 Fish Tag System

The fish tag system was “looked at” but it was explained that this system was under the fisheries control, and that the operators had no involvement.

Figure B1.6.6 Limitorque Operator with Disconnect Switch

Figure B1.6.7 Limitorque Operator without Disconnect Switch

B1.6.3 Control Systems

B1.6.3.1 Control System - Monitoring

The automatic functions of the gate operators are controlled by a PLC. This PLC will take operator commands and cause the various elements to operate in such a manner as to comply with the operator's intent. The I/O rack is in good condition, but is getting old. Much like similar electronic devices, the I/O components have a limited time where manufacturer support and spare parts are available. The I/O racks that form the part of the PLC operating the fish ladder system are obsolete and spare parts may be difficult to obtain. (See paragraph B1.6.3.2.)

The Corps of Engineers has opted to go to a different type of input/output (I/O) integrated with a PLC processor. Consideration may be given to update this fish ladder PLC.

Figure B1.6.8 Enclosure with Remote I/O Rack

B1.6.3.2 Control System - General

The 2004 report suggested that the control system, being mostly original equipment, should be inspected for operation and condition. As previously mentioned, we were unable to operate the system, including the controls, for safety reasons. The condition, however, was evaluated and is believed to be very serviceable. The system is well maintained and, with the exception of weathering, does not appear to have any significant issues. The only foreseeable problem with the older equipment is the availability of spare parts.

The PLC is an older style Square-D Sy/Max model introduced in the 1970s. This PLC is obsolete per the "Product Resource Guide" dated July 2004 by Square-D. Spare parts and support may not be available. Consideration should be given to replace this PLC with a newer, more up-to-date type. The fish ladder system was shut down for our inspection so the actual operation of the PLC could not be verified.

In order to access the product guide mentioned above, please visit the following website:

http://static.schneider-electric.us/docs/Automation%20Products/SYMAX%20Programmable%20Controller/8000IB0201R0704.pdf

B1.6.3.3 PLC Control System

The control of the fish ladder system is provided through a Soft PLC, with HMI (human machine interface) panels providing the operator indications and input. Water levels are controlled by selective gate/valve operation.

Figure B1.6.9 Soft PLC Located in the Power House Control Room for Operation of the Fish Ladders

Figure B1.6.10   HMI Located in Power House Control Room for Operation of the Fish Ladders

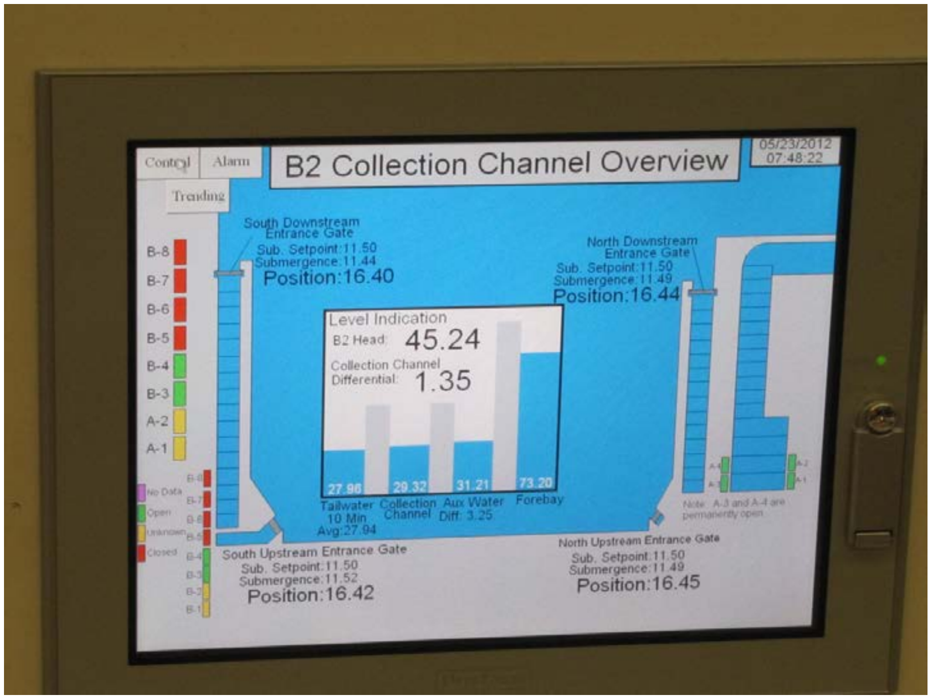

Figure B1.6.11 HMI used for Fish Ladder Operation

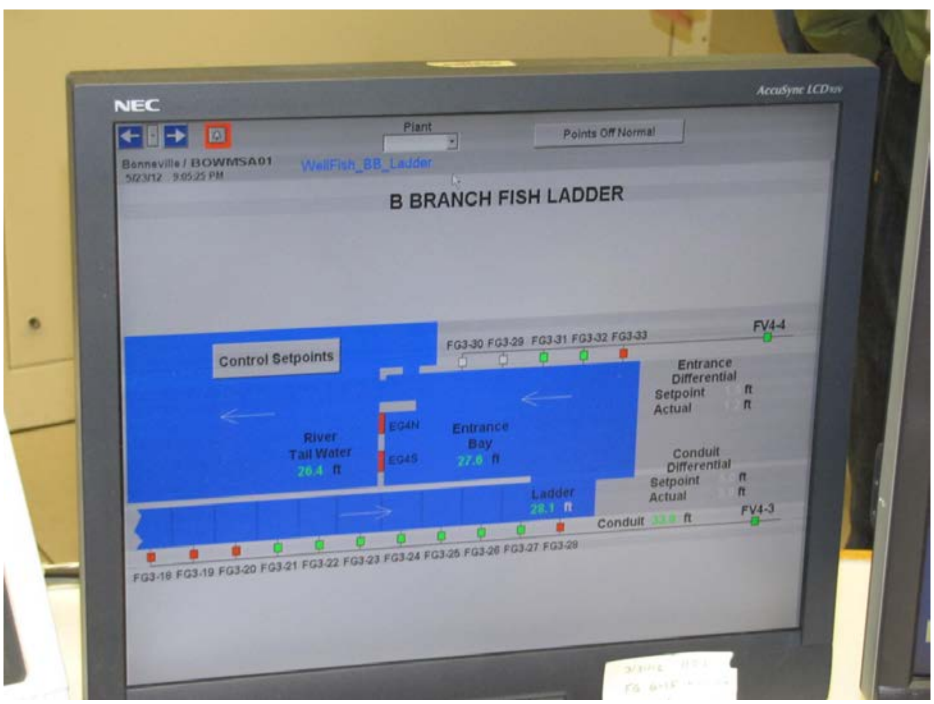

Figure B1.6.12 HMI used for B Branch Fish Ladder Operation

Figure B1.6.13 Remote I/O rack for communication with PLC

The SoftPLC is fully functional but the remote I/O racks are of old design and are obsolete. The Corps has a stock of spare parts available for these remote I/O racks but new spares are not being manufactured. The SoftPLC can accommodate a variety of I/O from various manufacturers so replacement is not an issue should the spares be depleted

B1.6.3.4 Motor Control Center (MCC)

The 2004 inspection report states that the MCCs are from the 1930s. It is believed that there may be some misunderstanding regarding the term MCC. The motor control center did not come into existence until the 1950s. When asked, the electrician could not think of an MCC in the fish ladder system, nor did we encounter any MCC in our inspection tour.

The MCC discussed in the 2004 Inspection Report was originally used for operation of the fish elevators and, when these elevators were taken out of service, the MCC was removed. The fish elevator machinery is the only part of the control system that remains.

The motor starters, other than those in the gate controllers, were in good condition. The motor starters within the Limitorque controllers were not examined as opening each controller enclosure would take quite a bit of time and would run the risk of damaging the seal.

B1.6.3.5 Control System Conduits

The 2004 reports some concern about conduits being overfilled with conductors. The National Electrical Code has conduit fill limitations, and these limitations may have changed over the years. There is, however, no requirement for retro fill adjustments. The conduits appear to be in good condition and, unless modifications to the control system are made, there is no need for concern regarding this issue.

B1.6.3.6 Circuit Breaker Panelboard FP-3

This is a Square-D, I-Line panelboard in good condition. This panelboard contains circuit breakers for the gate operators along with various other circuit breakers. The panelboard is a recent design and is in very good condition. We could not operate any of the gate operator circuit breakers as they were tagged out, but all indications are that they operate properly.

Figure B1.6.14 Panelboard FP-3.
(Note tag-out tags for gate operator power.)

B1.7 Summary of Condition Inspection

B1.7.1 List of Concerns

B1.7.1.1 Pressure Switch

An inoperable pressure switch was indicated on the 2004 inspection report. This inoperable pressure switch was not located and, therefore, the status is not known. A re-inspection of this pressure switch should be made and its condition (status) noted.

B1.7.1.2 Programmable Logic Controller

The PLC for the fish ladder system is of old design and is obsolete. Consideration should be given to replacing this unit with a new PLC of current design.

Appendix B2

Bradford Island Fishway Modifications
Structural/Mechanical Inspection Report
A Branch

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Appendix B2

Bradford Island Fishway Modifications
Structural/Mechanical Inspection Report
A Branch

Executive Summary

The goal of this report is to address the inspection findings of the Bradford Island Fishway Modifications at A Branch

The inspection was completed in accordance with the previously approved Project Hazard Analysis and Safety Plan to meet the safety requirements.

B2.1 Introduction

B2.1.1 Task

An inspection of the Bradford Island A Branch fishway was conducted by Tetra Tech INCA Staff on January 31st, 2012 and February 1st, 2012. Key fishway features, which had been previously identified, were more closely examined where access was made available.

B2.1.2 Product

This inspection report is the documentation of the findings of the inspection described above, and is to be included in Appendix B to the Bradford and Cascade Islands Fishway Modifications Engineering Document Report (EDR).

B2.1.3 Access Limitations and Considerations

B2.1.3.1 Planned Access

The following features were expected to be available for inspection

- Entrance Pool
- North AWS Conduits
- Fish Valves FV1-1, FV3-7, FV3-8, and FV3-9
- Fishway from Fish Exit to the North Entrance
- Diffuser features including fish gates diffuser chambers and diffuser grating.

B2.1.3.2 Actual Access

Upon arrival for inspection, the Fishway was only dewatered to tail water (approximately 15 feet in elevation). As a result, much of the lower portions of the fishway as well as the entrances and diffusers were not directly accessible. The inspection viewed these features from above and interviewed project staff to gain a more complete picture. Additionally the AWS intake for FV1-1 was not dewatered and had to be viewed from above. Due to safety concerns, the North AWS conduit was only inspected from FV3-7 to the diffuser at FG3-9.

B2.2 Tools and Support Required

This inspection required limited personnel support from the Project. Project support was arranged through Mr. Gary Henrie. The following paragraphs list the equipment and personnel were required to perform the gate inspection.

B2.2.1 Equipment and Personnel Provided by the Project

- Extension ladders
- Portable lights

B2.2.2.1 USACE Personnel in Attendance

Scott Harvey	Bonneville Operations	USACE
Gary Henrie	Hydraulics	USACE
Natalie Richards	Project Manager	USACE
Kevin Hace	Structural	USACE
Gary Bechtel	Cost Estimating	USACE
Alan Stokke	Mechanical	USACE
Kevin Perletti	Bonneville Engineering	USACE

B2.2.2 Equipment and Personnel to be provided by Tetra Tech INCA

TETRA TECH INCA inspection staff included a licensed Structural Professional Engineer as the lead inspector and graduate Mechanical Engineers as assistants. Inspection equipment is listed below.

B2.2.2.1 Tetra Tech INCA Personnel

Lois Loesch	Structural / Project Manager	Tetra Tech INCA
Jessica Gunderson	Mechanical	Tetra Tech INCA
Eric Flickinger	Mechanical	Tetra Tech INCA
LeRoy Mietzner	Mechanical	Tetra Tech INCA
John Plump	IDIQ Manager	Tetra Tech INCA

B2.2.2.2 Inspection Tools

- Metal rulers
- 25 foot extension measuring tape
- Inspection mirrors
- Magnifying glass
- Scrapers
- Wire brushes
- Inspection lights (flashlights, portable halogen lights, extension cords)

B2.2.2.3 Recording Tools

- Writing instruments (pencil and pen)
- Rite-in-the-rain notebook
- Digital camera
- Rechargeable batteries and battery charger
- Metal scribe

B2.2.2.4 Safety Equipment

- Hard hat
- Steel toed boots
- Safety glasses
- Gloves (heavy gloves for line handling, light gloves for general use)
- Hearing protection
- Tag lines (to secure ladders and to haul up tool bucket)
- First aid kit

B2.2.2.5 Access Equipment

- Fall protection harnesses
- Fall prevention lanyards (2 per climber)
- Flange clamps (lanyard anchors, one per lanyard)

B2.2.2.6 Specialty Attire

- Rain gear

B2.3 Inspection Procedure

Tetra Tech INCA performed inspections at the Entrance, Junction Pool Ladder and Auxiliary Water System Intake locations at the A Branch of Bradford Island. For the features listed in this section, please refer to Drawing BDF-9-6-OAO/1 for their location in the ladder. All notes regarding condition are from the 2011/2012 inspections unless noted as being from 2004.

The inspection schedule is provided below.

Day	Date	AM	PM
1st Day	31 Jan 2012	Branch A walkthrough with project personnel.	Continue walkthrough without project personnel. Inspection of FV3-7 AWS conduit from diffuser chimney FG3-9 to FV3-7.
2nd Day	01 Feb 2012	Discussion with project personnel.	Inspection of AWS intake at FV1-1. Inspection of Fish Exit. Inspection of fishway features noted on Day 1 walkthrough.

B2.3.1 Inspection of the South Entrance

B2.3.1.1 Planned Inspection

The following features, located at the South Entrance were identified to be inspected:

- Entrance Weirs
- Collection Channel
- Fish lock

- Channel to Fish Lock
- Bulkheads for Fish Lock

B2.3.1.2 Actual Inspection

This section was not dewatered at the time of inspection. As a result, these features were only viewed from above.

B2.3.2 Inspection of the North Entrance

B2.3.2.1 Planned Inspection

The following features, located at the North Entrance were identified to be inspected:
.

- Entrance Weirs
- Diffuser Chambers
- Collection Channel

B2.3.2.2 Actual Inspection

This section was not dewatered at the time of inspection. As a result, these features were only viewed from above.

B2.3.3 Inspection from the Fish Exit to the North Entrance

B2.3.3.1 Planned Inspection

The following features, located between the Fish Exit and the North Entrance were identified to be inspected:
.

- Weirs
- Orifices
- Junction Pool
- Ladder Pools

B2.3.3.2 Actual Inspection

This section was dewatered to tailwater (approximately an elevation of 15 feet) at the time of inspection. As a result the Diffuser Chambers, as well as much of the lower portion of the fishway were not accessible. The fishway features were viewed from above.

B2.3.4 Inspection of the Auxiliary Water Components

B2.3.4.1 Planned Inspection

The following features, located between the Fish Exit and the North Entrance were identified to be inspected:

- Diffusers (Gates, Gate Actuators, Grating, Diffuser Chambers)
- South AWS Conduit (Supplied by FV1-1)
- North AWS Conduit (Supplied by FV3-7)

B2.3.4.2 Actual Inspection

At the time of inspection the Fishway was dewatered to tailwater (approximately an elevation of 15 feet). As a result, the diffuser features, with the exception of the gate actuators, were not accessible for inspection. The South AWS conduit was also not dewatered and available for inspection. The North AWS conduit was inspected. However, due to safety concerns the inspection team only inspected the area between FV3-7 and the chimney leading to FG3-9.

B2.3.5 Inspection of the Fish Exit

B2.3.5.1 Planned Inspection

The following features, located at the Fish Exit were identified to be inspected:

- Exit Channel
- Makeup Water Supply System and Channel

B2.3.5.2 Actual Inspection

All features in this area were inspected.

B2.3.6 Inspection of the AWS Intakes

B2.3.6.1 Planned Inspection

The following features, located between the Fish Exit and the North Entrance were identified to be inspected:

- Fish Valve FV1-1
- Fish Valve FV3-9
- Fish Valve FV3-7

- Fish Valve FV3-8
- Backwash Valve

B2.3.6.2 Actual Inspection

Fish Valve FV1-1 was not available for direct inspection; it was viewed from above. All other features in this section were inspected.

B2.4 Inspection Findings

The following are the inspection findings for Bradford Island A Branch.

Photographs are attached in the observation section for each observation made. All the photographs taken during the inspection are in Appendix B in CD-Rom. General observation from the 2012 inspection is made at the end of each sub section for the respective item under the Phase 2 Assessment.

Following terms are used in this report for the observations made on the site. Observations of any item's condition that are made in the general description or under the Phase 1 Assessment are from the 2004 inspection.

Mothballed:	Equipment or features that are no longer in use but all components are still in place
Decommissioned:	Equipment that is no longer in use and all its components have been removed.
HSS	Hydraulic Steel Structure

B2.4.1 South Entrance

B2.4.1.1 Entrance Weirs

This is the main entrance area on the south side of the Powerhouse. There are two entrance weirs: WG-1 and WG-2. Only one unit is operated at a time. Each unit has three telescoping gate leaves that are connected to the bottom and can be raised upwards. The crest of the operating weir is operated at least 8 feet below the tailrace level (submergence), except when the tailrace goes below 10 feet since the minimum weir elevation is 2 feet.

B2.4.1.1.1 Weir Gate 1 (WG-1)

This entrance weir (Figure B2.4.1 and Figure B2.4.2) is in the south side of the south entrance and operates only at high tailrace levels. The opening width is 8.25 feet. The minimum weir crest level is 8.5 feet above sea level. When fully extended, the maximum weir level is 26 feet. This weir is typically operated at tailwater levels above 25 feet, or less than 10 percent of the time. (This weir is put into service when the tailrace level is rising and exceeds 26 feet. It is closed by means of a bulkhead when the level is falling and drops below 23 feet.) This weir unit is operated less frequently than the adjacent weir and might not be operated at all during low flow years. In 1995, an additional 6.5 feet weir leaf was added to the existing two weir gate leaves to provide additional extension.

B2.4.1.1.1.1 Phase 1 Assessments

Structural Assessment:

WG-1 appears to be in good condition.

Mechanical Assessment:

The mechanical equipment appears to be in good condition. Although the machinery cabinet was not opened for inspection, the wire rope is in good condition as are the sheaves. Drawings that show the lifting beam and hoist equipment could not be located. The Project staff have indicated that the hoist equipment is not very reliable.

B2.4.1.1.1.2 Phase 2 Assessments

Structural Assessment:

There is a lot of turbulence in this area, however, Weir Gate 1 seems to be in good condition (see Figure B2.4.1). A close inspection could not be conducted since the area was not dewatered. The sea lion exclusion device (SLED) shows no indication of damage at this time.

Figure B2.4.1 WG-1 and WG-2

Mechanical Assessment:

No noticeable change from the Phase 1 inspection.

B2.4.1.1.2 Weir Gate 2 (WG-2)

This entrance weir is in the north side of the south entrance and operates at low to medium tailrace levels. The opening width is 8 feet. The minimum weir crest level is 2 feet above sea level, flush with the concrete invert on the upstream side. When fully extended, the maximum weir level is 11 feet. This weir is typically operated at tailrace levels below 25 feet, more than 90 percent of the time. (This weir is put into service when the tailrace level is falling and drops below 23 feet. It is closed for service, by means of bulkhead, when the tailrace level is rising and exceeds 26 feet.) Prior to 1995, this opening was a submerged orifice controlled by a vertical sluice gate. It was replaced by the existing telescoping weir arrangement.

B2.4.1.1.2.1 Phase 1 Assessments

Structural Assessment:

WG-2 appears to be in good condition.

Mechanical assessment:

The Project indicates that this hoist experiences more problems than WG-1; it is likely because it is exposed to spray from the ice and trash sluiceway.

B2.4.1.1.2.2 Phase 2 Assessments

Structural Assessment:

There is a lot of turbulence in this area, however, Weir Gate 2 seems to be in good condition (see Figure B2.4.2). A close inspection could not be conducted since the area was not dewatered. The sea lion exclusion device (SLED) shows no indication of damage at this time.

Figure B2.4.2 WG-1 and WG-2

Mechanical Assessment:

No problems reported by Project staff.

B2.4.1.2 Collection Channel

The collection channel connects the South entrance of Branch A (Weir Gates 1 and 2) with the North entrance of Branch A (Weir Gates 64 and 65). There are a total of 63 bulkhead slots (typically six per turbine unit) that form the west sidewall between the Powerhouse Collection Channel and the tailrace. Starting from WG-2 at the south entrance, these slots are numbered from 3 to 63 from south to north (see Figure B2.4.2). At the time of the Phase 1 inspection, five slots were still equipped with special bulkhead assemblies with telescoping and sluice entrance gates at slot numbers 9, 21, 34, 58, and 62. However, these were also permanently closed in 2003 and have since been replaced with concrete bulkheads. In addition, the wooden stoplogs have also been replaced by concrete bulkheads. Project personnel have reported a considerable amount of leakage around the concrete bulkheads between the collection channel and the tail water. This prevents them from dewatering the entire collection channel. The current process is to dewater only a small section at a time in order to perform any repairs or inspections.

The collection channel has 24 diffuser bays, each bay having a gate and diffuser grating. Of the 24 diffuser bays, only seven are used. According to Project staff, all 24 bays are capable of being operated. However, the 17 diffusers that are no longer operated have not been used in a long time. The diffusers along the powerhouse are manually operated and, during fish passage, are in the open position.

This area was only dewatered to tail-water elevation (approximately El. 15 feet) at the time of inspection see Figure B2.4.3.

Figure B2.4.3 Collection Channel at the Location of FG2-6

B2.4.1.2.1 Phase 1 Assessment

Structural Assessment:

Entrance 3, steel/wood composite stoplogs leak, has been subject to degradation and should be further evaluated or replaced. These wood/steel composite stoplogs were apparently designed for 20 feet of hydrostatic head. The current capacity of these stoplogs could be less than this original design value. These stoplogs are considered a safety hazard. The lowest in elevation, Entrance 4 Stoplog should be structurally investigated.

Mechanical Assessment:

The Project indicated that the pipe is the discharge pipe from the Powerhouse south dewatering pumps. Water from the pumps is discharged into the collection channel through a flapper valve. Several years ago, a piping system was installed to eliminate any direct discharging into the collection channel. It is unknown to this study team, if this design change is structurally sound.

B2.4.1.2.2 Phase 2 Assessments

This area was only dewatered to tail-water elevation (approximately El. 15 feet) at the time of inspection; see Figure B2.4.3.

Structural Assessments:

There are a few vertical cracks in the walls of the diffuser structure as seen in Figure B2.4.4. There are also some areas along the walls where new concrete can be seen; see Figure B2.4.5 and Figure B2.4.6. The AWS cannot be drained if one of the gates fails and breaks loose. Vertical cracks are beginning to appear in the walls along the collection channel.

Figure B2.4.4 Cracks in Walls of Diffuser Structure

Figure B2.4.5 New Concrete Below Joint

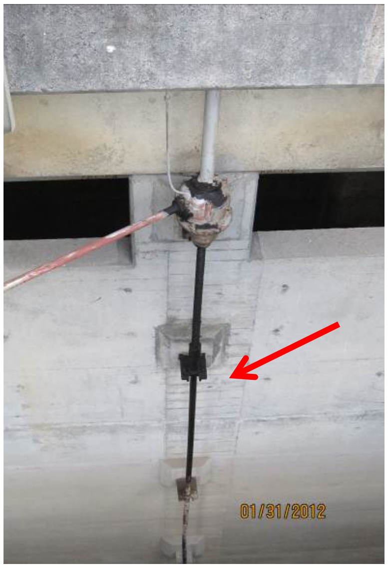

Figure B2.4.6 New Concrete

Mechanical Assessment:

The mechanical items in this area were not accessible for inspection.

B2.4.1.3 Fish Lock

The fish lock is a defunct fish elevator system that was installed during original fishway construction for the purpose of backing up the fish ladder. The system is comprised of two elevators, each with openings to the equalization chamber and collection channel. Water supplied to the fish lock was provided by FV1-3 and FV1-4. Both FV1-3 and FV1-4 remain in place but are no longer operable. The lock elevators are located on the south side of Powerhouse 1 and just west of FV1-1. Use of the fish lock system was discontinued about 50 years ago. See Figure B2.4.7.

Figure B2.4.7 Fish Lock Chamber

B2.4.1.3.1 Phase 1 Assessment

This section was not inspected in 2004.

B2.4.1.3.2 Phase 2 Assessments

Structural Assessment:

Cracks are appearing along the inside and outside of the walls on the structure (see Figures B2.4.8 and Figure B2.4.9).

Figure B2.4.8 Cracks in Walls of Fish Lock Structure

Figure B2.4.9 Cracks in Walls of Fingerling Bypass Structure

Mechanical Assessment:

The mechanical items in this area were not accessible for inspection.

B2.4.1.4 Channel to Lock

The fish lock channel is a short arm of the south Powerhouse Collection Channel that extends eastwardly from the south entrance back to the fish lock. This channel is largely rock lined and has no floor diffusers. This area was only dewatered to tail-water elevation (approximately 15 feet) at the time of inspection.

B2.4.1.4.1 Phase 1 Assessment

This section was not inspected in 2004.

B2.4.1.4.2 Phase 2 Assessment

Structural Assessment:

The Fingerling Bypass has developed a large crack in the structure. No one is ever allowed below where the structure can fall. The bypass is currently dewatered, as seen in Figure B2.4.10.

There are also significant leaks appearing in the actual channel around the rocky areas as seen in Figure B2.4.11.

Figure B2.4.10 Fingerling Bypass, Dewatered

Figure B2.4.11 Channel between Fish Lock and Collection Channel

Mechanical Assessment:

N/A

B2.4.1.5 Bulkheads for Fish Lock

Both fish lock openings to the fish lock channel are closed off with bulkheads. Since the elevators are not used, these bulkheads are always in place.

Structural Assessment:

Both bulkheads were in place and unable to be viewed for inspection.

Mechanical Assessment:

N/A

B2.4.1.6 Fish Lock Elevators

The two elevators are large rectangular shafts that were intended to raise upstream migrating fish from the collection channel to the forebay. The elevators had mechanical crowders to help the fish move up. These crowders have deteriorated into serious disrepair. Since the time of the Phase 1 inspection, the crowders have been removed.

B2.4.2 North Entrance

B2.4.2.1 Entrance Weirs

This is the main entrance area on the north side of the Powerhouse. There are two telescoping entrance weirs: WG-64 and WG-65. Only one unit is operated at a time. Each unit has three telescoping gate leaves that are connected to the bottom and can be raised upwards. The crest of the operating weir is operated at least 8 feet below the tailrace level (submergence), except when the tailrace goes below 10 feet since the minimum weir elevation is 2 feet.

B2.4.2.2 Weir Gates (WG-64 and WG-65)

Weir Gate 64 is in the south side of the north entrance and operates at low to medium tailrace levels. The opening width is 8 feet. The minimum weir crest level is 2 feet above sea level, flush with the concrete sill on the upstream side. When fully extended, the maximum weir level is 18 feet; seven feet higher than WG-2, the low weir on the south side. This weir is typically operated at tailrace levels below 25 feet or 90 percent of the time. This weir is put into service when the tailrace level is falling and drops below 23 feet. It is closed for service, by means of bulkhead, when the tailrace level is rising and exceeds 26 feet.

Weir Gate 65 is in the north side of the north entrance and operates only at high tailrace levels. The opening width is 8 feet 3 inches. The minimum weir crest level is 8.5 feet above sea level. When fully extended, the maximum weir level is 26 feet. This weir is typically operated at tailwater levels above 25 feet or less than 10 percent of the time. This weir is put into service when the tailrace level is rising and exceeds 26 feet. It is closed, by means of bulkhead, when the level is falling and drops below 23 feet. This weir unit is operated less frequently than the adjacent weir and might not be operated at all during low flow years. No modifications were made to this weir in 1995.

B2.4.2.2.1 Phase 1 Assessment

Structural Assessment:

WG-1 appears to be in good condition.

Mechanical Assessment:

The mechanical equipment appears to be in good condition. Although the machinery cabinet was not opened for inspection, the wire rope is in good condition as are the sheaves. Drawings that show the lifting beam and hoist equipment could not be located. The Project has indicated that the hoist equipment is not very reliable.

B2.4.2.2.2 Phase 2 Assessment

Structural Assessment:

The structure appears to be in good shape on both weirs.

Mechanical Assessment:

No noticeable difference from the Phase 1 Inspection.

B2.4.3 Junction Pool to North Entrance

B2.4.3.1 Weirs

The width of weir channel is 30 feet between Weirs 10 and 18, transitions from 30 feet to 40 feet between Weirs 18 to 20, and is a constant 40 feet for remaining weirs from 20 to 53 at the junction pool. Unlike Cascades Island, many weirs are notched on two sides to provide a limited overflow crest.

In general, each weir is comprised of the following multiple parts:

- The four-feet high permanent concrete weir that spans the width of the channel;

- The one or two rows of concrete stop-logs that rest atop the permanent weirs. If there are two rows, the upper row is shorter in length leaving lower notches for the overflow crests. The upper stop-log represents the non-overflow section with a crest set 2 feet higher.

- Two to three vertical metal support irons that hold the stop-log weirs in place. The system of weirs in A Branch is far more complicated than the other ladder systems.

B2.4.3.1.1 Phase 1 Assessment

Structural Assessment:

The weirs are in relatively good condition. The structural steel supports and steel anchorage are subject to corrosion.

Mechanical Assessment:

N/A

B2.4.3.1.2 Phase 2 Assessment

Structural Assessment:

Some cracks forming along walls around weirs but they are generally in good condition.

Mechanical Assessment:

N/A

B2.4.3.2 Orifices

There are a total of two orifice openings in each weir. The orifice openings are 2 feet square and are symmetrically oriented near each side of the channel. The orifices were originally arranged in pairs that alternated sides between adjacent weirs. In 1973, the inner, or middle, orifices were blocked and new orifices were cut into the opposite sides of the channel to produce the existing symmetrical design.

B2.4.3.2.1 Phase 1

No specific comments were made for this area.

B2.4.3.2.2 Phase 2

Structural Assessment:

No structural issues were noted.

Mechanical Assessment:

N/A

B2.4.3.3 Junction Pool

The A Branch and B Branch ladder merge at the junction pool. Weirs 54-67, the counting station and the exit section for Bradford Island are upstream of the junction pool. The downward flow from the exit section is split evenly between each branch. There is a permanently closed diffuser (FG3-13) in the floor of the Junction pool.

B2.4.3.3.1 Phase 1

Structural Assessment:

No structural issues were noted.

Mechanical Assessment:

N/A

B2.4.3.3.2 Phase 2

Structural Assessment:

No structural issues were noted.

Mechanical Assessment:

N/A

B2.4.3.4 Ladder Pools

Ladder pools are the areas between weirs. Expansion joints are typically located in these areas.

B2.4.3.4.1 Phase 1

No specific comments were made for this area.

B2.4.3.4.2 Phase 2

Structural Assessment:

At Weir 43, a vertical crack has appeared on the joint (see Figure B2.4.12). There is also a crack in the floor. The section of concrete floor contained within the perimeter of the crack deflects and water rises through the crack when it is stepped on. In the diffusion chamber between FG3-8. At FG3-9 there is a large vertical crack in the structure that is slightly offset from the center of the expansion joint (see Figure B2.4.13). A replacement concrete floor slab has been placed between Weirs 46 and 47. This slab has become slightly lifted and uneven. When looking down at the slab from behind the handrail, the top left corner is raised 2.25 inches, the top right corner is level with the ground, the bottom left corner is raised 1.5 inches, and the bottom right corner is raised 0.25 inches (see Figures B2.4.14, B2.4.15, and B2.4.16). Weirs 46 – 49 are showing significant corrosion. There are bushes and blackberries growing through the joint. The joint between Weirs 36 and 37 has broken open along the wall.

Figure B2.4.12 Crack between Expansion Joints at Weir 43

Figure B2.4.13 Crack in Wall

Figure B2.4.14 Raised Replacement Concrete Slab

Figure B2.4.15 Raised Replacement Concrete Slab

Figure B2.4.16 Raised Replacement Concrete Slab

Mechanical Assessment:

N/A

B2.4.4 Auxiliary Water Supply Components

B2.4.4.1 South AWS Conduit

The south AWS conduit supplies auxiliary water to the Powerhouse Collection Channel, the south entrance and partially the north entrance. The conduit runs adjacent (east) and partly below the Powerhouse Collection Channel. It supplies Diffusers FG2-1 through 22-b along the alignment of Powerhouse Collection Channel. The flow into the conduit is controlled by FV1-1 at the south end of the Powerhouse. The geometry of this conduit is very complex and undergoes several dimensional changes between FV1-1 and first diffuser. The AWS conduit may have a crack and leak downstream of FV1-1. This crack is located below and may be related to a crack in the wall of the fingerling bypass (Figure B.2.4.9).

B2.4.4.1.1 Phase 1 Assessment

Structural Assessment:

The team traveled the AWS conduit along the Powerhouse. Concrete is in excellent condition. Cracking is almost nonexistent. Noted abrupt rise in the conduit invert, roughly estimated at over 10 feet in elevation, at both ends of this conduit. Concrete beams above the floor are in excellent condition. Design Memorandum 1, Modification for Peaking, page 6-23 indicates that this conduit may be over stressed at some combinations of differential pressure and TW elevation. Apparently, a differential gage with alarm and provisions for automatic shutdown of the tainter valve was disabled when pressure transducer was found to be out of calibration. The pressure transducer has recently been recalibrated. The need for the emergency close function should be investigated. The AWS conduit in this area should be structurally investigated.

Mechanical Assessment:

N/A

B2.4.4.1.2 Phase 2 Assessment

This area was not inspected.

B2.4.4.2 North AWS Conduit

The north AWS conduit supplies the lower portion of the A Branch ladder and provides a portion of the flow through the north entrance. The 7.5-feet square conduit runs along the west side of the ladder starting next to the exit section and ending at FV3-8. The conduit feeds FG3-3 through FG3-9 in the floors of ladder pools between weirs 13 - 31. Inflow is controlled by FV3-7, located just east of the exit section and makeup water supply conduit. Only the section of conduit between FV3-7 and the chimney at FG3-9 was inspected.

B2.4.4.2.1 Phase 1 Assessment

Structural Assessment:

The AWS conduit between FV3-7 and A Branch Diffusion Chamber 13 is in excellent condition except for the expansion joints. Several of the expansion joints show evidence of spalling and reinforcing is exposed at one location. All expansion joints in this area have been subject to a previous repair (see Drawing BDF-2-13). It appears that a portion of concrete, in the vicinity of the expansion, was cut away and a PVC waterstop was embedded in concrete or epoxy repair material. This repair is about one foot in width and is continuous around the entire perimeter. Many of these old repairs have failed and a PVC waterstop is exposed at one location. As repair material fails, waterstops are exposed and leakage is probable. Annual inspection of expansion joints is suggested. The portion of the AWS (A Branch) conduit between Diffusion Chambers FG3-13 and FV3-8 was also found to be in good condition except for the expansion joints. Apparently, conduit leakage, from the conduit into surrounding soil, in this area has been a significant problem in the past. Several of the expansion joints show evidence of concrete and epoxy spalling. Most if not all of the expansion joints in this section of the A Branch conduit have been subject to an old repair as was done in the upper portion of this conduit. One of the old repairs has severely failed with exposed reinforcing at this location. More recently, (winter 2000/2001), three of the worst expansion joints were repaired with a new waterstops. This repair apparently used a concrete material to bond new waterstops in place. This repair, although deteriorated in some locations, is in relatively good condition and has apparently partially solved the conduit leakage problem. The status of the repair should be evaluated on an annual basis if possible. Drawings indicate that the waterstop used was JP Specialties EB350 Cap System (or equal). The concrete used was apparently 5,000 psi. The most recent waterstop repairs occurred between the following Diffusion Chambers: FG3-12 and 11, FG3-8 and 7, and FG3-6 and 5.

Mechanical Assessment:

N/A

B2.4.4.2.2 Phase 2 Assessment

Structural Assessment:

No changes from the Phase 1 inspection. (See Figures B2.4.17, B2.4.18 and B2.4.19 for current state of joints).

Figure B2.4.17 Joint with Exposed Rebar and Waterstop along Floor

Figure B2.4.18 Joint with Exposed Rebar and Waterstop along Ceiling

Figure B2.4.19 Joint with Exposed Rebar and Waterstop along Ceiling

Mechanical Assessment:

N/A

B2.4.4.3 Diffusers

The diffusers are the outlets from the AWS to the fish ladder system. They are designed to dissipate energy and diffuse the flow as it rises through the floor openings. With each diffuser system, there are certain common components (in the downstream direction): small square orifice opening for the gate, lateral expansion downstream from the orifice, wide energy dissipating concrete baffle block set in the path of the orifice jet, large chamber beneath and spanning the width of the fishway channel, concrete baffle beams in the ceiling of the chamber, metal grating attached to the top of the beams. The diffuser flow jets through the orifice, is slowed and diffused by the baffle and expansion, and is ultimately turned upward in the chamber to pass through the gratings into the fishway

B2.4.4.3.1 Phase 1 Assessment

Structural Assessment:

Diffusion chambers are generally in good condition with concrete erosion/damage noted. Concrete floors are subject to surface erosion.

Mechanical Assessment:

N/A

B2.4.4.3.2 Phase 2 Assessment

Typical diffusers were inspected at B-Branch. Refer to paragraph B3.4.3.1.

B2.4.4.3.3 Diffuser Grating

The Bradford Island fish way has 20 diffusion chambers. The chambers fill with water from the auxiliary water supply (AWS) conduits and then uniformly disperse the water through the diffuser gratings into the fish ladder. The gratings and fasteners are always corroding which leads to failure. Sometimes debris in the chamber builds up, blocking water from passing through the diffuser grates, to the point where the pressure blows the grating off.

B2.4.4.3.3.1 Phase 1 Assessment

This item not specifically addressed in report.

B2.4.4.3.3.2 Phase 2 Assessment

A typical diffuser grating was inspected at B Branch; grating is comparable at A Branch. Refer to paragraph B3.4.3.1.2.

B2.4.4.3.4 Diffuser Access Covers

The purpose of these covers is to gain access to the various diffusion chambers and their respective diffuser gates.

B2.4.4.3.4.1 Phase 1 Assessment

This item not specifically addressed in report.

B2.4.4.3.4.2 Phase 2 Assessment

A typical diffuser access cover was inspected at B Branch. Refer to paragraph B3.4.3.1.3.

B2.4.4.3.5 Diffuser Gates

The diffuser gates are open/close leaf gates that go over the downstream face of the diffuser orifice openings. All diffuser gates have the same configurations. The gates are connected to long gate stems that extend from the top of the ladder walls. The gate leaves are not rigidly connected to the stems.

During the modifications for Peaking, the gates guides for FG3-6 were altered to prevent full closure. When the gate is in the closed setting, the gate is held open 6 inches high. This was done to provide a constant 60 cfs to the pool of ladder Weir 22. This is where the overflow ladder crest width transitions from 10.4 to 30.3 feet. The extra 60 cfs is required to maintain the ladder head criteria through this transition.

B2.4.4.3.5.1 Phase 1 Assessment

Structural Assessment:

Most of these gates were not subject to inspection except from the AWS conduit. Those diffuser gates that could be inspected appeared to be subject to the same issues noted previously. Diffuser gates FG2-22a and FG2-22b are designed differently than diffuser gates FG2-1 through FG2-22.

Mechanical Assessment:

See structural findings above for FG2-1 through FG2-22b.

For FG3-3through FG3-9, the diffuser gates were in the same condition as those in the Cascades Island fishway as they also experience vibration and fatigue related issues. The team did note, however, that several shaft guides had been replaced in this area with more durable brackets. In addition, the Project had replaced the old style of diffuser covers with the new effective design.

B2.4.4.3.5.2 Phase 2 Assessment

Typical diffuser gates were inspected at B Branch. Refer to paragraph B3.4.3.1.4.

B2.4.4.3.6 Diffuser Gate Actuators

Each diffuser gate is operated using Limitorque or Electrodyne electric actuators.

B2.4.4.3.6.1 Phase 1 Assessment

Structural Assessment:

N/A

Mechanical Assessment:

They were installed in 1937 when the fish ladder was first built and although Project personnel have said that they are very reliable, they can no longer get some parts for them because they are no longer made. For this reason, broken actuators are repaired using spare parts from other decommissioned Limitorques. Additionally, the Project personnel have said that torque-limiting device is difficult to set.

B2.4.4.3.6.2 Phase 2 Assessment

Structural Assessment:

N/A

Mechanical Assessment:

No noticeable change from the Phase 1 inspection.

B2.4.5 Fish Exit

B2.4.5.1 Exit Channel

The exit channel consists of 17 pools separated by a labyrinth system of baffles and vertical slot openings. This channel goes from the exit pool (just upstream of the counting slot) to the fish exit to the forebay. The invert to the channel is 63 feet. The overall width of the channel is 31.5 feet and the slot widths vary between 1 foot 10 inches at the upstream end and 3 foot 9 inches at the downstream end.

There are seven rectangular screened orifice openings in the west sidewall of the exit channel. The openings are 7.5 feet long and vary in height from 4 feet at the upstream end to 3'-2" at the downstream end. The purpose of these openings is to exchange water between the exit channel and the adjacent makeup water channel. The upstream five orifices are termed ‘bleed-off’ orifices for the purpose of removing excess water from the exit channel. The downstream two orifices have the reverse function and are thus termed ‘add-in water’ orifices.

B2.4.5.1.1 Phase 1 Assessment

Structural Findings:

Concrete crack noted where fixed vertical baffle passes over an expansion joint. With respect to exit gate, except for leakage and bolt corrosion the exit gate appears to be in good condition. This component is classified as a HSS.

Mechanical Findings:

N/A

B2.4.5.1.2 Phase 2 Assessment

Structural Assessment:

There is a significant leakage at the exit gate as seen in Figure B2.4.20. Additionally, a couple of cracks have appeared in the walls around the channel leading up to the gate (See Figures B2.4.21 and B2.4.22)

Figure B2.4.20 Fish Exit Gate

Figure B2.4.21 Crack in Channel Leading Up to Exit

Figure B2.4.22 Crack in Channel Leading Up to Exit

Mechanical Assessment:

N/A

B2.4.5.2 Makeup Water Supply System and Channel

The makeup water supply system and channel augments the flow through the exit channel to ensure the ladder head criteria is met at Weir 67. The makeup water supply channel runs adjacent to the exit channel on the west side. This water is (adult) fish free—screened at the forebay by fish screens and upstream of Weir 67 by the picket leads. Fish Valve FV3-9 regulates the flow and adjusts to maintain ladder criteria as the forebay changes. A lamprey bypass system has been added to the makeup water supply channel (Figure B2.4.23).

Figure B2.4.23 Lamprey Bypass in the Makeup Water Supply Channel

Structural Assessment:

A leak in the water stop at the joint immediately upstream of the lamprey bypass system was observed and can be seen in Figure B2.4.24. Based on the location of the joint, the water is coming from the collection channel leading from the forebay to FV3-7.

Figure B2.4.24 Leak in the Waterstop

Mechanical Assessment:

N/A

B2.4.6 AWS Intake

B2.4.6.1 Fish Valves (FV1-1)

FV1-1 is the primary supply valve for the AWS supplying the collection channel portion of Branch A Bradford Island fishway. According to project personnel FV1-1 is difficult to maintain. At the time of inspection, the AWS conduit supplied by FV1-1 was not dewatered and considerable amount of leakage can be seen around the valve in Figure B2.4.25. Project personnel have said that it is difficult to insert the bulkheads to dewater this area.

Figure B2.4.25 FV1-1

Project staff explained during the 2012 inspection that the difficulty in placing the bulkheads has several causes. The bulkheads get stuck in the bulkhead slots. Project has noted that this has gotten worse over time. When the bulkheads get stuck it takes more pulling force to remove them. The only equipment available to move bulkheads is a 10-ton post crane built in 1936 that has been derated to a capacity of 5 tons (Figure B2.4.26 and B2.4.27). Projects concern is that the aging crane will not be able to remove a bulkhead after maintenance has been performed on FV1-1.

Figure B2.4.26 Crane at South AWS Intake

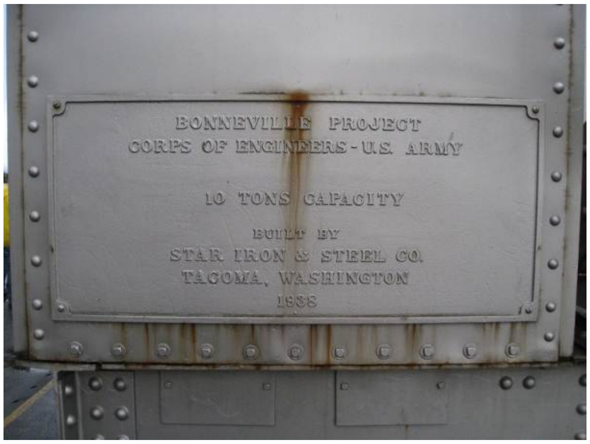

Figure B2.4.27 Bonneville Project Sign

Project has also encountered difficulties in dewatering the intake structure upstream of FV1-1, FV1-2, FV1-3 and FV1-4. The bulkheads do not seal on the sill properly. They have been worn over time and cannot be completely sealed. It should be noted that FV1-3 and FV1-4 supply water to the mothballed fish lock and to the recollection of Project staff, have not been operated. FV1-2 feeds into the AWS supply but is not considered an active valve and normally in the closed position.

B2.4.6.1.1 Phase 1 Assessment

Not specifically addressed in 2004 report.

B2.4.6.1.2 Phase2 Assessment

Structural Assessment:

Over time the bulkheads have gradually become more difficult to remove from their slots. The cranes originally provided to remove the bulkheads are no longer capable of this function and have been derated. There are leaks through the J-seals at the top and bottom of the valve along with a fair bit of corrosion as seen in Figure B2.4.28 and B2.4.29. The valve is left partially open to control the flow but this causes vibrations in the valve.

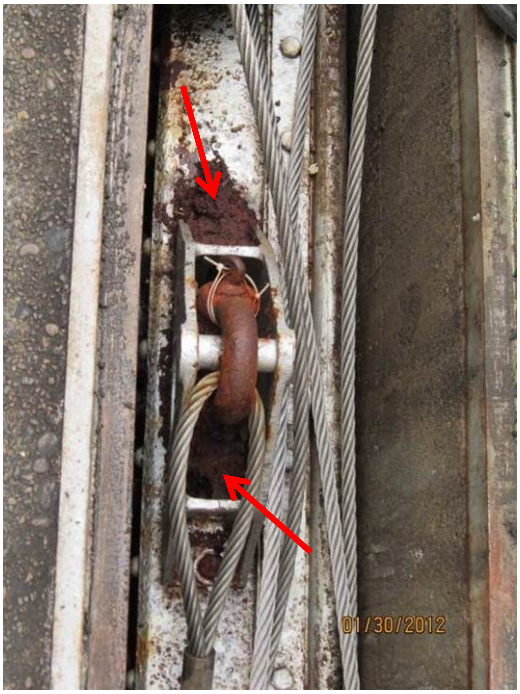

Figure B2.4.28 Corrosion around Bulkhead.

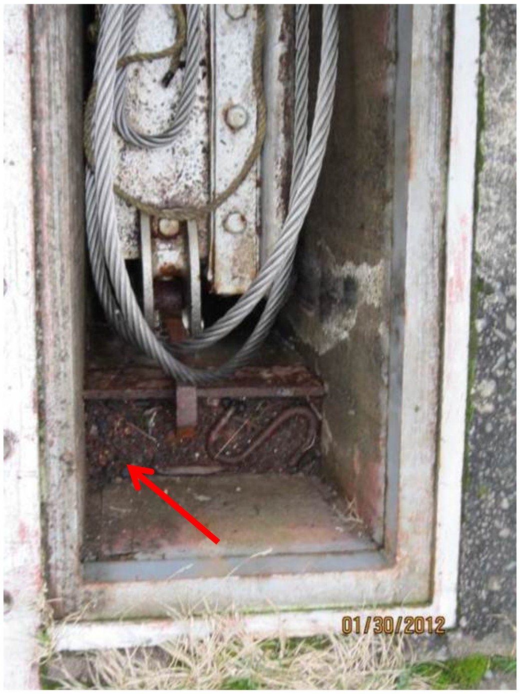

Figure B2.4.29 Corrosion around Bulkhead.

Mechanical Assessment:

N/A

B2.4.6.2 Fish Valves (FV3-9)

This valve provides makeup water to augment the flow from the exit section and automatically adjusts to maintain ladder head criteria at Weir 67. It is located in the makeup water supply channel, between the north AWS conduit and the exit channel (see Figure B2.4.30)

Figure B2.4.30 FV3-9

B2.4.6.2.1 Phase 1 Assessment

Structural Assessment:

The skin plate portion of this tainter gate is in good condition with most of the paint remaining. Side seal bolts are somewhat corroded. The gate frame and operating equipment were not inspected.

Mechanical Assessment:

Bolted components were rusted and the bottom seal should be replaced.

B2.4.6.2.2 Phase 2 Assessment

Structural Assessment:

FV3-9, located at the North side of the ladder at the exit, looks to be in good shape in general. About ten years ago an HSS inspector updated the bulkhead and replaced bolts with stainless steel bolts.

Mechanical Assessment:

The valve seals appear to be approaching the end of their useful life. The knife seal on the bottom of the valve shows significant wear. The bulb seals on the side of the valve are starting to crack and there are several places where grooves have been worn into the seal.

B2.4.6.3 Backwash Valve

This valve is located about 140 feet downstream (north) of FV3-9 in the makeup water supply channel. It was installed during the modification for peaking for the purpose of backing up the water level in the makeup water supply channel to back flush the fish screens for the bleed-off and add-in orifices. It has not been used within memory of any of the Project operators.

B2.4.6.3.1 Phase 1 Assessment

Structural Assessment:

The backwash valve appears to be in good condition.

Mechanical Assessment:

Because the valve has not been used in many years, an HSS inspection is recommended if it is to be used again.

B2.4.6.3.2 Phase 2 Assessment

Structural Assessment:

The valve appears to be in good condition but has not been used in years. An HSS inspection is recommended if it is to be used again. Some cracks are showing up in the walls around the valve as seen in Figure B2.4.31.

Figure B2.4.31 Backwash Valve

Mechanical Assessment:

N/A

B2.4.6.4 Fish Valves (FV3-7)

This valve is used to control the inflow to the north AWS conduit. The valve opening is 7.5 feet square. It is located northeast of the Powerhouse and adjacent to the makeup water supply channel and FV3-9. The forebay intake includes four screens. The invert for the valve is El. 56 feet and the discharge from the valve is not pressurized.

B2.4.6.4.1 Phase 1 Assessment

Structural Assessment:

The FV3-7 tainter valve appeared to be in good condition except for corrosion and a bent diagonal (Figure B2.4.32) (see Drawing T-7-61 for typical gate details). Concrete corrosion noted at both trunnions, possibly due to flow around a lubrication line.

Mechanical Assessment:

The bulkhead has some rusted components, particularly the fasteners and the valve are corroded. An HSS inspection is recommended.

B2.4.6.4.2 Phase 2 Assessment

Structural Assessment:

On further inspection, it was discovered that two of the cross beams were bent as seen in Figure B2.4.32. The cross member that was mentioned in the previous report runs horizontal through the photo. The newly discovered bent member runs diagonally from the top left to the bottom right in the photo. It is uncertain whether the diagonal member buckled recently or was missed in the previous inspection. A possible cause for these bent members is large debris being wedged between the gate and the wall in the conduit but a definite reason cannot be determined at this time. Figures B2.4.33 and B2.4.34 show that the seals are becoming worn out as well.

Figure B2.4.32 FV3-7

Figure B2.4.33 FV3-7 Seals

Figure B2.4.34 FV3-7 Seals

Mechanical Assessment:

No changes from 2004 report. That report mentioned that the bulkhead has some rusted components, particularly the fasteners and the valve are corroded. An HSS inspection is recommended.

B2.4.6.5 Fish Valves (FV3-8)

FV3-8, located near where the PH1 collection channel joins into the A Branch fish ladder, reportedly has not been used in years. FV3-8 separates the North and South AWS conduits on A Branch and is kept closed. The valve is still there in its entirety, but no maintenance has been performed on it in years. It is unclear if there would ever be an eventuality where this valve would need to be opened.

B2.4.6.5.1 Phase 1 Assessment

Structural Assessment:

The skin plate portion of FV3-8 was inspected. J-seals are beginning to deteriorate. The J-seal keeper bar is corroded and one seal bolt is missing.

Mechanical Assessment:

FV3-8 has not been operated or maintained in decades. As such, the actuators and control systems are in very poor shape. It is unclear if this fish valve will ever be operated in the future, but if it is ever returned to operation, it will need a complete retrofit.

B2.4.6.5.2 Phase 2 Assessment

Structural Assessment:

The valve structure appears to be in good condition though a thorough HSS inspection could not be conducted. See Figure B2.4.35.

Mechanical Assessment:

Mechanical components have not been used in years and were not inspected. See Figure B2.4.36.

Figure B2.4.35 FV3-8, Mechanical Components

Figure B2.4.36 FV3-8

B2.5 Summary of Condition Inspection

The summery of inspection only includes those items that differ from the Phase 1 inspection assessments.

B2.5.1 South Entrance and Collection Channel (Including AWS features in this area)

The area of the South Entrance was only inspected from the deck. This area has some of the oldest features of the Bonneville Fishway and many features that are no longer in use. It was noted during the inspection that a seismic event could potentially produce catastrophic damage to the features in the immediate area which would cause problems for the entire dam. The features of most concern in this area are the bulkheads and valves leading to the AWS supplying the collection channel diffusers. FV1-1 shows considerable leakage and is difficult to isolate with bulkheads.

The collection channel is another area of concern. Given the difficulty in inspecting and maintaining the features in this area and the unknown present condition, it has the potential to shut down the South Entrance of A Branch. Project staff reports that the diffuser gates in this area are not operated for fear that they may fail if moved.

The fish lock is little more than a large void. The expansion joints in the fish lock are spalling. There are several places in the channel to the fish lock that are leaking from unknown sources. The decommissioned fingerling bypass has several cracks in the area of the fish lock channel as well. A seismic event could potentially produce catastrophic damage to the features in this area.

B2.5.2 Ladder System from North Entrance to Fish Exit

In general, the ladder weirs and pools are in good condition given the age of the fishway. Some areas of concern are the expansion joints and the concrete slab in the bottom of some pools. Spalling was noted in many of the expansion joints. Some of these joints had deteriorated enough to expose the waterstop behind. In some of the pools between weirs the concrete slab that makes up the floor has begun to lift. In one case, it was several inches higher than the concrete that makes up the base of the weirs.

B2.5.3 AWS Components

There was no noticeable change from the 2004 inspection report in the condition of the North AWS conduit. The repairs to the expansion joints are failing and an alternative solution needs to be found to repair these features. No diffusers were inspected due to access restrictions. It is recommended that inspection of these features be a high priority during the next in water work period for the Bradford Island Fishway.

B2.5.4 Fish Exit

In general, the fish exit features are in good working order. There is a leak in the expansion joint in the makeup water channel that was not mentioned in the 2004 report. The leak is immediately upstream of the lamprey bypass system and is most likely coming from the collection channel that supplies FV3-7.

Appendix B3

Bradford Island Fishway Modifications
Structural/Mechanical Inspection Report
B Branch

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Appendix B3

Bradford Island Fishway Modifications
Structural/Mechanical Inspection Report
B Branch

Executive Summary

The goal of this report is to address the inspection findings of the Bradford Island Fishway Modifications at B Branch.

Phase 1 inspections were conducted in 2004 and Phase 2 in 2011.

B3.1 Introduction

B3.1.1 Task

An inspection of the Bradford Island B Branch fishway was conducted by Tetra Tech INCA Staff on December 13th, 2011. Key fishway features, which had been previously identified, were more closely examined where access was made available.

B3.1.2 Product

This inspection report is the documentation of the findings of the inspection described above, and is to be included in Appendix B to the Bradford and Cascade Islands Fishway Modifications Engineering Document Report (EDR).

B3.1.3 Access Limitations and Considerations

B3.1.3.1 Planned Access

The following features were expected to be available for inspection

- Entrance Pool
- AWS Conduits (North and South)
- Fish Valves FV4-3 and FV4-4
- Fishway from Junction Pool to Entrance

B3.1.3.2 Actual Access

Upon arrival for inspection, the AWS Conduits and the lower portion of the Fishway, between FG3-18 and FG3-26, were not available for direct inspection. As a result, this section of the fishway was observed from above. Additionally, Fish Valves FV4-3 and FV4-4 could only be seen from above, with no direct inspection available, due to the AWS Intake not being de-watered.

B3.2 Tools and Support Required

This inspection required limited personnel support from the Project. Project support was arranged through Ms. Liza Roy. The following paragraphs list the equipment and personnel were required to perform the gate inspection.

B3.2.1 Personnel and Equipment Provided by the Project

The following USACE personnel and equipment were provided to assist the inspection of the Fishway

B3.2.1.1 USACE Personnel

Liza Roy	Technical Lead	USACE
Gary Henrie	Hydraulics	USACE
Scott Harvey	Operations	USACE
Ben Filan	Mechanical	USACE
Mike Crump	Structural	USACE

B3.2.1.2 Equipment

- Extension ladders
- Portable lights
- Man Basket
- Mobile Crane

B3.2.2 Personnel and Equipment Provided by Tetra Tech INCA

INCA inspection staff included a licensed Structural Engineer as the lead inspector and a graduate Mechanical Engineer as an assistant. Inspection equipment used is listed below.

B3.2.2.1 Tetra Tech INCA Personnel

Lois Loesch	Structural	Tetra Tech INCA
LeRoy Mietzner	Mechanical	Tetra Tech INCA
Eric Flickinger	Mechanical	Tetra Tech INCA
John Plump	IDIQ Manager	Tetra Tech INCA

B3.2.2.2 Inspection Tools

- Metal rulers
- 25 foot extension measuring tape
- Dial calipers
- Personal flashlights

B3.2.2.3 Recording Tools

- Writing instruments (pencil and pen)
- Rite-in-the-rain notebook
- Digital camera
- Rechargeable batteries and battery charger
- Metal scribe
- Aluminum clipboards

B3.2.2.4 Safety Equipment

- Hard hat
- Steel toed boots
- Safety glasses
- Gloves
- Hearing protection
- Tag lines (to secure ladders and to haul up tool bucket)
- First aid kit

B3.2.2.5 Access Equipment

- Fall protection harnesses
- Fall prevention lanyards (2 per climber)
- Flange clamps (lanyard anchors, one per lanyard)

B3.2.2.6 Specialty Attire

- Rain Gear

B3.3 Inspection Procedure

INCA performed inspections at the Entrance, Junction Pool Ladder and Auxiliary Water System Intake locations at the Bradford Island B Branch Fishway.

The following is the inspection schedule.

Date	AM	PM
12/13/2011	Inspect Fishway from Junction Pool towards Entrance	Inspect Fishway Entrance

B3.3.1 Inspection of the Entrance

B3.3.1.1 Planned Inspection

The following features located in the B Branch Entrance were identified to be inspected:

- Entrance Weir
- Entrance Slide Gates
- Fish Gates FG3-29 – FG3-33

B3.3.1.2 Actual Inspection

The weirs and slide gates were available for inspection. Fish gates were seen from above.

B3.3.2 Inspection of the Junction Pool and Weirs Downstream towards the Entrance

B3.3.2.1 Planned Inspection

The following features, located in the Fishway between the Entrance and the Junction Pool, were identified to be inspected:

- Fishway Weirs
- Diffusers
- Fish Gates FG3-14 – FG3-28

B3.3.2.2 Actual Inspection

FG3-28 – FG3-26 were available for inspection. All fishway weirs and pools were also available for inspection.

B3.3.3 Inspection of the AWS Intake

B3.3.3.1 Planned Inspection

The following features of the AWS Intake were identified to be inspected:

- Fish Valves FV4-3 and FV4-4
- Trash Racks
- Bulkheads

B3.3.3.2 Actual Inspection

At the time of this inspection, the AWS Intake had not been de-watered and was not accessible for inspection, except for those features that were located at the deck level. These features included:

- Actuators for FV4-3 and FV4-4

B3.4 Inspection Findings

Following are the inspection findings for Bradford Island B Branch Fishway.

Photographs are attached in the observation section for each observation made. All the photographs taken during the inspection are in Appendix B4. A general observation is made at the end of each sub section for the respective item.

The following terms are used in this report for the observations made on the site.

Mothballed: Equipment or features that are no longer in use but all components are still in place

Decommissioned: Equipment that is no longer in use and all components have been removed.

HSS: Hydraulic Steel Structure.

B3.4.1 Entrance

The Fish Entrance to the B Branch is located on the North Side of Bradford Island, adjacent to Spill Bay 18. The Entrance consists of 3 gates, 2 facing parallel to the spillway (a sluice gate and a fixed weir), and 1 fixed weir facing perpendicular to the spillway.

B3.4.1.1 Fixed Entrance Weirs

Two fixed weirs are located in the north side of the entrance. The southern weir (SO-SG-2) is the main one that discharges parallel to the spillway flow and northern weir (SO-SG-7) is the side one that discharges perpendicular to the spillway flow into the adjacent Spill Bay 18. A bulkhead now permanently closes off SO-SG-7. See Figure B3.4.1.

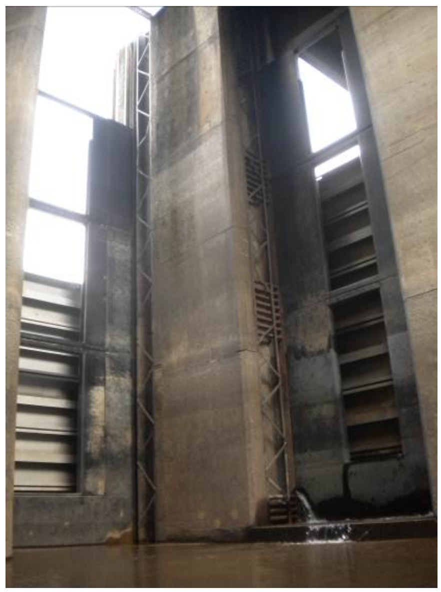

Figure B3.4.1 Fixed Weirs (SO-SG-2 and SO-SG-7)

B3.4.1.2 Sluice Gates

There are two sluice gates on the south side of the entrance system. Like the main fixed weir, the sluice gate assembly is mounted on a removable bulkhead set in the 15 feet wide entrance channel. The bulkhead dimensions are 40 feet high and 15 feet wide. The two sluice gate openings are 10 feet high and 6 feet wide when fully opened. The elevations of the bottom crest of the gate openings are 3 feet, one foot above the invert floor. The sluice gates are operated open/close. The number of open gates is a function of the tailrace level. As presently operated, both gates will be closed at medium to high tailrace levels (> 17 feet) and both are open at very low tailrace levels (< 9 feet). The north gate (3N) is opened first.

Figure B3.4.2 Sluice Gates (SW-SG-4N and 4S)

B3.4.1.2.1 Phase 1

Structural assessment:

The sluice gates appear to be in good condition. The bulkhead for these gates is classified as a HSS.

Mechanical Assessment:

The electric actuators for the sluice gates are in good shape and have no reported issues from the Project.

B3.4.1.2.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

No noticeable change from Phase 1 inspection.

B3.4.1.3 Fish Lock

The fish lock is a defunct fish elevator system that was installed during original fishway construction for the purpose of backing up the fish ladder. The system is comprised of two elevators, each with openings to the equalization chamber and collection channel. The lock elevators are located immediately west of the equalization chamber. Use of the fish lock system was discontinued about 50 years ago. However, use of one of the fish lock units may be reconsidered for sturgeon passage across the dam at some future point.

Figure B3.4.3 Channel to Fish lock with Fish Lock Bulkheads in Background

B3.4.1.3.1 Channel to Lock

At the south end of the bend, there is a straight branch that runs from the entrance to the downstream (west) end of the fish lock. This channel has the same invert and width as the collection channel on the west side. The east side of the channel is wider. Diffusers FG3-31-33 are located in the floor of this channel.

B3.4.1.3.1.1 Phase 1

Structural Assessment:

The channel to the fish lock appears to be in good condition.

Mechanical Assessment:

N/A

B3.4.1.3.1.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

N/A

B3.4.1.3.2 Bulkheads for Fish Lock

Both fish lock openings to the fish lock channel have been closed off with these bulkheads. Since the elevators are not used, these bulkheads are always in place. See Figure B3.4.3.

B3.4.1.3.2.1 Phase 1

Structural Assessment:

Fish lock bulkheads may be corroded, further inspection is recommended. The bulkheads are classified as HSS.

Mechanical Assessment:

N/A

B3.4.1.3.2.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

N/A

B3.4.1.3.3 Fish Lock Elevators

The two elevators are large rectangular shafts that were intended to raise upstream migrating fish from the collection channel to the forebay. The elevators had mechanical crowders to help the fish move up. These crowders have deteriorated into serious disrepair.

B3.4.1.3.3.1 Phase 1

Structural Assessment:

Fish lock elevators are inoperable.

Mechanical Assessment:

As with the other fishway locks, it is impossible to assess the condition of the machinery, as they have not been used for many years.

B3.4.1.3.3.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

No noticeable change from Phase 1 inspection.

B3.4.2 Ladder System from Junction Pool Downstream to Entrance

The ladder system consists of a series of overflow ladder weirs and orifices, rising in one foot increments from Weir 8 to Weir 53. The ladder is approximately 720 feet long and 30 - 40 feet wide with a slope of 1:16. The source of ladder flow comes from Bradford Island exit section, the flow evenly split between A and B Branch at the junction pool.

B3.4.2.1 Weirs

The width of the weir channel is 30 feet between Weirs 8 and 18, transition from 30 feet to 40 feet between Weirs 18 to 20, and is a constant 40 feet for remaining Weirs 20 to 53 at the junction pool. Unlike Cascades Island, the weirs are notched at two sides with approximately 10.4 feet of overflow crest. Each weir is comprised of the following multiple parts: The 4-foot high permanent concrete weir that spans the width of the channel; The two sets of 2-foot high beveled concrete stop-logs that rest atop the permanent weirs: a lower row of stop logs and a second row of stop-logs atop the lower set. The total length of the upper row is 10.4 feet less than the lower one, creating a notched weir with 10.4 of overflow crest and the remaining non-overflow section with a crest set 2 feet higher.

Three vertical metal support irons that hold the stop-log weirs in place: two on the upstream side, one on the downstream side. There are more vertical supports for the weirs in B Branch than in Cascades Island since there is an additional row of stop log panels here for the non-overflow section.

B3.4.2.1.1 Phase 1

Structural Assessment:

The weirs are in relatively good condition. The tops of the weirs have been fit with concrete stop-logs. These panels are supported with steel components anchored into concrete. The potential for anchorage corrosion and panel failure has been noted.

Mechanical Assessment:

N/A

B3.4.2.1.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

N/A

B3.4.2.2 Ladder Pools

Ladder pools are the areas between weirs. Expansion joints are typically located in these areas.

Figure B3.4.4 Expansion Joint between Weirs 37 and 36.

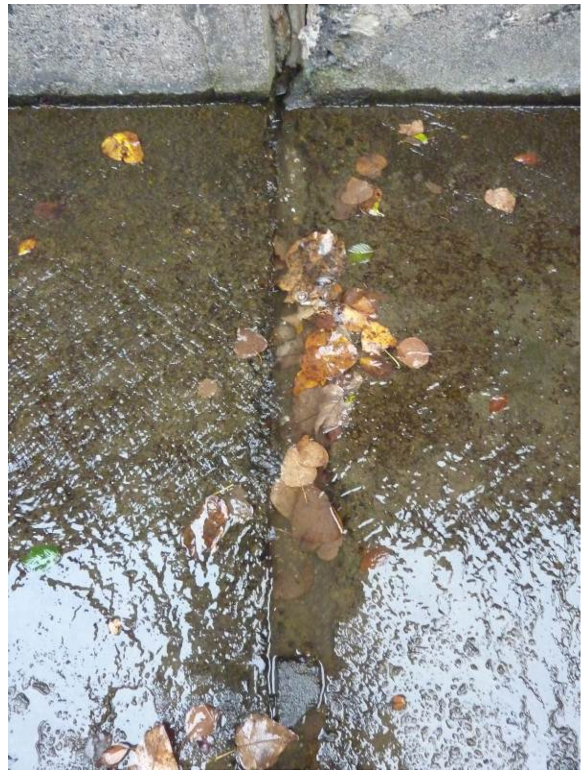

Figure B3.4.5 Floor Joint between Weirs 37 and 36

B3.4.2.2.1 Phase 1

No comments were found specifically addressing this area.

B3.4.2.2.2 Phase 2

Structural Assessment:

Concrete spalling was found at the location of several expansion joints. The joint between Weirs 37 and 36 had deteriorated worse than others. See Figure B3.4.4. An area of the joint deflected noticeably when stepped on and can be seen in Figure B3.4.5.

Mechanical Assessment:

N/A

B3.4.3 Auxiliary Water Supply System

B3.4.3.1 Diffusers

The diffusers are the outlets from the AWS to the fish ladder system. They are designed to dissipate energy and diffuse the flow as it rises through the floor openings. With each diffuser system, there are certain common components (in the downstream direction): small 4-foot square orifice opening for the gate, lateral expansion downstream from the orifice, wide energy dissipating concrete baffle block set in the path of the orifice jet, large chamber beneath and spanning the width of the fishway channel, concrete baffle beams in the ceiling of the chamber, and metal grating attached to the top of the beams. The diffuser flow jets through the orifice, is slowed and diffused by the baffle and expansion, and is ultimately turned upward in the chamber to pass through the gratings into the fishway. The original diffusers had wooden baffle beams in the place of the baffle block and wooden grating that was flush with the channel invert. With the new arrangement, the metal grating rests 2 to 4 feet below the fish ladder channel invert.

B3.4.3.1.1 Diffusion Chambers

The Diffusers FG3-18 through FG3-28 are located in the weir pools of the overflow ladder section. These are relatively small diffusers compared to those in the floor of the collection channel. The diffuser numbers go in opposite direction to the weir numbers. Diffuser 28 in the pool for Weir 8 and 18 is in the pool for Weir 32. There are four additional diffusers above Weir 33 (diffuser FG3-18) going all the way up to Weir 44. These diffusers, designated FG3-14 through FG3-17, are no longer used. The Diffusers FG3-29 through FG3-33 are located in the collection channel and the channel to the fish lock. These diffusers are larger than those in the ladder section. The inspection team only viewed some of these diffusers from above the grating

B3.4.3.1.1.1 Phase 1

The inspection team viewed Diffuser FG3-28, as representative samples of the diffusers in this group.

Structural Assessment:

Diffusion chambers are generally in good condition with minor concrete erosion.

Mechanical Assessment:

N/A

B3.4.3.1.1.2 Phase 2

The inspection team viewed diffuser FG3-28, as a representative sample of the diffusers in this group.

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

N/A

B3.4.3.1.2 Diffuser Grating

The Bradford Island fishway has 20 diffusion chambers. The chambers fill with water from the auxiliary water conduits and then uniformly disperse the water through the diffuser gratings into the fish ladder. The gratings and fasteners are always corroding which leads to failure. Sometimes debris in the chamber builds up blocking water from passing through the diffuser grates, to the point where the pressure blows the grating off. Below the slots are the diffusion chambers. See Figure B3.4.6.

Figure B3.4.6 Diffuser Grating

B3.4.3.1.2.1 Phase 1

Structural Assessment:

Gratings and grating anchorage are subject to corrosion and thus failure. In the past, fish have gained access to the diffusion chambers and the AWS system when grating and/or fasteners have failed. As the failure rate is high, the use of stainless steel is suggested for the grating and fasteners to reduce the risk of corrosion failure.

Mechanical Assessment:

N/A

B3.4.3.1.2.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection.

Mechanical Assessment:

N/A

B3.4.3.1.3 Diffuser Access Covers

The purpose of these covers is to gain access to the various diffusion chambers and their respective diffuser gates.

B3.4.3.1.3.1 Phase 1

Structural Assessment:

Historically, the covers have been blown off due to the pressure produced by operating the fish valves. Repeated attempts to fasten the covers to the concrete with bolts have compromised the integrity of the concrete. For this reason, a new design was developed. In the new design, the access cover bolts into a lipped metal block, this allows for a more secure fastening to the concrete floor to resist pressure changes. Many of the old covers have already been replaced with this new design and it has already proven to be effective. Within the next two years, all old access covers will be replaced.

Mechanical Assessment:

N/A

B3.4.3.1.3.2 Phase 2

Structural Assessment:

No noticeable change from Phase 1 inspection. There are still diffuser access covers that do not have the new design. Project personnel stated that the old covers will need to be replaced sometime in the future but there is currently no plan to do so.

Mechanical Assessment:

N/A

B3.4.3.1.4 Diffuser Gates

Bradford Island Fishway has 16 diffuser gates, which regulate water flowing from the auxiliary water supply conduits to the diffusion chambers to supply water to the fish ladder. The diffuser gates are open/close leaf gates that go over the downstream face of the diffuser orifice openings and wedge tight in the closed position. The gates are connected to long gate stems that extend above the ladder walls. They were supposed to be throttled as desired, but severe vibration and damage makes this impossible. When partially open, the slide gates are free to vibrate, valve stems and couplings have been damaged and broken, and parts of the gate bodies have worn away. They are now operated either completely open or completely closed. According to project personnel, vibration occurs when the gate cannot be retracted fully out of the flow of water from the AWS conduit into the diffuser. To solve this project has installed deflectors in the gate opening. The deflector for FG3-26 can be seen in Figure B3.4.7.

Figure B3.4.7 FG3-26 Deflector

Both FG3-26 and FG3-28 had deflectors installed to reduce the amount of damage caused by vibration. This modification has been done to several of the gates that cannot retract out of the flow but not all of them. At the time of the inspection Project personnel were unsure of which ones have or still need a deflector. The deflectors extend into the opening between the AWS conduit and the diffuser.

B3.4.3.1.4.1 Phase 1

At the time of this site visit, the gate stem for FG3-27 had become disconnected.

Structural Assessment:

Diffuser gates, gate guides, guide anchorages, gate stems, and gate stem anchorages are significant operational issues. Besides the eroding concrete, the gate assembly bolts, guides, gate leaf, operating shaft, and supports are severely corroded. Flow induced vibration and the associated damage remains a problem with respect to diffuser gates in the open position.

Mechanical Assessment:

The diffuser gates are operated by electric actuators, which rotate long lead screws attached to the operating shaft, lifting and lowering the gates. Because of the vibrational issues associated with this design, the bolts that connect the guides to the concrete wall have loosened. Over the life of the fish ladder, repeated attempts have been made to secure the guides to the concrete, resulting in over-drilling and thus compromising the integrity of the concrete. It is recommended that the gates are either modified to eliminate the vibrational issues or a new design is implemented.

Figure B3.3.8 FG3-28

Figure B3.4.9 FG3-26 Guides

B3.4.3.1.4.2 Phase 2

The diffuser gate FG3-28, seen in Figure B3.4.8, was open and available for inspection as a representative sample of the condition of the diffuser gates. Project personnel informed us that this gate along with the guides were rebuilt and strengthened 10 years ago. The gate opening was also retrofitted with a deflector to prevent vibration. The diffuser gate FG3-26 was removed for maintenance. Crews were preparing to rebuild / reinforce the gate guides. At the time of this inspection the guides had been cleaned and prepared for welding additional material to the gate guides. The preparation included cleaning off rust. The result of the preparation is shown in Figure B3.4.9. The deflectors we were able to inspect extended approximately 6 inches from the top of the 36-inch by 36-inch opening reducing the cross section of the gate opening by $1/6^{th}$. This restricts the flow and increases the velocity into the diffuser chamber. The effect the deflectors have on the efficiency of the AWS system is unknown at the time of this inspection.

Structural Assessment:

The diffuser gate FG3-28 was open and available for inspection. The overall appearance of the gate was good. The gate was slightly corroded with surface rust on the top and around the edges. The gate stem showed more corrosion than the gate although not enough to cause damage. If maintenance is not preformed its condition will deteriorate.

Mechanical Assessment:

N/A

B3.4.3.1.5 Diffuser Gate Actuators

Each diffuser gate is operated using Limitorque or Electrodyne electric actuators. See Figure B3.4.10.

Figure B3.4.10 Limitorque Gate Actuator for FG3-31

B3.4.3.1.5.1 Phase 1

Structural Assessment:

N/A

Mechanical Assessment:

They were installed in 1937 when the fish ladder was first built and although Project personnel has said that they are very reliable, they can no longer get some parts for them because they are no longer made. For this reason, broken actuators are repaired using spare parts from other decommissioned Limitorques. Additionally, the Project has said that torque-limiting device is difficult to set.

B3.4.3.1.5.2 Phase 2

Structural Assessment:

N/A.

Mechanical Assessment:

No noticeable change from Phase 1 inspection.

B3.4.3.2 South AWS Conduit

The south AWS conduit supplies the 11 diffusers in the ladder system. The conduit starts at the Control Valve FV4-3 at the equalization chamber and ultimately runs adjacent to the ladder on the south side from Weir 8 to Weir 45. Between the fish valve and the first diffuser, the conduit undergoes three vertical bends. The conduit invert starts at El. 4 feet at the valve, drops abruptly to –11 feet and rises back up to +20 feet, elevated 12 feet above Weir 8. The conduit is 8-foot square at Weir 8 and ultimately tapers to 4-foot square at the downstream end (Weir 45). At each diffuser, there are drop shafts from the conduit to the diffuser orifice and gate opening. At Weir 8, the drop shaft plunges nearly 25 feet. Since the conduit is sloped less adversely than the ladder, the drop shaft is less than 10 feet at Weir 45. The study team did not view the conduit in general. They were only able to view one of the drop shafts. The concrete was in good shape there.

B3.4.3.2.1 Phase 1

Structural Assessment:

N/A

Mechanical Assessment:

N/A

B3.4.3.2.2 Phase 2

Structural Assessment:

N/A

Mechanical Assessment:

N/A

B3.4.3.3 North AWS Conduit

The north AWS conduit supplies the 5 diffusers in the collection channel and fish lock channel. The conduit runs entirely within the large wing wall for Spill Bay 18. The conduit starts at the control valve FV4-4 at the equalization chamber, drops into a 180-degree vertical bend, and runs adjacent to the collection channel on the south side.

B3.4.3.3.1 Phase 1

The study team did not view this conduit.

Structural assessment:

N/A

Mechanical Assessment:

N/A

B3.4.3.3.2 Phase 2

The study team did not view this conduit.

Structural assessment:

N/A

Mechanical assessment:

N/A

B3.4.4 Auxiliary Water Supply Intake

B3.4.4.1 Fish Valves (FV4-3 and FV4-4)

The fish valves are the large radius tainter gates that control auxiliary water supply flow to the two AWS conduits.

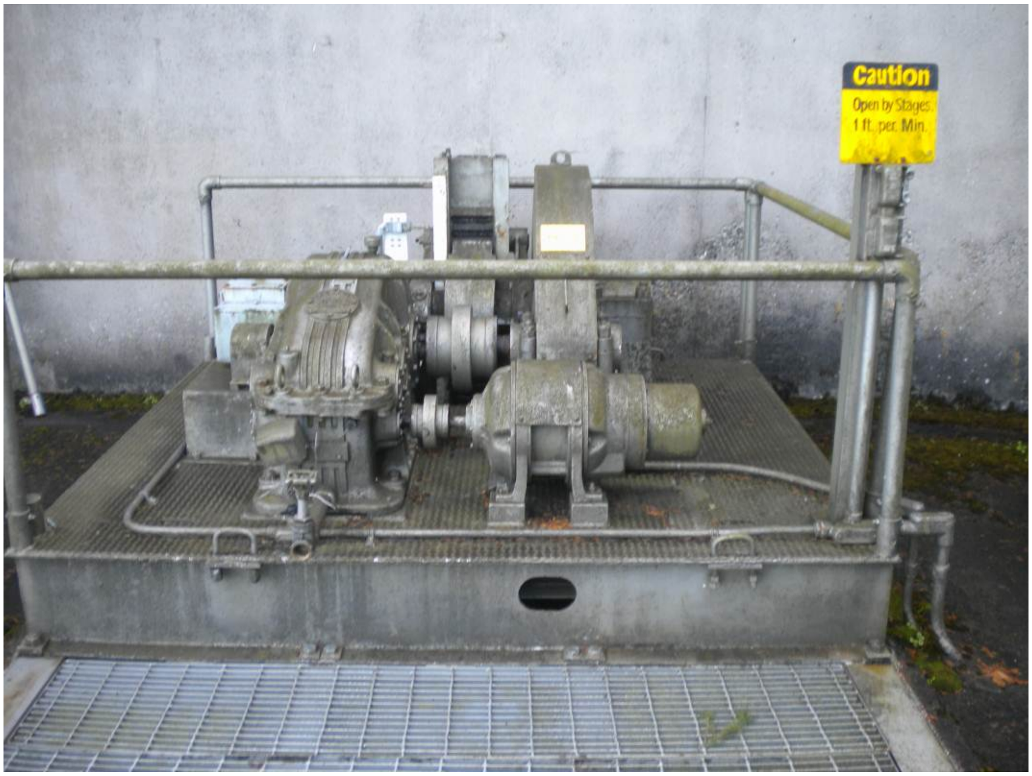

Figure B3.4.11 Electrical Actuators for FV4-3.

B3.4.4.1.1 Phase 1

Structural Assessment:

Except for corrosion, tainter valve FV4-3 appears to be in good condition. The J-seals on this valve are in excellent condition and have apparently been replaced recently. All interfaces between sections of seal have been bonded. The structural frame and operating system for this valve were not inspected. FV4-3 is classified as a HSS. Except for corrosion, tainter valve FV4-4 appears to be in good condition. The J-seals on this valve are in excellent condition and have apparently been replaced recently. All interfaces between sections of seal have been bonded. Bolts attaching bar (not the seal clamp bar) across the top of the gate are severely corroded. There is a missing bolt in the upper left corner. Upper two bolts on upper left side show more corrosion than the rest and are not completely seated. The concrete sidewall on the downstream side of FV4-4 is subject to concrete erosion. The structural frame for this valve was not inspected. FV4-4 is classified as a HSS.

Mechanical Assessment:

The fish valve's electric actuators and motor control systems are in good shape, however the age of the equipment makes finding replacement parts difficult.

B3.4.4.1.2 Phase 2

Structural Assessment:

The study team did not have access to the valves. The current state of the valves is unknown.

Mechanical Assessment:

No noticeable change from Phase 1 inspection. See Figure B3.4.11.

B3.4.4.2 Equalization Chamber

Figure B3.4.12 Equalization Chamber viewed from above.

The equalization chamber is the vast concrete chamber that houses four fish valves: the two AWS supply valves (FV4-3 and 4-4) and two defunct fish lock valves.

B3.4.4.2.1 Phase 1

Structural Assessment:

The concrete in this area is generally in good condition except for concrete surface deterioration above FV4-4.

Mechanical Assessment:

N/A

B3.4.4.2.2 Phase 2

The study team did not have access to the equalization chamber. It was viewed from above. A large amount of debris was noted. (Figure B3.4.12) The debris was not evenly distributed.

Structural assessment:

N/A

Mechanical Assessment:

N/A

B3.5 Summary of Phase 2 Inspection

The summary of inspection only includes those items that differ from the Phase 1 inspection assessments.

B3.5.1 Entrance

The Phase 2 inspection team found conditions in the entrance have not deteriorated from the time of the phase 1 inspection.

B3.5.2 Junction Pool and Downstream towards Entrance

Concrete spalling was found at the location of several expansion joints.

B3.5.3 Auxiliary Water Supply System

Areas of the AWS system have improved due to routine maintenance and replacement of fishway components. It should be noted that there is a finite number of times a component can be repaired before it will need replacement. In the case of concrete anchorages for the diffuser gate stem guides and the gate guides this includes the concrete they are attached to, i.e. the concrete these items mount to will need replacement in the future.

B3.5.3 Auxiliary Water Supply Intake

The Phase 2 study team did not have access to the valves or equalization chamber.

Appendix B4

Bradford Island Fishway Modifications
A and B Branch Photographs

Table of Contents

	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
1	x								x											x		
2	x								x											x		
3	x								x											x		
4	x								x											x		
5	x										x									x		
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	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
62							x		x								x					
63							x		x									x				
64							x						x									x
65							x		x										x			
66							x		x								x					
67							x		x								x					
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121	x																			x		
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	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
123	x																					x
124	x																			x		
125	x																				x	
126	x																				x	
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146							x											x				
147							x											x				
148																		x				
149																		x				
150							x										x					
151							x										x					
152							x											x				
153							x										x					
154							x										x					
155							x										x					
156							x										x					
157							x													x		
158							x											x				
159							x											x				
160							x											x				
161							x											x				
162							x											x				
163				x														x				
164				x													x					
165	x																x					
166	x																x					
167	x																x					
168	x																			x		
169	x																x					
170	x																	x				
171	x																	x				
172	x																x					
173	x																x					
174	x																x					
175	x																x					
176	x																x					
177	x																x					
178	x																x					
179	x																x					
180	x																	x				
181	x																	x				
182	x																	x				
183		x															x					

	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
184		x																x				
185		x																x				
186																		x				
187																		x				
188		x																x				
189		x																				
190		x																x				
191		x															x					
192		x															x					
193		x															x					
194		x															x					
195		x															x					
196		x															x					
197				x															x			
198				x															x			
199				x															x			
200				x															x			
201							x												x			
202							x												x			
203				x															x			
204				x															x			
205				x															x			
206				x															x			
207			x																x			
208					x														x			
209						x																x
210							x												x			
211							x												x			
212						x													x			
213							x												x			
214							x												x			
215							x															x
216							x									x						
217							x									x						
218							x									x						
219							x									x						
220							x															x
221							x													x		
222							x													x		
223							x												x			
224							x											x				
225							x												x			
226							x												x			
227							x											x				
228							x												x			
229																			x			
230																			x			
231																			x			
232				x														x				
233				x														x				
234				x														x				
235				x														x				
236				x														x				
237				x														x				
238				x														x				
239				x														x				
240				x														x				
241			x															x				
242			x															x				
243			x															x				
244	x																	x				

PHOTOS FROM A BRANCH

Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.
245	x							
246	x							
247	x							
248	x							
249	x							
250	x							
251							x	
252							x	
253							x	
254							x	
255							x	
256							x	
257							x	
258							x	
259							x	
260							x	
261							x	
262							x	
263							x	
264							x	
265							x	
266							x	
267								
268							x	
269							x	
270							x	
271							x	
272	x							
273	x							
274	x							
275	x							
276	x							
277	x							
278	x							
279	x							
280	x							
281	x							
282	x							
283	x							
284	x							
285	x							
286	x							
287	x							
288	x							
289	x							
290	x							
291	x							
292	x							
293	x							
294	x							
295	x							
296	x							
297	x							
298	x							
299	x							
300	x							
301	x							
302	x							
303	x							
304	x							
305	x							

ELECTRICAL PHOTOS

Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.

PHOTOS FROM B BRANCH

Photo Number	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
245				x				
246				x				
247				x				
248				x				
249				x				
250						x		
251						x		
252						x		
253								x
254					x			
255	x							
256	x							
257	x							
258	x							
259	x							
260	x							
261	x							
262	x							
263						x		
264						x		
265				x				
266	x							
267	x							
268						x		
269						x		
270						x		
271						x		
272						x		
273						x		
274						x		
275						x		
276						x		
277						x		
278						x		
279						x		

	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
306	x																					
307	x																					
308	x																					
309	x																					
310		x																				
311		x																				
312		x																				
313		x																				
314		x																				
315		x																				
316		x																				
317		x																				
318		x																				
319		x																				
320		x																				
321		x																				
322		x																				
323		x																				
324		x																				
325		x																				
326		x																				
327		x																				
328		x																				
329		x																				
330		x																				
331		x																				
332		x																				
333																						
334		x																				
335		x																				
336		x																				
337		x																				
338		x																				
339		x																				
340		x																				
341		x																				
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343		x																				
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346		x																				
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348		x																				
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350		x																				
351		x																				
352		x																				
353		x																				
354		x																				
355		x																				
356		x																				
357		x																				
358		x																				
359		x																				
360		x																				
361		x																				
362		x																				
363		x																				
364		x																				
365		x																				
366		x																				

	PHOTOS FROM A BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.
367		x						
368		x						
369		x						
370		x						
371		x						
372		x						
373				x				
374				x				
375				x				
376				x				
377				x				
378				x				
379				x				
380				x				
381				x				
382				x				
383				x				
384				x				
385				x				
386				x				
387				x				
388				x				
389				x				
390				x				
391				x				
392				x				
393				x				
394				x				
395				x				
396				x				
397				x				
398				x				
399				x				
400					x			
401					x			
402								
403								
404								
405							x	
406							x	
407							x	
408							x	
409							x	
410							x	
411							x	
412							x	
413							x	
414							x	
415							x	
416							x	
417							x	
418							x	
419							x	
420							x	
421							x	
422							x	
423							x	
424							x	
425							x	
426							x	
427							x	

ELECTRICAL PHOTOS					
Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.

PHOTOS FROM B BRANCH							
AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.

	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
428							x															
429							x															
430							x															
431							x															
432							x															
433							x															
434							x															
435							x															
436							x															
437							x															
438							x															
439						x																
440						x																
441						x																
442																						
443																						
444																						
445																						
446																						
447																						
448	x																					
449	x																					
450	x																					
451	x																					
452	x																					
453	x																					
454	x																					
455	x																					
456	x																					
457	x																					
458	x																					
459	x																					
460							x															
461							x															
462							x															
463							x															
464							x															
465							x															
466							x															
467							x															
468							x															
469							x															
470							x															
471							x															
472							x															
473																						
474							x															
475																						
476							x															
477																						
478							x															
479							x															
480							x															
481							x															
482							x															
483							x															
484							x															
485							x															
486							x															
487							x															
488							x															

	PHOTOS FROM A BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.
489							x	
490							x	
491							x	
492							x	
493							x	
494							x	
495							x	
496							x	
497							x	
498							x	
499							x	
500							x	
501							x	
502							x	
503							x	
504							x	
505							x	
506							x	
507							x	
508							x	
509								
510								
511							x	
512							x	
513							x	
514							x	
515							x	
516							x	
517							x	
518							x	
519							x	
520						x		
521						x		
522						x		
523						x		
524						x		
525						x		
526					x			
527					x			
528				x				
529				x				
530				x				
531				x				
532				x				
533				x				
534				x				
535				x				
536				x				
537				x				
538				x				
539				x				
540				x				

ELECTRICAL PHOTOS					
Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.

PHOTOS FROM B BRANCH							
AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.

Page 9 of 10

	PHOTOS FROM A BRANCH								ELECTRICAL PHOTOS						PHOTOS FROM B BRANCH							
Photo Number	Power House 1	Collection Channel	Conduit	B/T Collection Channel and Junction Pool	Junction Pool	B/T Junction Pool and Exit Section	Exit Section	Misc.	Electrical Boxes	Equipment	Labels	Limitorque Operator	Overall Site Views	Misc.	AWS Intake	Fish Valve Actuators	Collection Channel and Entrance	Diffuser Gate and Grates	Diffuser Actuators	Fishway Weirs and Orifices	Erosion over AWS South AWS conduit	Misc.
541				x																		
542				x																		
543				x																		
544				x																		
545			x																			
546			x																			
547			x																			
548			x																			
549			x																			
550			x																			
551			x																			
552			x																			
553			x																			
554			x																			
555			x																			
556			x																			
557			x																			
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561			x																			
562			x																			
563			x																			
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565			x																			
566			x																			
567			x																			
568			x																			
569			x																			
570																						
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572																						
573																						
574																						
575							x															
576	x																					
577	x																					
578	x																					
579	x																					
580								x														
581								x														
582								x														
583	x																					
584							x															
585							x															
586							x															
587							x															
588							x															
589							x															
590							x															
591							x															
592							x															
593							x															
594							x															
595							x															
596							x															
597							x															
598							x															
599							x															
600				x																		
601				x																		

Electrical Inspection Photographs


Electrical Inspection (1)


Electrical Inspection (2)


Electrical Inspection (3)


Electrical Inspection (4)

Electrical Inspection (5)


Electrical Inspection (6)

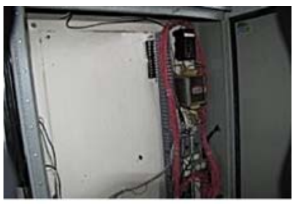

Electrical Inspection (7)

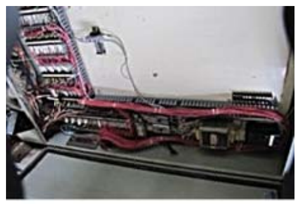

Electrical Inspection (8)

Electrical Inspection (9)


Electrical Inspection (10)


Electrical Inspection (11)


Electrical Inspection (12)


Electrical Inspection (13)


Electrical Inspection (14)


Electrical Inspection (15)


Electrical Inspection (16)


Electrical Inspection (17)


Electrical Inspection (18)


Electrical Inspection (19)


Electrical Inspection (20)


Electrical Inspection (21)


Electrical Inspection (22)


Electrical Inspection (23)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Electrical Inspection (25)


Electrical Inspection (26)


Electrical Inspection (27)


Electrical Inspection (28)


Electrical Inspection (29)


Electrical Inspection (30)


Electrical Inspection (31)


Electrical Inspection (32)

Electrical Inspection (33)


Electrical Inspection (34)


Electrical Inspection (35)


Electrical Inspection (36)


Electrical Inspection (37)


Electrical Inspection (38)


Electrical Inspection (39)


Electrical Inspection (40)


Electrical Inspection (41)


Electrical Inspection (42)


Electrical Inspection (43)


Electrical Inspection (44)


Electrical Inspection (45)


Electrical Inspection (46)


Electrical Inspection (47)

Electrical Inspection (48)


Electrical Inspection (49)


Electrical Inspection (50)


Electrical Inspection (51)


Electrical Inspection (52)

Electrical Inspection (53)


Electrical Inspection (54)


Electrical Inspection (55)

Electrical Inspection (56)


Electrical Inspection (57)


Electrical Inspection (58)


Electrical Inspection (59)


Electrical Inspection (60)


Electrical Inspection (61)


Electrical Inspection (62)


Electrical Inspection (63)


Electrical Inspection (64)


Electrical Inspection (65)


Electrical Inspection (66)


Electrical Inspection (67)

Electrical Inspection (68)


Electrical Inspection (69)

Electrical Inspection (70)


Electrical Inspection (71)

Electrical Inspection (72)

Electrical Inspection (73)


Electrical Inspection (74)


Electrical Inspection (75)


Electrical Inspection (76)


Electrical Inspection (77)


Electrical Inspection (78)

Electrical Inspection (81)

A Branch Inspection Photographs

(Structural and Mechanical)

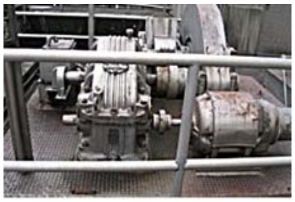

A-Branch Inspection (1)

A-Branch Inspection (2)

A-Branch Inspection (3)

A-Branch Inspection (4)

A-Branch Inspection (5)

A-Branch Inspection (6)

A-Branch Inspection (7)


A-Branch Inspection (8)

A-Branch Inspection (9)

A-Branch Inspection (10)

A-Branch Inspection (11)

A-Branch Inspection (12)

A-Branch Inspection (13)

A-Branch Inspection (14)

A-Branch Inspection (15)

A-Branch Inspection (16)

A-Branch Inspection (17)

A-Branch Inspection (18)

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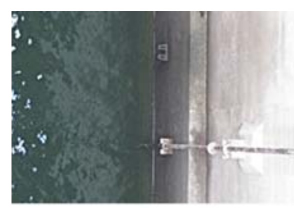
A-Branch Inspection (24)

A-Branch Inspection (25)

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A-Branch Inspection (27)

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A-Branch Inspection (30)

A-Branch Inspection (31)

A-Branch Inspection (32)

A-Branch Inspection (33)

A-Branch Inspection (34)

A-Branch Inspection (35)


A-Branch Inspection (36)


A-Branch Inspection (37)


A-Branch Inspection (38)


A-Branch Inspection (39)


A-Branch Inspection (40)


A-Branch Inspection (41)


A-Branch Inspection (43)


A-Branch Inspection (44)


A-Branch Inspection (45)


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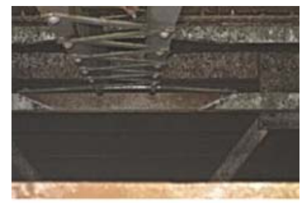
A-Branch Inspection (49)


A-Branch Inspection (50)


A-Branch Inspection (51)


A-Branch Inspection (52)


A-Branch Inspection (53)


A-Branch Inspection (54)


A-Branch Inspection (55)


A-Branch Inspection (56)


A-Branch Inspection (57)


A-Branch Inspection (58)


A-Branch Inspection (59)


A-Branch Inspection (60)


A-Branch Inspection (61)


A-Branch Inspection (62)


A-Branch Inspection (63)


A-Branch Inspection (64)


A-Branch Inspection (65)


A-Branch Inspection (66)


A-Branch Inspection (67)


A-Branch Inspection (68)


A-Branch Inspection (69)


A-Branch Inspection (70)


A-Branch Inspection (71)


A-Branch Inspection (72)

A-Branch Inspection (73)

A-Branch Inspection (74)

A-Branch Inspection (75)

A-Branch Inspection (76)

A-Branch Inspection (77)

A-Branch Inspection (78)

A-Branch Inspection (80)

A-Branch Inspection (81)

A-Branch Inspection (82)

A-Branch Inspection (83)

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A-Branch Inspection (85)

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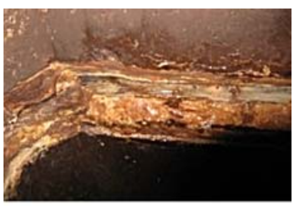
A-Branch Inspection (87)

A-Branch Inspection (88)

A-Branch Inspection (89)

A-Branch Inspection (90)

A-Branch Inspection (91)

A-Branch Inspection (92)

A-Branch Inspection (93)

A-Branch Inspection (94)

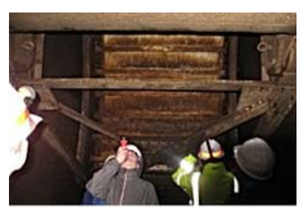
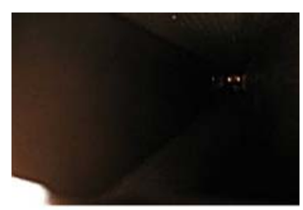
A-Branch Inspection (95)

A-Branch Inspection (96)

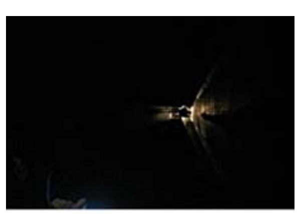
A-Branch Inspection (97)

A-Branch Inspection (98)

A-Branch Inspection (99)

A-Branch Inspection (100)

A-Branch Inspection (101)

A-Branch Inspection (102)

A-Branch Inspection (103)

A-Branch Inspection (104)

A-Branch Inspection (105)

A-Branch Inspection (106)

A-Branch Inspection (110)


A-Branch Inspection (111)


A-Branch Inspection (112)


A-Branch Inspection (113)


A-Branch Inspection (114)


A-Branch Inspection (115)


A-Branch Inspection (116)


A-Branch Inspection (117)


A-Branch Inspection (118)


A-Branch Inspection (119)


A-Branch Inspection (120)


A-Branch Inspection (121)


A-Branch Inspection (122)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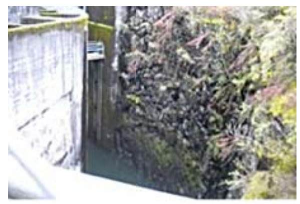
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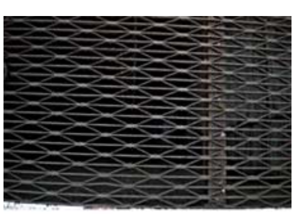
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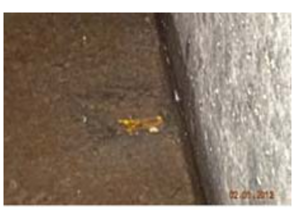
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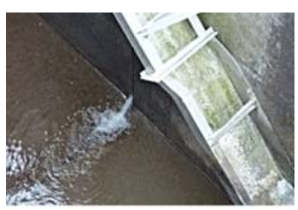
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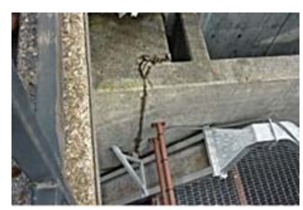
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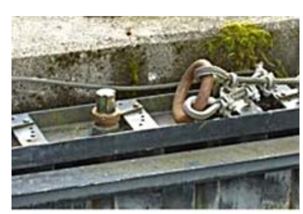
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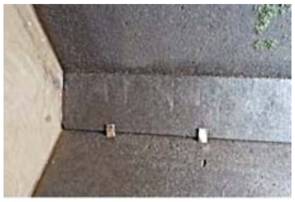
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B Branch Inspection Photographs

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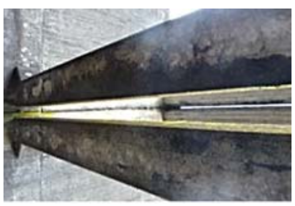
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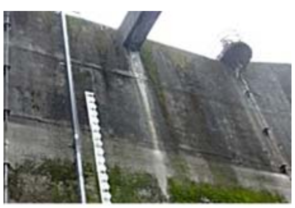
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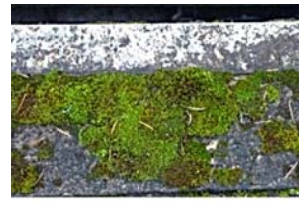
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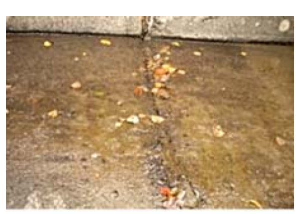
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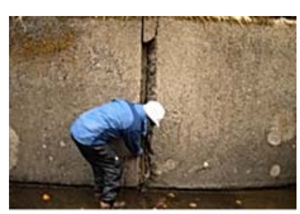
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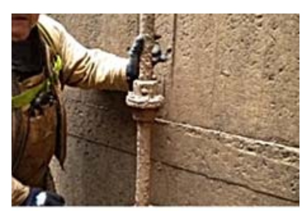
B-Branch Inspection (184)

B-Branch Inspection (185)

B-Branch Inspection (186)

B-Branch Inspection (187)

B-Branch Inspection (188)

B-Branch Inspection (190)


B-Branch Inspection (191)


B-Branch Inspection (192)


B-Branch Inspection (193)


B-Branch Inspection (194)


B-Branch Inspection (195)


B-Branch Inspection (196)


B-Branch Inspection (197)


B-Branch Inspection (198)


B-Branch Inspection (199)

B-Branch Inspection (200)


B-Branch Inspection (201)

B-Branch Inspection (202)


B-Branch Inspection (203)


B-Branch Inspection (204)


B-Branch Inspection (205)


B-Branch Inspection (206)


B-Branch Inspection (207)


B-Branch Inspection (208)


B-Branch Inspection (210)

B-Branch Inspection (211)


B-Branch Inspection (212)


B-Branch Inspection (213)


B-Branch Inspection (214)


B-Branch Inspection (216)


B-Branch Inspection (217)


B-Branch Inspection (218)


B-Branch Inspection (219)


B-Branch Inspection (221)


B-Branch Inspection (222)


B-Branch Inspection (223)


B-Branch Inspection (224)


B-Branch Inspection (225)


B-Branch Inspection (226)


B-Branch Inspection (227)


B-Branch Inspection (228)


B-Branch Inspection (229)


B-Branch Inspection (230)

B-Branch Inspection (231)


B-Branch Inspection (232)


B-Branch Inspection (233)


B-Branch Inspection (234)


B-Branch Inspection (235)


B-Branch Inspection (236)


B-Branch Inspection (237)


B-Branch Inspection (238)


B-Branch Inspection (239)


B-Branch Inspection (240)


B-Branch Inspection (241)


B-Branch Inspection (242)


B-Branch Inspection (243)


B-Branch Inspection (244)


B-Branch Inspection (245)


B-Branch Inspection (246)


B-Branch Inspection (247)


B-Branch Inspection (248)


B-Branch Inspection (249)


B-Branch Inspection (250)


B-Branch Inspection (251)


B-Branch Inspection (252)


B-Branch Inspection (254)


B-Branch Inspection (255)


B-Branch Inspection (256)


B-Branch Inspection (257)


B-Branch Inspection (258)


B-Branch Inspection (259)


B-Branch Inspection (260)


B-Branch Inspection (261)


B-Branch Inspection (262)


B-Branch Inspection (263)


B-Branch Inspection (264)


B-Branch Inspection (265)

B-Branch Inspection (266)

B-Branch Inspection (267)

B-Branch Inspection (268)

B-Branch Inspection (269)

B-Branch Inspection (270)

B-Branch Inspection (271)

B-Branch Inspection (272)

B-Branch Inspection (273)

B-Branch Inspection (274)

B-Branch Inspection (275)

B-Branch Inspection (276)

B-Branch Inspection (277)

B-Branch Inspection (278)

B-Branch Inspection (279)

APPENDIX C – QC DOCUMENTATION

Project Quality Checklist
W9127N-11-D-0009 Task Order: 0005

Project Name:	BON Bradford Island Fishways Modification EDR
Project No.:	11-045E
Project Manager:	Lois Loesch, P.E.
Project Status (Circle One):	**30%** **60%** **90%** **100%**

MAJOR COMPONENT	COMPONENT	Completed	Check Completed
EDR Chapter 1		x	
Chapter 2		x	
Chapter 3		x	
Chapter 4	N/A - Not this Task	N/A	
Chapter 5		x	
Chapter 6		x	
Appendix A	Matrix	x	
Appendix B1	Electrical	x	
Appendix B2	A Branch Structural / Mechanical	x	
Appendix B3	B Branch Structural / Mechanical	x	
Appendix B4	Photograph Index	x	
Respond to DrChecks	District 30% Comments	x	
	District 60% Comments	x	
	District 90% Comments	x	
QC / Review	(All)	x	
Appendix D	Correspondence	x	

I hereby certify that I have verified that the above checked items are completed to the level appropriate to this submittal and are in conformance with contract requirements.

Project Manager: Lois Loesch — Lois Loesch, P.E. Date: 8/13/12

I hereby certify that I believe that all appropriate quality control measures necessary for this submittal have been completed in accordance of INCA's QC Procedures and the Project Quality Control Plan.

QA Manager: James Costello — James Costello, P.E. Date: 8/13/12

30 Percent Comments

Comment Report: All Comments
Project: Bradford Island Adult Fishway Assessment Phase II EDR
Review: 30% EDR
Displaying 73 comments for the criteria specified in this report.
1906 ms to run this page

Id	Discipline	Section/Figure	Page Number	Line Number
4453455	Project Management	n/a'	Page 2-4 section 2.4 Auxiliary Water Supply	n/a
Please provide drawing showing ladder configuration so it will be easier to understand throughout. Submitted By: Natalie Richards (503-808-4755). Submitted On: 28-Feb-12				
1-0	Evaluation **Concurred** This will be added. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4453465	Project Management	n/a'	Chapter 6 matrix	n/a
Per discussions at yesterday's meeting (2/27/2012), please arrange table to fit text in whatever way is easiest so that it is easily reviewable by non-team members and Upper Management. Submitted By: Natalie Richards (503-808-4755). Submitted On: 28-Feb-12				
1-0	Evaluation **Concurred** The table has been re-organized to follow the text. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4453474	Project Management	n/a'	Chapter 6- Table 6-6	n/a
Per our discussion yesterday (2/27/2012), I recommend adding a intermediate condition(s) for 3. Failure likely to occur within In-Water-Work period. Maybe 2 would be failure likely in next 5 years or something like that (if that is possible to quantify) Submitted By: Natalie Richards (503-808-4755). Submitted On: 28-Feb-12				
1-0	Evaluation **Concurred** We have quantified. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4453479	Project Management	n/a'	Chapter 6- Matrix	n/a

How do we deal with Human Life Safety concerns? Multiply by 10? Add star? Submitted By: Natalie Richards (503-808-4755). Submitted On: 28-Feb-12				
1-0	Evaluation **Concurred** We have added a separate "Life Safety" column to note where this applies. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4457020	Project Management	n/a'	B1-1 under B1.1 Introduction	n/a
CENWPOD-TF--> add space CENWP-OD-TF Submitted By: Natalie Richards (503-808-4755). Submitted On: 29-Feb-12				
1-0	Evaluation **Concurred** Corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4457033	Project Management	n/a'	B1.6.3.3 Motor Control Centers (MCC)	n/a
"so we could not comment pm their condition." What is pm? Submitted By: Natalie Richards (503-808-4755). Submitted On: 29-Feb-12				
1-0	Evaluation **For Information Only** Typo - should be "on their condition" Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4457057	Project Management	n/a'	B2.2.2.1 USACE Personnel in Attendance	n/a
Please change: Kevin Hace- Structural USACE Gary Bechtel- Cost Estimating USACE Submitted By: Natalie Richards (503-808-4755). Submitted On: 29-Feb-12				
1-0	Evaluation **Concurred** Corrected.			

	Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4461230	Operations	n/a'	2-1, Paragrah 2.1	n/a

In second sub-paragraph change text to read "The fish use the overflow ladder weirs..." Also in subsequent sub-paragraph you somewhat mention that these ladder weirs were modified but dont say how?? Add some text to state that underwater orifices were added along with additions to the top elevation of the wiers.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Text is updated. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461239	Operations	n/a'	2-1, Paragrah 2.1 and 3-3, paragraph 3.4	n/a

In these two paragraphs, you mention that most of the attaction water is supplied by the AWS system. Add text to fully explain where all the water in the ladder is coming from including directly from the pool at the ladder exit.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

Revised 02-Mar-12.

1-0	Evaluation **Concurred** We will add further information. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461276	Operations	n/a'	2-2, Paragrah 2.3.2	n/a

Edit text to clarify that the "channel conveys fish from the south entrances to the bottom of the A-Branch Ladder". The north entrance conveys fish to this location as well.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Text is updated. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment.

	Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461288	Operations	n/a'	2-2, Paragrah 2.3.3	n/a

Add some text to state that there has been some undocumented modifications to the fish lock walls (i.e. holes cut) to allow for drainage of leakage water. The reason for additional clarification is to build the case that the south end area is not only deteriorated but has been modified outside the original design.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Additional text has been added to this paragraph. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461300	Operations	n/a'	2-3, Paragrah 2.3.6	n/a

Last sentence states "Failure would not necessarily....." Clarify Failure of what?? Are you referring to the crowder?

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

Revised 02-Mar-12.

1-0	Evaluation **Concurred** Revised text to clarify - "Failure of any part of the counting station..." Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461317	Operations	n/a'	2-4, Paragrah 2.3.7.1	n/a

Edit text "This water is (adult) fish free -- screened from at both ends" Not sure what you mean by this. The water from FV 3-9 is screened at the entrance of the forebay intake for that water supply.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12

Revised 02-Mar-12.

1-0	Evaluation **Concurred** We are clarifying this. The forebay intake screens for adult fish; the picket lead is located at the downstream end of the makeup water. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12
	Current Comment Status: **Comment Closed**

4461494	Operations	n/a'	2-4, paras 2.4.1 and 2.4.2	n/a
Last sentence in each of these paragraphs, text should be changed to "This would cause the ladder, collection channel and entrances to be out of criteira making it difficult for the fish to find the entrances". Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Change applied. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 07-May-12			
	Current Comment Status: **Comment Closed**			
4461743	Hydraulics	n/a'	various	n/a
Minor editorial changes: PAGE CHANGE various spelling: change "personal" to "personnel" various spelling: change "summery" to "summary" xii First paragraph, second sentence: remove redundancy: "...The Portland district prepared by the Portland District..." 3-3 Paragraph 3.3.5 second sentance: wording is confusing B2-2 Paragraph B2.2.2.1 spelling: Gary Henrie, Alan Stokke B2-19 Paragraph B2.4.2.2.2: specify that the lifted concrete slab is a floor slab B2-37 Paragraph B2.4.4.4.1 structural: what is a minter valve? B2-36 Figure B2.4.32: the arrows need to be adjusted to point to the bent members B2-41 Paragraph B2.5.2: remove "the" from the sentence "The in some of the pools between..." B3-2 Paragraph B3.2.1.1 change and add personnel: Gary Henrie Hydraulics, Ben Filan Mechanical, Mike Crump Structural Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** All changes incorporated. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Open Comment** Page x - Only the redundancy needed to be removed from the 2nd sentence (Portland District was mentioned twice); the 2nd sentence could read: "This is the follow-up to the Phase I Report (2004) the Portland Disctrict prepared in response..." Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 11-May-12			
1-2	Backcheck Recommendation **Open Comment** Page 3-3, Paragraph 3.3.5, sentence 2 - This sentence is still unclear. Would the following statement capture what you are trying to say? "This is also where the flow from the upper ladder is split evenly into the A and B branches." Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12			
2-0	Evaluation **Concurred** Sentence has is revised to say, "This is also where the flow from the upper ladder is split evenly into the A and B branches." Submitted By: Eric Flickinger (425-635-1000) Submitted On: 14-Jun-12			
2-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 23-Jul-12			
	Current Comment Status: **Comment Closed**			
4461759	Hydraulics	n/a'	B2-14	n/a
Verify the location of the crack referenced in Figure B2.4.9. Is it really a diffuser or the fingerling bypass? (diffusor should be spelled				

diffuser) Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Corrected as fingerling bypass. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 07-May-12			
	Current Comment Status: **Comment Closed**			
4461764	Other	n/a'	2-1	1st para 2nd line
Should include migrating lamprey. Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Added lamprey. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** corrected Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461772	Other	n/a'	B1-10	1st para 5th line
replace pm with on Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** corrected Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461792	Hydraulics	Table 6-1	6-2	n/a
Table 6.1 could use headings for each column. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12 Revised 02-Mar-12.				
1-0	Evaluation **For Information Only** Each column has a heading.			

	Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12
	Current Comment Status: **Comment Closed**

4461806	Other	n/a'	B1-10	para B2.2.2.1

Kevin Hace is strucural Gary Bechtel is cost engineering

Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** corrected Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12
	Current Comment Status: **Comment Closed**

4461810	Other	n/a'	B2-9	para B2.4.1.1.2 6th line

replace from with for

Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Replaced. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12
	Current Comment Status: **Comment Closed**

4461816	Other	n/a'	B2-16	para B2.4.2.2 6th line

replace from with for

Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12

1-0	Evaluation **Concurred** Replaced. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12
	Current Comment Status: **Comment Closed**

4461827	Hydraulics	Table 6-4	6-3	n/a

The inspection method factor definitions aren't immediately clear to me. Are we inspecting features remotely? Also, if we are going to use both inspection and detection as two different factors, we need to make sure the distinction between the two is clear so that a feature

doesn't get dinged twice for one reason. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **For Information Only** Features that are operated remotely are monitored remotely. Inspection refers to pre-failure condition; detection refers to post failure condition. As such, we don't believe we are double counting. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12			
	Current Comment Status: **Comment Closed**			
4461840	Hydraulics	Table 6-5	6-3	n/a
As discussed (2-27 checkpoint meeting), make sure to define what impacts to the fishway operation are being considered. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** This is being described under Potential Effect of Failure Mode Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12			
	Current Comment Status: **Comment Closed**			
4461844	Other	n/a'	B2-19	para B2.4.2.2.2 1st line
Figure B2.4.11 is on page B2-15 (fish lock and collection channel). Page B2-20 has two figure B2.4.12 Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Corrected. The correct Figure B2.4.12 is on the left. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461856	Other	n/a'	B2-22	para B2.4.3.2.1 11th line
add "be" between to and in Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Text added. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461866	Hydraulics	Table 6-6 and Table 6-8	6-4	n/a
The ranking definitions in these tables are fine as they are, but it may be helpful to quantify them with numbers (Likelihood of failure could be in terms of cycles before probable falure, and Downtime to repair could be in terms of days, weeks, months, etc.) Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** These definitions have been better quantified. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12			
	Current Comment Status: **Comment Closed**			
4461869	Other	n/a'	B2-26	para B2.4.2.1.6 7th line
add "to" between done and provide Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12 Revised 06-Mar-12.				
1-0	Evaluation **Concurred** Text added. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461878	Hydraulics	Table 6-5 and Table 6-8	6-3 and 6-4	n/a
Make sure that the Impact of Failure factors and Downtime to Repair factors are defined well enough that features won't be double-dinged for one issue. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** We believe we are not double counting with the updates to the matrix. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-May-12			
	Current Comment Status: **Comment Closed**			
4461898	Other	n/a'	B2-30	para B2.4.3.2 3rd line

remove "from" ?? Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Correct - delete "from". Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461917	Other	n/a'	B2-32	para B2.4.3.2 3rd line
remove "a" Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12 Revised 06-Mar-12.				
1-0	Evaluation **Concurred** Agree - remove word. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461929	Other	n/a'	B2-37	para B2.4.4.4 4th line
add "El." between is and 56 Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Added El. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461981	Other	n/a'	B2-37	para B2.4.4.4 4th line
add "El." between is and 56 Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Added El.			

	Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4461993	Other	n/a'	B2-37	para B2.4.4.4.1 1st line
replace minter with miter Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Non-concurred** Replaced with "tainter" Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4462030	Other	n/a'	B2-41	para B2.5.2 4th line
remove "the" and capitalize "in" Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Revised as noted. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4462050	Other	n/a'	B3-18	para B3.4.3.1.4.2 1st line
replace reprehensive with representative Submitted By: Gary Bechtel (503-808-4804). Submitted On: 02-Mar-12				
1-0	Evaluation **Concurred** Done; the danger of spell check. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 09-May-12			
	Current Comment Status: **Comment Closed**			
4468901	Electrical	n/a'	n/a	n/a
I was just told by an Electrician at Bonneville about tow SoftPLCs w/ MTL I/O which are controlling parts of Bradford B-Branch and Cascade				

Island Ladders. I do not recall seeing this hardware and do not see mention of them in the report. Submitted By: Bill Fortuny (503-808-4794). Submitted On: 06-Mar-12				
1-0	Evaluation **Concurred** We also did not see or know about this. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Inspection date is set for 5/23/12 to inspect this equipment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 14-May-12			
	Current Comment Status: **Comment Closed**			
4472981	Mechanical	n/a'	n/a	n/a
The report will benefit from a thorough proof reading as there are some minor spelling and grammatical errors. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** Agree. Submitted By: Lois Loesch (425-635-1000) Submitted On: 24-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473007	Mechanical	Table 6-1 Failure Ratings	n/a	n/a
Consider rewording "Inspection Method" definition to " The method used to inspect a feature prior to failure". Also some definitions start with uppercase letters and some start with lowercase ones. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** Done. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473040	Mechanical	Table 6-4 Inspection Method	n/a	n/a
Factor 3 - "scheduled visual monitoring" This is scheduled visual monitoring without de-watering, right? It is possible that the scheduled visual inspection is scheduled during the ladder maintenance/de-watering period. If the goal here is to rate the availability of inspection at any given time then I recommend clarifying the definitions or changing the table to reflect this. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** Factor 3 - "scheduled visual monitoring without dewatering". Factor 5 addresses case during maintenance			

	period. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473047	Mechanical	Attachment A for All Inspection Reports	n/a	n/a
Suggest naming the digital files for the photographs that were used in the report based on their figure number. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **For Information Only** Comment noted; not in our budget or SOW. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473049	Mechanical	App. B1	n/a	n/a
B2.4.2 is used twice. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** Agree - numbering is being corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473051	Mechanical	Inspection findings - All	n/a	n/a
Is "Mothballed" the official term that the USACE wants to use? Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **For Information Only** Comment noted - we will procede with USACE direction. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473056	Mechanical	B.2.4.1.1.2.1 phase I	n/a	n/a

		assessments - mechanical		

Refers to "problems" with WG2 hoist but doesn't say what they are. Can phase II mechanical comments elaborate on this? In other areas where this occurs I think it would benefit the report to prevent adopting ambiguous assessments/descriptions from the phase I report.

Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12

1-0	Evaluation **For Information Only** We will request this information from the Project. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4473060	Mechanical	B.2.4.1.1.3.2 phase II assessments - structural	n/a	n/a

For some reason this heading is underlined. This occurs randomly in other locations as well.

Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12

1-0	Evaluation **Concurred** Underline is being removed for these occurances. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4473065	Mechanical	B2.4.1.4.2 Phase 2 Assessments - mechanical	n/a	n/a

There is some mechanical hoist/actuator equipment near the fish lock, crane, and FV1-1. It might be good to include pictures and a short note on these items even though some of them are not used or could not be inspected.

Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12

1-0	Evaluation **Non-concurred** Comment noted; we did not include photos of equipment that is not used. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4473068	Mechanical	B2.4.2.2 Orifices	n/a	n/a

No assessment or is the assessment of the orifices combined with the junction pool assessment and if so why does the report format change here?

Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** THis was missed and is being added. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473071	Mechanical	B3.2.1.1 USACE Personnel	n/a	n/a
Some USACE personnel not listed and Gary's title is incorrect. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** This table has been corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473076	Mechanical	B3.4.2.2.2 Phase 2 - structural	n/a	n/a
Is "squishy" the right term for the concrete? Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** The term is accurate; we will look for a better term. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473077	Mechanical	Figure B3.4.6 Diffuser Grating	n/a	n/a
Suggest moving figure below intro paragraph for this section. Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **Concurred** We are moving the figure. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment.			

	Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4473078	Mechanical	B3.4.3.1.4.2 Phase 2	n/a	n/a
Why are the structural and mechanical assessments combined at this one location? Submitted By: Alan Stokke (503-808-4926). Submitted On: 08-Mar-12				
1-0	Evaluation **For Information Only** They are being separated. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477818	General	n/a'	page 3-1	n/a
I think that lamprey need to bew included on the list of fish using the fish ladder. Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **Concurred** Added lamprey to first sentece. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477820	General	n/a'	Matrix of Components	n/a
Will the listing have the number of each kind of items found in the in the fishways ? This list mentions various items but I think that how many is good to know. Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **For Information Only** It was not our intent to do so. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477821	General	n/a'	page 2-6	n/a
For Table 2-1 - There should be a reference to a drawing that locates all of these valves when the 60 % report comes out..				

Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **Concurred** We are adding this. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477825	General	n/a'	page B2-21	n/a
In paragraph B2.4.3.1.1 is the abrupt rise in the Invert of the conduit actually 10 ft. The number seems high and would seem to me to block flow if it is really this high. Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **For Information Only** This comment was made by Phase 1 team; Phase 2 team did not inspect. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477826	General	n/a'	page B2-25	n/a
Several places state that an item was not accessible at the time of inspection. Will this cause a problem with evaluating the entire matrix at a later date which could skew the results ? Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **For Information Only** USACE will have to determine if these areas need to be inspected and incorporated into the matrix at a later date. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12			
	Current Comment Status: **Comment Closed**			
4477827	General	n/a'	page B2-37	n/a
On this page and several others there is a comment that HSS inspections are recommended. I was wondering who was expected to do these inspections. Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12				
1-0	Evaluation **For Information Only** HSS inspection is not part of the scope of work for this task. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment.			

	Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4477830	General	n/a'	page B3-2	n/a

The list of USACE personnel for the inspection of Bradford Island B Branch fish ladder is missing Michael Crump Structural who was on this particular fishway inspection.

Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12

1-0	Evaluation **Concurred** You have been added to the list; thank you. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4477831	General	n/a'	page B2-39	n/a

There is a statement that says the assessment has not changed from 2004 report. If that report is not available then the reader doesn't have any info on hand to make a decision about this feature's condition. This means that this report is not a "stand alone" report which may not be a good thing.

Submitted By: Mike Crump (503-808-4946). Submitted On: 09-Mar-12

1-0	Evaluation **For Information Only** You are correct regarding "stand alone". Comparing to the 2004 inspection is how the task order scope is written. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 11-May-12
	Current Comment Status: **Comment Closed**

4499944	Hydraulics	Section 2.1	n/a	n/a

This section needs a reference to figures showing the ladder features.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12

1-0	Evaluation **Concurred** We have added this. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12
	Current Comment Status: **Comment Closed**

4499952	Hydraulics	Section 2.3	n/a	n/a

Recommend ordering the fish passage components in this section and in the matrix in the same order for clarity. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** Done. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Open Comment** Still not clear that the components in this section and in the matrix are in the same order. Section 2.3 is grouped with Branch A and B features together and the matrix has them separate. Also the order seems different. If the text of the report is going to be streamlined and largely supported by the matrix and appendices, it is important that the same order and feature names are used in all places for ease of use. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
1-2	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 08-Aug-12			
2-0	Evaluation **Concurred** We believe the 90% submittal will address these. Submitted By: Lois Loesch (425-635-1000) Submitted On: 22-Jun-12			
	Backcheck not conducted			
	Current Comment Status: **Comment Closed**			
4500033	Hydraulics	Table 6-1	n/a	n/a
Failure Ratings Definitions. 1. How does the Inspection Method relate to the Ability to Detect a failure? Consider that rating both of these categories might double weight components. Suggest just using one rating for "Detection or Prevention of Failure" or similar to rate our ability to detect or prevent failure modes. This gives some leeway to give a better rating if instrumentation or better inspection methods can be implemented to prevent failure. 2. How does the "Existing Condition" relate to "Likelihood of Failure". Again, consider that rating both of these might double weight, especially if the likelihood of failure ratings are based on condition at time of inspection rather than "newly installed" condition. Suggest combining these into one Likelihood of Failure rating based on the existing condition at time of inspection. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **For Information Only** 1. Refer to comment 4461827. 2. Disagree. Historically, some features are less likely to fail. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Open Comment** If the ratings will stay as they are, I'm fine with that, but a text description of what is meant by each should be included. The tables themselves do not seem to be enough to clearly define the use of the ratings. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
1-2	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 08-Aug-12			
2-0	Evaluation **Concurred** 1. There are times when they're related, but it's not always the case. THey are independent enough times that we are keeping them as-is. 2. Again, we tried to keep an open mind regarding the likelyhood (or not) of failure. Submitted By: Lois Loesch (425-635-1000) Submitted On: 22-Jun-12			
	Backcheck not conducted			
	Current Comment Status: **Comment Closed**			
4500091	Hydraulics	Table 6-5	n/a	n/a

Definitions for scores 2 and 3 are a little unclear. Suggest the following or similar: 1. Fishway Operation is within Typical Limits 2. Fishway Operation is within Typical Limits with Temporary Adjustment 3. Fishway Operation is Outside Typical Limits, but within Fisheries Criteria 4. Fishway Operations is Outside Fisheries Criteria 5. Fishway is Shutdown. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** We will revise as noted above. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500099	Hydraulics	Table 6-6	n/a	n/a
Include intermediate definitions for factors 2, 3, 4. Suggest using number of cycles or failure within a time duration as the definition basis. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** We have added these. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500108	Hydraulics	Table 6-7	n/a	n/a
Include ability to prevent failure in the definition. Suggest "Nearly certain detection/prevention" or similar. Or give a higher rating to those failures we can detect and prevent instead of detecting the failure. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Non-concurred** Table 6-4, Inspection, addresses the state of the feature prior to failure. Table 6-7 (post-failure) describes the ability to detect the failure. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500115	Hydraulics	Section B1.6.1.2	n/a	n/a
The Fish lock elevator descriptions in the trip report are not consistent with the Section 3.3.3 text in that they suggest removing the fish lock elevators. Remove the recommendations from the trip report. The trip report should just state inspection results, with recommendations left to the EDR text. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				

1-0	Evaluation **Concurred** We have removed. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500122	Hydraulics	Section B2.2	n/a	n/a
Gary Henrie coordinated project support for the A Branch inspection. Also, please note that Kevin Hace is a Structural Engineer, Gary Bechtel - Cost Engineer, Alan Stokke (correct spelling). Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** Updated and corrected. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500124	Hydraulics	Section B2.4.1.1.2	n/a	n/a
I see the SLEDs in the photos, but not a mention of them in the text. Were there any observations made of their condition during our trips or the 2004 report? Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** They were not in the 2004 report. We are adding to the text for 2012 inspection. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12			
	Current Comment Status: **Comment Closed**			
4500127	Hydraulics	Trip Reports	n/a	n/a
Trip Report appendices in general need consistent formatting. Some sections have underline headings, some have indent. The headings get down to very detailed levels (B3.4.1.3.1, for example) so the formatting is key to keeping track of where you are as a reader. If anything can be done to shorten up the number of heading levels, it might be good. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12				
1-0	Evaluation **Concurred** We are correcting our format and numbering. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment.			

	Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 08-Aug-12
	Current Comment Status: **Comment Closed**

4500134	Hydraulics	Section B2.4.1.3.2	n/a	n/a

Under Structural Assessments, 4th sentence, recommend removing this recommendation since it is not clear who made the recommendation or its priority. Suggest stating the observations of the inspection and including recommendations in the EDR so they are clear and prioritized as a result of the analysis.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12

1-0	Evaluation **Concurred** This has been deleted. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12
	Current Comment Status: **Comment Closed**

4500143	Hydraulics	Section B2.4.4.1	n/a	n/a

Second para, not clear whether the notes from the Project about the bulkheads are from the 2004 inspeciton or the 2012 inspection. Please clarify. I think this is an issue in other sections. Perhaps a statement up front in the trip report that all notes about condition are from 2011/2012 inspections unless noted as being from 2004 or something would easily clarify.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12

1-0	Evaluation **Concurred** Dded statement - All notes about condition are from 2011/2012 inspections unless noted as being from 2004. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12
2-0	Evaluation **Concurred** Dded statement - All notes about condition are from 2011/2012 inspections unless noted as being from 2004. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
	Backcheck not conducted
	Current Comment Status: **Comment Closed**

4500155	Hydraulics	Section B2.4.4.1.2	n/a	n/a

First sentence is poorly worded and needs to be reworded as it makes it sound like the bulkheads are currently stuck in place.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12

1-0	Evaluation **Concurred** This has been re-worded. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12

	Current Comment Status: **Comment Closed**

4500165	Hydraulics	Section B2.5.1	n/a	n/a

Third sentence is a far reaching, but rather general statement. Please clarify and reword as needed to be more specific or remove. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Mar-12	
1-0	Evaluation **Concurred** We have reworded this. Submitted By: Lois Loesch (425-635-1000) Submitted On: 25-Apr-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 18-May-12
	Current Comment Status: **Comment Closed**

60 Percent Comments

Comment Report: All Comments
Project: Bradford Island Adult Fishway Assessment Phase II EDR
Review: 60% EDR
Displaying 57 comments for the criteria specified in this report.
3344 ms to run this page

Id	Discipline	DocType	Spec	Sheet	Detail
4591639	Operations	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Para 1.2) You mention BI and CI fishways as the Adult Fish passage facilities at Bonneville Dam. There is the North Shore Fishway which should be mentioned as well, although it may not be covered in this task or the later CI fishway task. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 04-May-12					
1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12				
	Current Comment Status: **Comment Closed**				
4591662	Operations	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Para 1.4) In the first paragraph, first sentence you mention "...work is needed to improve and maintain these fishways to meet current standards." What standards are you referring to? How about mentioning these standards here. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 04-May-12					
1-0	Evaluation **Concurred** Correction applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12				
	Current Comment Status: **Comment Closed**				
4591679	Operations	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Figure 2.1) What are the stripes in this figure for? Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 04-May-12					
1-0	Evaluation **Check and Resolve** It is unclear which "stripes" you are referring to. Please attach a document with the stripes highlighted.				

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 02-Jul-12
	Current Comment Status: **Comment Closed**

4596244	Operations	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Figure 2-2)

Correct the presentation of this Figure. It is currently not legible.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 07-May-12

1-0	Evaluation **Concurred** Change applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4596248	Operations	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: para 3.1)

Mention that attraction water adjacent to the fish entrance area is provided by a minor opening of the spillway gate at Bay 18.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 07-May-12

Revised 08-May-12.

1-0	Evaluation **Concurred** Change applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4597572	Operations	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Matrix page 1 of 5)

You mention Entrance Weir WG-1 and WG-5 with a potential cause of failure being "Debris". Not sure this is appropriate for this matrix. Debris problems exist (or can exist) throughout the entire ladder system. Unless there is a specific design to prevent debris problems, debris issues should not be listed in this matrix.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Any issues regarding debris are automatically removed as a potential top 5 feature. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4597602	Operations	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Matrix page 1 of 5)

Floor grating in collection channel being blown out by too much pressure. I think this is specifically looking at the condition where we have a large debris load in the AWS that builds up on the underside of the gratings. Are you listing it hear to change the design of the grating support or prevent drebris from getting into the AWS (or both)?

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 08-May-12

1-0	Evaluation **For Information Only** Floor grating being blown out can be caused by a large differential pressure across the grating. This can be caused by debris build up or excess pressure in the AWS conduits. It is listed in the matrix as a possible failure mode. Failure due to corrosion of the supports ranks higher than too much back pressure in most cases and governs the repairs recommended. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4598617	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page x, final paragraph)

Only 2 appendices listed, the document contains 3 appendices

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598625	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page 2-4, paragraph 2.3.2)

The 4th sentence makes it sound like something is physically moving the fish. I'd recommend changing the wording to: ""Then the fish move to the ..." or something similar.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598630	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page 2-6, paragraph 2.3.7.1)

3rd sentence should read "...picket lead..." not "...picket load...".

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598646	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Figures 2.1 and 2.2)

Figures 2.1 and 2.2 provide a good overview of the project, but don't clearly show all features described in the text and rated in the decision matrix (Figure 2.2 is too small and blurry to see diffuser numbers, valve locations, etc., etc., etc.)

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598651	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Figure 2.2)

The north entrances to the A Branch are WG-64 and WG-65, not WG-63 and WG-64 as labeled in Figure 2.2 Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598657	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Page 3-1, 1st paragraph) "is" should be removed from the 2nd sentence (2nd sentence should read "It also comprises..."). "This" in the 3rd sentence appears to have a different font than the other text. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** Changes applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598672	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Page 6-1, first bullet) "elsewhere" is vague. Please where the features are described. Replace "was" with "were" (potential failure modes were brainstormed) Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598696	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Chapter 6)					

There should be some explanation that there are two decision matrix tables: one that rates all ladder features and one that presents only the highest-ranking features in order of repair/replace priority. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** Changes applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598718	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Table 6-1) change column heading "Destination" to "Definition" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598742	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a
(Document Reference: Table 6-1) I have to read some of the definitions in table 6-1 multiple times before I grasp their meanings. You might consider the following changes or something similar: Frequency of Operation - The frequency the feature is operated/cycled Impact of Failure - The impact to the fishway system should the feature fail Liklihood of Failure - The likelihood the feature will fail by this failure mode Ability to Detect Failure - The likelihood of detecting a failure of the feature Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12					
1-0	Evaluation **Concurred** All changes applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12				
	Current Comment Status: **Comment Closed**				
4598745	Hydraulics	Design Memorandum	n/a'	n/a	n/a

		or Report			

(Document Reference: Table 6-4)

Should "Failure" be "Feature"? This is pre-failure inspection method, correct?

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** This is a pre-failure inspection method. Change has been applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598748	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Table 6-5)

Please define what "Typical Limits" means.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598764	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Decision matrix)

The 5 sheet (high-ranking features) table needs to be differentiated from the 12 sheet (all features) table in some way (title?). It would also be nice if the 5-sheet table features were ranked from high to low priority without being subdivided by "Branch Features", "Branch AWS Components", and "Branch Control Systems" (all A branch features together).

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598772	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Decision matrix)

It needs to be readily apparent why the features (at least for the high-ranking features) were given the scores they were. This may be done by ensuring the text in chapters 2 and 3 and the inspection reports contains information about the feature's failure ratings (frequency of operation, existing condition, inspection method, impact of failure, likelihood of failure, ability to detect failure, and downtime to repair/replace) and note in ch 6 this is what the ratings were based on. Or by explaining the ranking of the features/failure modes in separate paragraphs.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Summary statements describing the findings for the top 5 of each branch are in the results section of the reliability assessment in the 90% EDR. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 19-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598786	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Decision matrix)

Some A-Branch features in the 12-sheet matrix are not in the same order as they are presented in the text in ch 2.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Some features in the matrix have been reordered. However, not all features will be in the same order as the text in ch 2. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598788	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Decision matrix, sheet 7 of 12)

I don't see mention of the B-Branch "Fish Lock Bulkhead at FV1-3" or the "Fish Lock Bulkhead at FV1-4" anywhere in the report text or inspection reports.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** Correction made to matrix. The feature discription is now "Fish Lock Bulkhead at Forbay" and Fish Lock Bulkhead at B-Branch Entrance. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598791	Hydraulics	Design Memorandum or Report	n/a'	general to all sheets	n/a

(Document Reference: Appendix B)

The formatting of the inspection reports make them difficult to scan and locate information. Specifically, some of the headings look the same (eg. "B2.4.1.1.1 Weirs Gate 1 (WG-1)" looks like it is on the same level as "B2.4.1.1.1.1 Phase 1 assessments")

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598815	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Cost Estimate)

It seems that the items in the cost estimates don't match the top five features in the decision matrix. From what I see in the matrix our top A Branch features are: 1. Collection channel diffuser gratings - 10,000 2. FV1-1 seal - 4,050 3. A Branch ladder diffuser gratings - 3,750 4. Collection channel fish gates (eg. FG2-1) - 3,200 5. Fish Lock - 3,000 It appears that matrix has the top B Branch features: 1. FV4-3 seal - 4,050 2. Fish Lock - 4,000 3. FV4-4 structural failure - 2,250 4. FV1-3 bulkhead failure - 2,000 5. FV1-4 bulkhead failure - 2,000

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred** After further input from project some values in the matrix have changed. Our current top 5 lists for each branch match the current cost estimate. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4598818	Hydraulics	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Cost Estimate, page 1, under 1.1)

The collection channel doesn't have weirs.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 08-May-12

1-0	Evaluation **Concurred**

	We will correct this. Submitted By: Lois Loesch (425-635-1000) Submitted On: 20-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4599710	Cost Engineering	Cost Estimate	n/a'	n/a	n/a

The estimate is a Rough Order of Magnitude estimate for planning and therefore is not in enough detail for proper analysis. It is sufficient as ROM for planning. The 90% or final should include a complete breakdown of labor hours and rates, materials, equipment rates, etc.

Submitted By: Gary Bechtel (503-808-4804). Submitted On: 09-May-12

Revised 09-May-12.

1-0	Evaluation **Non-concurred** Submitted on behalf of Ike Pace: For this task order, the scope of work is for Reconnaissance Estimates. Therefore the 90% and final cost estimates will also be ROM for planning purposes as per the scope of work and a complete breakdown of labor hours and rates, materials, equipment rates will not be provided. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 07-Aug-12
	Current Comment Status: **Comment Closed**

4602834	General	Planning Report	n/a'	n/a	n/a

No comments

Submitted By: Gary Bechtel (503-808-4804). Submitted On: 10-May-12

1-0	Evaluation **Concurred** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Bechtel (503-808-4804) Submitted On: 07-Aug-12
	Current Comment Status: **Comment Closed**

4606287	Design Team Leader	Planning Report	n/a'	n/a	n/a

(Document Reference: 3.0 Bradford Island B Branch pg 3-1 & pg 3-2)

"This" and "Spill Bay 18" look like larger text than the adjacent words.

Submitted By: Natalie Richards (503-808-4755). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Corrected. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 09-Jul-12				
	Current Comment Status: **Comment Closed**				
4606291	Design Team Leader	Planning Report	n/a'	n/a	n/a
(Document Reference: 6. Reliability Assessment) Per our discussions in the meeting, is anything being double covered in the scoring?? Submitted By: Natalie Richards (503-808-4755). Submitted On: 11-May-12					
1-0	Evaluation **Concurred** We have not discovered anything being double covered. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 09-Jul-12				
	Current Comment Status: **Comment Closed**				
4606407	Design Team Leader	Planning Report	n/a'	n/a	n/a
(Document Reference: 6. Reliability Assessment) Per the meeting discussion, Table 6-4 (add clarifying note "Before failure" Table 6-7 (After Failure) Submitted By: Natalie Richards (503-808-4755). Submitted On: 11-May-12					
1-0	Evaluation **Concurred** Changes applied to the tables. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12				
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 09-Jul-12				
	Current Comment Status: **Comment Closed**				
4606436	Project Management	Planning Report	n/a'	n/a	n/a
Coordinating Discipline(s): Design Team Leader Decision Matrix- 1) I like the matrix and find the scoring helpful. 2) page A-8 life safety only on 2 items with scores of 75 but they don't make the summary of highest rank becasue the score is so low. Are we going to bring them forward as 1 of the top 5? Submitted By: Natalie Richards (503-808-4755). Submitted On: 11-May-12					
1-0	Evaluation **Concurred** The feature flagged for life safety will not be part of the top five used to create the cost estimate. The mode of failure is due to a seismic event and there has been no seismic study completed for Bonneville. There is not enough data to require a repair only a lack of data to suggest further studies will need to be performed at the site. They will be highlighted in the body of the EDR under the paragraph "Reliability Assessment Results." Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12				

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 09-Jul-12
	Current Comment Status: **Comment Closed**

4606478	Project Management	Planning Report	n/a'	n/a	n/a

Coordinating Discipline(s): Cost Engineering

BI Fishway- Cost Estimate Page 1- Recommend adding general comment that apply to all. For example, a) Total cost is not a total project cost and does not include Lands and Damages....... b) Assumes the area would be dewatered prior..... c) Assumes a crane could have access..... Side note with the crane--> are you assuming a Contractor Crane or a Project Crane? Page 6-16- Items # dont jive with Decision Matrix numbers, for example, item # 1.5 is actually 9.4.2.1.1 Page 17- I don't know what CE protocol is but if the cost + contingency is more realistic then I would recommend saying that's the "otal Estimated Contract Cost"- $2,859,240. Funding will be difficult to get and we do not want to be short with the requests. Pg 26- I like the risk score table can that in anyway be combined with the Decision Matrix? Thank you, Natalie

Submitted By: Natalie Richards (503-808-4755). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: Some of the general notes will be discussed in cost estimate write-up as requested and the more specific notes will be shown on the cost estimates The risk score table should not be combine with the Decision Matrix as it is for Cost and Schedule Risk not operation risk. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
	Backcheck not conducted
2-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: Some of the general notes will be discussed in cost estimate write-up as requested and the more specific notes will be shown on the cost estimates The risk score table should not be combine with the Decision Matrix as it is for Cost and Schedule Risk not operation risk. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
2-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 09-Jul-12
	Current Comment Status: **Comment Closed**

4607143	Mechanical	Technical Report	n/a'	n/a	n/a

Coordinating Discipline(s): Mechanical

No comment.

Submitted By: Alan Stokke (503-808-4926). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Noted. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Alan Stokke (503-808-4926) Submitted On: 16-Jul-12
	Current Comment Status: **Comment Closed**

4607541	Cost Engineering	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Cost Estimates Summary Page)

Seems like the Contingency percentage should be to the nearest 1 percent. Having the contingency amount shown to the nearest one hundredth of a percent seems a little much and implies high accuracy to me which might not be the case.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: The contingencies will be rounded to the nearest 1 percent Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607542	Cost Engineering	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Costs for the Individual Items)

From pages 7 to 16, the charts show the totals to the nearest one dollar. Seems more practicable to me to have the totals rounded up to the nearest 100 dollars or rounded up to the nearest 1000 dollars.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: The costs will be rounded up to the nearest 100 dollars or 1000 dollars as appropriate. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607543	Cost Engineering	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Summary Sheet page 17)

On this summary sheet it seems a little much to have the contingency percentages shown to a hundredth of a percent. This is an estimate so it seem like to the nearest one percent is good enough.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: The contingencies will be rounded to the nearest 1 percent Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607544	Cost Engineering	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Summary Sheet page 17)

I think that the total amount should be shown rounded up to the nearest 1000 dollars as this is an estimate and having one hundredth of a percentage looks more like highly precise numbers are being determined..

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Submitted on behalf of Ike Pace: The costs will be rounded up to the nearest 100 dollars or 1000 dollars as appropriate. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 21-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607546	General	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page B1-10)

In paragraph B1.6.3.5 In 3rd line. Should have the word " in " used before the word "very" to make sentence read better.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

Revised 11-May-12.

1-0	Evaluation **Concurred** Correction applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607548	Cost Engineering	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page B2-36)

There is still a typo in the second line at "HSS" where "an" should be used instead of "and"

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Correction applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12

	Current Comment Status: **Comment Closed**

4607550	General	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page A-6 to A-9, Attachment A for A Branch)

There a number of photos that have the info lopped off on both ends of the captions. They should be reworded to allow readers to see the entire caption or have less photos per page.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Photos will be made larger to allow the entire filename to be included. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607552	General	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page A-13 to A-19, Attachment A for A Branch)

There a number of photos that have the info lopped off on both ends of the captions. They should be reworded to allow readers to see the entire caption or have less photos per page.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

1-0	Evaluation **Concurred** Photos will be made larger to allow the entire filename to be included. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4607553	General	Design Memorandum or Report	n/a'	n/a	n/a

(Document Reference: Page A-7 to A-9, Attachment A for B Branch)

There are a number of photos that have the info lopped off on both ends of the captions. They should be reworded to allow readers to see the entire caption or have less photos per page.

Submitted By: Mike Crump (503-808-4946). Submitted On: 11-May-12

Revised 11-May-12.

1-0	Evaluation **Concurred** Photos will be made larger to allow the entire filename to be included. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 10-Jul-12
	Current Comment Status: **Comment Closed**

4609588	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix A - Matrix of Components)
Coordinating Discipline(s): Electrical

There are two separate matrices in this appendix. The first looks like a summary matrix of the most critical items, and the second looks to be a comprehensive matrix. Each matrix should have a different title inidcating the purpose of each one. Right now they are both simply titled "Bonneville Dam Bradford Island Fishway Decision Matrix".

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **Concurred** The first matrix has been renamed as Summery Matrix. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4609590	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix A - Matrix of Components)
Coordinating Discipline(s): Electrical

I do not see any B-Branch controls section in either Matrix, or any mention of the B-Branch control system in the B-Branch features sections (like the ones in the A-Branch Matrix sections).

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4609596	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix B1)
Coordinating Discipline(s): Electrical

The last sentence of paragraph B1.2 is incomplete.

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **Concurred** Correction applied.

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4609610	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix B1)
Coordinating Discipline(s): Electrical

Paragraph B1.6.1.1 refers to lovel display in PLC photograph Figure B1.6.4, but no level display is evident in this photo. If there is a level display in this photo, suggest placing an arrow indicator or something to point out level display on this photo.

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **Concurred** This reffrence has been corrected so say "(see level display in PLC photograph Figure B1.6.10 and B1.6.11)" Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4609679	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix B1)
Coordinating Discipline(s): Electrical

Paragraph B1.6.3.5, first sentence "conditions" should read "condition". Third sentence "Panelboard is of..." needs proofreading after comma. "... is in very good condition"

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **Concurred** Changes applied. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4609681	General	Technical Report	n/a'	n/a	n/a

(Document Reference: Appendix B1)
Coordinating Discipline(s): Electrical

B1.7.1.1 Suggest getting more information on this during the upcoming electrical site visit, if possible.

Submitted By: Bill Fortuny (503-808-4794). Submitted On: 14-May-12

1-0	Evaluation **For Information Only** Noted

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Bill Fortuny (503-808-4794) Submitted On: 03-Jul-12
	Current Comment Status: **Comment Closed**

4612114	Operations	Design Memorandum or Report	Reference No. 10.8.1.1.1-10.8.1.6.1	Page 2 of 5	n/a

(Document Reference: Matrix)

Combine all of these as they are dealing with a bad gate valve, FG2-1-22B. Any repair or replacement for this valve will include all of these items as part of the repair/replacement.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 15-May-12

1-0	Evaluation **Non-concurred** These items are combined in the "top 5" ranking and in the cost estimate. Each cause of failure receives an individual reference number, a feature may have multiple failure modes and each failure mode may have multiple causes of failure. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 02-Jul-12
	Current Comment Status: **Comment Closed**

4612123	Operations	Design Memorandum or Report	Reference No. 10.3.2.1.1 and 10-3.2.2.1	Page 2 of 5	n/a

(Document Reference: Matrix)

Combine these. The reason that the crane cannot pick the bulkhead is becasue the bulkhead gets hung up in the slot due to the slot guides not being square. fixing the slot guides should allow for the crane to pick and place the bulkhead.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 15-May-12

1-0	Evaluation **Concurred** The crane has been identified as a separate feature. The crane not having enough capacity was removed as a cause of failure. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4612180	Operations	Design Memorandum or Report	Reference No. 18.2.1.1.1	Page 4 of 5	n/a

(Document Reference: Matrix)

Where is the item for structural failure of FV 4-3? Why is its overall failure rating much lower than FV 4-4? (see pages 8 of 12 and 10 of 12)

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 15-May-12	
1-0	Evaluation **Concurred** The ratings have been revised for the 90% matrix. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 15-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 25-Jun-12
	Current Comment Status: **Comment Closed**

4621230	Hydraulics	Design Memorandum or Report	n/a'	Decision Matrix	n/a

Comment made by Gary Henrie on behalf of Scott Harvey. For your consideration: the attached document contains Scotts comments on the decision matrix. (Attachment: document2012-05-18-112113.pdf) Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 18-May-12	
1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 13-Jul-12
	Current Comment Status: **Comment Closed**

4621808	Hydraulics	Technical Report	n/a'	n/a	n/a

Suggest switching section 5 and 6, to have the matrix come first, then cost estimates for the top items. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 18-May-12	
1-0	Evaluation **Concurred** Sections will be switched. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4621809	Hydraulics	Technical Report	n/a'	n/a	n/a

Section 6. Reliability Assessment. Text documenting the population of the matrix, any sorting, results, any use of the life safety factor, why the results do/don't make sense, etc. should be included for the 90% report. A summary table of the top features/failure modes for each branch could be included in the report text for clarity in this section or conclusions. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 18-May-12	
1-0	Evaluation **Concurred** Summery added to this section. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4621810	Hydraulics	Technical Report	n/a'	n/a	n/a

Table 6-3. If the unknown condition or in need of replacement both get a 5 for this rating, it seems like a backcheck should be done on the matrix results to mark any items (if any) that end up high on the list due to "unknown condition" inflating the score. then we could differentiate between "unknown" and "in need of replacement" items.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 18-May-12

1-0	Evaluation **Concurred** Features that were not inspected are noted in the comments in the matrix. A discussion of how these features were evaluated in the top 5 is included in the results paragraphs of the reliability section. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4621811	Hydraulics	Technical Report	n/a'	n/a	n/a

Matrix: Matrix is difficult to follow as sorted. Suggest grouping just by ladder branch and listing features in the same order as presented in Section 2. Then in a second version, group by ladder branch and then sort by overall failure rating.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 18-May-12

1-0	Evaluation **Concurred** Noted see comments for 4598786 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 18-Jun-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

90 Percent Comments

Comment Report: All Comments
Project: Bradford Island Adult Fishway Assessment Phase II EDR
Review: 90% EDR
Displaying 67 comments for the criteria specified in this report.
2860 ms to run this page

Id	Discipline	Section/Figure	Page Number	Line Number
4704689	Engineering Support	2, para 2.1, third sub-paragraph	n/a	n/a

This third suparagraph is misordered. First you discuss flow into the ladder is from the pool. Then you discuss flow out of the collection channel through the fish entrance gates. The next discussion is the AWS supplying water to the collection channel and the lower pools of b-branch. Finally, you discuss Fish Valves FV 1-1and FV3-7 along with FV3-9 providing AWS flows and additional flow to the ladder. How about edit the text to start on the fish ladder exit and FV1-1 and work your way down to the collection channel before going out the fish Entrance Gate areas?

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Jul-12

Revised 02-Jul-12.

1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 30-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4704695	Engineering Support	2, para 2.1, llast sub-paragraph	n/a	n/a

Last sentence of last sub-paragraph change the text "...main entrances..." to "...fish entrances were upgraded with new telescoping entrance gates 1, 2, and 64, 65."

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Jul-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4704714	Engineering Support	paragraph 2.4	n/a	n/a

In 2.4.1 and 2.4.2, add text to reflect actual valves providing water to the AWS. State that FV 3-7 feeds the north conduit and FV 1-1 feeds the south conduit

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Jul-12

1-0	Evaluation **Concurred** Change applied

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4704716	Engineering Support	paragraph 2.4.3	n/a	n/a

Edit text to state that the open/close leaf gates that go over the downstream face of the AWS diffuser Orifices, supplying each ladder diffuser with water

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 02-Jul-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4706435	Engineering Support	Paragraph 3.4.3	n/a	n/a

What is meant by the text: "The gate leaves are not rigidly connected to the stems"?

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12

1-0	Evaluation **Concurred** Changed to "The gate leaves are pinned to the stems." Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4706660	Engineering Support	paragraph 5.2.1.3	n/a	n/a

While you do mention mono 18, clarify that the "fingerling bypass" that you are referring to is south AWS water supply location. We also have a fingerling bypass system near FV 4-3 and 4.4.

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12

1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4706682	Engineering Support	paragraph 5.2.1.4.1	n/a	n/a
In second paragraph clarify that the FV bulkheads are the ones that get stuck, not the dewatering bulkheads for the entire AWS intake area. The text states that ...For this reason, the bulkheads are only used....." I believe you are now referring to the AWS intake area bulkheads not the FV bulkheads. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** Sentence is clarified. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706708	Engineering Support	paragraph 5.2.1.4.1	n/a	n/a
Last paragraph. ARe you sure the ladder would be down if one of the south FV failed? Could we not bulkhead off the valve or even bulkhead off the AWS entrance area? If we then put in a transverse bulkhead say around bay 9, could we not operate the A-Branch and just use the entrance gates 64 and 65? Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** Clarified to say " the south entrance to A Branch would be down until repairs can be made." Submitted By: Eric Flickinger (425-635-1000) Submitted On: 30-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706722	Engineering Support	paragraph 5.2.1.4.2	n/a	n/a
In third sentence, change the words "valves are" to "valve is". Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12 Revised 03-Jul-12.				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706779	Engineering Support	para 5.2.1.5.2	n/a	n/a
Rearrage the text in this paragraph. Describe what the panels function are, describe how they can be inspected, describe what types of failures can occur, describe what currently needs to be repaired/replaced, and describe fish action should a				

panel blowout not be repaired. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706903	Engineering Support	para 6.2.3	n/a	n/a
To dewater a section of the collection channel to repair diffusers or diffuser gates, we can use our 65-ton and 30 ton mobile cranes to handle the transverse bulkheads and the entrance gate bulkheads. We do not need to rent a barge crane. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12 Revised 03-Jul-12.				
1-0	Evaluation **Concurred** On behalf of Scott Vose: All use of a barge mounted crane will be removed throughout the estimate and report. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706912	Engineering Support	para 6.2.3	n/a	n/a
Is stainless steel grates really something we should specify? These diffusers are large areas which would be fairly expensive using SS. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** On behalf of Scott Vose : Gratings will be carbon steel galvanized and powder coated. . Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706920	Engineering Support	para 6.2.4	n/a	n/a
Add temporary lighting as a requirement for the north AWS conduit repair				

Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** On behalf of Scott Vose; Temporary lighting will be added to the cost estimate for the North AWS Conduit repair Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706931	Engineering Support	para 6.3.1	n/a	n/a
Edit the paragraph about installing the bulkhead just upstream of the fish valve. These bulkheads are not yet HSS approved. We would install the AWS intake bulkheads and dewater the whole intake area to allow us to remove the valve. Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** Change applied Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706936	Engineering Support	para 6.3.3	n/a	n/a
Add temp lighting to the requriements to work on South AWS of B-Branch Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** On behalf of Scott Vose; Temporary lighting will be added to the cost estimate for the South AWS Conduit repair. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12			
	Current Comment Status: **Comment Closed**			
4706944	Engineering Support	A and B branch grating replacement - General Comment	n/a	n/a
Is there any concern or direction to replace grating with gratings that have small openings to restrict lamprey from swimming through a grating and getting into the AWS conduit? COE fish bios should be able to answer this. If we are recommending the replacement of grating is it replace in kind or with some new design based on new fish requirements? Submitted By: Kevin Perletti ((541) 374-4572). Submitted On: 03-Jul-12				
1-0	Evaluation **Concurred** On behalf of Scott Vose: The cost estimate assumes an in-kind replacement of the grating. A note			

	will be added to the cost estimate to reflect this. A change in grating bar spacing will increase the cost of the grating as well as require a modification of the intake trash rack and a hydraulic evaluation. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Kevin Perletti ((541) 374-4572) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4713194	Project Management	n/a'	page 5-8, 5.2.1.4.2	n/a

minor comment-space needed between 4 to 5 years (currently 4 to5 years)

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

Revised 09-Jul-12.

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Open Comment** Not corrected- Please correct on Page 5-9 Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
1-2	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 07-Aug-12
2-0	Evaluation **Concurred** This has been corrected see attached. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 31-Jul-12 (Attachment: Page_5-9.pdf)
	Backcheck not conducted
	Current Comment Status: **Comment Closed**

4713197	Project Management	n/a'	6.0 Cost Estimate	n/a

1) Found cost summary sheet in the downloaded copy and printed out 4 more for the paper copies provided. 2) In the 60%, there were 16 cost sheets and these are gone now. Was that the expectation?

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

Revised 09-Jul-12.

1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
	Current Comment Status: **Comment Closed**

4713251	Project Management	n/a'	6.2.1 Page 6-2 & 6.3.1.Page 6-5 2nd to last bullet item	n/a

minor comment on 1st bullet- I think there should be a comma after Additionally,

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

Revised 09-Jul-12.

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Open Comment** Page 6-7-Additionally, (add comma) B2.1.3.2- Additionally, (add comma) Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
2-0	Evaluation **Concurred** This has been corrected see attached. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 31-Jul-12 (Attachment: Page_6-7.pdf)
2-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 07-Aug-12
	Current Comment Status: **Comment Closed**

4713265	Project Management	n/a'	Page 6-3- last bullet item	n/a

Throughout Cost estimate document- (6.2.3, 6.2.4, 6.3.2, 6.3.3, 6.3.4, 6.3.5) All stainless recommended- are there any existing carbon steel/dissimilar metal concerns?

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

Revised 09-Jul-12.

1-0	Evaluation **Concurred** Yes there is a concern when stainless and carbon steel come in direct contact. This can easily be mitigated in the design of the connections between stainless and carbon steel. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
	Current Comment Status: **Comment Closed**

4713333	Project Management	n/a'	Page 6-6, 6.3.3 3rd bullet-	n/a

Assumes a new entrance- Can we discuss this at a meeting?

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

1-0	Evaluation **Concurred**

	Clarified to state a " new maintenance access " Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12
1-1	Backcheck Recommendation **Open Comment** 6.3.3 B.3 – South AWS Conduit Joints bullet 3 "entranceat"- Need space between entrance at Also- The Cost summary in Chapter 6 is not the same as Chapter 7 Summary. Please carefully check that they agree. Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
2-0	Evaluation **Concurred** This has been corrected see attached Submitted By: Eric Flickinger (425-635-1000) Submitted On: 31-Jul-12 (Attachment: Page_6-6.pdf)
	Backcheck not conducted
3-0	Evaluation **Concurred** Chapter 7 summary is updated to match the cost estimate. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 31-Jul-12 (Attachment: Table_7-1.pdf)
3-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 07-Aug-12
	Current Comment Status: **Comment Closed**

4713394	Project Management	n/a'	Cost Estimate Summary	n/a

Throughout the cost section, some are 6.2.4 "repairing one joint" X (# of Joints ?), 6.3.2-"one unit of the ladder" X 28 (?)-$90,000 X 28, one unit of the collection channel. In the summary, please also include a 2nd total cost column so we know what the total price would be to do all of each feature.

Submitted By: Natalie Richards (503-808-4755). Submitted On: 09-Jul-12

1-0	Evaluation **Concurred** On behalf of Scott Vose : The cost summary spreadsheet will be reformatted to include a quantity column so that the total cost of replacing all "units" is shown in the summary Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Natalie Richards (503-808-4755) Submitted On: 31-Jul-12
	Current Comment Status: **Comment Closed**

4716163	General	n/a'	Pg 2-4	n/a

In section 2.3 Fish Passage Components, there are a number of features that should be identified on Figures 2.1, 2.2 and 2.3 in order to let the readers know where these features are located in the ladder systems Should be similar coverage of features as on Figure 3.1 . For instance I didn't see the Fish Lock on any of the various figures but I think that those not real familiar with Bonneville will need to know where these features are located.

Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4716164	General	n/a'	Pg 3-2	n/a

In the Figure 3.2 there is a line leading to a "missing" descriptor on the left side.

Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4716167	General	n/a'	Pg 5-5	n/a

I looked at the Figures trying to see if FV1-2 and FV3-7 were shown on any of the figures but didn't see them anywhere . These and other features should be located on the figures for the readers/managers of this report to know where these locations are.

Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12

1-0	Evaluation **Concurred** FV3-7 is shown on Figure 2.2 and 3.1. FV1-2 is added to Figure 2.3 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4716169	General	n/a'	Pages 5-9 to 5-11, pages 6-6 and 6-7	n/a

Within these pages there are statements regarding grating replacement. Will these grating need to be replaced with lamprey friendly grating that have narrower clear spaces between the bearing bars ? Probably need to have comment regarding hydraulic flow checks for narrower bar gaps.

Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12

1-0	Evaluation **Concurred** See response to comment 4706944 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4716170	General	n/a'	Page 6-2	n/a
In second item regarding the 65 ton crane the middle of the sentence looks like something needs to be revised as "the carry deck crane" phrase doesn't look to be correct. Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12 Revised 10-Jul-12.				
1-0	Evaluation **Non-concurred** This statement is correct. A 65 ton crane would be required to place a smaller carrydeck crane onto the deck around the FV1-1 as there is no road access to this location. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716171	General	n/a'	Page 6-4	n/a
Should include temporary lighting in the 5th paragraph. Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **Concurred** On behalf of Scott Vose Temporary lighting has been added to the discussion in the cost section of both the North and South AWS conduit repair. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716174	General	n/a'	Page 6-7	n/a
In paragraph 6.3.4 in the 5th line suggest using "grating panels" instead of the word "grates". Also should replace that word as it shows up in next couple lines of text and in the very last line. Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716176	General	n/a'	Item no. A.3 on page 6-21	n/a

Suggest using "grating panels" instead of the word "grates". Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716177	General	n/a'	Item nos. B.2 & B.4 on pgs 6-25, etc	n/a
Suggest using "grating panels" instead of the word "grates". Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **For Information Only** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716179	General	n/a'	Items B.4 and B.5	n/a
Are these two items actually the same amount as indicated ? Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **For Information Only** Yes they are the same amount. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4716181	General	n/a'	Appendix A	n/a
As I reviewed the Matrix of Components I started wondering about the significance of the light blue and light brown shaded areas. Also the greenish shade on the last page of the Matrix. Maybe use a Legend to show this info Submitted By: Mike Crump (503-808-4946). Submitted On: 10-Jul-12				
1-0	Evaluation **Concurred** Lengend added to end of the matrix.			

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mike Crump (503-808-4946) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726701	Hydraulics	n/a'	General to whole document	n/a
Throughout the document the decision matrix is referred to as both "matrix of components" (pg x, Appendix A, etc.) and "decision matrix" (pg 5-1, 5-2, 5-5, Appendix A, etc.). Please either make it clear that the matrix of components and decision matrix are the same thing, or use only one term to refer to it. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			

4726730	Hydraulics	Paragraph 1.2	1-1	n/a
It should be mentioned that there is also a "Washington Shore" fishway that serves Powerhouse 2. It isn't assessed/addressed in this Phase 2 report but it's existence should be noted. Paragraph 1.2 would be a good place to mention it. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			

4726743	Hydraulics	Paragraph 2.2 and 3.2	2-4 and 3-3	n/a
Please change the text "The fishway consists of three components:" to read "The fishway consists of three types of components:" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment.			

	Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726783	Hydraulics	Paragraph 2.3.1	2-4	n/a
Please change the text, "...and five telescoping slide gates in between the powerhouse Collection Channel", to, "...and five telescoping slide gates between the Powerhouse Collection Channel and the tailrace that were permanently closed in 2003" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726787	Hydraulics	Paragraph 2.4.1	2-6	n/a
Please change text, "22B" to "FG2-22B" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726840	Hydraulics	2nd Paragraph of 2.4.3 and Table 2-1 title	2-7 and 2-10	n/a
To keep naming consistent, please change text "Adult Fish Collection Channel Diffuser Valve Settings" to "Powerhouse Collection Channel Diffuser Valve Settings" in both paragraph 2.4.3 and the title of Table 2-1. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726854	Hydraulics	1st paragraph	2-10	n/a

Change text "FG3-10 through 13" to "FG3-10 through FG3-13" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726859	Hydraulics	Figure 3.1	3-2	n/a
I could not find Figure 3.1 referenced in the text, please ensure that it is referenced in the text. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726884	Hydraulics	Paragraph 3.3.1	3-3	n/a
This section mentions both weirs and sluice gates but only describes the affect of loss or failure of the entrance weirs. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726895	Hydraulics	Paragraph 3.3.4	3-4	n/a
Please change text "1 on 16" to "1:16" for consistency with paragraph 2.3.4 Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			

1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726921	Hydraulics	Section 3.4	3-4 and 3-5	n/a

There is no mention of FG3-14 through FG3-17 in the text. Please include a statement that diffusers FG3-14 through FG3-17 have been permanently closed. (This is noted on Figure 3.1, but should be mentioned in the text as well.)

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726942	Hydraulics	n/a'	5-1	n/a

Please mention that the decision matrix is in the appendix. The creation of the decision matrix is described but I could not find the location of the actual matrix given anywhere in chapter 5.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726947	Hydraulics	Table 5-4	5-3	n/a

Please change the text "Not Able to Inspect the Failure" to "Not Able to Inspect the Feature"

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726949	Hydraulics	Table 5-9	5-5	n/a

Remove the "," after "...FV1-1 and FV1-2" Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726952	Hydraulics	Table 5-11	5-6	n/a
Please alter the text "North AWS Conduit" to read "B Branch North AWS Conduit" to make it immediately clear that it is the B Branch North AWS Conduit that has been omitted from the top 5. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726964	Hydraulics	Paragraph 5.2.1.3	5-7	n/a
Please change the text "...a seismic study was initiated at Monolith 18 but was not completed..." to "...a seismic study had been initiated at Monolith 18 but had not been completed..." Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			
4726987	Hydraulics	Paragraph 5.2.1.4.1	5-7	n/a
Please change the text "Based on reports from project personal these..." to "Based on reports from project personnel, these..." Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred**			

	Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Open Comment** Please make the minor edits submitted by email to Lois and Eric on 8/8/2012. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 08-Aug-12
1-2	Backcheck Recommendation **Close Comment** The original comment as well as the minor edits emailed to Lois and Eric have been addressed Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4726995	Hydraulics	Paragraph 5.2.1.4.1	5-8	n/a

This section refers to the phase 1 assessment and project staff input. It would be good to mention here that the valves and bulkheads were not inspected in the phase 2 just viewed from above (so it is clear to the reader why you are refering to others and not making your own statements about their condition and likely failure).

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4726997	Hydraulics	Paragraph 5.2.1.4.3	5-8	n/a

Please change text "FG2-1-FG2-22B" to "FG2-1 - FG2-22B" in both the section heading and the first sentence of the section.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4727004	Hydraulics	Paragraph 5.2.1.4.3	5-8	n/a

It isn't clear what is meant by the statement "The gates would only be operated to adjust the AWS to meet hydraulic criteria outlined in the 2003 HELCRABS Report". Please clarify.

Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Statement clarified. "The gates would only be operated to meet the open / closed settings outlined in the 2003 HELCRABS Report."

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 20-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12
	Current Comment Status: **Comment Closed**

4727013	Hydraulics	Chapters 5 and 6	n/a	n/a
Please alter the top 5 headings to make them consistent across sections. For example "Fish Valves FV1-1 and FV1-2 and Bulkheads FV1-1 and FV1-2. Rank of A1" (page 5-7) and "A.1 - Fish Valves FV1-1 and FV1-2" (page 6-1) should match. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			

4727045	Hydraulics	Appendix A	n/a	n/a
It would be good to have a couple sentences before the tables describing that there are two tables and what the difference between the two is. It would also be good to have an explanation of what the colored rows represent. Submitted By: Gary Henrie ((503) 808-4831). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Gary Henrie ((503) 808-4831) Submitted On: 06-Aug-12			
	Current Comment Status: **Comment Closed**			

4727249	Mechanical	n/a'	n/a	n/a
No comments. Submitted By: Alan Stokke (503-808-4926). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** No comment Submitted By: Eric Flickinger (425-635-1000) Submitted On: 23-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed. Submitted By: Alan Stokke (503-808-4926) Submitted On: 01-Aug-12			
	Current Comment Status: **Comment Closed**			

4737429	Hydraulics	n/a'	n/a	n/a

List of Acronyms: Several are missing from the list (check document for others) including IFR, OFR, FMEA.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0	Evaluation **Concurred** Accronyms are added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4737432	Hydraulics	n/a'	n/a	n/a

Section 1.2. Suggest moving the reference to Figure 2.1 up to Section 1.2 to hit it sooner. Also in Section 2.1, second sentence, suggest "It also comprises one half of the Bradford Island system, which includes B Branch as shown in Figure 2.1" (but this would be the image that is currently in Fig 2.2.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0	Evaluation **Concurred** Figure 2.1 has been moved to section 1. Figure references have been fixed. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 30-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4737433	Hydraulics	n/a'	n/a	n/a

Section 1.2. Suggest moving the reference to Figure 2.1 up to Section 1.2 to hit it sooner. Also in Section 2.1, second sentence, suggest "It also comprises one half of the Bradford Island system, which includes B Branch as shown in Figure 2.1" (but this would be the image that is currently in Fig 2.2.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0	Evaluation **Concurred** See comment 4737432 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4737434	Hydraulics	n/a'	n/a	n/a

Section 3.1. I am not sure if Figure 3.1 has a figure reference in the text. Please check and if not, reference it in Section 3.1.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12				
1-0	Evaluation **Concurred** See comment 4726859 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12			
	Current Comment Status: **Comment Closed**			
4737459	Hydraulics	n/a'	n/a	n/a
Section 5.2. I appreciate the addition of Section 5.2 and think it adds to the explanation of the rankings. A couple of suggestions to make it more clear: 1. In the headings throughout, suggest "Top Five OFR Feature Lists" to make it clear that the rankings are based on OFR. 2. First Sentence section 5.2.1.1, suggest ..."each branch of the fishways based on OFR." 3. 4th sentence, suggest, "... A Branch top five features had higher OFR values than the top B Branch features." 4. Table 5-9, add 4th column with OFR numbers (same for all other tables, where relevant). 5. Distinguish section 5.2.1.4 from previous sections with title "A Branch Top Five OFR Explanation of Rankings, or similar. These comments are relevant for the other similar text and tables in Section 5.2. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12				
1-0	Evaluation **Concurred** 1) Added 2) Changed 3) Noted 4) Added 5) Changed Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12			
	Current Comment Status: **Comment Closed**			
4737471	Hydraulics	n/a'	n/a	n/a
Section 5.2.1.5.3 wording for second and third sentences is confusing, since second sentence says the conditions of the conduit is unknown and third says it can be visually inspected during normal maintenance. Please confirm and make wording more clear. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12				
1-0	Evaluation **Concurred** Changed to: "The conduit can be visually inspected during mormally scheduled ladder maintenance periods if lighting, ventilation and other safety equipment are in place." Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12			
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12			
	Current Comment Status: **Comment Closed**			
4737481	Hydraulics	n/a'	n/a	n/a
Section 6 has a good description of the cost assumptions. Thank you. I would like to note that at some point the Cascade Island cost estimate information and assumptions will need to fit into this section. As formatted now, there isn't a placeholder section for it. Either add it for the 90% or room will need to be made during the CI Phase. Not critical either way.				

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0 Evaluation **Concurred**
This will take place during the CI phase.

Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12

Current Comment Status: **Comment Closed**

4737482	Hydraulics	n/a'	n/a	n/a

Section 6 headings should follow the same nomenclature and formatting as Section 5 for clarity.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0 Evaluation **Concurred**
See Comment 4727013

Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12

Current Comment Status: **Comment Closed**

4737485	Hydraulics	n/a'	n/a	n/a

Section 6.2.3 (and other similar sections) for the diffuser grating costs, please make a note that the costs assume replacement in-kind and do not include narrower spaced grating for lamprey consideration. If we need to install narrower grating in the future, the costs will need to be adjusted and hydraulic impacts will need to be confirmed prior to isntallation.

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12

1-0 Evaluation **Concurred**
On behalf of Scott Vose: The section referenced will be changed to include a statement that the diffuser gratings are to be replaced in-kind, which is galvanized and powder coated. Also, it will be stated that if modified grating is necessary for lamprey considerations then a hydraulic analysis will be required and the cost estimate will need to be updated.

Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12

Current Comment Status: **Comment Closed**

4737490	Hydraulics	n/a'	n/a	n/a

Cost estimates and risk analysis: Suggest putting the cost estimates and rish analysis tables in an appendix with a reference in Section 6. Not critical, but might make the document more readable. Also, add a Section 7: Conclusions with brief paragraph or two summarizing the results and a summary table of the top ten OFR items, OFR #, cost, and any relevant comments. Items down-ranked off the list might be included at the bottom of the summary table, in a separate table/list, or noted in the conclusion text. Thanks!

Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12	
1-0	Evaluation **Concurred** Noted Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

4737492	Hydraulics	n/a'	n/a	n/a
Add a reference to the matrices in Section 5 and their location (in Appendix X), with Table # for clarity. Submitted By: Elizabeth Roy (503-808-4849). Submitted On: 20-Jul-12				

1-0	Evaluation **Concurred** Reference to matrices has been added to section 5 Submitted By: Eric Flickinger (425-635-1000) Submitted On: 26-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Elizabeth Roy (503-808-4849) Submitted On: 09-Aug-12
	Current Comment Status: **Comment Closed**

Independent Technical Reviews

REVIEW COMMENT FORM

INCA ENGINEERS INC.
A Tetra Tech Company

Project Name Bradford Island Fishway Modifications EDR INCA Project Number 11-045E

Submittal Type (50%, etc.) 60% - EDR Date of Review 4/26/12 Date of Response 4/27/12

File: Document1

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Addl. Ref. 2	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Reviewer
11	Acronyms	R				Add AWS – Auxiliary Water System	This has been added.	LAL	JS
2	Chapter 5	R				Preliminary cost estimate is missing	This will be furnished separately.	LAL	JS
3	Chapter 5	R				Additional text for cost estimate is missing.	This will be furnished separately.	LAL	JS
4	Chapter 6	R				Additional text for matrix is missing.	Refer to edited text. Additional text is not required.	LAL	JS
5	Appendix A	R				Priority replacement matrix is missing.	Appendix A is a separate document; it will be provided for your review and comments.	LAL	JS
6									
7									
8									

(1) **Type**: D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) **No:** Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature

Date Checked 4/27/2012

Comment Report: All Comments
Project: Bradford Island Adult Fishway Assessment Phase II EDR
Review: ITR (90% EDR)
Displaying 12 comments for the criteria specified in this report.
656 ms to run this page

Id	Discipline	Section/Figure	Page Number	Line Number
4725669	Structural	n/a'	n/a	n/a
(Document Reference: General) I recommend adding the dimensions of the conduits, gates, and bulkheads and drawing references to these components at the sections where they are being described. There are no records of the HSS inspections in this report. I recommend, for the final report, we include any HSS inspections available for the components of this project. Submitted By: Mehdi Roshani (509-527-7577). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Known overall dimensions are provided in the text for some features. For example the conduit is listed in the text as 7.5 feet square. For many features drawings were not available for this study. Records of HSS inspections can be added to the report once they are made available to the inspection team. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12			
1-1	Backcheck Recommendation **Open Comment** An email was sent out in regards to the XL file for HSS Inventory with following comments and request. This will help to get information and locate the existing reports: "It will be sufficient to be including only the first 3 columns on the left side having to do with the Description, HSS ID and Drwg Number plus the Remarks column on the right side of this file. Also suggest going thru the list of HSS items and putting in just those that are mentioned in the EDR and not showing the others in this report. If a report in the original Remarks column in the XL file is not available then N/A should be in the Remarks column when shown in the EDR. . A reference needs to be added as a footnote stating that HSS inspection reports for these features are on file in the Corps project folders and then list the link as Z:\Miscellaneous_Projects\Hydraulic_Steel_Structures\Reports_Repository\Bonneville" Submitted By: Mehdi Roshani (509-527-7577) Submitted On: 02-Aug-12			
1-2	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mehdi Roshani (509-527-7577) Submitted On: 13-Aug-12			
2-0	Evaluation **For Information Only** This email as well as the HSS Inventory spreadsheet is included in Appendix D, the reference to the file location is on the footer of the spreadsheet. The information provided in the spreadsheet is sufficient to determine which features have had an HSS inspection. Incorporating the existing HSS reports into the EDR is beyond the scope of work for the phase 2 assessment. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 03-Aug-12			
	Backcheck not conducted			
	Current Comment Status: **Comment Closed**			
4725692	Structural	Section 3.4.2	Page 3-4	n/a
Does the North AWS conduit start at the Fish Valve FV4-4? Please make a note of that. Submitted By: Mehdi Roshani (509-527-7577). Submitted On: 16-Jul-12				
1-0	Evaluation **Concurred** Clarified			

	Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mehdi Roshani (509-527-7577) Submitted On: 02-Aug-12
	Current Comment Status: **Comment Closed**

4725703	Structural	Section 5.2.1.4	Page 5-7	n/a

Title "A Branch Top Five". Please change the text to read: "A Branch Explanation of Results for the Top Five" to match 5.2.1.5.

Submitted By: Mehdi Roshani (509-527-7577). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mehdi Roshani (509-527-7577) Submitted On: 02-Aug-12
	Current Comment Status: **Comment Closed**

4725711	Structural	Section 6.2.1	Page 6-1	n/a

One to the last sentence of the text reads: 'It is assumed that the guides for these two fish valves are still in good condition and do not need to be replaced". The Section 5.2.1.4.1 explains that the bulkheads frequently get stuck in these slots which are no longer square. Please correct the text.

Submitted By: Mehdi Roshani (509-527-7577). Submitted On: 16-Jul-12

1-0	Evaluation **Concurred** This sentence refers to the sealing surfaces of the valves. It will be clarified. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Mehdi Roshani (509-527-7577) Submitted On: 02-Aug-12
	Current Comment Status: **Comment Closed**

4734391	General	1.3 Authorization	1-1	n/a

Authorization refers to USACE authority to study this project and/or make changes, not the contacting mechanism for the A/E firm to do the work. This should reference the original project authorization, specifically fish passage.

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

1-0	Evaluation **Concurred** Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12

	Current Comment Status: **Comment Closed**

4734422	General	5.1 Assessment Description	5-1	n/a

The assessment description uses the FMEA evaluation with three criteria: RPN = S x O x D and apparently all have equal weighting. The matrix evaluation table uses 7 evaluation criteria, all with apparent equal weighting. The reasoning for including additional criteria should be described in the text. If all criteria have equal importance, equal weighting is appropriate, if not, weighting factors should be established and applied accordingly. A sample calcuation with the 7 evaluation criteria should be included for at least one specific feature in the evaluation matrix table.

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

Revised 19-Jul-12.

1-0	Evaluation **Concurred** Text added: Individual Failure Rating (IFR) categories were established based on the three FMEA criteria listed above. It was felt that the results should be weighted to reflect the difficulty in accessing the features for inspection and detection. For this reason the original three criteria used in the FMEA model was expanded to seven IFR categories. Severity having two IFR's, frequency of occurrence having two IFR's, and likelihood of detection having three IFR's. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734428	General	5.2.1 Assessment Results	5-5	n/a

A link or reference should be provided to show where the Assessment Results are (link to matrix). Any additional text to justify the ratings shoudl also be provided (link to assessment descriptions)

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

1-0	Evaluation **Concurred** Reference to the Matrix has been added Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734438	General	5.2.1.1 and 5.2.1.2 Top Five List	5-5, 5-6	n/a

The features in the evaluation table have been grouped together in a systematic manner, then ranked against eachother. The overarching goal is to establish an out year plan for feature replacement. It makes sense that a Fish Valve cannot be replaced/serviced/maintained if a bulkhead is not available to dewater the system, therefore they have been grouped together. The logic behind the groupings should be explained in the text. The reasoning behind the top five rankings should also be explained (was it the sum of all the features in the group? was it the highest individual score in a group?)

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

1-0	Evaluation **Concurred**

	Text Added Some features have been grouped together in a systematic manner then ranked against each other. The feature groupings were the result of discussions between project personal, the phase 2 inspection team and estimating specialists. For example the level of effort required to dewater the collection channel to repair or replace the diffuser gates justified grouping these repairs with repairs needed for the diffuser grating. The highest OFR of a feature in a group established that group's ranking. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734472	General	n/a'	A-1 through A-3	n/a

(Document Reference: Attachment A - Photographs)

The photographs should (at a minimum) have some description of the feature being photographed (valve number, gate number, electrical panel location/description/function). If the pictures are to be used to establish a condition assessment, they should be labeled and referenced accordingly. Same comment applies to other picture index sheets. Attachment number and page number in Appendix B2 should be verified and/or corrected (all are listed as Attachment A and page numbers start at A-1, resulting in duplicate page numbers).

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

Revised 19-Jul-12.

1-0	Evaluation **Concurred** We are regrouping the photos by location, leaving them numbered, and adding a table with descriptions. Some photos will just be in the group without further description. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734487	General	n/a'	Appendix A (matrix) and Appendix B (Investigation reports)	n/a

Attaching an expected timeframe for criteria "Likelihood of Failure" seems to be applied in an arbitrary manner. For instance, if the last time FV1-1 was visually inspected was in 2004, how can it be assigned a likelihood of failure of in the 3-4 year range? I agree the valves are old and in poor condition, but what specifically would cause that valve to fail (is it the actuator, motor, skin plate, etc) and what is being monitored to determine it will only last another 3-4 years? Reference to observed increases in maintenance may help justify some of these ratings.

Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12

1-0	Evaluation **Concurred** The likelihood of failure is subjective. Values were estimated and reviewed and revised by project personal and the various disciplines involved in the phase 2 inspection Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment.

	Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734515	General	6.2.1 Fish Valves	6.1	n/a
Are the ladders taken down on a biannual basis (twice a year) or on a biennial basis (once every two years)? Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12				

1-0	Evaluation **Concurred** Biennial, Corrected Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

4734534	General	n/a'	6.1 General Cost Estimates	n/a
The cost estimates appear to be a good programatic budget level. The features have been grouped (i.e. FV1-1 and 1-2), and estimates have been provided for the features within a group. Assuming complete funding is provided, this would work well for implementation as well, but if only partial funding is provided, the features within the group that are essential should be identified and/or sequenced in a logical manner. If the valves cannot be replaced without a bulkhead, it should be noted and grouped together accordingly. Funding for the bulkhead should come before funding for valve work, etc. While the funding has been grouped together, from an implementation standpoint, they may need to occur in a different order or even in a different fiscal year. Submitted By: Sean Askelson ((503) 808-4882). Submitted On: 19-Jul-12				

1-0	Evaluation **For Information Only** The cost estimate is for budgetary purposes only. If full funding is not available it is up to the core to prioritize the individual subtasks in the group. The information contained in the cost estimate sheets contains enough information for the individual tasks to be broken out if necessary. Submitted By: Eric Flickinger (425-635-1000) Submitted On: 27-Jul-12
1-1	Backcheck Recommendation **Close Comment** Closed without comment. Submitted By: Sean Askelson ((503) 808-4882) Submitted On: 03-Aug-12
	Current Comment Status: **Comment Closed**

REVIEW COMMENT FORM

INCA ENGINEERS INC.
A Tetra Tech Company

Project Name Bradford and Cascade Island Fishway Modifications EDR TT INCA Project Number 189-11-045E

Submittal Type (50%, etc.) 90% ITR Date of Review 6/21/12 Date of Response 6/22/12

File: L:\2011\11-045E\Submittals\Draft Final Submittal\Appendix C - QC Documentation\REVIEW COMMENT FORM - ITR - CHIN.docx

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Revwer
1	Ginette Chin	Gen			Fix typos and grammar throughout report (see markup)	Concur	LL	gDC
2	Ginette Chin	R	1.2		Exit Sections?	Clarified that it's only one exit section. No changes.	JLG	gDC
3	Ginette Chin	R	2.0		This fishway vs. Branch A fishway? Please clarify	Concur. Text has been revised.	JLG	gDC
4	Ginette Chin	R	2.3.4		1 on 16? Shouldn't it be 1:16 as a standard in the report format? A&B Branches?	Concur. Text has been revised.	JLG	gDC
5	Ginette Chin	R	2.4.1		FG22-C? Figures 2.2 and 2.3 only go to FG-22B	Concur. Text has been revised.	JLG	gDC
6	Ginette Chin	R	2.4.1		Figures 2.2 and 2.3 are not mentioned in the text.	Concur. Text has been revised.	JLG	gDC
7	Ginette Chin	R	2.4.2		Please clarify statement "conduit feeds ~~of~~ IS FG3-3 through 9". Is this FG3-3 through FG3-9 or just FG-9?	Concur. Text has been revised.	JLG	gDC
8	Ginette Chin	R	2.4.3	Table 2-1	The paragraph below Table 2-1 mentions FG3. FG3 is not mentioned in the table. Also, FG22c is not mentioned in the table, but is in paragraph 2.4.1. Please clarify.	The table was originally on the previous page and does not refer to the text following it. Text has been revised for clarity.	JLG	gDC
9	Ginette Chin	R	3.3.4		A&B Branches?	Concur. Text has been revised.	JLG	gDC
10	Ginette Chin	R	3.4.1		Please clarify reference. Is it FG3-18 to FG3-28 or FG3-18 to FG-28.	Concur. Text has been revised.	JLG	gDC

(1) Type: D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) No: Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature Ginette L Chin

Date Checked 8.10.12

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Revwer
11	Ginette Chin	R	3.4.2		Please clarify reference. Is it FG3-29 to FG3-33 or FG3-29 to FG-33.	Concur. Text has been revised.	JLG	gDC
12	Ginette Chin	R	5.1	Table 5-5	Should the title to Table 5-5 read as follows " Impact of Failure Factors (After Failure)"?	Wish to keep it as "Failure Factors"	JLG	gDC
13	Ginette Chin	R	5.2.1.4.3		Please clarify reference. Is it FG2-1 through FG2-22B?	Concur. Text has been revised.	JLG	gDC
14	Ginette Chin	R	5.2.1.4.3		2nd paragraph. Please clarify this statement. "The gates would only be operated to adjust the AWS to meet hydraulic criteria if the gate failed to operate the ladder would be outside of criteria."	Reference to 2003 HELCRABS Hydraulic Criteria Report added to text.	JLG	gDC
15	Ginette Chin	R	App A		Is there identification for typical limits in the Matrix?	Identification added.	JLG	gDC
16	Ginette Chin	R	App A		What is the difference between values given in red or black?	Concur. Text has been revised.	JLG	gDC
17	Ginette Chin	R	App B1		Revise paragraph B1.4.2. Statements do not mesh.	Concur. Text has been revised.	LL	gDC
18	Ginette Chin	R	App B1	B1.5.3.1	Was the control system reviewed for operation?	No, this one was tagged out.	LL	gDC
19	Ginette Chin	R	App B1	B1.6.1.1	Revise reference to read B1.6.2.1	Concur. Text has been revised.	LL	gDC
20	Ginette Chin	R	App B1	B1.6.1.1	Clarify location of referenced Figures.	Concur. Text has been revised.	LL	gDC
21	Ginette Chin	R	App B1	B1.6.1.2	Clarify title on Figure B1.6.4.			
22	Ginette Chin	R	App B2	B2.4.1.1.1	Please clarify the following statement. "This weir is typically operated at tailwater levels above 25 feet or less than 10 percent of the time."	Text revised - "…above 25 feet, or less than 10 percent of the time."	LAL	gDC

(1) **Type:** D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) **No:** Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature Ginette D Chin

Date Checked 8.10.12

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Revwer
23	Ginette Chin	R	App B2	B24.1.1.1.1	Clarify what is shown in Figures B2.4.1 and B2.4.2. Such as "No wire or sheeves were seen as shown in….."	Revise text to "Although the machinery cabinet was not opened for inspection, the wire rope is in good condition as are the sheaves. '	LAL	GDC
24	Ginette Chin	R	App B2	B2.4.1.1.2	Is the weir used as a bulkhead?	No, the bulkhead is separate.	LAL	GDC
25	Ginette Chin	R	App B2	B2.4.1.2	The figure mentioned does not appear to be the correct reference,	Incorrect; FG2-6 is underwater. Only the operator is visible.	LAL	GDC
26	Ginette Chin	R	App B2	B2.4.2.1	Are you referring to PH1? Please clarify.	Yes, Bradford is near Powerhouse 1; no change in text. Bradford between PH1 & PH2	LAL	GDC
27	Ginette Chin	R	App B2	B2.4.3.1	Are the notches on two sides or one?	Notched ON two sides; text corrected.	LAL	GDC
28	Ginette Chin	R	App B2	B2.4.4.1	You reference FG22c, however, the table only goes to FG22b.	Text is corrected; FG-22b	LAL	GDC
29	Ginette Chin	R	App B2		Please clarify reference. Is it FG3-3 to FG3-9 or FG3-3 to FG-9?	Text is corrected; FG3-3 to FG3-9	LAL	GDC
30	Ginette Chin	R	App B2	B2.4.4.2.1	Only one repair? Weren't there several?	Terminology in the text is correct as shown.	LAL	GDC
31	Ginette Chin	R	App B2	B2.4.4.3.6.1	Reword Mechanical Assessment so that it is not an exact copy of the previous paragraph.	Paragraph B2.4.4.3.6 is revised to delete the text (duplicated) in B2.4.4.3.6.1	LAL	GDC
32	Ginette Chin	R	App B2	B2.4.6.1	2nd paragraph. You state that there are several causes for the bulkheads sticking, however, only one is discussed.	Two causes placing the bulkheads: (1) sticking in the slots and (2) crane capacity.	LAL	GDC
33	Ginette Chin	R	App B2	B2.5.1	Add comment regarding seismic concerns to the last sentence in paragraph 4.	Revised text. "A seismic event could potentially produce catastrophic damage to the features in this area."	LAL	GDC
34	Ginette Chin	R	App B3	B3.4.1.3.3.1	Add "and are inoperable" to the end of the Mechanical Assessment sentence?	Disagree; it is unknown if they are operable or not.	LAL	GDC

(1) Type: D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) No: Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature Ginette B. Chin

Date Checked 8.10.12

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Revwer
35	Ginette Chin	R	App B3	B3.4. 2.2.2	Either the figure or the statement under the Structural Assessment is incorrect. Please clarify whether it is Weir 38 or Weir 36.	Corrected: Weir 36	LAL	gDC
36	Ginette Chin	R	App B3	B3.4. 3.1.1	Please clarify reference. Is it FG3-14 to FG3-17 or FG3-14 to FG-17? The same with FG3-29 through 33. FG3-29 to FG3-33 or FG-33?	Revised text: These diffusers, designated FG3-14 through FG3-17, are no longer used. The Diffusers FG3-29 through FG3-33 are located…"	LAL	gDC
37	Ginette Chin	R	App B3	B3.4. 3.1.1	Are FG3-17 the same as FG3-29 - 33?	No. Diffusers FG3-29 through FG3-33 are located near the main fixed weir entrance and are different from those along the ladder.	LAL	gDC
38	Ginette Chin	R	App B3	B3.4. 3.1.4	Fix Figure reference at the end of the paragraph	Concur. Text has been revised.	LAL	gDC
39	Ginette Chin	R	App B3	B3.4. 3.1.2	What about the electrical actuators?	Text is correct as stated, referring to Phase 1 assessment.	LAL	gDC

(1) Type: D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) No: Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature Ginette D Chin

Date Checked 8.10.12

REVIEW COMMENT FORM

INCA ENGINEERS INC.
A Tetra Tech Company

Project Name **Bradford Island Fishway Modifications EDR** TT INCA Project Number **189-11-045E**

Submittal Type (50%, etc.) **100% QC** Date of Review **7/30/12** Date of Response ______

File: L:\2011\11-045E\Submittals\Draft Final Submittal\Appendix C - QC Documentation\REVIEW COMMENT FORM - QC - Sheikhizadeh.docx

Item #	Name	Type (1)	No. (2)	Addl. Ref. 1	Comments	Action Taken (C = Correction made. Use dwg or para number where correction made. If not corrected, explain)	Response By	QC Revwer
1	Mo Sheikhizadeh	R	Page vii		Change FEMA to FMEA	Concur.	LL	EoF
2	Mo Sheikhizadeh	R	Page X		Include findings/ recommendations in Ex Summary	Not applicable.	LL	
3	Mo Sheikhizadeh	R	Page B1-1		Include findings/ recommendations in Ex Summary	Not applicable.	LL	
3	Mo Sheikhizadeh	R	Page B2-1		Include findings/ recommendations in Ex Summary	Not applicable.	LL	
4	Mo Sheikhizadeh	R	Page B3-1		Include findings/ recommendations in Ex Summary	Not applicable.	LL	

(1) **Type**: D = Drawing SP = Spec R = Report CE = Cost Estimate SC = Schedule CA = Calculation SK = Sketch
(2) **No:** Drawing number, Spec number, Page number, Paragraph number, etc.

QC Reviewer Signature ______

Date Checked 8/10/12

APPENDIX D – CORRESPONDENCE

Silverblatt, Tara

From:	Loesch, Lois
Sent:	Friday, May 18, 2012 1:34 PM
To:	Gunderson, Jessica; Flickinger, Eric
Cc:	Silverblatt, Tara; Mietzner, LeRoy; Stewart, Dave
Subject:	FW: BI Adult Fishway Assessment Phase II - 60% Comments from Harvey (UNCLASSIFIED)
Attachments:	document2012-05-18-112113.pdf

FYI - take a look. These comments will go into Dr Checks. I would like you two to lead the comment response effort.

-----Original Message-----
From: Henrie, Gary S NWP [mailto:Gary.S.Henrie@usace.army.mil]
Sent: Friday, May 18, 2012 12:35 PM
To: Loesch, Lois
Cc: Roy, Elizabeth W NWP
Subject: BI Adult Fishway Assessment Phase II - 60% Comments from Harvey (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Lois,

For your consideration: the attached file contains Scott Harvey's comments about the 60% decision matrix. I also put a copy in DrChecks to keep all the review comments in one place.

Gary Henrie
CENWP-EC-HD
503-808-4831

Classification: UNCLASSIFIED
Caveats: NONE

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
A-Branch Features																	
4.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	4	5	3	2	5	No	3000		Requires seismic report data to complete.
9.4.3.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	4	1	2	5	No	1200		
1.2.2.2..1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	2	4	3	Yes	720		
2.1.2.2.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	2	4	3	Yes	720		
9.4.1.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	1	1	5	No	750		
9.5.1.2.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forebay	Damaged or stuck adjustable weir	Jammed weir	Prevention of fish entering forebay/loss of exit criteria	5	2	1	5	2	1	5	No	500		
9.4.2.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	2	3	1	1	5	3	No	450		
4.1.1.2.1	Fish Lock	Bulkhead at FV1-3	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No	400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
4.2.1.1.1	Fish Lock	Bulkhead at FV1-4	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No	400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
1.1.2.2.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	2	4	4	Yes	384		
2.2.2.2.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	2	4	4	Yes	384		
3.1.1.1.1	Collection Channel	Collection Channel Stoplogs	Separates tailwater from Collection Channel	Leaky stoplogs	Inadequate sealing	Inability to dewater collection channel	1	5	3	1	5	1	4	No	300		
1.1.2.1.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes	288		
2.2.2.1.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes	288		
9.5.1.1.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forebay	Damaged or stuck adjustable weir	Loss of Power	Prevention of fish entering forebay/loss of exit criteria	5	2	1	5	2	1	2	No	200		
A-Branch Auxiliary Water Supply (AWS) Components																	
10.8.2.1.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No	10000		✓
10.8.2.2.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No	10000		✓ Corrosion to metal Grating
10.2.21.1	South AWS Conduit	Fish Valve FV-1-1	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	5	3	3	No	4050		✓
11.11.1.1.1	North AWS Conduit	Floor Grating in A-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	5	3	5	2	5	5	No	3750		✓
11.11.1.2.1	North AWS Conduit	Floor Grating in A-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	5	3	5	2	5	5	No	3750		Corrosion to ✓ metal Grating

Reference Number	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Opera	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failur	Ability to Detect Fa	Downtime to Repa	Feature Redundan	Overall Failure Rat	Life Safety	Comments
10.8.1.1.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken gate stem	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		Insufficient Down-time for Repairs-Insufficient Funding Limited Access
10.8.1.2.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken actuator	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		"
10.8.1.3.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Jammed gate	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		"
10.8.1.4.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken gate stem	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		"
10.8.1.5.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken actuator	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		"
10.8.1.6.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Jammed gate	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	~~4~~ 5	Yes	3200		"
10.3.2.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Crane doesn't have the capacity to remove bulkhead	Cannot supply Auxiliary Water to Fishway	2	3	3	5	5	1	5	No	2250		Aging Crane ✓ Movement of Concrete Structure
11.2.1.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	1	2	~~5~~ 4	No	2250		✓
10.2.3.1.1	South AWS Conduit	Fish Valve FV-1-1	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	2	2	2	No	1800		✓
10.3.2.2.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	3	3	5	4	1	5	No	1800		✓
11.6.1.1.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Aging Electronics Set Limits not working Correctly
11.6.1.3.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		" " " " " " "
11.6.1.4.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Corrosion to imbedded mild steel guides
11.7.1.1.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Aging Electronics Limits not working
11.7.1.3.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		" " " " "
11.7.1.4.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Corrosion to imbedded mild steel guides
11.8.1.1.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	~~2~~ 3	2	2	3	Yes	1440		Aging Electronics Limits not working
11.8.1.3.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	~~2~~ 3	2	2	3	Yes	1440		" " " " "
11.8.1.4.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	~~2~~ 3	2	2	3	Yes	1440		Corrosion to steel guides

Print Date: 4/27/2012 - 3:35 PM
Bradford and Cascade Island Fishway Modifications EDR
60 Percent Submittal
Appendix A - Matrix

Reference Number	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
A-Branch Control Systems																	
13.1.1.1.1	Ladder Entrance	Diffuser Gate Operator	Maintain the flow of the water	Operator fails	Loss of power	Lose control of the flow	5	2	3	4	2	3	2		1440		
13.1.1.2.1					Failure of the controller	Lose control of the flow	5	2	3	4	2	3	2		1440		
14.1.1.2.1	Control Systems	PLC	Operator Interface to the controllers	Failure of the PLC	CPU failure	Lose the ability to control the gates	1	2	2	4	3	1	2	No	96		Operable, but obsolete. Spare parts availability questionable.
12.1.1.1.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4N	Measure the water elevation	Lack of feedback to the PLC	Loss of power	Lose control of the flow	5	1	1	4	1	1	2	No	40		Only A-Branch
12.1.1.2.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4N	Measure the water elevation	Lack of feedback to the PLC	Failure of the instrument	Lose control of the flow	5	1	1	4	1	1	2	No	40		Only A-Branch
12.2.1.1.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4S	Measure the water elevation	Lack of feedback to the PLC	Loss of power	Lose control of the flow	5	1	1	4	1	1	2		40		Only A-Branch
12.2.1.2.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4S	Measure the water elevation	Lack of feedback to the PLC	Failure of the instrument	Lose control of the flow	5	1	1	4	1	1	2		40		Only A-Branch
14.1.1.1.1	Control Systems	PLC	Operator Interface to the controllers	Failure of the PLC	Loss of power	Lose the ability to control the gates	1	2	2	4	1	1	2	No	32		Operable, but obsolete. Spare parts availability questionable.
14.2.1.1.1	Control Systems	Circuit Breaker Panel board FP-3	Supply power to the various controllers	Loss of power	Feeder circuit breaker failure	Loss of power to control Fishway components	1	2	2	2	2	2	1	No	32		
14.2.1.2.1	Control Systems	Circuit Breaker Panel board FP-4	Supply power to the various controllers	Circuit Breaker trips	Short circuit	Loss of power to control Fishway components	1	2	2	2	2	2	1	No	32		
12.3.1.1.1		Fish Lock Elevators	No current function														
13.2.1.1.1		Fish Tag System	Counts fish. Not part of this system.														N/A - Not Used
B-Branch Features																	
16.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	4	5	4	2	5	No	4000		Requires seismic report data to complete.
16.1.1.2.1	Fish Lock	Bulkhead at FV1-3	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	5	No	2000		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
16.2.1.1.1	Fish Lock	Bulkhead at FV1-4	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	5	No	2000		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
16.3.1.1.1	Fish Lock	Bulkhead at South Entrance	Provides separation between defunct Fish Lock and South Entrance	Structural failure	Age	Allow fish into Fish Lock	1	5	5	1	1	5	5	No	625		
17.1.1.1.1	Ladder Section	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Failure to meet ladder criteria for a particular section of ladder	1	2	3	3	1	3	3	No	162		Localized problem
17.2.1.1.1	Ladder Section	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	3 ~~1~~	2	5	3	Yes	150		Maintenance to clear
15.3.1.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.3.2.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.4.1.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.4.2.2.1	B-Branch Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.2.1.2.1	B-Branch Entrance	North Fixed Entrance Weir SO-SG-7	Permanently closed with bulkhead	Bulkhead failure	Debris Impact	Inability to maintain entrance head and criteria	1	1	3	2	2	3	3	No	108		
B-Branch Auxiliary Water Supply (AWS) Components																	
18.2.2.1.1	South AWS Conduit	Fish Valve FV-4-3	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	5 ~~2~~	4 ~~5~~	3	5 ~~3~~	No	4050		Aging Electronics - Limits
19.2.1.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	4 ~~1~~	3 ~~2~~	5	No	2250		Aging Metal Structure " " "

Reference Number - **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operatio	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failur	Downtime to Repair/R	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
18.10.1.1.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Aging Electronics + Limits
18.10.1.3.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		" " "
18.10.1.4.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Corrosion to steel guides
18.11.1.1.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Aging Electronics + Limits
18.11.1.3.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		" " "
18.11.1.4.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 3	~~2~~ 3	2	3	Yes	1800		Corrosion to steel guides
18.2.3.1.1	South AWS Conduit	Fish Valve FV-4-3	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	~~2~~ 4	~~2~~ 3	~~2~~ 5	No	1800		Aging Electronic Limits
18.3.2.2.1	South AWS Conduit	FV4-3-Bulkhead	Dewater FV4-3 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	3	3	5	4	~~1~~ 2	5	No	1800		
18.6.1.1.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Aging Electronics + Limits
18.6.1.3.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		" " "
18.6.1.4.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Corrosion to steel guides
18.7.1.1.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Aging Electronics + Limits
18.7.1.3.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		" " "
18.7.1.4.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Corrosion to steel guides
18.8.1.1.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Aging Electronics + Limits
18.8.1.3.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		" " "
18.8.1.4.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Corrosion to steel guides
18.9.1.1.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Aging Electronics + Limits

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
18.9.1.3.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Aging Electronics + Limits
18.9.1.4.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	2	2	2	3	Yes	1800		Corrosion to steel guides
19.2.3.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	~~1~~ 4	~~2~~ 3	~~3~~ 5	No	1350		Aging Electronics + Limits
18.4.1.1.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		" " "
18.4.1.3.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		" " "
18.4.1.4.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		Corrosion to steel guides
18.5.1.1.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		Aging Electronics + Limits
18.5.1.3.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		" " "
18.5.1.4.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	2	2	3	Yes	1080		Corrosion to steel guides

* - Key to Failure Ratings

Frequency of Operation:	1 - 0 Cycles per Year, 2 - 0-2 Cycles per Year , 3 - 3-10 Cycles per Year, 4 - 11-20 Cycles per Year, 5 - > 20 Cycles per Year
Existing Condition:	1 - Good Condition Well Maintained, 2 -Operable but in need of routine maintenance , 3 -Operable but in need of repair , 4 -Inoperable but repairable , 5 - Unknown Condition or In need of replacement
Inspection Method:	1 - Remote Monitoring with Alarm, 2 - Remote Monitoring without Alarm, 3 - Scheduled Visual Monitoring, 4 - Readily Apparent to a Casual Observer, 5 -Not able to Inspect the Feature
Impact of Failure:	1 - Fishway Operation is within Typical Limits, 2 - Fishway Operation is within Typical Limits with Temporary Adjustment, 3 - Fishway Operation is outside Typical Limits, but within Fisheries Criteria, 4 - Fishway Operation is Outside Fisheries Criteria, 5 - Fishway is Shutdown
Likelihood of Failure:	1 - Failure Highly Unlikely/ Greater than 10 years, 2 - 6 to 10 years , 3 - 4 to 5 years- , 4 - 1 to 3 years , 5 - Failure Likely to Occur at any time
Ability to Detect Failure:	1 - Nearly Certain detection, 2 - High Chance of detection, 3 - Moderate Chance of detection, 4 - Low Chance of detection, 5 - Remote Chance of detection
Downtime to Repair/Replace:	1 - No effect on Fishway Operation, 2 - Minor effect on Fishway Operation, 3 - Can be accomplished during Normally Scheduled De-Watering of Fishway, 4 - Requires Longer than Normal De-Watering of Fishway, 5 - Requires Longer than Normal De-Watering of Fishway and/or Immediate De-Watering of

The Overall Failure Rating is the Product of all of the Individual Failure Ratings

** - Key to Reference Numbers

X.*.*.*.*	X = Feature Location
.X..*.*	X = Feature Description
..X.*.*	X = Potential Failure Mode of this Feature
..*.X.*	X = Potential Cause of this Failure Mode
..*.*.X	X = Potential Effect of this Cause of Failure

A-Branch Features

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Re	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
4.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	4	5	3	2	5	No	3000		Requires seismic report data to complete.
9.4.3.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Failure to regulate flow	Jammed Valve	Inability to control flow	5	2	3	~~4~~ 5	~~1~~ 2	2	5	No	1200		Electronics + Set Limits
1.2.2.2..1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	~~2~~ 3	4	~~2~~ 4	Yes	720		
2.1.2.2.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	5	1	3	2	~~2~~ 3	4	~~2~~ 4	Yes	720		
1.2.2.1.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	5	1	3	2	4	2	3	Yes	720		Maintenance to clear
2.1.2.1.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	5	1	3	2	4	2	3	Yes	720		Maintenance to clear
9.4.1.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	2	3	5	1	1	5	No	750		Electronics + Limits
9.5.1.2.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forebay	Damaged or stuck adjustable weir	Jammed weir	Prevention of fish entering forebay/loss of exit criteria	5	2	1	5	2	~~1~~ 2	5	No	500		
9.4.2.1.1	Exit Section	Fish Valve FV3-9	Regulate flow and adjust to maintain ladder criteria as the forebay changes	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	2	3	1	1	5	3	No	450		
4.1.1.2.1	Fish Lock	Bulkhead at FV1-3	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No	400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
4.2.1.1.1	Fish Lock	Bulkhead at FV1-4	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	1	No	400		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
1.1.2.2.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	~~2~~ 3	4	4	Yes	384		
2.2.2.2.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Worn components	Entrance head requirement is not met.	2	1	3	2	~~2~~ 3	4	4	Yes	384		
3.1.1.1.1	Collection Channel	Collection Channel Stoplogs	Separates tailwater from Collection Channel	Leaky stoplogs	Inadequate sealing	Inability to dewater collection channel	1	5	3	1	5	1	4	No	300		Inadequate sealing of concrete bulkheads
1.1.2.1.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes	288		
2.2.2.1.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Debris	Entrance head requirement is not met.	2	1	3	2	4	2	3	Yes	288		
9.5.1.1.1	Exit Section	Exit Weir	Provides the transition from the ladder to the forebay	Damaged or stuck adjustable weir	Loss of Power	Prevention of fish entering forebay/loss of exit criteria	5	2	1	5	2	1	2	No	200		
1.2.1.2.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	5	1	3	~~2~~ 3	1	3	~~2~~ 4	Yes	180		
1.2.2.3.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	5	1	3	~~2~~ 3	1	3	~~2~~ 4	Yes	180		
2.1.1.2.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	5	1	3	~~2~~ 3	1	3	~~2~~ 4	Yes	180		
2.1.2.3.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	5	1	3	~~2~~ 3	1	3	~~2~~ 4	Yes	180		
5.1.1.1.1	Ladder Section	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes	162		Localized problem
7.1.1.1.1	Ladder to Counting Station	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes	162		Localized problem

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
9.1.1.1.1	Exit Section	Exit Channel	Provides ladder function	Concrete failure	Excessive cracking	Concrete falls into ladder	1	2	3	3	1	3	3	Yes ✓	162		Localized problem
5.2.1.1.1	Ladder Section	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes ✓	150		Maintenance to clear
7.2.1.1.1	Ladder to Counting Station	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes ✓	150		Maintenance to clear
4.3.1.1.1	Fish Lock	Bulkhead at South Entrance	Provides separation between defunct Fish Lock and South Entrance	Structural failure	Age	Allow fish into Fish Lock	1	5	5	1	1	5	1	No ✓	125		
1.2.1.1.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	5	1	3	2	4	1	~~1~~ 3	Yes ✓	120		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
2.1.1.1.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	5	1	3	2	4	1	~~1~~ 3	Yes ✓	120		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
1.1.1.2.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	3	~~2~~ 3	Yes ✓	72		
1.1.2.3.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	3	~~2~~ 3	Yes ✓	72		
2.2.1.2.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	3	~~2~~ 3	Yes ✓	72		
2.2.2.3.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Jammed Weir	Single Broken Wire Rope	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	3	~~2~~ 3	Yes ✓	72		
1.2.1.4.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	60		
1.2.1.5.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	60		
2.1.1.4.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	60		
2.1.1.5.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	60		
1.1.1.1.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	2	1	3	2	4	1	~~1~~ 3	Yes ✓	48		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
2.2.1.1.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Loss of Power	Entrance head requirement is not met.	2	1	3	2	4	1	~~1~~ 3	Yes ✓	48		Assume enough redundancy in this branch to ensure minimal effect if failure occurs in one gate.
5.3.1.1.1	Ladder Section	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes ✓	48		
7.3.1.1.1	Ladder to Counting Station	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes ✓	48		
9.2.1.1.1	Exit Section	Pit Tag Antennae	Fish counting	Not counting fish	Broken wires	Failure to count fish	1	1	4	1	2	2	3	Yes ✓	48		
1.2.1.3.1	South Entrance	Entrance Weir WG-2	Provides control of water at South Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	1	~~1~~ 3	Yes ✓	30		
2.1.1.3.1	North Entrance	Entrance Weir WG-64	Provides control of water at North Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	5	1	3	2	~~1~~ 2	1	~~1~~ 3	Yes ✓	30		
1.1.1.4.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	24		
1.1.1.5.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	24		
2.2.1.4.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Broken Driveshaft	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	24		
2.2.1.5.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Bearing Failure	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	2	~~1~~ 3	Yes ✓	24		
8.1.1.1.1	Counting Station	Fish Crowder	Improves viewing access of fish	Mechanical	Age	Inability to count fish	5	1	2	1	2	1	1	No ✓	20		

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Bradford and Cascade Island Fishway Modifications EDR
60 Percent Submittal
Appendix A - Matrix

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
1.1.1.3.1	South Entrance	Entrance Weir WG-1	Provides control of water at South Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	1	~~1~~ 3	Yes	12		Insufficient Downtime for Repairs
2.2.1.3.1	North Entrance	Entrance Weir WG-65	Provides control of water at North Entrance.	Hoist Failure	Speed Reducer Failure	Entrance head requirement is not met.	2	1	3	2	~~1~~ 2	1	~~1~~ 3	Yes	12		" " " "
6.1.1.1.1	Junction Pool		Combines A-Branch and B-Branch and connects both to exit	None identified	None identified	None identified								No	0		
9.3.1.1.1	Exit Section	Makeup Water Supply System	Provides additional water upstream of Junction Pool	Failure of FV3-9										No	0		Refer to Item 9
A-Branch Auxiliary Water Supply (AWS) Components																	
10.1.1.1.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Erosion of surounding terrain due to leakage	1	5	5	~~1~~ 5	~~1~~ 2	5	5	No	625		
10.1.1.2.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Erosion of surounding terrain due to leakage	1	5	5	~~1~~ 5	~~1~~ 2	5	5	No	625		
10.1.1.3.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Erosion of surounding terrain due to leakage	1	5	5	~~1~~ 5	~~1~~ 2	5	~~4~~ 5	No	500		
10.2.1.1.1	South AWS Conduit	Fish Valve FV-1-1	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	~~3~~ 4	5	~~1~~ 3	~~1~~ 3	4	No	900		Corrosion, Wear + Age
10.2.21.1	South AWS Conduit	Fish Valve FV-1-1	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	~~3~~ 4	2	5	3	3	No	4050		Wear + Age
10.2.3.1.1	South AWS Conduit	Fish Valve FV-1-1	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	~~3~~ 4	5	~~1~~ 3	2	~~2~~ 4	No	1800		Aging Electronics + Limits
10.3.1.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to seal properly	Age of seal	Inability to De-water AWS	2	3	3	1	5	2	~~1~~ 2	No	180		Seal Replacement
10.3.2.1.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Crane doesn't have the capacity to remove bulkhead	Cannot supply Auxiliary Water to Fishway	2	3	3	5	5	1	5	No	2250		Aging Crane
10.3.2.2.1	South AWS Conduit	FV1-1-Bulkhead	Dewater FV1-1 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	3	3	5	4	1	5	No	1800		Aging Crane
10.4.1.1.1	South AWS Conduit	Fish Valve FV-1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Jammed Valve	Inability to restore AWS operation	2	~~3~~ 4	~~3~~ 5	5	~~2~~ 4	~~1~~ 4	5	No	900		Unwatering + Access
10.4.1.2.1	South AWS Conduit	Fish Valve FV-1-2	Equalization valve between FV1-1 and Bulkheads	Failure to equalize pressure between valve and bulkhead	Operator (stem) failure	Inability to restore AWS operation	2	~~3~~ 4	~~3~~ 5	5	~~2~~ 4	~~1~~ 4	5	No	900		" "
10.5.1.1.1	South AWS Conduit	FV1-2 -Bulkhead	Dewater FV1-2	Failure to seal properly	Age of seal	Inability to repair FV1-2 if necessary	1	3	3	1	1	1	1	No	9		
10.6.1.1.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Seismic event	Loss of South AWS	1	5	3	1	5	1	1	No	75	X	Requires seismic report data to complete.
10.6.1.2.1	South AWS Conduit	Fingerling Bypass	Defunct feature, no longer in use.	Structural Failure	Age of concrete	Loss of South AWS	1	5	3	1	5	1	1	No	75	X	Requires seismic report data to complete.
10.8.1.1.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken gate stem	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	~~4~~ 5	~~4~~ 5	Yes	3200		Insufficient Downtime for Repairs Corrosion and Age
10.8.1.2.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Broken actuator	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	4	Yes	3200		Age + Corrosion
10.8.1.3.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Open but not Operated	Inability to close	Jammed gate	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	~~4~~ 5	~~4~~ 5	Yes	3200		Insufficient Downtime - Access Electronics, Corrosion + Age
10.8.1.4.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken gate stem	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	~~4~~ 5	~~4~~ 5	Yes	3200		Insufficient Downtime - Access Corrosion + Age
10.8.1.5.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Broken actuator	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	4	4	Yes	3200		Age + Corrosion
10.8.1.6.1	South AWS Conduit	Gate Valve between AWS and Collection Channel (FG2-1 -22B)	Broken and/or Closed	Inability to open	Jammed gate	Inability to dewater channel	1	5	5	~~2~~ 4	~~4~~ 5	~~4~~ 5	~~4~~ 5	Yes	3200		Insufficient Downtime - Access Electronics, Corrosion + Age

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
10.8.2.1.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No ✓	10000		Corrosion to metal grating
10.8.2.2.1	South AWS Conduit	Floor Grating in Collection Channel	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	5	5	4	4	5	5	No ✓	10000		Corrosion to metal grating
11.1.1.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Erosion of surounding terrain due to leakage	1	~~2~~ 4	~~2~~ 5	~~1~~ 5	~~5~~ 3	~~4~~ 5	~~4~~ 5	No ✓	720		Access
11.1.1.2.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Erosion of surounding terrain due to leakage	1	~~3~~ 4	~~3~~ 5	~~1~~ 5	~~5~~ 3	~~4~~ 5	~~4~~ 5	No ✓	720		Access
11.1.1.3.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Erosion of surounding terrain due to leakage	1	~~2~~ 4	~~3~~ 5	~~1~~ 5	~~5~~ 3	~~4~~ 5	~~4~~ 5	No ✓	720		Access
11.10.1.1.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	~~3~~ 4	5	3	~~2~~ 5	2	2	~~3~~ 4	Yes	1080		Corrosion
11.10.1.2.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	~~3~~ 4	5	3	~~2~~ 5	2	2	~~1~~ 4	Yes	360		Corrosion
11.10.1.3.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	~~3~~ 4	5	3	~~2~~ 5	2	2	~~3~~ 4	Yes	1080		Electronics + Limits
11.10.1.4.1	North AWS Conduit	Diffuser Gate FG3-9	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	~~3~~ 4	5	3	~~2~~ 5	2	2	~~3~~ 4	Yes	1080		Corrosion
11.11.1.1.1	North AWS Conduit	Floor Grating in A-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	~~5~~ 4	3	5	~~2~~ 3	5	5	No	3750		Corrosion of steel grating
11.11.1.2.1	North AWS Conduit	Floor Grating in A-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	~~5~~ 4	3	5	~~2~~ 3	5	5	No	3750		" " " "
11.2.1.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	~~1~~ 2	2	5	No	2250		Corrosion
11.2.2.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	~~2~~ 3	3	~~1~~ 2	2	5	~~3~~ 5	No	900		Age
11.2.3.1.1	North AWS Conduit	Fish Valve FV3-7	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	~~1~~ 2	2	~~3~~ 5	No	1350		Electronics + Limits
11.3.1.1.1	North AWS Conduit	Fish Valve FV3-8	Separates flow between North and South AWS conduits. Currently closed and non-operable.	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	1	~~2~~ 5	3	4	~~2~~ 5	~~2~~ 3	~~4~~ 5	No	384		Out of Service Repair requires North and South AWS to be dewatered
11.3.2.1.1	North AWS Conduit	Fish Valve FV3-8	Separates flow between North and South AWS conduits. Currently closed and non-operable.	Failure to seal properly	Age of seal	More flow than anticipated	1	~~5~~ 5	3	2	~~2~~ 5	~~2~~ 3	~~3~~ 5	No	360		Out of Service Repair requires North and South AWS to be dewatered
11.4.1.1.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	~~5~~	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1080		Corrosion + Age
11.4.1.2.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~1~~ 4	Yes	360		Electronics + Age
11.4.1.3.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	~~2~~ 4	~~2~~ 4	2	~~3~~ 4	Yes	1080		Electronics, Corrosion + Age
11.4.1.4.1	North AWS Conduit	Diffuser Gate FG3-3	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1080		Corrosion + Age

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
11.5.1.1.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 ~~2~~	3 ~~2~~	3 ~~2~~	4 ~~3~~	Yes	1080		Corrosion + Age
11.5.1.2.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 ~~2~~	3 ~~2~~	3 ~~2~~	4 ~~1~~	Yes	360		Electronics + Age
11.5.1.3.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	4 3	Yes	1080		Electronics, Corrosion + Age
11.5.1.4.1	North AWS Conduit	Diffuser Gate FG3-4	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	4 3	Yes	1080		Corrosion + Age
11.6.1.1.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	4 3	Yes	1800		Corrosion + Age
11.6.1.2.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	4 1	Yes	600		Electronics + Age
11.6.1.3.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	4 3	Yes	1800		Electronics, Corrosion + Age
11.6.1.4.1	North AWS Conduit	Diffuser Gate FG3-5	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	4 3	Yes	1800		Corrosion + Age
11.7.1.1.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	3 3	Yes	1800		Corrosion + Age
11.7.1.2.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	3 1	Yes	600		Electronics + Age
11.7.1.3.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	3 3	Yes	1800		Electronics, Corrosion + Age
11.7.1.4.1	North AWS Conduit	Diffuser Gate FG3-6	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	4 2	3 2	3 2	3 3	Yes	1800		Corrosion + Age
11.8.1.1.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4 2	3 2	3 2	3 3	Yes	1440		Corrosion + Age
11.8.1.2.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4 2	3 2	3 2	3 1	Yes	480		Electronics + Age
11.8.1.3.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4 2	3 2	3 2	3 3	Yes	1440		Electronics, Corrosion + Age
11.8.1.4.1	North AWS Conduit	Diffuser Gate FG3-7	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4	5	3	4 2	3 2	3 2	3 3	Yes	1440		Corrosion + Age
11.9.1.1.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	3 3	Yes	1080		Corrosion + Age

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11.9.1.2.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	3 1	Yes	360		Electronics + Age
11.9.1.3.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	3 3	Yes	1080		Electronics, Corrosion + Age
11.9.1.4.1	North AWS Conduit	Diffuser Gate FG3-8	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	4 2	3 2	3 2	3 3	Yes	1080		Corrosion + Age
A-Branch Control Systems																	
12.1.1.1.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4N	Measure the water elevation	Lack of feedback to the PLC	Loss of power	Lose control of the flow	5	1	1	4	1	1	2	No	✓ 40		Only A-Branch
12.1.1.2.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4N	Measure the water elevation	Lack of feedback to the PLC	Failure of the instrument	Lose control of the flow	5	1	1	4	1	1	2	No	✓ 40		Only A-Branch
12.2.1.1.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4S	Measure the water elevation	Lack of feedback to the PLC	Loss of power	Lose control of the flow	5	1	1	4	1	1	2		✓ 40		Only A-Branch
12.2.1.2.1	North and South AWS Intakes	Ultrasonic Sensor AWS-SG-4S	Measure the water elevation	Lack of feedback to the PLC	Failure of the instrument	Lose control of the flow	5	1	1	4	1	1	2		✓ 40		Only A-Branch
12.3.1.1.1		Fish Lock Elevators	No current function												✓		N/A - Not Used
13.1.1.1.1	Ladder Entrance	Diffuser Gate Operator	Maintain the flow of the water	Operator fails	Loss of power	Lose control of the flow	5	2	3	4	2	3	2		✓ 1440		
13.1.1.2.1					Failure of the controller	Lose control of the flow	5	2	3	4	2	3	2		✓ 1440		
13.2.1.1.1		Fish Tag System	Counts fish. Not part of this system.												✓		
14.1.1.1.1	Control Systems	PLC	Operator Interface to the controllers	Failure of the PLC	Loss of power	Lose the ability to control the gates	1	2	2	4	1	1	2	No	✓ 32		Operable, but obsolete. Spare parts availability questionable.
14.1.1.2.1	Control Systems	PLC	Operator Interface to the controllers	Failure of the PLC	CPU failure	Lose the ability to control the gates	1	2	2	4	3	1	2	No	✓ 96		Operable, but obsolete. Spare parts availability questionable.
14.2.1.1.1	Control Systems	Circuit Breaker Panel board FP-3	Supply power to the various controllers	Loss of power	Feeder circuit breaker failure	Loss of power to control Fishway components	1	2	2	2	2	2	1	No	✓ 32		
14.2.1.2.1	Control Systems	Circuit Breaker Panel board FP-4	Supply power to the various controllers	Circuit Breaker trips	Short circuit	Loss of power to control Fishway components	1	2	2	2	2	2	1	No	✓ 32		
B-Branch Features																	
15.1.1.1.1	B-Branch Entrance	South Fixed Entrance Weir SO-SG-2	Provides fixed flow restriction at entrance	None identified	Age	Inability to maintain entrance head and criteria									0		
15.2.1.1.1	B-Branch Entrance	North Fixed Entrance Weir SO-SG-7	Permanently closed with bulkhead	Bulkhead failure	Age	Inability to maintain entrance head and criteria	1	1	3	2	1	3	3	No	54		
15.2.1.2.1	B-Branch Entrance	North Fixed Entrance Weir SO-SG-7	Permanently closed with bulkhead	Bulkhead failure	Debris Impact	Inability to maintain entrance head and criteria	1	1	3	2	2	3	3	No	108		
15.3.1.1.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Loss of Power	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	1	Yes	40		
15.3.1.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.3.2.1.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Jammed Gate	Debris	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~2~~	3 ~~2~~	1	Yes	80		
15.3.2.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	2 ~~2~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.4.1.1.1	B-Branch Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Actuator Failure	Loss of Power	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	1	Yes	40		
15.4.1.2.1	B-Branch Entrance	South Sluice Gate SO-SG-4S	Provides control of water at the B Branch Entrance.	Actuator Failure	Broken Connection	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~1~~	3 ~~2~~	3	Yes	120		
15.4.2.1.1	B-Branch Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Jammed Gate	Debris	Inability to maintain entrance head and criteria	5	2 ~~1~~	2	2	2 ~~2~~	3 ~~2~~	1	Yes	80		

Reference Number **	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Repla	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
15.4.2.2.1	B-Branch Entrance	North Sluice Gate SO-SG-4N	Provides control of water at the B Branch Entrance.	Jammed Gate	Worn components	Inability to maintain entrance head and criteria	5	~~1~~ 2	2	2	~~1~~ 2	~~2~~ 3	3	Yes	120		
15.5.1.1.1	B-Branch Entrance	Collection Channel													0		Reference B-Branch AWS
16.1.1.1.1	Fish Lock	Defunct feature	No current function	Structural failure	Seismic event	Uncontrolled water release into AWS and Collection Channel	1	5	4	5	4	2	5	No	4000		Requires seismic report data to complete.
16.1.1.2.1	Fish Lock	Bulkhead at FV1-3	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	5	No	2000		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
16.2.1.1.1	Fish Lock	Bulkhead at FV1-4	Provides separation between defunct Fish Lock and Forebay	Structural failure	Age	Allow water into Fish Lock	1	5	5	1	4	4	5	No	2000		Unable to determine current condition therefore likelihood of failure is unknown. Project staff unaware of previous inspection.
16.3.1.1.1	Fish Lock	Bulkhead at South Entrance	Provides separation between defunct Fish Lock and South Entrance	Structural failure	Age	Allow fish into Fish Lock	1	5	5	1	1	5	5	No	625		
17.1.1.1.1	Ladder Section	Weirs	Provides ladder function	Concrete failure	Excessive cracking	Failure to meet ladder criteria for a particular section of ladder	1	2	3	3	1	3	3	No	162		Localized problem
17.2.1.1.1	Ladder Section	Orifice	Fish passage through weirs	Blockage	Debris	Ladder criteria not met locally	1	1	5	1	2	5	3	Yes	150		Maintenance to clear
17.3.1.1.1	Ladder Section	Pit Tag Orifice	Fish counting	Not counting fish	Broken wires	Inability to count fish	1	1	4	1	2	2	3	Yes	48		
B-Branch Auxiliary Water Supply (AWS) Components																	
18.1.1.1.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Leakage	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.1.1.1.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Rebar Corrosion	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.1.1.2.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Leakage	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.1.1.2.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Rebar Corrosion	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.1.1.3.1	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Leakage	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.1.1.3.2	South AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Rebar Corrosion	1	5	5	4 1	2 1	5	5 ~~4~~	No	500		
18.10.1.1.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Corrosion + Wear
18.10.1.2.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	1	Yes	600		Wear + Age
18.10.1.3.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Electronics, Limits, Corrosion + Wear
18.10.1.4.1	South AWS Conduit	Diffuser Gate FG3-24	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Concrete, Corrosion, Wear + Age
18.11.1.1.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Corrosion + Wear
18.11.1.2.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	1	Yes	600		Wear + Age
18.11.1.3.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Electronics, Limits, Corrosion + Wear
18.11.1.4.1	South AWS Conduit	Diffuser Gate FG3-25	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	~~2~~ 4	~~2~~ 3	~~2~~ 3	~~3~~ 4	Yes	1800		Concrete, Corrosion, Wear + Age

Reference Number	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
18.12.1.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Corrosion + Wear
18.12.2.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	1	Yes	120		Wear + Age Electronics, Limits
18.12.3.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Corrosion + Wear
18.12.4.1	South AWS Conduit	Diffuser Gate FG3-26	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Concrete, Corrosion, Wear + Age
18.13.1.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5 ~~3~~	1	3	4 2	3 2	3 2	4 3	Yes	216		Corrosion + Wear
18.13.2.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5 ~~3~~	1	3	4 2	3 2	3 2	1	Yes	72		Wear + Age Electronics, Limits,
18.13.3.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5 ~~3~~	1	3	4 2	3 2	3 2	4 3	Yes	216		Corrosion + Wear
18.13.4.1	South AWS Conduit	Diffuser Gate FG3-27	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5 ~~3~~	1	3	4 2	3 2	3 2	4 3	Yes	216		Concrete, Corrosion, Wear + Age
18.14.1.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Corrosion + Wear
18.14.2.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	1	Yes	120		Wear + Age Electronics, Limits
18.14.3.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Corrosion + Wear
18.14.4.1	South AWS Conduit	Diffuser Gate FG3-28	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	1	3	4 2	3 2	3 2	4 3	Yes	360		Concrete, Corrosion Wear + Age
18.15.1.1	South AWS Conduit	Floor Grating in B-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much back pressure	Allow adult fish to enter the AWS	1	4 ~~1~~	3	5	3 ~~2~~	5	5	No	750		Corrosion of Metal Grating
18.15.2.1	South AWS Conduit	Floor Grating in B-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	4 ~~1~~	3	5	4 ~~2~~	5	5	No	750		Corrosion of Metal Grating
18.2.1.1	South AWS Conduit	Fish Valve FV-4-3	Regulate flow to South AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	3 ~~2~~	3 ~~2~~	5 ~~4~~	No	900		Corrosion, Wear + Age
18.2.2.1	South AWS Conduit	Fish Valve FV-4-3	Regulate flow to South AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3	3	2	5	3	5 ~~5~~	No	4050		Corrosion, Wear + Age
18.2.3.1	South AWS Conduit	Fish Valve FV-4-3	Regulate flow to South AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	3 ~~2~~	3 2	5 ~~2~~	No	1800		Electronics + Limits
18.3.1.1	South AWS Conduit	FV4-3-Bulkhead	Dewater FV4-3 and Collection channel AWS	Failure to seal properly	Age of seal	Inability to De-water AWS	2	3	3	1	5	2	1	No	180		Seal Replacement
18.3.2.2	South AWS Conduit	FV4-3-Bulkhead	Dewater FV4-3 and Collection channel AWS	Failure to remove Bulkhead	Bulkhead slot is not squared	Cannot supply Auxiliary Water to Fishway	2	3	3	5	4	1	5	No	1800		Seal Replacement

Print Date: 4/27/2012 - 3:37 PM
Bradford and Cascade Island Fishway Modifications EDR
60 Percent Submittal
Appendix A - Matrix

Reference Number	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
18.4.1.1.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3 2	2	3	Yes	1080		Corrosion + Wear
18.4.1.2.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3 2	2	1	Yes	360		Age + Wear
18.4.1.3.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3 2	2	3	Yes	1080		Electronics, Limits, Corrosion + Wear
18.4.1.4.1	South AWS Conduit	Diffuser Gate FG3-18	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5	3	2	3 2	2	3	Yes	1080		Concrete, Corrosion, Wear + Age
18.5.1.1.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~3~~	5	3	2	3 2	2	3	Yes	1080		Corrosion + Wear
18.5.1.2.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~3~~	5	3	2	3 2	2	1	Yes	360		Age + Wear
18.5.1.3.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~3~~	5	3	2	3 2	2	3	Yes	1080		Electronics, Limits, Corrosion + Wear
18.5.1.4.1	South AWS Conduit	Diffuser Gate FG3-19	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~3~~	5	3	2	3 2	2	3	Yes	1080		Concrete, Corrosion, Wear + Age
18.6.1.1.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~5~~	5	3	2	3 2	2	3	Yes	1800		Corrosion + Wear
18.6.1.2.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~5~~	5	3	2	3 2	2	1	Yes	600		Age + Wear
18.6.1.3.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~5~~	5	3	2	3 2	2	3	Yes	1800		Electronics, Limits, Corrosion + Wear
18.6.1.4.1	South AWS Conduit	Diffuser Gate FG3-20	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	4 ~~5~~	5	3	2	3 2	2	3	Yes	1800		Concrete, Corrosion, Wear + Age
18.7.1.1.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 ~~2~~	3 2	2	3	Yes	1800		Corrosion + Wear
18.7.1.2.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 ~~2~~	3 2	2	1	Yes	600		Age + Wear
18.7.1.3.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 ~~2~~	3 2	2	3	Yes	1800		Electronics, Limits, Corrosion + Wear
18.7.1.4.1	South AWS Conduit	Diffuser Gate FG3-21	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 ~~2~~	3 2	2	3	Yes	1800		Concrete, Corrosion, Wear + Age.
18.8.1.1.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 ~~2~~	3 2	2	3	Yes	1800		Corrosion + Wear

Reference Number	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of Operation	Existing Condition	Inspection Method	Impact of Failure	Likelihood of Failure	Ability to Detect Failure	Downtime to Repair/Replace	Feature Redundancy	Overall Failure Rating	Life Safety	Comments
18.8.1.2.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	1	Yes	600		Age + Wear
18.8.1.3.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	3	Yes	1800		Electronics - Limits - Corrosion + Wear
18.8.1.4.1	South AWS Conduit	Diffuser Gate FG3-22	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	3	Yes	1800		Concrete, Corrosion, Wear + Age
18.9.1.1.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	3	Yes	1800		Corrosion + Wear
18.9.1.2.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	1	Yes	600		Age + Wear
18.9.1.3.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	3	Yes	1800		Electronics, Limits, Corrosion + Wear
18.9.1.4.1	South AWS Conduit	Diffuser Gate FG3-23	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	5	5	3	3 2	3 2	2	5 3	Yes	1800		Concrete, Corrosion, Wear + Age
19.1.1.1.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Leakage	5 1	3	3	4 1	5	4	5 3	No	540		
19.1.1.1.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Age	Rebar Corrosion	5 1	3	3	4 1	5	4	5 3	No	540		
19.1.1.2.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Leakage	5 1	3	3	4 1	5	4	5 3	No	540		
19.1.1.2.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Erosion	Rebar Corrosion	5 1	3	3	4 1	5	4	5 3	No	540		
19.1.1.3.1	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Leakage	5 1	3	3	4 1	5	4	5 3	No	540		
19.1.1.3.2	North AWS Conduit	Conduit	Supplies Auxiliary Water	Joint Failure	Improper Joint Repair	Rebar Corrosion	5 1	3	3	4 1	5	4	5 3	No	540		
19.15.1.1.1	North AWS Conduit	Floor Grating in B-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Too much backpressure	Allow adult fish to enter the AWS	1	2 1	3	5	2	5	5	No	750		Corrosion
19.15.1.2.1	North AWS Conduit	Floor Grating in B-Branch Fishway Diffuser	Prevents adult fish from entering the AWS	Blowout grating panels	Age	Allow adult fish to enter the AWS	1	2 1	3	5	3 2	5	5	No	750		Corrosion
19.2.1.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Structural Failure	Structural members fail	Uncontrollable flow in the AWS system	5	3	3	5	3 ~~1~~	3 2	5	No	2250		Corrosion, Wear + Age
19.2.2.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to seal properly	Age of seal	More flow than anticipated for valve set point	5	3 2	3	3 1	3 2	5	5 3	No	900		Wear + Age
19.2.3.1	North AWS Conduit	Fish Valve FV4-4	Regulates flow for the North AWS	Failure to regulate flow	Jammed Valve	Inability to control flow	5	3	3	5	2 1	3 2	5 3	No	1350		Electronics + Limits
19.4.1.1.1	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 ~~1~~	3	3 2	2	2	4 3	Yes	144		Age + Corrosion
19.4.1.1.2	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 ~~1~~	3	3 2	2	2	1	Yes	48		Age + Corrosion
19.4.1.1.3	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 ~~1~~	3	3 2	2	2	4 3	Yes	144		Electronics Corrosion + Age
19.4.1.1.4	North AWS Conduit	Diffuser Gate FG3-29	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 ~~1~~	3	3 2	2	2	4 3	Yes	144		Cracking Concrete Corrosion + Age

Reference Numb	Feature Location	Feature Description	Feature Function	Potential Failure Mode	Potential Cause of Failure	Potential Effect of Failure Mode	Frequency of C	Existing Condit	Inspection Me	Impact of Failu	Likelihood of F	Ability to Dete
19.4.1.2.1	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 1	3	3 2	3 2	4 2
19.4.1.2.2	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 1	3	3 2	3 2	2
19.4.1.2.3	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 1	3	3 2	3 2	4 2
19.4.1.2.4	North AWS Conduit	Diffuser Gate FG3-30	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	2	5 1	3	3 2	3 2	4 2
19.4.1.3.1	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.3.2	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	2
19.4.1.3.3	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.3.4	North AWS Conduit	Diffuser Gate FG3-31	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.4.1	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.4.2	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	2
19.4.1.4.3	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.4.4	North AWS Conduit	Diffuser Gate FG3-32	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.5.1	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken gate stem	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.5.2	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Broken actuator	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	2
19.4.1.5.3	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Jammed gate	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2
19.4.1.5.4	North AWS Conduit	Diffuser Gate FG3-33	Regulate Flow between the North AWS conduit and the Diffuser bays.	Inability to open or close	Gate guide failure	Inability to regulate flow at the fish ladder and possibly maintain entrance criteria	3	5 1	3	3 2	3 2	4 2

BONNEVILLE PROJECT'S FISH FACILITY EVALUATION OF BOTH BRADFORD IS. & CASCADE IS. FISH LADDERS

(Note: The ratings and evaluations of the Bonneville project's fish facility are systematically rated 5 thru 1, from worst physical condition (5) to better condition (1).)

a.) Powerhouse One Collection Bay Channel – Including all Diffusers from FG2-2 thru FG2-22B. Less than half of the diffusers along the collection bay are operational. All physical elements with-in the Collection Bay is deteriorating faster than maintenance can keep up with. The mild steel features are corroding that includes diffuser gates, diffuser guides, mounting bolts and hardware, the imbedded iron and metal gratings. The concrete around the diffusers and imbedded hardware are deteriorating and braking away from around the attachments. Access into this area for the project has been a problem for some time. Small segments of the collection are taken down at a time because of dewatering difficulties. The maintenance required for repairs, far exceeds the out-of-service time allowed. Lack of funding, manpower, equipment such as cranes and time allowed for repairs has been a problem. Other higher maintenance task priorities (such as generator unit overhauls, generator unstacking and contractor support) have ruled over the Fish Facility repairs. Conflicts with contractors working in the same area have limited access into areas of the fish ladder. Closing down the project's roadway along the powerhouse tailrace roadway has limited crane activity along the collection bay. Mobile crane activity is crucial for dewatering and providing access into the Collection bay. Removal of Sturgeon and severe weather conditions have been other hurdles presented to the maintenance.

Repair Options: Consider which diffusers are needed for optimum fish facility operations and completely overhaul those diffusers. Remove any old, deteriorating concrete and replace the diffuser gates, imbedded iron guides and all attached hardware with stainless steel hardware. Replace all gratings and I-Beam supports in those diffusers selected for restoration. All the other diffusers that are not needed should be removed. That includes removing the diffuser gate and pouring a concrete wall in the opening between the auxiliary water supply conduit and the diffuser chamber. Remove the entire old metal grating in the same decommissioned chamber and pour a concrete lid over the top. Leave the chamber section open with a vent tube to allow water pressure fluctuation.

Repair Grade Level Rating - 5.

Rec'd 5/23/12

b.) FV1-1 Intake Facility – Including the Intake Trash Rack, Intake Bulkheads, Bulkhead Sill, FV1-1 Tainter Valve, and T.V. Bulkhead, FV1-2 Tainter Valve and the Post Derrick Crane. The most important consideration for this FV1-1 intake area is the structural integrity results relating to the seismic activity structural integrity report (if significant funding ever becomes available to complete the seismic/earthquake study). There are numerous concrete cracks and deteriation along this area. Should an investment be made to restore the auxiliary intake facility or should a complete relocation be considered. One feasible location would be on the north side of powerhouse one, just upstream of the old DSM intake. There is a cove located between the old DSM and the intake for FV3-7 along the upstream north shore of powerhouse one. An intake facility could be built with intake trash racks, followed by a bulkhead slot and a tainter valve for water regulation. This all could tie into the north section of the 1-1 auxiliary water conduit channel that runs along the tailrace of powerhouse one.

The FV1-1 collection bulkhead slot sill is deteriating and the bulkheads them self's when placed into the slot for maintenance de-watering, do a very poor job of holding back water and the bulkhead leaks can never be completely dried up. The NL1 Post Derrick Crane is aging quickly and no longer has the lift capacity to remove the Tainter Valve Bulkhead (located just upstream of the 1-1 Valve) when the bulkhead is placed down in service and has any kind of water pressure be hide the bulkhead. FV1-2 Tainter Valve needs to remain operational for emergency use only for the removal of water in the 1-1 intake pool area.

Repair Grade Level Rating - 4-1/2 to 4.

c.) A-Branch Fish Ladder – Includes the portion of the A-Branch Fish Ladder downstream from the Y Junction Pool. Diffuser Gates involved in this section are FG3-9, FG3-8, FG3-7, FG3-6, FG3-5, FG3-4 and FG3-3. Also includes the FV3-7 Conduit that runs alongside the south portion of the ladder. A fair amount of time and resources have been invested in the last 20+ years regarding repairs to the A-Branch Diffusers. Most are running but are not very reliable due to the age of the fish way components. The electronics that include the upper / lower limits are not very reliable. The embedded mild steel and cast of the diffuser gate guide system has corrosion / rusting problems. The concrete around the diffuser gates and up-right guides are breaking away from the wall. A complete Diffuser Gate, guide system, stem and hardware, drive motor and control box replacement will be required in the near future. A stainless steel guide system with stainless components and hardware would work best in this type of environment. All the old and cracking concrete around the diffuser guide system should all be removed and replaced with new concrete and rebar.

d.) The buried portion of the FV3-7 conduit has water leakage breaking the ground surface coming most likely from the conduits expansion joints. FV3-7 conduit has an access entry hatch for inspections and repairs inside the conduit. There are no visual indications if leakage is occurring underneath the Fish Ladder.
Repair Grade Level Rating - 3-1/2 to 3.

e.) B-Branch Collection Pool, FV 4-4 Valve and Intake Pool, FV 4-4 Conduit - This section includes the Fish Valve FV4-4, Upper Intake Pool, FV 4-4 Conduit, Collection Diffuser Gates FG3-33, FG3-32, FG3-31, FG3-29 and FG3-30. The Intake Pool area and intake pool trash racks are cleaned of debris whenever the ladder is dewatered. The condition of the intake pool area and trash racks are in good condition. The FV3-7 Valve has had repairs in the past and the main problem that occurs are the electrical lower limits not kicking out the valve when lowered to closed position. Causing major structural damage to the valve arm and components. Access into the 4-4 conduit is difficult for inspections inside the conduit. Gates FG3-30 and FG3-29 has had repairs in the past and is in good operational condition. Gates FG3-31, FG3-32 and FG3-33 have also had repairs in the past, but are in a more worse for wear condition, because of the inability of the un-watering pump not being able to completely de-water the last 3 feet of water inside the lower collection. When future repair work in the lower collection pool is required, external submersible pumps and piping will need to be installed in FG3-31 access hatch opening and water discharged into the lower tail water section to gain access to FG3-31 thru FG3-33. Repair Grade Level Rating - 3-1/2

f.) B-Branch Fish Ladder – This section includes Diffusers FG3-18 through FG3-28. A fair amount of work has been performed on all the diffusers in the B-Branch section in the past 20+ years. New gates, guides, stems and yokes have been replaced on a majority of the components along the B-Branch section. The diffusers still have electrical limit issues and metal component wear problems. However, the condition of the diffusers and concrete structure seem to be in better condition then the A-Branch diffusers.
Repair Grade Level Rating – 2-1/2.

g.) FV4-3 Valve and 4-3 Conduit – The FV4-3 Valve has also had electrical lower limit issues that has caused major damage to the valve's structural arm and components. The conduit is difficult to access for inspections inside the conduit for possible leakage or structural deterioration. Repair Grade Level Rating - 2-1/2.

h.) **Upper Bradford Island Fish Ladder – This section includes the section from 3-9 Fish Exit, FV3-9 Intake, FV3-7 Intake, Visitor Fish viewing area, down to the Y Junction Pool. This area has had major structural and concrete work performed back in the mid 1970's and is still in good condition.**
Repair Grade Level Rating - 2.

Scott Harvey
Structural Crew
Bonneville Lock and Dam
541-374-4533

Silverblatt, Tara

From: Loesch, Lois
Sent: Monday, July 23, 2012 3:24 PM
To: Gunderson, Jessica
Cc: Flickinger, Eric; Silverblatt, Tara
Subject: FW: BONN BI-Authority- Last lines or include all as you see fit

For the EDR

-----Original Message-----
From: Richards, Natalie A NWP [mailto:Natalie.A.Richards@usace.army.mil]
Sent: Monday, July 23, 2012 2:56 PM
To: Richards, Natalie A NWP; Henrie, Gary S NWP; Loesch, Lois
Cc: Roy, Elizabeth W NWP
Subject: BONN BI-Authority- Last lines or include all as you see fit

Authority:
• 1848 - sec 12, Oregon Territorial Act, fish passage on Columbia required for salmon at any man-made blockage
• 1888 - Authority for fish ladders at Corps dams and locks (RHA Aug 1888)
• 1934 - First major salmon fish study - USFWS; first Fish & Wildlife Coordination Act (16 USC 662)
• 1937 - Bonneville Project Act (16 USC 832 - Corps -BPA partnership)
• 1950 - H Doc 531 Columbia River basin master plan; includes Dalles & John Day Dams, plus Hatcheries; large expansion of Willamette Basin flood control project dams (all but Foster)
• 1970's - Boldt fish treaty litigation: treaty rights extended from just fishing site access to 50% share of fishery; US v Oregon implements for Columbia River; Zone 6 created (Bonn to McNary dams)
• 1980 - Pacific NW Power Act (16 USC 839); Salmon & Steelhead Act; Magnusson-Stevens Act EFH amendments
--->>>>>>• 1988 - CRTFAS Act; CRFM program authorized in appropriations act<------
--->>>>>>• 1990's - 2000's - ESA litigation over salmon (16 USC 1536); WRDA Sec 511 authority for CRFM<-------

-----Original Message-----
From: Richards, Natalie A NWP
Sent: Monday, July 23, 2012 2:43 PM
To: Henrie, Gary S NWP; Loesch, Lois
Cc: Roy, Elizabeth W NWP
Subject: FW: Scanned Document

All,
Here is the powder coating specification. Still looking into the Authorization.
Natalie

-----Original Message-----
From: Natalie.A.Richards@usace.army.mil [mailto:Natalie.A.Richards@usace.army.mil]
Sent: Monday, July 23, 2012 2:29 PM
To: Richards, Natalie A NWP
Subject: Scanned Document

Please see the attached document.

Silverblatt, Tara

From: Loesch, Lois
Sent: Wednesday, July 25, 2012 6:27 AM
To: Vose, Scott; Pace, Ike
Cc: Gunderson, Jessica; Flickinger, Eric; Silverblatt, Tara
Subject: FW: Scott Harvey Comment

Please update the estimate to account for this.

Sent from my Android phone using TouchDown (www.nitrodesk.com)

-----Original Message-----
From: Perletti, Kevin P NWP [Kevin.P.Perletti@usace.army.mil]
Received: Tuesday, 24 Jul 2012, 8:12am
To: Loesch, Lois [Lois.Loesch@tetratech.com]
CC: Henrie, Gary S NWP [Gary.S.Henrie@usace.army.mil]; Roy, Elizabeth W NWP [Elizabeth.W.Roy@usace.army.mil]
Subject: Scott Harvey Comment

Lois,

From yesterday's meeting there was a comment that was attributed to Scott Harvey concerning the need for a barge crane to do work on diffusers located in the adult fish channel. I talked with Scott this morning and he confirmed that there is NO need for a barge crane to do any work that has been discussed in the adult channel or other areas around the AWS and the channel. He thinks the discussion about a barge crane was probably related to if we ever had a need to tried to pull one of the concrete stoplogs that were installed in the entrance slots along the face of the powerhouse. These concrete stoplogs were dropped and then pounded into place. To remove one of those would probably take a barge crane. But these stoplogs should not need to be removed for any repairs being considered in the BI fishladder assessment.

Kevin

Kevin P. Perletti P.E.
Mechanical Engineer
Bonneville Lock and Dam
Cascade Locks, OR. 97014
541-374-4572
541-374-8761 Fax
kevin.p.perletti@usace.army.mil

From:	Loesch, Lois
Sent:	Friday, July 27, 2012 3:34 PM
To:	Flickinger, Eric; Gunderson, Jessica
Cc:	Silverblatt, Tara
Subject:	FW: HSS Inspection Reports (UNCLASSIFIED)
Attachments:	Bonneville_HSS_Inventory.xls

-----Original Message-----
From: Henrie, Gary S NWP [mailto:Gary.S.Henrie@usace.army.mil]
Sent: Friday, July 27, 2012 3:00 PM
To: Loesch, Lois
Cc: Perletti, Kevin P NWP; Roy, Elizabeth W NWP; Crump, Michael A NWP; Mason, Bryan C NWP
Subject: RE: HSS Inspection Reports (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Lois,

The attached excel file contains the most current Bonneville Dam Fishway HSS inspection information we could find.

Gary Henrie
CENWP-EC-HD
503-808-4831

-----Original Message-----
From: Loesch, Lois [mailto:Lois.Loesch@tetratech.com]
Sent: Friday, July 27, 2012 2:00 PM
To: Henrie, Gary S NWP; Roy, Elizabeth W NWP
Cc: Perletti, Kevin P NWP
Subject: HSS Inspection Reports

Do you have any information on these for us to add to our 100% Bradford Island Submittal on Monday?

Lois A. Loesch, P.E. | Senior Project Manager

Dir: 425 732-5708 | Cell: 206-919-4309 | Main: 425 635-1000 | Fax: 425 635-1150

lois.loesch@tetratech.com <mailto:lois.loesch@tetratech.com>

Tetra Tech | Complex World, Clear Solutions

400 112th Ave NE, Ste 400 | Bellevue, WA 98004 | www.tetratech.com <http://www.tetratech.com/>

Classification: UNCLASSIFIED
Caveats: NONE

HSS Inventory -- Bonneville Dam

Compiled by: Kevin Perletti
Last Updated: 2/10/2012

HSS inspection reports for these features are on file in the Corps project folders
Z:\Miscellaneous_Projects\Hydraulic_Steel_Structures\Reports_Repository\Bonneville

HSS Description & Project POC	HSS ID or Designation	Drawing Number	Remarks
BONNEVILLE			
FISHWAYS			
Around PH 1			
Entrance Gate Bulkheads		T-7-1A, 1B, 1C1	Repaired, Dec 2005
Transverse Bulkheads			Repaired, Dec 2005
Fingerling Bypass Channel Supply Valve			Has been closed for years
Fingerling Bypass Channel Bulkhead			Has been down for years
FV-1-1 Valve	FV 1-1	T-7-60	Jan 21-Feb 23, 2004
FV 1-1 Bulkhead	FV 1-1 BH	T-7-62, Sh 2	Email on 19 Dec recommended we change the bolts on the lifting device. This has been done. Gate safe for use.
FV 1-2, 1-3, and 1-4 Valves		T-7-60	FV1-2 has been closed for years. FV1-3 and FV1-4 removed many years ago
FV 1-2, 1-3, and 1-4 bulkheads			Has been down for years
FG 1-2, 1-3 and 1-4 Valves			Has been down for years
Around A&B Branch Fishladder			
FV 3-7 Valve		T-7-61	Jan 21-Feb 23, 2004
FV 3-7 Bulkhead	FV 3-7	T-7-62 Sh 3	Bulkhead safe for use. Lubricate wheels
FV3-9 Vavle		BDX-3-3/1, 2, 3	Jan 21-Feb 23, 2004
FV 3-9 Bulkhead	FV 3-9	BDF-2-2/1, 2, 3, 4, 5	Bulkhead safe for use. Lubricate wheels
Ladder Aux Water Intake Bulkheads (sets)	FL-AWS	None -	
Ladder Exit Bulkhead (set of 5)	LE	BDF-3-3/5	Bulkhead safe for use. Lubricate wheels
Backwash Tainter Valve		BDF-3-3/3	Not used in at least 15 years, Should inspect when ladder is dewatered.
Around Spillway Dam			
FV 4-3			
FV 4-4			
FV 4-3 & 4-4, or 5-3 & 5-4 Bulkheads(2 small, 8 large)	SWFVEB		Jan 21-Feb 23, 2004
South Spillway Fingerling BP Valve		T-7-62, Sheet 5	Has been Closed for years
Bulkheads for Entrance Gate (N and S)		T-7-70A/1, 70A/2	13 inspected, 12 others in water
Bulkheads for Entrance Gate (N and S)		T-7-70A/1, 70A/2	12 inspected (Pulled out of slot between ladders and bays 1 and 18). Some minor repairs to a few. Most bulkheads do not see water but are stacked out of water on top of others.