US Army Corps of Engineers ®

Draft Value Study Report

The Dalles AWSBS Debris Management Project

Columbia River Basin, The Dalles, Oregon
Portland District

P2 No.: TBD

Value Study No: TBD

Workshop Dates: 9-19 August 2021

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EXECUTIVE SUMMARY

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US Army Corps of Engineers®

The Dalles AWS Backup Debris Management

Project Location:	**The Dalles, Oregon**		
District or Division:	**Portland**	**Program: TBD**	
Value Study Date:	9-19 August 2021	**Project No.: TBD**	
Value Study Timing:	Criteria & Constraints	**Original Project Cost:**	**TBD**

RECOMMENDED / ACCEPTED RESULTS

Reliability:	TBD	**Initial Cost Avoidance:**	$1,000,000
Operations & Maintenance:	TBD	**Schedule Savings:**	6 months
Functionality:	TBD	**Return on Investment:**	20:1

PROJECT OVERVIEW

The Dalles Lock and Dam is 192 miles upriver from the mouth of the Columbia River and two miles east of the city of The Dalles, OR. The Auxiliary Water System (AWS) supplies water to the east, west, and south fish ladder entrances to attract upstream migrating adult fish. Water is currently supplied to the AWS by two fish turbine units located on the west end of the powerhouse.

The East Fish Ladder AWS Backup System (AWSBS) was designed and constructed to provide an emergency backup supply of water to the AWS, when one or both fish turbine units fail, and design AWS flow is not available.

A trash rake was recommended in the DDR, but during P&S the PDT decided to eliminate the trash rake mainly because of the emergency usage of the system. Currently, operations staff turn off the AWSBS and allow the river to drift debris off the trash rack screens when needed. This process successfully clears the trash racks after debris builds up during emergency operations.

The strategy for operation of the AWSBS is changing to more frequent use and with the upcoming Fish Unit Rehabilitation Project, starting in 2024, the AWSBS will be required to be operational for at least two years to provide adequate flow for fish attraction during fish unit rehabilitation.

The purpose of The Dalles Auxiliary Water System Backup System (AWSBS) project is to evaluate and decide what actions are needed to manage the debris build up on the trash racks located at the entrance of the East Fish Ladder AWSBS inlet.

VALUE STUDY BENEFITS

The main benefit of the value study was to assist the project team in prioritizing potential alternatives for managing debris build up on the trash racks utilizing tools from the Value Methodology. These tools are typically used later in the project development cycle. The team used Paired Comparisons to prioritize the relative importance of the project criteria. The team also performed Function Analysis on the project criteria to develop additional alternatives (value proposals). The prioritized criteria were then used to evaluate which existing and new alternatives best met the project criteria.

KEY RECOMMENDATIONS

The value team developed nine proposals and prioritized five existing alternatives to meet project criteria. Utilizing the prioritized project criteria, the team's evaluation identified the following proposals and/or alternatives as providing best value:

- Automate the valve cycling process (ML-4)
- Install level sensors to tie into the project SCADA
- Use a brush instead of a trash rake (ME-1)
- Utilize a horizontal backspray manifold (MF-2)

Four quality review comments (QRC) were also identified for consideration by the PDT.

VALUE STUDY BACKGROUND

KEY CHALLENGES AND ISSUES

For dam safety purposes, the AWSBS consists of flow closure redundancies including a closure gate at the inlet and three butterfly valves – one 10-foot and two 7-foot. These butterfly valves were designed for a life of 1,400 cycles and turning the system on and off continuously to float debris off trash racks will reduces the remaining design life of the 7-foot butterfly valves. There are currently no spare parts for these butterfly valves and replacement parts are long-lead items (up to 6+ months).

It is not yet known how often the AWSBS trash racks will require cycling to float off debris during the anticipated two-year fish rehabilitation project starting in 2024. Two potential scenarios discussed during the study have significantly different impacts to the butterfly valve life cycle. If performed nightly, about 730 cycles would be performed. However, if only performed weekly, about 104 cycles would be performed.

CONSTRAINTS

The key project constraints are summarized below:

- Environmental protection and compliance to be considered during all design work and repairs, including compliance with NOAA, NMFS, and CRS BiOp
- In water work to be performed during established IWW period
- Forebay deck to remain open to deck traffic to not interfere with ongoing dam O&M functions
- 7-foot butterfly valves not to exceed design life of 1,400 cycles
- Maintain existing flowrate through trash racks
- Equipment mounting to the existing structure will be limited to the face of the dam and the deck of the existing AWSBS Precast structures
- Debris management solution cannot use project mobile crane
- Remote monitoring and operation of the debris management system available 24/7 by existing operators

VALUE STUDY OBJECTIVES

The Engineering Design Report (EDR) identifies 16 potential alternatives to the trash rake – nine using the existing trash racks and seven using modified or new trash racks. To assist the PDT during the Criteria and Constraints phase, a value study was held to utilize the Value Methodology to both evaluate the 16 potential alternatives based on the project Criteria and Constraints previously identified in the EDR, as well as identify new potential alternatives. The value study objectives were:

- Identify key project risks
- Use weighted paired comparisons to develop performance criteria

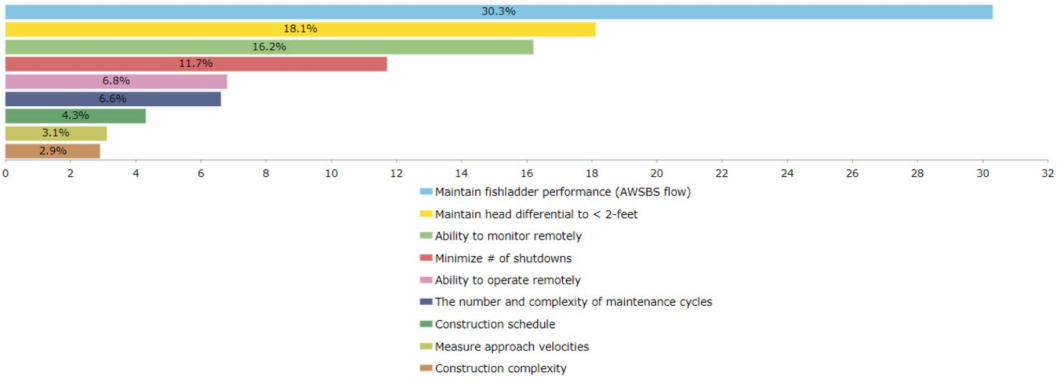
- Rank existing alternatives
- Develop and rank proposals and enhanced alternatives

VALUE STUDY HIGHLIGHTS

During the value study, various tools were used to help the project team identify existing alternatives and develop new proposals to best meet project criteria. The team performed a risk assessment which identified two high priority risks:

- Adequate funding might not be available for construction of a debris management solution due to expected depletion of the project funding source (the Columbia River Fish Mitigation (CRFM))
- A new debris management system might not be in place by the start of the fish unit rehabilitation, requiring continued butterfly valve cycling to remove debris from the trash racks

As mentioned earlier, weighted paired comparisons was used to develop performance criteria for ranking existing alternatives and new proposals. The graph below shows the results of this analysis, which shows maintaining fish ladder performance (AWSBS flow), maintaining head differential below 2', and the ability to monitor the head differential remotely were the most important project criteria to use.



Function Analysis was used to help the team gain a better understanding of both project criteria and constraints. For example, two functions of *maintaining fish ladder performance (AWSBS flow)* include Optimize AWSBS Flow and Maintain Entrance Criteria. By understanding these functions, the team brainstormed on alternative ways to achieve these functions which led to the development of proposal MF-2 (travelling horizontal backspray manifold), ME-1 (install level sensors to tie into project SCADA systems), and ME-2 (modify entrances to ladders to use less flow).

All proposals, as well as the team's assessment of the top five existing potential alternatives, were evaluated against the performance criteria developed using the weighted paired comparisons which yielded the four recommended solutions referenced earlier in this summary.

This value study demonstrated the potential of using the Value Methodology, and specifically weighted paired comparisons, as a tool to expedite the Constraints & Criteria project development phase.

VALUE STUDY RESULTS & PROPOSALS

VALUE STUDY PROPOSALS

INTRODUCTION

The value team developed nine value proposals for consideration by the project team. The team reviewed all of the proposals presented in this report and have created a “recommended” list of value proposals. This set of recommended value proposals was viewed to offer the best overall value to the project considering performance, criteria, and constraints. To avoid confusion with the numerical proposed alternatives identified in the EDR, these value proposals will retain the alphanumerical numbering system generated during the value study.

Following this section of the report are the individual value proposals. Each proposal provides detailed technical information that includes descriptions, narratives, sketches, and estimates.

Table of Value Proposals

No.	Proposal Title	Initial Cost Avoidance	LCC Cost (Gross)	Schedule Savings	Preliminary Decision	Preliminary Decision Rationale
IR-2	Test debris boom for effectiveness in reducing debris build up on trash racks	TBD	TBD	TBD	TBD	
ME-1	Realign road next to Bldg. 101 to increase standoff	TBD	TBD	TBD	TBD	
MF-2	Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating	TBD	TBD	TBD	TBD	
ML-2	Acquire spare parts for the 7-foot butterfly valves	TBD	TBD	TBD	TBD	
ML-4	Replace 7-foot butterfly valve seals after completing fish unit rehab	TBD	TBD	TBD	TBD	
PF-2	Pull the racks at night or during a shutdown for manually cleaning	TBD	TBD	TBD	TBD	
PF-3	Construct additional racks so existing may be pulled and rotated for thorough cleaning	TBD	TBD	TBD	TBD	
PS-1	Convey running tally on 7-inch butterfly valve cycles to operators	TBD	TBD	TBD	TBD	

QUALITY REVIEW COMMENTS

Review comments represent another category of recommendations. Review comments are observations made during the value team's review and are not typically the result of Function Analysis or creative thinking. Common examples of review comments include errors, omissions, estimate corrections, schedule corrections, and document quality issues. Review comments do not require a formal response to accept or reject. The types of comments that would fall into this category could include, but are not limited to:

- Errors
- Omissions
- Schedule Corrections
- Estimate Corrections
- Document Quality Issues

The quality review comments submitted by the value team can be found on the following pages.

REVIEW COMMENT AO-3

Dedicated camera inspection system during fish unit rehabilitation

REVIEW COMMENT SYNOPSIS:

A dedicated camera inspection system would be utilized to assist operations in performing visual inspection of debris buildup on the trash racks.

PERFORMANCE	Degraded	Maintained	Improved
Fish ladder Performance			✓
Head Differential			✓
Approach Velocities		✓	
Remote Monitoring			✓
Remote Operating		✓	
AWSBS Shutdowns		✓	
Maintenance			✓
Constructability		✓	

Discussion: The operations staff at The Dalles currently utilizes head differential measurements to determine if and when the AWSBS needs to be cycled off to float off accumulated debris on the trash racks. To assist with this operation, a dedicated camera inspection system, similar to the Aqua-Vu HD101 shown below, could be installed to provide visual inspections of the trash racks.

The camera system runs along a cable that is anchored to the river bottom and can be operated to travel up and down the cable. A fin installed on the top of the camera housing ensures that the water flow directs the camera lens toward the trash racks. The camera could be used in lieu of, or in conjunction with, a Remotely Operated Vehicle (ROV) inspection system. The camera would only be utilized during the fish unit rehabilitation, when the AWSBS will be used continuously.

REVIEW COMMENT IR-1

Include two debris management systems (primary and secondary)

REVIEW COMMENT SYNOPSIS:

Include a primary and secondary debris management system.

PERFORMANCE	Degraded	Maintained	Improved
Fish ladder Performance			✓
Head Differential			✓
Approach Velocities		✓	
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance	✓	✓	
Constructability	✓	✓	

Discussion: The VE study team suggests adopting an alternative secondary debris management system. An added benefit of a secondary system would increase reliability of the system and reduce the risk of a ladder going out of criteria from shutdowns. This could be a much simpler solution with limited infrastructure needed. The VE team suggested contract divers to clean the screen when necessary. Also, there would be the need to investigate cleaning from a boat or barge.

REVIEW COMMENT MF-6

Eliminate the fish units and redesign the penstock

REVIEW COMMENT SYNOPSIS:

Investigate removing fish units and redesign penstock to provide flow into ladder.

PERFORMANCE	Degraded	Maintained	Improved
Fish ladder Performance			✓
Head Differential		✓	
Approach Velocities		✓	
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability	✓		

Discussion: The VE study team suggests investigating the feasibility of removing the fish unit turbines and redesigning the penstock to provide adequate flow into the East fish ladder to meet ladder criteria. This would eliminate the need to replace the fish unit turbines and instead have a simpler system that would be more reliable and less prone to failure in the future. It would reduce the replacement cost and maintenance of the current system being proposed for replacement.

The concept would require energy dissipation and a series of orifices which may not be feasible with the configuration of the fish units. This would result in a substantial loss of revenue of approximately $7M per year, associated with the fish units' power generation.

HD: This would require a long study to determine whether and how the energy is dissipated over

REVIEW COMMENT UE-2

Sequence functions to minimize power load

REVIEW COMMENT SYNOPSIS:

This would reduce the likelihood of overloading the 175A breaker at FCQ7 by sequencing the startup operations of all equipment attached to the breaker to minimize total simultaneous inrush current.

PERFORMANCE	Degraded	Maintained	Improved
Fish ladder Performance			✓
Head Differential			✓
Approach Velocities			✓
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Discussion: There are several debris management design alternatives and value proposals that would require additional power loads from the 175A breaker at FCQ7. To maintain fish ladder operations, standard operating procedures (SOP) should be created to ensure that equipment startup is sequenced on FCQ7's electrical bus to reduce inrush current. Currently, the highest load on FCQ7's 175A breaker is the 100A breaker feeding panel BVCC10, which controls the actuator valve's operation of opening and closing (13 minutes, 0.75 HP, ~3A max inrush current was as measured during initial commissioning).

If any additional equipment is added to FCQ7's electrical bus, load calculations will need to be performed. In addition to reducing inrush current with proper sequencing, simultaneous operation of equipment might also need to be limited based on what is being added to the bus. Where possible (and if feasible), a fail-safe system could be implemented, as well.

VALUE PROPOSAL IR-2

Test debris boom for effectiveness in reducing debris build up on trash racks

VALUE PROPOSAL SYNOPSIS:

This proposal would test a potential system to reduce or prevent debris buildup on the trashrack.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance			✓
Head Differential			✓
Approach Velocities			✓
Remote Monitoring			✓
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance	✓		
Constructability	✓		

Baseline Concept Description: The baseline concept is to continue existing operations and cycling the valves to release debris from the trash racks.

Value Proposal Description: This proposal suggests adding a floating debris boom with a floating debris curtain that will be tested to see if debris can be routed around the intake and debris buildup can be reduced.

Advantages:

- Construction would take place in the reservoir – no need to drain the AWSBS
- The debris boom can be readily installed
- If the floating boom and the floating curtain are found to be ineffective, then they can be easily removed
- To reduce fatigue on the floating boom or floating curtain, they could be deployed during the heavy debris season (May through November); installation could occur in April before the spring snowmelt flows arrive

Disadvantages:

- With the floating boom, debris management would be limited to the surface of the reservoir. Debris at deeper depths may still accumulate on the trashrack
- With the floating curtain, debris may accumulate on the curtain
- A debris boom with a curtain would reduce the sweeping flow for the surface area and potentially capture debris that has been clean from the trash rack resulting in the re-entrainment of the debris on the trashrack

VALUE PROPOSAL IR-2

Test debris boom for effectiveness in reducing debris build up on trash racks

Performance Impacts:

- **Fish ladder Performance:** Some improvement in fish ladder performance is possible– magnitude to be estimated from tests.
- **Head Differential:** Some improvement in fish ladder performance is possible – magnitude to be estimated from tests.
- **Approach Velocities:** Some improvement in approach velocities is possible – magnitude to be estimated from tests.
- **Remote Monitoring:** If a debris boom is used, the VA team assumes it would be in conjunction with installation of remote monitoring.
- **Remote Operating:** There is currently no remote operating.
- **AWSBS Shutdowns:** Some improvement in AWSBS shutdowns is predicted – magnitude to be estimated from tests.
- **Maintenance:** More maintenance may be needed to reduce or eliminate buildup of debris on floating boom and on floating curtain.
- **Constructability:** The floating boom and floating curtain will need to be anchored securely to withstand hydraulic load especially if there is debris buildup. It may be challenging to drill and anchor in the Columbia River Basalt.

Discussion: A phased approach would be used to test this proposal. The floating debris boom only would be tested first. The floating debris curtain would then be added to the debris boom and the assembly tested.

Potential alignments of the floating debris boom and the floating debris curtain include a triangle and a semi-circle.

Effectiveness of both concepts would be evaluated by monitoring the following:

- Measurement of head differential at the trashrack
- Observations of debris accumulation on the trashrack (determine if a reduction has occurred)
- Measurement of approach flow velocities with Acoustic Doppler Current Profiler (ADCP); given the variability of debris loading, these measurements may be the most reliable indicator of effectiveness
- Observations of debris buildup on the floating debris boom and the hanging curtain
- Measurement of hydraulic load on floating debris boom and floating debris curtain

The floating boom would be less effective in reducing debris buildup at the trashrack than the floating curtain. The risk of debris buildup on the floating curtain would be greater than it would be on the floating boom. The approach velocities to the curtain would be smaller than the approach velocities to

the trashrack. So, debris buildup on the curtain may be of less concern than debris buildup on the trashrack.

As laid out in the figures, the floating boom and floating curtain would not interfere with fish exiting the ladder.

Review Comments: There was concern about the situation with the curtain as the team was not sure how that could be constructed. Maintenance would also be a concern. There is also currently a boom located in this area for oil; it would be convenient to have a boom for both oil and debris.

Baseline Concept Sketch

Plan View of Existing Entrance to AWSBS

HD: Recommend we implement Alt-4-1 instead of a temporary boom or curtain. Alt 4-1 would represent a supporting component to an overall solution. The alignment proposed for Alt 4-1 would likley be more successful tat diverting surface oriented debris downstream than as shown in this proposal.

The PDT has serous design concerns about a curtain due to heavy hydraulic loads. Temporary implementation would likely be costly and problematic.

VALUE PROPOSAL IR-2

Test debris boom for effectiveness in reducing debris build up on trash racks

Proposal Concept Sketches

Plan view of existing entrance to AWSBS with triangular and semicircular floating boom or floating curtain

VALUE PROPOSAL ME-1

Install level sensors to tie into project SCADA system

VALUE PROPOSAL SYNOPSIS:

This proposal provides monitoring of the water level differential across the Auxiliary Water System Backup System (AWSBS) trashrack which is a direct indication of the level of debris accumulation on the trashrack.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance			✓
Head Differential			✓
Approach Velocities			✓
Remote Monitoring			✓
Remote Operating			✓
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The baseline condition assumes that the differential across the trashrack is not monitored by the Supervisory Control and Data Acquisition (SCADA) system and measurement is limited to direct observations.

Value Proposal Description: The idea of this proposal is to install level sensors to measure the water surface differential across the AWSBS trashrack, connect to the SCADA system, effectively display alarm conditions for the operations personnel, and provide automatic and remote initiation of the trashrack cleaning process.

Advantages:

- Reduces the risk of the trashracks failing structurally during extreme debris loading
- Allows the AWSBS to provide full flow and maintain optimal attraction flow when only one Fish Unit and the AWSBS are operating
- Allows for automated cleaning cycles to be initiated
- Reduces the labor required to observe the conditions at the trashrack
- Reduces the labor required to initiate cleaning of the trashrack if the cleaning system is automated
- Automatic trashrack cleaning can be scheduled at night when a shutdown of the AWSBS has less impact on the passage performance of upstream migrating fish

Disadvantages:

- Connection may be difficult at this location to achieve reliable communication between the level transmitters and the SCADA system

VALUE PROPOSAL ME-1

Install level sensors to tie into project SCADA system

Performance Impacts:

- **Fish ladder Performance:** This optimizes performance by maintaining the best flow conditions at the fish ladder entrances with just one Fish Unit operating in addition to the AWSBS**.**
- **Head Differential:** This minimizes the head differential across the trashrack by alerting the condition of a dirty trashrack and proactively scheduling a shutdown for rack cleaning or initiating other means of cleaning.
- **Approach Velocities:** This would help maintain low approach velocity near the surface. Approach velocities tend to be higher adjacent to the AWSBS pipe inlet at the bottom of the trashrack and lower at the top which is desirable because fish tend to be oriented toward the surface at this location. As the trashrack plugs up the approach velocity near the surface increase along with the possibility of harming fish by entrainment or impingement on the trashracks.
- **Remote Monitoring:** Remote monitoring of the trashrack head differential would be enabled.
- **Remote Operating:** This enables remote and automatic cleaning of the trashrack.
- **AWSBS Shutdowns:** AWSBS shutdowns would be scheduled at night when the upstream fish passage is least impacted.
- **Maintenance:** Maintenance would be reduced by limiting manual observations and would allow the ability to better manage and possibly automatically initiate trashrack cleaning (this is particularly beneficial during harsh weather conditions).
- **Constructability:** Level or differential sensors can be readily installed. The difficulty of establishing communications between the sensors and the existing SCADA system is unknown.

Discussion: In general, this proposal has significant advantages with little downside associated with cost and time. The ability to readily monitor the differential across the AWSBS trashracks provide two major benefits by protecting the trashracks, protecting fish from being entrained or impinged by the trashracks, and maintain the best fish ladder entrance conditions while operating the AWSBS and only one of the Fish Units for attraction flow.

The trashracks are designed for a water differential of 5 feet. The AWSBS has the potential of exceeding this differential by approximately 10 times that amount during extreme debris loading and if the butterfly valves are not closed efficiently. A catastrophic failure of the trashrack would likely result in passing significant debris onto the upstream side of the attraction flow diffuser panels that are very difficult to clean and result in a lengthy shutdown of the associated fish ladder and significant delay of upstream migratory fish.

As the trashracks plug up with debris the flow seeks out the least path of resistance and debris tends to be uniformly distributed across the face of the trashrack. The higher velocities through the trashrack that tend to be oriented at the bottom shift up and increase overall across the screen putting the surface-oriented fish more at risk of being entrained into the AWSBS system (which would likely be

fatal) or impinged on the trashrack. This proposal prevents this condition by automatically scheduling shutdown when a relatively low differential setpoint is met and the operator is alerted via the SCADA system, or a cleaning event is automatically initiated.

Plugging the trashrack reduces the flow to the fish ladder attraction water system and could result in delay of upstream migratory fish.

There are several different level transmitters that can be used to measure the differential across the trashrack. Typically, the differential is measured by using a level transmitter upstream of the trashrack and one downstream then subtracting the upstream level from the downstream. Different transmitters include:

- Submersible transducers that measure the pressure at a known elevation
- Ultrasonic transmitters that bounce a sound wave off the water surface from a known elevation
- Radar transmitters that measure down from a known elevation to the water surface using radar
- Differential submersible transmitters that directly measure the pressure difference (requiring a sensing tube to either the upstream or the downstream side of the trashrack depending on which side the transmitter is positioned)

Any of these types of transmitters can be used, but an important consideration is matching the type of transmitter already used on the project for the benefits of familiarity to the operation and maintenance staff and uniformity for spares.

Placing the transmitters in stilling wells will help dampen wave oscillations and protect the transmitters.

Two sets of each upstream and downstream transmitter would provide redundancy and ensure that an erroneous reading is not produced if a given transmitter fails.

Communication with the SCADA can be achieved over a variety of pathways depending on the type, preference, and difficulty of the pathway to the existing SCADA system. A few options include:

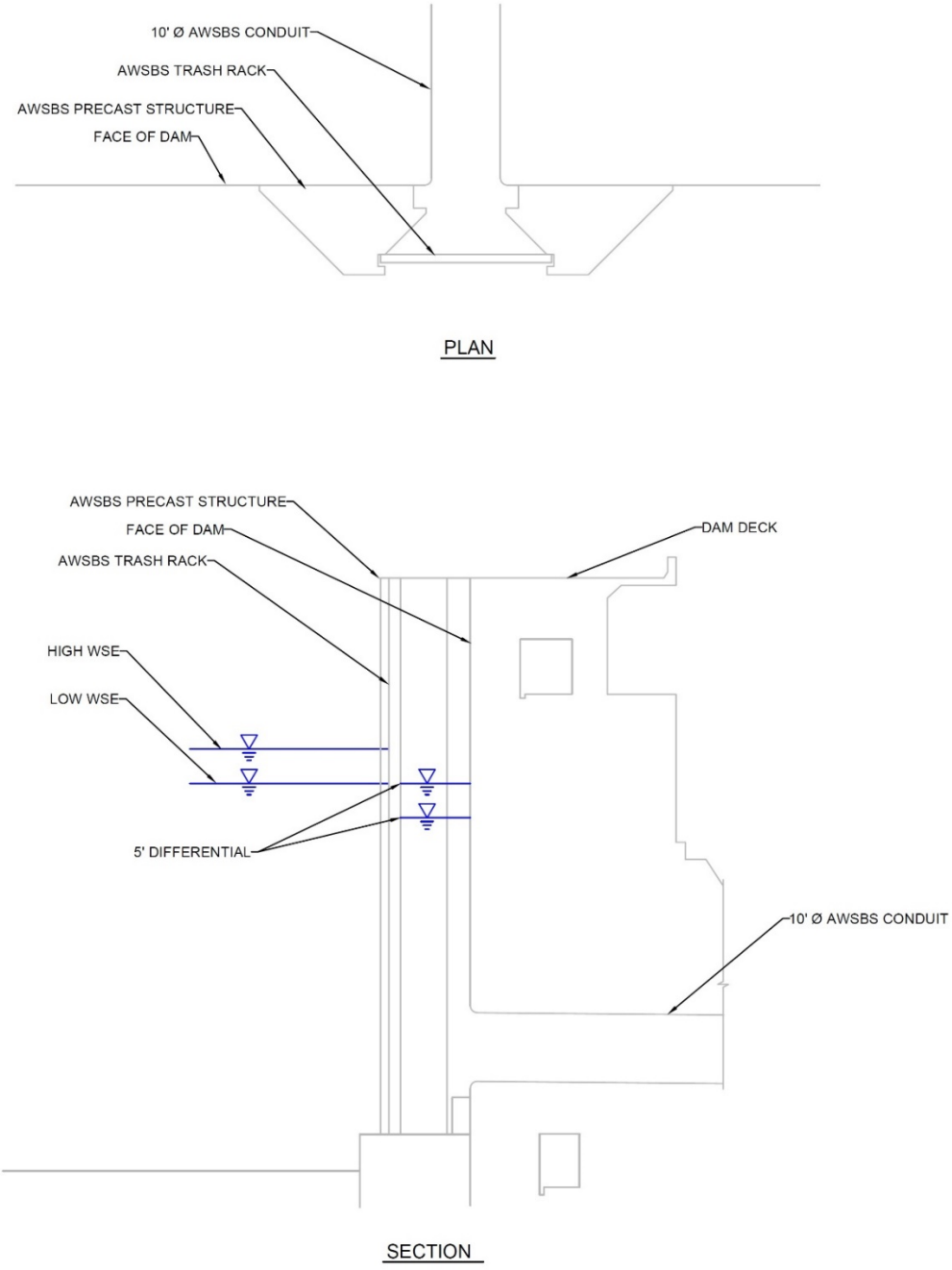
- 4-20 mA electrical current signal from each of the transmitters over multiple pairs of wires
- A local network that communicates digitally over a single pair of wires (limited distance)
- Ethernet communication over fiberoptic cable (extended distance)
- Radio communications digitally with another radio on the SCADA system

Review Comments: It was noted that, while this proposal was well received, a delay would occur in deciphering shutdown times for the valves; the delay time would be calculated through learned experience.

VALUE PROPOSAL ME-1

Install level sensors to tie into project SCADA system

Baseline Concept Sketch

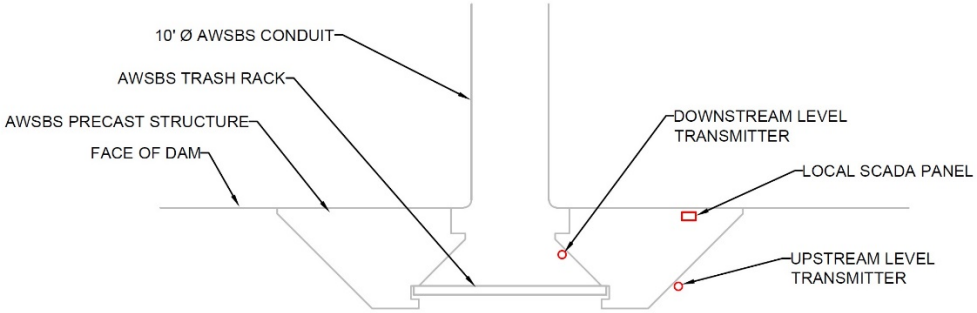


AWSBS Existing Plan and Section

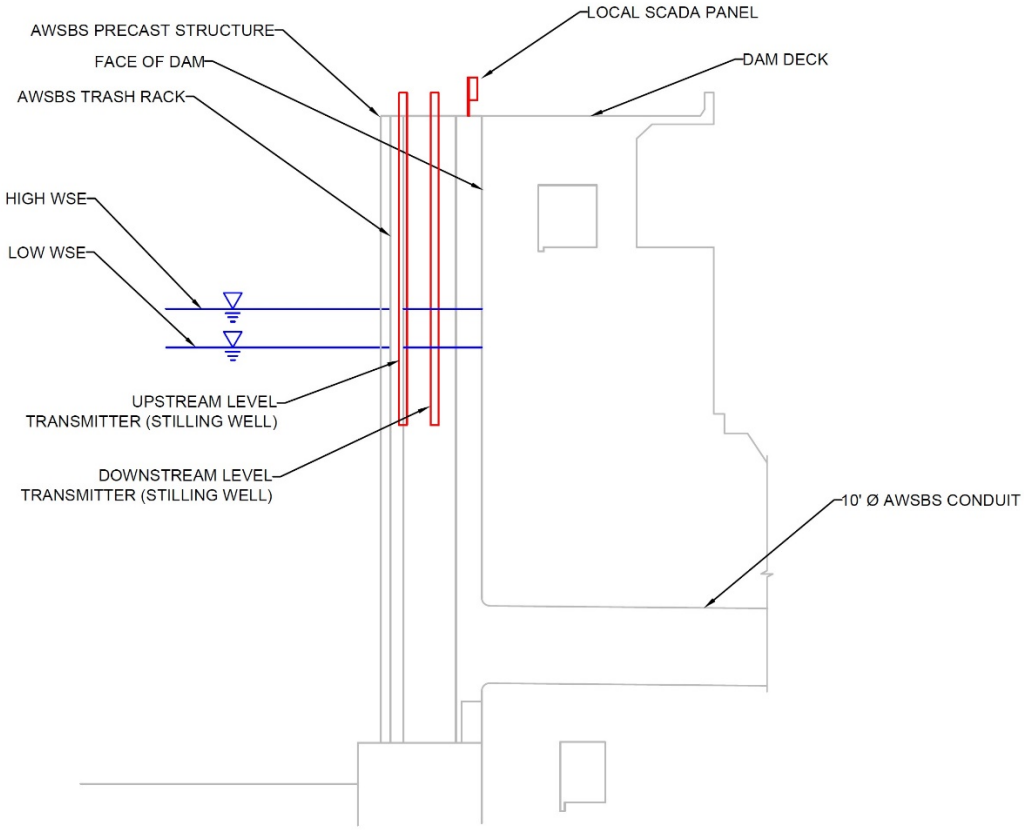
VALUE PROPOSAL ME-1

Install level sensors to tie into project SCADA system

Proposal Concept Sketch



PLAN



SECTION

AWSBS with Level Transmitters

VALUE PROPOSAL ME-1

Install level sensors to tie into project SCADA system

Assumptions and Calculations:

- Two each level transmitters
- Two each stilling wells (approximately 6-inch Sch 40 steel pipe x 45 feet long)
- Local control panel (connect level transmitters to SCADA system)
- Coring, conduit, and wiring/fiber optic to connect level transmitters to SCADA system
- Optional radio communication with SCADA system
- Extend AC power to local panel (power supply possible battery backup)
- Option photovoltaic system to power local transmitters
- Optional 4-20 mA control signal loop power of transmitters
- Expansion of analog inputs to accept Level inputs
- Expansion of network communication for SCADA if needed

SCADA system programming will incorporate inputs, translate to level differential in feet, display status of differential on central display, generate alarm conditions, annunciate alarms on the central display, generate alarm text or calls, and programming for automatic/remote operation of cleaning.

VALUE PROPOSAL ME-2

Modify entrances to ladders to use less flow

VALUE PROPOSAL SYNOPSIS:

This proposal would operate the East fish ladder entrances without the need for the AWS backup system to operate.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance	✓		
Head Differential		✓	
Approach Velocities		✓	
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The assumption is the ladder would run on one fish unit and keep the AWSBS as a backup.

Value Proposal Description: The proposed concept would eliminate the need to operate the AWSBS by modifying the entrance operations and rely on flow from one fish unit for attraction flow; this would eliminate the cycling of the valves which would increase their longevity and reduce maintenance to the system.

Advantages:

- Limit the number of maintenance cycles
- Construction of new system not needed
- Approach velocities are eliminated

Disadvantages:

- Fishladder performance degraded
- No remote monitoring or operation
- Difficult to obtain regional approval

Performance Impacts:

- **Fish ladder Performance:** Fish ladder performance would be negatively affected by closing entrance weirs which would cause delay to fish passage.
- **Head Differential:** The head differential would be maintained.
- **Approach Velocities:** The current approach velocities are maintained by the proposal.

VALUE PROPOSAL ME-2

Modify entrances to ladders to use less flow

- **Remote Monitoring:** No remote monitoring is required.
- **Remote Operating:** No remote operation is required.
- **AWSBS Shutdowns:** With the system not operating, the number of shutdowns would be reduced.
- **Maintenance:** Maintenance would be reduced by the system not needing to operate unless an outage occurred to one of the fish units.
- **Constructability:** There is no construction required in this proposal.

Discussion: This proposed alternative would modify entrance operations to reduce the amount of flow needed to operate the fish ladder.

The current trashracks would be used as the primary debris management system. A new system would not be constructed. This would save on cost and potential scheduling conflicts with the fish unit rehab and other project operations.

A reduction in overall maintenance would be achieved by adopting this proposal. Not cycling the 7-foot butterfly valves would reduce wear and tear on the valves and their component parts. This would save time on performing costly repairs and reduce risk of failure.

Fish ladder criteria from the Fish Passage Plan (FPP) would be greatly affected. Closing entrance weirs at the South and West entrances would limit the available passage routes for migrating fish and leave only the East entrance as the only entrance into the fishway. The risk of delay and straying would increase by limiting flow to one entrance area. The proposal would have to be coordinated and approved through regional forums

Implementing this proposal would likely require very challenging negotiation with the agencies and possible lawsuits from other stakeholders.

Review Comments: As it stands, it is required that two of the three entrances on the east/west and both on the south, remain open. There is potential for the southern entrance to be partially closed.

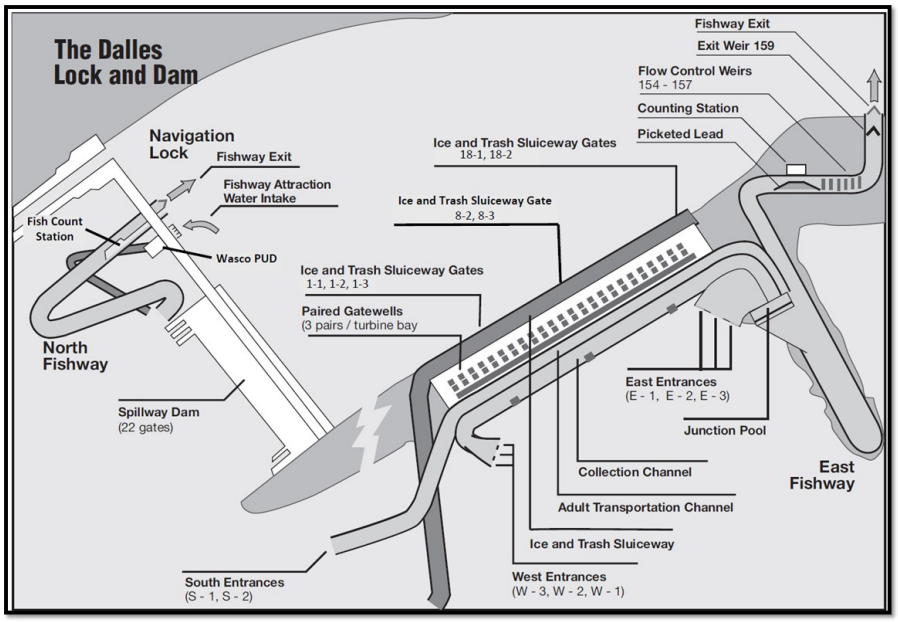
HD: We already recommend a closure of one of the 15-ft wide south entrance gates during a combined AWSBS and single FU operation. Otherwise the system will be operating in full criteria.
Closing additional entrances to allow sole operation of a single fish unit without AWSBS augmentation may be acceptable for short term situation, but is not likely obtain regional acceptance for a duration of a FU rebuild.

Reduction of existing 8-foot wide openings for the East and West entrances would reduce hydraulic signature in the tailrace needed to attract adult fish. Modification of the entrance openings might be a difficult construction.

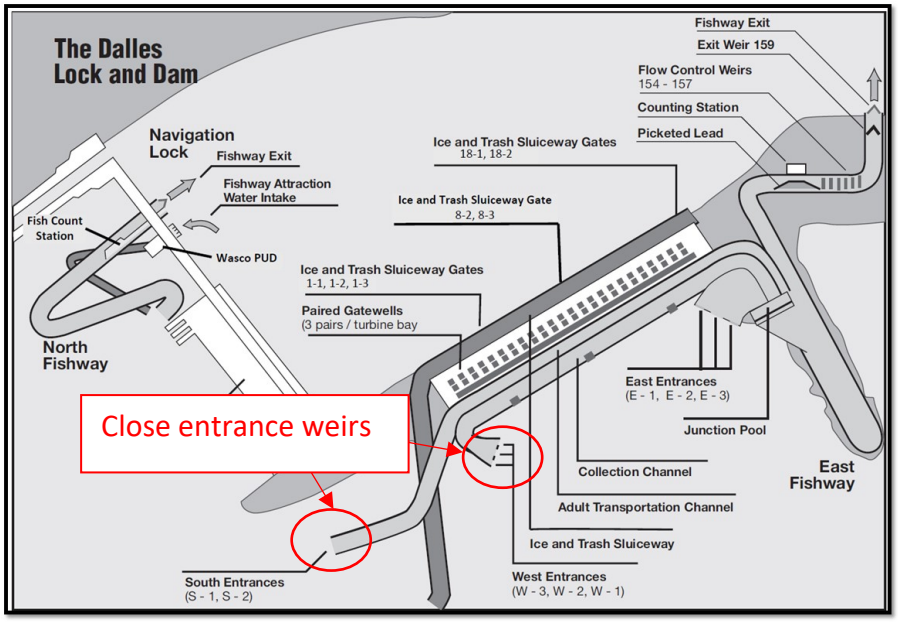
VALUE PROPOSAL ME-2

Modify entrances to ladders to use less flow

Baseline Concept Sketch



Proposal Concept Sketch



East Fish Ladder Entrances at The Dalles Dam

VALUE PROPOSAL ME-2

Modify entrances to ladders to use less flow

Assumptions and Calculations:

- There is adequate flow for acceptable fish ladder entrance differential
- No dual outages are needed during fish unit rehab construction

VALUE PROPOSAL MF-2

Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating

VALUE PROPOSAL SYNOPSIS:

This proposal provides a trashrack cleaning system that can effectively clean the trashracks without having to shut down the AWSBS.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance			✓
Head Differential			✓
Approach Velocities			✓
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The baseline condition assumes that the AWSBS will be cleaned by shutting the 7-foot diameter butterfly valves, thereby stopping flow through the system, and allowing the debris to float off and away from the trashrack.

Value Proposal Description: The proposal suggests constructing a backspray system to clean the trashrack. The system would be located behind the trashrack and consist of a horizonal manifold that can spray water jets across the entire width of the existing trashrack.

Advantages:

- Reduces the risk of the trashracks failing structurally during extreme debris loading by providing effective and fast cleaning
- The backspray jets will push the debris several feet out into the forebay and reduce the risk of the debris re-entraining on the trashrack
- Allows the AWSBS to operate continuously at optimal attraction flow when only one fish unit and the AWSBS are operating
- Reduces the risk of harm to fish by maintaining low approach velocity through the upper portion of the trashrack (where fish vulnerable to entrainment or impingement are likely to be)
- Reduces the cycling of the 7-foot diameter butterfly valves
- Most of the work can be constructed within an area isolated by stoplogs and is therefore not subject to the in-water-work period once the area is isolated

Disadvantages:

- Annual maintenance associated with cleaning the system would increase

VALUE PROPOSAL MF-2

Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating

Performance Impacts:

- **Fish ladder Performance:** Performance is optimized by maintaining the best flow conditions at the fish ladder entrances with just one Fish Unit operating in addition to the AWSBS by maintaining a clean trashrack.
- **Head Differential:** This minimizes the head differential across the trashrack with effective and relatively fast cleaning cycles.
- **Approach Velocities:** This proposal helps maintain low approach velocity near the surface by maintaining a clean trashrack. Approach velocities tend to be higher adjacent to the AWSBS pipe inlet at the bottom of the trashrack and lower at the top which is desirable because fish tend to be oriented toward the surface at this location. As the trashrack plugs up the approach velocity near the surface increase along with the possibility of harming fish by entrainment or impingement on the trashracks.
- **Remote Monitoring:** No effect is noted (but it is likely that this proposal will be paired with ME-1 which provides remote monitoring).
- **Remote Operating:** This can be readily operated remotely and automatically when paired with proposal ME-1.
- **AWSBS Shutdowns:** Maintenance is reduced by allowing for effective automatic trashrack cleaning without shutting down the AWSBS system.
- **Maintenance:** This reduces maintenance by allowing for effective automatic trashrack cleaning.
- **Constructability:** The majority of the work area can be isolated with stoplogs placed in the trashrack slots. A barge may be required for work on the dam face (installing the pump) and providing additional work area so as not to inhibit access across the dam.

Discussion: This proposal is based on a design concept that has been used to successfully clean fish screens on several large surface fish collectors used for the passage of downstream migratory fish. The basic design uses a line of orifices spaced along a manifold which result in a linear series of jets that spray from the back of the screen out through the screen face. The jets are spaced such that as the submerged jets expand, they effectively merge into one long linear jet that provide continuous coverage over the entire width. Implementing this cleaning system on the trashrack would provide an effective cleaning system that could be operated while the AWSBS is running and be capable of cleaning the trashrack once every seven minutes. A normal cleaning cycle would result in two passes of the jet through the trashrack. Sketches of the existing AWSBS intake and the proposed backwash cleaning system are depicted following this discussion.

The manifold would be a 16-inch diameter stainless steel pipe with 45 orifices spaced at 6 inches on center. The 3/8-inch diameter orifices operating at 82 PSI differential results in a total flow of 1080 GPM. Note that 82 PSI is likely a conservative differential pressure. Typically, 40 to 60 PSI is used depending on the configuration of the system (how close and orifices are to the surface being cleaned

and the orifice spacing). In this case the orifices are located further back than is typical (16 inches rather than 6 inches) and the orifices spacing is wider (6 inches rather than 3 inches). A pump rated for this flow and 200 feet of total dynamic head will require about a 75-horsepower motor. The pump intake will be screened for fish criteria with a 12-mesh screen that Is continuously backwashed. This criterion is met with a Clemons-Clearwater Screen Model CW1000. The pump intake screen is sized to maintain approach velocity to this screen at less than 0.4 inches per second and the screen will not only protect fish but keep the backwash system from clogging with debris. The backwash pump will be located downstream of the trashrack on the face of the dam.

A rubber dredge type hose will connect the backwash pump to the backwash manifold piping. This hose will need to be between 6 and 8 inches in diameter. The hose is typically reinforced for full vacuum to 150 PSI pressure. Rollers would be used to maintain a long bending radius (two to three times the radius allowed) to prevent fatigue failure. The hose system is effectively counterweighted will lessen the load on the hoist. The system will need to be carefully designed to ensure that the backspray assembly has sufficient weight to lower it.

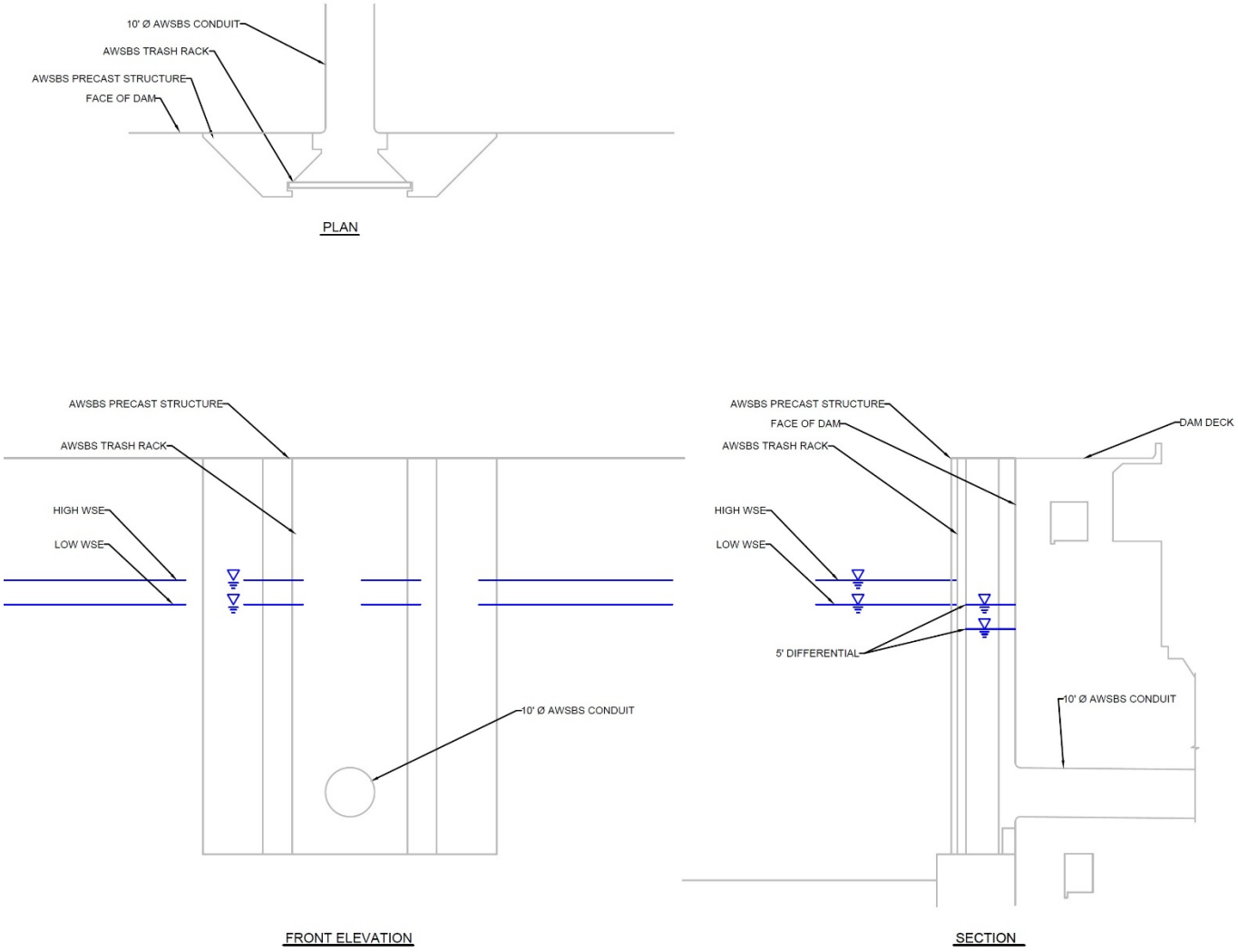
The backwash manifold would be connected to a 6-inch pipe frame that rides in guides mounted to the interior walls of the AWSBS intake. The frame would be approximately 18 feet tall to allow a vertical guide wheel spacing to prevent the assembly from binding when traveling up and down. The total travel required at full pool is 55 feet. Using a hoist speed of 8 feet per minute results in a total 2-pass (down then back up) cleaning cycle duration of 14 minutes. The hoist would have about a 1.5-horsepower motor and could likely have a single hoist cable although a 2-cable drum type hoist is depicted on the sketch. The back spray manifold assembly is estimated to weigh about 2000 pounds.

Operation of the cleaner would have an insignificant impact on the flow into the AWSBS.

VALUE PROPOSAL MF-2

Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating

Baseline Concept Sketch

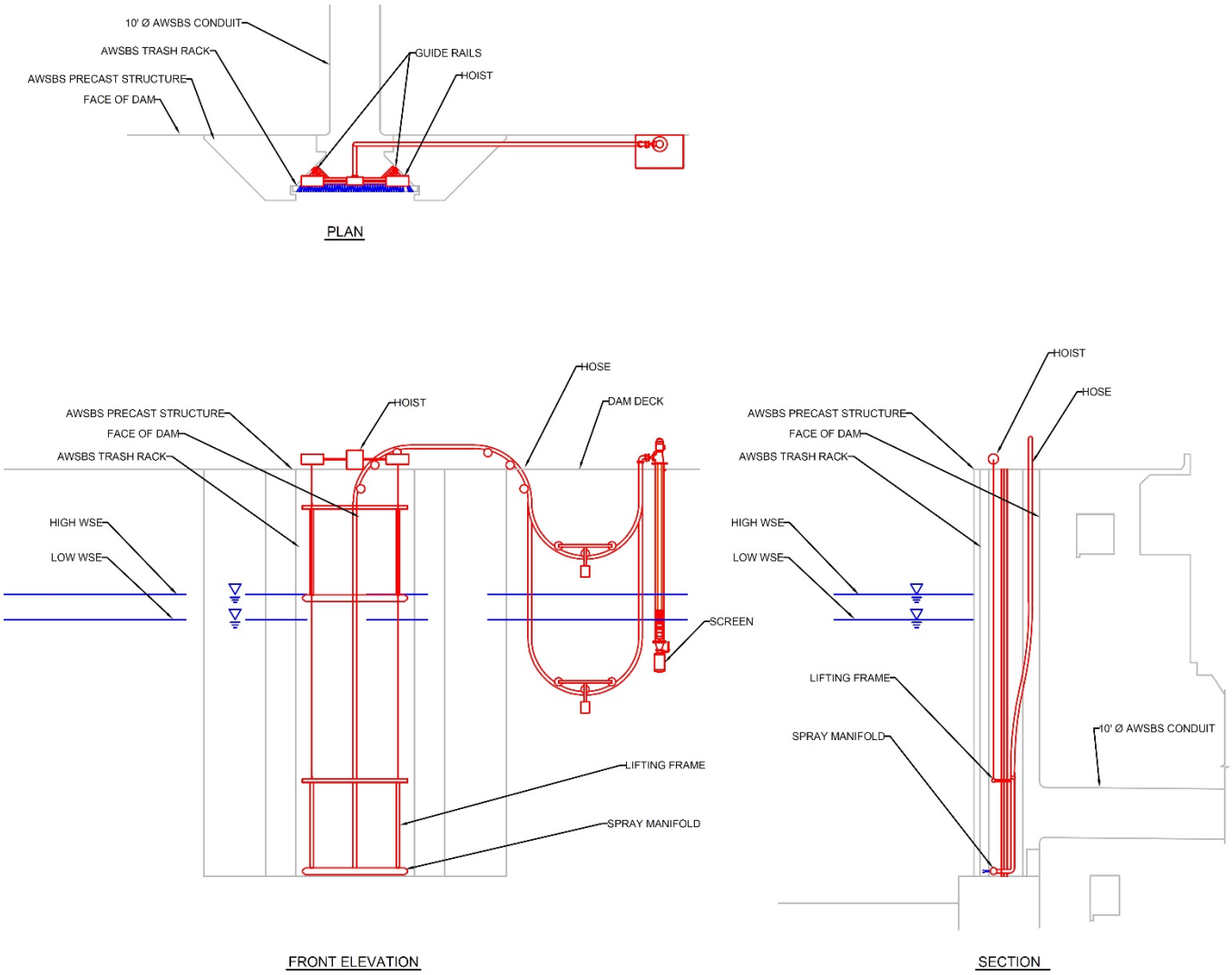


AWSBS Existing Plan and Section

VALUE PROPOSAL MF-2

Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating

Proposal Concept Sketch



AWSBS with Backwash System

VALUE PROPOSAL MF-2

Construct a travelling horizonal backspray manifold to remove debris while the AWSBS is operating

Assumptions and Calculations:

- 16-inch x 21-foot long Sch 40 stainless steel backspray manifold
- 8-inch Sch 40 stainless steel backspray piping
- 6-inch sch 40 galvanized steel backspray frame
- 8-inch by 140-foot of dredge type hose
- Three sets of long radius hose guides (two fixed and one hanging)
- 4-inch and 6-inch diameter nylon guide wheels
- Two each W10 at 80-foot-long guides fastened to existing concrete wall with epoxy anchors
- 1.5-ton hoist assembly rated for 8 fpm with position transmitter and limit switches
- 75-horsepower vertical turbine pump (1080 GPM at 200-foot TDH)
- 20-inch diameter pump can with mounting brackets to face of dam and 20 x 10 reducer for intake screen connection at bottom
- Intake Screen: Clemons-Clearwater Screen Model CW1000 with 30 GPM backwash filter and 1.5-inch piping for intake cleaning system
- 100-amp power supply from existing service
- 75-horsepower pump control panel
- Integration of control into the existing SCADA system
- Removing existing trashracks, setting stop logs in slots, deploying dewatering system (likely not able to drain leakage into fish ladder entrance during construction)
- Removing stoplogs and re-setting trashracks in slots

VALUE PROPOSAL ML-2

Acquire spare parts for the 7-foot butterfly valves

VALUE PROPOSAL SYNOPSIS:

This proposal would acquire spare parts for the butterfly valves to maintain system reliability and compliance with fish passage criteria.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance		✓	
Head Differential		✓	
Approach Velocities		✓	
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The baseline project plans to cycle the valves to allow debris to float off the racks; it does not specifically include spare part acquisition for the 7-foot butterfly valves, however, the EDR does reference the need for spare parts in criteria and constraints.

Value Proposal Description: The value proposal concept is to acquire key spare parts for the 7-foot butterfly valves to maintain system reliability.

Advantages:

- Increases the reliability of the system by reducing downtime when the seals or ancillary components wear out
- Reduces risk of non-compliance with fish passage criteria

Disadvantages:

- None noted

Performance Impacts:

- **Fish ladder Performance:** No significant impact on fish ladder performance.
- **Head Differential:** No significant impact on head differential.
- **Approach Velocities:** No significant impact on approach velocities.
- **Remote Monitoring:** No significant impact on remote monitoring.
- **Remote Operating:** No significant impact on remote operating.

VALUE PROPOSAL ML-2

Acquire spare parts for the 7-foot butterfly valves

- **AWSBS Shutdowns:** This reduces the duration of an AWSBS shutdown by providing spare parts for the 7-foot butterfly valves onsite in lieu of waiting for delivery from the manufacturer (which could be 18-26+ weeks).
- **Maintenance:** This improves maintainability by providing spare 7-foot butterfly valves on site to reduce downtime in the event of a butterfly valve failure.
- **Constructability:** No significant impact on constructability.

Discussion: The AWSBS consists of one 10-foot butterfly valve in series with two parallel 7-foot butterfly valves. This proposal is to acquire key spare parts to maintain system reliability. While the fish units are being rehabilitated, there will only be one fish unit running. The combination of one fish unit and the AWSBS is necessary to maintain fish passage criteria. If the AWSBS is out of service during this time, then the fish ladder will fail to maintain criteria. Acquiring spare parts will reduce downtime of the AWSBS by having the parts necessary to make common repairs onsite. The main spare parts necessary to maintain system reliability are as follows: disc spiral wound gasket, laminated seal ring, packing, O-ring, AD90 750 KW motor, and seal kit. These spare parts are based on the suggested list of spare parts from the original construction contract for the construction of the AWSBS. The full list of spare parts is included in the Proposal Concept Sketch below.

This proposal increases initial project cost but saves money and time by acquiring the spare parts before a repair is needed. Some of the parts require 18 weeks lead time from the manufacturer. The cost of an emergency repair and expediting the acquisition will be more expensive than acquiring the spare parts ahead of time.

The proposal also reduces risk of nonconformance with fish passage criteria by increasing the reliability of the AWSBS system. If a seal, O-ring, or motor stops working the component can be quickly replaced with the on-hand spare parts. This is more likely to be accepted by stakeholders since it improves fish passage reliability.

VALUE PROPOSAL ML-2

Acquire spare parts for the 7-foot butterfly valves

Proposal Concept Sketch

SPARE PARTS AND INTERCHANGEABILITY RECORD (S.P.I.R.)

The Dalles Dam Project - Kiewit / USACE

EMERSON AUTOMATION SOLUTIONS - VANESSA MANUFACTURING PLANT
VIA PIACENZA, 29018 LUGAGNANO VAL D ARDA
PIACENZA ITALY

EMERSON

PRICES VALIDITY 60 DAYS

P. O. *102942-2521*

DATE 8/16/2017

ACK. N° ***6016/03680/ SO#7338117***

TAG ITEM NO.	EF-RW-BV10 (120")	EF-RW-BV7A (84")	EF-RW-BV7B (84")	TOTALS	UNIT OF MEANS	DESCRIPTION OF PART	VENDOR MANUFACTURER'S PART NUMBRER	REF. DWG & NUMBER		MATERIAL	COMMISIONING SPARE PART	2 YEARS SPARE PART (OPERATIONS)	EX-WORKS DELIVERY (WEEKS)
CODE	1KFAMKA0	1KF84KA8	1KF84KA8										
SERIAL No	6016/03680.002	6016/03680.004	6016/03680.004										
No OF UNITS	1	1	1	3									
NUMBER OF PARTS PER UNITS													
AA	1			1	PC	DISC SPIRAL WOUND GASKET	3SDAAM001721	SPID	3B	AISI316+GRAFITE	0	1	14
AB	1			1	PC	LAMINATED SEAL RING	3KRAAM002751	SPID	3A	UNS S31803 (DUPLEX) +GRAFITE H.D.	0	1	18
AC	1			1	PC	BOTTOM SPIRAL WOUND GASKET	3SB230001721	SPID	6C	AISI316+GRAFITE	0	1	12
AD	1			1	PC	PACKING	8P4223016699	SPID	5A	GRAPHITE + BRAIDED GRAPHITE	0	1	14
AE	4			2	PC	O-RING 2-447	8020002447635	SPID	82&84	VITON-A	0	4	12
AF		1	1	2	PC	DISC SPIRAL WOUND GASKET	3SDA80001721	SPID	3B	AISI316+GRAFITE	0	1	12
AG		1	1	2	PC	LAMINATED SEAL RING	3KRA80104751	SPID	3A	UNS S31803 (DUPLEX) +GRAFITE H.D.	0	1	18
AH		1	1	2	PC	BOTTOM SPIRAL WOUND GASKET	3G32191364721	SPID	6C	AISI316+GRAFITE	0	1	12
AI		1	1	2	PC	PACKING	8P3216016699	SPID	5A	GRAPHITE + BRAIDED GRAPHITE	0	1	12
AJ		2	2	4	PC	O-RING 2-438	8020002438635	SPID	82&84	VITON-A	0	2	12
AK		2	2	4	PC	O-RING 2-363	8020002363635	SPID	82&84	VITON-A	0	2	12
AL	1			1	PC	MOTOR VDQ90.2-2-0.60KW 400V-50HZ	Z107.855*	NA	NA	SEE DESCRIPTION	0	1	18
AM	1	1	1	3	PC	SEAL KIT LARGE SA14.2/6	SPA0.082A	NA	NA	SEE DESCRIPTION	0	3	14
AN	1	1	1	3	PC	AC.2 BD ASSY 115V SING I/O TH	SPA1.003	NA	NA	SEE DESCRIPTION	0	3	14
AO	1	1	1	3	PC	CONTRACTOR ASSLY A1 WITH 24 VAC COILS	K007.186	NA	NA	SEE DESCRIPTION	0	3	14
AP		1	1	2	PC	MOTOR AD90.2-4-0.750KW 440-50	Z109.641*	NA	NA	SEE DESCRIPTION	0	2	18

DELIVERY TIME HAS BEEN CALCULATED AT PRESENT STOCK SITUATION (SEE SPIR DATE) PLS NOTE THAT IT CAN CHANGE DAILY

Spare Parts List

VALUE PROPOSAL ML-4

Replace 7-foot butterfly valve seals after completing fish unit rehab

VALUE PROPOSAL SYNOPSIS:

This proposal would replace the seals on the 7-foot butterfly valves after the fish unit rehabilitation contract.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance		✓	
Head Differential		✓	
Approach Velocities		✓	
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The EDR mentions the need to acquire spare parts for the butterfly valves if valve cycling is expected to increase during the fish unit rehabilitation contract; there is no baseline mentioned in the existing proposal.

Value Proposal Description: This proposal is to replace the seals on the 7-foot butterfly valves after the fish unit rehabilitation contract.

Advantages:

- New seals on the 7-foot valves will reset the 1,400-cycle life expectancy and ensure reliability of the AWSBS after the fish unit rehabilitation contract

Disadvantages:

- None noted

Performance Impacts:

- **Fish ladder Performance:** No significant impact on fish ladder performance.
- **Head Differential:** There is no significant impact on head differential.
- **Approach Velocities:** There is no significant impact on approach velocities.
- **Remote Monitoring:** There is no significant impact on remote monitoring.
- **Remote Operating:** There is no significant impact on remote operating.
- **AWSBS Shutdowns:** The Maintenance performance will be improved due to a reduced risk of AWSBS failure.

VALUE PROPOSAL ML-4

Replace 7-foot butterfly valve seals after completing fish unit rehab

- **Maintenance:** By pre-emptively replacing the worn valves before they reach the 1,400-cycle life expectancy, maintenance will be reduced.
- **Constructability:** No significant impact on constructability is estimated.

Discussion: It is likely that the AWSBS will need to be repeatedly cycled during the fish unit rehabilitation contract. These butterfly valves have a design life of 1,400 cycles. The rehabilitation project is scheduled for two years, which could use up to 700 cycles. If construction is delayed, then even more cycles would be used. During normal valve cycling operations only the 7-foot butterfly valves are cycled to turn off flow through the AWSBS. This proposal is to pre-emptively replace the seals on the 7-foot butterfly valves to ensure the robustness of the AWSBS. An inspection should be done at the end of the fish unit rehabilitation project to determine if the valve seals are worn enough to require replacement.

This proposal reduces the risk of AWSBS failure by resetting the 1,400-cycle life expectancy of the 7-foot valves after the fish unit rehabilitation contract. This is an increase in project costs, but a potential savings in the cost and time for future maintenance activities. It reduces risk of future failure by pre-emptively replacing the worn valves before they reach the 1,400-cycle life expectancy. Performance will be the same since there aren't any modifications to the function of the valves. Replacing the worn valves will decrease future maintenance costs by resetting the life expectancy of the equipment.

This proposal could be included as an optional bid item to the fish unit rehabilitation. If the valves are cycled hundreds of times during the fish unit rehabilitation, then it is more warranted to replace the valves. However, if the valves aren't cycled often USACE could choose not to exercise the optional bid item.

VALUE PROPOSAL PF-2

Pull the racks at night or during a shutdown for manually cleaning

VALUE PROPOSAL SYNOPSIS:

This proposal would provide a backup system if existing operations and valve cycling are not sufficient to prevent debris buildup.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance			✓
Head Differential			✓
Approach Velocities		✓	
Remote Monitoring			✓
Remote Operating		✓	
AWSBS Shutdowns	✓		
Maintenance	✓		
Constructability	✓		

Baseline Concept Description: The baseline concept is to continue existing operations and cycling the valves to release debris from the trash racks.

Value Proposal Description: If cycling the valves does not remove the debris then the racks would be pulled at night (as needed) or during a shutdown and would be manually cleaned with the pressure washer.

Advantages:

- This approach for debris removal would be more efficient than the proposed baseline concept of cycling valves

Disadvantages:

- Operations at nighttime may be needed
- This is a very labor-intensive effort
- The dam access would likely be blocked while trashracks are being removed, cleaned, and replaced requiring space for the crane and for the cleaning and stacking the screens
- Fish may be trapped in the intake area while the trashracks are removed (especially given the proximity to the fish ladder exit)
- May increase the number and duration of shutdowns

Performance Impacts:

- **Fish ladder Performance:** Removal of debris should improve fish ladder performance.
- **Head Differential:** Removal of debris should reduce the head differential.

VALUE PROPOSAL PF-2

Pull the racks at night or during a shutdown for manually cleaning

- **Approach Velocities:** Removal of debris should maintain approach velocities.
- **Remote Monitoring:** It is assumed that remote monitoring would be installed at an elevation below ice buildup.
- **Remote Operating:** Remote operating is currently not available. This is not expected to change.
- **AWSBS Shutdowns:** Removal of debris may increase the number and duration of shutdowns**.**
- **Maintenance:** More maintenance would be required compared to the baseline condition.
- **Constructability:** An additional crane might be needed. The workspace should be carefully selected to minimize the footprint and maintain access to the project.

Discussion: A water tank will need to be installed on the forebay deck. A hose will connect the tank to a portable pressure washer to spray debris off the trash racks. A pump and water pipes will need to be installed to pump water from the reservoir into the tank.

The valves would be cycled as in normal operations. If debris buildup is not reduced from this normal operation, operations personnel will remove the trash racks for cleaning. Once the trash racks are cleaned, they can be replaced to continue normal operation.

The water tank will need to be installed in a peripheral location. It should be slightly elevated above the forebay deck elevation so that it can feed water to the pressure washer using only gravity.

A large water tank of at least 500 gallons will need to be installed on the intake deck. A pressure washer will need to be either purchased or rented if operations staff does not currently have one.

VALUE PROPOSAL PF-2

Pull the racks at night or during a shutdown for manually cleaning

Baseline Concept Sketch

Plan view of entrance to AWSBS

Proposal Concept Sketch

Plan view of potential work area for cleaning trashrack

VALUE PROPOSAL PF-3

Construct additional racks so existing may be pulled and rotated for thorough cleaning

VALUE PROPOSAL SYNOPSIS:

This proposal would construct additional racks to replace existing racks to reduce the frequency of shutdowns.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance			✓
Head Differential			✓
Approach Velocities			✓
Remote Monitoring		✓	
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance	✓		
Constructability	✓		

Baseline Concept Description: In the baseline concept nine of the eleven trashracks are fully inundated and exposed to debris blockage under flow.

Value Proposal Description: The proposal suggests furnishing ten additional trashrack members that can be used to drop into place of the lower ten members.

Advantages:

- Reduces the frequency of shutdowns
- Reduces valve cycling due to periodic resetting conditions with clean racks
- Access to spare screen members reduces the downtime that currently occurs when the existing racks must be pulled, cleaned, and then reinserted

Disadvantages:

- Need to store and transport the spare racks
- More frequent operations and maintenance effort in switching trashracks

Performance Impacts:

- **Fish ladder Performance:** This reduces the frequency of shutdowns.
- **Head Differential:** This will reduce the frequency of head differential buildup.
- **Approach Velocities:** There is overall improvement to the project.
- **Remote Monitoring:** There is no major impact on remote monitoring.
- **Remote Operating:** There is no major impact on remote operating.

VALUE PROPOSAL PF-3

Construct additional racks so existing may be pulled and rotated for thorough cleaning

- **AWSBS Shutdowns**: This will reduce the overall number of shutdowns.
- **Maintenance:** Operations and maintenance will be increased by pulling and inserting trashracks more frequently.
- **Constructability:** With this proposal there will be added furnishing of trashracks.

Discussion: This proposal trades periodic proactive operations and maintenance action versus the risk of more frequent system shutdowns and valve cycles. The possession of the spare trashrack members removes the time required to clean the trashracks from the duration of the shutdown.

The trashrack in the baseline concept consists of 11 stacked members 6 feet tall x 25 feet wide. The base elevation of the trashracks is 104 feet NGVD 29 and the top of the stacked trashracks is 170 feet NGVD 29. The forebay ranges between 155 – 160 feet. The median is approximately 158.5 feet. Therefore, the uppermost member is never inundated, and the second member is inundated between 0 – 33%, and the median less than 8%.

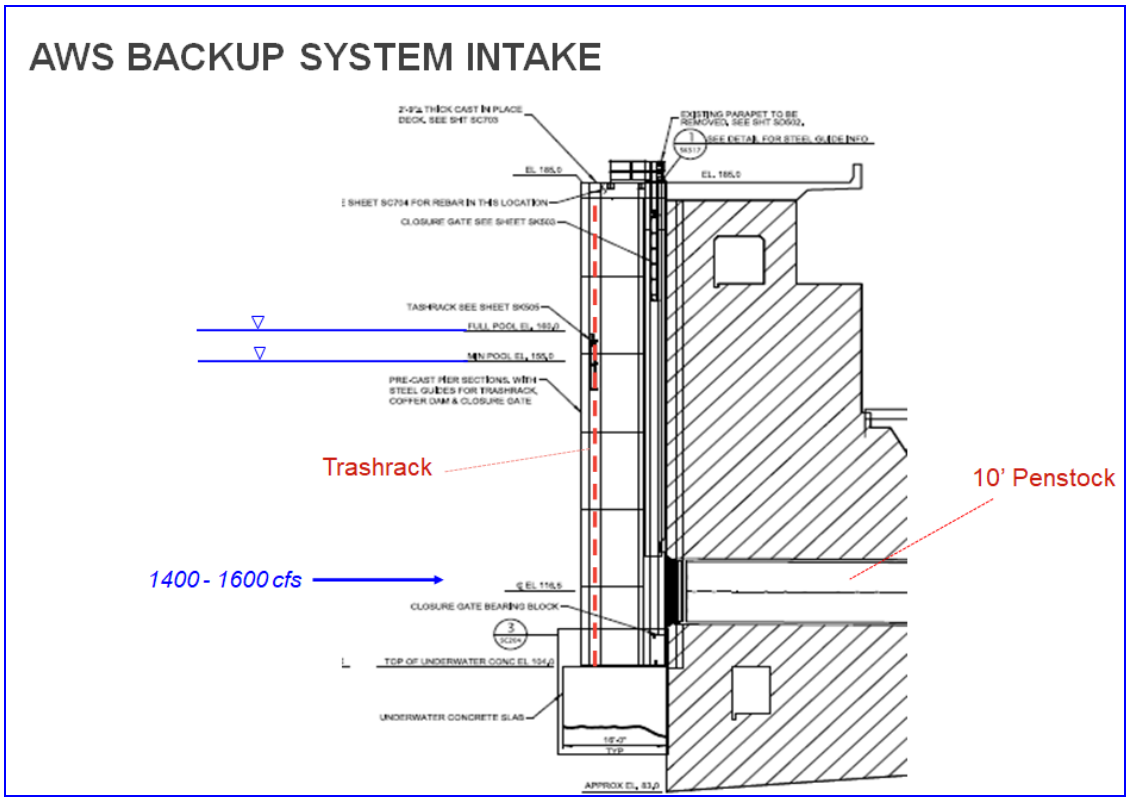
The second and third lowest members are immediately upstream of the 10-foot penstock intake and likeliest to plug earlier due the higher screen velocities. These and adjacent members may not clean as easily or completely when the AWSBS system is shut down to allow the river currents to remove the accumulated debris.

In the proposed concept the suggested lower ten members would be pulled for more thorough cleaning. This switch of trashrack operations would be done under a nighttime shutdown approximately every one to two months. The frequency of switching will increase during high debris periods such as June. The periodic resetting of the screens should reduce the number of shutdowns and perhaps avoid an increasing frequency of shutdowns due to incremental debris retainage.

VALUE PROPOSAL PF-3

Construct additional racks so existing may be pulled and rotated for thorough cleaning

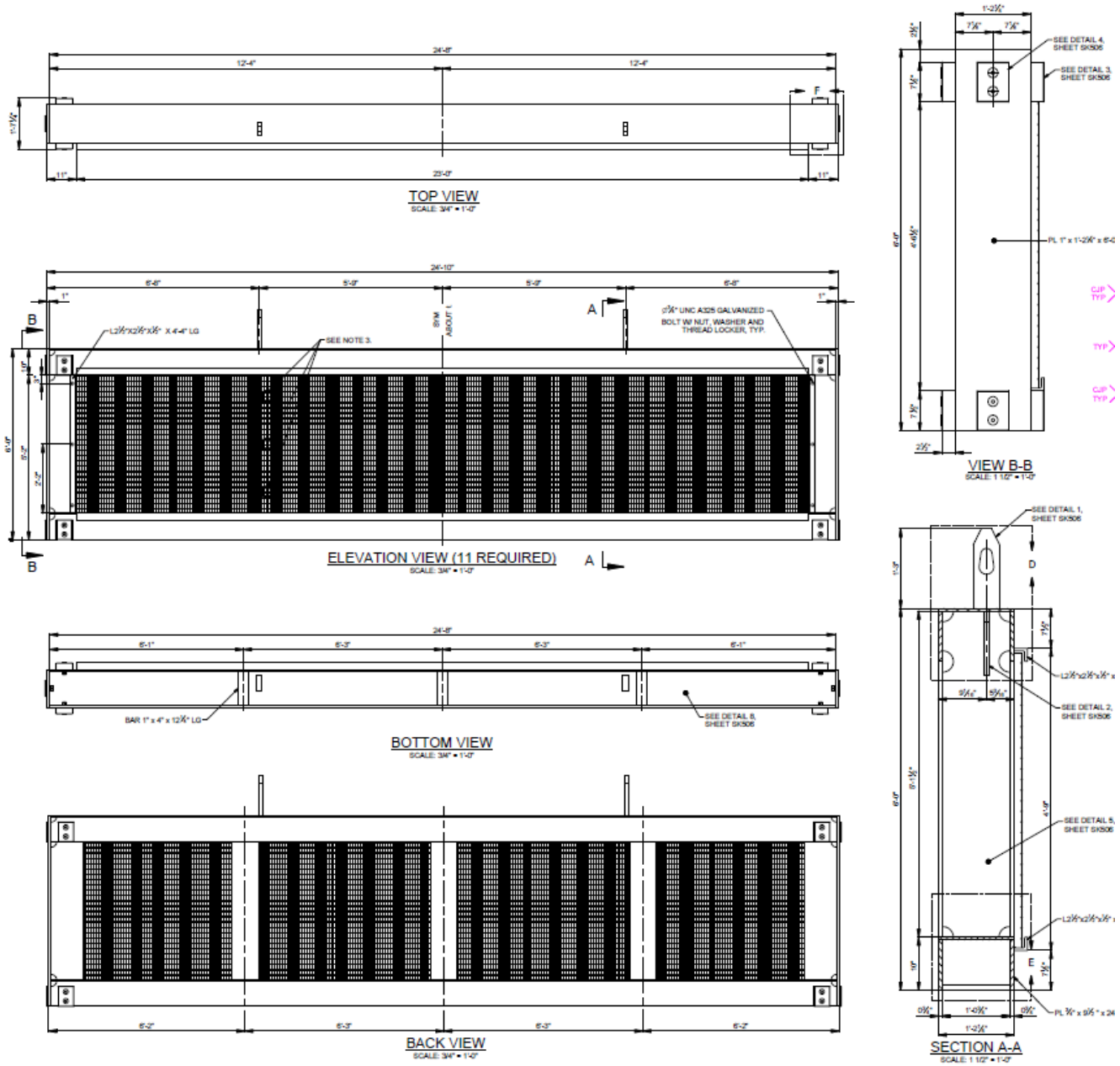
Baseline Concept Sketch



Elevation View with Location of Trashrack

VALUE PROPOSAL PF-3

Construct additional racks so existing may be pulled and rotated for thorough cleaning



Existing trashrack Member

VALUE PROPOSAL PS-1

Convey running tally on 7-inch butterfly valve cycles to operators

VALUE PROPOSAL SYNOPSIS:

This proposal would assure reliable documentation of a running total of 7-foot valve operation cycles with respect to the estimated life expectancy of 1400 valve cycling operations.

PERFORMANCE	Degraded	Maintained	Improved
Fish Ladder Performance		✓	
Head Differential		✓	
Approach Velocities		✓	
Remote Monitoring			✓
Remote Operating		✓	
AWSBS Shutdowns			✓
Maintenance			✓
Constructability		✓	

Baseline Concept Description: The baseline concept does not include an automatic means of counting valve cycles.

Value Proposal Description: The proposal concept would run 7-foot valve operation cycles assuring management awareness of the valve status with respect to life expectancy and provides timely information to react appropriately beforehand as needed.

Advantages:

- Automatic means of maintaining a tally of valves cycles
- Maintains management awareness of valve cycling status with respect to valve life expectancy
- Reduces likelihood of management being caught off guard by sudden valve failure and prolonged valve outages

Disadvantages:

- Added counting component may require minor periodic maintenance

Performance Impacts:

- **Fish ladder Performance:** This proposal provides awareness to avoid potential long valve outage.
- **Head Differential:** There is no impact to head differential.
- **Approach Velocities:** There is no impact to approach velocities.
- **Remote Monitoring:** The proposal would augment the remote monitoring system.
- **Remote Operating:** There is no impact to remote operating.

VALUE PROPOSAL PS-1

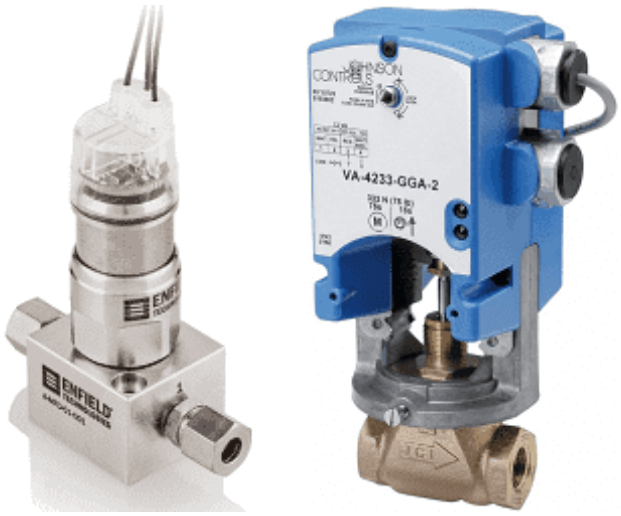
Convey running tally on 7-inch butterfly valve cycles to operators

- **AWSBS Shutdowns:** The likelihood of long valve outage is reduced.
- **Maintenance:** There would be minor periodic maintenance, though this concept accounts for potentially significant O&M.
- **Constructability:** There is no impact to constructability.

Discussion: A cycle for a valve is defined as the valve moving from the unactuated to the actuated state and returning to the unactuated state. Therefore, a valve opening operation later followed by a closing sequence represents two valve cycles. Each 7-foot valve is estimated to have a life expectancy of 1400 valve cycles, after which the valve seals are liable to fail. The counter can either be a mechanical device that counts the movement of the valve or an electronic device that measures the number of times the valve actuator is energized (in this case, the counts would need to be divided by two).

The proposed counters represent an automated and reliable means of maintaining valve cycle records. This continuous awareness of the valve status compared to life expectancy allows management to have sufficient lead time to procure appropriate spare parts, replacement valves, and or make operations and maintenance adjustment to avoid potential long valve outages.

Proposal Concept Sketch



counter examples

Assumptions and Calculations:

VALUE PROPOSAL PS-1

Convey running tally on 7-inch butterfly valve cycles to operators

- Range of $100 - $400 per unit; approximately $1000 for installation per counter
- Minimal Life Cycle Costs; may have to replace counters over time

Records have been kept by Biologist inspectors since the valves were commissioned in 2018. The current tally per valve is estimated to be:

- Commissioning tests (April, August 2018) 6 + 14
- Operational tests (November 2018) 4
- AWSBS Operations 2019-2021 24
- Contingency (25%): 12
- Total: 60

Initial Cost Estimate

2 x $1000 = $2000

Life-Cycle Cost Estimate

Assume replacement of both counters every 10 years

APPENDIX A: Value Study Overview

APPENDIX A: VALUE STUDY OVERVIEW

PROJECT DESCRIPTION

The Dalles Dam auxillary water supply (AWS) supplies water to the east, west, and south fish ladder entrances in order to attract upstream migrating adult fish. Water is currently supplied to the AWS by two Fish Units (FU) located on the west end of the powerhouse.

With both FUs operating the total fish attraction discharge is approximately 5,000 cfs to the fish ladder. Presently, both fish units must be in operation to maintain full entrance flow criteria conditions. However, results of the recent operational testing of the fish units and the AWS Backup System (AWSBS) at the end of 2018 demonstrated the capability to provide minimum acceptable fish flow attraction water with only one FU operating in conjunction with the AWSBS. This testing confirmed that the AWS could be operated continuously during any season, 24/7, to reliably augment attraction flow of the FUs.

A 2008 risk failure analysis report for the fish turbines confirmed that the probability of fish turbine unit failure within 10 years is elevated (USACE 2008). Individually, they are at high risk of failure (25 percent). While the risk of both units failing simultaneously is substantially lower (1.4 percent), the consequences are severe.

Recently, the Portland District has decided to allow the AWSBS to be operated in conjunction with one FU in an emergency situation when one of the two FUs is taken out of service.

Fish Unit Rehab, starting in the year 2024, requires the AWSBS to operate during the rehab to provide adequate flow for fish attraction. Fish Unit Rehab duration is one year per unit for a total of two years.

List of Documents Reviewed

The following project documents were provided to the Value Study team for their use during the study:

- The Dalles AWS Backup Debris Management EDR, July 2021
- CombinEx Weighed Pair Comparison Outline notes-2020-0714, July 14, 2020

Note: The information presented in this report may have been excerpted in part from the document listed above which were provided to the Value Study team for their use during the workshop.

In-Brief Presentation

This value study was conducted virtually using collaborative, online tools, including WebEx and Miro. The project team prepared an excellent in-brief presentation that covered all aspects of the project. The entire first day of the value study focused on discussions around this presentation.

Site Visit

A "virtual" site visit was performed using a combination of the in-brief presentation materials described above in conjunction with Google Earth, which provided highly detailed three-dimensional and street view information. From this information, the value team was able to develop a fairly good level of understanding related to existing site conditions.

VM PROCESS

The value study was conducted in a virtual environment using WebEx and Miro. WebEx is a virtual meeting platform that supports audiovisual communications and facilitates the use of breakout sessions to allow for multiple, parallel meetings. Miro is a collaborative whiteboard platform that supports a variety of activities. This platform was used extensively to allow participants to share information visually. It was used explicitly to support the Information, Function Analysis, Creativity, and Evaluation Phases of the VM Process.

1. **Preparation Phase:** The purpose of the Preparation Phase is to identify the value study objectives, participants, dates, and information needed to support the effort. It also includes the initial review of the project information by the Value Team prior to the commencement of the workshop.
2. **Information Phase:** The Information Phase is concerned with developing a better understanding of the project information and transforming that information in different ways to develop meaningful insight relative to opportunities for value improvement.
3. **Function Analysis Phase:** The Value Team analyzed the functions of the project in order to identify those areas that offered the greatest opportunity for value improvement. In VM, a function is articulated using a verb and a noun. These two-word function statements describe what the project elements do and why they do them. The Value Team leverages these function statements later in the Creativity Phase in order to generate other ways of achieving the same functions differently.
4. **Creativity Phase:** The purpose of the Creativity Phase is to generate as many ideas as possible relative to the functions selection at the end of the Function Analysis Phase. The Value Team focused on brainstorming 25 focus areas comprised of 79 individual functions. Approximately 61 ideas were generated during the Creativity Phase. These ideas are listed in *Appendix D* of this report.
5. **Evaluation Phase:** The Evaluation Phase is focused on judging the ideas generated during the Creativity Phase and identifying the best ideas for potential development. The Evaluation Phase was conducted in three stages using different techniques and levels of critical thinking.

   The first level of the evaluation was performed using the Miro platform's voting function. This tool is essentially a form of nominal group technique whereby a group of ideas are selected for consideration and the evaluation participants are assigned a small number of "votes". Typically, the number of votes assigned equate to about 20-25% of the total number of ideas being considered. For example, if a cluster of 20 ideas were being evaluated in a discrete session, then each participant would be given four to five votes to

identify what they feel are the best value adding ideas. Once the individual voting is completed, the total votes for the ideas area revealed and those ideas receiving the most votes are advanced into the second round for more detailed evaluation.

During the second round of evaluation, the surviving ideas were broken down by discipline and individual breakout sessions were facilitated in WebEx so that the appropriate design disciplines could discuss the ideas in greater detail. During this process, comments were captured where appropriate concerning the ideas.

For the third and final round of evaluation, the compiled shortlist of ideas surviving round two were reviewed as a group and further discussed. Additional comments were captured and decisions made concerning the final list of ideas that the Value Team would carry forward into the Development Phase. Individual ideas were then assigned to the Value Team members. A mid-point review, as described above, was performed to review the shortlist with the Project Team and receive their initial feedback on the concept being considered. The idea evaluation results are included in *Appendix D* of this report.

6. **Development Phase:** During the development phase, each highly rated idea was expanded into a workable solution referred to as a value proposal. Each value proposal includes a description of the baseline and proposed concepts, advantages and disadvantages, a narrative discussing the technical considerations and baseline case, sketches, and cost estimates. The developed ideas are summarized in the main body of the report following the *Executive Summary*.
7. **Presentation Phase:** A formal presentation as described above was performed on the final day of the study to the Project Team and stakeholders. This presentation was intended as an informational review of the value study results and recommendations and not a decision meeting.
8. **Implementation Phase:** Following the issuance of the Draft Value Study Report, the Project Team will review the value study proposals and recommendations with the USACE District Value Officer, and a Preliminary Decision will be made for each proposal. This information will be captured in the Final Value Study Report, which will formally document the outcome of the Value Study effort. This information will be included in the *Value Study Proposals* section of the report.

VALUE STUDY PARTICIPANTS

Dalles AWSBS Debris Management Project

August 9 – August 19, 2021

8/9	8/10	8/11	8/12	8/17	8/18	8/19	Name	Organization	Position/Role	E-mail
X	X	X	X	X	X	X	Dave Eisenberg	VMS, Inc.	VA Study Team Leader	David.eisenberg@vms-inc.com
X	X	X	X	X	X	X	Meaghan Rowland	VMS, Inc.	Assistant Team Leader	Meaghan.rowland@vms-inc.com
X	X	X	X	X	X	X	Caleb Meyer	USACE - Portland	Mechanical Engineer	Caleb.a.meyer@usace.army.mil
X			X			X	Dr. Smart Ocholi	USACE - Portland	Chief of ENC-T	smart.ocholi@usace.army.mil
X	X	X	X	X	X	X	Eric Grosvenor	USACE - PMP	Fish Biologist	eric.grosvenor@usace.army.mil
X			X			X	Erin Kovalchuk	USACE	Project Manager-CENWP-PM	erin.h.kovalchuk@usace.army.mil
X	X	X	X	X	X	X	Frank Postlewaite	Kleinschmidt	Mechanical	Frank.Postlewaite@kleinschmidtgroup.com
X	X	X	X			X	Jason Weber	USACE	District Value Officer	Jason.M.Weber@usace.army.mil
X	X	X	X			X	Mehdi Roshani	USACE	Structural Engineer/Tech Lead	Mehdi.Roshani@usace.army.mil
X			X	X		X	Phet Indra	USACE	ENC-DE	phetkhamphai.w.indra@usace.army.mil
X	X						Scott Hull	CPAC	Director	scott.a.hull@usace.army.mil
X	X	X	X	X	X	X	Stephen Schlenker	USACE	Structural Hydraulic Engineer	stephen.j.schlenker@usace.army.mil
X	X	X	X	X	X	X	Staurt Beck	Kleinschmidt	Senior Engineering Consultant, Hydraulics, and Hydrology	Stuart.Beck@kleinschmidtgroup.com
X	X	X	X	X	X	X	Greg Westling	USACE	Civil Engineer	Gregory.W.Westling@usace.army.mil
						X	Bob Cordie	USACE	Biologist	Robert.P.Cordie@usace.army.mil
						X	Sean Askelson	USACE	Chief Hydraulics and Hydrology Branch	

Value Management Strategies, Inc.

VALUE STUDY AGENDA

The Dalles
AWS Debris Management
Portland, OR

Workshop Meeting Location: **Virtual Value Study (all times Pacific)**

August 9, 2021 **Monday**

8:00	***VE Opening Comments***	***Jason Weber, DVO***
	• *Welcome & Introductions* • *Value Study Goals & Focus Areas* • *Value Study Overview and Schedule*	***David Eisenberg, VMS***
8:30	***Presentation: Weighted Paired Comparison***	***Jason Weber, DVO***
09:30	***Break***	
9:45	***Project Overview***	***Project Team***
	• *Presentation of overall project (purpose, objectives, constraints)* • *Presentation of pertinent project technical features* • *Identify key project/program issues* • *Current cost and schedule*	
10:30	***Value & Project Team Discussion***	***Project Team,***
	• *Q&A* • *Key project issues*	***Value Team***
11:00	***Review Project Risks***	***Project Team,***
	• *Identify, categorize, and rate risk*	***Value Team***
12:00	*Lunch*	
13:00	***Discuss Project Constraints & Criteria***	***Project Team,*** ***Value Team***
15:00	*Adjourn*	

August 10, 2021 Tuesday

8:00	**Recap day one and complete Information Phase**	Value Team
10:00	**Criteria and Constraints Function Analysis Phase**	Value Team
11:30	Lunch Break	
12:30	**Function Analysis Phase (cont.)**	Value Team
15:00	Adjourn	

August 11, 2021 Wednesday

08:00	**Weighted Paired Comparison-Existing Alternatives**	Value Team
09:30	**Creativity Phase**	Value Team
11:30	Lunch Break	
12:30	**Creativity Phase**	Value Team
14:30	**Evaluation Phase**	Value Team
15:00	Adjourn	

August 12, 2021 Thursday

8:00	**Evaluation Phase**	Value Team
10:30	***Mid-Point Review***	***Value Team***
		Project Team
11:30	Lunch Break	
12:30	**Development Phase – Develop Value Proposals**	Value Team
3:00	Adjourn	

August 17, 2021 Tuesday

8:00	**Development Phase – Develop Value Proposals**	Value Team
11:30	Lunch Break	
12:30	**Development Phase – Develop Value Proposals**	Value Team
3:00	Adjourn	

August 18, 2021 Wednesday

08:00	**Development Phase – Develop Value Proposals**	Value Team
11:30	Lunch Break	
12:30	**Development Phase – Develop Value Proposals**	Value Team
15:00	Adjourn	

August 19, 2021 Thursday

08:00	**Weighted Paired Comparison-Revised Alternatives**	Value Team
09:00	**Presentation Preparation**	Value Team
10:30	***Value Study Presentation***	***Value Team*** ***Project Team***
11:30	Wrap-up and Next Steps	Value Team
12 :00	Adjourn	

APPENDIX B: Project Analysis

APPENDIX B: PROJECT ANALYSIS

SUMMARY OF ANALYSIS

The following analysis tools were used to study the project:

- Paired Comparisons
- CombinEX

WEIGHTED PAIRED COMPARISON SCORING FOR EVALUATION CRITERIA

EVALUATION CRITERIA		Preferred Criteria: If both meet criteria, which is more important to improve: Score (1= slightly more important; 3= significantly more important)															RAW SCORE	%-AGE
		A	B	C	D	E	F	G	H	I	J	K	L	M	N			
A	Fishladder Performance	letter	B	A	A	A	A	A	A	A						A	35.3	30.3
		weight	2.2	2.6	4.8	4.7	5.6	5.5	5.6	6.5								
B	Head Differential <2 ft			B	B	B	B	B	B	B						B	26.9	18.1
				1.2	2.6	3.6	4	4.6	4.3	4.4								
C	Monitor Remotely				C	C	C	C	C	C						C	23.7	16.2
					1.4	3.4	2.7	4.8	5	6.4								
D	Minimize Shutdowns					D	D	D	D	D						D	18	11.7
						3.3	1.2	4.5	4.2	4.8								
E	Operate Remotely						E	E	E	E						E	10.8	6.8
							1.4	2.6	3.5	3.3								
F	# & Complexity of Maintenance Cycles							F	F	F						F	6.7	6.6
								2	1.6	3.1								
G	Construction Schedule								G	G						G	4.6	4.3
									2	2.6								
H	Measure Approach Velocities									I						H	0	3.1
										1.4								
I	Construction Complexity															I	1.4	2.9
J	J															J	0	0.0
K	K															K	0	0.0
L	L															L	0	0.0
M	M															M	0	0.0
N	N															N	0	0.0
																TOTAL	127.4	100

ALTERNATIVE RANKING

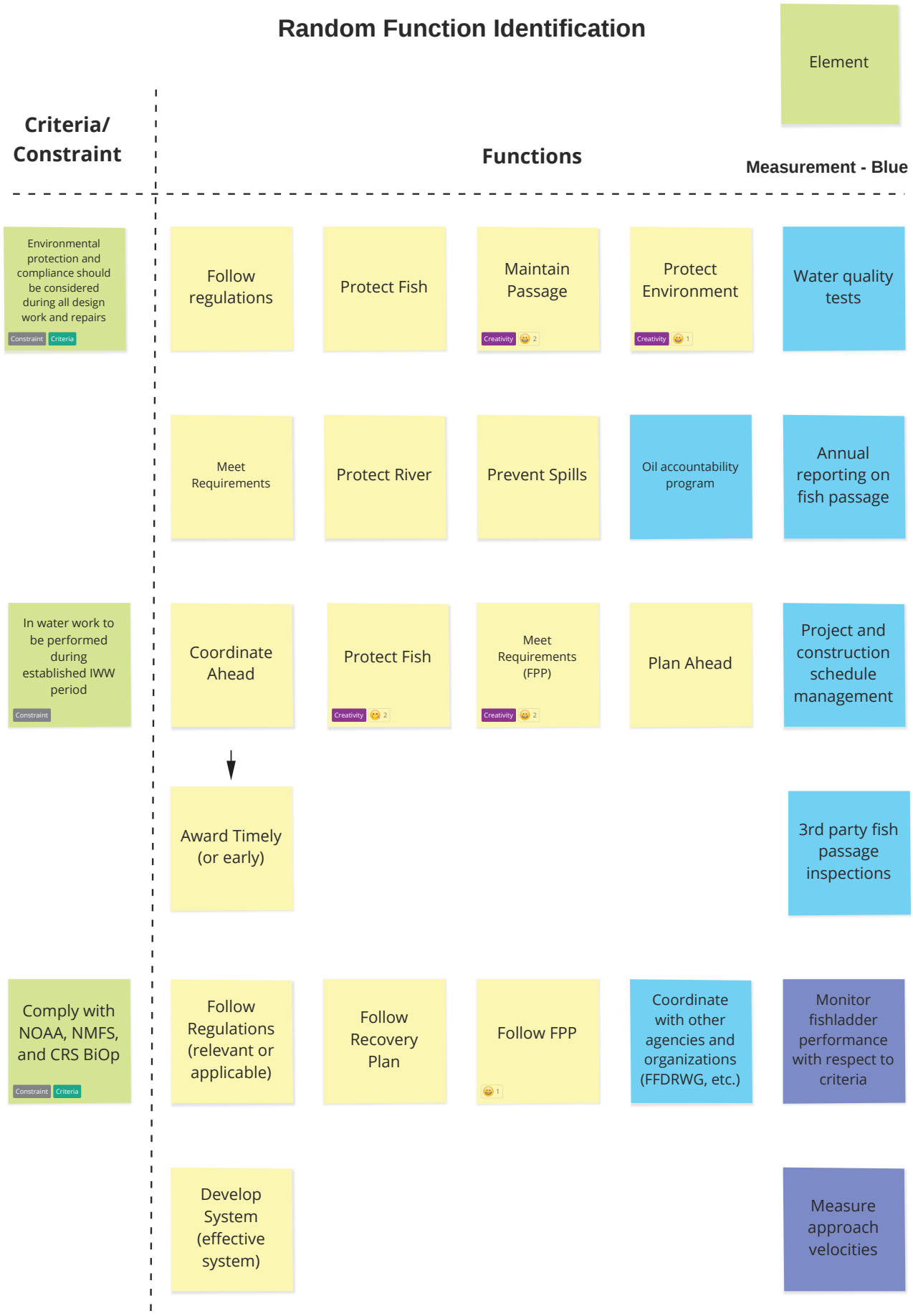
EVALUATION CRITERIA		FACTOR %x10	ALT #0X Baseline - Trash Rake	ALT #01 No Action, Continue Cycling	ALT #4.1 Add a Floating Debris Boom	ALT #06 Automate Valve Cylcing	ALT #07 Power Wash Racks	ALT #11 Use a Brush instead of a Rake	ME-1 Install Level Sensors to tie into Project SCADA	ME-2 Modify Ladder Entrance	MF-2 Horizontal backspray manifold	PF-3 Additional Trash Racks
A	Fishladder Performance	303.0	5.7	6.0	5.0	6.2	4.2	6.8	7.4	2.5	6.3	6.2
			1727.1	1818.0	1499.9	1878.6	1272.6	2060.4	2242.2	757.5	1908.9	1878.6
B	Head Differential <2 ft	181.0	6.3	6.0	5.0	7.8	4.4	6.8	7.2	5.8	6.8	6.3
			1140.3	1077.0	905.0	1411.8	796.4	1230.8	1303.2	1049.8	1230.8	1140.3
C	Monitor Remotely	162.0	3.3	0.5	2.2	8.8	1.0	4.3	8.5	2.1	4.5	2.1
			534.6	81.0	356.4	1425.6	162.0	696.6	1377.0	340.2	729.0	340.2
D	Minimize Shutdowns	117.0	5.9	3.9	4.2	4.9	4.3	6.9	5.9	6.5	6.8	4.1
			690.3	456.3	491.4	573.3	503.1	807.3	690.3	760.5	795.6	479.7
E	Operate Remotely	68.0	3.3	1.0	3.2	8.5	1.0	3.5	7.0	2.1	3.7	1.1
			224.4	68.0	217.6	578.0	68.0	238.0	476.0	139.4	251.6	74.8
F	# & Complexity of Maintenance Cycles	66.0	4.3	3.8	4.3	6.2	4.1	6.9	6.3	6.3	5.1	5.1
			283.8	250.8	280.5	409.2	270.6	455.4	415.8	415.8	336.6	336.6
G	Construction Schedule	43.0	4.3	8.9	5.2	6.5	6.1	3.8	6.8	5.0	4.9	6.2
			184.9	382.7	223.6	279.5	262.3	163.4	292.4	215.0	210.7	266.6
H	Measure Approach Velocities	31.0	3.3	3.3	2.1	3.9	2.1	2.8	5.1	2.5	3.1	2.0
			102.3	102.3	65.1	120.9	63.6	86.8	158.1	77.5	96.1	62.0
I	Construction Complexity	29.0	3.9	9.6	5.9	6.1	5.8	3.1	5.9	5.0	4.6	6.6
			113.1	278.4	171.1	176.9	168.2	89.9	171.1	145.0	133.4	191.4
TOTAL		1000.0	**5000.8**	**4514.5**	**4210.6**	**6853.8**	**3566.8**	**5828.6**	**7126.1**	**3900.7**	**5692.7**	**4770.2**
ORDER OF MAGNITUDE FIRST COST												
COST PER POINT			$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
ORDER OF MAGNITUDE LIFE CYCLE COST												
COST PER POINT			$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Risk Information						Un-Managed State (Pre-Response)						
							Cost		Schedule		Performance	
Risk	Risk Category	Risk Event Name	Risk Description	Risk Trigger	Additional Comments	Probability	Impact	Severity	Impact	Severity	Impact	Severity
8	Biological	A new debris management system will not be in place prior to FU rehab	A new, upgraded debris management system will not be in place prior to the FU rehab requiring continuation of debris management by cycling the 7' butterly valves (existing debris management process).	New and/or upgraded debris management is not in place when fish unit rehab begins.	This could delay the fish rehab project because there could be concerns about continuing to cycle the butterfly valves with the current process. This would push out the rehab until a different debris management system was in place. Lack of funding could cause this delay if a new or upgraded debris management system is not able to be constructed. The assumption is that funding will be availble for a debris management system, however it just won't be in place by the start of the FU rehab. Increases wear and tear on equipment, especially the butterfly valves.	Very High	--	--	--	--	Medium	0.6
6	Construction	Availability of funding	Adquate funding is not available for construction of debris management solution(s).	At 60% DDR, would have a budget that could be used for justification (Class 5 cost estimates),	CRFM (Columbia River Fish Mitigation) is the funding source. CRFM funds have been dwindling and it is expected to continue to go down. This project might not be rated high enough to receive funding. Funding will be very competitive. O&M funding could be just as high of a risk. Possibly funding from any upcoming infrastructure bill.	Very High	--	--	--	--	Very High	1
7	Construction	FU rehab schedule exceeds 2 years	Rehabilitation of the FU exceeds the planned 2 years (1 year/FU) resulting in only a single fish unit in operation	Funding issues - something occurs once construction starts that impacts completion of one or both FUs, material and labor shortages, contractor mismanagement, weather, unknown site conditions.	These impacts are to the AWSBS and the fish ladders that they serve, not the rehab: Work begins in 2024, 2 year construction completing in 2026. In-water work period is December - February (winter maintenance season). AWS will be operated outside of the in-water work period. Installing debris management system will have to be in place by 2024. Construction in December will need to take into account holidays. Could get approval to perform in-water work at night in November and possibly in March (Nov easier to get than March). The outcome of this risk is that the butterfly valves will go through more cycles than anticipated due to the AWSBS running more than the anticipated 2 years. There will be more disruptions to the fish passage operations due to more debris accumulation events that force shutdowns (even with some of the anticipated alternatives, there is an assumption that there will still need to be a shutdown). Would still have one of the FUs running during this time. Impact could exceed Low depending on how long construction is delayed.	Medium	--	--	--	--	Low	0.24
4	Maintenance	7' butterfly valve seals wear out/fail	The 7' butterfly valve seals wear out after meeting their design life (~1,400 cycles)	Most likely excess vibration or noise when in the valve room OR 1,400 cycles reached OR during inspection.	To change the seals, will need to dewater the AWS system. Actuators probably undergo routine maintenance. No method to inspect the seals without dewatering. Flow test annually, will need to determine what their routine inspection period is (hydraulic steel structure (HSS) is 5 years)). The replacement costs are not accounted for in the O&M budget. There are no spare parts onsite and the team's understanding is that there is no budget for replacement parts (as of the time of this study). 6 months lead time from Italy. Assuming the butterfly valves are around 50 cycles as of this study. Assuming during construction, cycling daily (~300 cycles over 2 years, worse case) After that, should go back to emergency usage only. With both FU rehabed, probably should be low. Would be cycled even less if only done when exceed head differential.	Very Low	--	--	--	--	High	0.16
1	Operations	Trash racks damaged due to excessive head differential	The debris on the trash racks could create excessive head differential that could damage the trash racks and cause the AWS backup system outage.	Buildup of debris over time, measured by head loss > 2-feet.	Assumes debris is aquatic vegetation up to large wooded debris. Miscellaneous trash items. Neutrally buoyant debris. Assumes system is monitored 2x daily including weekends. System can be shutdown within 13 minutes of a decision to do so. Shutdown is manual, not automated. Debris could get into system and block the diffuser panels requiring dewatering the fish ladder - time consuming, fish rescue, staff, etc.	Low	--	--	--	--	Very High	0.4

Risk Information						Un-Managed State (Pre-Response)						
							Cost		Schedule		Performance	
Risk	Risk Category	Risk Event Name	Risk Description	Risk Trigger	Additional Comments	Probability	Impact	Severity	Impact	Severity	Impact	Severity
2	Operations	Trash rack debris results in AWS shutdown	The debris on the trash racks could create excessive head differential that would result in a shutdown which will reduce flow to the AWS below required criteria.	Buildup of debris over time, measured by head loss > 2-feet	Assumes debris is aquatic vegetation up to large wooded debris. Miscellaneous trash items. Neutrally buoyant debris. Assumes system is monitored 2x daily including weekends. System can be shutdown within 13 minutes of a decision to do so. Shutdown is manual, not automated. Failure impact will primarily be on fish passage. Trash racks most likely would be able to maintain structural integrity due to size.Currently no active cleaning. AWSBS will be operating for 2 years during FU rehab.Probability between M and H.Impact would be lower at night due to reduction in fish passage.Assumes at least 1 FU is still operational.Could be mitigated by closing one of the south entrance gates but east and west might be marginal. However, fish in the south channel would be stranded temporarily.	High	--	--	--	--	Low	0.32
3	Operations	Fish unit fails during rehab	During the replacement of the first FU, the second (operational) FU fails.	Failure of operational FU.	FU could come back in hours to days, depending on failure. Wouldn't meet criteria but still are able to provide water to the fish ladder with the AWSBS. Would only be able to rely on the East fish ladder, still getting 80% of the fish passing through.	Low	--	--	--	--	High	0.32
9	Operations	AWSBS failure	The AWS backup system has a catastrophic failure that disables it operationally for a undetermined period of time. This failure would include any system component (not just the 7' butterfly valves).	Shutdown of the AWSBS.	Could be caused by the bulkhead getting stuck and not being able to get lifted, in addition to the 7' butterfly valve seals. Could be unanticipated failures. Could be caused by a large volume of debris that break through the trashrack and damage the AWSBS. During the period of repair, there would be an impact to the fish passage operations. There have been various construction related issues that have already been resolved (incorrect actuator bolts and plugging air vacuum valve). Impact could vary depending on how long it takes to repair the AWSBS.	Very Low	--	--	--	--	High	0.16
5	Regulatory	Impinging downstream migrant fish due to debris on the trashrack	Excess debris on trash racks impinges or entrains migrating fish (juvenile lamprey).	Visual inspection.	From acoustic data, most fish are not passing by the trashracks. Debris is building up but has not yet exceed the 2' differential. A 1' differential most likely would be uniform distribution of debris with some hot spots. Debris can increase the take approved by NOAA	Very Low	--	--	--	--	Very Low	0.04

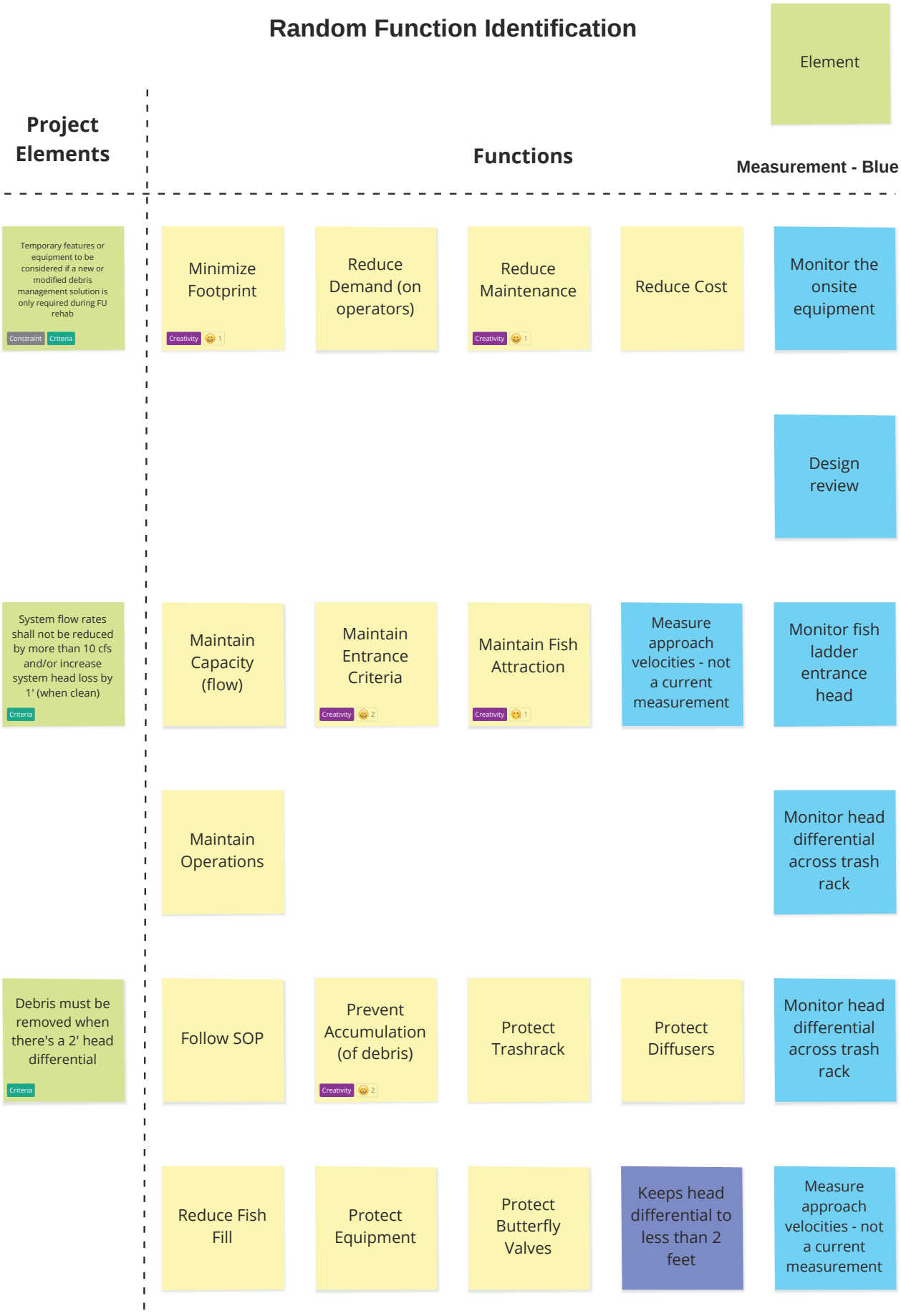
APPENDIX C: Function Analysis

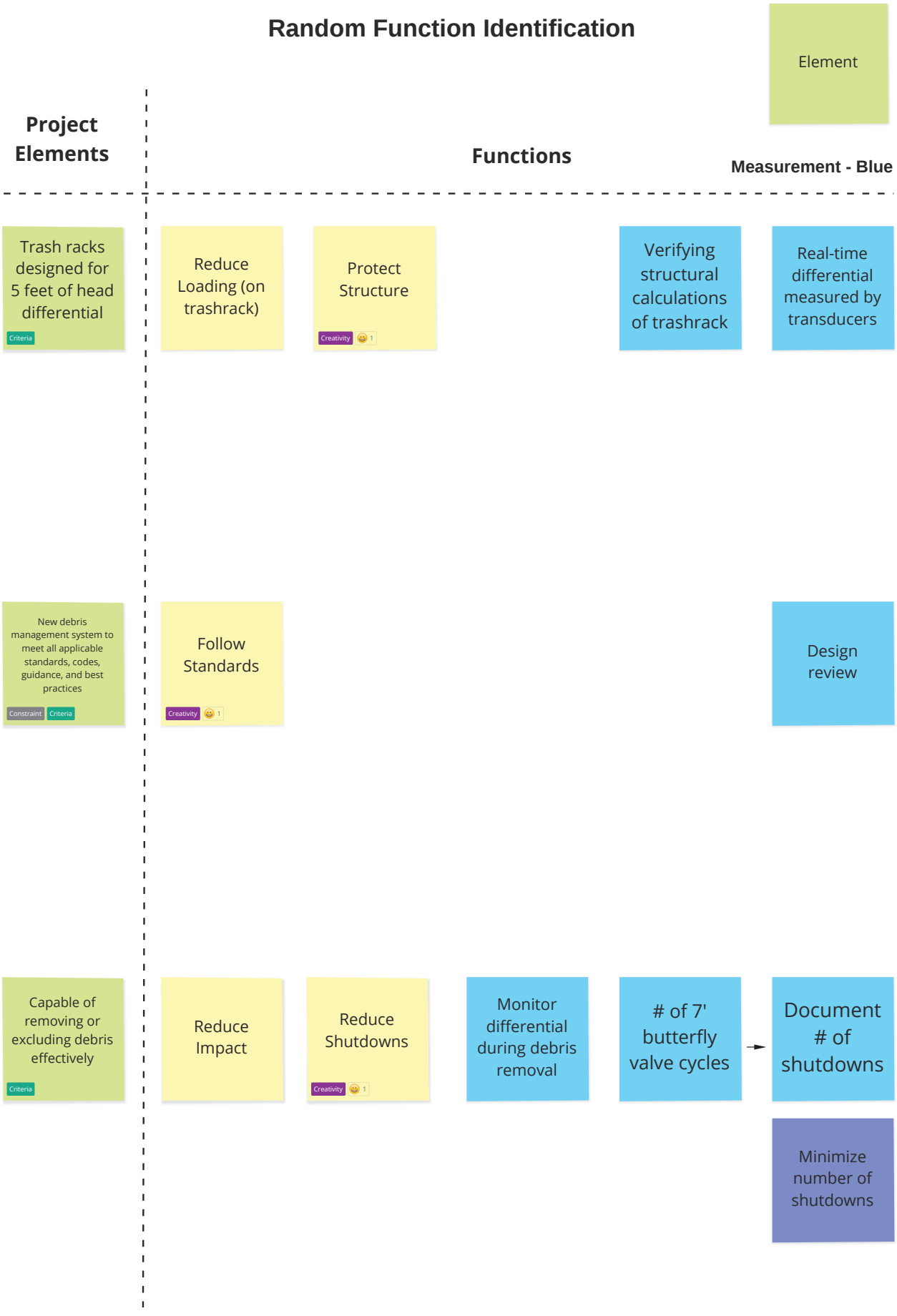
Random Function Identification



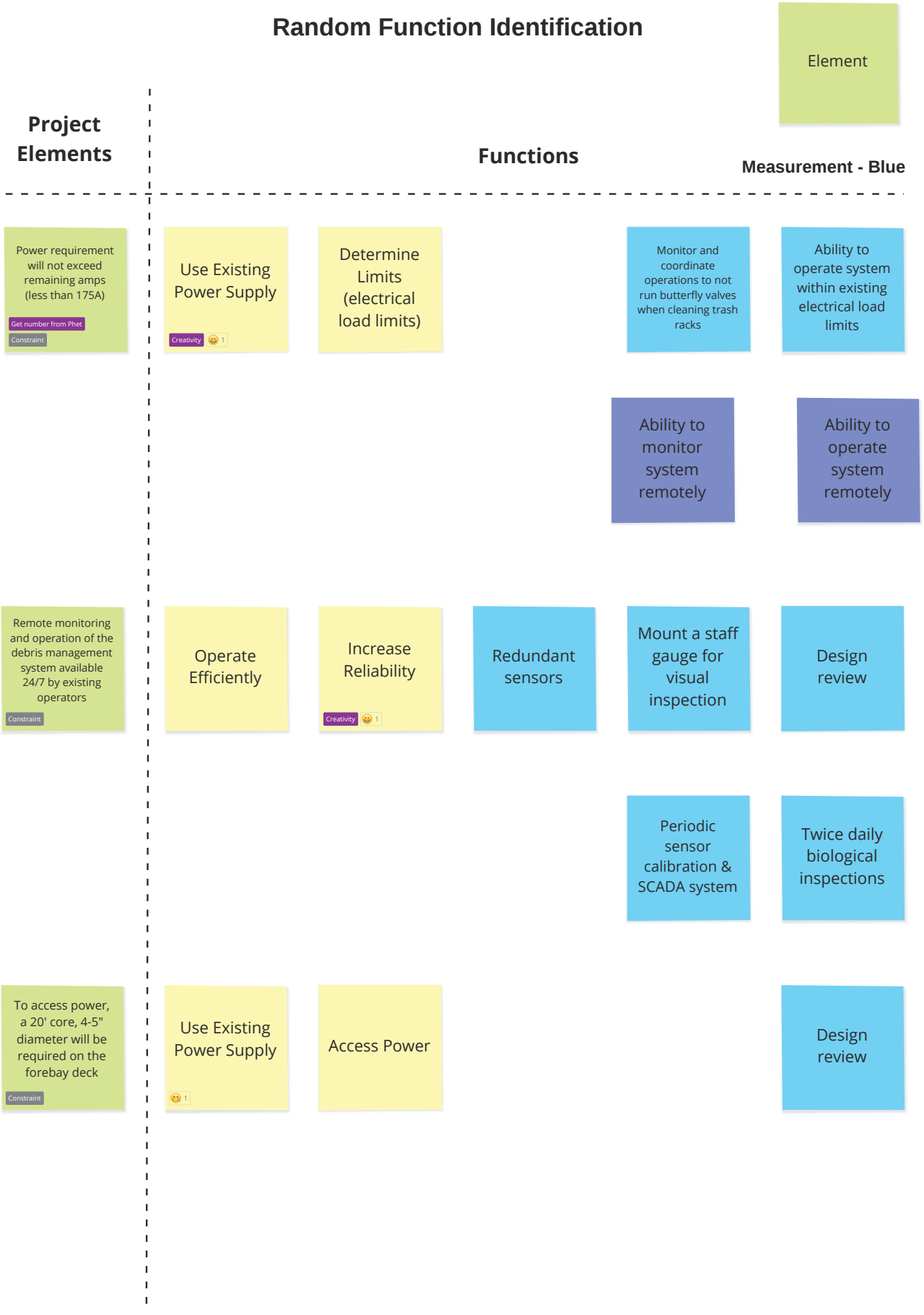
Random Function Identification

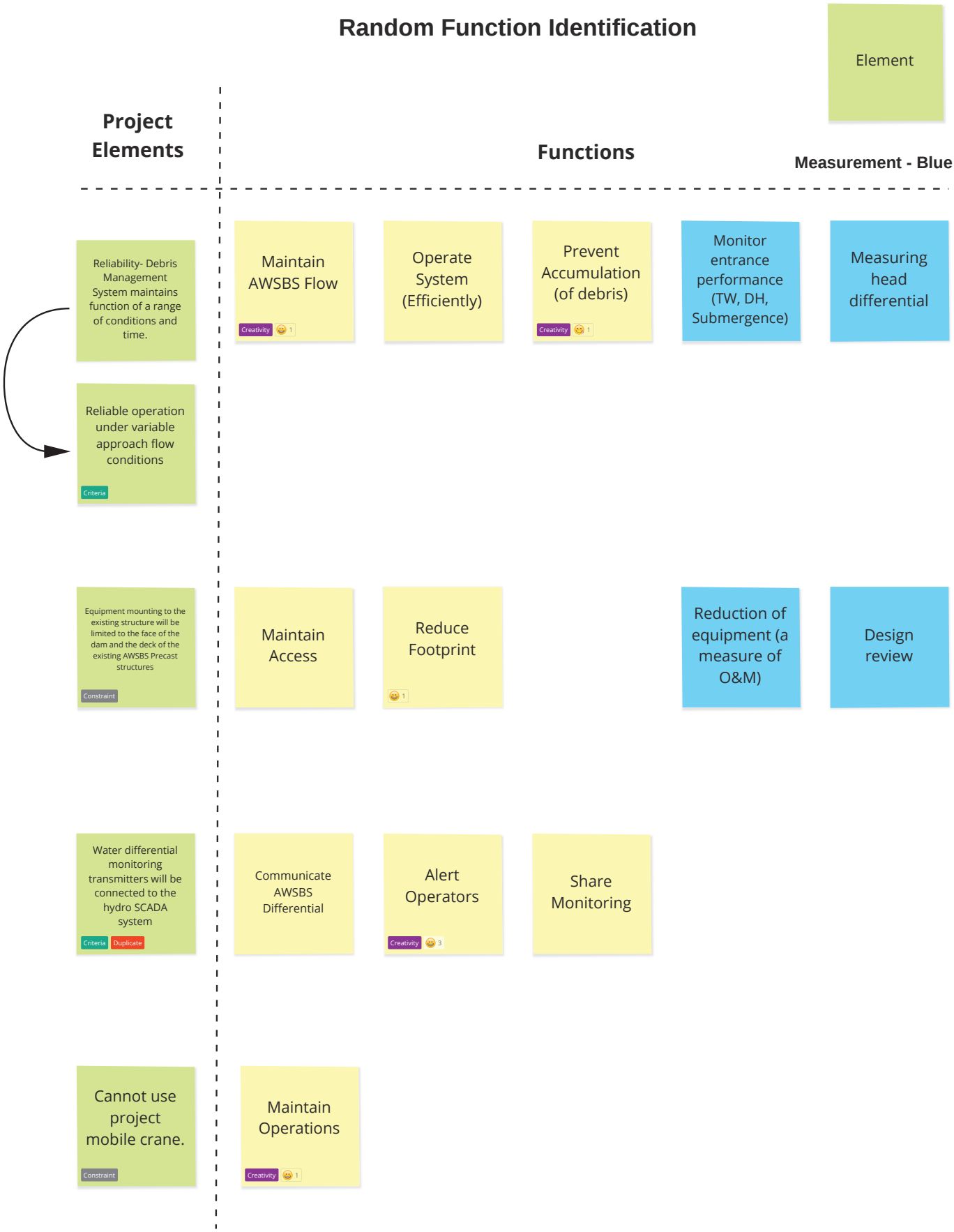
Random Function Identification


Random Function Identification
Element
Project Elements
Functions
Measurement - Blue
Temporary features or equipment to be considered if a new or modified debris management solution is only required during FU rehab
Constraint
Criteria
Minimize Footprint
Creativity
Reduce Demand (on operators)
Reduce Maintenance
Creativity
Reduce Cost
Monitor the onsite equipment
Design review
System flow rates shall not be reduced by more than 10 cfs and/or increase system head loss by 1' (when clean)
Criteria
Maintain Capacity (flow)
Maintain Entrance Criteria
Creativity
Maintain Fish Attraction
Creativity
Measure approach velocities - not a current measurement
Monitor fish ladder entrance head
Maintain Operations
Monitor head differential across trash rack
Debris must be removed when there's a 2' head differential
Criteria
Follow SOP
Prevent Accumulation (of debris)
Creativity
Protect Trashrack
Protect Diffusers
Monitor head differential across trash rack
Reduce Fish Fill
Protect Equipment
Protect Butterfly Valves
Keeps head differential to less than 2 feet
Measure approach velocities - not a current measurement

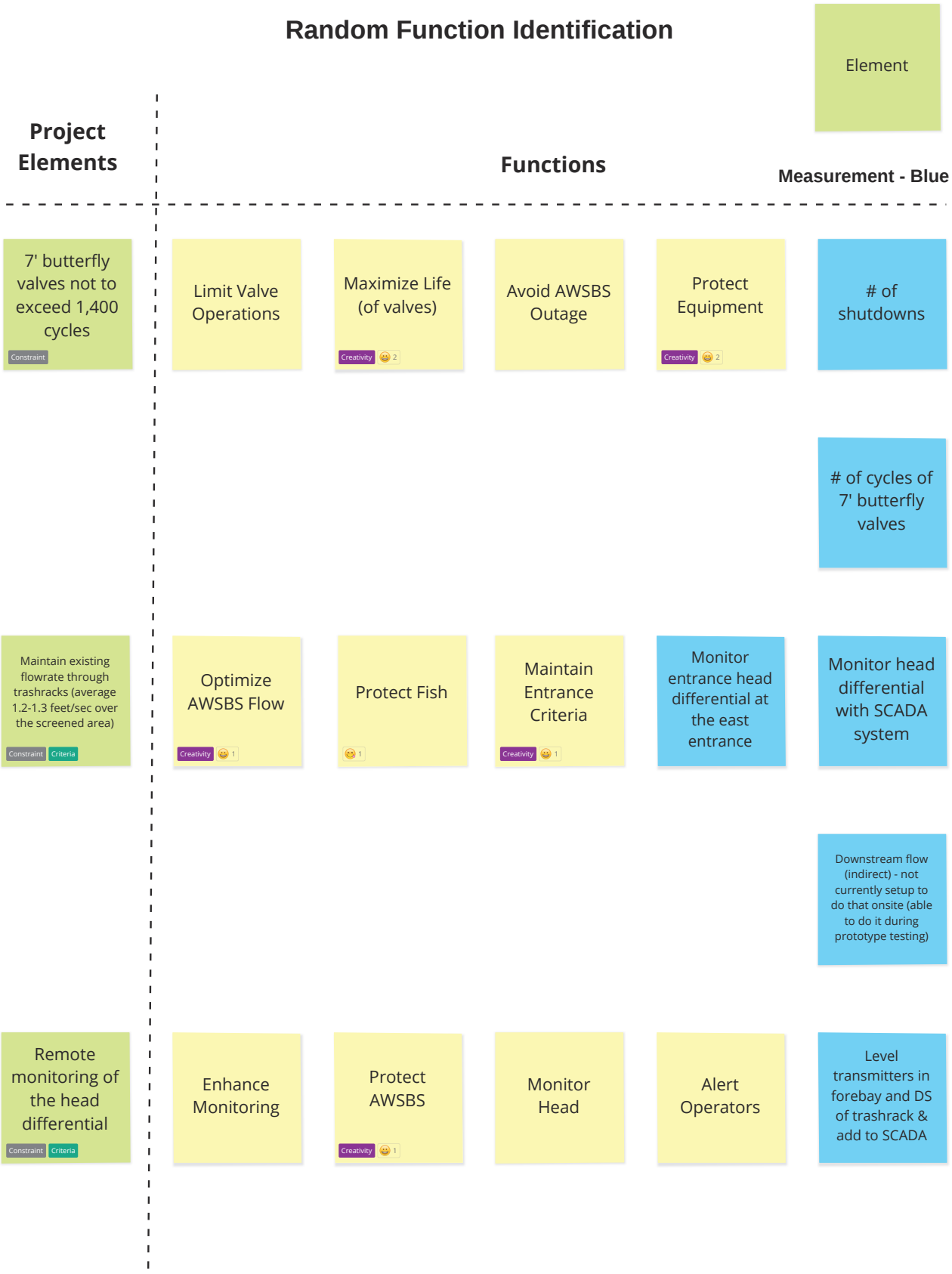

Random Function Identification
Element
Project Elements
Functions
Measurement - Blue
Trash racks designed for 5 feet of head differential
Criteria
Reduce Loading (on trashrack)
Protect Structure
Creativity 1
Verifying structural calculations of trashrack
Real-time differential measured by transducers
New debris management system to meet all applicable standards, codes, guidance, and best practices
Constraint
Criteria
Follow Standards
Creativity 1
Design review
Capable of removing or excluding debris effectively
Criteria
Reduce Impact
Reduce Shutdowns
Creativity 1
Monitor differential during debris removal
# of 7' butterfly valve cycles
Document # of shutdowns
Minimize number of shutdowns

Random Function Identification




Random Function Identification
Element
Project Elements
Functions
Measurement - Blue
Reliability- Debris Management System maintains function of a range of conditions and time.
Maintain AWSBS Flow
Creativity 1
Operate System (Efficiently)
Prevent Accumulation (of debris)
Creativity 1
Monitor entrance performance (TW, DH, Submergence)
Measuring head differential
Reliable operation under variable approach flow conditions
Criteria
Equipment mounting to the existing structure will be limited to the face of the dam and the deck of the existing AWSBS Precast structures
Constraint
Maintain Access
Reduce Footprint
1
Reduction of equipment (a measure of O&M)
Design review
Water differential monitoring transmitters will be connected to the hydro SCADA system
Criteria
Duplicate
Communicate AWSBS Differential
Alert Operators
Creativity 3
Share Monitoring
Cannot use project mobile crane.
Constraint
Maintain Operations
Creativity 1

Random Function Identification



APPENDIX D: Idea Evaluation

APPENDIX D: IDEA EVALUATION

INTRODUCTION

A total of 61 ideas were generated during the Creativity Phase of the VM Job Plan. During the Evaluation Phase, 9 ideas were elevated forward into the Development Phase as having strong potential for improving project value.

In addition to evaluating the new ideas generated during the value study, the value team also evaluated potential alternatives identified in the EDR. The value team identified five top candidates that were the most viable to meet the criteria and constraints of the project.

Maintain Flow (MF) | 6

MF-1 Add an emergency pump and electric generator at the fishway exit to supplement AWSBS when flow fall below a certain level.

For use during construction

MF-2 Construct a travelling horizonal backspray manifold that can be hoisted up and down behind the existing trashracks and remove debris while the AWSBS is operating.

Proposal

MF-3 Construct a blank panel that can be hoisted up and down that seal behind the existing trashracks while the AWSBS is operating to allow the debris to float off while operating.

Dismiss

MF-4 Construct a blank panel with an air burst system that can be hoisted up and down that seal behind the existing trashracks while the AWSBS is operating to remove debris.

MF-5 Rehab only one fish Unit and redesign the other penstock to provide flow directly to the fish ladders.

MF-6 Eliminate the fish units and redesign the penstock to provide flow directly to the fish ladders eliminating the need for Fish unit replacement and future maintenance

Review Comment

Maintain Flow (MF) | 5

MF-7 Construct an air scour array an be hoisted up and down that seal behind the existing trashracks to remove debris .

MF-8 Retrofit John Day aws debris crane and borrow for 2 years during rehab.

MF-9 Could specify a cleaning frequency and lower criteria to 6-inch head differential to maintain 1400 cfs

MF-10 Add attraction water pumps to pump from the tailrace to add flow to the entrance .

MF-11 Perform a quantitative risk analysis of the existing system to determine actual need for an upgrade.

Maintain Passage (MP) | 1

MP-1 Fish attraction criteria requires the use of one fish unit and the AWSBS or both fish units. So instead of relying on the AWSBS, just install a 3rd fish unit that can be used as a backup. This could be integrated into the existing fish units by adding in a parallel conduit with valves that can divert flow from the units to a 3rd fish unit.

Use Existing Power Supply (U... | 2

UE-1 Keep load of any debris management equipment below about 100 hp

UE-2 Sequence functions to minimize power load.

Review Comment

Prevent Accumulation (PA) | 6

PA-1 Replace the existing traskracks with a set of rotating screen intakes

PA-2 Add floating boom to divert debris (4)

Duplicate

PA-3 Add a water jet system that enhances sweeping flow across the face of the existing screens

PA-4 Deploy a net across trashrack face that can be pulled up or pulled away when the system is shut down

PA-5 Guide debris around intake (4-1 or 4-2)

PA-6 Deploy a removable net across the face of the intake

Maintain Constructible Desig... | 1

MC-1 Make a modified trash structure which has normal trash racks on the bottom and then a modified moving screen for the upper half. This could allow for cleaning of half the racks to maintain low head differentials while keeping the moving screen structure to within constructible limits.

Dismiss

Maintain Entrance Criteria (M... | 5

ME-1 Install level sensors to tie into project SCADA system

Add to Existing Alt | Proposal

ME-2 Modify entrances to ladders to use less flow

Proposal

ME-3 Close south entrance to use less flow (combine w/ME-2)

Proposal

ME-4 Close weir gates to reduce submergence to reduce flow (combine w/ME-2)

Proposal

ME-5 Reduce opening at all entrances to reduce flow and maintain entrance head (combine w/ME-2)

Proposal

Protect Fish (PF) | 2

PF-1 Use the monitoring to proactively schedule the shutdown/cleaning cycles to occur during night time only (currently FPP states cleaning cycles to occur during night). (combine w/ ME-1)

Proposal

PF-2 Enhance monitoring system to improve when cleaning of trash racks is needed (combine with ME-1).

Proposal

Promote Fish Passage (PF) | 4

PF-1 Replace only the first three trashrack below the forebay level with actual trashracks that can be raked with an automatic rake and release material downstream of the AWSBS. (ALT 1).

Remove after FU Rehab or keep.
https://www.youtube.com/watch?v=fXOizYnfD_k

https://ossberger.de/en/hydropower-technology/trash-rack-cleaners/

PF-2 Pull the racks at night (as needed) or during a shutdown and manually clean them (alt 7).

Add to Existing Alt | Proposal

PF-3 Construct additional racks so existing may be pulled and rotated for thorough cleaning (Alt 7)

Add to Existing Alt | Proposal

PF-4 Replace the upper trashracks with traveling fish screens

Reduce Maintenance (RM) | 2

RM-1 Have something passive that doesn't require power or operator.

RM-2 Use a weighted net with a series of winches to clean the debris from the rack. This could be hand powered to reduce the need to have monthly preventative maintenance on a motor.

Reduce Loading (RL) | 6

RL-1 Monitor pressure differential remotely and install staff gauges for visual inspection (tie to ME-1)

Add to Existing Alt Proposal

RL-2 Replace trash racks with stronger ones to handle more load.

RL-3 Increase the space between the bars on the trash rack to be the same as the trash rack for the fish units. Those trash racks have never needed to be raked. Since the AWSBS has less flow compared to the fish units we can assume the new trash racks also won't need to be raked.

RL-4 potential modification to RL3. Change the downstream side of the AWSBS/AWS to a moving screen so that the screen does not get clogged. This would allow for lots of flow through the AWSBS while not clogging the fish screens at the fish ladder entrance. The structure on the downstream end is smaller. (assumed to be smaller)

RL-5 Widen the spacing of the trashrack bars and install a type of debris separator on the downstream side of the dam.

RL-6 Replace bottom 20' of trash rack and cover upper portion. Less area for accumulation and raking.

Exclude Lamprey (EL) | 2

EL-1 Keep existing trashrack bar spacing

EL-2 Place a lamprey "barrier" around trashrack (abrupt edges) to allow a greater spacing

Reduce Shutdowns (RS) | 3

RS-1 Implement system that can clean the trashrack while it is operating

RS-2 Modified 4-2. Utilize a full depth debris curtain that is anchored to the river bottom.

RS-3 Leave the lower two trashracks with 3/4" bar spacing and use a wider spacing above (2-4", maybe) to reduce the potential for clogging.

Increase Reliability (IR) | 3

IR-1 Include two debris management systems (primary and secondary) for increased reliability. Secondary might include diving for example or another proposal

Review Comment

IR-2 Test debris boom (4.1 and 4.2) for effectiveness in reducing debris build up on trash racks

Proposal

IR-3 Space out fish unit rehabilitation schedule (year(s) between rehab in lieu of sequential)

Protect Environment (PE) | 1

PE-1 Limit improvements to the face of the dam adjacent (SW side) to the AWSBS intake and within footprint of the precast AWSBS structure (SW side)

Maintain Budget (MB) | 4

MB-1 Get BPA to pay for debris management system in lieu of CRFM.

MB-2 Passive system with little to no moving parts

MB-3 Integrate in to Fish Unit Project, and pay for in part possibly by CRFM, O&M and/or BPA. This would help ensure that the debris management system does not impact rehab schedule due to lack of funding.

MB-4 Request a higher O&M budget from Fed.

Alert Operators (AO) | 3

AO-1 Connect level transmitter at the trashrack to the SCADA system and annunciate alarms (combine with ME-1)

Proposal

AO-2 Add functionality to alert operators via their mobile devices (e.g., text message, etc.)

AO-3 Dedicated camera inspection system - could be used prior to sending down divers. Can see how debris floats off. Would need lights. Is the water clear enough? Need to consider turbulence. TDA does have an ROV regularly used for inspection (but flow needs to be shutoff).

Maybe temporary camera setup for fish rehab period only.

Review Comment

Protect Structure (PS) | 1

PS-1 Convey running tally on 7' butterfly valve cycles to operators (e.g., meters, start counters, SCADA system monitoring, etc.)

Add to Existing Alt Proposal

Maximize Life (ML) | 4

ML-1 Implement a cleaning system that doesn't use the valves

ML-2 Acquire spare parts for the 7' butterfly valves

Add to Existing Alt | Proposal

ML-3 Determine optimal opening for 7' butterfly valves to extend cycles

ML-4 Replace 7' butterfly valve seals after completing fish unit rehab (consider combining with ML-2, could be an optional bid item in the fish rehab contract, along with spare part procurement)

Add to Existing Alt | Proposal

APPENDIX E: VERS Data

APPENDIX E: VERS DATA

This section of the report is provided to support USACE reporting requirements. This information will be updated (as necessary) following the preliminary determination step of the post-workshop phase. The DVO is responsible for ensuring the necessary VERS information is included in the report and may be required to provide or supplement specific components of this data (e.g., VE Activity Cost).

The DVO should verify the information in this table before transferring it to VERS.

Value Engineering Reporting System Data

VERS Data Fields	Data	Report Version
Number of Proposals Developed	9	Draft
Number of Accepted Proposals	TBD	Final
Number of Quantitative Proposals	0	Draft
Number of Accepted Quantitative Proposals	TBD	Final
Number of Qualitative Proposals	9	Draft
Number Accepted Qualitative Proposals	TBD	Final
Potential/Projected Cost Avoidance (Gross)	TBD	Draft
Accepted Cost Avoidance	TBD	Final
Maximum Life Cycle Cost (Gross)	TBD	Draft
Accepted Life Cycle Cost	TBD	Final
VE Activity Cost (DVO to provide)	$	Draft
Return on Investment	TBD	Final

VALUE STUDY CERTIFICATION STATEMENT

VALUE STUDY CERTIFICATION STATEMENTS

Dalles AWSBS Debris Management Project
9-19 August 2021

The undersigned Certified Value Specialist (CVS®) facilitator attests that the Value Study documented by this report meets the USACE Value Standard and that the Value Study was facilitated in accordance with the SAVE International® Standards of Conduct.

David Eisenberg
CVS, No. 202001002
Value Study Facilitator

As the District Value Officer, I attest that the Value Study documented by this report was executed in accordance with the USACE Value Standard. I have validated the Value Study using the Standard Evaluation Tool; uploaded it to VERS; and shared it with the Certified Value Specialist® (CVS®) facilitator.

Jason Weber
VQR No. 019-V15
District Value Officer