2024
Chapter 2 – North Santiam Subbasin

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1. NORTH SANTIAM SUB-BASIN OVERVIEW

1.1. The North Santiam subbasin drains about 760 square miles (Figure NS-1). Two U.S. Army Corps of Engineers (USACE) dams were constructed on the North Santiam River. Detroit and Big Cliff dams were both completed in 1953 and are a barrier to upstream fish passage. Multiple smaller diversions/canals are located on the North Santiam River downstream of Big Cliff Dam including:

- Lower Bennett Dam (5.3-feet high) at river mile (RM) 29 owned by the City of Salem.
- Upper Bennett Dam (5.7-feet high) at RM 31.5 owned by the City of Salem.
- Salem Ditch (diversion) just upstream of Lower Bennett Dam and owned by the City of Salem.
- Minto Dam (10-feet high) at RM 55 and owned by the USACE and operated by the Oregon Department of Fish and Wildlife (ODFW).

1.2. The North Santiam subbasin is inhabited by Upper Willamette River (UWR) winter steelhead, UWR spring Chinook salmon, and Oregon chub.

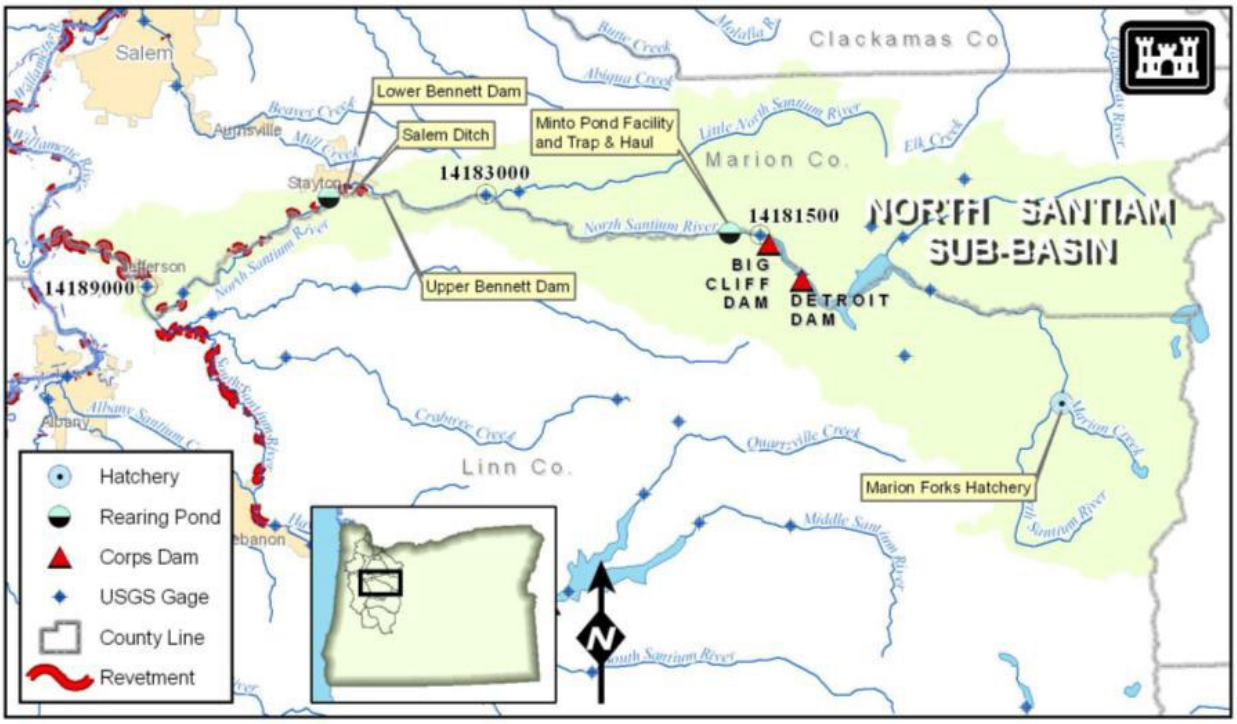


Figure NS-1. North Santiam Subbasin

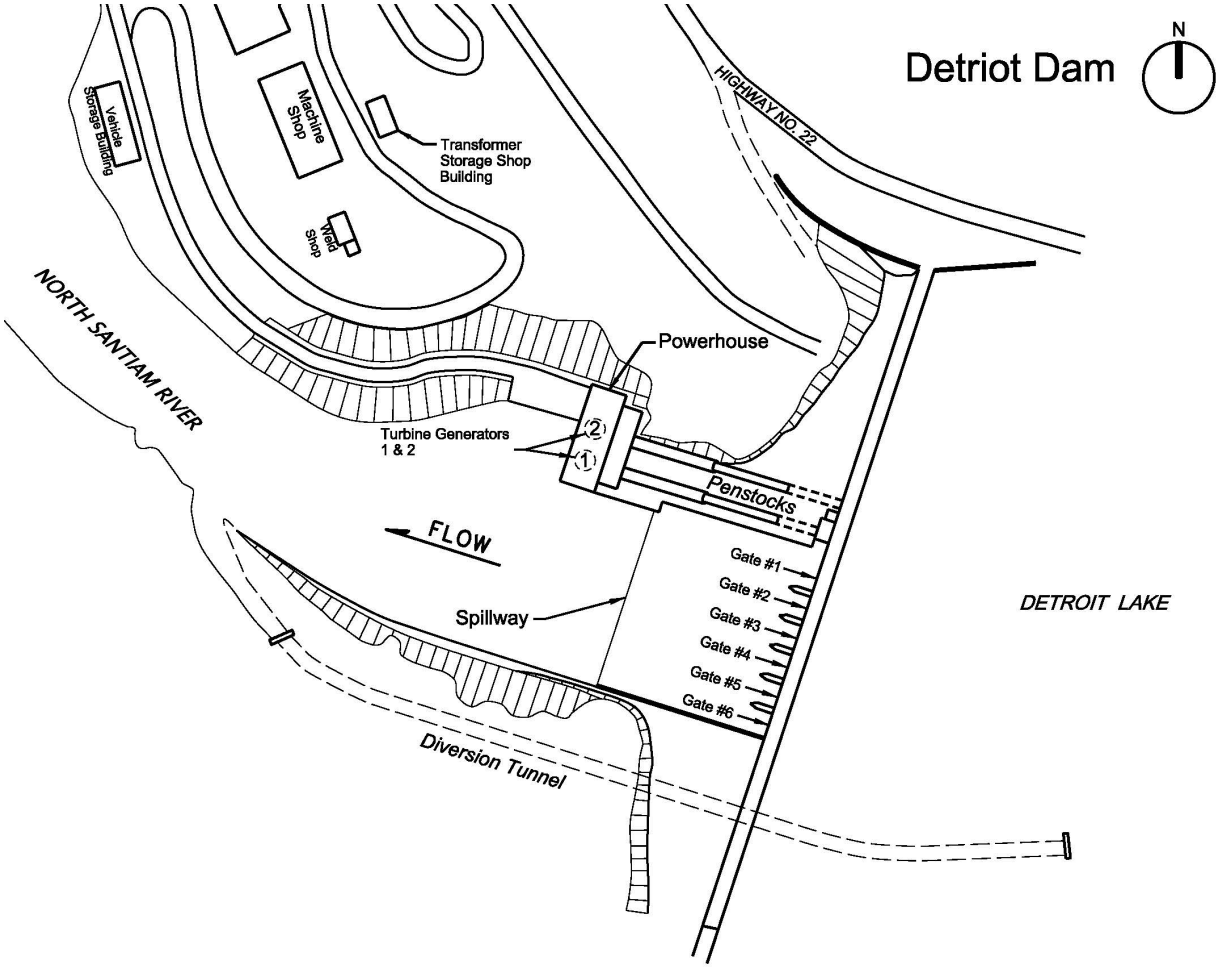


Figure NS-2. Detroit Dam

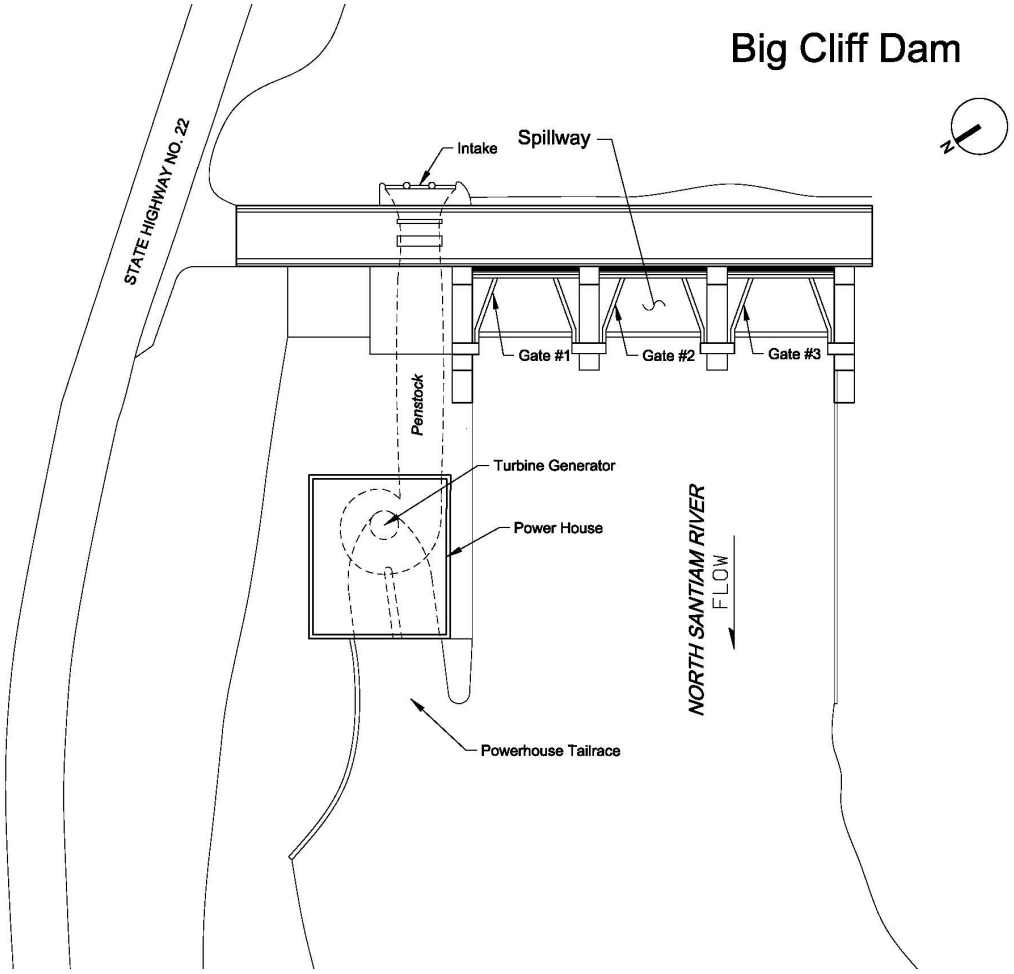


Figure NS-3. Big Cliff Dam

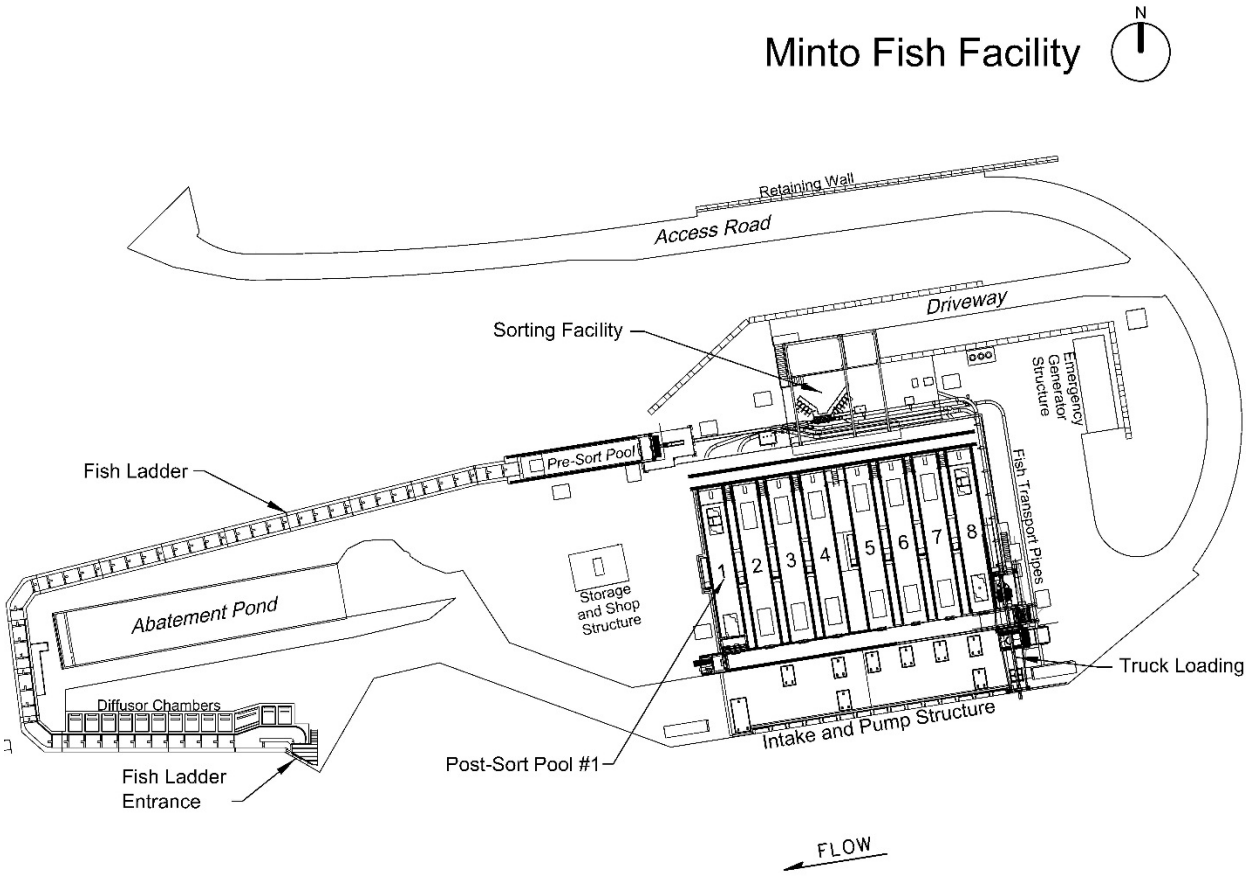


Figure NS-4. Minto Fish Facility

Table NS-1. Periodicity Table for Spring Chinook in the North Santiam River below Big Cliff Dam

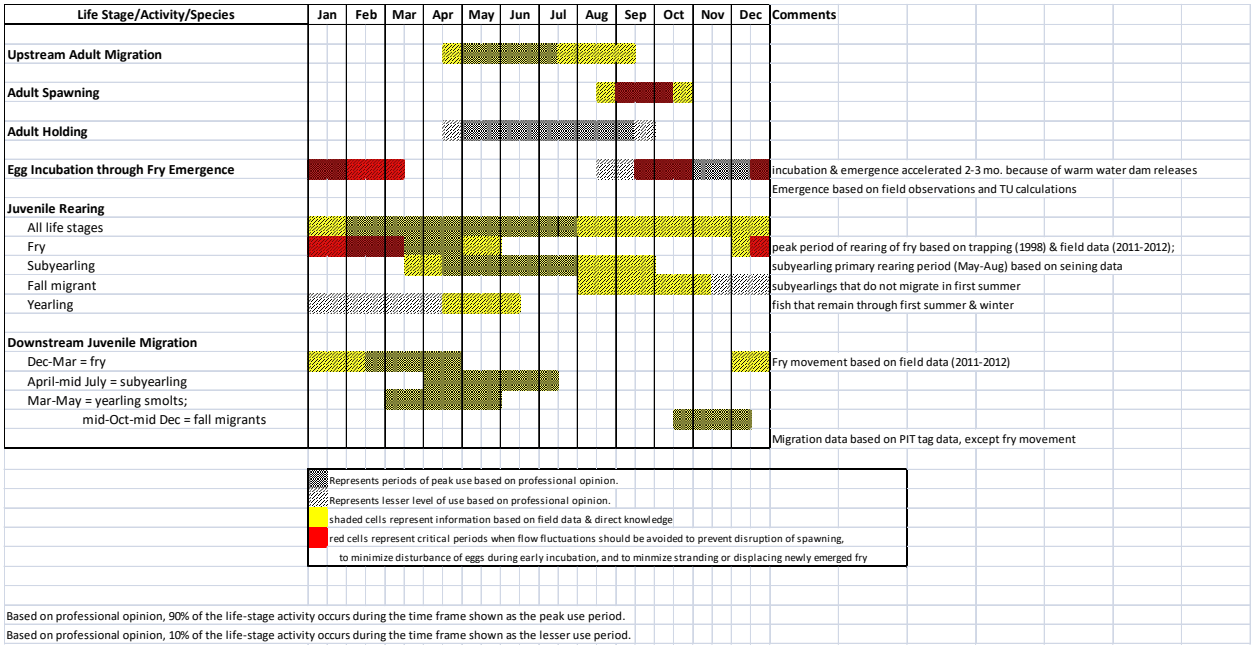
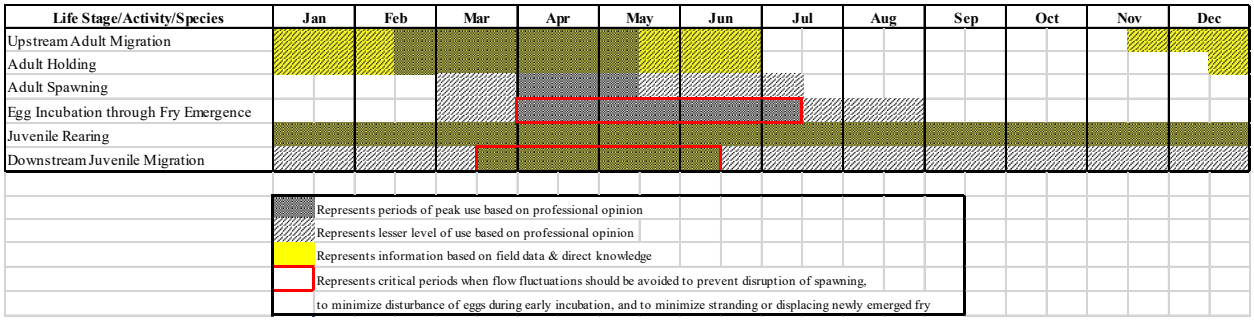


Table NS-2. Periodicity Table for winter steelhead in the North Santiam River below Big Cliff Dam



2. FACILITIES

Detroit and Big Cliff are the two Willamette Valley Project (WVP) dams located on the North Santiam subbasin. There are no downstream fish passage facilities at either dam, with trapping of adults for upstream fish passage occurring at the Minto Fish Facility located downstream of Big Cliff Dam, and hatchery fish production occurring at the Marion Forks Hatchery located upstream of Detroit Dam in Idanha, OR. Spring Chinook salmon and winter steelhead trapped at this location are released above the Minto barrier, transported to designated release sites (above and below the project dams), used for hatchery brood stock collection, or other approved dispositions.

The operation and maintenance of the Detroit and Big Cliff projects can impact downstream habitat conditions. The operations may alter flow conditions, both total flow and rate of change, and water quality, primarily temperature and total dissolved gas (TDG). To mitigate for these impacts, the USACE operates the Detroit and Big Cliff projects to meet specific flow and ramp rate targets (NMFS 2008). In addition to these flow constraints, the USACE has been providing interim operational temperature control in the North Santiam subbasin.

Both dams are operated from the Detroit Dam control room, which relies on the Supervisory Control and Data Acquisition (SCADA) system. Although SCADA allows for remote operation of Big Cliff Dam, it does have limitations. The precision of SCADA controls are not tuned enough to adjust the amount of water through Big Cliff to meet small flow changes. Additionally, there can be a lag time (30-60 minutes) from when an operational change is made at Big Cliff and when the control room observes the change recorded at the nearest downstream U.S. Geological Survey (USGS) gage at Niagara for verification located three miles below Big Cliff Dam.

2.1. Detroit Dam

Detroit Dam is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, power generation, recreation, navigation, municipal and industrial water supply, and downstream water quality improvement. The dam is 450-feet high and situated in the steep, rocky slopes of North Santiam Canyon. The dam is a concrete gravity structure with a gated spillway containing six spillbays and four regulating outlets (ROs).

2.1.1.Turbines

Detroit Dam has two Francis turbines rated at 57.5 megawatts (MW) each. For both turbines combined, the hydraulic capacity ranges from 4,300 to 5,300 cubic feet per second (cfs) depending on head (the difference between forebay and tailwater elevations).

2.1.2.Spillway Gates

Detroit Dam has six radial tainter spillway gates and a spillway crest at elevation 1,541 feet. The project cannot spill until water has risen above that elevation. The gates can only be controlled locally via a control panel with a mechanical dial detailing the spillway gate position or remotely from the control room.

2.1.3.Regulating Outlets

Detroit Dam has two sets of ROs (upper and lower) that are controlled with vertical sliding gates. The two upper RO gates at elevation 1,340 feet are controlled with hydraulic gates either locally or from the Detroit control room. A staff gage is used to measure the opening locally. Readings on the staff gage are spaced at 0.1 foot and the SCADA dial is set to 0.01-foot increments. The precision of the gate adjustments limit fine-tuning of RO flows. During emergency use, the RO outlet is controlled locally. There are two lower ROs (LRO) at elevation 1,265 feet. During the drought of 2015 the LRO was tested, passed inspection, and used for temperature management operations. The LRO was successfully operated for temperature management operations from October 08 through November 03. The lower RO can be used at reservoir elevations less than 1,450 feet for temperature management operations during low water years.

2.2. Big Cliff Dam

Big Cliff is a re-regulating dam with a small reservoir, located nearly 3 miles downstream from Detroit Dam. Big Cliff is used to capture power generation water releases from Detroit Dam and to control downstream river level fluctuations. Big Cliff Dam is a 172-feet high concrete dam.

2.2.1.Turbines

Big Cliff Dam has one Kaplan turbine rated at 23 MW with a hydraulic capacity that ranges from 2,800 to 3,200 cfs. Turbines are adjusted by making changes to the wicket gate openings. Small flow changes can be difficult due to wicket gate limitations.

2.2.2.Spillway Gates

Big Cliff Dam has three radial tainter spillway gates. The spillway crest is at elevation 1,161.5 feet. The gates can be controlled locally via a control panel with a mechanical dial detailing the gate position or remotely through the SCADA system. One of the spillway gates automatically opens to a specified opening (1 foot) if the turbine wicket gate opening goes to zero, indicating the turbine has tripped off.

At both Big Cliff and Detroit dams, there is only one speed that the spillway gate can be opened or closed (there is no variable frequency drive). The mechanical dial measures the amount of gate opening locally at the project. The SCADA dial is in 0.01-foot increments and the local dial is set to 1-foot increments. These settings limit the precision that flow changes can be made. The SCADA monitor provides the ability to set a specific gate opening at Big Cliff Dam. This is a unique feature for Big Cliff and is not used at other Willamette Projects.

2.2.3.Regulating Outlets

Big Cliff Dam does not have any ROs.

2.3. Minto Fish Facility

Adult spring Chinook salmon and steelhead needed for ongoing fish management activities in the North Santiam subbasin are collected at the Minto Fish Facility located on the North Santiam River (Figure NS-4). The facility is owned by the USACE and operated by ODFW. The Minto Fish Facility consists of a fish ladder, presort pool and crowder, sorting flume, eight post-sort holding ponds, fed by pumps, and many other features that accommodates both holding adult salmon and steelhead as well as acclimation of juveniles.

3. DAM OPERATIONS

3.1. Flow Management

3.1.1.Tributary Flow Targets

The 2008 BiOp requires specific flow regimes below Big Cliff Dam. These operations include minimum and maximum flow targets, increasing and decreasing flow rate targets (ramp rates) and recommendations for operations during high flow periods.

Required minimum and maximum flows for Big Cliff Dam vary by time of year and are shown in Table NS-2. Minimum outflow from Big Cliff Dam is 1,000 cfs from July 16 to August 31. Spring spawning flows for winter steelhead are 1,500 cfs from March 16 to May 15, followed by incubation flows of 1,200 cfs lasting until July 15. Spring Chinook salmon spawning requires flows of 1,500 cfs from September 1 to October 15, followed by incubation flows generally through January 31. Maximum flows during spawning are 3,000 cfs if possible. In years when spawning flows exceed targets (i.e., 3,000 cfs), the Flow Management and Water Quality Team should assess both the proportion of redds affected and to what magnitude given available information and evaluate options that could include increased incubation flows to improve survival from some or all redds.

Table NS-3. Flow Rates and Ramp Rate Requirements for Big Cliff Dam

Time Period or Criterion	Target
High Flow (> 2,000 cfs)	
Minimum Flow	1,000 cfs

Time Period or Criterion	Target
Normal Maximum Flow* (for evacuation of stored flood water)	17,000 cfs
Normal Rate of Increase per hour	
100-1,000 cfs	500 cfs
1,000-3,000 cfs	1,000 cfs
3,000-17,000 cfs	1,500 cfs
Maximum Rate of Increase per hour	2,000 cfs
Maximum Rate of Decrease per hour	20% of flow
Low Flow (< 2,000 cfs)	
February 1 – March 15	1,000 cfs
March 16 – May 31 (winter steelhead spawning)	1,500 cfs
June 1 – July 15 (winter steelhead incubation)	1,200 cfs
July 16 – Sept 4 (rearing)	1,000 cfs
Sep 5 – Oct 30 (Chinook spawning)	1,500 cfs
Nov 1 – Jan 31 (Chinook incubation)	1,200 cfs
Rate of Change (increase)	
Normal	based on a tailwater change of 0.3 feet/hour (ft/hr) and 0.5 ft/day
Special	use when there is an emergency – power requirements, boating accident; based on a tailwater change of 0.3 ft/hr and 0.5 ft/day
Rate of Change (decrease)	
Maximum Rate	- 0.1 ft/hr nighttime hrs, -0.2 ft/hr daytime hrs
Maximum Daily	-1.0 ft/day

*Project outflows during major flood events may exceed these levels. Source: USACE 2009.

These flows are not always achievable in the case of flood damage reduction operations during years with wet springs or large snowpack accumulations. During the high water season (generally November through February), the normal evacuation rate of stored flood waters is 10,000 cfs with a maximum rate of 17,000 cfs. The primary goal of high water outflow regulation is to avoid exceeding bank full at downstream control points when evacuating the reservoir for potential future storm events, while making best efforts to adhere to the general ramping rate guidelines (discussed in next subsection). Additionally, higher spawning flows may result in desiccation of redds if spawning occurs at higher streambed elevations than can be maintained under the specified incubation flows.

3.1.2.Rates of Flow Change (24 hour, day and night)

The North Santiam River downstream from Big Cliff Dam was historically operated with ramping rates that allowed relatively aggressive ramp ups and ramp downs. Since 2006, the USACE has limited the maximum down-ramping rates below Big Cliff Dam to follow general ramping rate guidelines of 0.1 foot/hour during nighttime and 0.2 foot/hour during daytime unless such restrictions have been infeasible with existing equipment at the dam (Table NS-2; USACE et al. 2007). Maximum up-ramping rates vary from 500 cfs per hour at initial flows between 100 and 1,000 cfs to 2,000 cfs per hour at initial flows above 17,000 cfs; Table NS-2). Historically, during high flows the

project was allowed to reduce outflow at 30% per half hour. During real-time storm events where a storm has been under forecast, it may be necessary to ramp the project down at a faster rate than general guideline allowances. In this case, the guideline is 20% per hour at the operator's discretion for purposes of human health and safety.

3.2. Downstream Fish Passage and Water Temperature

Detroit Dam will be operated to provide downstream fish passage in the spring and water temperature management throughout late spring, summer and fall. Downstream fish passage will also occur during winter. Spillway operations will start when the reservoir reaches spillway crest elevation (El. 1541.0 ft.) and continue until the reservoir is drafted below the spillway crest. A combination of turbine and regulating outlet discharges will be implemented until water temperature management is no longer possible due to reservoir turnover.

Downstream total dissolved gas (TDG) management will be implemented at Big Cliff Dam. When possible, spill will be spread across multiple gates to minimize TDG impacts as best as possible.

During high flow events, this operation will be modified to carry out flood risk reduction measures. Spill may also be reduced to prevent elevated downstream TDG levels.

3.3. Spill Management

3.3.1.Operations to Limit Total Dissolved Gas

Both Detroit and Big Cliff dams generate TDG supersaturation when spillways are operated. The extent of TDG saturation is dependent on the type and duration of operation and whether multiple spillways are operated simultaneously. While spill primarily occurs involuntarily due to high-flow events during winter months, spill also occurs infrequently in other months during powerhouse outages or late spring rainstorms when Detroit reservoir is near full or full.

Special, interim, and other operations to minimize negative impacts from total dissolved gas levels are listed below:

3.3.1.1. **Big Cliff Dam:**

SPILLWAY OPERATION – UNIT ONLINE

Ensure either spillway gate 1 or 3 is selected as the auto-gate.

Raise a single gate as necessary to achieve the desired spillway discharge.

For a given forebay elevation, flow should be passed through two gates as soon as the desired outflow can be achieved by opening two gates at or above the minimum gate opening defined by the spillway rating table.

As lake elevation or desired downstream flows change, continue to spread flow across the two manually operated gates as long as doing so does not result in operating a gate under the minimum gate opening.

SPILLWAY OPERATION – UNIT OFFLINE

Ensure the auto-gate function is disabled.

For a given forebay elevation, flow should be passed through multiple gates as soon as the desired outflow can be achieved by opening two to three gates at or above the minimum gate opening defined by the spillway rating table.

As lake elevation or desired downstream flows change, continue to spread flow across all available gates as long as doing so does not result in operating a gate under the minimum gate opening.

CONSIDERATIONS

When passing flow from multiple gates, up to a 0.25 ft difference in gate opening is permitted between spillway gates.

Spillway gate 2 should be opened to a level equal to or greater than gates 1 & 3 when flow is discharged from multiple gates.

Spillway gates 1 or 3 can be set as an auto-gate that will open to 1.0 ft in the event the Big Cliff unit is offline. The intent of an auto-gate to limit the variability in river flows when the generator trips offline.

When flow is channeled down the center of the raceway, bank erosion is reduced. Discharge from spillway gate 2 has the least impact on bank erosion.

3.3.1.2. **Detroit Dam:** When units are offline or when capacity is exceeded spill will be spread through multiple spillway bays (1-6) or multiple ROs depending on elevation to reduce potentially high TDG levels (Figure NS-2). Minimum gate openings may restrict this action depending on the desired outflow.

Table NS-4. Monthly Temperature Targets for North Santiam River below Big Cliff Dam

Month	Temperature Maximum/Minimum	
	°F	°F
January	42	38
February	42	38
March	44	42
April	46	42

May	50	46
June	54	48
July	55	52
August	55	52
September	54	48
October	52	46
November	46	42
December	46	41

Interim temperature control operations may be modified annually based on water availability, meteorological conditions, project constraints/limitations, and from information gathered from prior operating years.

Annual results for operational temperature control are provided in the Willamette Basin Annual Water Quality Report. These annual reports detail periods of non-conformance from the temperature targets, providing the duration and cause of the deviation.

3.4. Spill Management

3.4.1. **Big Cliff Dam**. The configuration and numbering of the spillway bays at Big Cliff Dam are shown in Figure NS-3. Spill is spread through bays 1-3 to control TDG when not generating or when flows exceed turbine capacity between September 1st and July 31st for spring Chinook and winter steelhead incubation. Minimum gate openings may restrict this action depending on the desired outflow.

3.4.2. **Detroit Dam**. Operational flexibility at Detroit Dam allows us to conduct interim temperature control operations, minimize TDG, and has potential to aid downstream passage of juvenile salmonids. When turbine units are offline or when capacity is exceeded spill is spread through multiple spillway bays (1-6) or multiple ROs depending on elevation to reduce potentially high TDG levels (Figure NS-2). However, minimum gate openings may restrict this action depending on the desired outflow. Existing outlet use for interim temperature control June through November 15th is a biological priority. The focus should be on spreading spill or prioritizing use of the ROs all other times to limit TDG. Recent information suggests that ROs produce less TDG than the spillways. Furthermore, to prevent elevated TDG from being transported downstream, the Big Cliff turbines should be used when the Detroit spillways or ROs are in operation. Consideration should also be given to providing larger gate openings to benefit downstream juvenile passage survival.

4. DAM MAINTENANCE

The annual maintenance periods discussed below for Detroit and Big Cliff dams are provided as applicable for the projects and will be adhered to during annual maintenance planning. Potential effects on ESA-listed fish include temperature, TDG, and flow-related impacts downstream of Big Cliff Dam. Detroit contains two turbine units allowing for maintenance to be completed on individual units without impacting flow. Maintenance that requires both turbine units to be offline should be completed during the period identified to avoid impacts to interim operational water temperature control.

4.1. Big Cliff

Target outage periods:
Feb 16-Mar 31: Tertiary target period.
Apr 1-Jul 15: Restricted from outage scheduling.
Jul 16-Aug 31: Primary target period
Sep 1-Oct 15: Secondary target period
Oct 16-Feb 15: Restricted from outage scheduling.

4.1.1. Considerations/Rationale for unit outage scheduling:
Feb 16-Mar 31: March is the only month when spring Chinook fry are mostly emerged, however, adult winter steelhead are present in the N. Santiam mainstem.
Apr 1-Jul 15: Peak egg incubation and fry emergence for winter steelhead.
Jul 16-Aug 31: No sensitive life stages have peak use during this time for either species, so this timing is ideal for minimizing biological impacts. Only limitation is power valuation.
Sep 1-Oct 15: Fluctuations in flow should be limited due to spawning spring Chinook salmon.
Oct 16-Feb 15: Minimize generation outages in order to maintain TDG below limit due to impacts on spring Chinook salmon sac fry.

4.2. Detroit

Target outage periods:
Mar 1-May 31: Primary target period.
Jun 1-Dec 1: Restricted to one unit at a time in outage status.
Nov 16-Feb 28: Limited outage scheduling due to power valuation considerations.

4.2.1. Considerations/Rationale for unit outage scheduling:
Jun 1-Dec 1: At least one unit is required for temperature control.
Nov 16-Feb 28: Minimize generation outages in order to maintain TDG below limit due to impacts on sac fry. TDG is not a large concern if Big Cliff is generating. When Big Cliff is not generating and spill is required at Detroit, spill should be spread across as many spill gates as possible.

5. FISH FACILITY OPERATIONS

The Minto Fish Facility is a complex system that must be operated carefully to maintain hydraulics for efficient fish passage and holding. Many features of the facility are automated but can also be operated manually. The facility O&M manual (see Appendix) contains specific information regarding startup, normal and manual operations, as facility shutdown as well as how to maintain hydraulic criteria.

The Minto Fish Facility will operate most of the year except during shutdown if necessary for maintenance or other activities.

5.1. Juvenile Fish

Juvenile hatchery fish will be acclimated at the Minto Fish Facility for a minimum of 30 days prior to release. Fish may be held less than 30 days due to biological/environmental factors (e.g., elevated TDG).

5.2. Adult Fish

Disposition of adult fish will be determined annually through WFPOM, and published or attached in the WFOP upon finalization.

5.2.1. Fish Collection and Handling

5.2.1.1. All adult trapping facilities shall be operated for adult spring Chinook salmon and winter steelhead in a manner that minimizes the duration of holding and delay.

5.2.1.2. All trapping, hatchery, and transport personnel must avoid excessive handling of adult fish to minimize stress and reduce the chance of injury.

5.2.1.3. All transfer of fish shall be completed through water to water transfers, unless logistically infeasible.

5.2.1.4. Sorting of adult spring Chinook salmon and winter steelhead for outplanting shall be completed in manner that minimizes stress and injury.

5.2.1.5. All efforts should be made to minimize sorting adult fish if feasible. Fish used for broodstock and outplanting purposes will be handled more than once due to current facility design and infrastructure limitations (inherent with trap and haul operations).

5.2.1.6. Healthy fish should be used for both broodstock collection and outplanting efforts (to support reintroduction) to increase the probability of survival and should be representative of the run.

5.2.1.7. Sorting shall be completed to separate by species or origin (hatchery or natural origin) to ensure an adequate sex ratio for outplanting and brood production. To the extent possible, adjust the sex ratio of releases based on known differences in pre-spawning mortality between males and females to maximize reproductive success. Ensure an adequate number of females are outplanted to seed available habitat.

5.2.1.8. The WFPOM Team will develop the annual guidelines regarding when to outplant fish from each location and will be vetted through the WFPOM team. Collect fish on a regular basis throughout the run and outplant when collected, ensuring temporal outplants are representative of the run. However, pre-spawning mortality of early-released fish may be high and thus should be monitored to ensure effectiveness of this strategy. Fish could be held at the Minto Fish Facility if found beneficial to reduce pre-spawning mortality. Fish will not be held longer than the agreed upon time to be developed through the WATER process.

5.2.1.9. During processing/sorting, the anesthetic used will be dependent upon whether a fish will be: for brood, returned to the fishery, outplanted, sampled for RM&E, or surplused (e.g., sold, food bank). Fish will be moved out of the trap quickly and frequently. Fish will be handled as gently as possible during processing and loading onto the truck, attempting to minimize stress and skin abrasions associated with handling.

5.2.1.10. Once fish are sorted, they will spend no longer than the allotted time that will be agreed to through the WATER process within holding tanks prior to being transported to their

destination, which is determined by the fish disposition table. Environmental factors such as flow, fish health, and temperature will be considered.

5.2.1.11. The presort pool will be checked once daily during periods of normal fish movement. During peak migration periods the trap will be checked throughout the day to ensure the presort pool is not exceeded.

5.2.1.12. Spring Chinook and winter steelhead will be removed and placed in holding tanks with a density approximately 25 gallons of water per fish. Adult holding will reflect IHOT and NMFS recommendations.

5.2.1.13. Oxygen levels in the holding tank water should not exceed saturation (100%) or drop below 7 parts per million (7 mg/L), however, spill during the wet and flood risk reduction season may preclude meeting this guideline.

5.2.1.14. The fish disposition table, developed collaboratively by WFPOM and approved by NMFS, will be used to guide the management of anadromous and resident fish as they are encountered in adult fish traps.

5.2.1.15. MS-222/CO_2/AQUI-S 20E. At fish handling facilities in the Willamette Basin operated by ODFW, the ODFW and ODEQ have agreed upon a process of dispersal and evaporation (or volatilization) for the disposal of water treated with anesthetics, which are highly volatile substances. The USACE will continue to use eugenol (clove oil) at USACE-operated adult fish trapping facilities (Cougar and Fall Creek).

5.2.1.16. Reduce multiple handling/anesthesia of fish during sorting for outplanting or brood production whenever possible.

5.2.1.17. During processing/sorting, fin clip samples will be collected for genetic analysis from all natural origin (intact adipose fin) adult UWR spring Chinook salmon and winter steelhead collected. These samples will be preserved, associated with any relevant individual ID information (e.g., floy tag number) and data collected at sorting, and stored at the facility with appropriate records until other disposition is agreed on through the WFPOM or other WATER coordination team.

5.2.2. Transport and Outplanting

5.2.2.1. All transport tanks will be treated with NovAqua® or equivalent per manufacturer's instructions to reduce stress during transport.

5.2.2.2. Transport adult spring Chinook at a density of $\geq$ 25 gallons of water per fish (60 fish/1,500 gallon tank).

5.2.2.3. Oxygen levels above 100% should be minimized in the transport truck or should not drop below 7 parts per million [7 milligrams per liter (mg/L)].

5.2.2.4. All trapping, hatchery, and transport personnel must adhere at all times to existing ODFW policies and procedures to reduce the transfer of pathogens.

5.2.2.5. *No handling* will occur at adult trapping facilities when water temperatures exceed 70°F in the pre-sort pool.

5.2.2.6. In certain situations, the transfer of fish for outplanting or to cooler hatchery waters may occur if fish are being held, or may be held, in waters exceeding 70°F for an extended period of time. Coordination with NMFS prior to transfer and notification to the WFPOM Team is required under these circumstances.

5.2.2.7. When outplanting adult spring Chinook salmon, receiving water temperature shall be less than 68°F *as measured prior to release*. If water temperature is greater than 68 degrees F, outplanting should not occur at that site and an alternate should be sought. If an alternate site is not available, hold fish at the collection facility. Attempt to outplant fish during early morning hours during the season when elevated temperatures are observed.

5.2.2.8. Monitoring of water temperature can be completed using USGS gages or temperature meters, where available.

5.2.2.9. Drivers will measure the temperature of the water in the transport tank and the receiving water prior to releasing the fish.

5.2.2.10. If the temperature difference between the receiving water and tank water is > 7°F, the water will be tempered to a difference of < 5°F at a rate of 1°F/6 minutes if possible and equipment is available.

5.2.2.11. Fish facility personnel are responsible for recording the holding pool water temperature prior to transport, liberation truck water temperatures, and receiving water temperature upon release.

5.2.2.12. If liberation truck waters require tempering, beginning and end temperature as well as time required for acclimation will also be recorded.

5.2.2.13. All outplanting shall be completed at designated outplanting sites consistent with the appropriate disposition table for each subbasin. Releases shall be made in a manner to minimize stress and chance of physical injury. In-season variances to either outplant site use, fish disposition, or other outplanting protocols can be completed with agreement from the WFPOM Team with notification provided to the WATER Steering Team. NMFS must agree to any in-season variances proposed by the WFPOM Team before the action is taken.

5.2.2.14. Release trucks shall have a minimum of a 12-inch opening on all. Set pipes at proper discharge angle and use discharge chutes. Use a waterspout to flush fish from the truck. Avoid abrupt changes in temperature. Release fish early in the day whenever possible. If receiving waters are known to be too warm at certain times of year, release fish when or where waters are cooler. Investigate the options to improve survival such as holding fish in a hatchery pond and treating with antibiotics until they are ready to spawn, at which time they would be released. Releasing ripe fish may limit numbers outplanted and potentially reduce pre-spawning mortality. Staff will use best judgment to avoid releasing ripe fish under adverse conditions by using a release site with the most suitable conditions.

5.2.2.15. Fish liberation truck driver and/or trained volunteer will observe released fish and document any mortality and unusual behavior after release.

5.2.2.16. All truck drivers will complete an adult salmonid outplant form to document oxygen levels, temperatures in the tank and release stream, immediate mortalities, loading densities, and release method. These data will be used to enable better monitoring of outplanted fish.

5.2.2.17. Hauling frequency will depend on factors that include run size, stream temperatures, and transport/ holding constraints. Some fish will likely be held prior to outplanting to some extent depending on these constraints. Unless environmental conditions in areas where fish are to be transported are poor, hauling frequency should be such that it minimizes holding times.

5.2.2.18. It is the intent to reduce holding times and complete outplanting as soon as possible upon a fish's return to the adult trapping facility. Given the typical adult monthly return timing and abundance observed, expected hauling frequencies are dependent upon run size and outplanting location (e.g., Later outplanting for spring Chinook destined to Breitenbush):

Species	M or NM	Trap Inspection	Trap Frequency	Outplant Location	Outplant Criteria	Outplant Frequency
Winter steelhead	NM	daily	3x/week May 16 - June 30. 2x/week other times	Above Minto	TDG <110% @ Niagara	As collected (see Trap Frequency)

Spring Chinook	M	daily	3x/week May 16 - June 30. 2x/week other times	Breitenbush	Hold until late Aug	Hold at Minto for late outplanting
Spring Chinook	M	daily	3x/week May 16 - June 30. 2x/week other times	N. Santiam		
Spring Chinook	NM	daily	3x/week May 16 - June 30. 2x/week other times	Above Minto	TDG <110%	As collected (see Trap Frequency)

- M: marked, NM: non-marked

5.2.2.19. The current program involves releasing fish according to the targets identified in Table NS-4. Detailed protocols for the disposition of excess hatchery fish will be contained in the WFOP. These goals will be updated annually by the WFPOM team. When numerical adult abundance recovery goals are established for the North Santiam spring Chinook salmon population through the recovery planning process, these targets will be adjusted accordingly.

Table NS-5. Number of Adult Spring Chinook to be Outplanted

Location	Target Number of Fish (number of pairs in parentheses)	Origin	
		Hatchery	Natural
North Santiam River upstream of DET	900 (450)	X	
Breitenbush River upstream of DET	600 (300)	X	
North Santiam River upstream of Minto[a]	All		X

Table NS-6. Outplanting release sites

Release Site
Log Deck (2.5 miles above head of reservoir)
Parish Lake Road (15 river miles above head of reservoir)
Hot Springs (Breitenbush River)

6. Fish Facility Maintenance

6.1. The proposed maintenance period where a shutdown is required for the ladder will be from **November 1 to February 15**. The following will be performed during the maintenance period:

6.1.1. All staff gages and water level indicators will be inspected, cleaned, and repaired as necessary.

6.1.2. The fish ladder will be dewatered and inspected for debris, projections, or clogged orifices that could injure or impede fish. Necessary repairs will be completed at this time.

6.2. The proposed maintenance period where a shutdown is required for the post sort pools will be from **April 16 to May 31**. The following will be performed during the maintenance period:

6.2.1. All staff gages and water level indicators will be inspected, cleaned, and repaired as necessary.

6.2.2. The pools will be dewatered and inspected for damage, cracks, debris, or projections that could injure fish. Necessary repairs will be completed at this time.

6.2.3. Specific maintenance activities listed for monthly, quarterly, and annual actions will be appended to the WFOP.

7. INSPECTIONS, REPORTING, AND NOTIFICATIONS

7.1. The following will be checked on a daily basis:

7.1.1. Intake structure sump pumps
7.1.2. PLC s, both on the spawning deck and in the IPS, for any alarms, make sure all systems are in AUTO
7.1.3. FWS pumps oil level
7.1.4. FWS pumps packing box for adequate water
7.1.5. FWS pump VFD panels for any fault codes and proper lighting on panel
7.1.6. Deck wash pump panel for light indication and check tank for pressure between 35 - 65 psi
7.1.7. Intake pressure gages and flow meter working
7.1.8. Intake air compressor oil level
7.1.9. Air compressor condensate traps and drain if needed
7.1.10. Intake air compressor for abnormal vibration or noise
7.1.11. Intake header for any leaks
7.1.12. Intake structure for any leaks
7.1.13. Intake structure power panels
7.1.14. Domestic water controller in Mechanical/Electrical room
7.1.15. Presort pool for correct water level
7.1.16. Post Sort pools for correct water level
7.1.17. Diesel Generator block heater on
7.1.18. Diesel Generator in AUTO
7.1.19. Battery charger on generator working
7.1.20. Any fuel leaks around generator and tank
7.1.21. Lighting around facility working correctly

7.2. Fish facility inspections will be performed in accordance with guidelines in the operations and maintenance (O&M) manual.

7.3. The results of all inspections and the readiness of the facilities for operation will be reported by the operator to the Willamette Fish Passage Operations and Maintenance Team (WFPOM) by March 1.

7.4. More frequent inspections will occur as requested by the WFPOM Team or at any time by facility personnel. During the field season, WFPOM members will visit fish facilities to evaluate adherence to protocols and SOPs. The site visit assessment activities include observing fish sorting and handling procedures. A check sheet will be filled out and initialed indicating whether procedures

are or are not being performed according to protocol. Protocol drift for any activity must be reported to the immediate supervisor and corrective actions must be implemented immediately.

7.5. Fish trapping facilities will be initially inspected prior to being removed from service for the year to assess facility condition and maintenance needs.

7.6. Staff gages and other water-level sensors will be installed, cleaned, and/or repaired as required to allow for monitoring facility performance.

7.7. Fish facility personnel shall prepare monthly reports throughout the year summarizing project operations. These monthly reports will provide an overview of how the project operated during the prior month.

7.8. The reports shall cover a monthly period and they shall be provided to WATER stakeholders at monthly WFPOM Team meetings and recorded in a record of the meeting minutes.

7.9. The reports shall include:

7.9.1. Any out-of-criteria situations, observed deviations from the WFOP, and subsequent corrective actions taken.

7.9.2. Any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities.

7.9.3. Progress in reaching outplant numbers targeted in the fish disposition table.

7.9.4. Mechanical and/or structural issues preventing optimum facility operation.

7.9.5. General hatchery operations including trap counts, transfer information, juvenile releases, and updates on hatchery research.

7.9.6. Adult outplanting data documenting release locations, numbers released, any observed transport or liberation mortalities, holding, transport and receiving water temperatures, and poaching/harassment issues.

7.9.7. Any adult mortality that occurs within the trapping facility during holding or handling prior to transport and must documents species, origin, size, marks/injuries, cause and time of death, and future preventative measures. When mortality occurs, this should also be reported immediately to USACE that will be included in a memorandum to the Services.

7.9.8. Adult mortalities should be reported as soon as possible to the Services.

7.10. The facility operator will produce an annual report summarizing the species, number, origin, and destination of all fish collected at USACE fish facilities in the Willamette Basin, as well as all BiOp deviations. This annual report will be a summary of the monthly or quarterly progress reports. The report shall assist in identifying potential operational changes. Reporting may be included in baseline hatchery monitoring or the annual hatchery operations reports and provided at specified dates (WFOP, contract, cooperative agreement).

7.11. Hazardous Spills. Hazardous spill notification will continue to be completed through the Oregon Emergency Response System (OERS). This system provides 24-hour service through Oregon Emergency Management of the Department of State Police. Local public safety agencies such as law enforcement, fire and emergency medical services normally provide the first response to an incident. Access to this local assistance is through 9-1-1. Once notified, local public safety agencies would call OERS at 800-452-0311 or in the Salem area at 503-378-6377. If necessary, responsible parties would then call the National Response Center at 800-424-8802. The USACE operations fisheries biologist will be included as an initial contact to address any immediate fisheries response needs, as well as to provide additional notification directly to the Services.

Although the OERS serves to disseminate spill response notification to both the state and federal fisheries agencies, the USACE operations fisheries biologist will notify the Services directly of the incident.

7.12. Any poaching, suspicion of poaching activities or observed harassment of outplanted fish shall be reported immediately to the Oregon State Police at 1-800-452-7888.

7.13. The annual report will be distributed to the members of the WFPOM Team.

8. DEWATERING PLAN

Fish facilities and turbines are drained for regularly scheduled maintenance and sometimes for emergency maintenance. These activities may involve handling fish and could cause other adverse effects on juvenile and adult fish in the watershed (e.g., stranding of fish in the reservoir). This plan is subject to change as improvements are developed and will be revised on an annual basis as part of the WFOP. Not all dewatering efforts will require fish salvage; as such, the need will be determined by USACE and ODFW fish biologists.

8.1. Coordination

8.1.1. Facility outages will be scheduled to minimize impact on fish while accomplishing necessary repairs and maintenance on facilities. Specific outages will be scheduled according to maintenance periods detailed in appendices. Fish facility personnel (either ODFW or USACE) will coordinate these activities with Portland District Operations Division fishery biologists and will ensure that the fisheries agencies, particularly those whose activities may be impacted, are kept informed. Primary points of contact include ODFW, NMFS, and USFWS.

8.1.2. The Willamette Project Supervisory Fisheries biologist coordinates fishway dewatering and salvage activities with the project operations and maintenance supervisor. This includes having the appropriate personnel and equipment on site. The designated fish facility lead, likely the Operations Division project biologist for USACE operated facilities, or an ODFW hatchery manager for ODFW operated facilities, directs execution of the drainage plan at least until fish removal is complete. Before or at the beginning of each draining operation, a pre-work briefing will be held to explain procedures, responsibilities and safety considerations for all participants. After the salvage activity, lead personnel are responsible for reporting species, number, and condition of fish. The reporting template is attached at the end of the document and will be provided to the WFPOM Team.

8.2. Fish Handling

8.2.1. When facilities are drained, a primary objective is to minimize stress and injury to all fish. Generally, the best way to protect fish during facility draining is to avoid having to handle them. Instructions for draining most facilities involve steps, such as operating with low ladder flow just prior to draining, intended to minimize handling fish by encouraging the fish to exit the ladder. When it is necessary to handle fish, they are handled in plenty of fresh water, if possible. Holding fish in nets unnecessarily is avoided (e.g., tank or fish bag not ready). When it is necessary to transport fish in bags, ensure that the salvage bags contain a sufficient amount of water and that fish return to fresh water as soon as possible.

8.2.2. Tanks should be large enough to carry plenty of water with the fish. Tanks should be covered to keep fish from leaping out. When large numbers of fish are placed in a tank, supplemental oxygen will be used to increase the level of dissolved oxygen. Reduce fish concentration when river temperature is greater than 65°F. During warm weather, the temperature in tanks will be monitored and kept within 2°F of the river release point temperature. Further, the time fish are kept in tanks will be minimized and not exceed 2 hours.

8.2.3. Fish will be released at a predetermined site. However, when the tank contains a mixed load, it can be released into the forebay or tailrace depending upon the recommendation of lead personnel.

8.2.4. When it is necessary to prioritize attention to different species, generally ESA-listed species and adult salmonids should be helped first. Lamprey are relatively stress resistant and can be collected as a lower priority. However, their numbers are declining and care should be given to salvage them, as well as the more sensitive fish. All fish are to be salvaged.

8.3. Adult Fish Trap/Ladder

The general procedures for draining the adult fish trapping facilities are described below. Whenever possible, action should be timed to coincide with lowest fish presence, typically late October to December. In the case of an emergency, staff will take immediate action if needed.

8.3.1. **Prior to Dewatering**

8.3.1.1. 24 to 48 hours before draining, stop attraction flow by minimizing auxiliary water flow.

8.3.1.2. For at least 24 hours before dewatering, but not longer than 96 hours, operate the ladder at orifice flow (discharge below top of orifice).

8.3.2. **On Dewatering Day**

8.3.2.1. Convene safety meeting before starting activity. Describe the procedure for all participants and assign responsibilities (ensure clearances are in place)
8.3.2.2. Stage fish bags or transport tank.
8.3.2.3. Place ladder near the pre-sort holding pool.
8.3.2.4. The water supply level to the ladder should be reduced to approximately 1" to 2".
8.3.2.5. Begin visual inspection of ladder for stranded fish. Salvage personnel will need to access any pools where fish are stranded and either remove the stranded fish and put into a fish bag or tank or, if the fish is close to the entrance pool, gently guide fish down the ladder to the entrance pool.
8.3.2.6. Drain pre-sort holding pool.
8.3.2.7. Salvage fish with a net and put them into a fish bag.
8.3.2.8. Place fish from fish bag into post sort holding raceway for transport or into recovery tank for direct release to the river.
8.3.2.9. Shut down facility water supply when fish salvage is complete.

8.3.3. Fish Salvage Equipment

The following fish salvage equipment is required.

8.3.3.1. Dip nets/buckets
8.3.3.2. Fish salvage bags
8.3.3.3. Seine
8.3.3.4. Extension ladder for access into the fish ladder

8.3.3.5. Fish truck with oxygen bottle
8.3.3.6. Personal protection equipment such as life vests/float coats, fall protection (harness/lanyard), waders w/felt soles, gloves (sealskins), hearing protection, and hardhats
8.3.3.7. Communication devices
8.3.3.8. Submersible pumps

9. FOREBAY DEBRIS REMOVAL

9.1. Debris at projects can adversely impact fish passage conditions. Debris can plug or block trashracks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. Debris can be removed from the forebay by:

9.2. Using a boat to physically encircle debris with a log boom to pull it to the spillway where operators can spill it or to the shore to be removed by crane;
9.3. Removing the debris from the top of the dam using a crane and scoop;
9.4. Passing debris through the spillway with special powerhouse and/or spill operations; or
9.5. Using a boom, spreader bar or other device, suspended from a crane, to move the debris to the spillway, in coordination with special powerhouse and spill operations (if needed).