

Appendix A

Outline of Willamette Fish Passage and Management Plan with Fall Creek Example

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Submitted to:

**National Marine Fisheries Service
U.S. Fish and Wildlife Service**

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Willamette Project Supplemental Biological Assessment

Outline of Willamette Fish Passage and Management Plan

CHAPTER 1 – BIG CLIFF DAM AND MINTO POND FISH FACILITY

Facility Description

Fish Passage Information

Adult Migration Timing and Run Size

Juvenile Migration, Timing, and Survival

Fish Facility Operation

Schedule

Sorting and Disposition

Daily Fish Collection Facility Operation

Handling and Transport Protocol

Release Protocol

Data Summary and Distribution

Subbasin Map

Fish Facility Maintenance

Scheduled Maintenance

Unscheduled Maintenance

Project Operations

Spill Management

Total Dissolved Gas Management

Project Maintenance

Outages - Turbine Unit and Regulating Outlet

Scheduled

Unscheduled

Forebay Debris Removal

CHAPTER 2 – DETROIT DAM

Project Operations

Spill Management

Total Dissolved Gas Management

Project Maintenance

Outages - Turbine Unit and Regulating Outlet

Scheduled

Unscheduled

Forebay Debris Removal

CHAPTER 3 – GREEN PETER DAM AND FISH COLLECTION FACILITY

Facility Description

Fish Passage Information

Adult Migration Timing and Run Size

Juvenile Migration, Timing, and Survival

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Data Summary and Distribution
Subbasin Map

Fish Facility Maintenance

Scheduled Maintenance
Unscheduled Maintenance

Project Operations

Spill Management
Total Dissolved Gas Management

Project Maintenance

Outages - Turbine Unit and Regulating Outlet
Scheduled
Unscheduled

Forebay Debris Removal

CHAPTER 4 – FOSTER DAM AND FISH COLLECTION FACILITY

Facility Description

Fish Passage Information

Adult Migration Timing and Run Size
Juvenile Migration, Timing, and Survival

Fish Facility Operation

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Subbasin Map

Fish Facility Maintenance

Scheduled Maintenance
Unscheduled Maintenance

Project Operations

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Outages - Turbine Unit and Regulating Outlet
Scheduled
Unscheduled

Forebay Debris Removal

CHAPTER 5 – COUGAR DAM AND FISH COLLECTION FACILITY

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Fish Facility Maintenance

Scheduled Maintenance
Unscheduled Maintenance

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Spill Management
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Outages - Turbine Unit and Regulating Outlet
Scheduled
Unscheduled

Forebay Debris Removal

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Outages - Turbine Unit & Regulating Outlet

Scheduled
Unscheduled

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CHAPTER 7 – DEXTER DAM AND SORTING PONDS

Facility Description

Fish Passage Information

Adult Migration Timing and Run Size
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CHAPTER 8 – FALL CREEK DAM AND FISHWAY

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Scheduled

Unscheduled

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CHAPTER 9 – HILLS CREEK DAM

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Spill Management

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Outages - Turbine Unit and Regulating Outlet

Scheduled

Unscheduled

Forebay Debris Removal

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Appendix A – Special Project Operations and Studies

Appendix B – Guidelines for Dewatering and Fish Handling Plans

Appendix C – Protocols for Adult Fish Trapping Operation at Dexter, Fall Creek, Foster, and Big Cliff Dams

Example of Fall Creek Fish Passage and Management Plan

CHAPTER 8 – FALL CREEK DAM AND FISHWAY

Facility Description

The adult fish facilities at Fall Creek are composed of one fish ladder, two submerged orifices, and one entrance from the regulating outlet (RO) to a secondary stilling basin, holding pool, power fish crowder, and anesthetizing tank. Salmon and steelhead enter a short fishway at the base of the dam, either through a raceway at the downstream end or through one of two submerged orifices that open into a secondary stilling basin. The fish follow a series of pools up into a holding pool at the head of the fishway. A steel finger weir prevents them from dropping back out of the holding pool. The fishway operator uses a power sweep to crowd fish in the holding pool into a tank for subsequent anesthetizing. The operator then transfers the anesthetized adults into a 1,000-gallon-capacity liberation truck, releases other game species and rough fish back into the tailrace. The adult salmon are transported to a release site located approximately 2 miles upstream of full pool on North Shore Road called Site “C.”

The juvenile fish facilities at Fall Creek is composed of nine fish horns arranged in groups of three at three different reservoir elevations, transport conduits, dewatering structure, and a concrete conduit to the fishway approach channel. The fish horns are arranged in groups of three, each at the 800-, 765-, and 720-foot elevations on the face of the dam, to collect emigrating salmon and steelhead smolts. Each tier contains a large, intermediate, and small fish horn. Three individual conduits serve to pass emigrants from the horns through the dam and discharge them into the fishway approach channel. The three large horns are connected to a 36-inch diameter pipe conduit, the intermediate horns to a 24-inch pipe, and the small horns to an 18-inch pipe. The volume of attraction flow into the transport system can be varied by operating any of the three sets of horns, according to size and elevation. The operator can manipulate temperature of the discharge when the reservoir is stratified thermally by opening horns in the tier nearest the desired thermal stratum, provided that the water temperatures in the reservoir are known at each level.

The head of water over the horns determines the volume of discharge from the emigrant-transport system. At full pool, maximum discharge cannot exceed 280 cfs. Ball valves, located at the base of each horn adjacent to the transport conduit, regulate flow into the fish horns. Gate valves, located in the downstream segments of the individual transport pipes, are used in instances of emergency.

Downstream migrants enter the open horns, pass through the ball valves into the respective transport conduits that originate at the top of the dam in a venting chamber, and are transported down the face of the dam on the reservoir side. The transport pipes turn downstream under the dam near the intake structure. At this point, the 30-inch and 24-inch pipes constrict to 24 inches and 18 inches, respectively. Immediately downstream of the dam, the transport pipes expand and rise abruptly into a deceleration unit, from which water and fish are discharged at a reduced velocity onto a set of perforated plates, known as a separator unit. At the separator, most of the water falls through the perforations and into a supply pool that subsequently provides attraction water for the adult fish facility. A small amount of water, along with the downstream migrants, passes off the end of the perforated plating into a concrete conduit. This channel leads to the fishway approach channel and the stream below.

Fish Passage Information

Adult Migration Timing and Run Size

Adult spring chinook salmon begin returning to the Fall Creek fishway in May. Approximately 70% of the run returns in May and June with the remainder entering the fishway in July to October (Figure 1). Annual returns from 1965-2006 for the fishway range up to 4,518 fish (Figure 1).

Juvenile Migration, Timing, and Survival

Naturally produced, downstream migrant Chinook salmon and winter steelhead must pass through the regulating outlets of Fall Creek Dam and may incur injury or mortality. The juveniles are offspring of adults that are trapped at the dam and released upstream. The greatest source of injury and mortality is thought to occur as the fish pass under the regulating outlet gates, because fish released downstream of the gates generally do not incur significant injuries (Downey and Smith 1992). Injury and mortality rates generally increase with head and flow rate through the regulation outlets. Studies conducted in 1991 determined that of 1,000,000 smolts released into the reservoir, 250,000 survived to be passed downstream through the regulating outlets, out of which 163,000 migrants survived. It was also estimated that the “mothballed” downstream passage fish horn system resulted in a mortality rate of approximately 68%, and that the survivors were in poor condition, with a majority receiving severe head and eye abrasion (Downey and Smith 1992). Lowering the reservoir water levels in September and October was determined to decrease the head and flow through the outlets, with lower mortality rates.

Until recently, hatchery Chinook salmon fry were released into Fall Creek reservoir, where they reared to smolts in four or five months. The ODFW terminated the rearing of chinook in the reservoir in 1998 because of the high downstream passage mortality and now rear the salmon to smolt size in the hatchery. Approximately 100,000 smolts are now released annually below Fall Creek Dam. Much higher survival is anticipated since the migrants do not have to pass through the regulating outlets.

The fish horn system proved to be ineffective and smolts were instead passed downstream through 1977 by draining the reservoir in the fall. After 1977, the reservoir was kept up through Labor Day for recreation and the smolts exited through the regulating outlets under high head and high flow conditions. The reservoir rearing program was a success for a number of years following project construction, producing returns of fish in excess of the original run. However, returns after 1977 continued to decline. The ODFW assessed the cause of the decline and determined that reservoir operations should be returned to a modified version of the pre-1977 conditions to reduce the high mortality associated with passing the fish through the regulating outlet at high head and flow (Downey and Smith 1992).

The modified drawdown procedure began in 1992 and continued until 1998. The reservoir was drawn down beginning in July from elevation 830 ft at full pool to elevation 824 feet by 15 August and 815 feet by Labor Day. Discharges were raised after Labor Day to 1,200 cfs to bring the lake down below the minimum flood control pool elevation (710 feet) by 15 October. Discharges were lowered at this point to bring the pool to elevation 694 feet by the end of October. Operations guidelines included that the system be shut down when the forebay elevation comes within 20 feet of the center line of the fish horn inlets. The procedure was halted when rearing of fingerlings in the reservoir was abandoned in favor of releasing 100,000 marked smolts below the dam. The horn system is presently operated only to provide supplemental water to the adult collection facility.

Figure 1. Migration Timing of Adult Spring Chinook Passed Over Fall Creek Dam, 2002-2005

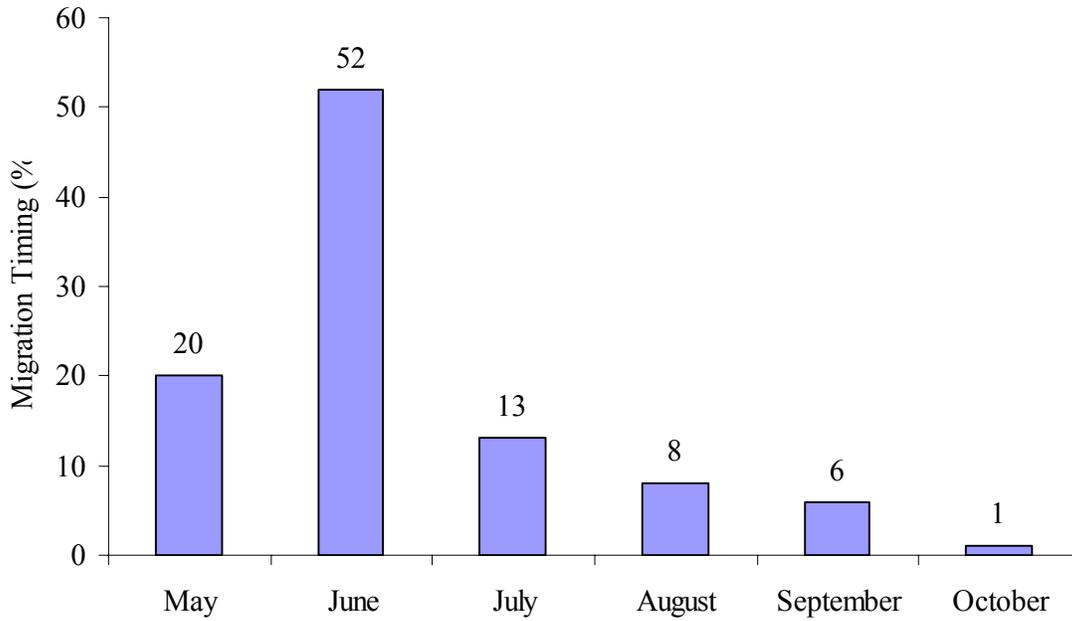
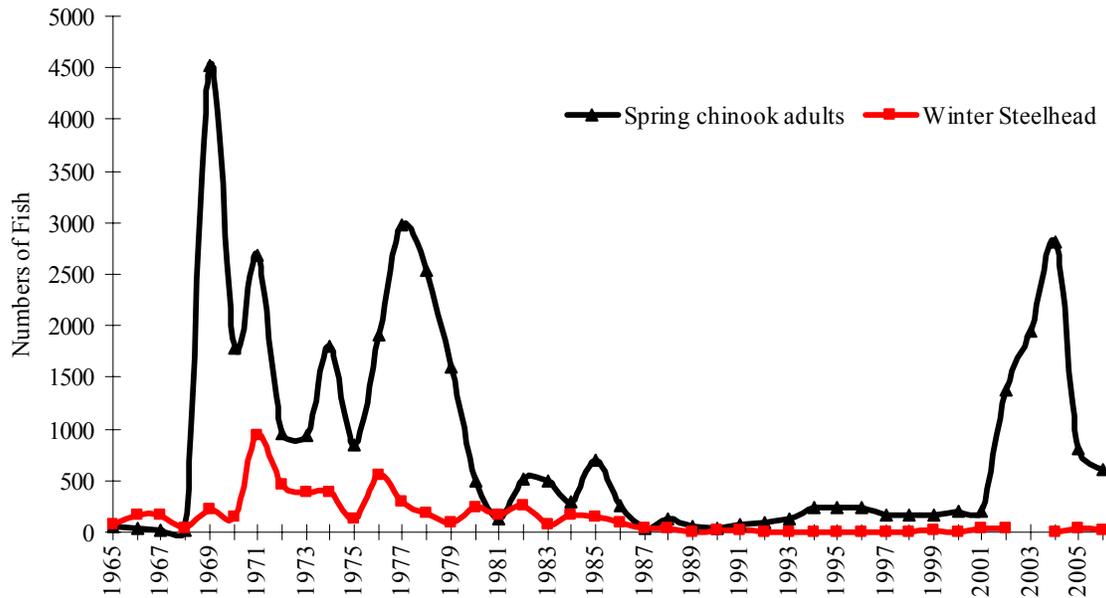


Figure 2. Number of Adult Spring Chinook Salmon and Winter Steelhead Collected at the Fall Creek Fishway, 1965-2006



Daily Fish Collection Facility Operation

1. Call the control room and notify the operator at Lookout Point Dam that you are entering the fish facility (541-937-2131).
2. Open the facility and turn on the necessary electrical breaker switches (all personnel operating the breakers will be trained and authorized to use switching permits).
3. Check trap counter and holding pool to determine the number of fish holding in the trap.
4. Before filling the fish truck with water, run the pump clear of any rust or other debris.
5. Fill the fish truck tank to the appropriate level.
6. Fill the anesthetic tank with water.
7. Add anesthetic to tank and mix well.
8. Turn on crowder.
9. Crowd fish from the trap into the loading hopper.
10. Hand-load the fish from the hopper into the transport truck.
11. Complete the "Fall Creek Fishway Transport Form" (Appendix).

Handling and Transport Protocol

At fish handling facilities in the Willamette Basin operated by Oregon Department of Fish and Wildlife (ODFW), the ODFW and the Oregon Department of Environmental Quality (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. At the Fall Creek fishway the treated water is dispersed on the parking lot where there is no direct connection to any water body.

Fish Anesthetic and Disposal: Clove Oil (1/2 oz / 150 gallons)

Treatment: All transport tanks are treated with Nov-Aqua, per manufacturer's instructions, to reduce stress during transport.

Loading Density: Transport adult spring Chinook at a density of ≤ 25 gallons of water per fish (60 fish/1,500 gallon tank).

Oxygen: Oxygen levels in the transport truck water should not exceed saturation or drop below 7 parts per million.

Temperature: Fish will not be released into receiving waters with a seven day average maximum temperature $> 65^{\circ}\text{F}$ or weekly mean temperature $> 60^{\circ}\text{F}$. Drivers will measure the temperature of the water in the transport tank and the receiving water prior to releasing the fish. If the temperature difference between the receiving water and tank water is $> 7^{\circ}\text{F}$, the water will be tempered to a difference of $< 5^{\circ}\text{F}$ at a rate of $1^{\circ}\text{F}/6$ minutes.

Hauling frequency:

Transport Period	Hauling Frequency
April 1 - May 15	2 times per week
May 16 - June 30	3 times per week
July 1 - Oct 15	2 time per week

Release Protocol

All fish are released at site “C” in Fall Creek approximately 2 miles above the reservoir. The release site is comprised of a developed ramp, truck block, and large holding pool located behind a locked gate. The transport truck backs down the developed ramp to the truck block to release the fish. The operator opens the gate on the transport tank and allows the fish and water to flow into a 12-inch diameter release pipe directly into the holding pool.

Data Summary and Distribution

The Willamette Project Fisheries Biologist will inspect fish passage facilities at the frequencies developed in collaboration with the Fish Passage and Hatchery Management (FPHM) Committee. He/she will prepare reports during the trapping season that summarize the findings of the inspections. The reports will include violations of criteria and corrective actions taken; equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; and any unusual activities that occurred at the project that may affect fish passage. The reports will be distributed to members of the FPHM Committee or other interested parties via e-mail.

The FPHM Committee will produce an annual report that summarizes the species, number, origin, and destination of all fish collected at USACE fish facilities in the Willamette Basin. The annual report will be distributed to the members of the FPHM Committee and posted on the website: https://www.nwp.usace.army.mil/pm/e/en_admin.asp.

Subbasin Map

Fish Facility Maintenance

Scheduled Maintenance

Scheduled maintenance of the Fall Creek fishway that requires the facility to be un-watered or will have a significant effect on fish passage will be completed from October 16 to March 14. Maintenance of facilities that will not have a significant effect on fish trapping may be conducted during the rest of the year. During the fish passage season, parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

October 16 to March 14:

1. Inspect all staff gauges and water level indicators, repair and/or clean where necessary.
2. Dewater ladder/trap/holding pool and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices, which could injure fish or impede fish passage up the ladder or into the adult trap. Inspect all diffuser grating and chambers annually by dewatering and physically inspecting the gratings and chambers.
3. Calibrate all mechanical and electronic water level control devices, as necessary, for proper facility operations.
4. Inspect all components associated with the hopper hoist.
5. Auxiliary water system maintained and debris removed as appropriate.
6. Record all maintenance and inspections.

Unscheduled Maintenance

Unscheduled maintenance may occur when any situation prevents the Fall Creek fishway from operating according to criteria or impacts fish trapping and/or survival. Unscheduled maintenance that has a significant effect on fish trapping will be coordinated within the FPHM Committee with NMFS, USFWS, and ODFW. If part of the facility malfunctions or is damaged during fish migration season and the facility can still be operated within criteria without any detrimental effects on fish trapping, repairs may not be conducted until the maintenance period or until fewer numbers of fish are arriving at the project. If part of the facility is damaged or malfunctions and may significantly impact fish passage, it will be repaired as soon as possible. The Willamette Project Operations Manager has the authority to initiate work prior to notifying USACE biologists when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. For each occurrence of unscheduled maintenance the Willamette Project Fisheries Biologist will draft a report that contains a description of the problem, type of outage required, impact on facility operation, estimated length of time for repairs, expected impacts on fish passage and proposed measures to mitigate for them. The report will be provided to the members of the FPHM Committee within in 24 hours.

Project Operations

Spill Management

Fall Creek Dam is a non-power project so all water is spilled through the fish horns or regulating outlet no capability exists to manage spill.

Total Dissolved Gas Management

Fall Creek Dam is a non-power project so all water is spilled through the fish horns or regulating outlet no capability exists to manage TDG.

Temperature Management

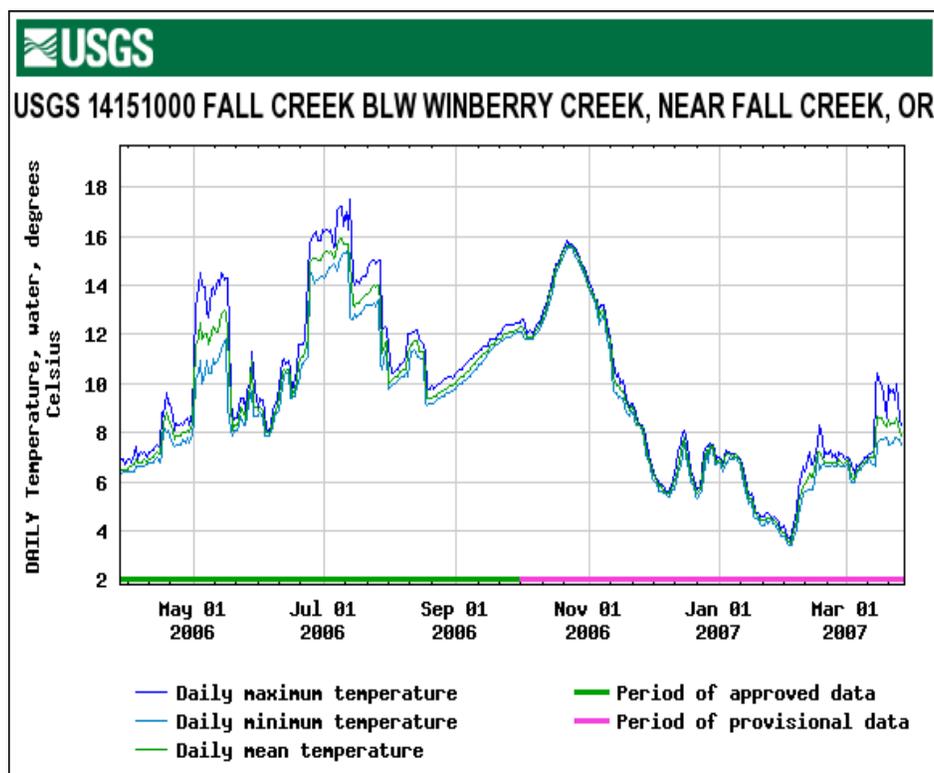
Water temperatures below Fall Creek Dam are shown in Figure 4. Temperatures in Fall Creek downstream of Fall Creek Dam can be managed to some degree with the fish horns used to supply water to the fishway.

Project Maintenance

Outages – Turbine Unit and Regulating Outlet

Scheduled. Each calendar year a schedule is produced for routine and non-routine maintenance that will require turbine units, regulating outlets, and spillway gates at Willamette projects to be placed out of service. To help minimize potential impacts to ESA-listed fish resulting from these outages the Willamette Project Fisheries Biologist will participate in the development of the draft annual outage schedule. The draft schedule will be reviewed by members of the FPHM Committee. A final outage schedule will be developed based on input from the committee. Changes in the final schedule will be coordinated with the committee through the Willamette Project Fish Biologist.

Figure 4. Water Temperatures below Fall Creek Dam



Unscheduled. Each year turbine units, regulating outlets, and spillway gates malfunction or are placed out of service for an emergency which results in an unscheduled outage. Unscheduled outages that will have an impact on ESA-listed fish will be coordinated with the FPHM Committee on a case-by-case basis by the Willamette Project Fisheries Biologist. The FPHM Committee will be notified as soon as possible. The Willamette Project Operations Manager has the authority to initiate work prior to notifying the committee when delay of the work will result in an unsafe situation for people, property, or fish.

Forebay Debris Removal

Debris can plug or block trashracks and facility piping resulting in inadequate water for the adult trapping facility. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions.