Columbia River Fish Mitigation Juvenile Improvements With Completed Status 1988-2006

Year	Improvement	Benefit
Bonneville Dam		
1988-2006	Spillway deflectors added to five bays.	Reduces TDG production during spill and increases flexibility for spill operations
	Power distribution system modified for fish operations.	Allows for B2 priority for powerhouse operations to improve juvenile survival (and reduce adult
	Installation of minimum gap turbine runners - five units completed by 2006 (two additional units in 2007 and remaining three by 2009).	Reduces injury and mortality for fish passing through turbines
	Removal of STS screens during juvenile fish passage season.	Reduce injury, stress, and mortality for fish passing through the bypass system
	Juvenile bypass system upgraded, including outfall relocation and new collection channel and dewatering facility.	Relocated bypass avoids predation at original outfall location. New collection channel and dewatering facility, reduces injury and stress. These features provided survival improvements.
	Surface bypass Corner Collector with one- half mile conveyance channel.	Further increases the percentage of fish that avoid turbine passage and provides outfall in location to improve survival.
	Improvements for fish guidance into juvenile bypass system (3 out of 8 units completed by 2006, 2 additional units completed in 2007).	Improves percentage of fish guided away from turbines.
	Full flow PIT-tag detection on bypass outfall flume.	Reduces need to subject juveniles to very low flow levels for PIT-tag detection, which reduces stress levels.
	PIT-tag antenna installed in the Corner Collector channel.	Capable of detecting tagged fish moving at high speeds down flume.
The Dalles Dam		
1988-2006	Constructed spillway wall between bays 6-7.	Allows increased flows and fish at the north end of spillway, which improves collection efficiency and juvenile egress from the spillway.
	Sluiceway improvements completed, including opening additional gates.	Provides increased sluiceway efficiency and reduced turbine entrainment.
John Day Dam		
1988-2006	Juvenile fish monitoring facility built.	Allows evaluation of juvenile condition and counting/sampling of PIT-tagged fish.
	Spill deflectors installed on 18 of 20 bays.	Reduces TDG production during spill, and increases flexibility for spill operations.
	Refurbished two north shore fish pumps.	Improves reliability.
	Full flow PIT-tag detection completed.	Improves detection and reduces stress on juvenile fish.
McNary Dam		
1988-2006	ESBSs installed.	Guides more migrants away from the turbines into the bypass system.
	Spill deflectors placed in remaining four bays. Others installed earlier.	Reduces TDG production during spill, and increases flexibility for spill operations.
	Collection and bypass system upgrades including full flow system. Juvenile holding and loading facilities.	Improves fish survival and health as they transit the bypass system. Improves juvenile transportation system.

Columbia River Fish Mitigation Juvenile Improvements With Completed Status 1988-2006

Year	Improvement	Benefit
	Spillway gates rehabilitated and hoists added.	Allowed optimal spillway operation for fish passage.
Ice Harbor Dam		
• 1988-2006	• STSs and VBSs put into each turbine intake, 12-inch orifices drilled from gatewell to bypass channel in old sluiceway, evaluation/marking facilities constructed at bottom of bypass flume.	• Increases the percentage of fish bypassed from the turbines.
	• Spill deflectors installed on all spillbays.	• Reduces TDG production during spill, and increases flexibility for spill operations.
	• PIT-tag detection on main bypass flume	• Allows PIT-tag monitoring with lower potential for stress.
	• RSW installed in 2005.	• Allows more efficient spillway passage, reduces delay in the forebay.
• Lower Monumental Dam		
• 1988-2006	• STS overhauled.	• Ensures STS efficacy and reliability.
	• Collection and bypass system upgrades including full flow system. Juvenile holding and loading facilities.	• Improves fish survival and health as they transit the bypass system. Improves juvenile transportation system.
	• Spill deflectors installed on bays one and eight.	• Reduces TDG production during spill and increases flexibility for spill operations.
	• Improved barge loading and improved dewatering facilities.	• Improves juvenile transportation system.
	• Parapet wall added.	• Reduces TDG levels and allows full use of end bays at the spillway
• Little Goose Dam		
• 1995-2006	• Installed new ESBSs and VBSs improved.	• Increases FGE and reduces turbine entrainment on juveniles.
	• Upgraded PIT-tag sort by code, routing, and bypass outfall.	• Reduces fish delay, stress, and predation.
	• Trash shear boom installed.	• Reduces amount of debris entering gatewells, thereby reducing fish injury and mortality.
• Lower Granite Dam		
• 1995-2006	• New ESBSs and VBSs installed.	• Fish stress and injury reduced in bypass system.
	• PIT-tag sort by code improvements.	• Decrease stress through reduced handling of juvenile fish.
	• Spill deflectors.	• Reduces TDG production during spill and increases flexibility for spill operations.
	• RSW installed and tested.	• Allows more efficient spillway passage and decreased forebay delay.

1. Columbia River Fish Mitigation Adult Improvements Completed Between 1988-2007

2. Year	3. Improvement	4. Benefit
5. Bonneville Dam		
6. 1988-2006	7. Gates were taken out of entrances 1, 2, 64, and 65 to provide 8 feet of opening.	8. Enhances collection system effectiveness and reliability.
	9. Floating gate/orifice operating system modified with new motors and control system.	10. Enhances collection system effectiveness and reliability
	11. Adult PIT-tag detectors were installed.	12. Provides for monitoring PIT-tags on adults.
	13. Sea Lion Exclusion Devices (SLED) were installed.	14. Reduces marine mammals' presence in the ladders.
15. The Dalles Dam		
16. 1988-2006	17. Modifications to allow for adult entrance channel dewatering.	18. Allows for inspection and maintenance to ensure reliability of adult ladder system.
19. John Day Dam		
20. 1988-2006	21. Rehabilitated auxiliary water pumps.	22. Provides reliable auxiliary water supply for attraction/passage of fish.
	23. South ladder exit control section reconfigured.	24. Reduces fish jumping and delays in the south ladder.
25. McNary Dam		
26. 1988-2006	27. Adult PIT-tag detection systems in both fish ladders.	28. Improves PIT-tags monitoring of adult passage through main stem dams.
	29. Replaced powerhouse collection system stop log with new stop logs.	30. Increases reliability of adult fish passage system.
31. Ice Harbor Dam		
32. 1988-2006	33. North shore auxiliary water supply system modified, new fish pumps installed.	34. Makes auxiliary water system effective and reliable.
	35. Adult PIT-tag detection systems.	36. Improves PIT-tag monitoring of adults through main stem dams.
37. Lower Monumental Dam		
38. 1988-2006	39. All three auxiliary water supply pumps rehabilitated.	40. Ensures fish ladder auxiliary water system efficacy and reliability.
41. Little Goose Dam		
42. 1988-2006	43. Picketed leads in collection system channel.	44. Decreases adult fish falling out of the channel into the tailrace.
	45. Improved auxiliary water supply.	46. Improves fish ladder system reliability.
47. Lower Granite Dam		
48. 1988-2006	49. PIT-tag detectors added.	50. Allows for monitoring of returning adult fish.
	51. Fish trap modified and expanded.	52. Provides better adult fish handling conditions.
	53. Modified diffuser and transition pools.	54. Improves adult passage by eliminating fishway fallout.
	55. Improved auxiliary water supply.	56. Increases reliability of ladder operation.

Columbia River Fish Mitigation RPA Actions 18-25 (Juvenile Improvements) Completed 2007-2014 (Addressing 2008, and 2010/2014 Supplemental FCRPS Biological Opinions)		
Year	**Improvement**	**Benefit**
Bonneville Dam (RPA Action 18)		
2007	Juvenile bypass system full-flow PIT-tag detection at Powerhouse II.	Allows PIT detection at full bypass flow, which is safer for fish and therefore increases survival.
2008	Juvenile fish bypass guidance efficiency improvements at Powerhouse II .	Reduces the proportion of fish passing through turbines, which generally have lower survival compared to other routes
2010	Conversion of the sluiceway at Powerhouse I to a surface passage system.	Provides a safe surface passage route at Powerhouse I
2010	Installation of minimum gap runner turbines at Powerhouse I. [1]	Increase survival of fish passing through turbines.
The Dalles Dam (RPA Action 19)		
2010	Installation of extended-length spillway spillwall between bays 8-9.	Improves survival of juvenile fish by improving stilling basin hydraulic conditions and tailrace egress.
2011	Added tailrace avian deterrent wire array.	Reduces avian predation on juvenile fish.
John Day Dam (RPA Action 20)		
2007	Juvenile bypass system full-flow PIT-tag detection.	Allows PIT detection at full bypass flow, which is safer for fish and therefore increases survival.
2010	Installation of two spillway weirs.	Increases juvenile fish survival by passing a greater proportion of fish through the spillway and reducing the proportion of fish passing through turbines
2010	Added tailrace avian deterrent wire array.	Reduces avian predation on juvenile fish.
2010	Installation of spillbay 20 extended-length deflector.	Creates hydraulic conditions that improve tailrace egress for juvenile fish and reduces total dissolved gas production.
McNary Dam (RPA Action 21)		
2007	Installation of two spillway weirs.	Increases juvenile fish survival by passing a greater proportion of fish through the spillway and reducing the proportion of fish passing through turbines
2012	Relocation of juvenile bypass outfall pipe.	Improves survival of bypassed fish by releasing fish back to the river in an area with few predators.
Ice Harbor Dam (RPA Action 22)		
2010 thru Present	Turbine unit 2 and 3 replacement runner design, supply and installation (CRFM only funds biological design evaluations and inputs).	Provide safer turbine passage route that will improve juvenile fish survival and reduce oil leakage.
Lower Monumental Dam (RPA Action 23)		
2007	Juvenile bypass system full-flow PIT-tag detection.	Allows PIT detection at full bypass flow, which is safer for fish and therefore increases survival.
2008	Installation of spillway weir.	Increases juvenile fish survival by passing a greater proportion of fish through the spillway and reducing the proportion of fish passing through turbines
2012	Relocation of juvenile bypass outfall pipe.	Improves survival of bypassed fish by releasing fish back to the river in area with few predators.

[1] Turbine replacement was funded by BPA under the Large Capitol Program; CRFM funded the biological design criteria for the new runners and biological testing.

Columbia River Fish Mitigation
RPA Actions 18-25 (Juvenile Improvements) Completed 2007-2014
(Addressing 2008, and 2010/2014 Supplemental FCRPS Biological Opinions)

Year	Improvement	Benefit
Little Goose Dam (RPA Action 24)		
2009	Juvenile bypass system full-flow PIT-tag detection.	Allows PIT detection at full bypass flow, which is safer for fish and therefore increases survival.
2009	Installation of defectors in spillbays 1 and 8.	Improves juvenile fish egress and reduces total dissolved gas production.
2009	Installation of spillway weir.	Increases juvenile fish survival by passing a greater proportion of fish through the spillway and reducing the proportion of fish passing through turbines
2010	Relocation of juvenile bypass outfall pipe.	Improves survival of bypassed fish by releasing fish back to the river in an area with few predators.

Columbia River Fish Mitigation and O&M Program
RPA Action 28 - Adult Passage Improvements Completed 2007-2014
(Addressing 2008, and 2010/2014 Supplemental FCRPS Biological Opinions)

Year	Improvement	Benefit
Bonneville Dam		
2008-2013	Repairs to the Bradford Island fish ladder (O&M).	Ensures reliability of the system.
2014	Modification to the Adult Fish Facility (CRFM)	Ensures reliability of the flows within the AFF and safety of fish collected, thereby reducing fish morality.
The Dalles Dam		
No Actions Taken		
John Day Dam		
2007-2013	North fish ladder improvements (CRFM).	Improve adult passage and increases reliability of the auxiliary water system.
McNary Dam		
No Actions Taken		
Ice Harbor Dam		
2009	Repairs to gear shafts and gear boxes on the North shore auxiliary water supply system (CRFM).	Makes auxiliary water system effective and reliable.
Lower Monumental Dam		
No Actions Taken		
Little Goose Dam		
No Actions Taken		
Lower Granite Dam		
2010	Replace valve controlling auxiliary water supply to the adult fish trap (O&M).	Allows full auxiliary water supply to holding raceways when forebay operated at MOP.
2014	Adult fish ladder interim measures to address temperature differentials (O&M)	Improve adult passage and delay by reducing temperature differentials within the ladder during summer months using temporary pumps.