



**US Army Corps
of Engineers**®
Walla Walla District

Salmon Survival Surface Bypass Systems

Most Columbia River Basin juvenile anadromous salmon and steelhead tend to stay in the upper 10 to 20 feet of the water column as they migrate downstream to the ocean. Juvenile fish passage routes at the Corps' lower Columbia and Snake river dams, because of the dams' configurations, cause the juvenile fish to dive to depths of 50 to 60 feet to find the passage routes.

Engineers and biologists have been pursuing new technologies that would provide more surface-oriented, less stressful, passage routes for juvenile fish.

Surface bypass structures are currently used at all eight Corps dams on the lower Columbia and lower Snake rivers.

Three types of surface bypass structures are completed and installed – removable spillway weirs, temporary spillway weirs and surface bypass channels.



A removable spillway weir was installed in February 2005 at Ice Harbor Lock and Dam, near Burbank, Wash.



Removable Spillway Weirs (RSWs) were installed at Lower Granite, Lower Monumental and Ice Harbor dams on the lower Snake River. The RSW is attached to the upstream side of the dam and fitted into a spillbay, raising the spillway opening to the salmon's preferred depth. Juvenile salmon and steelhead are safely passed over a raised spillway crest, similar to a waterslide, more efficiently than with conventional spill while reducing migration delays at the dam.

The first RSW was installed at Lower Granite Dam in 2001. The Corps installed an RSW at Ice Harbor Dam in 2005 and another at Lower Monumental Dam during 2008. Testing at Lower Granite and Ice Harbor noted a range of survival rates between 95-100 percent.

The RSW also is designed to be "removable" by controlled descent to the bottom of the dam forebay. This capability permits returning the spillway to original flow capacity during major flood events.

Temporary Spillway Weirs (TSWs) were installed in 2007 at McNary Dam and in 2008 at John Day Dam on the Columbia River. Another was installed at Little Goose Dam on the Snake River in 2009. The TSW is a based on design elements of an RSW to create a surface-oriented passage route.

The TSW does not have the pump-operated ballast system used in RSWs to lower the structure during flood operations – TSWs can be removed using the dam's gantry crane to accommodate increased spill operations.

Two styles of TSWs are being tested: one has a "slide" section that comes in contact with the spillway, the other TSW has only the crest structure.

Unlike a Removable Spillway Weir, a Temporary Spillway Weir is smaller and significantly less expensive to build, yet provides a similar benefit in creating surface passage via a dam's spillway.

It can be fitted into any one of multiple spillway bays at a particular dam. It is shipped in sections and assembled during installation. The structure has a low relative cost, is easier to implement and allows for flexible biological testing.



Temporary spillway weirs were installed at McNary Lock and Dam, near Umatilla, Ore., John Day Lock and Dam, near Rufus, Ore., and Little Goose Lock and Dam, near Starbuck, Wash.

SPILLWAY WEIR FAST FACTS

Advantages

- Safe – RSW & TSW tests showed high survival
- Reduces delays – fish spend less time in reservoirs
- Improved efficiency of passages – more fish with less flow
- Less flow = opportunity to improve water quality – lower total dissolved gases
- Less flow improves the opportunity for power generation

Differences from Conventional Spill

- HOW water and fish are passed – surface “overflow” versus under deep gates
- HOW MUCH flow is required – less flow is required to pass comparable numbers of fish

Removable

- To maintain flood flow capacity at the spillways, the RSWs can be “removed” by controlled sinking
- TSWs can be removed by a gantry crane



A RSW is towed upriver for installation at Lower Monumental Lock and Dam (above); a TSW is lowered into a spillbay at McNary Lock and Dam (right).



Surface Bypass Channels are used at two dams on the lower Columbia River to safely pass outmigrating juvenile fish. Bonneville Dam’s corner collector, completed in 2004, provides effective surface bypass – the ice and trash chute at the second powerhouse was modified for safer passage, and a 2,800-foot-long transport channel and 500-foot-long outfall channel were constructed to guide fish around the dam. Tests in 2004 and 2005 indicate a nearly 100 percent survival rate for spring Chinook, steelhead and fall Chinook through the Corner Collector, and a 94 -99 percent survival rate, depending on the species, through all passage routes combined at this dam. The ice and trash sluiceway at The Dalles Dam is also used by outmigrating fish as a surface bypass route with similar survival rates. Additionally, an extended spillwall is under construction, designed to move juvenile fish more quickly and safely downstream once they passed through the spillway with a two to four percent survival improvement.

FOR MORE INFORMATION

Spillway Weirs: www.usace.army.mil/spillway_weir/default.html
 Federal Fish Recovery Efforts in the Region: www.salmonrecovery.gov

