Experimental Sprinkler System for Reducing Larval Lamprey Mortality during Irrigation Diversion Dewatering Events - Highlights and Lessons Learned

(Cover Photo: Sprinkler system set up at Wapato Diversion upstream of the fish screens to help maintain the dewatered fine sediment wet overnight on October 19, 2018.)

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Introduction

An experimental sprinkler system was designed by the Yakama Nation Pacific Lamprey Project to provide a supply of water to larval lampreys trapped in dewatered banks. The sprinkler system was constructed with various sizes of PVC (ranging from 0.5-2 inch diameter), and deployed on dewatered banks at Sunnyside and Wapato diversions on the first day of dewatering. In the results section, we provide a general overview of the system's construction, coarse cost estimate of the system, as well as our experiences and lessons learned that can be used to make further improvement for the use of this tool in the future.

Methods

The sprinkler system was set up and operated at Sunnyside and Wapato diversions immediately after dewatering at each facility. At both facilities, the sprinkler system was ran for 3-4 days after dewatering to provide water to lampreys on or within dewatered banks. An overview of the system at Sunnyside and Wapato diversions are shown in Photo 1 and 2. The total estimated cost for one system (approximately 30 m in length with 4-6 sprinkler heads) is approximately $1600; $600 for the water supply pump and hose, and $1000 for the PVC sprinkler system itself. This cost can likely be brought down considerably once a design is finalized with a minimal list of supplies/equipment (our estimate includes component purchases stemming from trial and error). This sprinkler system can be extended or scaled down to fit any dewatering scenario. Although this system could certainly be improved further, it is a cheap and an adaptable way to provide life support to lampreys that have a low chance of reaching the water's edge due to dewatering. See "Results" section below for an overview of the sprinkler system, as well as important lessons learned during our first year of operation.

Results

Overview of the Sprinkler System Set-up

Water Supply (~$600)

- The sprinkler system consists of a ½ Horsepower Pump (capable of ~60 gallons/min with 15 ft of head) with a modified fish screen. The pump provides water to the system (~$300).
- The pump was hooked to a 100 ft long flexible Helix Flex Hose. The flex hose allows for easy maneuvering and positioning of the pump and sprinkler system (~$300).
- The Helix Hose then connected to the main sprinkler system (via a cam-lock fitting).

Main Sprinkler System (~$1000)

- The main line of the sprinkler system was constructed out of different sizes of PVC pipe (2", 1.5", 1.25", 1", ¾", and ½").
- The first series (~30 ft) of PVC was 2" diameter pipe (connected to the flexible hose). Connected to the end of the 2" PVC was the smaller diameter PVC pipe (~30 ft each of 1.5" and then smaller diameter pipes). The gradual decrease in pipe sizes was designed to compensate for the reduced pressure experienced towards the opposite end of the pump.
- A total of 4 to 6 Sprinkler heads (rated for ~5,000 ft^2 of water coverage each) were attached to the PVC via a T-connector and various adapters/fittings needed to attach those sprinkler heads. Approximately one sprinkler head was attached to the PVC every ~30 ft.
- At the very end of the system was a "blow-out" valve. The purpose of the blow-out valve was to remove any sediment that accumulated in the main pipe line before or during the operation.

Discussion

Important lessons learned during our operation

The smaller the diameter of PVC, the easier the system is to maneuver

- The gradual decrease in PVC sizes within our system not only appeared to increase pressure throughout the system, but also made for easy maneuvering around large humps and other obstacles.

Keep the pump electrical connections with the power supply DRY at all times

- Our pump shut off during night operations on several occasions. One probable cause of the system malfunction was moisture reaching the electrical supply (mostly from rain or morning dew). It is imperative that the electrical connection stays dry during this operation.

"Blow-out value" at the end of the sprinkler system is essential

- During the set-up process, sediment became lodged in many of the pipes. The system was first turned on with all sprinkler heads closed, and the blow-out valve was then opened. This effectively pushed out all debris/sediment lodged in the pipes (which would otherwise clog the sprinkler heads).

Focus sprinkler spray on the low gradient dewatered sediment

- We recommend the placement of the sprinkler system on dewatered low gradient fine sediment where lamprey tend to collect in high numbers during the dewatering process. Lampreys tend to have difficulty reaching the water's edge in these

locations as the water level drops. On sloped banks, lamprey have a higher chance of "rolling" or "sliding" down the sloped bank to reach the water's edge, so it is more important to keep the sprinkler system spray focused on these low gradient areas that instigate the most amount of stranding.

Sprinkler spray can provide water to isolated pools

- Isolated pools (pools of water surrounded by dry sediments) can hold large densities of larval lampreys. These pools can dry up quickly over time. The sprinkler system, if set up in proximity with these pools, will keep water in the pool and extend the life of trapped lamprey, thereby allowing future rescue efforts to save them.

Photo 1. Overview of the sprinkler system operation upstream of the fish screens at Wapato Diversion immediately after dewatering occurred (left photo). In the right photo, the sprinkler spray is submerged to some extent in the large water body because we were not certain how far the water level was going to drop overnight (and what new sediment would become exposed).

Photo 2. Overview of the sprinkler system operation downstream of the fish screens at Sunnyside Diversion immediately after dewatering occurred. Part of the sprinkler system covers the high density isolated pools.