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RE: Memorandum – November 10, 2010 Bonneville (BON) Adult Fish Facility (AFF) Site Visit with Jeff Fryer CRITFC

Jeff Fryer and I traveled to the BON AFF to assess possible fish routing alternatives, and other improvements, that would improve data collection for ongoing CRITFC adult studies.

CRITFC Desired AFF Improvements:

1. Improve the ability to route a more representative percentage of upstream migrating fish into the AFF sample loop
2. Improve the AFF recovery tank to enable PIT detection of fish returning to the main ladder

FPOM Desired AFF improvement:

Return non-target fish directly to the main ladder or into one of the half Ice Harbor ladder pools leading back to the main ladder from the AFF

The following include descriptions of desired CRITFC functional improvements, existing features, and proposed changes discussed/developed in our November 10 AFF site visit:

1. CRITFC Desired Improvement: Improve the ability to route a more representative percentage of upstream migrating fish into the AFF sample loop

Background: Currently, fish are passed through the AFF on a daily intermittent basis, to gather index information on salmon and steelhead adult returns. A series of problems, however, has adversely affected sample sizes and introduced biases into data, thereby compromising research objectives.

CRITFC ideas for improving data collection: Lower all angled diffusers in the diffuser pool to route all fish into the AFF where they would be held in a holding tank until sampling. This was envisioned as an off-ladder holding pool (OLHP) that fish passing from the large AFF fish collection pool over one of the false weirs and down one of the two active flumes would enter. Fish could then be routed from the new OLHP a few at a time, into a proposed new and larger anesthetic pool. Appreciable modifications to construct this new OLHP would entail substantial design and construction costs, and implementation time.

Steve Rainey Fish Passage Engineering Comments and Recommendations:

A fish ladder sampling loop is generally designed to route fish into an OLHP, where they can be either sampled or returned back to the ladder above the picket pool. NOAA Fisheries Anadromous Salmonid

Passage Facility Design (2008) require the sample loop to include an OLHP, water-to-water transport, anesthesia before handling fish, and a recovery tank to allow fish revival prior to returning fish to a fish ladder.

By definition, an OLHP is a pool that *disallows* upstream migrating fish entering the pool to volitionally egress, and potentially drop back down and exit the ladder into tailwater. While building a new OLHP that fish would enter after passing over one of the AFF false weirs would create such an OLHP, an alternative and lower cost approach is recommended, which could be implemented sooner.

Description: The AFF Fish Collection Pool (FCP) is the large pool that is just upstream of the false weirs, and inside the AFF building. It is currently not an OLHP, because fish can enter and either pass over the false weirs, or egress the FCP and ladder, back to tailwater. Or, some may be descending a few pools, before re-ascending on the south side of the ladder and passing the portion of the angled diffuser pool with pickets raised. Therefore, addition of a vee-trap is recommended to convert the FCP to an OLHP. It can be lowered into the 8 ft wide channel at the FCP flow outlet, which is just inside the AFF building and leads from the FCP to the main ladder picket pool. 4-inch embedded guides on both sides would allow easy installation of a fabricated vee trap. While FCP floor diffuser flow (to attract fish into the sample loop) would be the basis for structural design of the vee-trap, it would need to be large enough to occlude the 8 ft wide x 16 ft deep channel. Design of the vee-trap would need to entail enough velocity to assure proper function, so that adult fish would have to back out instead of leaving head-first. I suspect this would require a minimum upstream approach velocity of 1 fps. (See Figure 1 sketch of vee-trap at the FCP outlet channel.) Note that the vee-trap panel may need to be designed to be lowered into the confined slot in the access deck, then hinged panels cocked into place to attain the vee configuration (a design detail). Functionally, fish blocked by a period of lowered picketed diffusers completely across the main ladder would be able to either enter the FCP through the vee-trap (making it an OLHP) or reject entry into the AFF through the vee-trap and (initially) descend the ladder.

Comment on Fish Behavior:

At BON 2nd ladder, wary behavior of adult salmon and steelhead may be responsible for rejection of composite lowered pickets and the more confined side channel leading to the FCP. It is probable that many fish entered the FCP, spent a relatively short period looking for an acceptable route upstream, rejected passing over the false weir(s), and purposely dropped back down the ladder. One reason is that there was no trapping mechanism for fish entering the FCP. Even after installing the longitudinal diffusers, a large percentage of fish may be rejecting the sample loop route, and falling back one or more pools to re-ascend the ladder on the south side of the ladder. If a vee-trap is installed as recommended above, it is possible that some blocked fish will approach the vee-trap, before rejecting it and purposely falling back. However, it is expected that many will pass through the large vee-trap before deciding to move back down the ladder. They will be unable to egress the FCP, which the vee-trap has converted into an OLHP. Their only egress will be the false weir(s), which can be turned on and off to control the number of fish passing down the flume to the anesthetic tank.

As necessary, the vee-trap can be designed/adapted for PIT tag detection.

2. CRITFC Desired Improvement: Improve the AFF recovery tank to enable PIT detection of fish returning to the main ladder

Existing situation: After fish pass through the enlarged anesthetic tank, they are routed to a brail pool, which serves as a record tank, located adjacent to a return channel to the half ice harbor fish ladder (which leads to the main ladder). The return channel passes enough flow that adult fish are attracted in an upstream direction to the return ladder; however, flow passes through a large "grizzly" dewatering grate just downstream of the recovery tank. Flow passes this on the way to a closed pipeline that drains flow from the AFF. The concern is that fish passing out of the recovery tank (potentially partially under the influence of anesthetic) can be swept back a few feet and impinged on the grizzly. The reason is that velocities accelerate as return channel flow passes through the grating. Meanwhile, CRITFC previously desired to install a PIT detector in the existing small return opening from the brail pool to the adjacent fish return channel. However, due to the presence of vertical structural steel wide-flange posts (which also serve as guides to maintain the 'wall' diffuser partition between the recovery tank and return channel) the PIT detectors would need excessive shields to limit detector metallic field. Shields would extend into the return channel, and (very incrementally) increase velocity just upstream of the grizzly, which was objectionable to FPOM.

Recommended Approach:

As the AFF was dewatered during our November 10 site visit, we climbed down into the return channel, and observed that existing steel diffuser panels are starting to show their age. Extensive rust was observed below the operating water level. Panels are 74 inches (high) x 40 inches (wide) and are perimeter banded, with 1-inch deep bars space and ½-inch clearance between bars. Bar thickness was 1/8 – 3/16 inch. Recommended actions to achieve CRITFC functional needs are to replace one of the recovery tank/return channel wall panels further upstream from the existing recovery tank fish egress port with a similarly sized port, which can be fabricated with hard strong plastic (or other) and shielded for PIT detection without a projection into the return channel. Like the existing return port, it could be designed with an upward-closing diffuser panel. (See Figure 2)

FPOM Desired AFF improvement: Return non-target fish directly into one of the half Ice Harbor ladder pools leading back to the main ladder from the AFF, or the main ladder itself. This was briefly examined. Returning non-target fish directly to the main ladder appears to not be possible due to insufficient slope, however returning fish to the pools leading back to the main ladder may be feasible but would require AFF design drawings and funding for further analysis.

Please contact me at 503-260-6990 if there are questions or comments regarding this memorandum.

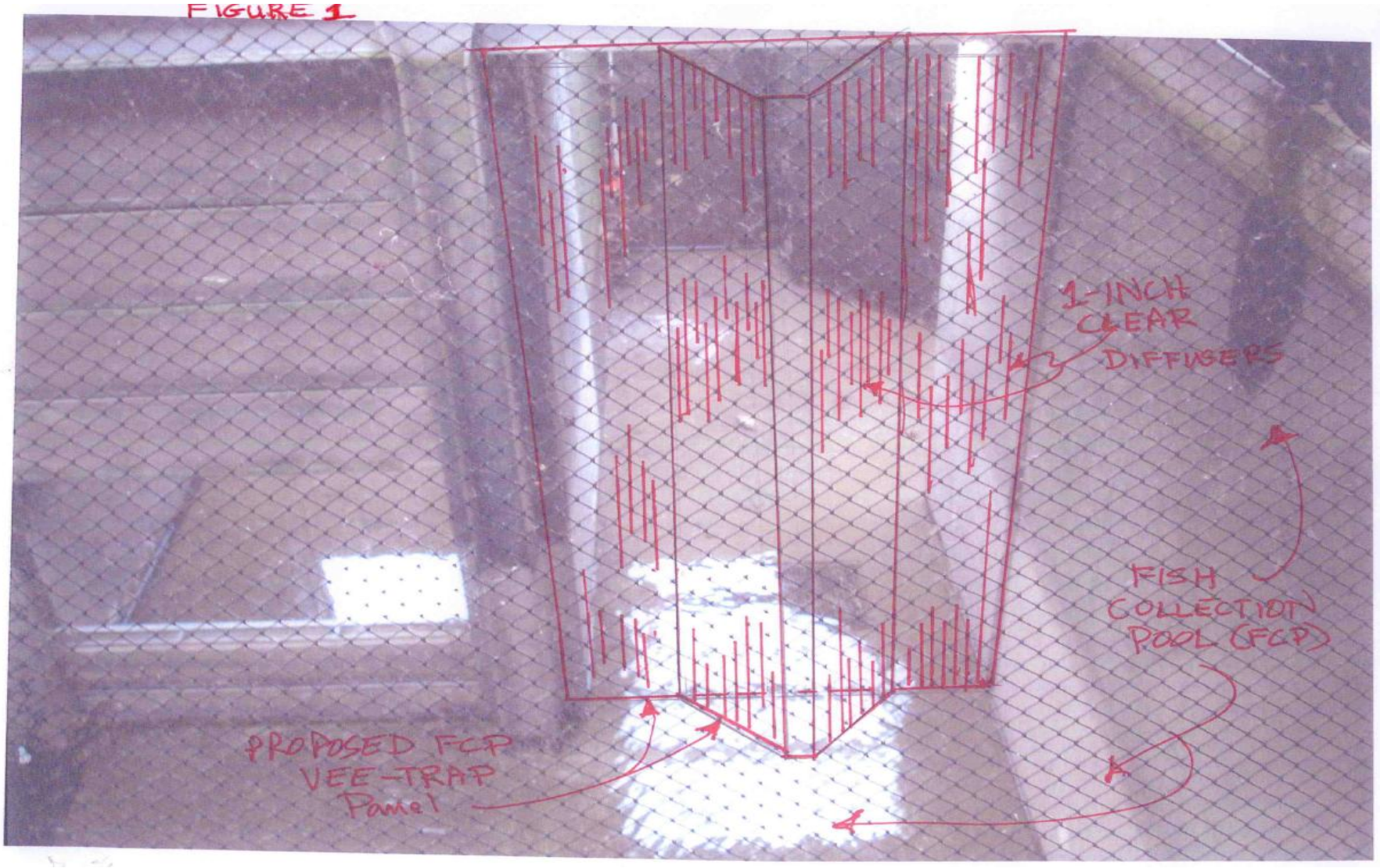

Figure 1. Sketch of vee-trap at the FCP outlet channel.

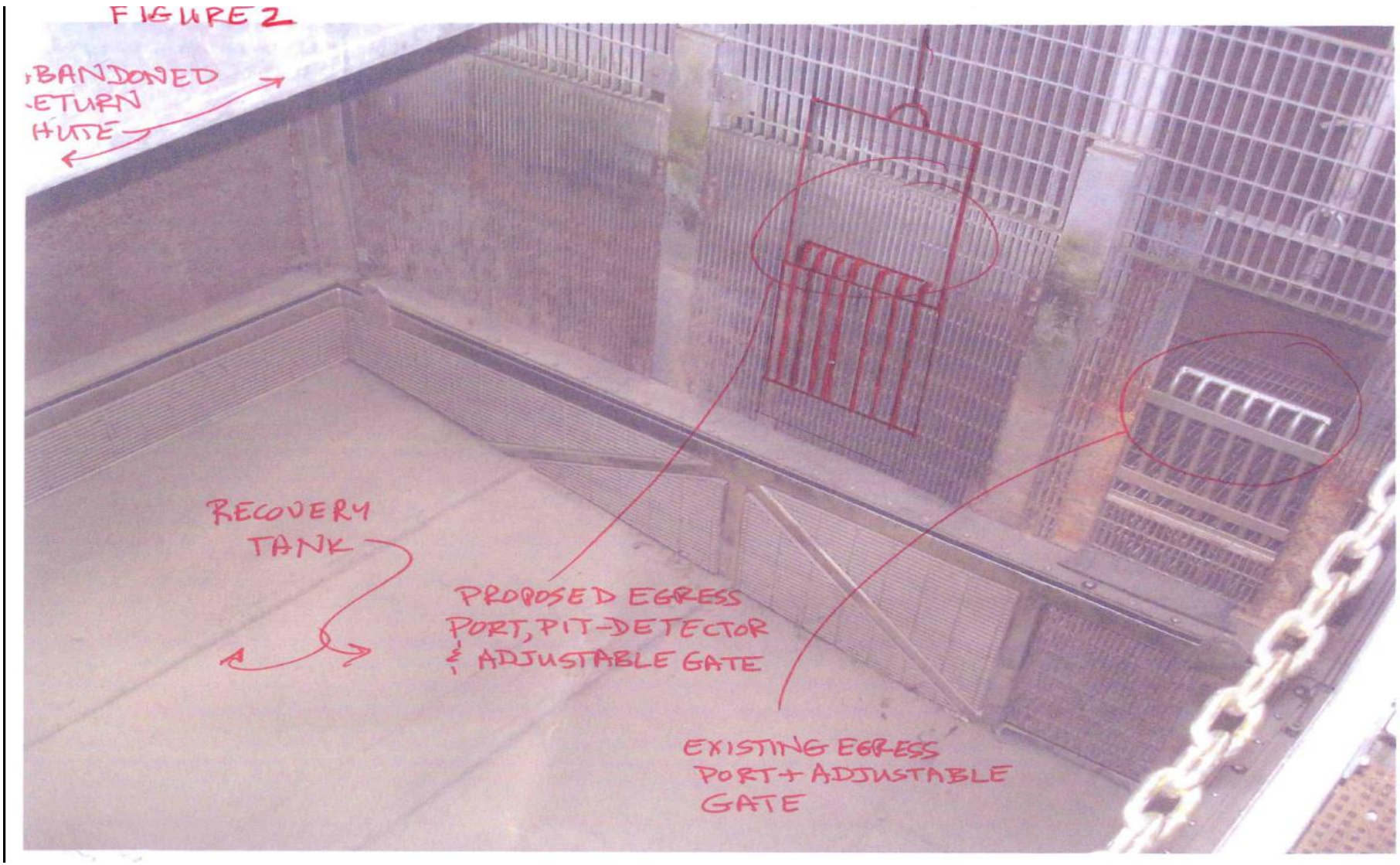

Figure 2. Proposed new AFF brail pool exit. (The exit could also be moved one panel downstream with modifications to the lifting mechanism to avoid the sockeye recovery tank return flume.)