# Fish Passage Plan (FPP) Change Form

**Change Form # & Title**: 22LGS004 – ASW Crest Elevation

**Date Submitted**: 25 May 2022

**Project**: Little Goose Dam

**Requester Name, Agency**: Chuck Barnes, USACE Little Goose Dam Fisheries

**Final Action:** **APPROVED AS ORIGINALLY SUBMITTED**

**FPP Section**: 2.3.2.7. Adjustable Spillway Weir (ASW)

**Justification for Change**: This Fish Passage Plan (FPP) change form is to propose criteria to adjust the operation of the ASW at Little Goose Dam. Currently, the ASW is set to one of two specific crest elevations relative to river flow to provide a surface route for fish passage and to optimize tailrace conditions for egress. Unlike the previous spillway weir which required a crew and crane to adjust the ASW, the current ASW can be automatically adjusted from the control room; however the FPP has not been updated to accommodate any changes other than to adjust the elevation relative to river flow.

The current FPP spill patterns assume a specific spill rate through the ASW at both crest elevations with the forebay in the MOP range (633-634.5’). Throughout the spill season, the forebay elevation may need to be increased above MOP to maintain safe navigation, which increases the flow rate through the ASW.

This proposed change would adjust the ASW elevation relative to an increase in MOP elevation in order to maintain the intended amount of spill over the ASW (approximately 7-8 kcfs at high crest and 11-12 kcfs at low crest). The proposed change would only adjust the ASW elevation when operating in a raised MOP range (Table 1) and would not account for hourly or day to day forebay elevation fluctuations within that range.

Table 1. ASW crest elevation relative to minimum forebay elevation.

|  |  |  |
| --- | --- | --- |
| **Minimum Forebay Elevation** | **ASW-Hi Elevation** | **ASW-Lo Elevation** |
| 633’(MOP) | 622’ | 618’ |
| 634’ (1’ Raised MOP) | 623’ | 619’ |
| 635’ (2’ Raised MOP) | 624’ | 620’ |
| 636’ (3’ Raised MOP) | 625’ | 621’ |

**Proposed Changes**: Add criteria to adjust the ASW crest elevation at different raised MOP elevations to maintain the intended amount of spill over the ASW. For example, when LGS is operating in a 1’ raised MOP, the ASW would be raised 1’, etc.

**2.3.2. Juvenile Facilities – Fish Passage Season (April 1 – third week of December).**

**2.3.2.7. Adjustable Spillway Weir (ASW).**

**2.3.2.7.a.** Little Goose has one adjustable spillway weir (ASW) in spillbay 1 that provides a surface route for fish passage. The ASW can be operated from the control room and the crest elevation can be adjusted lower or higher to pass more water or less water, respectively, according to the flow and forebay criteria defined below. The ASW spill rate is a function of the crest elevation versus forebay elevation – as the pool elevation over the crest increases, more water is spilled over the ASW. Therefore, in order to maintain the intended spill rate over the ASW (approximately 7-8 kcfs at high crest and 11-12 kcfs at low crest), the ASW crest elevation will be set relative to the forebay operating range, as defined below:

**Table LGS-5. ASW Crest Elevation Relative to Forebay Range to Maintain High Crest Spill at ~7-8 kcfs and Low Crest Spill at ~11-12 kcfs.**

|  |  |  |
| --- | --- | --- |
| **LGS Forebay Operating Range**  **(ft)** | **ASW High Crest Elevation (ft)**  **= ~7-8 kcfs spill** | **ASW Low Crest Elevation (ft)**  **= ~11-12 kcfs spill** |
| MOP (633.0 - 634.5) | 622’ | 618’ |
| 0.5’ Raised MOP (633.5 - 635.0) | 622.5’ | 618.5’ |
| 1’ Raised MOP (634.0 - 635.5) | 623’ | 619’ |
| 1.5’ Raised MOP (634.5 - 636.0) | 623.5’ | 619.5’ |
| 2’ Raised MOP (635.0 - 636.5) | 624’ | 620’ |
| 2.5’ Raised MOP (635.5 - 637.0) | 624.5’ | 620.5’ |
| 3’ Raised MOP (636.0 - 637.5) | 625’ | 621’ |
| 3.5’ Raised MOP (636.5 - 638.0) | 625.5’ | 621.5’ |

**2.3.2.7.b. High Crest (ASW-Hi):**

The ASW high crest spills approximately 7–8 kcfs when operated relative to the forebay operating range (**Table LGS-5**). High crest spill patterns are in **Table LGS-7** (Spring Spill) and **Table LGS-8** (30% Spill).

*Unless flow conditions defined below are met, ASW spill for fish passage will occur with the ASW at high crest (approximately 7-8 kcfs spill)*.

**2.3.2.7.c. Low Crest (ASW-Lo):**

The ASW low crest spills approximately 11–12 kcfs when operated relative to the forebay operating range (**Table LGS-5**). Low crest spill patterns are in **Table LGS-7** (Spring Spill) and **Table LGS-9** (30%).

Change the ASW to low crest elevation relative to forebay (**Table LGS-5**) to pass more water during high flow (i.e., spring freshet) when the following flow criteria are met: 1) day average total project outflow above 85 kcfs, and 2) NWRFC inflow forecast above 85 kcfs for at least the next 3 days. Set the ASW to low crest elevation relative to forebay **(Table LGS-5**) except during high flow events above 150 kcfs when the ASW shall be kept at elevation 618 feet regardless of the forebay operating range.

When the previous day’s average outflow drops below 85 kcfs and is forecasted to stay below 85 kcfs for at least the next three days, change back to high crest elevation relative to the forebay range.

**COMMENTS**:

June 9, 2022 - FPOM:

Lorz thinks this is a good start but could use some thinking on whether to add a high flow threshold where the low crest doesn’t get raised. At these current high flows, it might be better to pass more water over the ASW. Maybe something around 150 kcfs?

Bettin asked if there’s a need for a lower low crest elevation to pass even more water. Lorz said no; going lower risks hydraulic issues with the ogee.

Wright will check with NWW engineers (Milligan, Laughery) to see whether it makes sense hydraulically to leave the ASW at low crest elevation 618 ft when flows are above 150 kcfs, regardless of where the forebay is.

**From:** Milligan, Sean C CIV USARMY CENWW (USA), **Sent:** Friday, June 10, 2022, 1:03 PM

I would not be opposed to that idea.  At Q>150 kcfs (I think this is a reasonable threshold), the powerhouse is full on and there is plenty of training spill to go along with the ASW bulk flow so I don’t think keeping an extra 1-2 kcfs over the ASW (due to leaving the crest elev at 618 with a higher forebay) would create a problem in the tailrace.  Keep in mind that ASW discharge increases roughly 1 kcfs per additional foot of head. Trying to describe it will complicate the change form/FPP language – will add another branch of if/then to the mix, but I can understand the potential benefit.”

**From:** Wright, Lisa S CIV USARMY CENWD (USA), **Sent:** Monday, June 13, 2022, 10:51 AM

Hi FPOM. Per Tom’s comments on keeping the Little Goose ASW low crest at 618 ft elevation during high flows (>150 kcfs), the attached change form has been revised to add this flow threshold.

**->From:** Swank, David R, **Sent:** Monday, June 13, 2022 11:32 AM  
I'm fine with the 150k flow threshold to keep it at 618ft. It seems we might want to add language similar to section ii (just above the new language) to specify exactly when it will be kept at 618ft. Just substitute 150 for 85.

**-->From:** Wright, Lisa S CIV USARMY CENWD (USA), **Sent:** Monday, June 13, 2022, 1:54 PM

Thanks Dave, that’s a good point. I added some clarifying language to capture that the ASW will be changed to low crest when flows go above 85 kcfs and operated relative to the forebay range unless flows go above 150k. Let me know if this gets to what you were asking.

**->From:** Tom Lorz, **Sent:** Monday, June 13, 2022, 12:00 PM:

Thanks for the update, what was the rationale for 150 river flow?  I was looking at the spill tables and was thinking maybe 120 since at those flows you have high 30's of spill and 1 kcfs extra through the RSW should not be the end of the world.  Also that is the point that all bays are at 2 stops each which from my old notes and bad memory seemed pretty stable and relative good to point that an extra 1 kcfs+ should not be noticeable.  Just wondering what your guys thinking was on the 150?

**-->From:** Wright, Lisa S CIV USARMY CENWD (USA), **Sent:** Monday, June 13, 2022, 1:37 PM

The 150 kcfs came from the discussion at the FPOM meeting. I followed up with Sean Milligan and he thought it was a reasonable threshold since the project would be at full powerhouse and there is plenty of training spill at that flow level.

**--->From:** Tom Lorz, **Sent:** Monday, June 13, 2022, 1:55 PM

Why not just set to powerhouse then.  I can go along with that, which just so happens to normally be around 120ish.  So powerhouse flows at 1% whatever that is.

**---->From:** Wright, Lisa S CIV USARMY CENWD (USA), **Sent:** Monday, June 13, 2022, 4:24 PM  
Sounds reasonable. Your original proposal of 150k is actually closer. Assuming a spill cap of 80 and all units at the lower 1% would mean all units are on right around 150k.

**----->From:** Tom Lorz, **Sent:** Monday, June 13, 2022, 4:51 PM

I was looking more at the 30% spill concept since that is when the extra spill would have the biggest impact so at 120 flow 30% spill you have 36ish spill.  2 stops on all the non asw bays, the notes said look ok so was thinking anytime above 120 would be fine.  Will see if anyone else chimes in.......

**->From:** Trevor Conder - NOAA Federal, **Sent:** Tuesday, June 14, 2022, 12:35 PM

I am fine with the FPP change form as originally proposed, but I do still have hesitation about the 150K low crest/ high flow operation. Sorry Tom, you're still 9/10. It seems we are operating at a larger range in the LGS pool these days and disregarding the pool level with the ASW setting at high flows might create some adverse, or at least additional variability in tailrace hydraulic conditions. We know LGS is a very sensitive project for adult passage, and up to 15K of flow from the ASW could affect tailrace conditions and lead to additional delay for adults if the project is forced above 30% performance spill during high flow. This would also seem to cause some variability in project flow that could be more difficult to track for operators. I am ok with approving the original change form, but I am not ready to sign off that we should ignore pool level at some flow level given the uncertain impacts to adult passage at that project. Anywhere else, I probably wouldn't care.  Let me know if we need additional discussion/ arm wrestling.

**->From:** Morrill, Charles (DFW) **Sent:** Wednesday, June 15, 2022 3:16 PM  
After a considerable amount of thought and looking at the FPP for Lgo, I am comfortable with the change form and 2.3.2.7.c. iii. During high flow events above 150 kcfs, keep the ASW crest at elevation 618 feet, regardless of the forebay operating range.  And, here are my comments:

The purpose of the ASW is to provide surface passage route for juvenile salmonids.  We know based on PIT detections at the LGR RSW that sub yearling chinook continue to use the TSW through the summer when sub yearlings are present.  Given that, I am comfortable with and support keeping the ASW at 618, low crest, when flows are 150 or greater as suggested by Sean.  The 150 threshold as suggested by Sean, in addition to the footnotes, LGS-37 below Table LGS-9:

‘**[1]** Total Spill (kcfs) is calculated as a function of total # of gate stops in Bays 2–8 + ASW spill at forebay elevation 633.5’ (in MOP). ASW spill is a function of crest and forebay elevation (see **section 2.3.2.7**).

**[1]** Turbine flow is shown as an example of how the special Unit 1 operation will look (see **section 4.2.2.2**), not a precise requirement.

**[1]** Spill is > 30% when Total Outflow is > 156 kcfs (assuming all turbines available and max powerhouse capacity is approx. 109 kcfs.

Higher flows can temporarily slow adult passage.  That said, these high flow events are typically relatively short and the long-term cumulative conversion rates for adult spring chinook from IHR to LGR continue to average close to 98 %.  There are steps co-managers (some not all) and the AA’s have supported and taken to address concerns with observed delays both due to operations and high flows.  Continued monitoring is prudent, and I’m certain discussions will continue to occur to address slower than expected passage rates during the migration period.   I am willing to referee the arm wrestling match between Trevor and Tom 😉.

**->From:** Wright, Lisa S CIV USARMY CENWD (USA) **Sent:** Wednesday, June 15, 2022 3:43 PM  
Thanks all for the feedback and discussion. Just to clarify, the 150k threshold came from the FPOM discussion at the meeting last week. Sean thought it was a reasonable threshold but doesn’t have a strong preference either way (150k, 120k, or no high flow threshold). “Our physical modeling has shown generally good tailrace flow conditions for most configurations once the river discharge is that high. Shifting 1-2 kcfs from training spill to the ASW is not likely to make a significant difference. I also think the ASW will continue to perform well to attract fish without making any changes beyond the original change form to allow the weir crest to adjust to follow forebay elevation.”

At this point, we can plan to implement the ASW crest change with the start of summer spill on Tuesday 6/21 when flows should be receding below 120k anyway. Then I’ll keep it on the FPOM agenda so y’all can duke it out over whether or not to have a high flow threshold.

**RECORD OF FINAL ACTION**:

Approved except for added language regarding the high flow threshold. FPOM will discuss at the July meeting.