OFFICIAL COORDINATION REQUEST FOR
NON-ROUTINE OPERATIONS AND MAINTENANCE

COORDINATION TITLE - 17 LWG 01 - Lower Granite Unit 2 Blade Position
COORDINATION DATE - 3 February 2017
PROJECT- Lower Granite Dam
RESPONSE DATE- 9 February 2017

Description of the problem - Intermittent sheens of oil were observed in Lower Granite tailrace December 19-21. The source of the oil was determined to be from failed blade packing in unit 2. When the unit 2 blade seal rings were removed, project maintenance personnel found one of the blade packing sleeves had failed with cracks extending through the sleeve (see photos). This magnitude of failure requires the placement of unit 2 blades into fixed positions prior to operation. The temporary repair of unit 2 for the 2017 fish passage season will include modified blade seals in the failed blade packing box and hydraulically locking the unit at a 29 degree angle of pitch as recommended for unit 1 fixed blades (see photos below). This work is expected to take about 4-6 weeks to complete depending on parts delivery. The Project would like confirmation of 29 degrees as the angle to position the blades as was coordinated for unit 1 (12LWG 001).

Type of outage required - Unit 2 will be out of service for about 20 days during the adult fish passage season.

Impact on facility operation (Fish Passage Plan deviations) - Unit 2 will need to be operated outside of unit priority order.

Impact on unit priority - Unit priority will be impacted. While unit 2 is out of service, unit priority will be unit 3 then units 4, 5 and 6 in any order. Unit 1 is expected to return to service early this spring. Following the return of unit 1 to service, the unit priority order will be unit 1, unit 3, units 4 - 6 any order, and then unit 2.

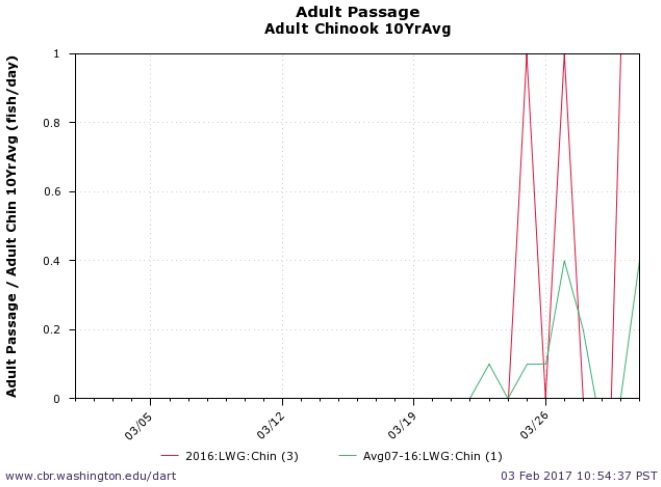
Impact on forebay/tailwater operation - Changes in tailwater conditions are expected with the change in unit operating priority.

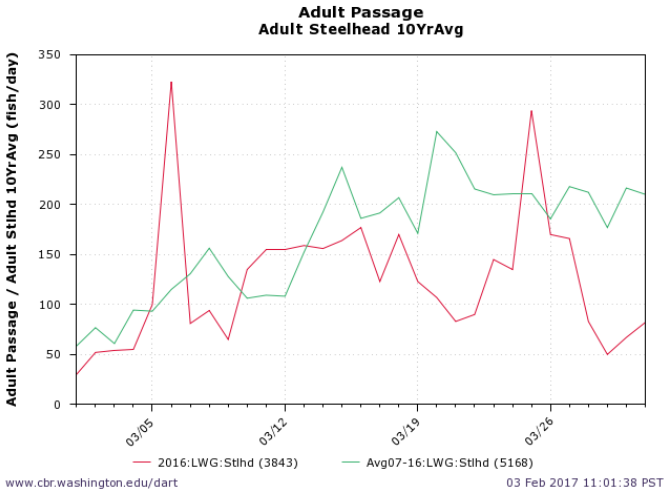
Impact on spill - No additional impacts to spill are expected however excess discharge during spring runoff will need to be directed to the spillway if powerhouse hydraulic capacity is exceeded. This may result in increased tailrace TDG (Total Dissolved Gas).

Dates of impacts/repairs - March 1-20.

Length of time for repairs - Temporary repair of unit 2 is expected to take 4 - 6 weeks.

Analysis of potential impacts to fish





1. 10-year average passage by run during the period of impact for adults and juvenile listed species, as appropriate for the proposed action and time of year: The 10 year average adult passage for the month of March is 1 chinook and 5,168 steelhead. The work should be completed prior to the peak of juvenile out migration.
2. Statement about the current year's run (e.g., higher or lower than 10-year average); N/A
3. Estimated exposure to impact by species and age class (i.e., number or percentage of run exposed to an impact by the action): Based on the 10 year average unit 2 being out of service for the month of March can potentially impact about 3.0% of steelhead annual average passage.
4. Type of impact by species and age class (increased delay, exposure to predation, exposure to a route of higher injury/mortality rate, exposure to higher TDG, etc.): The potential for increased adult delays should be minimized due to the repairs being completed prior to the start of spring spill operation on April 3. Based on available information impacts to juvenile passage will be minimal.

Summary statement - expected impacts on:

Downstream migrants: Minimal impact based on current information available.

Upstream migrants (including Bull Trout): N/A

Lamprey: N/A

Comments from agencies

-----Original Message-----
From: Shutters, Marvin K CIV USARMY CENWW (US)
Sent: Friday, February 03, 2017 12:11 PM

TSP, A proposal to block another Kaplan.

-----Original Message-----
From: Patla, Daniel P CIV USARMY CENWP (US)
Sent: Friday, February 03, 2017 12:39 PM
To: Shutters, Marvin K CIV USARMY CENWW (US)

Please note that the plan is to hydraulically block this unit; no physical blocks will be welded into place.

Dan Patla

-----Original Message-----
From: Bailey, John C CIV CENWW CENWD (US)
Sent: Friday, February 03, 2017 12:48 PM
To: Shutters, Marvin K CIV USARMY CENWW (US)

Marvin:

Note that the project is proposing to hydraulically set the blades in position for the 2017 season, not to weld them in place permanently.

John B.

-----Original Message-----
From: Kiefer,Russell [mailto:russ.kiefer@idfg.idaho.gov]
Sent: Monday, February 06, 2017 8:02 AM
To: Bailey, John C CIV CENWW CENWD (US) <John.C.Bailey@usace.army.mil>;
Subject: [EXTERNAL] RE: MOC - 17 LWG 01 - Lowe Granite Unit 2 Blade Position

John,

We should have a discussion on the trade-offs of which angle to fix the blade at.
If I'm correct in my thinking: 29 degrees will allow efficient operation with more water going through unit 2.
This results in a little more power, less spill, and less TDG at higher flows.

This also can result if turbine 1 is out of service during a low flow period that we could be faced with a decision on running a turbine farther from the ladder or reducing planned spill levels.

Let me know if I'm correct in my summary of the choice.

Russ

-----Original Message-----
From: Bill Hevlin - NOAA Federal [mailto:bill.hevlin@noaa.gov]
Sent: Monday, February 06, 2017 11:43 AM
Subject: [EXTERNAL] Re: MOC - 17 LWG 01 - Lowe Granite Unit 2 Blade Position

Hi John.
a couple quick questions on the blade angle and flow through unit two. At 29 degrees what is the most efficient and min and max flow through it. At lessor degrees, say 26 degrees, what is the most efficient and min and max flow? At higher degrees, say 32 degrees, what is the most efficient and min and max flow?

bill

-----Original Message-----
From: Setter, Ann L CIV USARMY CENWW (US)
Sent: Monday, February 06, 2017 12:45 PM
Subject: RE: MOC - 17 LWG 01 - Lowe Granite Unit 2 Blade Position

Russ:

We can have some discussion at FPOM meeting on Thursday of tradeoffs.

Ann Setter
-----Original Message-----
From: HILT, RICHARD ARLAN (Rich) CIV USARMY CENWW (US)
Sent: Monday, February 06, 2017 4:20 PM
Subject: RE: [EXTERNAL] Re: MOC - 17 LWG 01 - Lowe Granite Unit 2 Blade Position

Bill,

I can give you a qualitative answer. If you want a quantitative answer, we need to go to one of our technical engineering folks, or to HDC.

My understanding is that 29 degrees coincides with operating Unit 2 (and Unit 1 before) at the upper end of the 1% range. For Unit 2 that would be approximately 127-135 MW and around 18.6 -20.6 KCFS of flow (see FPP table LWG -6, it is dependent on net head, we typically operate around 100 ft). It was also my understanding that this angle was originally chosen by HDC because, at that flow/power, is where the wicket gates (opening) align with the stay vanes, which I understand to be the most fish friendly with respect to the water entering the into the unit before it pushes the blades and makes the turbine spin.

The blade angle is a function of what power we want to operate the Unit at, for a given net head. Realistically we are restricted to operate it within the 1% range, hence we are restricted to a blade angle that coincides to a chosen power between 85-130 MW (assuming a 100 ft. head, see the above table). I do not know what the change in blade angle is over the 1% range, HDC or Technical personnel would have to answer that.

So in summary, you don't directly chose the blade angle. You choose the power/flow. The corresponding blade angle and wicket gate opening will be a function of the chosen power/flow to get you at the peak efficiency (least turbulence and best operating condition for a given power). Obviously the 1% range is the peak 1% of turbine efficiency for a given unit, hence the overall smoothest operating point (or in this case set of points). The only advantage I see in picking 130 MW over any other operating power, is the alignment of the wicket gates with the stay vanes. The key is that you only get to choose one power/flow, and you only get one shot at it, well without significant effort and cost anyway.

Hopefully this helps...?

Rich Hilt
U.S. Army Corps of Engineers,
Chief of Operations
Lower Granite Dam
Work (509) 843-2253

Final coordination results

Approved by FPOM 2/9/2017. From meeting minutes: "17LWG01 Lower Granite Unit 2 blade position – WDFW, NOAA, IDFG and FWS concurred with the MOC; ODFW would prefer the angle set at a 12Kcks flow".

After Action update

Please email or call with questions or concerns.
Thank you,

Elizabeth Holdren
Supervisory Fisheries Biologist
Lower Granite Lock and Dam
Ph. 1(509) 843-1493 ext.263
Cell. 1(509) 592-6109
Elizabeth.a.holdren@usace.army.mil

Photographs

Photo 1. Broken sleeve as found in the blade packing box

Photo 2. Fatigue on left side of sleeve after removal from unit 2.

Photo 3. Example of square packing to be installed.

Photo 4. Centering and locking pilot valve after moving blades to final position.

Photo 5. Monitor blade angle digital readout to verify minimal or no blade movement.

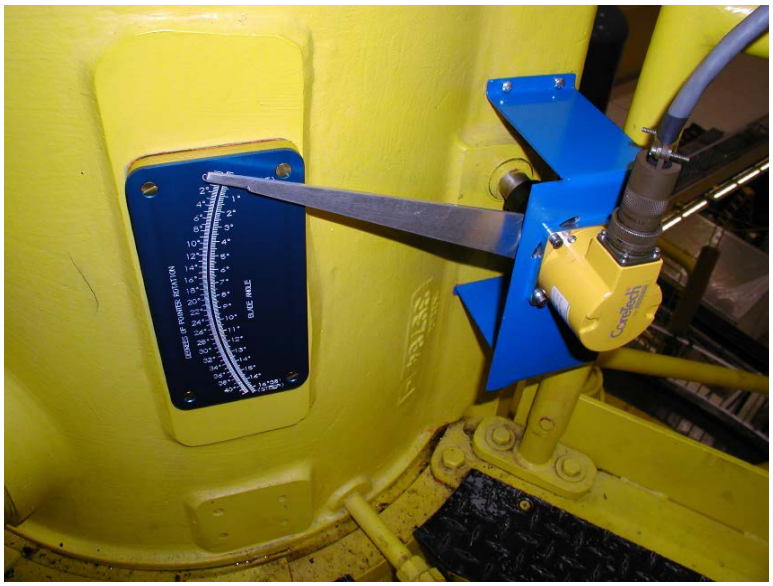


Photo 6. Monitor oil head blade indicator to verify minimal or no blade movement.