

## **Fish Passage Plan (FPP) Change Form**

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**Change Form # & Title:** 25BON001 – Unit 10 Fixed-Blade  
**Date Submitted:** 11-DEC-2024  
**Project:** Bonneville Dam  
**Requester Name, Agency:** Jeanette Flemmer, COE BON, and Lisa Wright, Corps RCC  
**Final Action:**

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**FPP SECTION:** Chapter 2 (BON), Table BON-15. Turbine Unit Operating Range.

### **JUSTIFICATION FOR CHANGE:**

Add footnote to Table BON-15 regarding Unit 10 with blades hydraulically locked at 25.5°. See MFR [24BON058](#), emailed to FPOM 10/21/2024, and coordinated at the November meeting:

*In early September 2024 following successful blade seal replacement, an oil leak was discovered in Unit 10 between the shaft and hub during pressure testing. This leak was originally identified upon taking the unit out of service in January 2024 but could not be replicated until September. The cause of this leak is suspected to be a failed O-ring between the shaft and hub, but this area cannot be accessed without fully unstacking the unit. The USACE Hydroelectric Design Center (HDC) provided Bonneville Project staff with several proposed fixed blade options. After much deliberation and coordination with USACE and BPA, locking the runner blades via digital governor block has been identified as the most feasible interim option to return U10 to service. This option is considered a short-term solution (about 5 years) until a more permanent resolution is developed and funding sources can be established, while providing Bonneville Project time to evaluate the extent of this failure mode in other PH1 units.*

*Using data from past Turbine Survival Program (TSP) research, the preferred fixed blade angle for U10 that has been selected is 25.5°. These investigations consider results based on physical injury and mortality, best geometric alignment turbine (wicket gates, stay vanes, and runner blades), barometric pressure, turbulence, and draft tube egress conditions. TSP Phase II determined the target operating range for best fish passage survival occurs when PH1 Units are operated with turbine unit flows between 8.5 and 11.5 kcfs. 10 kcfs was selected as a “sweet spot” to target via fixed-blade configuration. A 25.5° fixed-blade angle will result in constant turbine unit flows between about 9.5 and 10.3 kcfs.*

**PROPOSED CHANGE:** See following pages for edits to existing FPP in “track changes”.

**COMMENTS:**

**RECORD OF FINAL ACTION:**

**Table BON-1. Bonneville Dam Turbine Unit Power (MW) and Flow (cfs) at ±1% of Peak Efficiency (1% Range), Operating Limit, and PH1 Best Operating Point (BOP).<sup>a, b</sup>**

Project Head (feet)	PH1 Units 1–10 <sup>c</sup>							
	1% Lower Limit		1% Upper Limit		Best Operating Point (BOP)		Operating Limit	
	MW	cfs	MW	cfs	MW	cfs	MW	cfs
35	19.2	7,463	23.1	8,964	27.3	10,527	26.4	10,473
36	19.9	7,476	23.9	8,994	28.3	10,564	28.0	10,816
37	20.5	7,485	24.8	9,050	29.2	10,598	29.6	11,174
38	21.1	7,486	25.7	9,111	30.2	10,627	31.3	11,532
39	21.7	7,487	26.6	9,180	31.2	10,654	33.0	11,927
40	22.3	7,495	27.5	9,241	32.1	10,677	34.8	12,350
41	22.9	7,510	28.4	9,293	33.2	10,759	36.7	12,732
42	23.6	7,530	29.3	9,331	34.3	10,837	38.6	13,047
43	24.3	7,552	30.1	9,362	35.4	10,910	40.4	13,331
44	25.0	7,573	31.1	9,411	36.5	10,979	42.2	13,616
45	25.7	7,588	32.1	9,489	37.6	11,045	44.0	13,910
46	26.3	7,597	33.2	9,599	38.8	11,109	45.7	14,213
47	26.9	7,604	34.4	9,729	39.9	11,170	47.4	14,519
48	27.5	7,609	35.6	9,864	41.0	11,227	47.9	14,288
49	28.1	7,615	36.8	9,981	42.1	11,282	48.1	13,901
50	28.7	7,623	37.9	10,063	43.2	11,333	48.5	13,608
51	29.4	7,632	38.9	10,109	44.2	11,356	48.9	13,331
52	30.0	7,641	39.8	10,131	45.2	11,378	49.2	13,048
53	30.6	7,648	40.6	10,141	46.2	11,398	49.6	12,778
54	31.3	7,657	41.5	10,156	47.2	11,418	50.0	12,565
55	31.9	7,668	42.3	10,180	48.2	11,465	50.3	12,381
56	32.5	7,679	43.2	10,212	49.2	11,478	50.6	12,202
57	33.1	7,690	44.2	10,249	50.3	11,518	51.0	12,031
58	33.8	7,701	45.2	10,293	51.4	11,557	51.1	11,831
59	34.4	7,714	46.2	10,344	52.4	11,594	51.1	11,600
60	35.1	7,726	47.2	10,400	53.5	11,630	51.2	11,384
61	35.7	7,737	48.3	10,461	54.3	11,610	51.4	11,215
62	36.3	7,747	49.3	10,526	55.1	11,591	51.6	11,053
63	36.9	7,756	50.4	10,590	56.0	11,572	51.7	10,876
64	37.6	7,768	51.5	10,654	56.6	11,519	51.6	10,655
65	38.2	7,783	52.6	10,713	56.8	11,388	51.4	10,438
66	38.8	7,780	53.4	10,712	57.1	11,265	51.0	10,172
67	39.4	7,775	54.2	10,703	57.3	11,124	51.0	10,026
68	39.9	7,769	54.9	10,690	57.6	11,021	51.1	9,881
69	40.4	7,765	55.6	10,679	57.8	10,896	50.8	9,673
70	41.0	7,766	56.3	10,651	58.0	10,736	50.3	9,439

a. Values provided by HDC (May 2022), except PH1 BOP from Turbine Survival Program (TSP) modeling and analysis (Jan 2013). Flow (cfs) is a calculated value based on turbine efficiency, project head, and power output (MW).

b. “Operating Limit” (added Feb 2018) is the maximum safe operating point based on cavitation or generator limit. BON PH2 units have a generator limit that restricts turbine output at higher heads. Values shaded in gray indicate the Operating Limit is below the modeled 1% Upper Limit.

b-c. [Unit 10 runner blades are hydraulically locked at 25.5° to prevent oil leaks due to a failed O-ring between the shaft and hub. Until the unit is repaired, the operating range is restricted to a turbine flow of approximately 9.5–10.3 kcfs.](#)