

Separator Monitoring at Bonneville Dam

2020 Annual Report

February 2021



**US Army Corps
of Engineers®**
Portland District



Bonneville Juvenile Separator Monitoring 2020 Annual Report

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Abstract—A global pandemic in 2020 did not change our separator monitoring schedule or our level of diligence in insuring safe passage of millions of fish through the facility's flumes, diversion gates, and wetted separator. While safety protocols were in place to insure the health and well-being of onsite personnel, monitoring efforts and results remained essentially unchanged from past seasons. Debris levels at the Primary Dewatering Structure (PDS) and Fish and Debris Separator (FDS) were generally light for the majority of the season. The highest debris levels were observed from March through early-June and again from September-October, but for the season, debris levels averaged a level 1 rating almost 91% of the time. Sticks and other forms of woody debris comprised the bulk of debris removed from the system from March into June, and again in October. Facility inspections typically revealed optimal passage conditions. Water fluctuations at the PDS, as in recent years, were extremely rare.

A total of 325 adults salmonids were recorded passing over the separator bars in 2020. Of those, two kelts, or about 0.6% of the total fallbacks were assisted manually from the separator bars. May was the peak fallback passage month with 32% of the season total, followed by October (13%) and March (11%). Diel fallback passage was highest during day shift (0800-1600) with 42% while grave shift (0000-0800) and swing shift (1600-2400) comprised 31% and 27% of the overall passage total, respectively.

INTRODUCTION

In 2020, Pacific States Marine Fisheries Commission (PSMFC) contracted with the BPA to monitor all fish passageways and holding areas within the Juvenile Fish Monitoring Facility (JMF). PSMFC also contracts with BPA for Smolt Monitoring at Bonneville so including this task simplifies contracting and allows for personnel sharing that achieves a substantial cost savings to the region.

The purpose of the project is to provide continual monitoring of the fish passageways and holding tanks at the JMF. This monitoring is responsible for the safe passage of millions of fish through the facility's flumes, diversion gates, and wetted separator. Many of the fish passing the project via the juvenile bypass system are endangered species and the importance of insuring safe passage and holding conditions cannot be overstated.

METHODS AND MATERIALS

Separator Monitoring Overview and Responsibilities

Separator Monitoring at the JMF occurs 24/7 typically from 1 March through 31 October. All fish passageways and holding areas below the upper switch gate are monitored (Figure 10.) Specific duties and responsibilities are described below:

1. Monitor and adjust fish dewatering and PIT tag interrogation equipment, distribution flumes, diversion gates, and holding tanks.
2. Conduct facility inspections, about every two hours, and record data results.
3. Identify and record if possible all adult fish passing over the separator bars and manually remove any that get stranded.
4. Remove and dispose of debris from separator bars and other areas, and inspect all system components for debris plugs.
5. Transfer all records from the data sheet to a spreadsheet including but not limited to: water levels, adjustments, observations from inspection form, and fallback tally form.
6. Perform data summaries as instructed.
7. Maintain a thorough understanding of emergency response protocol through regular review of documentation. Emergencies may include a sudden drop or rise in water level, a debris plug in a flume, a stuck rotating gate, or any number of unforeseeable situations.
8. Assist researchers with logistical support as possible without detracting from specified tasks.

Primary Dewatering Structure and Fish and Debris Separator

In sample mode, the fish pass over the Primary Dewatering Structure (PDS) where most (29 of 30 cfs) of the water is removed (Figure 1). The remaining water and fish flow onto the large fish and debris

separator (FDS), which is a series of parallel aluminum bars with a 1.25" gap. Juveniles pass through while most of the adults and debris slide off the end and return to the river (Figure 1). Under the separator bars is a collection area known as the "hopper". A sloped floor directs the juveniles into the distribution flume leading to the facility subsample gate and PIT tag diversion systems. If not diverted by the subsample or research gate, fish return to the river.



Figure 1. Primary Dewatering Structure (PDS) and the separator bars at the Juvenile Monitoring Facility.

Monitoring the PDS and FDS is accomplished via a combination of on-structure and video monitoring from the facility office or laboratory. Staff spent as much time as possible monitoring the separator bars so response time to stranded fish and debris removal could be minimized. Debris removal and screen cleaning at the PDS were accomplished manually. Debris levels at the PDS are recorded on a data sheet and assigned a rating of 1 through 5 (Table 1).

Adult fish that become stranded on or between the separator bars are removed, identified and their disposition (alive or dead) recorded. Additional attention is given to Kelts stranded at the separator where their general external condition is assessed and recorded. Similarly, adult fish passing over the separator are recorded as Steelhead, Salmon, or Unknown Salmonid.

Table 1. Debris rating criteria used at the Bonneville Primary Dewatering Structure.

Rating	Debris Load	Criteria
1	Light	-Little significant wood or plant material builds up. PDS rarely needs cleaning.
2	Light to Moderate	-Wood or plant material build up occurs. Over an hour can go by between PDS cleanings.
3	Moderate	-Significant wood or plant material build up. PDS needs cleaning at least once every hour.
4	Moderate to Heavy	-Heavier wood or plant material builds up. PDS needs cleaning two or three times /hour.
5	Heavy Debris	-Very heavy wood or plant material build up occurs. PDS needs constant cleaning.

Facility Inspections

Complete facility inspections are performed about every two hours, more frequently when conditions warrant, with results recorded on data sheets. All system passage and holding areas are inspected and problems are reported to the project biologist or control room as appropriate.

RESULTS AND DISCUSSION

Debris Levels

The PDS performed well throughout the season as few flow fluctuations were observed. Debris levels observed at the PDS fluctuated between light to moderate from March to mid-June consisting almost entirely of sticks and woody debris. Woody debris disappeared by late June transitioning to aquatic macrophytes (milfoil, filamentous green algae) and leaves until returning in mid-October. Debris levels remained generally light from late June into mid-September when debris loads increased to moderate levels, which continued through the end of the season (Figure 2).

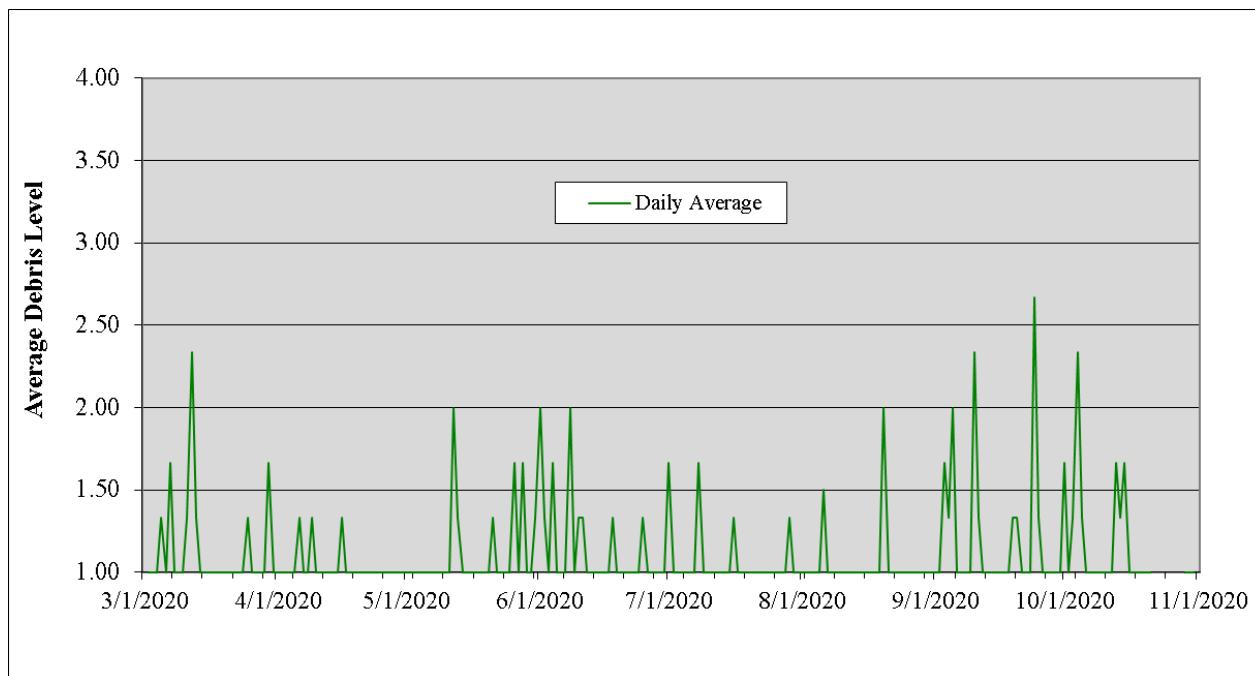


Figure 2. Daily average debris levels at Bonneville JMF, 2020.

Overall, debris levels at the facility were level 1 (light) for 91.1% of the season while level 2 (light to moderate) was recorded 6.6% of the time. Level 3 (moderate) was rare at 2.0%, while level 5 (heavy) occurred on only two day shifts in September and October, representing 0.3% of the season. Debris level 4 (moderate to heavy) was never achieved in 2020. Debris levels during day shift showed the greatest variability while little variation was observed during swing and grave shifts throughout the season (Table 2).

Table 2. Debris level percentage by shift and combined totals, 2020.

Debris Level	Shift			Average Combined Shifts
	Day	Swing	Grave	
1	84.5%	94.5%	94.5%	91.1%
2	9.6%	5.0%	5.1%	6.6%
3	5.0%	0.5%	0.5%	2.0%
4	0.0%	0.0%	0.0%	0.0%
5	0.9%	0.0%	0.0%	0.3%

Primary Dewatering Structure Coverage

Combined coverage (on-station PDS and video monitoring) rates varied slightly by month and by shift dependent upon adult fallback rates and downstream migrant numbers. Coverage ranged from 68% to 84% by month for all shifts (Figure 3). The percent PDS and video coverage averaged 75% for both day and swing, while grave shift had the highest coverage (79%) throughout the season. Periods without monitoring are due to staff being away from the PDS for inspections, restroom breaks, lunch, talking to visitors, and a variety of other activities.

Even as smolt numbers and fallback rates declined after June, on-station coverage rates remained relatively consistent during swing and grave shifts. Day shift PDS coverage varied from August through October because the separator monitor for those shifts assisted with juvenile shad processing. This is an example of the employee sharing made possible by PSMFC holding both contracts. Coverage for sick employees is another major advantage.

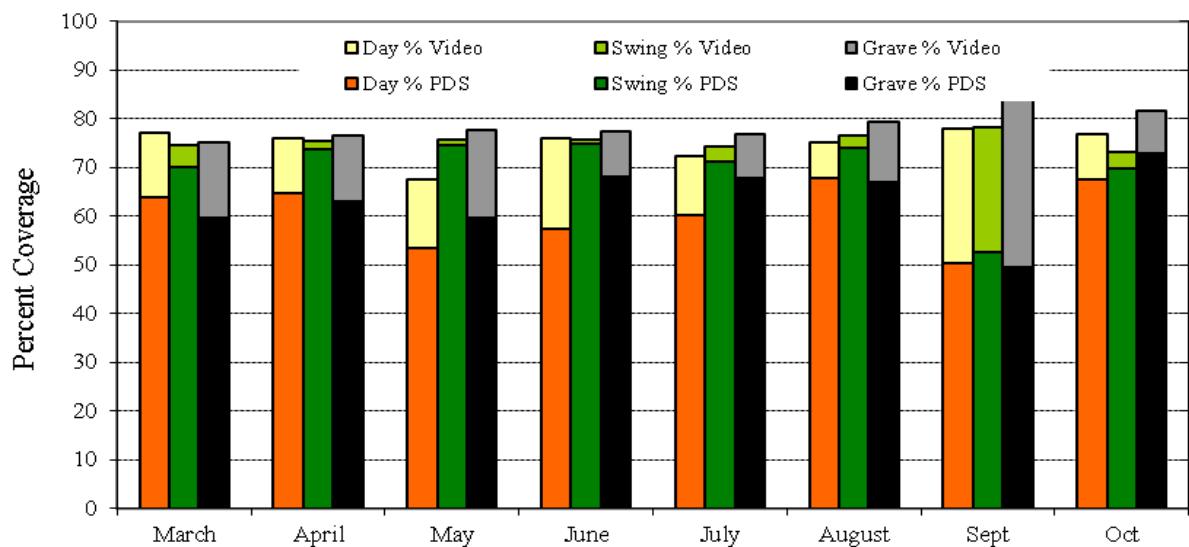


Figure 3. Primary Dewatering Structure coverage type, Bonneville PH2.

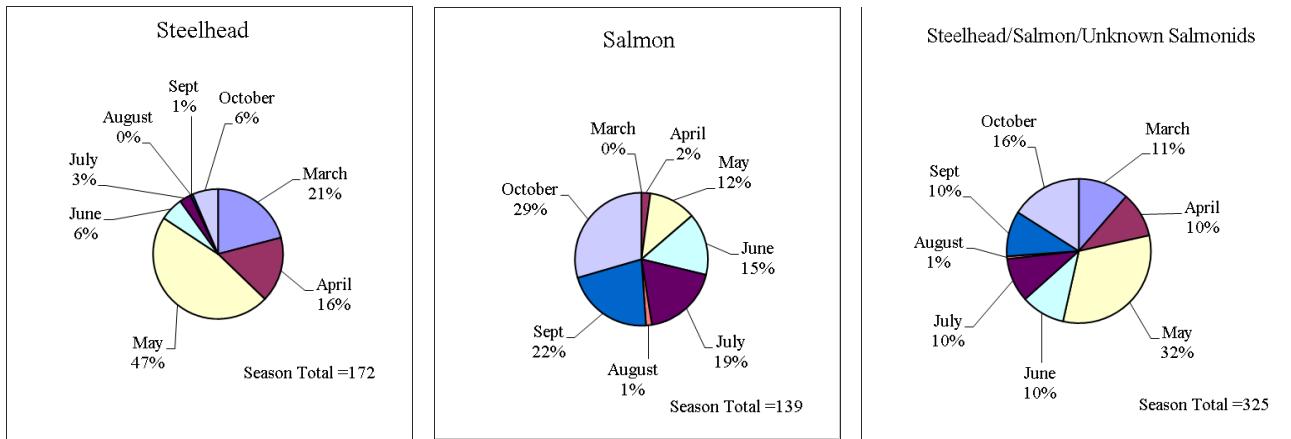
Types are; on-PDS or video.

AdultFallback Observations

A total of 325 adult salmonids were recorded as they passed over the separator bars throughout the season. The highest monthly fallback passage occurred in May when approximately 32% (104) were observed while 16% (52) were recorded passing in October (Table 3 and Figure 7). The highest daily total fallback count was recorded on 15 October when 15 adult salmonids crossed the separator bars.

May had the highest percentage of steelhead crossing the separator bars when 47% of the season total were observed followed by March with 21% (Figure 5). For salmon, October was the biggest month with 29% of the total, followed by September with 22% (Figure 6).

Incidental adult species such as carp, smallmouth bass, American shad, sturgeon, and suckers were observed passing the separator bars throughout the season.



Figures 5 and 6 and 7. Fallbacks, as percent of total by month, 2020.

Stranded Kelt Observations

Personnel spent as much time as possible at the separator bars so response time to assist stranded fish and debris removal could be minimized. Stranded kelts were recorded from 30 April through 9 May. Two kelts, which represented about 0.6 percent of total adults counted at the separator, were stranded on or between the separator bars this year. One of those was recorded as dead on arrival (Table 3). Daily fallback observations by species are presented in Figure 4.

Table 3. Fallback summary, Primary Dewatering Structure, Bonneville PH2, 2020.

	Stranded Kelts				Pass By Adults			Monthly Total	
	Alive	% Alive	Dead	% Dead	Total	Steelhead	Salmon	Unk. Sal.	
March						36	0	1	37
April			1	100%	1	28	3	2	33
May	1	100%			1	81	16	7	104
June						10	21	1	32
July						5	26	1	32
Aug						0	2	0	2
Sept.						1	30	2	33
Oct.						11	41	0	52
Total	1	50%	1	50%	2	172	139	14	325

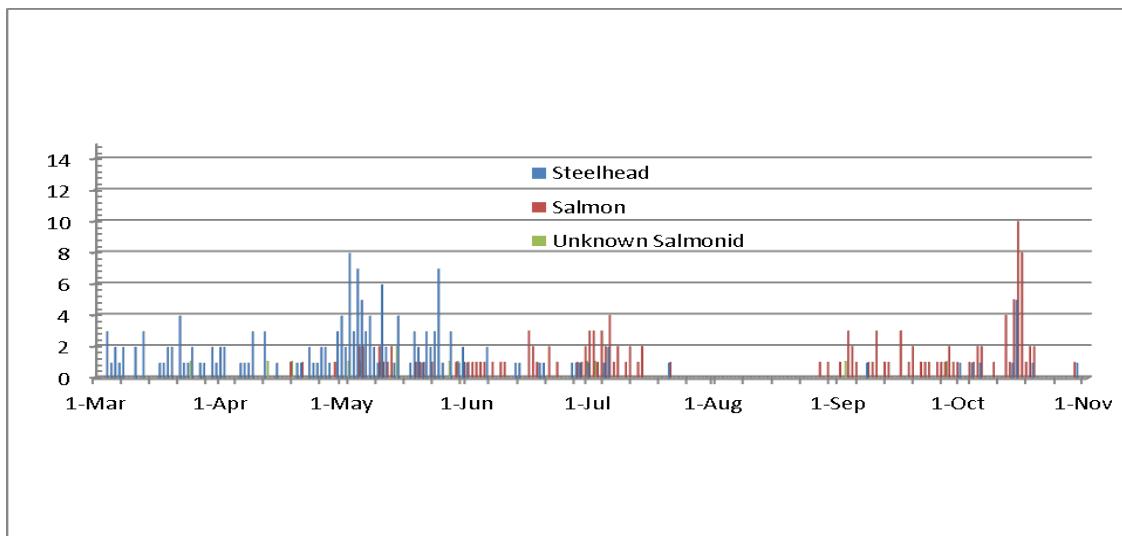


Figure 4. Fallbacks recorded at Bonneville Primary Dewatering Structure, 2020.

Diel Passage Observations

Diel passage of steelhead and salmon fallbacks was recorded at the JMF throughout the season. A total of 172 adult steelhead and 139 adult salmon were observed in 2020. Percentage of total fallback passage by hour is presented in Figure 8. Day shift recorded the highest percentage of the total fallbacks observed throughout the season at 42%, while grave and swing shifts noted 31% and 27%, respectively (Figure 9). Approximately 71% of grave shift's steelhead and salmon fallbacks were observed between the hours of 3am and 6am while 65% of swing shift's totals were recorded between 7 and 10pm. Almost 52% of day shift's total fallbacks were recorded between 1 and 4pm.

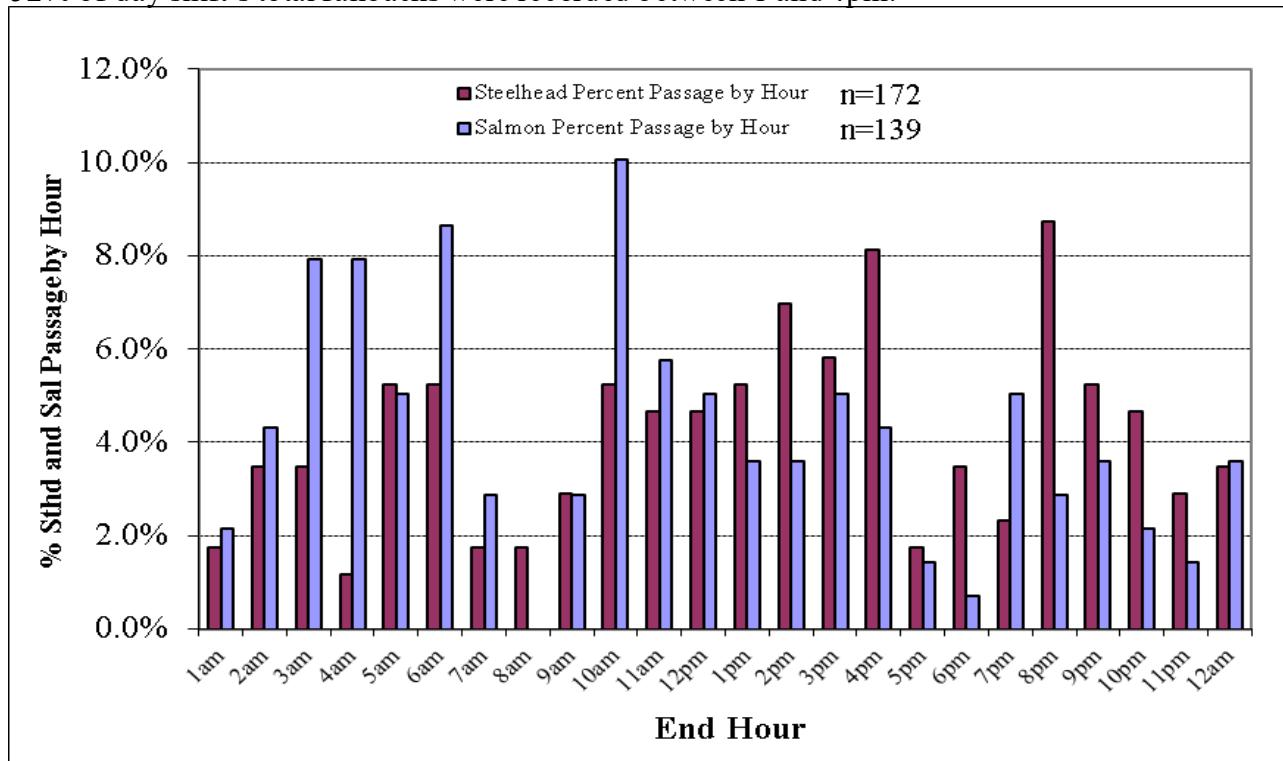


Figure 8. Diel passage of fallbacks, Bonneville JMF in 2020.

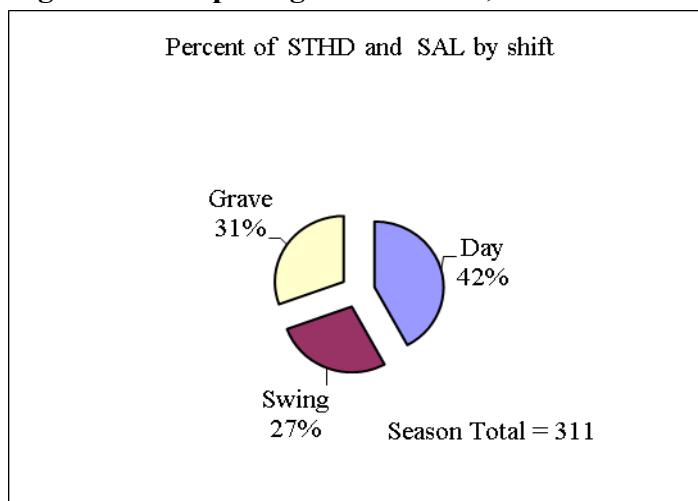


Figure 9. Fallbacks by shift, Bonneville JMF in 2020.

Facility Inspections

Facility inspections are performed every two hours, more frequently when conditions warrant. In general, inspections were routine as optimal conditions were noted in the system for the majority of the time. The most common problem in past years, similar to this season, was debris plugs in the fish distribution flumes. Almost always it was just one or two sticks lodged at various points in the fish flumes. The most common location where debris was found was the point where the fish distribution flume connects to the juvenile hopper. Water velocities are slowest there and the flume exits at a 90 degree angle, making it a prime spot for sticks to lodge.

The rotating gates functioned normally throughout the season requiring only routine maintenance and replacement of shock absorbers once. Fluctuations in water levels were again rare this season as flooding in the juvenile hopper occurred only twice. Dry screen was almost never experienced as the Emergency Relief Gate (ERG) in PH2 tripped only once in 2020. Significant drops in air pressure to system components did not occur this season.

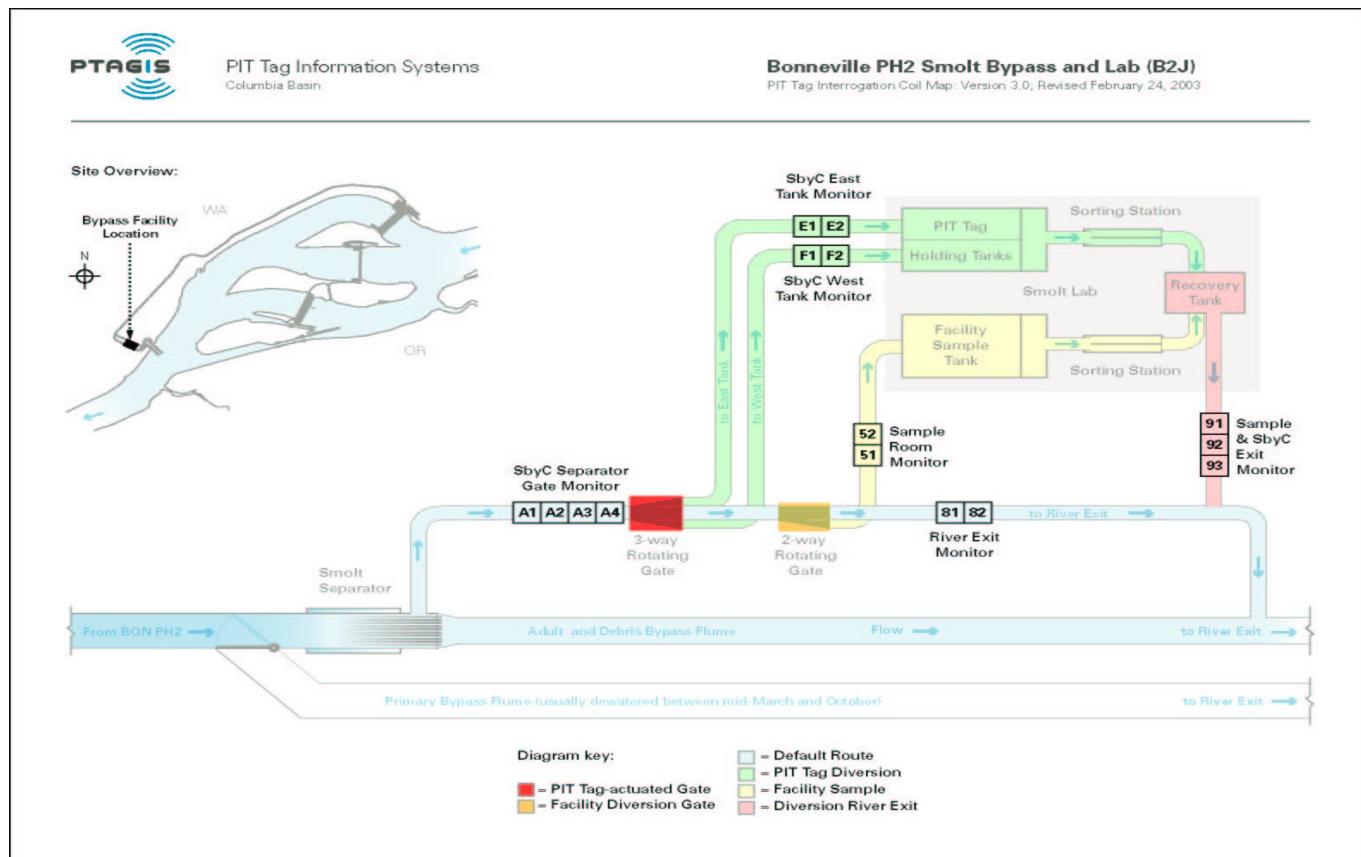


Figure 10. Bonneville JMF PIT tag detection system and fish distribution flumes. (Graphic courtesy of the Columbia Basin PIT Tag Information Systems)

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