FOSTER DOWNSTREAM FISH PASSAGE ALTERNATIVES ANALYSIS UPDATE

Engineering Documentation Report (EDR) Completion Schedule:

ATR & WATER Review of EDR	NLT 4/19/2016 – 5/17/2016
Finalize EDR	5/17/2016 – 6/14/2016

FIGURE 1: Comparison of estimated biological benefit and costs of downstream passage alternatives for Foster Dam.

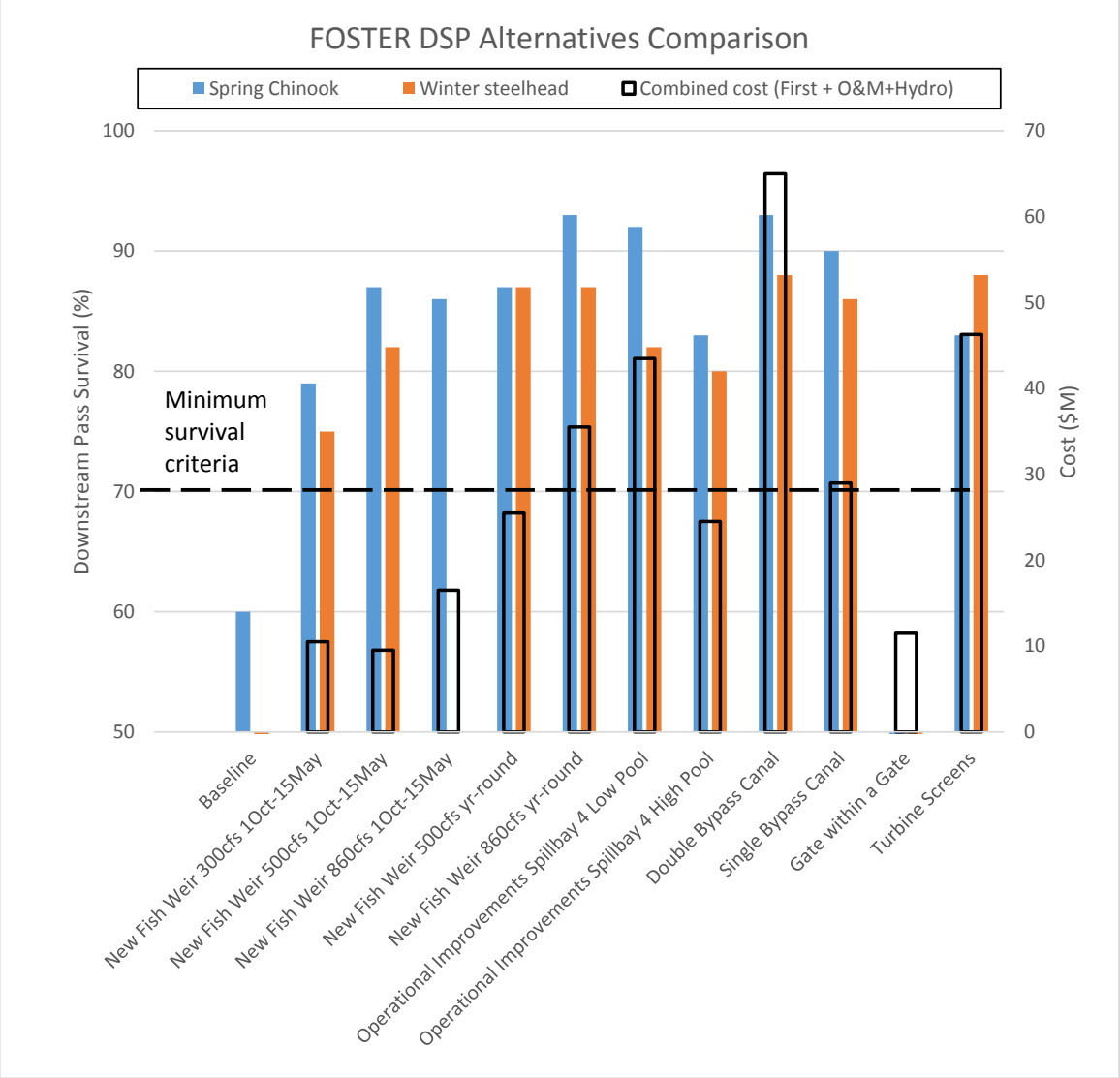


TABLE 1: Comparison of estimated biological benefit and costs of downstream passage alternatives for Foster Dam.

	Spring Chinook – Project survival (%)	Winter steelhead – Project survival (%)	Average % Survival	Project First Costs (Total CRFM) ($ MIL)	Additional O&M (PV) ($ MIL)	Combined cost (First + O&M)	Lost Hydropower ($M)	Combined cost (First + O&M+Hydro)
Baseline	60	49	54.5					
New Fish Weir 300cfs 1Oct-15May	79	75	77	$2 M	$500k	2.5	$8 M	10.5
New Fish Weir 500cfs 1Oct-15May	87	82	84.5	$2 M	$500k	2.5	$7 M	9.5
New Fish Weir 860cfs 1Oct-15May	86	Tbd*	86	$2 M	$500k	2.5	$14 M	16.5
New Fish Weir 500cfs yr-round	87	87	87	$2 M	$500k	2.5	$23 M	25.5
New Fish Weir 860cfs yr-round	93	87	90	$2 M	$500k	2.5	$33 M	35.5
Operational Improvements Spillbay 4 Low Pool	92	82	87	$0	$500k	0.5	$43 M	43.5
Operational Improvements Spillbay 4 High Pool	83	80	81.5	$0	$500k	0.5	$24 M	24.5
Double Bypass Canal	93	88	90.5	$30 M	$2 M	32	$33 M	65
Single Bypass Canal	90	86	88	$20 M	$2 M	22	$7 M	29
Gate within a Gate	-----	-----	---	$4 M	$500k	4.5	$7 M	11.5
Turbine Screens	83	88	85.5	$45 M	$1 M	46	$0.3 M	46.3

*Under review – correcting issue with FBW run.

Foster Downstream Fish Passage Alternatives Analysis:
ALTERNATIVE DESCRIPTIONS & RES-SIM

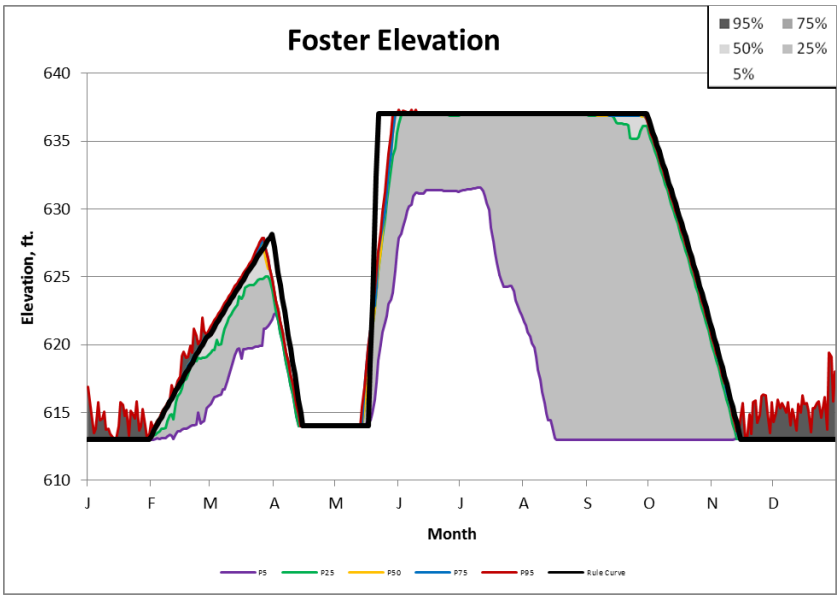
BASELINE: This simulation sets the baseline which will be used as the comparison for all FOS downstream passage simulations. All templates set up for comparison use the Early Implementation results as the comparative values.

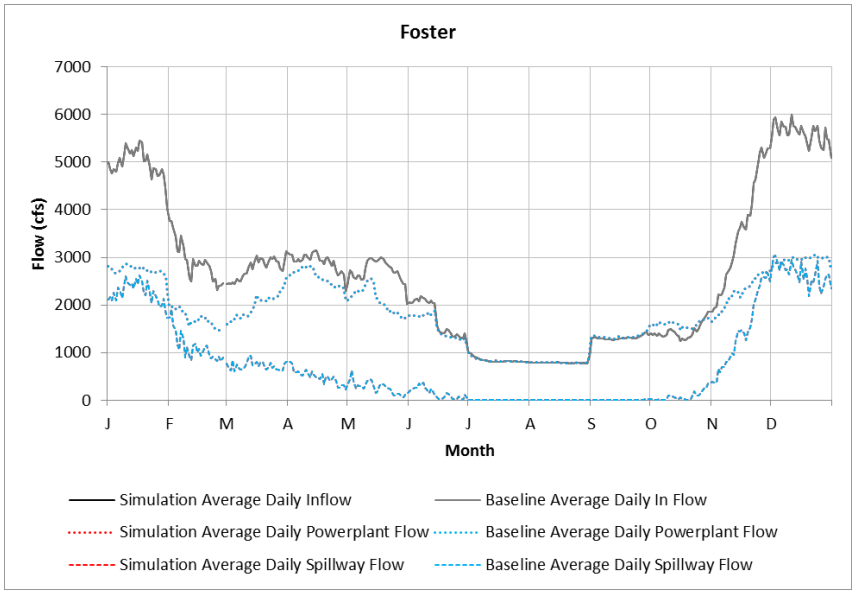
COMMENTS:

All IRRMs removed.
No pool restrictions at LOP.
FOS has has outlets two turbines and the four spillways, with the priority given to the powerhouse.
The rule curve for FOS has the partial fill and then the draft to 614 for one month, then fill to maximum conservation zone.

FBW Runs:

Baseline





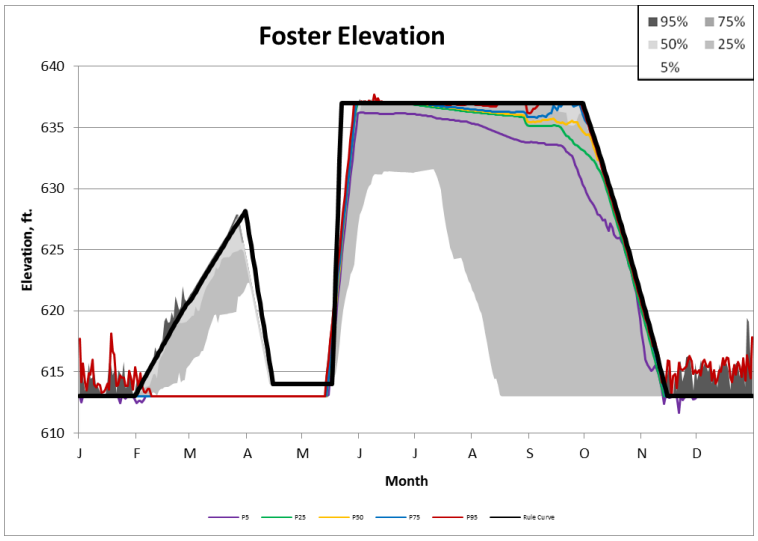
Fish Weir 300 Nov-Apr with use of powerhouse: FOS modeled with 300 cfs over the fish weir spillway constantly for Nov through end of April. The rule is set to account for pool elevations as well, with a +/- 2 foot range about 613. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

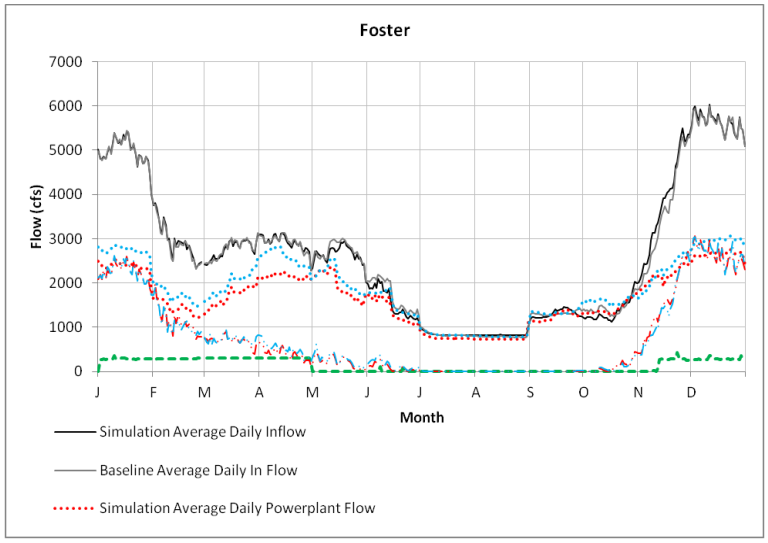
Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
Has "Fish Facility Pipe" which is one outlet with a 50 cfs constant capacity.
Has "Spillways B, C, and D" which are three bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then the three spillways B-D, then the fish weir. This is the default, not the rule sets.

FBW Runs:

Fish Weir 300 cfs 1NOV-30APR





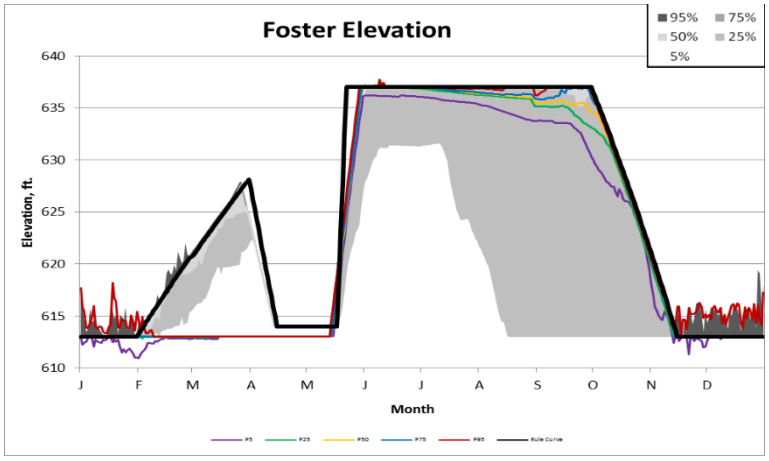
Fish Weir 860 Nov-Apr with use of powerhouse: FOS modeled with 850 cfs over the fish weir spillway constantly for Nov through end of April. This is in all zones. All zones also have the flow specified thru the fish facility pipe as a high rule. Conservation and Buffer zones set to parse flow during weir time to go thru the turbines if min flow can be met, else the flow goes over another spillway. Note weir spill for 613 elevations, or low pool.

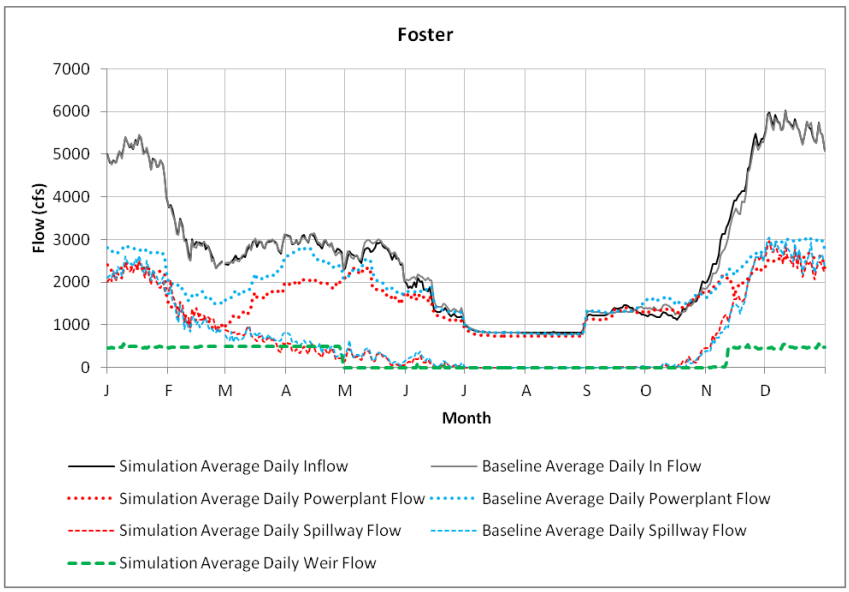
Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
Has "Fish Facility Pipe" which is one outlet with a 50 cfs constant capacity.
Has "Spillways B, C, and D" which are three bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then the three spillways B-D, then the fish weir. This is the default, not the rule sets.

FBW Runs:

Fish Weir 860cfs 1NOV-30APR





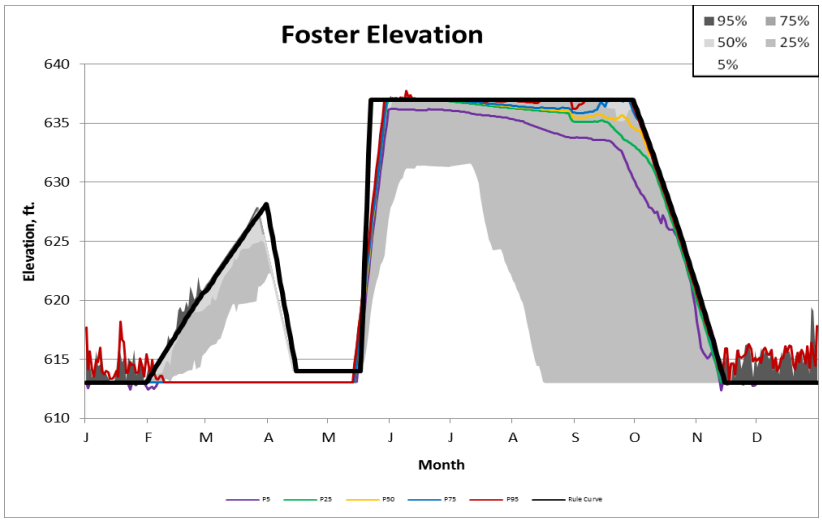
Fish Weir 500 Nov-Apr with use of powerhouse: FOS modeled with 500 cfs over the fish weir spillway constantly for Nov through end of April. The rule is set to account for pool elevations as well, with a +/- 2 foot range about 613. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

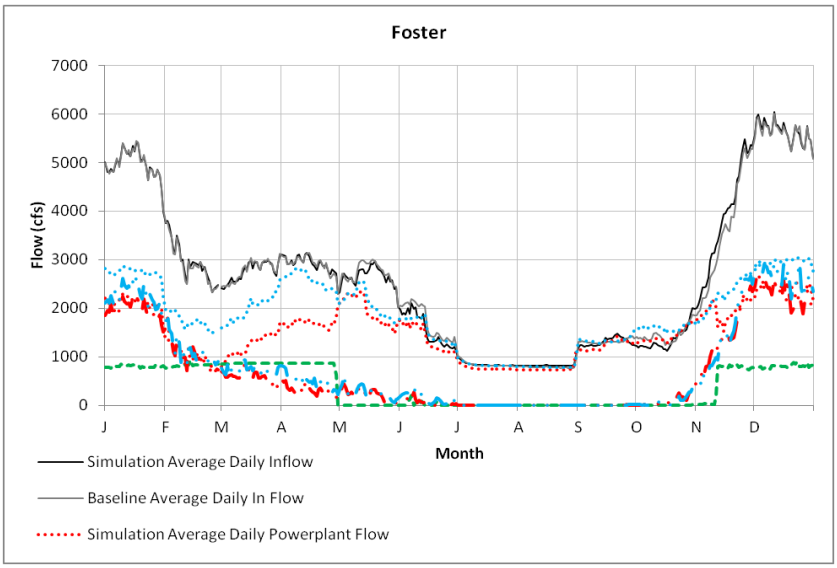
Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay.
This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
Has "Fish Facility Pipe" which is one outlet with a 50 cfs constant capacity.
Has "Spillway B", "Spillway C", & "Spillway D" bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then fish weir spillway, then the spillways in order of B, C, then D.

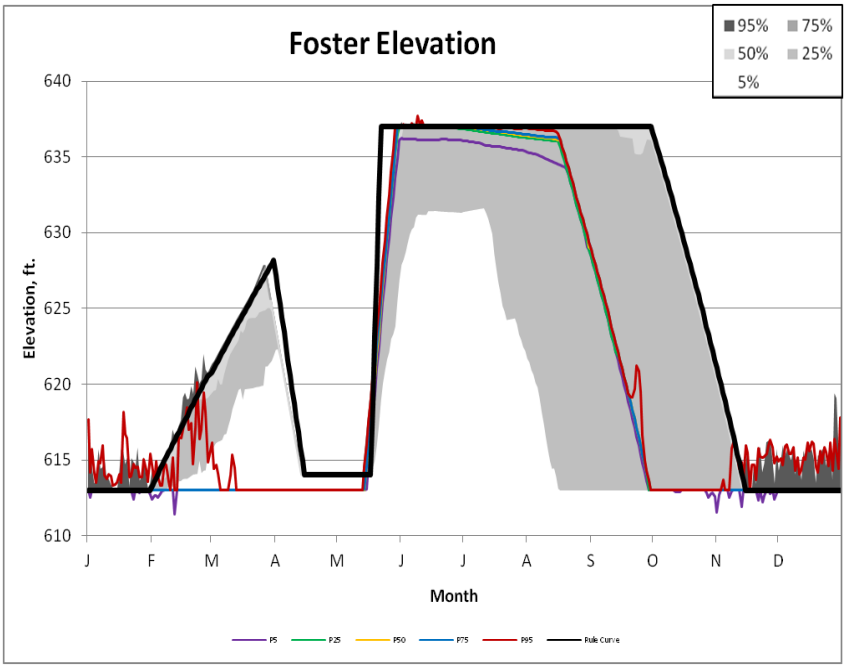
FBW Runs:

Fish Weir 500 cfs 1NOV-30APR



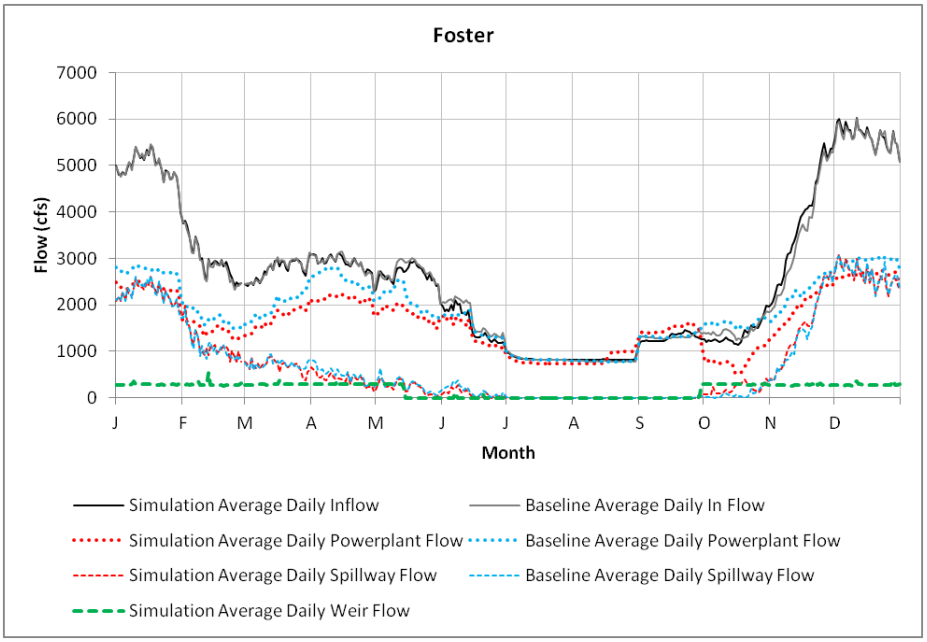


Fish Weir 300 01 Oct – 15 May with use of powerhouse: FOS modeled with 300 cfs over the fish weir spillway constantly from 01 Oct through 15 May. The rule is set to account for pool elevations as well, with a +/- 2 foot range about 613. The powerhouse is used if there is enough water being released.

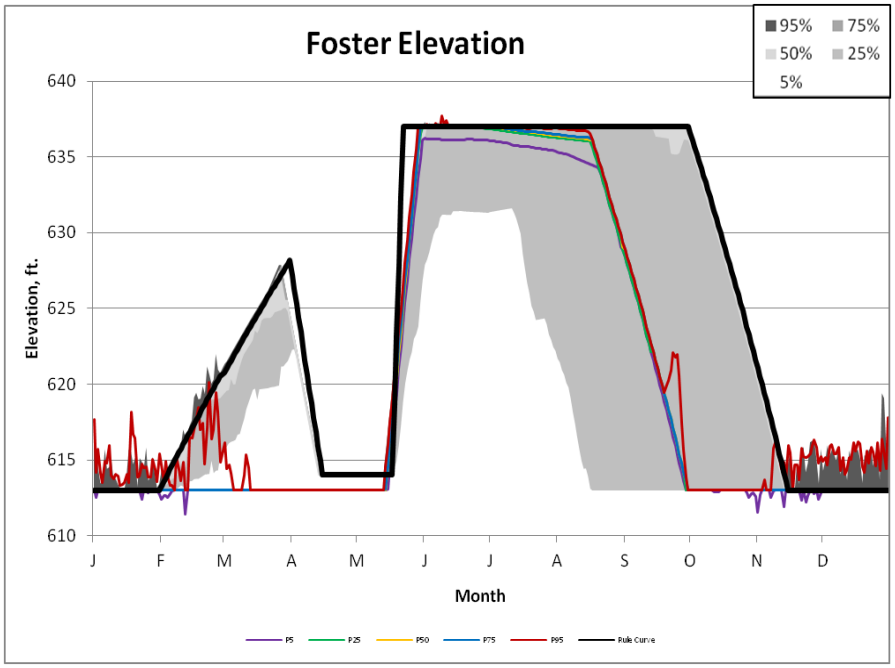


FBW Runs:

Fish Weir 300 cfs 1OCT-15MAY

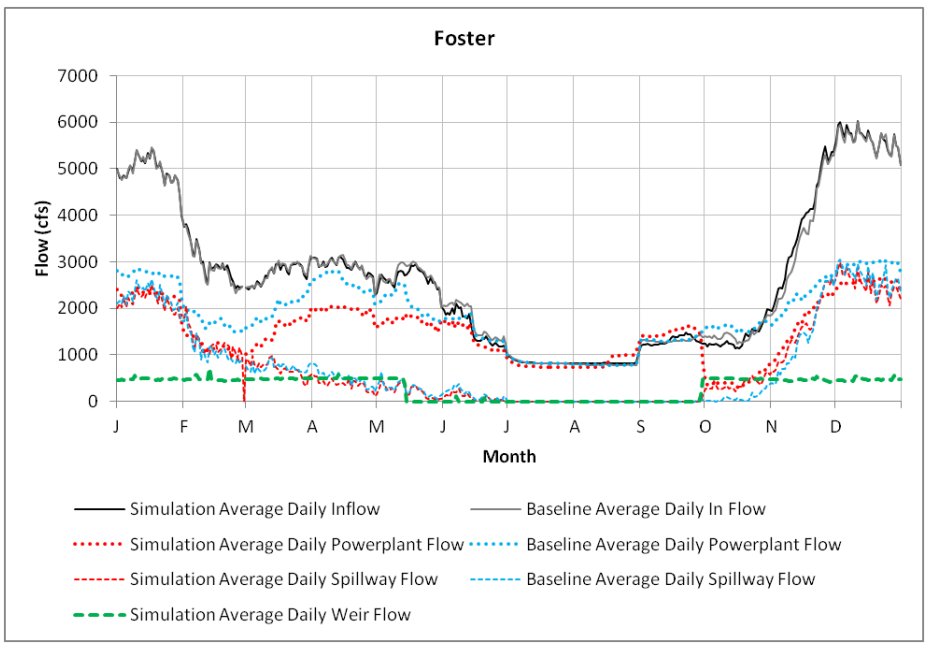


Fish Weir 500 01 Oct – 15 May with use of powerhouse: FOS modeled with 500 cfs over the fish weir spillway constantly from 01 Oct through 15 May. The rule is set to account for pool elevations as well, with a +/- 2 foot range about 613. The powerhouse is used if there is enough water being released.

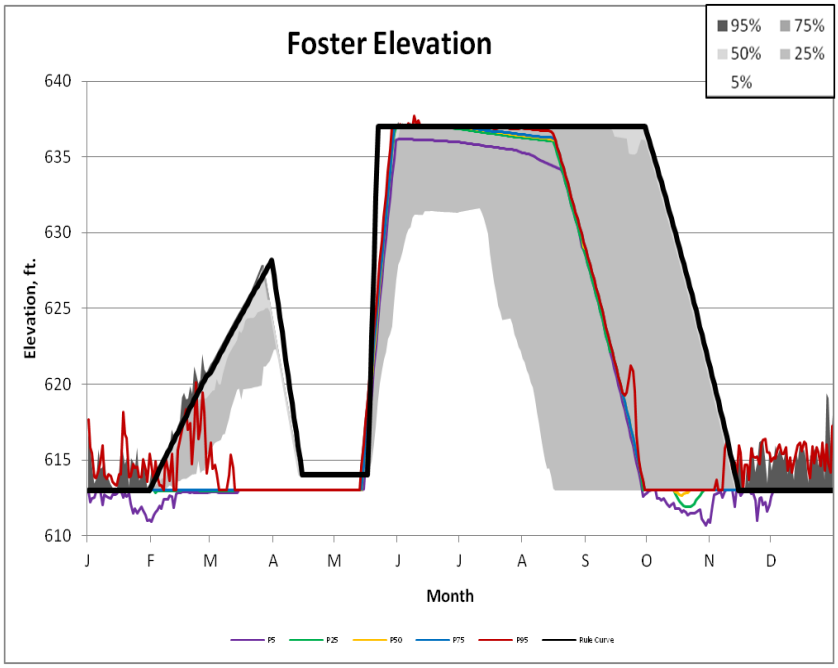


FBW Runs:

Fish Weir 500 cfs 1OCT-15MAY

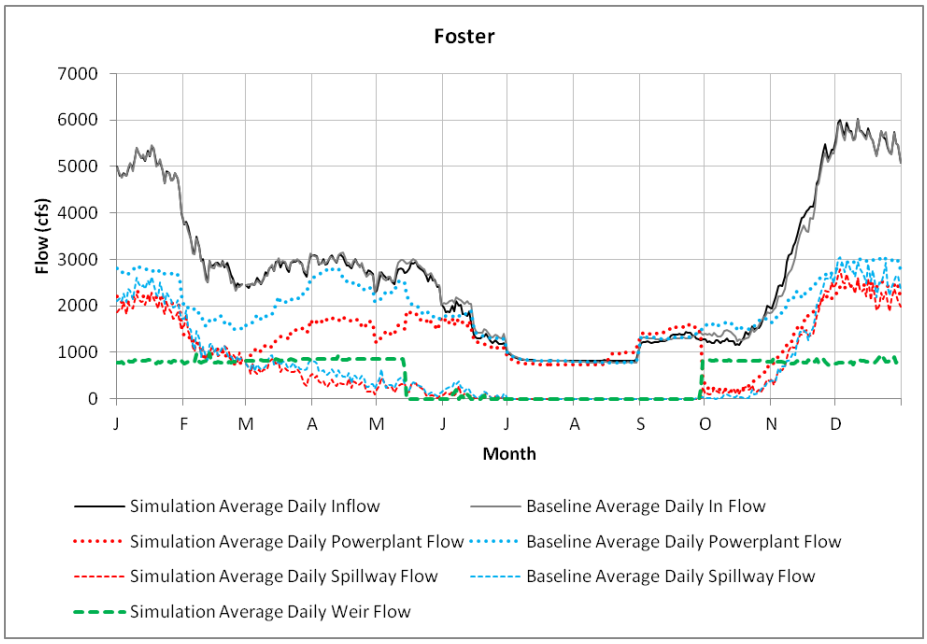


Fish Weir 860 01 Oct – 15 May with use of powerhouse: FOS modeled with 860 cfs over the fish weir spillway constantly from 01 Oct through 15 May. The rule is set to account for pool elevations as well, with a +/- 2 foot range about 613. The powerhouse is used if there is enough water being released.



FBW Runs:

Fish Weir 860 cfs 1OCT-15MAY



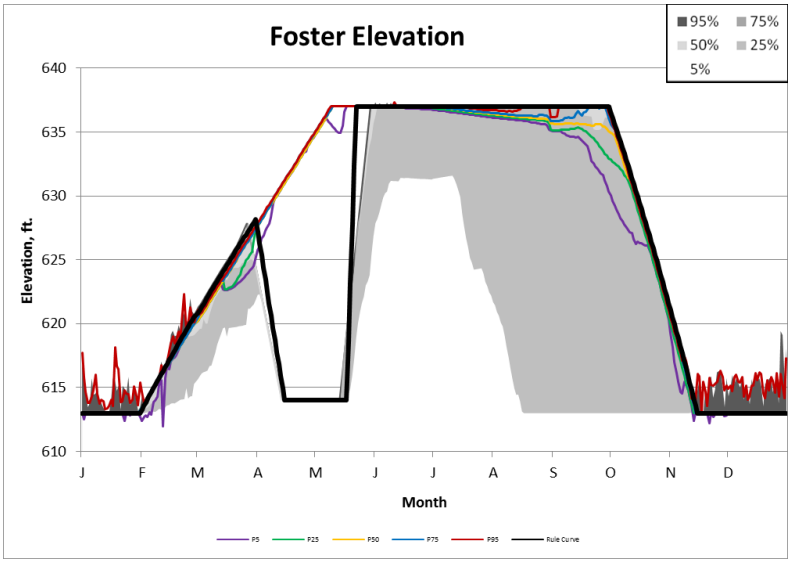
Fish Weir 300 Year round with use of powerhouse: FOS modeled with 300 cfs over the fish weir all year, regardless of pool elev. Note rule curve is the same as the water control manual with no delay in fill and no partial fill then draft. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

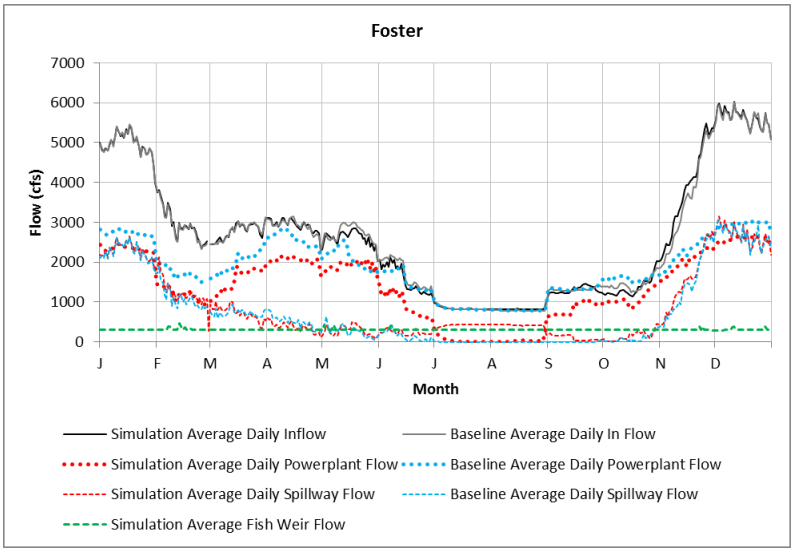
Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay.
This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
Has "Fish Facility Pipe" which is one outlet with a 50 cfs constant capacity.
Has "Spillway B", "Spillway C", & "Spillway D" bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then fish weir spillway, then the spillways in order of B, C, then D.

FBW Runs:

Fish Weir 300 cfs Year Round
Single Bypass
Turbine Screen





Fish Weir 860 Year round with use of powerhouse: FOS modeled with 860 cfs over the fish weir all year, regardless of pool elev. Note rule curve is the same as the water control manual with no delay in fill and no partial fill then draft. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
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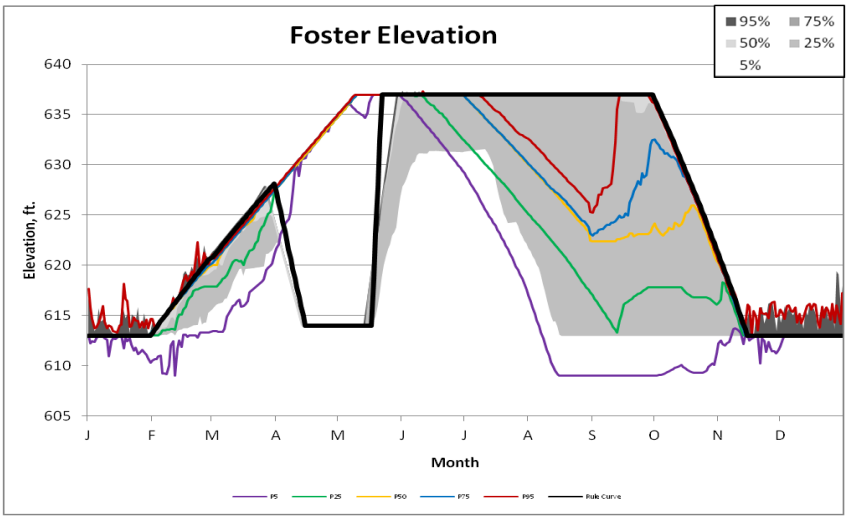
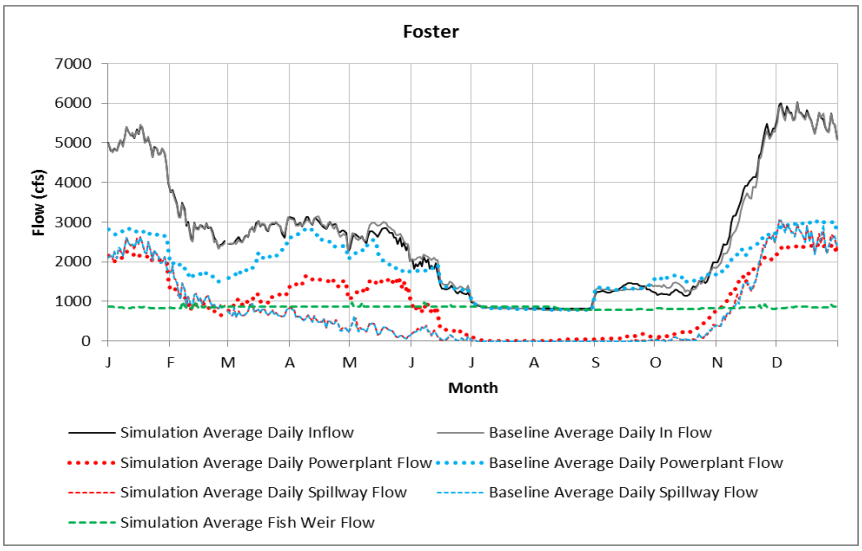
Has "Spillway B", "Spillway C", & "Spillway D" bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then fish weir spillway, then the spillways in order of B, C, then D.

FBW Runs:

Fish Weir 860cfs Year Round
Double Bypass





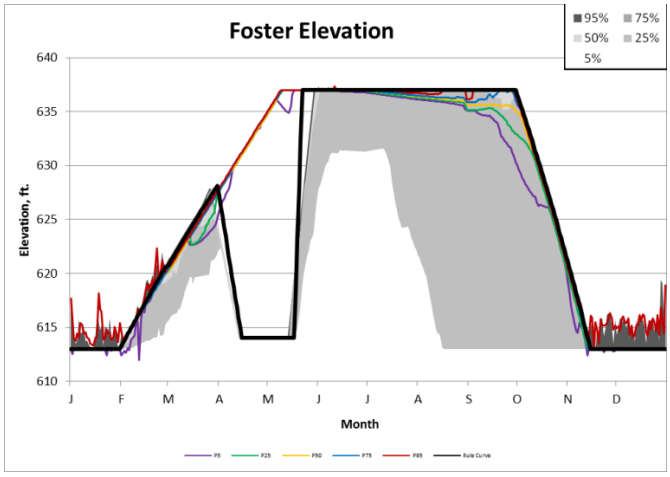
Fish Weir 500 Year round with use of powerhouse if can meet min flows: FOS modeled with 500 cfs over the fish weir all year, regardless of pool elev. Note rule curve is the same as the water control manual with no delay in fill and no partial fill then draft. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

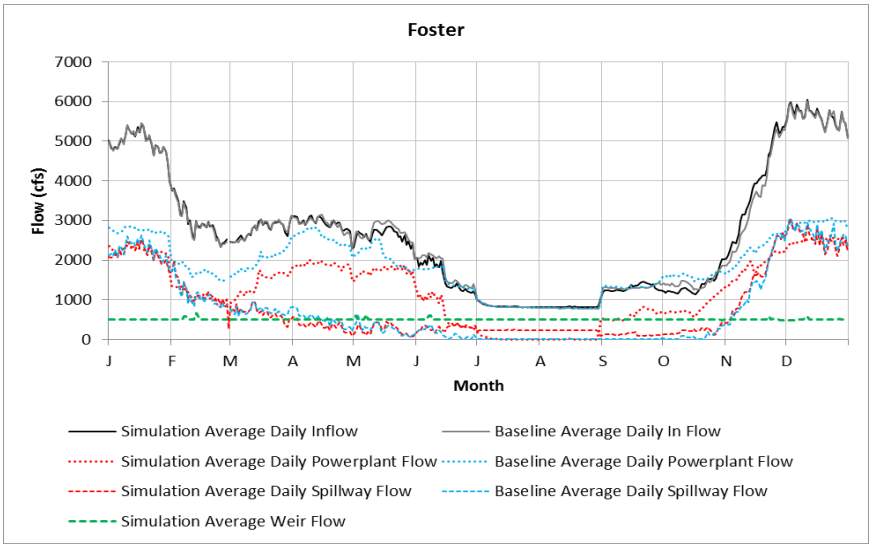
Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
Has "Fish Facility Pipe" which is one outlet with a 50 cfs constant capacity.
Has "Spillway B", "Spillway C", & "Spillway D" bays each with normal spillbay capacity.
Priority is: Fish Facility Pipe, then the power plant, then fish weir spillway, then the spillways in order of B, C, then D.

FBW Runs:

Fish Weir 500 cfs Year Round





Do not use a weir, use spillway at high pool to pass fish: Pass fish over spillway without a weir during high pool time, but have to use the minimum gate opening for that pool level, so there is lots of flow over that spillway and the pool level cannot be readily sustained.

Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
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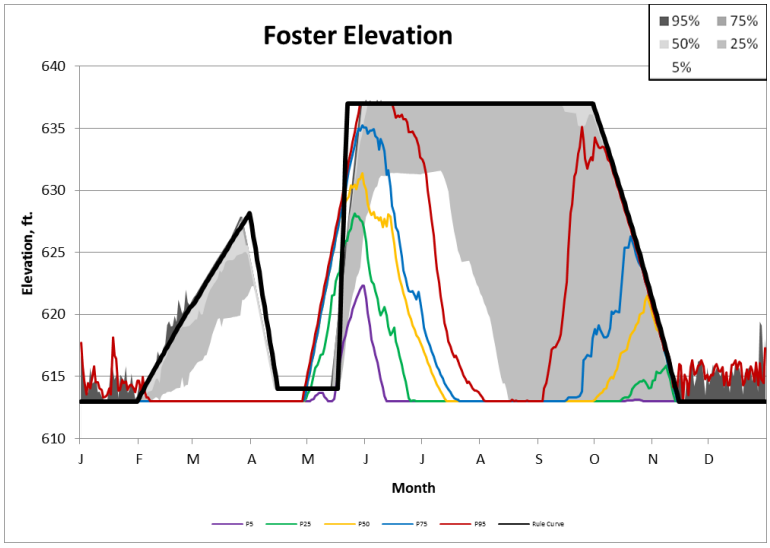
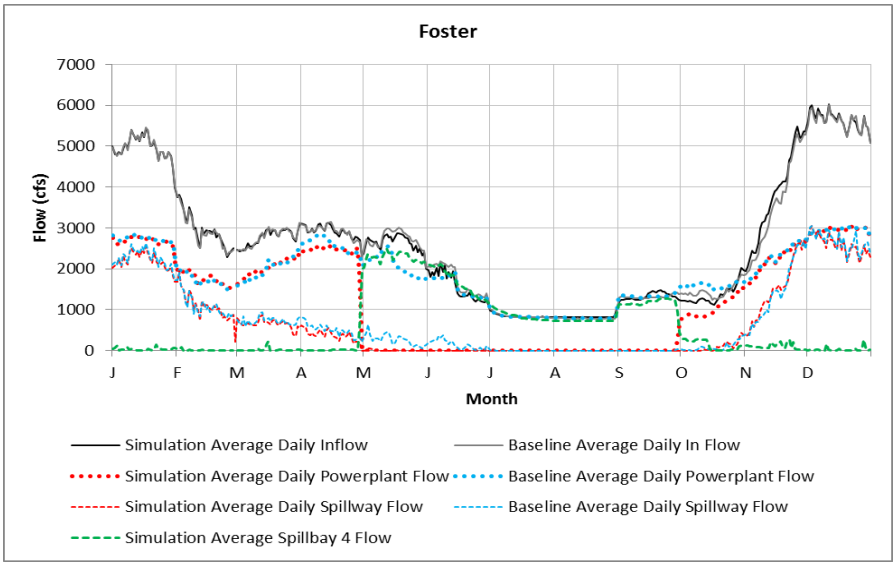
FBW Runs:

Spillbay 4 High Pool





Do not use a weir, use spillway for 860 cfs Nov-Apr: FOS modeled with minimum flow over the fish weir for Nov-Apr, based on pool elevations, which is about 860 cfs when pool is 613. Min flow over the weir outlet is zero outside of this time window. Powerhouse can have flow during weir flow if it can meet the min required, otherwise flow goes over the other spillways.

Comments:

Network Modifications for FOS only:
Has "Spillway with Fish Weir", which is a single spillway with the normal capacity of one bay. This outlet is always used for the fish weir.
Has "Power Plant", which is the usual two turbines as in early implementation.
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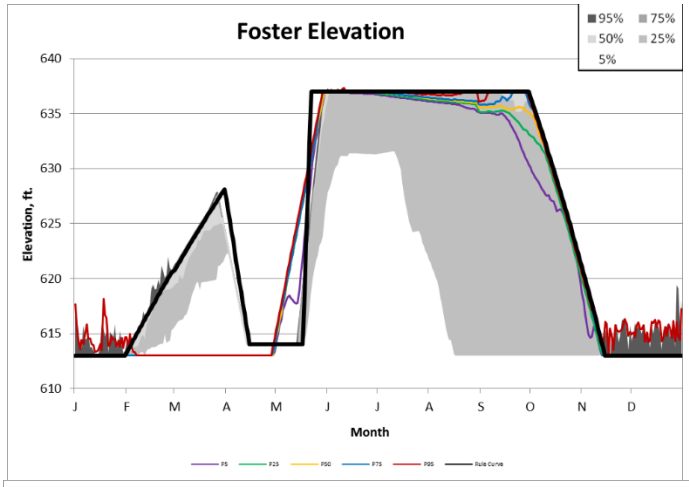
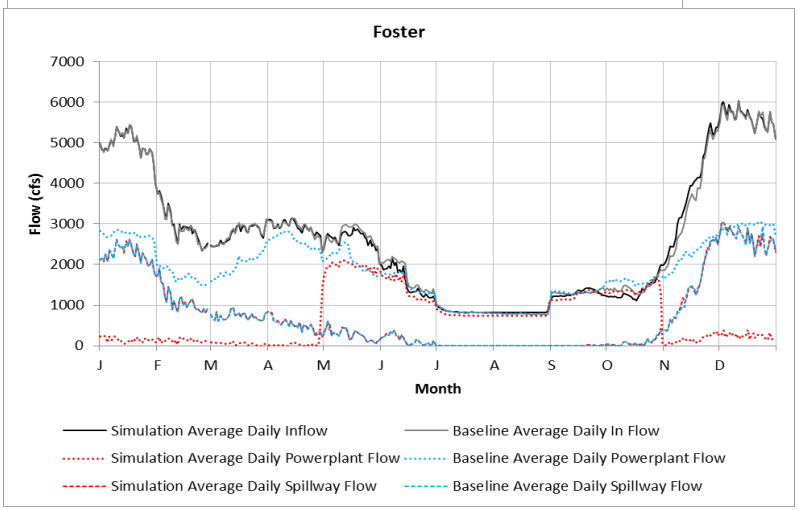
FBW Runs:

Spillbay 4 Low Pool





Foster Downstream Fish Passage Alternatives Analysis: FBW parameters

Dam Passage Efficiency (DPE)

All life stages

Pool elev.	Baseline	Fish Weir 300cfs	Fish Weir 500cfs	Fish Weir 860cfs	Spillbay 4 low pool	Spillbay 4 high pool	Single Bypass 300cfs	Double Bypass 860cfs	Turbine Screens
637.00	0.80	0.80	0.90	0.95	0.98	0.95	0.95	0.95	0.98
614.00	0.80	0.90	0.95	0.98	0.98	0.98	0.98	0.98	0.98
613.00	0.80	0.90	0.95	0.98	0.98	0.98	0.98	0.98	0.98
609.00	0.80	0.90	0.95	0.98	0.98	0.98	0.98	0.98	0.98
596.80	0.80	0.90	0.95	0.98	0.98	0.98	0.98	0.98	0.98
583.25	0.80	0.90	0.95	0.98	0.98	0.98	0.98	0.98	0.98

Information sources used to prepare *DPE* assumptions:

- PNNL, 2014
- PNNL, 2015
- Also see summary of PNNL hydroacoustics and radio telemetry study results prepared by Fenton Khan

Route Survival
Chinook and Steelhead

Fry

	Baseline (UPDATED*)	New Fish Weir 300cfs	New Fish Weir 500cfs	New Fish Weir 860cfs	Spillbay 4 low pool	Spillbay 4 high pool	Single Bypass 300cfs	Double Bypass 860cfs	Turbine Screens
Spillway Survival	0.90	0.95	0.95	0.95	0.98	0.95	0.98	0.98	0.95
Turbine Survival	0.80	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Fish Passage Survival	0.90	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Sub-yearlings

	Baseline (UPDATED)	New Fish Weir 300cfs	New Fish Weir 500cfs	New Fish Weir 860cfs	Spillbay 4 low pool	Spillbay 4 high pool	Single Bypass 300cfs	Double Bypass 860cfs	Turbine Screens
Spillway Survival	0.90	0.94	0.94	0.94	0.98	0.92	0.98	0.98	0.92
Turbine Survival	0.70	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Fish Passage Survival	0.75	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Yearlings

	Baseline (UPDATED)	New Fish Weir 300cfs	New Fish Weir 500cfs	New Fish Weir 860cfs	Spillbay 4 low pool	Spillbay 4 high pool	Single Bypass 300cfs	Double Bypass 860cfs	Turbine Screens
Spillway Survival	0.82	0.94	0.94	0.94	0.98	0.90	0.98	0.98	0.90
Turbine Survival	0.62	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Fish Passage Survival	0.65	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Information sources used to prepare *route survival* assumptions:

- Hughes et al. 2016
- PNNL, 2014
- Normandeau, 2013
- John Day spillway route survival.

* Assume survival decreases with size (i.e. better for fry than subs). Updated values based on PNNL RT study presentation at FEB8, 2016 WFSR, and previous Normandeau ballon tag estimates.

Percent Fish Approaching

(All alternatives)

Chinook salmon

fry		subyr		yearlings	
% Fish Approaching		**% Fish Approaching**		**% Fish Approaching**	
September	0.00	September	0.10	September	0.00
October	0.00	October	0.15	October	0.00
November	0.00	November	0.15	November	0.00
December	0.07	December	0.10	December	0.00
January	0.14	January	0.00	January	0.25
February	0.32	February	0.00	February	0.25
March	0.32	March	0.05	March	0.25
April	0.10	April	0.10	April	0.15
May	0.05	May	0.10	May	0.07
June	0.00	June	0.10	June	0.03
July	0.00	July	0.05	July	0.00
August	0.00	August	0.10	August	0.00

Steelhead

fry		Yearlings		Age-2	
% Fish Approaching		**% Fish Approaching**		**% Fish Approaching**	
September	0.09	September	0.19	September	0.07
October	0.12	October	0.42	October	0.38
November	0.03	November	0.15	November	0.11
December	0.01	December	0.01	December	0.00
January	0.00	January	0.00	January	0.09
February	0.00	February	0.00	February	0.02
March	0.00	March	0.00	March	0.01
April	0.00	April	0.00	April	0.11
May	0.00	May	0.00	May	0.14
June	0.04	June	0.00	June	0.02
July	0.32	July	0.03	July	0.01
August	0.39	August	0.20	August	0.02

Information sources used to prepare *% fish approaching* assumptions:

- Fred Monzyk, personal communication (email) to Fenton Khan, December, 2015.

Route Effectiveness (RE)
(UPDATED)

BASELINE

Chinook

Fry					Subs and Yearlings				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.50	4.18	0.00	1.10	**0.10**	0.37	4.18	0.00	0.05
0.20	0.50	2.59	0.00	1.10	**0.20**	0.73	2.59	0.00	0.10
0.30	0.50	2.86	0.00	1.10	**0.30**	1.10	2.86	0.00	0.14
0.40	0.50	2.86	0.00	1.10	**0.40**	1.13	2.86	0.00	0.19
0.50	0.50	2.86	0.00	1.10	**0.50**	1.15	2.86	0.00	0.24
0.60	0.50	2.86	0.00	1.10	**0.60**	1.19	2.86	0.00	0.34
0.70	0.50	2.86	0.00	1.10	**0.70**	1.22	2.86	0.00	0.44
0.80	0.50	2.86	0.00	1.10	**0.80**	1.13	2.86	0.00	0.62
0.90	0.50	2.86	0.00	1.10	**0.90**	1.09	2.86	0.00	0.56
1.00	0.50	2.86	0.00	1.10	**1.00**	1.00	2.86	0.00	0.77

Steelhead

Fry					Subs, Yearlings and Age-2				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	1.67	5.92	0.54	1.16	**0.10**	0.10	5.92	0.00	0.05
0.20	1.67	4.58	0.54	1.16	**0.20**	0.20	4.58	0.00	0.09
0.30	1.67	3.82	0.54	1.16	**0.30**	2.25	0.00	0.09	0.25
0.40	1.67	3.82	0.54	1.16	**0.40**	0.41	3.82	0.00	0.19
0.50	1.67	3.82	0.54	1.16	**0.50**	0.51	3.82	0.00	0.23
0.60	1.67	3.82	0.54	1.16	**0.60**	0.61	3.82	0.00	0.28
0.70	1.67	3.82	0.54	1.16	**0.70**	0.72	3.82	0.00	0.33
0.80	1.67	3.82	0.54	1.16	**0.80**	0.57	3.82	0.00	0.36
0.90	1.67	3.82	0.54	1.16	**0.90**	0.55	3.82	0.00	0.55
1.00	1.00	3.82	1.00	1.00	**1.00**	0.56	3.82	0.00	0.58

Fish Weir 500 cfs – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	6.00	0.00	0.05	**0.10**	0.10	6.00	0.00	0.05
0.20	0.73	6.00	0.00	0.10	**0.20**	0.20	6.00	0.00	0.09
0.30	1.10	6.00	0.00	0.14	**0.30**	2.25	0.00	0.09	0.25
0.40	1.13	6.00	0.00	0.19	**0.40**	0.41	6.00	0.00	0.19
0.50	1.15	6.00	0.00	0.24	**0.50**	0.51	6.00	0.00	0.23
0.60	1.19	6.00	0.00	0.34	**0.60**	0.61	6.00	0.00	0.28
0.70	1.22	6.00	0.00	0.44	**0.70**	0.72	6.00	0.00	0.33
0.80	1.13	6.00	0.00	0.62	**0.80**	0.57	6.00	0.00	0.36
0.90	1.09	6.00	0.00	0.56	**0.90**	0.55	6.00	0.00	0.55
1.00	1.00	6.00	0.00	0.77	**1.00**	0.56	6.00	0.00	0.58

Fish Weir 860cfs – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	7.00	0.00	0.05	**0.10**	0.10	7.00	0.00	0.05
0.20	0.73	7.00	0.00	0.10	**0.20**	0.20	7.00	0.00	0.09
0.30	1.10	7.00	0.00	0.14	**0.30**	0.31	7.00	0.00	0.14
0.40	1.13	7.00	0.00	0.19	**0.40**	0.41	7.00	0.00	0.19
0.50	1.15	7.00	0.00	0.24	**0.50**	0.51	7.00	0.00	0.23
0.60	1.19	7.00	0.00	0.34	**0.60**	0.61	7.00	0.00	0.28
0.70	1.22	7.00	0.00	0.44	**0.70**	0.72	7.00	0.00	0.33
0.80	1.13	7.00	0.00	0.62	**0.80**	0.57	7.00	0.00	0.36
0.90	1.09	7.00	0.00	0.56	**0.90**	0.55	7.00	0.00	0.55
1.00	1.00	7.00	0.00	0.77	**1.00**	0.56	7.00	0.00	0.58

Spill bay 4 (low & high pool) – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	0.00	0.00	0.05	**0.10**	0.10	0.00	0.00	0.05
0.20	0.73	0.00	0.00	0.10	**0.20**	0.20	0.00	0.00	0.09
0.30	1.10	0.00	0.00	0.14	**0.30**	0.31	0.00	0.00	0.14
0.40	1.13	0.00	0.00	0.19	**0.40**	0.41	0.00	0.00	0.19
0.50	1.15	0.00	0.00	0.24	**0.50**	0.51	0.00	0.00	0.23
0.60	1.19	0.00	0.00	0.34	**0.60**	0.61	0.00	0.00	0.28
0.70	1.22	0.00	0.00	0.44	**0.70**	0.72	0.00	0.00	0.33
0.80	1.13	0.00	0.00	0.62	**0.80**	0.57	0.00	0.00	0.36
0.90	1.09	0.00	0.00	0.56	**0.90**	0.55	0.00	0.00	0.55
1.00	1.00	0.00	0.00	0.77	**1.00**	0.56	0.00	0.00	0.58

Single Bypass (300cfs) – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	7.00	0.00	0.05	**0.10**	0.10	7.00	0.00	0.05
0.20	0.73	7.00	0.00	0.10	**0.20**	0.20	7.00	0.00	0.09
0.30	1.10	7.00	0.00	0.14	**0.30**	2.25	0.00	0.09	0.25
0.40	1.13	7.00	0.00	0.19	**0.40**	0.41	7.00	0.00	0.19
0.50	1.15	7.00	0.00	0.24	**0.50**	0.51	7.00	0.00	0.23
0.60	1.19	7.00	0.00	0.34	**0.60**	0.61	7.00	0.00	0.28
0.70	1.22	7.00	0.00	0.44	**0.70**	0.72	7.00	0.00	0.33
0.80	1.13	7.00	0.00	0.62	**0.80**	0.57	7.00	0.00	0.36
0.90	1.09	7.00	0.00	0.56	**0.90**	0.55	7.00	0.00	0.55
1.00	1.00	7.00	0.00	0.77	**1.00**	0.56	7.00	0.00	0.58

Rational for RE of fish passage route: single bypass will only be located along one shoreline and operated at 300cfs. Only fish approaching from shoreline where bypass canal is located will use the canal, and therefore used 7.0, as compared to 8.0 for the double bypass.

Double Bypass (860 cfs) – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	8.00	0.00	0.05	**0.10**	0.10	8.00	0.00	0.05
0.20	0.73	8.00	0.00	0.10	**0.20**	0.20	8.00	0.00	0.09
0.30	1.10	8.00	0.00	0.14	**0.30**	2.25	0.00	0.09	0.25
0.40	1.13	8.00	0.00	0.19	**0.40**	0.41	8.00	0.00	0.19
0.50	1.15	8.00	0.00	0.24	**0.50**	0.51	8.00	0.00	0.23
0.60	1.19	8.00	0.00	0.34	**0.60**	0.61	8.00	0.00	0.28
0.70	1.22	8.00	0.00	0.44	**0.70**	0.72	8.00	0.00	0.33
0.80	1.13	8.00	0.00	0.62	**0.80**	0.57	8.00	0.00	0.36
0.90	1.09	8.00	0.00	0.56	**0.90**	0.55	8.00	0.00	0.55
1.00	1.00	8.00	0.00	0.77	**1.00**	0.56	8.00	0.00	0.58

Rational for RE of fish passage route: double bypass will have canals along both shorelines and each operated at 430cfs (860cfs total). Fish approaching from either shoreline could encounter the bypass canals, and therefore used 8.0, as compared to 7.0 for the single

Turbine Screen – all life stages

Chinook					Steelhead				
Q Ratio	Spill	Fish Pass	RO	Turb	**Q Ratio**	Spill	Fish Pass	RO	Turb
0.10	0.37	0.00	0.00	0.05	**0.10**	0.10	0.00	0.00	0.05
0.20	0.73	0.00	0.00	0.10	**0.20**	0.20	0.00	0.00	0.09
0.30	1.10	0.00	0.00	0.14	**0.30**	2.25	0.00	0.09	0.25
0.40	1.13	0.00	0.00	0.19	**0.40**	0.41	0.00	0.00	0.19
0.50	1.15	0.00	0.00	0.24	**0.50**	0.51	0.00	0.00	0.23
0.60	1.19	0.00	0.00	0.34	**0.60**	0.61	0.00	0.00	0.28
0.70	1.22	0.00	0.00	0.44	**0.70**	0.72	0.00	0.00	0.33
0.80	1.13	0.00	0.00	0.62	**0.80**	0.57	0.00	0.00	0.36
0.90	1.09	0.00	0.00	0.56	**0.90**	0.55	0.00	0.00	0.55
1.00	1.00	0.00	0.00	0.77	**1.00**	0.56	0.00	0.00	0.58

Information sources used to prepare *RE* assumptions:

ALTERNATIVE	SOURCE
ALL, except those listed separate in this table	Data from radio-telemetry study of juvenile Chinook and steelhead; James Hughes, Pers. Comm., January 2016 emailed to Khan and Piaskowski
Weir 500	Professional judgment, Corps. Adjusted from PNNL rt study data, assuming improved route effectiveness of: Weir 500 - RE values of 6, all flows. Weir 860 - RE values of 7, all flows. Single bypass - RE values of 7, all flows. Double bypass - RE values of 8, all flows
Weir 860	
Single Bypass	
Double Bypass	

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