
Eklutna Fish & Wildlife Program Alternatives Analysis - Meeting 1

April 6, 2023

Agenda

10:00 – 10:15	Introduction
10:15 – 10:45	Instream Flow Regimes
10:45 – 11:30	Cost Effectiveness/ICA
11:30 – 12:00	Lunch
12:00 – 12:45	Alternatives Discussion
12:45 – 1:00	Next Steps
1:00	Adjourn



Alternatives Analysis

- Process outlined in the 1991 Agreement jumps from study reporting to the issuance of a Draft Fish and Wildlife Program
- We feel an alternatives analysis is needed to provide a bridge from the study program to the issuance of the Draft Fish and Wildlife Program
- Goal is to ensure consistent analysis of various alternatives with information/tools developed during the study program

Remaining Schedule

- **April – August 2023** – Alternatives Analysis
- **October 2023** – Distribute Draft Fish and Wildlife Program
 - 30 days for review and comment
 - Attempt to resolve differences
- **January 2024** – Public Meetings (Anchorage and Mat-Su Valley)
- **April 2024** – Submit Proposed Final Fish and Wildlife Program
 - 60 days for parties to review and comment
 - 30 days for project owners to respond
 - Allows 2 months for Governor to consider
- **October 2024** – Governor issues Final Fish and Wildlife Program



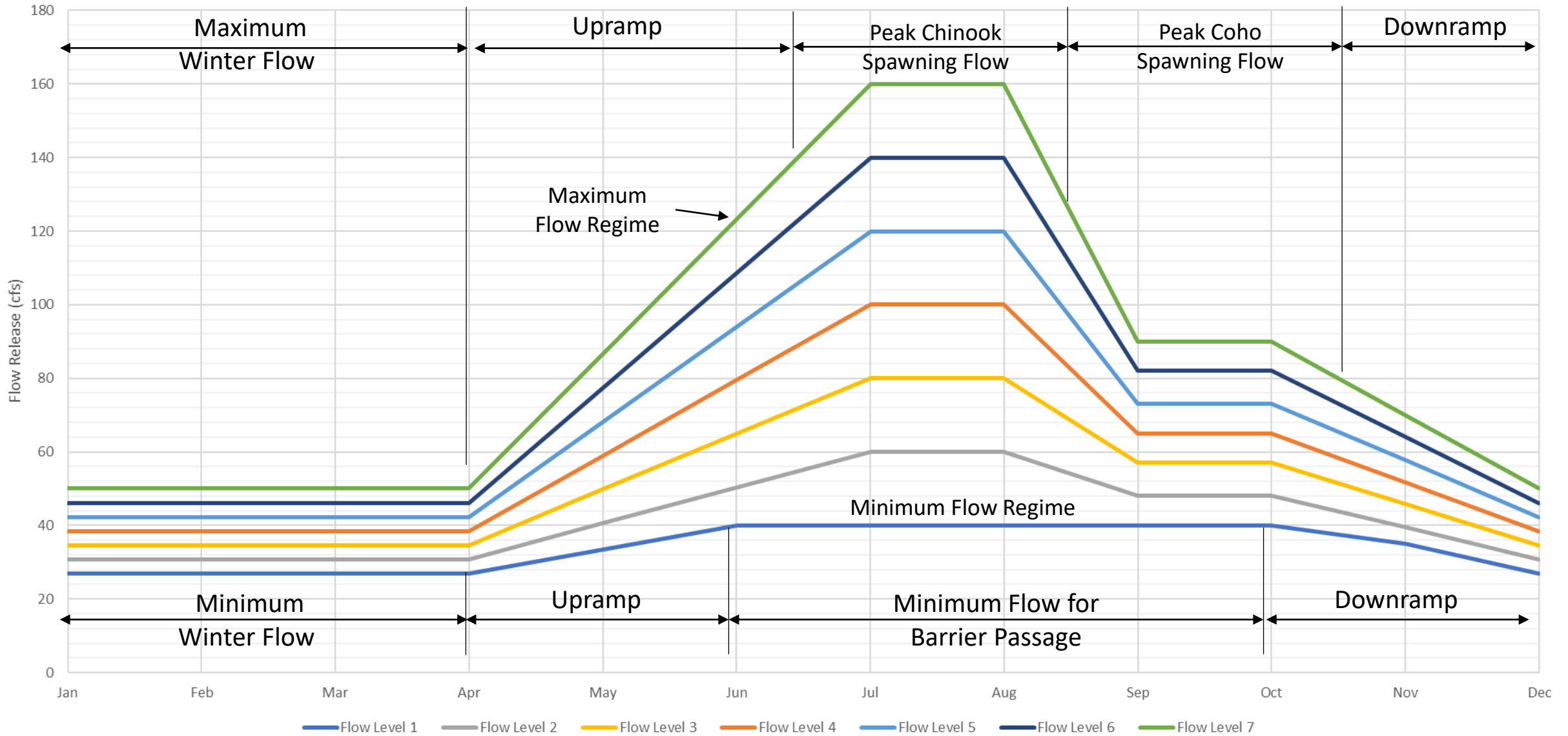
Alternatives Analysis

- Meeting 1 (April)
 - Review Potential Flow Regimes
 - Introduce CE/ICA (compares habitat benefits and cost)
 - Solicit Comprehensive Alternatives
- Meeting 2 (May)
 - Share and discuss first round of CE/ICA results (narrow down potential alternatives)
 - Allow opportunity for everyone to revise their alternatives
- Meeting 3 (June)
 - Share and discuss second round of CE/ICA results (narrow down potential alternatives)
 - Reintroduce information matrix (incorporates potential impacts to public water supply, recreation, dam safety, etc.)
- Meeting 4 (July)
 - Share and discuss completed information matrix (narrow down potential alternatives)
 - Discuss appropriate monitoring program and potential adaptive management
- Meeting 5 (August)
 - Continue discussing appropriate monitoring program and potential adaptive management
 - Outline Draft Fish and Wildlife Program



Instream Flow Regimes

Flow Regime – Methodology



Winter Flow Regime

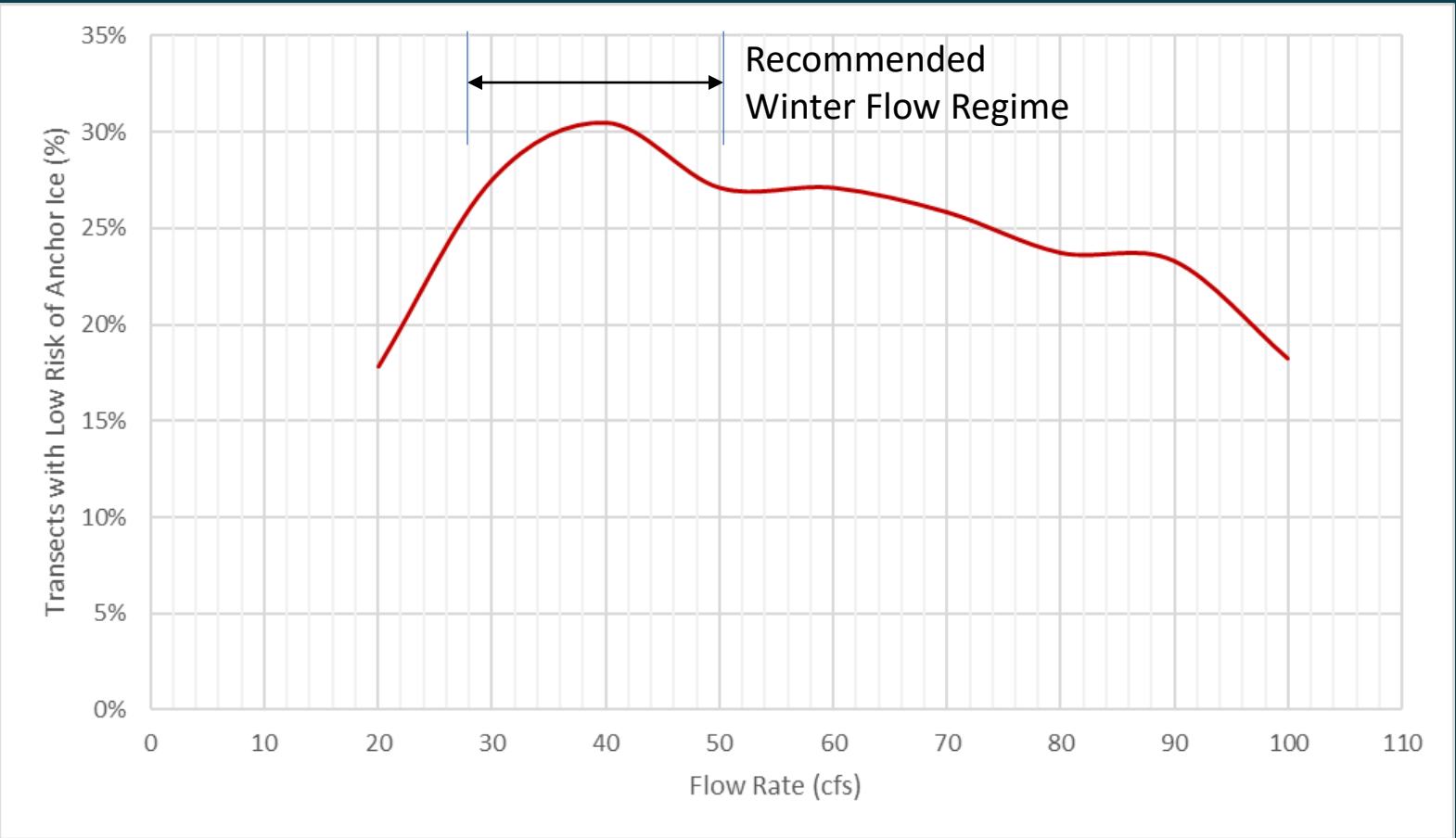
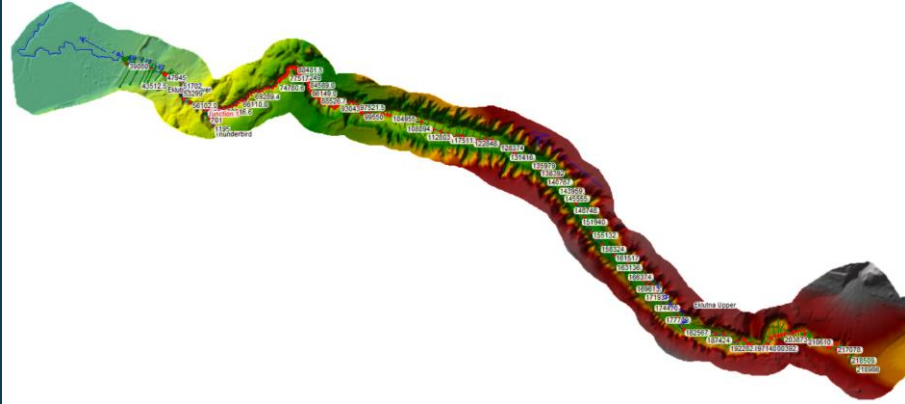
Criteria

Using 1D River Model (236 Transects):

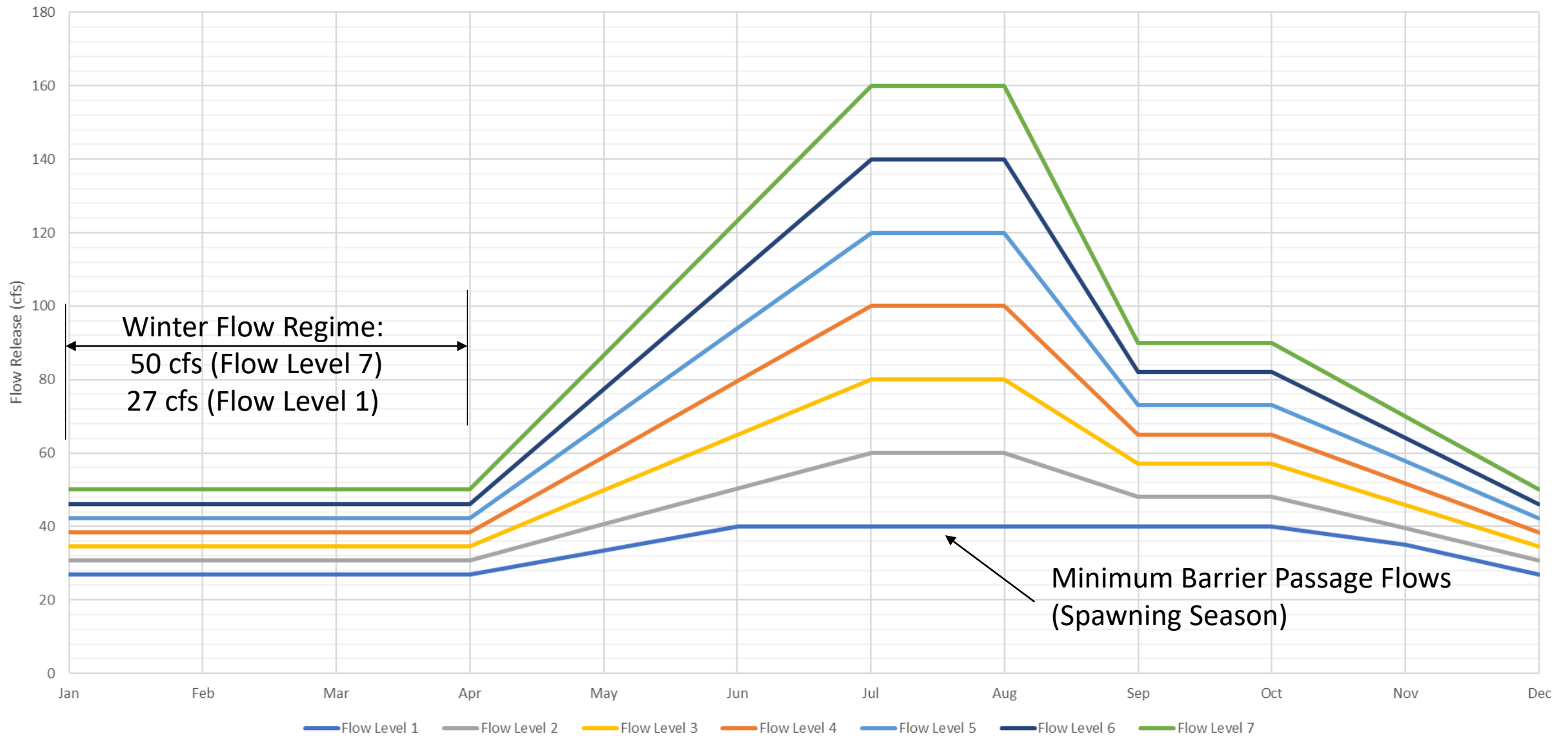
Determine Number of Transects with:

$$v < 2.0 \text{ ft/s}$$

$$d \geq 15''$$



Flow Regime

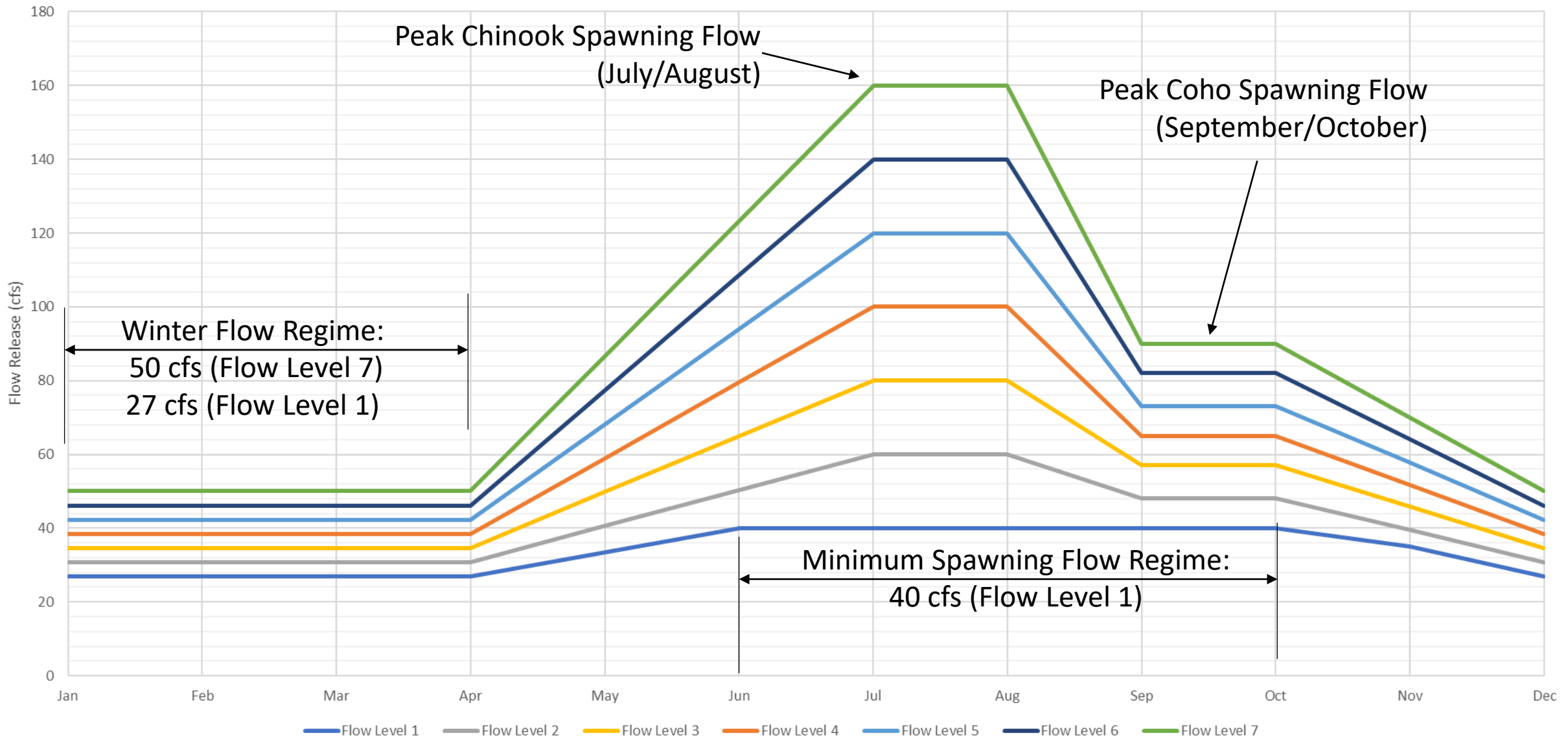


Minimum Barrier Flow Regime

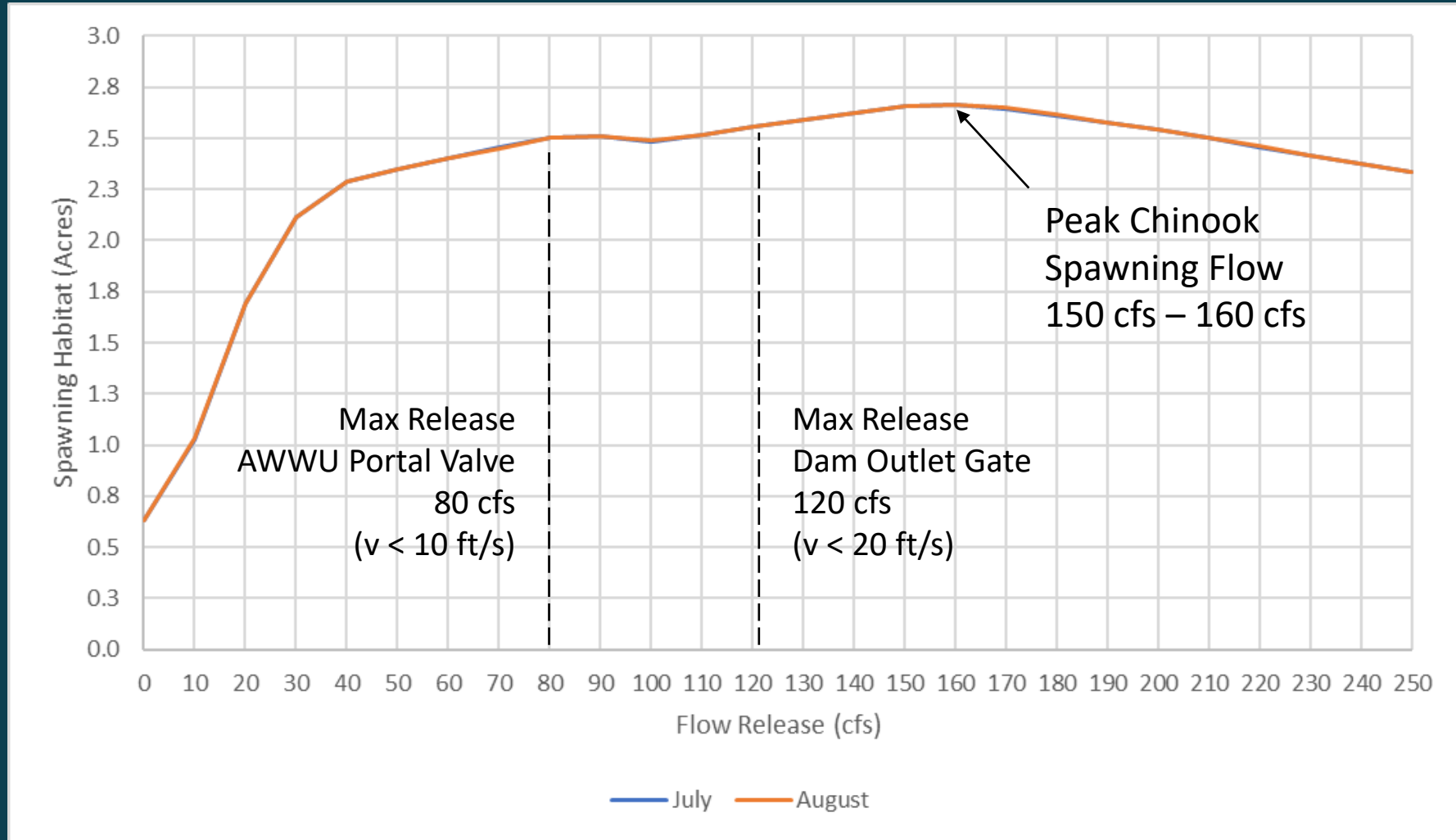
	Site A	Site B	Site C	Site D	Site E
Minimum passage Q (cfs)	40.0	50.0	8.8	40.0	40.0
Velocity at critical transect (ft/s)	8.35	6.25	4.71	4.340	3.76
Depth at critical transect (ft)	0.62	0.57	0.69	0.600	0.43
Froude at critical transect	1.90	1.50	1.00	0.990	1.01
Potential barrier average slope (ft/ft)	0.16	0.14	0.087	0.068	0.12
Passage barrier type	Depth	Depth	Depth	Depth	Depth



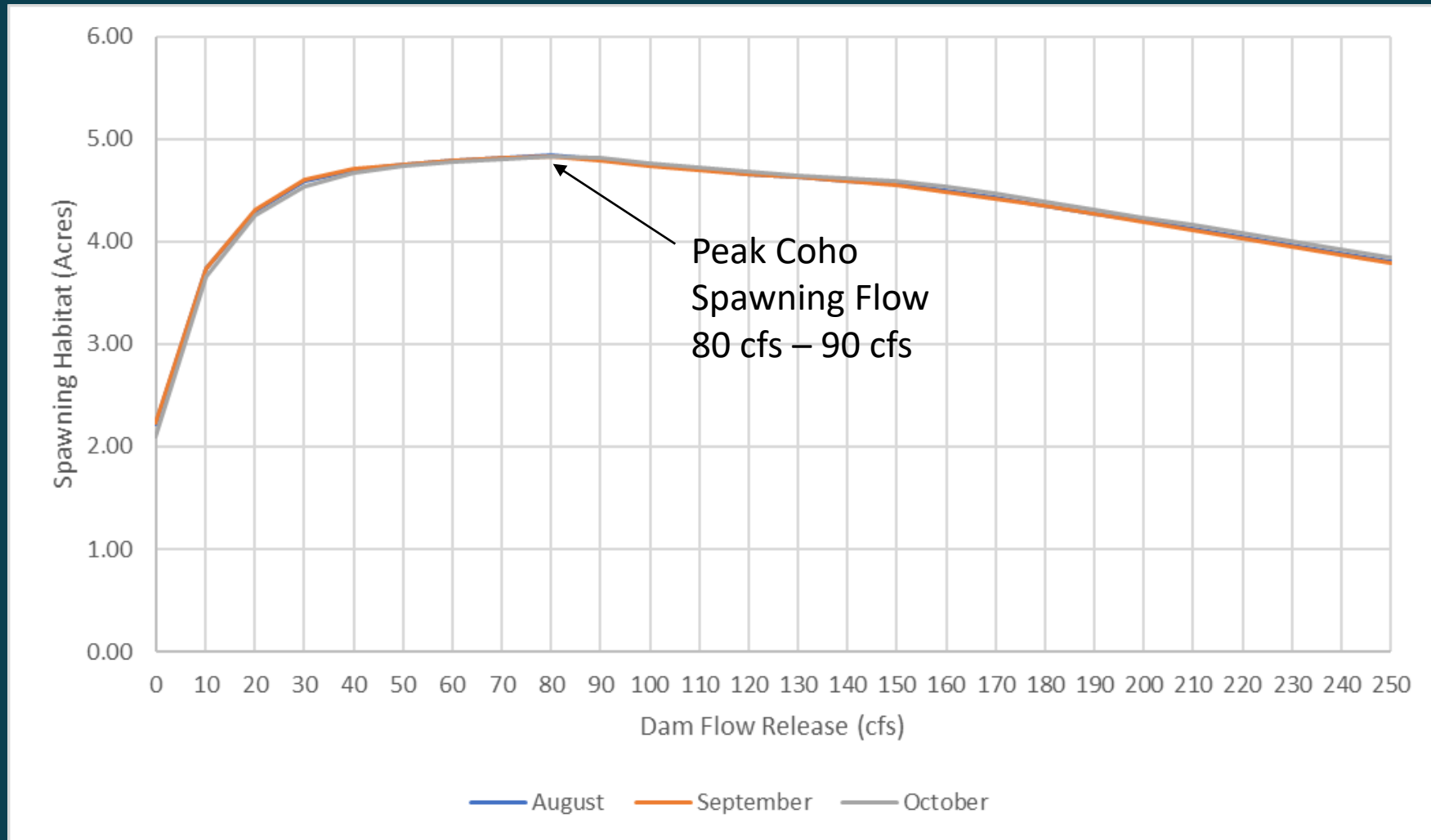
Flow Regime



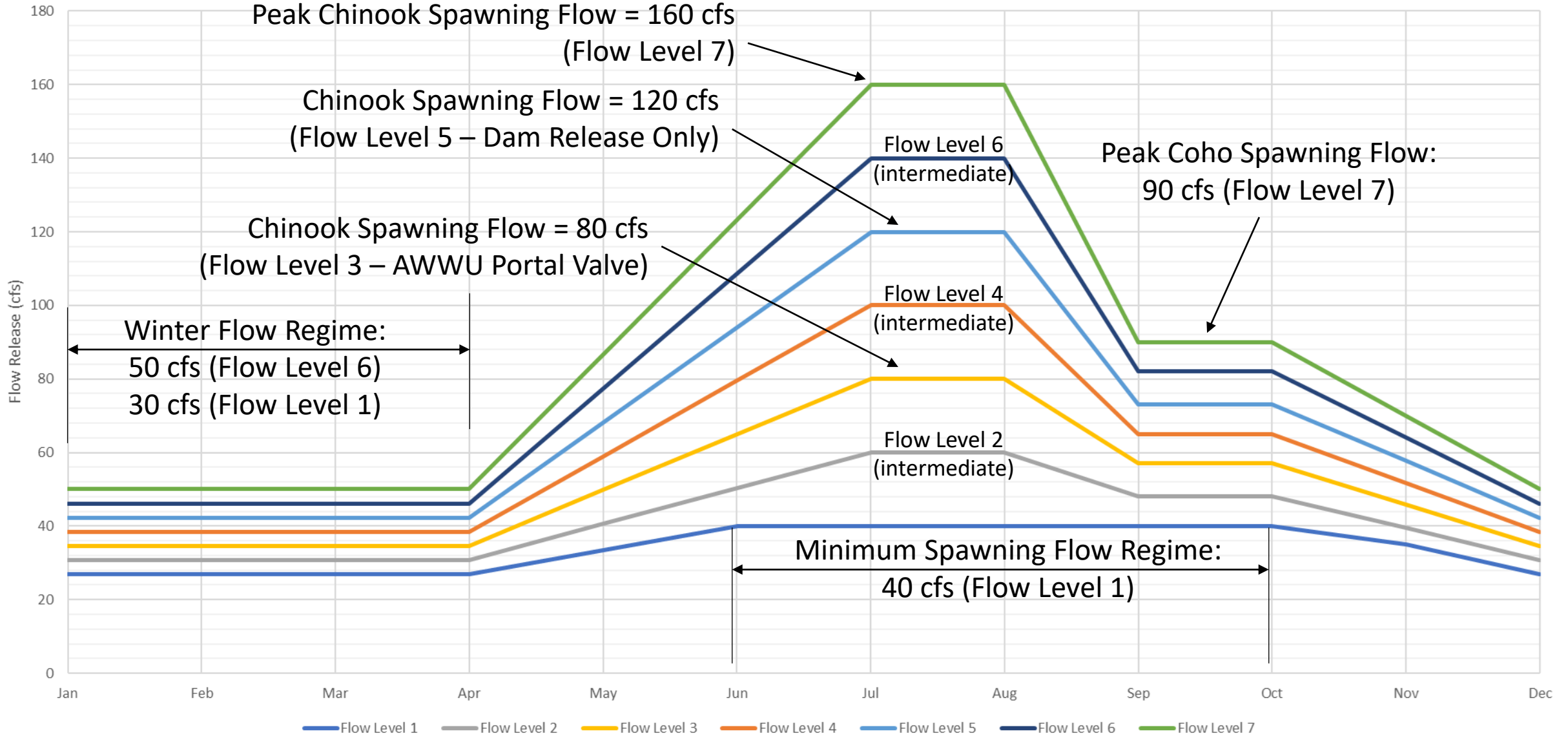
Peak Chinook Spawning Flow



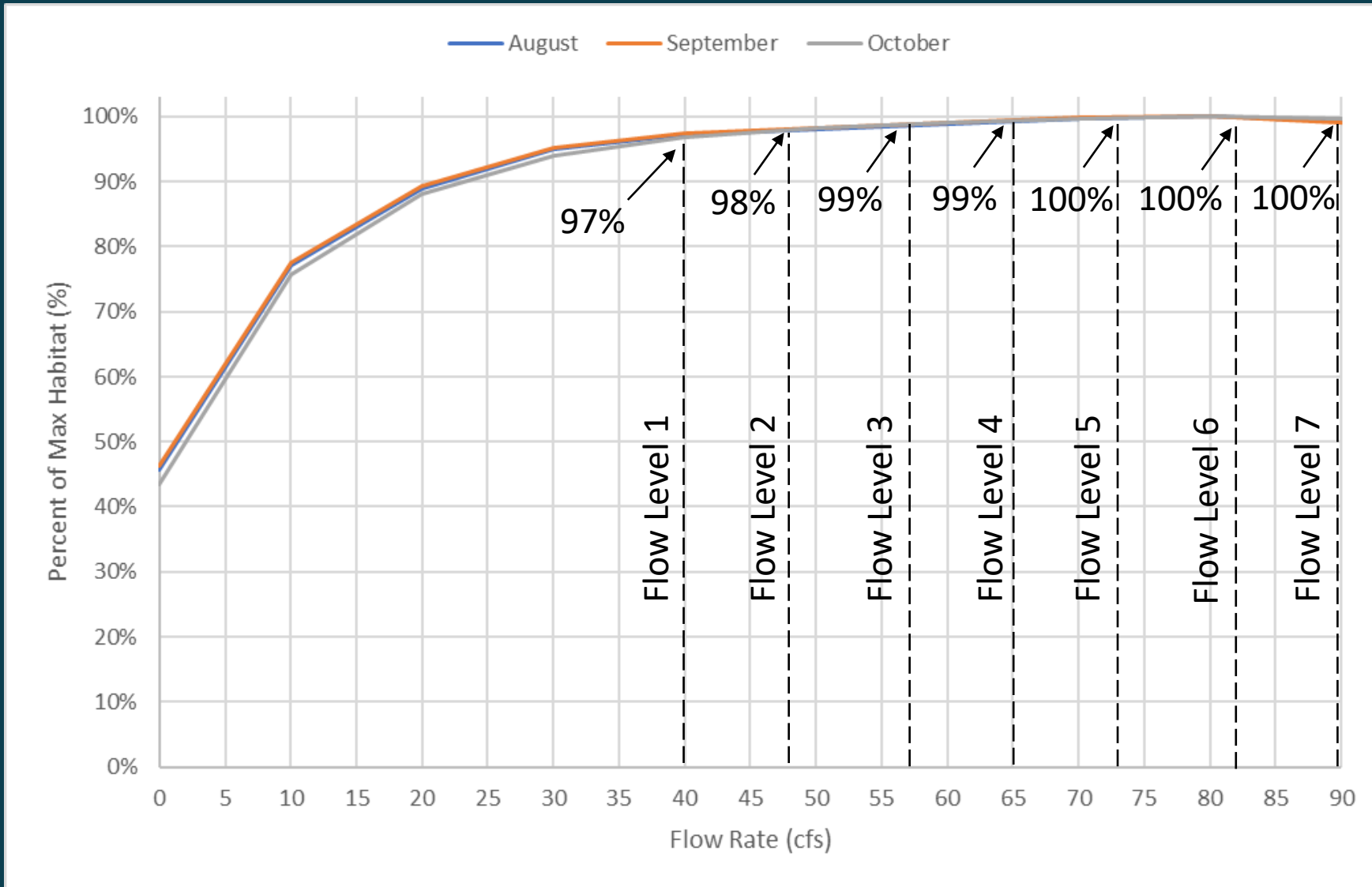
Peak Coho Spawning Flow



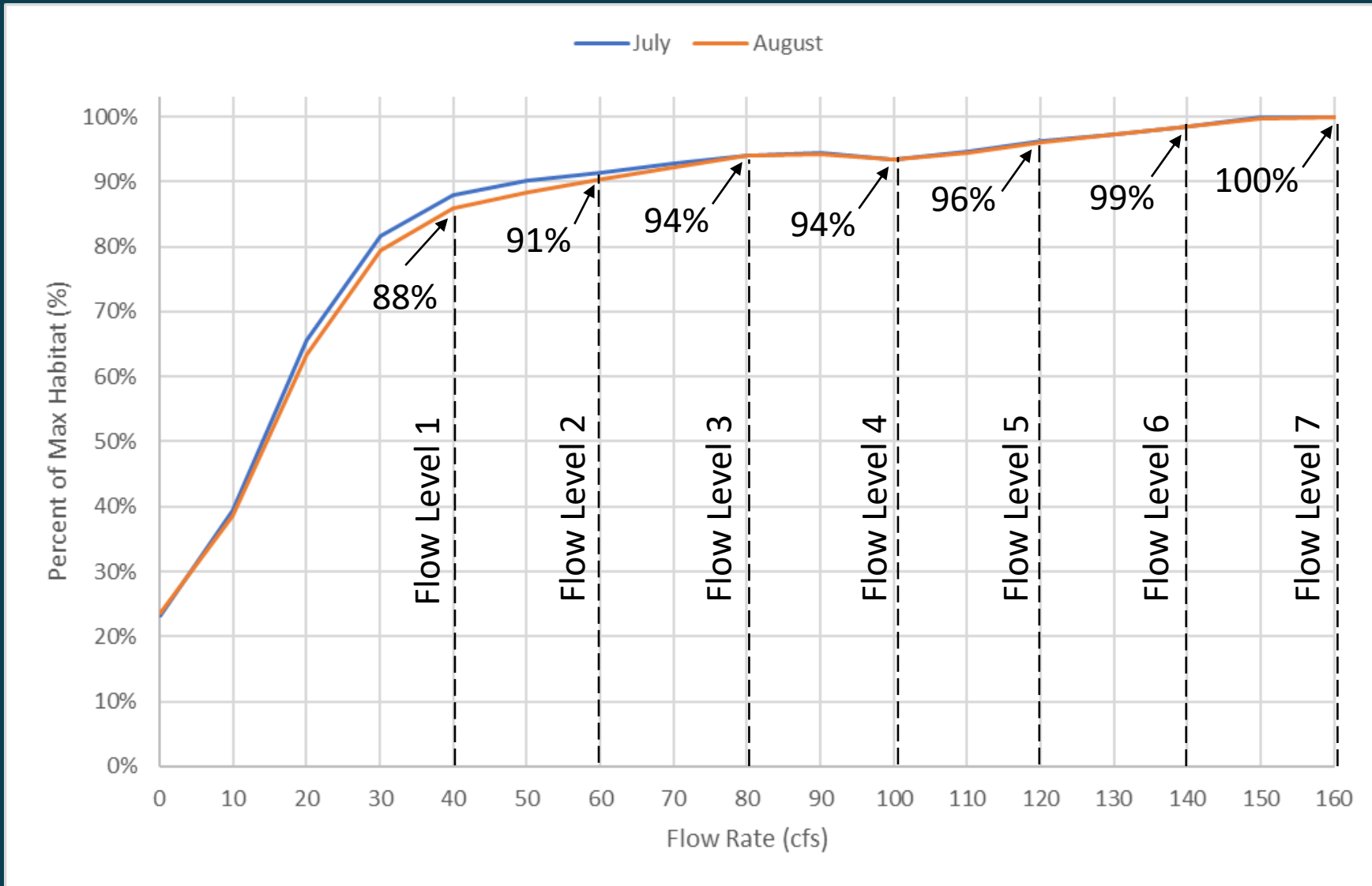
Flow Regime



Coho Spawning Flow



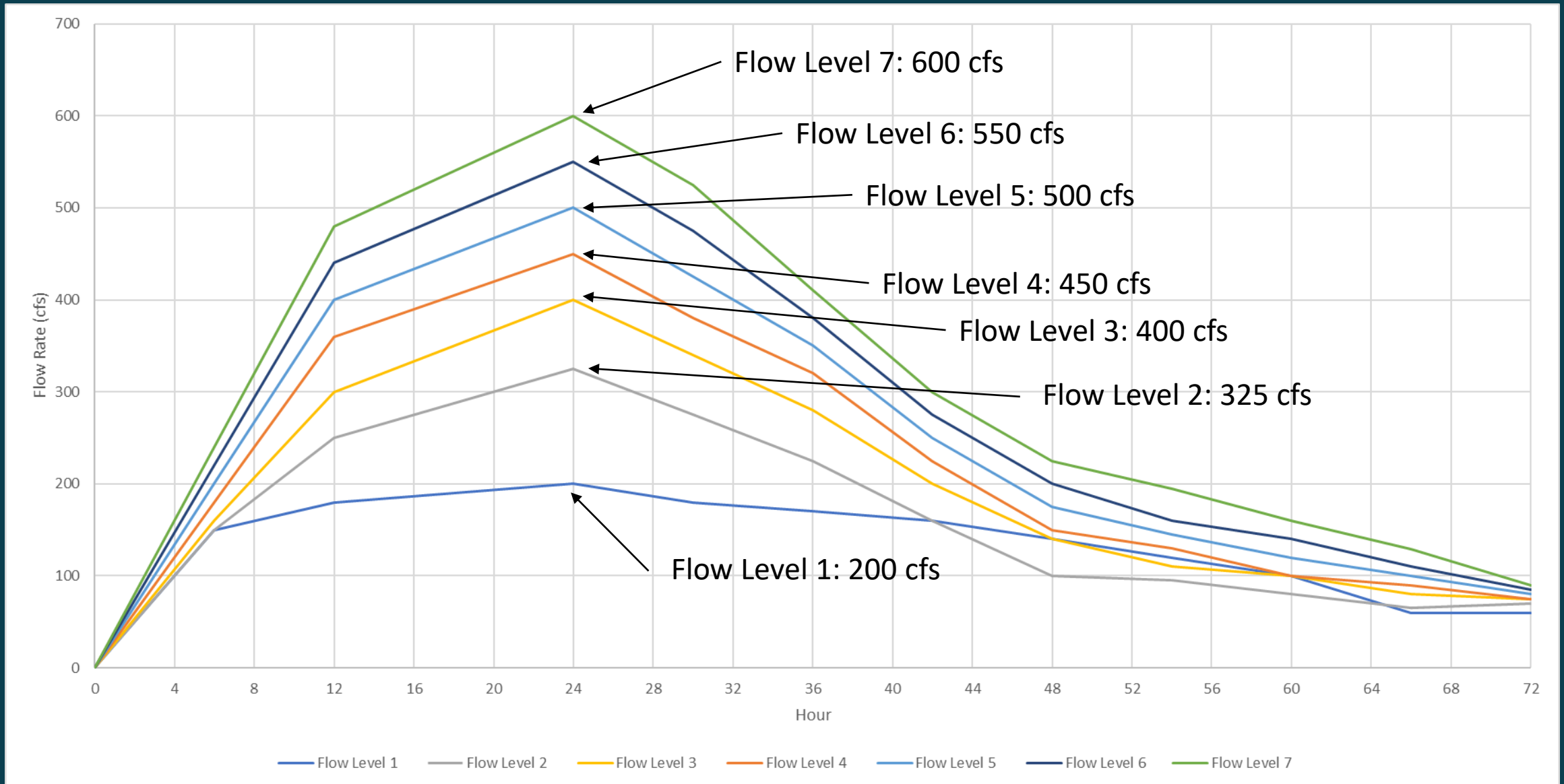
Chinook Spawning Flow





Channel Maintenance Flow Regimes

Channel Maintenance Flow Regime



Eklutna Water Balance



Eklutna Water Balance

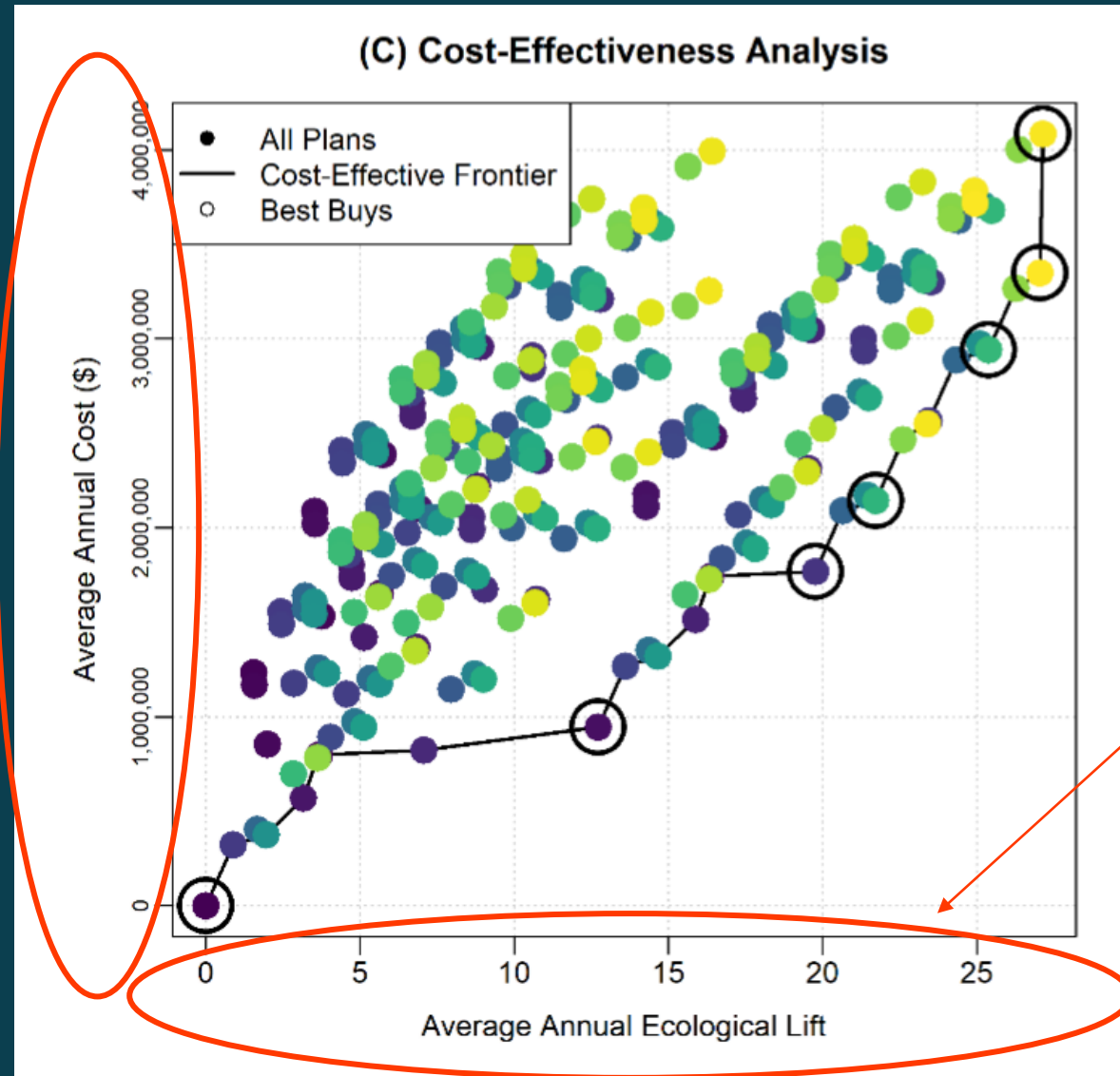
Eklutna Water Volume (Acre-Ft) - GATED SPILLWAY								
	Inflows	Powerhouse Water Usage	AWWU Water Usage	Instream Flow Habitat Usage	Peak Water Releases (Gated)	Powerhouse	AWWU	Instream Flow
Baseline	262,456	238,444	24,670	0	0	91%	9%	0%
Flow Level 1	262,456	212,804	24,670	25,241	873	81%	9%	10%
Flow Level 2	262,456	206,734	24,670	31,303	1,051	79%	9%	12%
Flow Level 3	262,456	199,981	24,670	38,048	1,282	76%	9%	14%
Flow Level 4	262,456	193,448	24,670	44,574	1,443	74%	9%	17%
Flow Level 5	262,456	186,910	24,670	51,104	1,609	71%	9%	19%
Flow Level 6	262,456	180,219	24,670	57,787	1,778	69%	9%	22%
Flow Level 7	262,456	173,665	24,670	64,334	1,961	66%	9%	24%

Eklutna Water Volume (Acre-Ft) - UNGATED SPILLWAY								
	Inflows	Powerhouse Water Usage	AWWU Water Usage	Instream Flow Habitat Usage	Peak Water Releases (Ungated)	Powerhouse	AWWU	Instream Flow
Baseline	262,456	238,444	24,670	0	0	91%	9%	0%
Flow Level 1	262,456	212,804	24,670	25,241	873	81%	9%	10%
Flow Level 2	262,456	201,590	24,670	36,447	6,195	77%	9%	14%
Flow Level 3	262,456	191,235	24,670	46,795	10,028	73%	9%	18%
Flow Level 4	262,456	181,397	24,670	56,625	13,494	69%	9%	22%
Flow Level 5	262,456	171,548	24,670	66,466	16,971	65%	9%	25%
Flow Level 6	262,456	159,236	24,670	78,770	22,761	61%	9%	30%
Flow Level 7	262,456	143,524	24,670	94,475	32,101	55%	9%	36%

Cost Effectiveness and Incremental Cost Analysis (ICA)

Cost Effectiveness / ICA

Total CAPEX
Annual O&M
Energy Losses
Carbon Costs
= Average Annual
Costs over 35 Years



Habitat Improvement
New Rearing Habitat (Acres)
New Spawning Habitat (Acres)

Cost Effectiveness / ICA



US Army Corps
of Engineers®
Los Angeles District

Plan Formulation - Cost Effectiveness

Salt River Watershed, Rio Salado Oeste, Phoenix, Arizona

Average Annual Functional Capacity Units (AAFCU)
(for Remaining Alternatives and "Refines")

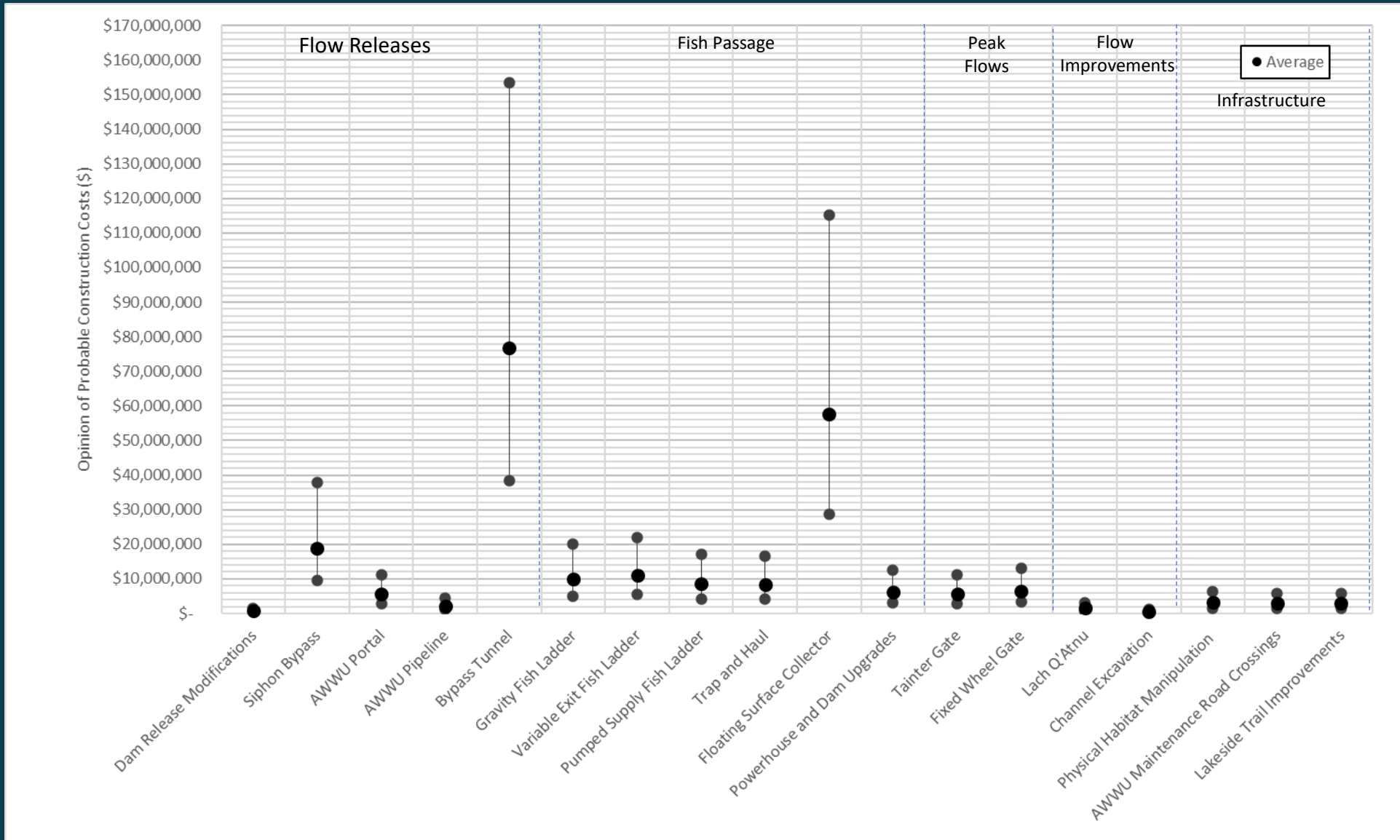




CAPEX

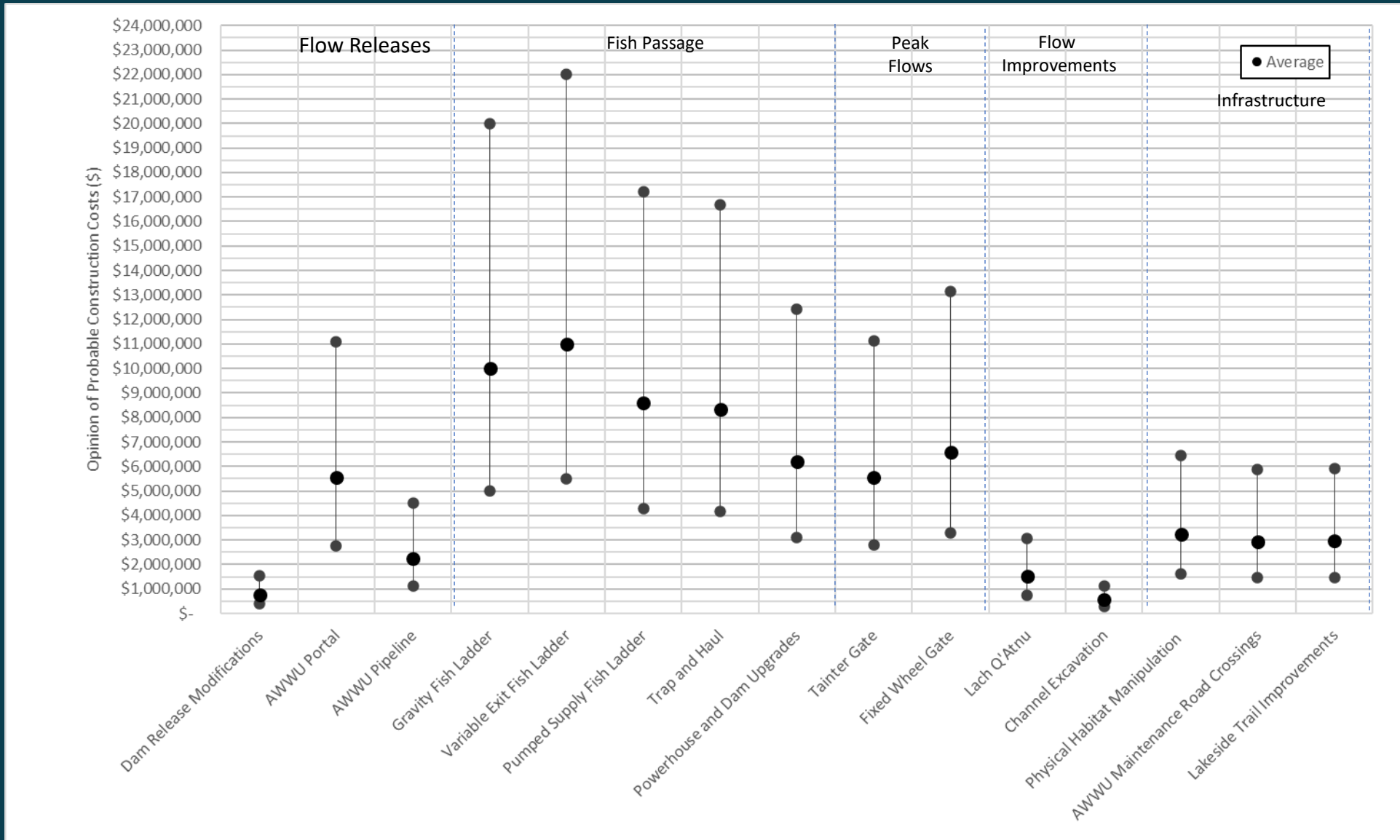


Opinion of Probable Construction Costs (Class 5)





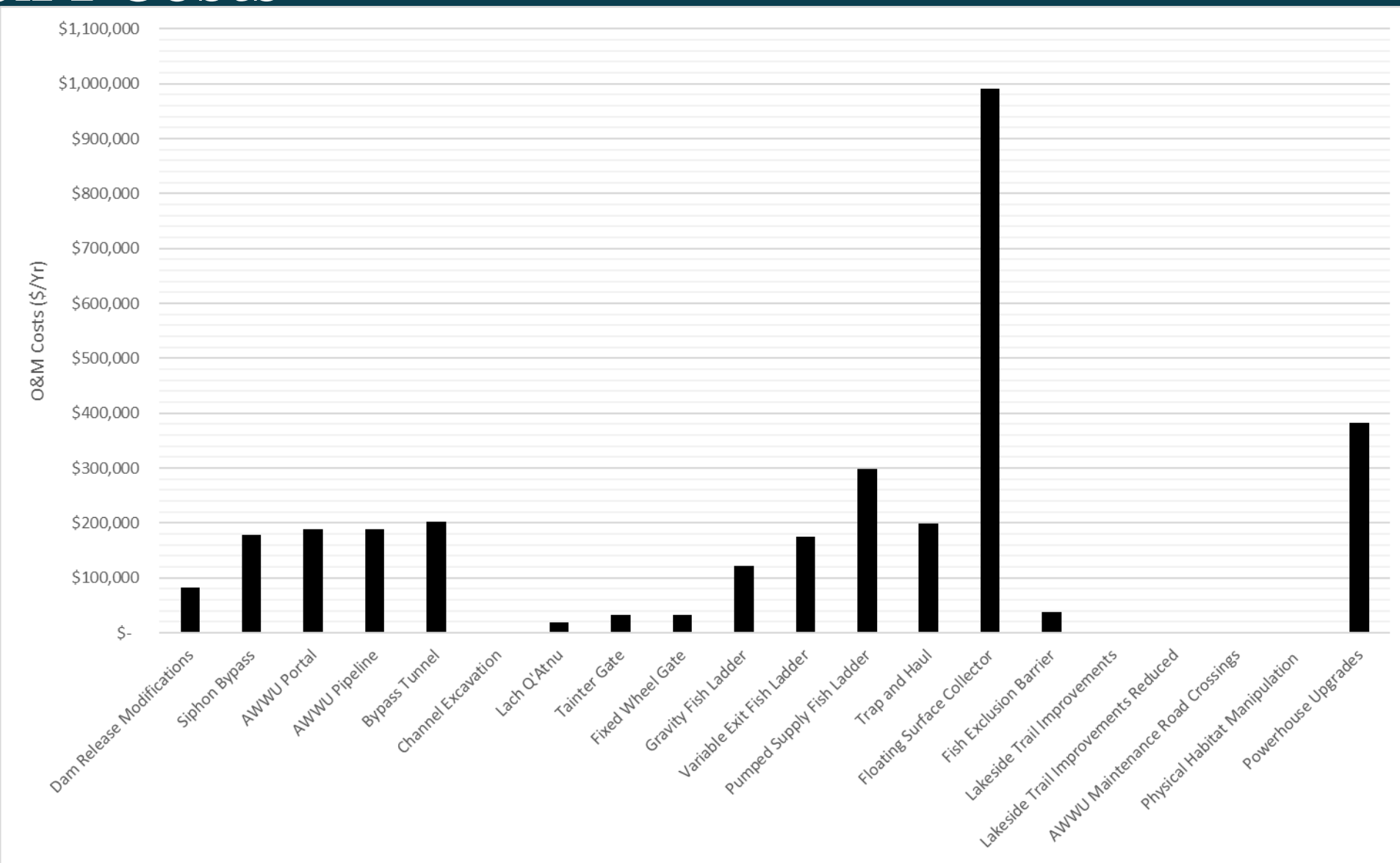
Opinion of Probable Construction Costs (Class 5)





O&M Costs

O&M Costs

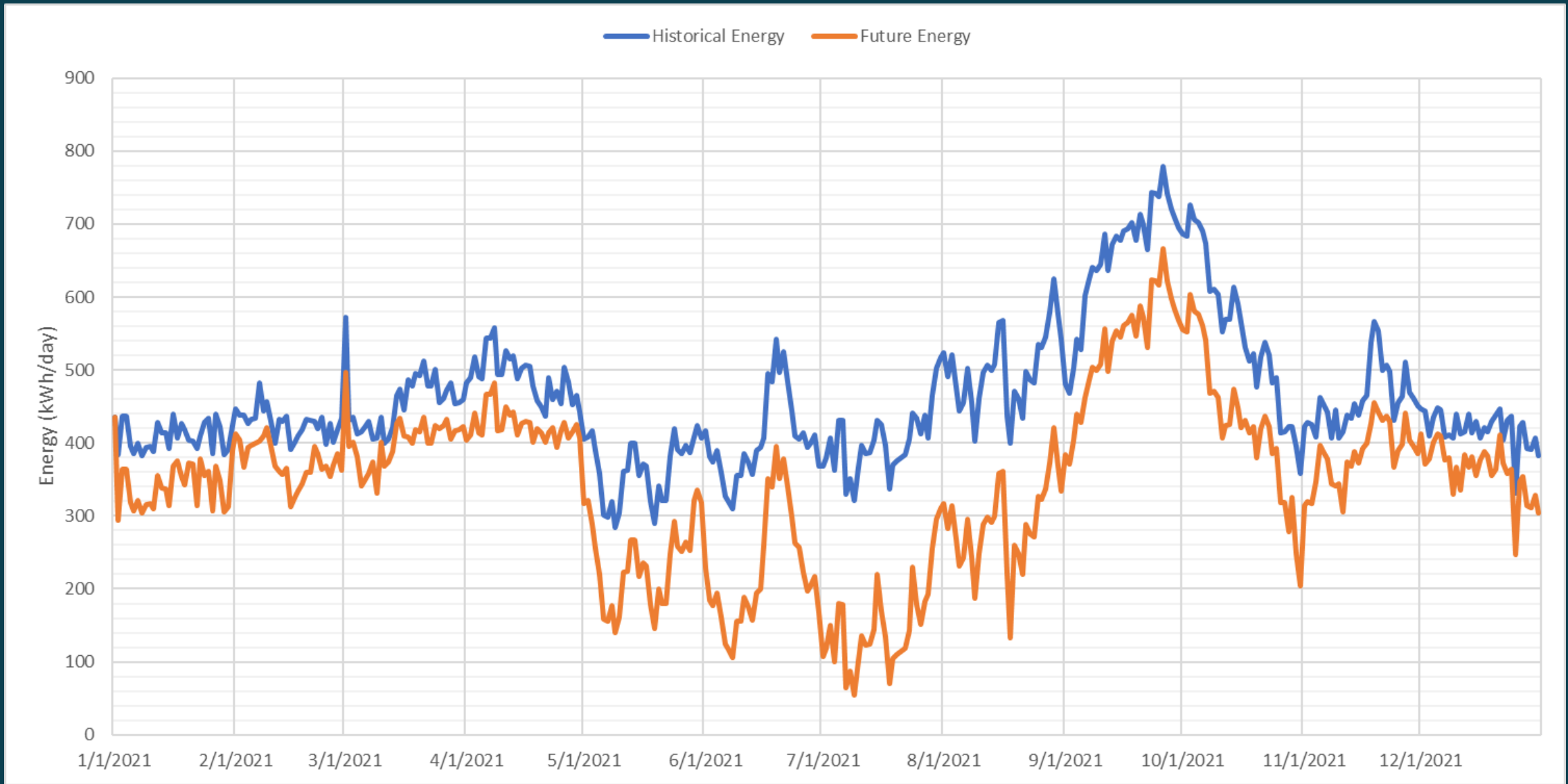




Energy Losses



Annual Energy Losses (MWh/Yr)





Financial Inputs

Financial Analysis

Input Parameters

- Discount Rate – 5%
- Annual Increase in O&M Costs – 3%
- Annual Increase in Energy Costs – 1%
- Carbon Emissions – 0.43 MTCO₂eq/MWh

Utility Pricing

- CEA: \$64.61/MWh
- MEA: \$88.48/MWh

Input Pricing

- \$73.13/MWh *Based on 64.29%/35.71% CEA/MEA Split
- \$51/MTCO₂eq *Carbon Costs

Ratepayer Impacts:

Matanuska Electric:

1.12% Energy Rate Increase /\$1M

Chugach Electric:

1% Energy Rate Increase /\$1M

Municipality of Anchorage:

.03 mils / \$1M

(\$3 Increased Property Tax per \$/100k Property Value)

Financial Analysis

Model Inputs

Eklutna Fish & Wildlife Project Financial Analysis

Input Parameters		
Total Project Cost	\$12,572,073	*Cost Estimate, see CAPEX tab
Average Annual Energy Loss (MWh)	24793	*Total Energy Lost
Average Annual Carbon Emissions (MTCO2Eq)	10,661	* Total Carbon Emissions
Annual Escalation	0.5%	*Default - 0.5%
Annual Interest Rate	5.0%	*Utility Discount Rate
Annual Increase in O&M Costs	3.0%	*Typically 3%
Annual Increase in Energy Price	1.0%	
Current O&M Cost	\$462,800	*See Tables
Energy Price (\$/MWh)	\$67.86	*Provided by CEA/MEA
Carbon Price (\$/MTCO2Eq)	\$51.00	



Financial Analysis									
Year	End of Year	Project Cost							
		Beginning of Year (\$M)	Interest (On Negative Balance)	(0.5% Annual Increase) End of Year	O&M Costs	Total	Average Energy Price (\$/kWh)	Energy Loss (\$)	Carbon Emissions (\$)
2028	0	-\$12,572,073	-\$628,604	-\$13,266,680	\$462,800	-\$13,729,480	\$67.86	\$1,682,332	\$543,705
2029	1	-\$15,955,517	-\$797,776	-\$16,837,059	\$476,684	-\$16,360,375	\$68.53	\$1,699,155	\$543,705
2030	2	-\$18,603,235	-\$930,162	-\$19,631,064	\$490,985	-\$19,140,079	\$69.22	\$1,716,146	\$543,705
2031	3	-\$21,399,931	-\$1,069,997	-\$22,582,277	\$505,714	-\$22,076,563	\$69.91	\$1,733,308	\$543,705
2032	4	-\$24,353,576	-\$1,217,679	-\$25,699,111	\$520,885	-\$25,178,226	\$70.61	\$1,750,641	\$543,705
2033	5	-\$27,472,572	-\$1,373,629	-\$28,990,431	\$536,512	-\$28,453,919	\$71.32	\$1,768,147	\$543,705
2034	6	-\$30,765,772	-\$1,538,289	-\$32,465,581	\$552,607	-\$31,912,973	\$72.03	\$1,785,829	\$543,705
2035	7	-\$34,242,507	-\$1,712,125	-\$36,134,406	\$569,186	-\$35,565,220	\$72.75	\$1,803,687	\$543,705
2036	8	-\$37,912,613	-\$1,895,631	-\$40,007,285	\$586,261	-\$39,421,023	\$73.48	\$1,821,724	\$543,705
2037	9	-\$41,786,453	-\$2,089,323	-\$44,095,154	\$603,849	-\$43,491,305	\$74.21	\$1,839,941	\$543,705
2038	10	-\$45,874,951	-\$2,293,748	-\$48,409,543	\$621,965	-\$47,787,578	\$74.95	\$1,858,341	\$543,705
2039	11	-\$50,189,624	-\$2,509,481	-\$52,962,601	\$640,623	-\$52,321,977	\$75.70	\$1,876,924	\$543,705
2040	12	-\$54,742,606	-\$2,737,130	-\$57,767,135	\$659,842	-\$57,107,293	\$76.46	\$1,895,693	\$543,705
2041	13	-\$59,546,692	-\$2,977,335	-\$62,836,647	\$679,637	-\$62,157,009	\$77.23	\$1,914,650	\$543,705
2042	14	-\$64,615,365	-\$3,230,768	-\$68,185,363	\$700,027	-\$67,485,337	\$78.00	\$1,933,797	\$543,705
2043	15	-\$69,962,839	-\$3,498,142	-\$73,828,286	\$721,027	-\$73,107,258	\$78.78	\$1,953,135	\$543,705
2044	16	-\$75,604,098	-\$3,780,205	-\$79,781,225	\$742,658	-\$79,038,567	\$79.57	\$1,972,666	\$543,705
2045	17	-\$81,554,938	-\$4,077,747	-\$86,060,848	\$764,938	-\$85,295,910	\$80.36	\$1,992,393	\$543,705
2046	18	-\$87,832,008	-\$4,391,600	-\$92,684,727	\$787,886	-\$91,896,841	\$81.17	\$2,012,317	\$543,705
2047	19	-\$94,452,862	-\$4,722,643	-\$99,671,383	\$811,523	-\$98,859,860	\$81.98	\$2,032,440	\$543,705
2048	20	-\$101,436,005	-\$5,071,800	-\$107,040,345	\$835,868	-\$106,204,476	\$82.80	\$2,052,764	\$543,705
2049	21	-\$108,800,946	-\$5,440,047	-\$114,812,198	\$860,944	-\$113,951,254	\$83.62	\$2,073,292	\$543,705
2050	22	-\$116,568,251	-\$5,828,413	-\$123,008,647	\$886,773	-\$122,121,874	\$84.46	\$2,094,025	\$543,705
2051	23	-\$124,759,604	-\$6,237,980	-\$131,652,572	\$913,376	-\$130,739,196	\$85.31	\$2,114,965	\$543,705
2052	24	-\$133,397,867	-\$6,669,893	-\$140,768,099	\$940,777	-\$139,827,322	\$86.16	\$2,136,115	\$543,705
2053	25	-\$142,507,141	-\$7,125,357	-\$150,380,661	\$969,000	-\$149,411,661	\$87.02	\$2,157,476	\$543,705
2054	26	-\$152,112,842	-\$7,605,642	-\$160,517,076	\$998,070	-\$159,519,006	\$87.89	\$2,179,051	\$543,705
2055	27	-\$162,241,761	-\$8,112,088	-\$171,205,619	\$1,028,013	-\$170,177,606	\$88.77	\$2,200,841	\$543,705
2056	28	-\$172,922,152	-\$8,646,108	-\$182,476,101	\$1,058,853	-\$181,417,248	\$89.66	\$2,222,850	\$543,705
2057	29	-\$184,183,803	-\$9,209,190	-\$194,359,958	\$1,090,619	-\$193,269,340	\$90.55	\$2,245,078	\$543,705
2058	30	-\$196,058,123	-\$9,802,906	-\$206,890,334	\$1,123,337	-\$205,766,997	\$91.46	\$2,267,529	\$543,705
2059	31	-\$208,578,231	-\$10,428,912	-\$220,102,178	\$1,157,037	-\$218,945,141	\$92.37	\$2,290,204	\$543,705
2060	32	-\$221,779,050	-\$11,088,953	-\$234,032,343	\$1,191,748	-\$232,840,595	\$93.30	\$2,313,106	\$543,705
2061	33	-\$235,697,406	-\$11,784,870	-\$248,719,687	\$1,227,501	-\$247,492,187	\$94.23	\$2,336,237	\$543,705
2062	34	-\$250,372,129	-\$12,518,606	-\$264,205,189	\$1,264,326	-\$262,940,863	\$95.17	\$2,359,600	\$543,705
2063	35	-\$265,844,168	-\$13,292,208	-\$280,532,058	\$1,302,256	-\$279,229,803	\$96.12	\$2,383,196	\$543,705

Breakeven Power Price	
Estimated total project cost	\$12,572,073
Annual Increase each year	0.50%
Annual Interest Rate	5.00%
Life of Equipment (years)	35
Breakeven Goal (years)	35
35 Yr Annualized Capital Costs	(\$767,798)
Average Annual O&M Costs	(\$813,447)
Average Annualized Energy Costs	(\$2,013,044)
Average Annual Carbon Costs	(\$543,705)
Estimated Annual Costs - 35 Yr	\$4,137,995

35-Year Model
 Annualized Capex
 Annualized O&M
 Annualized Energy Costs
 Annualized Carbon Costs
 Total Annualized Costs



Habitat Improvements



Habitat Improvements (Acres)

Scenario		Time-Averaged Habitat (acres)					
		Chinook		Coho		Sockeye	
		Spawning	Juvenile Rearing	Spawning	Juvenile Rearing	Spawning	
Baseline		0.7	11.8	2.5	14.7	2.1	
Habitat Improvement (Acres)	Dam Release	Flow Level 1	1.6	8.9	2.2	13.2	1.6
		Flow Level 2	1.7	9.9	2.3	14.5	1.7
		Flow Level 3	1.8	10.9	2.3	15.8	1.6
		Flow Level 4	1.8	11.7	2.3	16.9	1.6
		Flow Level 5	1.9	12.4	2.3	17.9	1.5
		Flow Level 6	1.9	13.0	2.3	18.9	1.4
		Flow Level 7	2.0	13.8	2.2	20.0	1.3
	Portal Release	Flow Level 1	1.5	6.3	1.6	9.9	1.2
		Flow Level 2	1.5	7.2	1.6	11.0	1.2
		Flow Level 3	1.6	8.1	1.6	12.2	1.2
	Pipeline Release	Flow Level 1	0.3	3.3	0.8	4.7	0.7
		Flow Level 2	0.3	4.1	0.8	5.7	0.7
		Flow Level 3	0.3	4.9	0.7	6.7	0.6



Habitat Improvements (% Gain)

Scenario		Time-Averaged Habitat (%)					
		Chinook		Coho		Sockeye	
		Spawning	Juvenile Rearing	Spawning	Juvenile Rearing	Spawning	
Habitat Improvement (%)	Dam Release	Flow Level 1	227%	75%	89%	90%	75%
		Flow Level 2	240%	84%	92%	99%	78%
		Flow Level 3	254%	92%	94%	108%	77%
		Flow Level 4	254%	99%	94%	115%	74%
		Flow Level 5	265%	104%	93%	122%	71%
		Flow Level 6	274%	110%	93%	128%	67%
		Flow Level 7	280%	116%	91%	136%	62%
	Portal Release	Flow Level 1	209%	53%	65%	67%	58%
		Flow Level 2	215%	61%	65%	75%	57%
		Flow Level 3	221%	69%	65%	83%	54%
Pipeline Release	Flow Level 1	48%	28%	32%	32%	35%	
	Flow Level 2	44%	35%	31%	39%	33%	
	Flow Level 3	42%	42%	29%	45%	30%	

Additional Habitat Improvements (Acres)

Lach Q'Atnu Re-Route

Scenario		Time-Averaged Habitat (acres)			
		Chinook		Coho	
		Spawning	Juvenile Rearing	Spawning	Juvenile Rearing
Lach Q'Atnu Re-Route					
Portal Release	Lach Q'Atnu	0.0	0.6	0.1	0.7
Pipeline Release	Lach Q'Atnu	0.1	1.1	0.2	1.5



Additional Habitat Improvements (Acres)

Fish Passage:

(E. & W. Forks Eklutna Creek)

Spawning Habitat: 1.145 Acres (50% Suitability)
Rearing Habitat: Unknown

(Eklutna Lake Shoreline)

Spawning Habitat: 2.6 Acres (w/o Fluctuation)
Spawning Habitat: 0.03 Acres (w Existing Fluctuation)
Rearing Habitat: Low Productivity



▮▮▮ | Additional Habitat Improvements (Acres)

Physical Habitat Manipulation

Rearing Habitat: 0.55 Acres (Based on proposed improvements)



Cost Effectiveness and Incremental Cost Analysis (ICA)

Example Comprehensive Alternative

Upstream Passage

Downstream Passage

Flow Release Method

Flow Release Level

Lach Q'Atnu Re-Route

Gravity Fish Ladder

Spill

Dam Release

Level 4

Not Implemented

Peak Flow

Habitat Improvements

Lakeside Trail Improvements

AWWU Bridge Crossings

Ungated

Implemented

Implemented

Implemented

Example Comprehensive Alternative

CAPEX / O&M

U/S Passage:	Gravity Fish Ladder	\$12.6M	\$121K
D/S Passage:	Spill	\$0	\$0
Flow Release:	Dam Release	\$7M	\$464k
Lach Q'Atnu:	No Change	\$0	\$0
Peak Flow:	Ungated	\$0	\$0
Lakeside Trail:	Implemented	\$1.7M	\$0
AWWU Bridges:	Implemented	\$2.9M	\$0
Habitat Manipulation:	Implemented	\$1.5M	\$0

Energy

Lost Energy:	Level 4 Release	91,574 MWh/Yr
Lost Revenue:	Level 4 Release	\$6.7M/Yr

Carbon Emissions

Carbon Costs:	\$51/MTCO ₂ Eq/MWh	\$2M/Yr
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Example Comprehensive Alternative



Input Parameters		
Total Project Cost	\$25,714,550	*Cost Estimate, see CAPEX tab
Average Annual Energy Loss (\$)	\$6,727,761	*Total Energy Lost
Average Annual Carbon Emissions (MTCO2Eq)	\$2,018,328	* Total Carbon Emissions
Annual Escalation	0.5%	*Default - 0.5%
Annual Interest Rate	5.0%	*Utility Discount Rate
Annual Increase in O&M Costs	3.0%	*Typically 3%
Annual Increase in Energy Price	1.0%	
Current O&M Cost	\$585,000	*See Tables

Financial Analysis										
Year	End of Year	Project Cost							Annualized Cost Revenue	Project Cost End of Year
		Beginning of Year (\$M)	Interest (On Negative Balance)	(0.5% Annual Increase) End of Year	O&M Costs	Total	Average Energy Loss (\$)	Carbon Emissions (\$)		
2028	0	-\$25,714,550	-\$1,285,727	-\$27,135,279	\$585,000	-\$27,720,279	\$6,727,761	\$2,018,328	\$0	-\$36,466,368
2029	1	-\$36,466,368	-\$1,823,318	-\$38,481,135	\$602,550	-\$37,878,585	\$6,795,039	\$2,018,328	\$0	-\$46,691,952
2030	2	-\$46,691,952	-\$2,334,598	-\$49,271,682	\$620,627	-\$48,651,056	\$6,862,989	\$2,018,328	\$0	-\$57,532,373
2031	3	-\$57,532,373	-\$2,876,619	-\$60,711,037	\$639,245	-\$60,071,791	\$6,931,619	\$2,018,328	\$0	-\$69,021,739
2032	4	-\$69,021,739	-\$3,451,087	-\$72,835,190	\$658,423	-\$72,176,767	\$7,000,935	\$2,018,328	\$0	-\$81,196,031
2033	5	-\$81,196,031	-\$4,059,802	-\$85,682,111	\$678,175	-\$85,003,936	\$7,070,945	\$2,018,328	\$0	-\$94,093,209
2034	6	-\$94,093,209	-\$4,704,660	-\$99,291,859	\$698,521	-\$98,593,338	\$7,141,654	\$2,018,328	\$0	-\$107,753,320
2035	7	-\$107,753,320	-\$5,387,666	-\$113,706,691	\$719,476	-\$112,987,215	\$7,213,070	\$2,018,328	\$0	-\$122,218,614
2036	8	-\$122,218,614	-\$6,110,931	-\$128,971,192	\$741,060	-\$128,230,132	\$7,285,201	\$2,018,328	\$0	-\$137,533,661
2037	9	-\$137,533,661	-\$6,876,683	-\$145,132,396	\$763,292	-\$144,369,104	\$7,358,053	\$2,018,328	\$0	-\$153,745,485
2038	10	-\$153,745,485	-\$7,687,274	-\$162,239,923	\$786,191	-\$161,453,732	\$7,431,634	\$2,018,328	\$0	-\$170,903,694
2039	11	-\$170,903,694	-\$8,545,185	-\$180,346,123	\$809,777	-\$179,536,347	\$7,505,590	\$2,018,328	\$0	-\$189,060,625
2040	12	-\$189,060,625	-\$9,453,031	-\$199,506,225	\$834,070	-\$198,672,154	\$7,581,010	\$2,018,328	\$0	-\$208,271,492
2041	13	-\$208,271,492	-\$10,413,575	-\$219,778,492	\$859,092	-\$218,919,400	\$7,656,820	\$2,018,328	\$0	-\$228,594,548
2042	14	-\$228,594,548	-\$11,429,727	-\$241,224,397	\$884,865	-\$240,339,532	\$7,733,388	\$2,018,328	\$0	-\$250,091,248
2043	15	-\$250,091,248	-\$12,504,562	-\$263,908,790	\$911,411	-\$262,997,379	\$7,810,722	\$2,018,328	\$0	-\$272,826,429
2044	16	-\$272,826,429	-\$13,641,321	-\$287,900,089	\$938,753	-\$286,961,336	\$7,888,829	\$2,018,328	\$0	-\$296,868,493
2045	17	-\$296,868,493	-\$14,843,425	-\$313,270,477	\$966,916	-\$312,303,561	\$7,967,717	\$2,018,328	\$0	-\$322,289,607
2046	18	-\$322,289,607	-\$16,114,480	-\$340,096,108	\$995,923	-\$339,100,184	\$8,047,394	\$2,018,328	\$0	-\$349,165,907
2047	19	-\$349,165,907	-\$17,458,295	-\$368,457,323	\$1,025,801	-\$367,431,522	\$8,127,868	\$2,018,328	\$0	-\$377,577,719
2048	20	-\$377,577,719	-\$18,878,886	-\$398,438,888	\$1,056,575	-\$397,382,313	\$8,209,147	\$2,018,328	\$0	-\$407,609,788
2049	21	-\$407,609,788	-\$20,380,489	-\$430,130,229	\$1,088,272	-\$429,041,957	\$8,291,239	\$2,018,328	\$0	-\$439,351,524
2050	22	-\$439,351,524	-\$21,967,576	-\$463,625,695	\$1,120,920	-\$462,504,775	\$8,374,151	\$2,018,328	\$0	-\$472,897,254
2051	23	-\$472,897,254	-\$23,644,863	-\$499,024,827	\$1,154,548	-\$497,870,279	\$8,457,892	\$2,018,328	\$0	-\$508,346,500
2052	24	-\$508,346,500	-\$25,417,325	-\$536,432,644	\$1,189,185	-\$535,243,460	\$8,542,471	\$2,018,328	\$0	-\$545,804,259
2053	25	-\$545,804,259	-\$27,290,213	-\$575,959,945	\$1,224,860	-\$574,735,084	\$8,627,896	\$2,018,328	\$0	-\$585,381,309
2054	26	-\$585,381,309	-\$29,269,065	-\$617,723,626	\$1,261,606	-\$616,462,020	\$8,714,175	\$2,018,328	\$0	-\$627,194,524
2055	27	-\$627,194,524	-\$31,359,726	-\$661,847,021	\$1,299,454	-\$660,547,567	\$8,801,317	\$2,018,328	\$0	-\$671,367,212
2056	28	-\$671,367,212	-\$33,568,361	-\$708,460,250	\$1,338,438	-\$707,121,813	\$8,889,330	\$2,018,328	\$0	-\$718,029,471
2057	29	-\$718,029,471	-\$35,901,474	-\$757,700,599	\$1,378,591	-\$756,322,009	\$8,978,223	\$2,018,328	\$0	-\$767,318,560
2058	30	-\$767,318,560	-\$38,365,928	-\$809,712,911	\$1,419,949	-\$808,292,962	\$9,068,005	\$2,018,328	\$0	-\$819,379,296
2059	31	-\$819,379,296	-\$40,968,965	-\$864,650,002	\$1,462,547	-\$863,187,455	\$9,158,686	\$2,018,328	\$0	-\$874,364,469
2060	32	-\$874,364,469	-\$43,718,223	-\$922,673,106	\$1,506,423	-\$921,166,682	\$9,250,272	\$2,018,328	\$0	-\$932,435,283
2061	33	-\$932,435,283	-\$46,621,764	-\$983,952,332	\$1,551,616	-\$982,400,716	\$9,342,775	\$2,018,328	\$0	-\$993,761,820
2062	34	-\$993,761,820	-\$49,688,091	-\$1,048,667,160	\$1,598,165	-\$1,047,068,996	\$9,436,203	\$2,018,328	\$0	-\$1,058,523,527
2063	35	-\$1,058,523,527	-\$52,926,176	-\$1,117,006,952	\$1,646,110	-\$1,115,360,842	\$9,530,565	\$2,018,328	\$0	-\$1,126,909,735

Breakeven Power Price	
Estimated total project cost	\$25,714,550
Annual Increase each year	0.50%
Annual Interest Rate	5.00%
Life of Equipment (years)	35
Breakeven Goal (years)	35
35 Yr Annualized Capital Costs	(\$1,570,431)
Average Annual O&M Costs	(\$1,028,234)
Average Annualized Energy Costs	(\$8,050,304)
Average Annual Carbon Costs	(\$2,018,328)
Estimated Annual Costs - 35 Yr	\$12,667,298

**\$12.67M/Yr
For 35 Years**

Example Comprehensive Alternative

Habitat Improvement

Chinook Spawning:

Fish Passage: 3.79 Acres
Level 4 Dam Release: 1.79 Acres

Total: 5.58 Acres

Incremental Cost: \$2.3M/Acre

Coho Spawning:

Fish Passage: 3.79 Acres
Level 4 Dam Release: 2.30 Acres

Total: 6.09 Acres

Incremental Cost: \$2.1M/Acre

Sockeye Spawning:

Fish Passage: 3.79 Acres
Level 4 Dam Release: 1.58 Acres

Total: 5.37 Acres

Incremental Cost: \$2.4M/Acre

