BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

DOCKET NO. UE-19_____

EXH. CGK-2

CLINT G. KALICH

REPRESENTING AVISTA CORPORATION

Avista Rate Case Power Supply Modeling

Workshop No. 1 Agenda

Wednesday, June 13, 2018, 10:00-16:00

Location: 7141 Cleanwater Drive SW, Tumwater, WA 98501

Topic	**Time**
Welcome and Introductions	10:00
Review of Commission Order Language	10:15
Process Overview and Expectations a) Workshop schedule/content b) PAC/PSE participation c) Power supply modeling “experts” d) Modeling methods	10:30
Lunch	12:00
Process Overview and Expectations, Cont.	13:30
Next Steps/Schedule	15:30
Adjourn	16:00

Commission Order Language

161 Further, we order the Company to engage Staff, Public Counsel, ICNU, and other interested stakeholders in a discussion about how power cost modeling may be simplified and improved. While we do not think that a technical topic like power cost modeling lends itself to a formal collaborative or Commission proceeding at this time, we direct Avista to consult with its peer utilities, independent experts in the power cost modeling industry, Staff, and the other parties in this case on ways in which the Company may document the functionality and rationale of its power cost modeling and make changes to eliminate its directional bias. We order the Company to report back on this process and identify any resulting changes in its methodology in its next general rate case filing.

Building A Power Supply Model for Ratemaking

August 1, 2018

Areas of Discussion

- Variable Generation (Hydro, Wind, Solar)
- Natural Gas Prices
- Electricity Prices
- Oversupply (Negative Prices) Conditions
- Hydro Shaping
- Plant Maintenance
- Outside- vs. Inside-Of-Model Contracts Modeling

Thank You.

PAC and PSE Power Supply Modeling Methods

August 1, 2018

Puget Sound Energy Method Summary

- Start with Aurora “Out of the Box”
  - EPIS database, resource assumptions, model settings (e.g., bid factors)
  - Adjust PSE project assumptions and add contracts
- Input 80 water years of data (from BPA)
- Input monthly forward natural gas prices
- Run portfolio for the 80 water years, keeping gas prices constant
  - includes rate period loads
- Average results become basis for power supply expense

Puget Sound Energy Method Pros/Cons

- No means to account for oversupply conditions (i.e., negative prices)
- Modeled market prices likely will vary greatly from forward prices
- No representation of
  - year-to-year wind variability
  - intra-month gas variability
  - WA gas tax
- Addresses water year variability
  - However, hydro shaped generically, might not be tied to actual history of utility
- Simpler, with no need to affect items like bidding adders, regional loads

PacifiCorp WA Method Summary

- Use company-built “GRID” software
- Prices input into the model
  - Shape monthly forward electricity prices using 5-year average hourly price shape
  - Input forward monthly gas prices
- Input median hydro (30-year median only)
- Model only west-side resources
- Recent 48-month average for outages and PPA/renewables
- Input actual maintenance plan for company resources
- Run portfolio for the single median water year

PacifiCorp WA Method Pros/Cons

- No consideration of renewables variability (hydro, wind)
- Use of proprietary GRID model
- Simpler approach to represent prices
  - No need to “adjust” model to arrive at forward market prices
- Much faster results because of one median water year run

Methods Comparison

- Variable Generation (Hydro, Wind, Solar)
  - PAC: single average year, no variability for wind or solar
  - PSE: full (80+year) water record, no variability for wind or solar
  - AVA: full (80+year) water record, plus bootstrap solar, wind to match
- Natural Gas Prices – All Use Forward Price Strip
- Electricity Prices
  - PAC: forwards shaped using 5-year average hourly price shape
  - PSE: Aurora-generated prices with no modifications
  - AVA: Aurora-generated prices with various modifications
    - (regional loads, thermal bidding factors, bidding adders, transmission, new COB zone)

AVISTA

Methods Comparison, Cont.

- Oversupply (i.e., negative prices) Conditions
  - PAC: historical market price shapes
  - PSE: ignored
  - AVA: negative bidding adders on wind, solar, hydro

Avista Method (Detailed)

1. Start with most recent AURORA database, typically IRP file. Update for any known changes from EPIS, such as transmission, area load, etc. Make any other known updates to region
2. Remove all long-term data assumptions
3. Update all contract energy deliveries to 5 year average of historical- except upriver, this uses a longer time horizon due to being a hydro facility, adjust any mid-c contracts
4. Add any new contract if any, also add financial/physical short-term contracts to AURORA
5. Update Avista resources for VOM, capacity, heat rates to match position report assumptions, add any other known adjustments to resources

Avista Method (Detailed), Cont.

6. Gather 3 month average natural gas prices for each hub in the Western Interconnect and enter into AURORA
7. Gather historical daily natural gas prices to create day natural gas price curve
8. Gather historical transmission de-rate between NW and California, enter as the phantom transmission constrain in the links table
9. Gather historical station service load quantities and enter into aurora
10. Gather historical maintenance and forced outage data and enter into aurora- we use 5 year history (except Colstrip we use 6 years).
11. Get kettle falls and Colstrip fuel forecasts, Colstrip is split between variable and fixed fuel costs

Avista Method (Detailed), Cont.

12. Update historical wind data set to include additional wind years (these are randomly drawn in the historical water year
13. Update BPA historical hydro record if necessary, also update Avista's 80 year record when necessary
14. Add Avista test period load file to AURORA and also proforma loads (this is used for rates study). Test period loads must be weather adjusted (this comes from rates)
15. Run the model to test Avista's hydro dispatch to match 5 year historical on/off peak shape by month. Historically this is to be within 10% of historic shapes, but typically is less than 5%. This is an iterative process. To adjust these rates, use the hydro shaping factor feature.

Avista Method (Detailed), Cont.

16. Run the model to test to see if Mid-C prices by month and on/off peak are within 10% of forward markets, if not, adjusts prices by changing the phantom transmission amount between NW and CA, adjust regional hydro shaping (this adjusts the on/off peak price), modify regional loads up or down, adjust the dispatch margin (i.e. bidding factor). This is an iterative process, requiring running all 80 years!
17. Once run is complete with satisfactory pricing. Four output tables are pasted into the AURORA proforma. This Proforma is used by B. Johnson for the test case loads. Bill only uses the fuel and balancing purchases and sales costs. He does not use the contract cost estimates
18. The proforma is re-run using proforma loads for a rate study

Avista Method (Detailed), Cont.

19. Use energy amounts in AURORA to develop all contract expense and revenue that are energy amount dependent (AURORA energy times appropriate contract rate)
20. Use AURORA electric price to calculate contract expense and revenues that are based on index prices (AURORA energy times AURORA electric prices)
21. Develop all non-energy related expenses and revenues that are outside of AURORA model
22. Add line items for AURORA calculated financial electric mark-to-model price for actual financial electric purchases and sales in place in the pro forma period

Avista Method (Detailed), Cont.

13. Calculate mark-to-model price position for actual forward gas purchases and sales
14. Include outside AURORA optimization such as gas transport optimization
15. Sum up all AURORA generated and non-AURORA generated expenses and revenues to derive total system net expense

Avista WA Method Pros/Cons

- Accounting for “Realities” of Wholesale Marketplace
  - Oversupply
  - Variable generation (wind, hydro, solar) impact on market
  - Ties forward markets for gas and electricity
  - Reflects full water year variability
- Complexity
  - Lots of analytical work to create/audit
  - Complexity/concerns over “adjustments”
    - Bidding factors, negative dispatch margins, load adjustments
  - Runs take a long time
- Contract costs modeled outside of Aurora
- Others

Thank You.

Power Supply Modeling Workshop 3

December 13, 2018

Agenda

Introductions	10:00 – 10:15
Review of Last Meeting/Questions	10:15 – 10:45
Results of Modeled Power Cases	10:45 – 12:00
Lunch	12:00 – 1:30
Results of Modeled Power Cases, Cont.	1:30 – 2:30
Other Analyses	2:30 – 3:15
Schedule Next Steps/Meeting	3:15 – 3:30
Wrap-Up/Adjourn	3:30 – 3:45

Basic Assumptions Across Modeling

- From 2016 Case Unless Stated Otherwise…
  - All costs presented are system total (ID/WA)
  - 2017 calendar year
  - 80-year hydro record, sourced from BPA
  - Fuel prices
  - Forced outage and maintenance schedule
  - Power and gas transactions
  - EPIS Aurora v12.0.1090 and North-American_DB_2015-02.xdb (version available Aug-2015 at time of filing)

Evaluated Modeling Cases

Descriptions of Each In Following Slides

- Actuals
- Filed Case
- Median Water
- Out-of-the-Box
- Closed System
  - Median water
  - 80-Year water
  - Backcast

Modeling Case Definitions

- Actuals (not a modeling case, per se, but a reference)
  - Experienced utility operations, including fuel, generation, purchases and sales, outages, hydro conditions, etc.
- Filed Case
- Median Water
  - Run only median hydro of 80-year hydro record
- Out-of-the-Box
  - Modify our resources and contracts
  - Update with BPA 80-year regional hydro conditions
  - Adjust natural gas prices for WECC and Colstrip 3/4 fuel

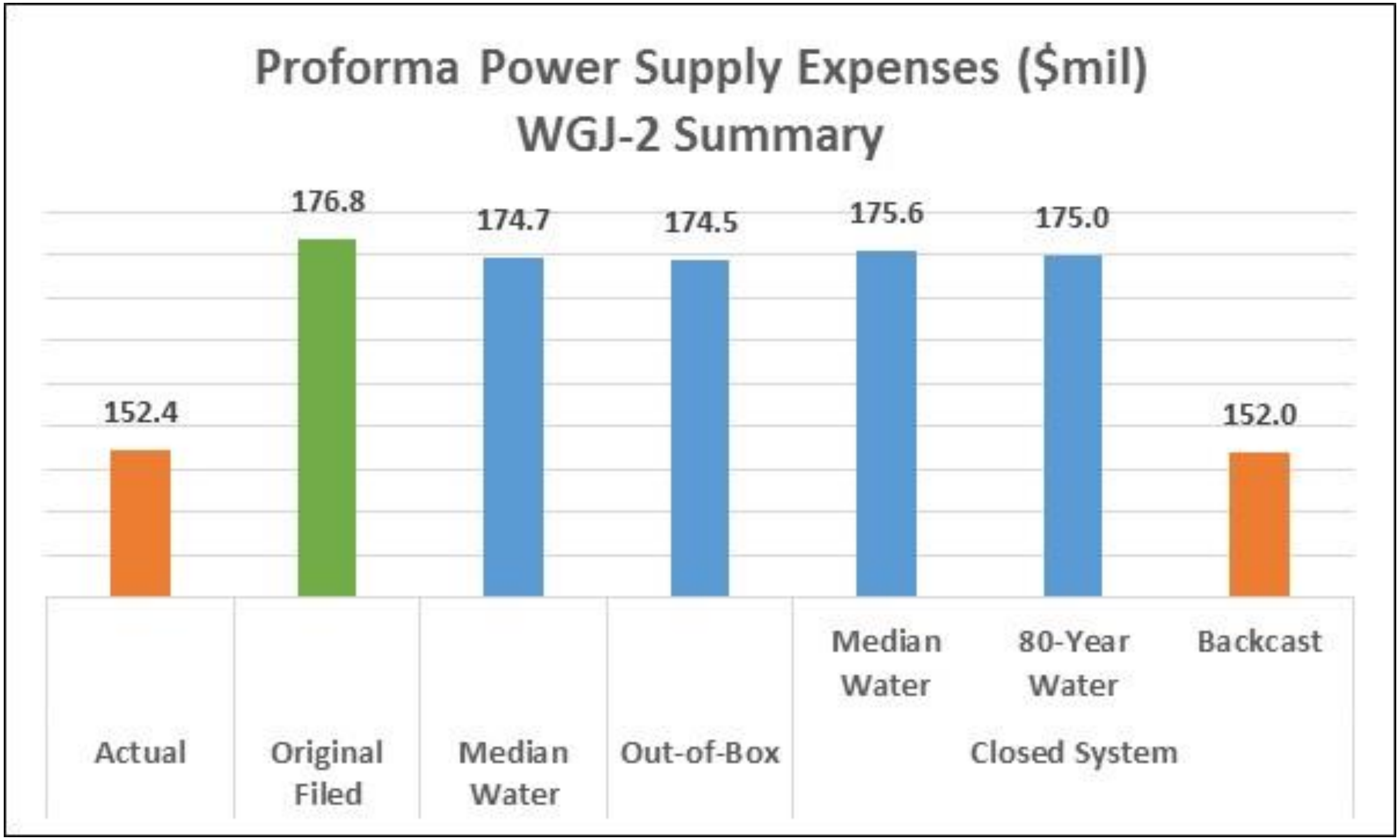
Modeling Case Definitions, Cont.

- Closed System
  - Input hourly electricity prices and run Avista-only portfolio
  - Uses latest version of Aurora
  - Two hydro modeled variations
    - median water (average of 80-year hourly prices)
    - 80-Year BPA water and hourly prices
  - Backcast
    - Actual 2017 hydro, fuel and power prices, forced outage and maintenance schedules AND power and gas term transactions

Analyses Performed

- Proforma Power Supply Costs
- Generation Levels
- Market Purchases and Sales
- Mark-To-Market of Portfolio Assets
- Contract Costs
- 80 Water Year Input Prices and Single Median Water Year Run

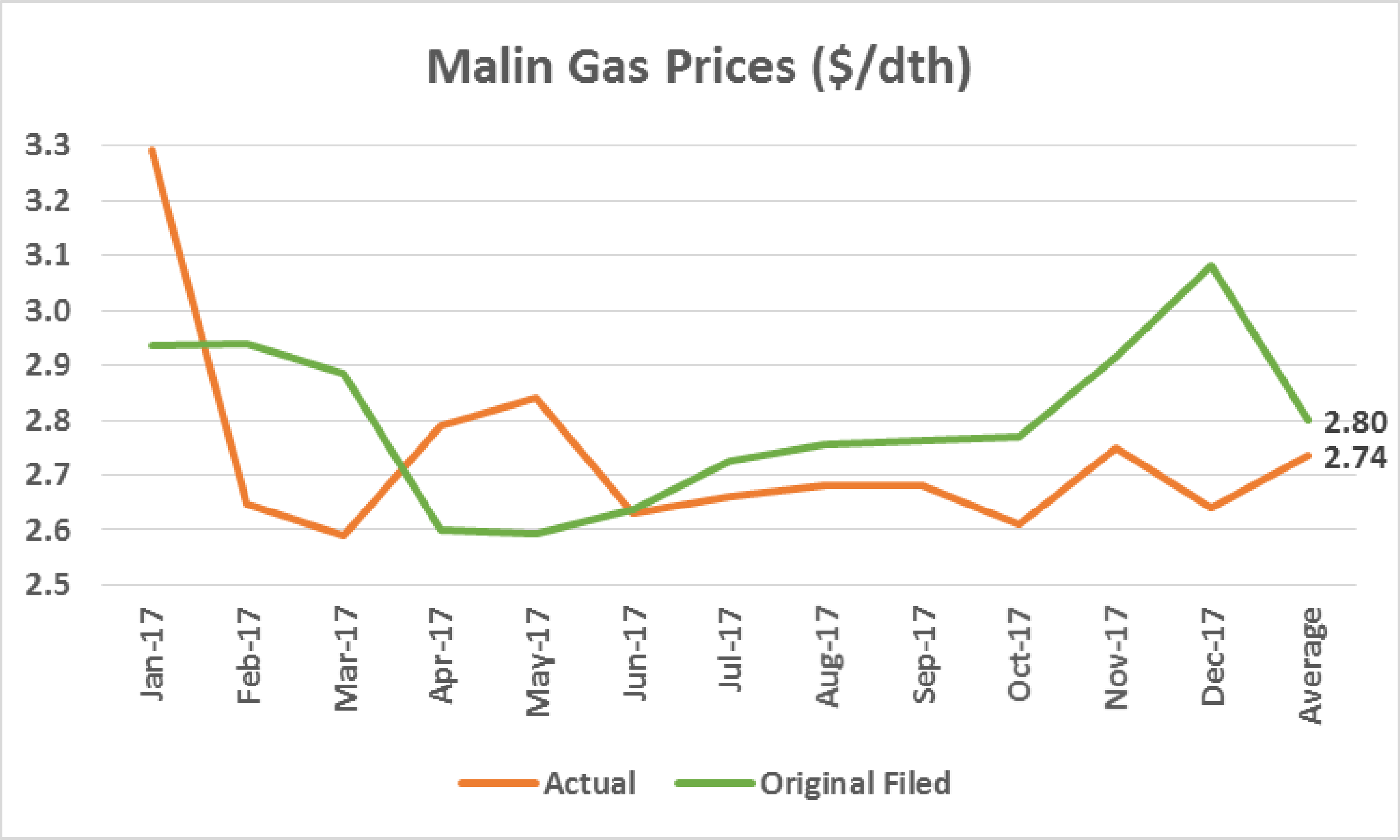
Power Supply Costs (Exh. WGJ-2)



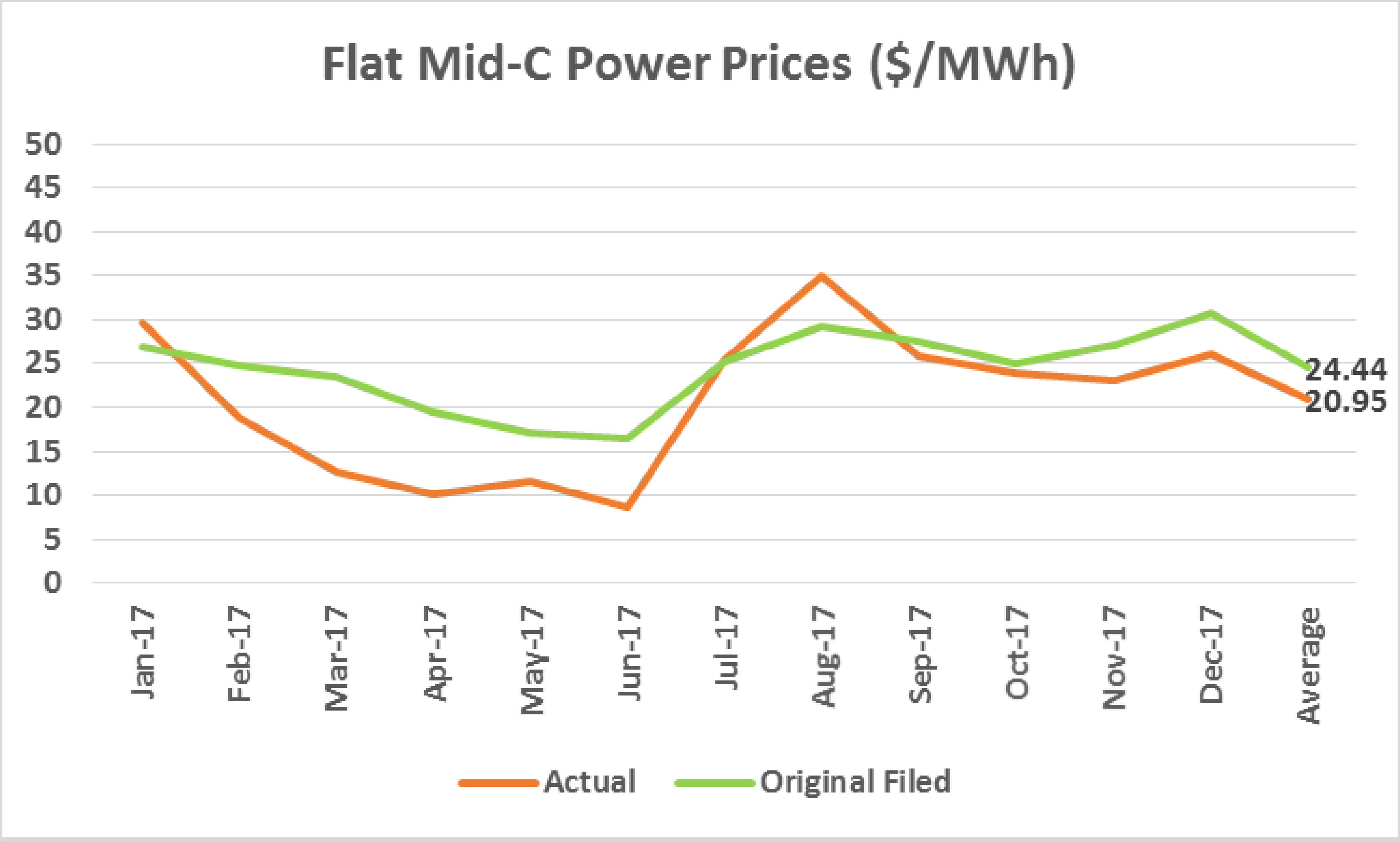
Power Supply Costs (Exh. WGJ-2)

Line No.	Item	Actual	Original Filed	Median Water	Out-of-Box	Closed System Median Water	Closed System 80-Year Water	Closed System Backcast
		$000s	$000s	$000s	$000s	$000s	$000s	$000s
	555 PURCHASED POWER	130,675	109,783	105,158	105,974	105,370	106,726	100,241
	447 SALES FOR RESALE	-88,779	-57,504	-65,134	-60,896	-67,086	-65,078	-58,162
	557 OTHER EXPENSES	61,870	407	407	407	407	407	407
	456 OTHER ELECTRIC REVENUE	-67,200	0	0	0	0	0	0
	501 THERMAL FUEL EXPENSE	26,289	29,225	29,791	29,444	29,376	28,532	26,199
	547 OTHER FUEL EXPENSE	69,528	76,583	86,152	81,247	89,161	86,052	65,017
	565 TRANSMISSION OF ELECTRICITY BY OTHERS	17,569	17,766	17,766	17,766	17,766	17,766	17,766
	536 WATER FOR POWER	997	1,029	1,029	1,029	1,029	1,029	1,029
	453 SALES OF WATER AND WATER POWER	-418	-466	-466	-466	-466	-466	-466
	WNP-3 CONTRACT MID-POINT VS. ACTUAL	1,820	N/A	N/A	N/A	N/A	N/A	N/A
74	**TOTAL NET EXPENSE**	152,351	176,824	174,703	174,504	175,556	174,968	152,032
	Delta From Filed Case	-13.8%	0.0%	-1.2%	-1.3%	-0.7%	-1.0%	-14.0%

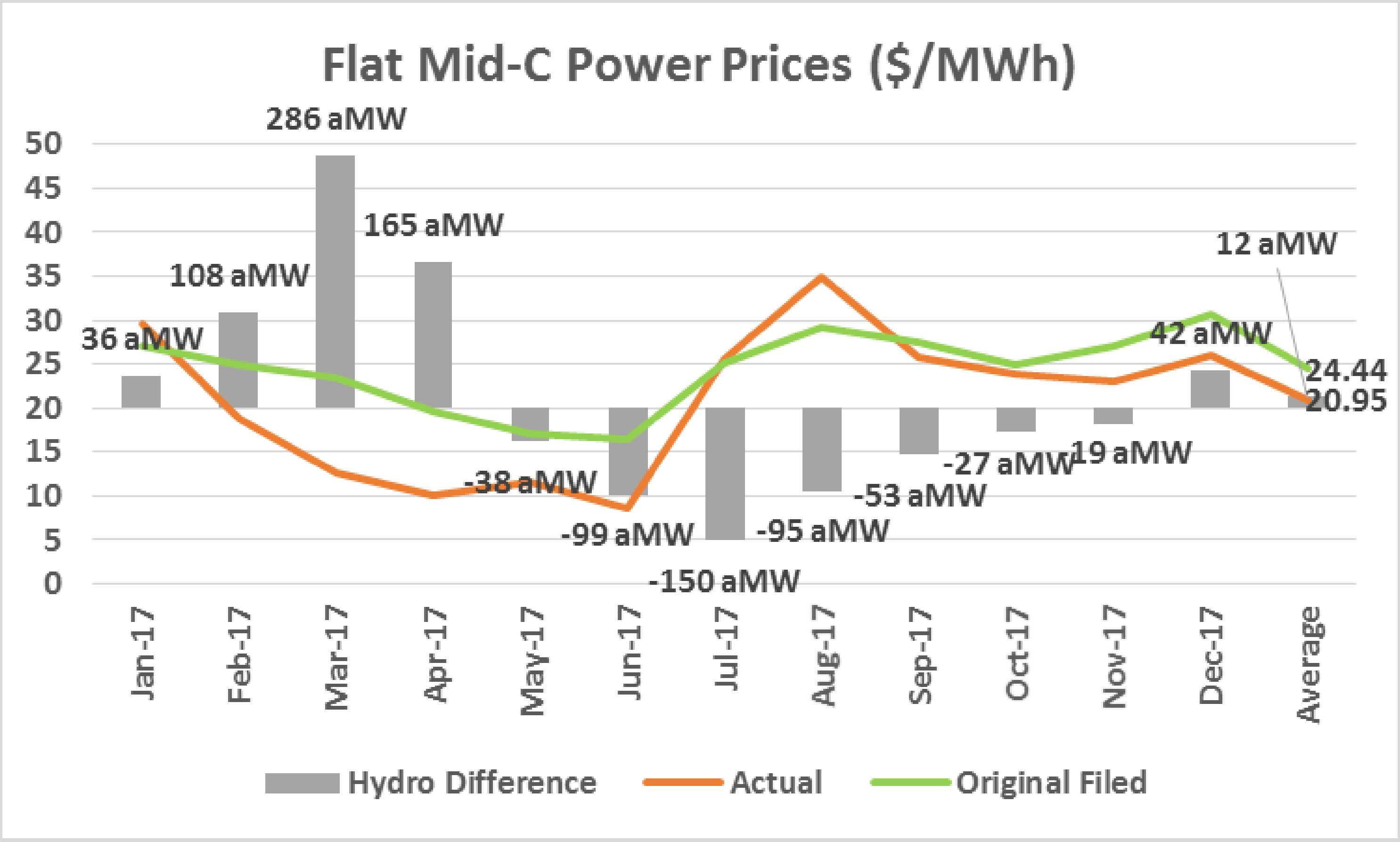
Market Prices Summary – Malin Gas



Market Prices Summary – Mid-C Power



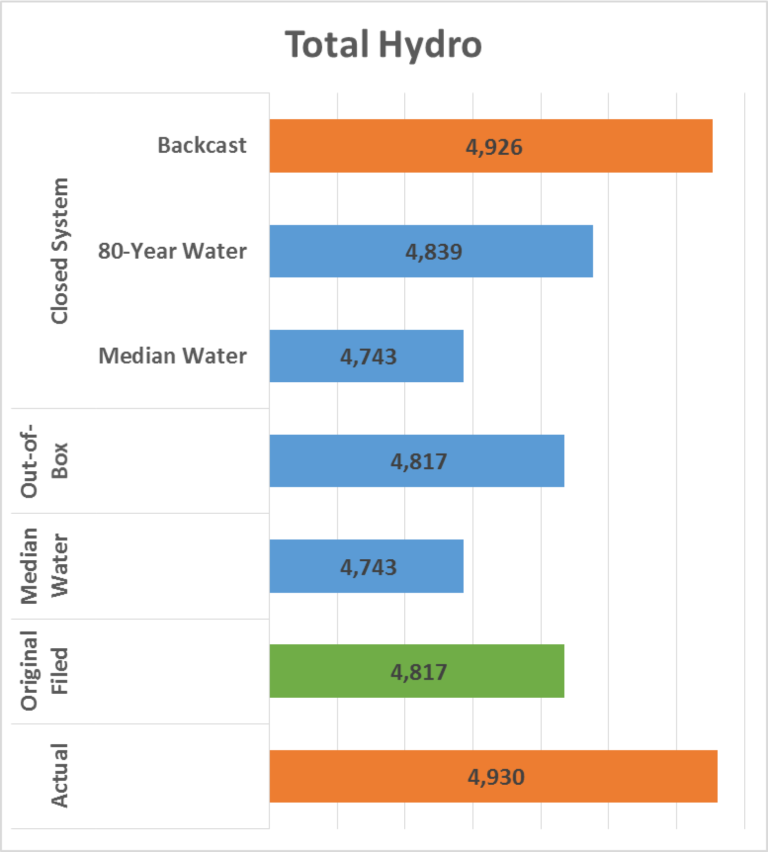
Market Prices Summary – Mid-C Power

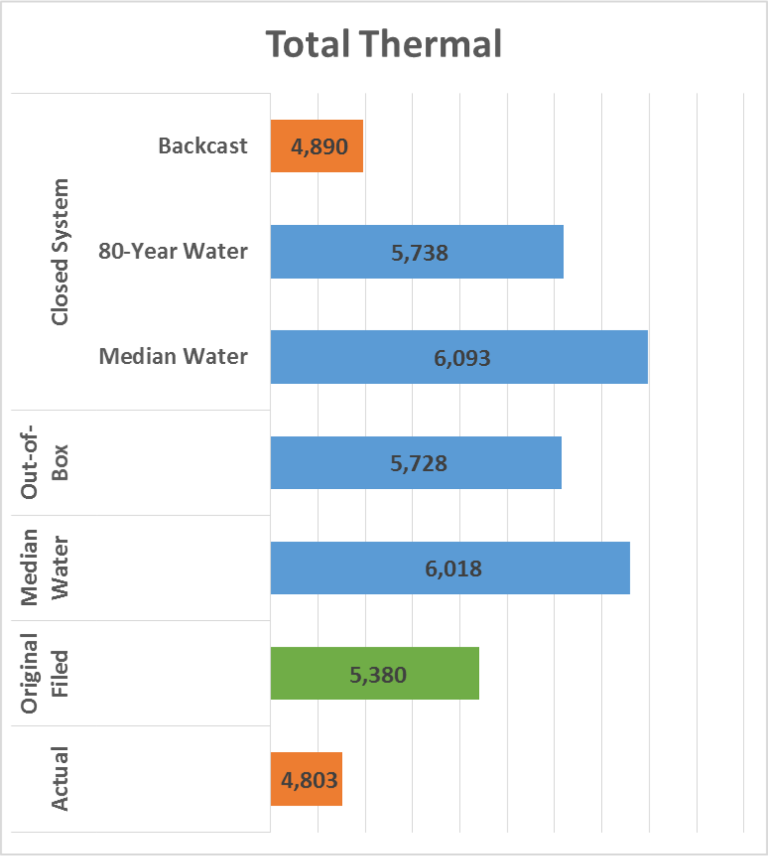


Market Prices Summary

	Average	Delta	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
Malin Gas Price ($/dth)														
Actual	2.736		3.294	2.649	2.590	2.790	2.842	2.630	2.662	2.681	2.680	2.610	2.748	2.640
Original Filed	2.799	2.3%	2.937	2.939	2.885	2.599	2.592	2.636	2.725	2.755	2.761	2.769	2.914	3.083
Mid-C Electricity 7x24 Prices ($/MWh)														
Actual	20.95	-14.3%	29.60	18.72	12.65	10.04	11.63	8.66	25.48	34.93	25.78	23.93	23.10	26.07
Original Filed	24.44	0.0%	26.96	24.84	23.54	19.53	17.14	16.48	25.13	29.22	27.44	25.03	27.09	30.74
Median Water	24.54	0.4%	26.36	24.68	24.66	20.47	18.85	18.89	24.56	27.78	26.90	24.47	26.44	30.28
Out-of-the-Box	24.51	0.3%	27.82	26.75	24.96	20.96	15.52	15.84	25.36	28.69	27.84	26.98	27.66	25.75
Closed System - Median Water	24.54	0.4%	26.36	24.69	24.66	20.47	18.85	18.89	24.57	27.77	26.89	24.47	26.44	30.28
Closed System - 80-Yr. Water	24.45	0.0%	26.96	24.84	23.54	19.53	17.13	16.48	25.13	29.22	27.45	25.04	27.09	30.74
Closed System - Backcast	20.94	-14.3%	29.60	18.72	12.65	10.04	11.63	8.66	25.48	34.93	25.78	23.93	23.10	26.07

Generation Levels (GWh)

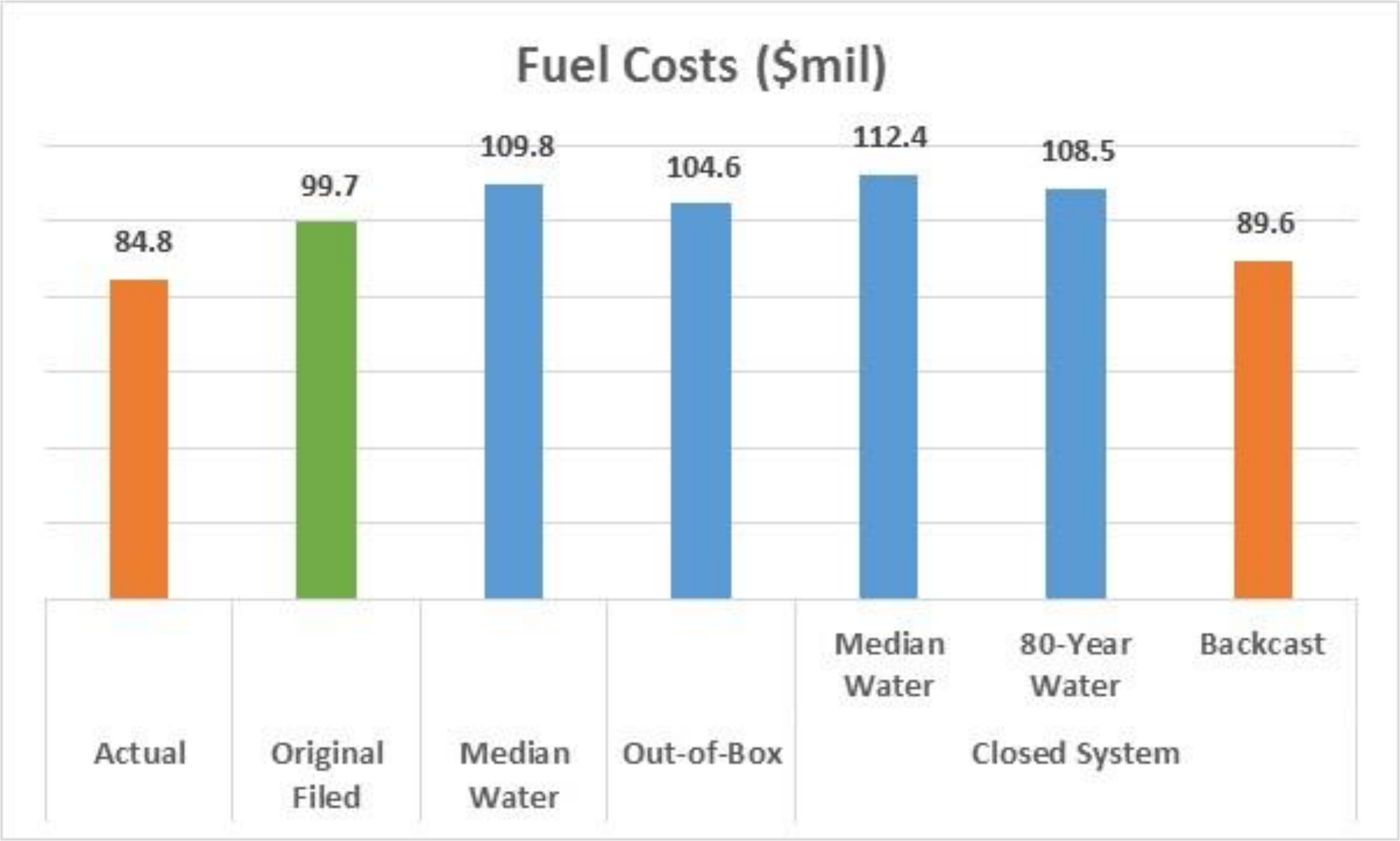




Generation Levels (GWh)

	Actual	Original Filed	Median Water	Out-of-Box	Closed System Median Water	Closed System 80-Year Water	Closed System Backcast
Generation (GWh)							
Company Hydro	3,978	3,877	3,808	3,877	3,808	3,877	3,978
Mid C Hydro	952	940	935	940	935	962	949
Total Hydro	**4,930**	**4,817**	**4,743**	**4,817**	**4,743**	**4,839**	**4,926**
Delta From Filed Case	**2.4%**		**-1.5%**	**0.0%**	**-1.5%**	**0.5%**	**2.3%**
Colstrip	1,423	1,582	1,634	1,567	1,614	1,553	1,439
Kettle Falls	290	291	299	313	276	258	268
Coyote Springs 2	1,659	1,798	2,141	2,012	2,148	1,943	1,592
Lancaster	1,327	1,606	1,909	1,811	1,984	1,757	1,375
Boulder Park	27	31	22	14	16	25	25
Rathdrum	72	59	10	8	40	155	146
Kettle Falls CT	5	10	4	3	14	23	19
Northeast	0	4	-	0	0	25	26
Total Thermal	**4,803**	**5,380**	**6,018**	**5,728**	**6,093**	**5,738**	**4,890**
Delta From Filed Case	**-10.7%**		**11.9%**	**6.5%**	**13.2%**	**6.7%**	**-9.1%**
Total Generation	**9,734**	**10,197**	**10,761**	**10,545**	**10,835**	**10,577**	**9,817**
Delta From Filed Case	**-4.5%**		**5.5%**	**3.4%**	**6.3%**	**3.7%**	**-3.7%**

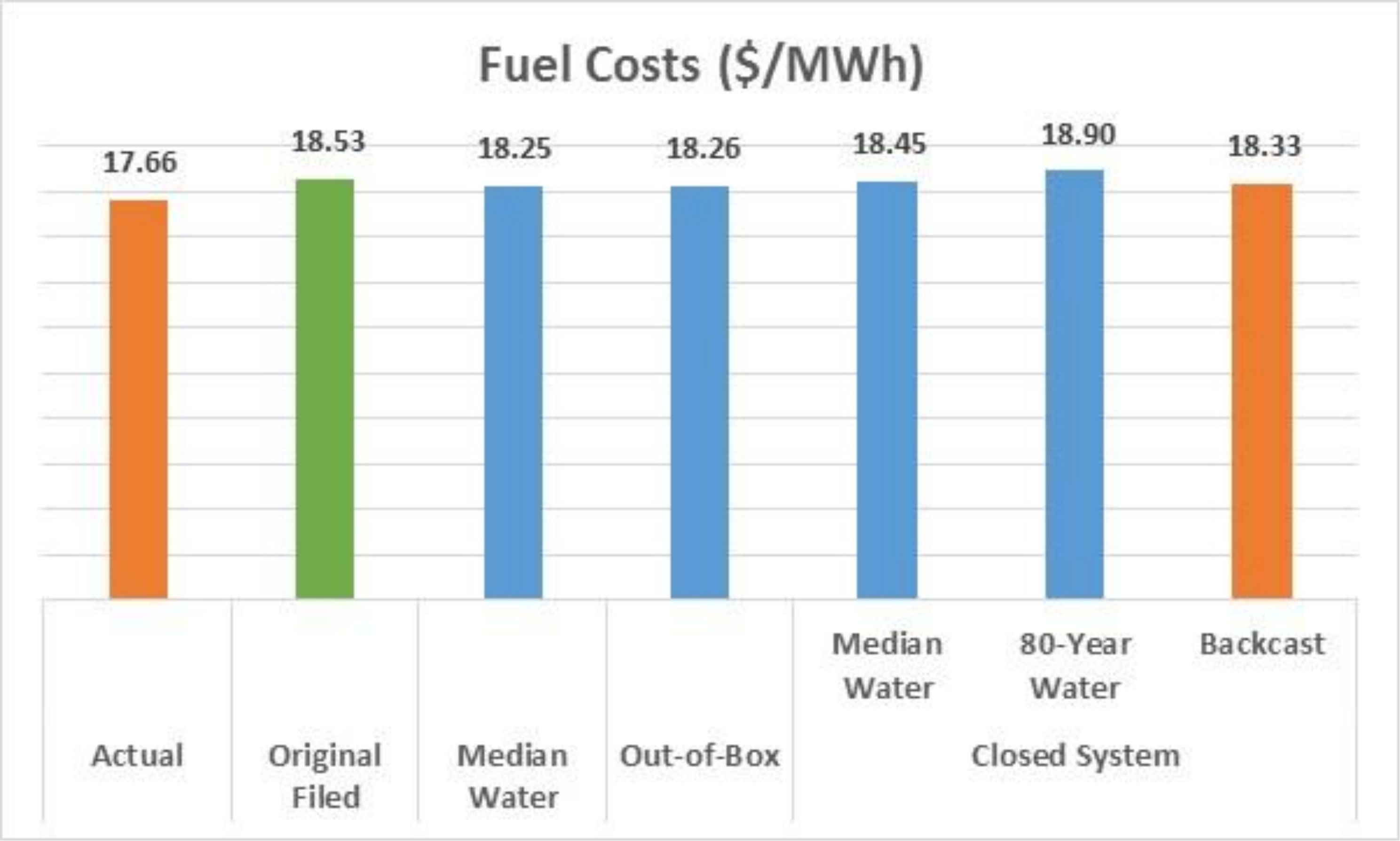
Marginal Fuel Costs ($millions)



Fuel Costs ($millions)

	Actual	Original Filed	Median Water	Out-of-Box	Closed System Median Water	Closed System 80-Year Water	Closed System Backcast
Fuel Costs ($millions)							
Company Hydro	-	-	-	-	-	-	-
Mid C Hydro	-	-	-	-	-	-	-
Colstrip	20.2	23.5	23.9	23.4	24.0	23.4	20.9
Kettle Falls	5.9	5.5	5.6	5.8	5.2	4.8	5.1
Coyote Springs 2	30.5	35.1	41.3	38.7	41.6	37.7	30.2
Lancaster	25.1	32.4	38.0	35.9	39.6	35.1	26.8
Boulder Park	0.7	0.8	0.6	0.4	0.4	0.7	0.6
Rathdrum	2.3	2.0	0.3	0.3	1.3	5.2	4.7
Kettle Falls CT	0.2	0.2	0.1	0.1	0.4	0.6	0.5
Northeast	0.0	0.1	-	0.0	0.0	0.9	0.9
Total Thermal	**84.8**	**99.7**	**109.8**	**104.6**	**112.4**	**108.5**	**89.6**
Delta From Filed Case	**-14.9%**		**10.2%**	**4.9%**	**12.8%**	**8.8%**	**-10.1%**

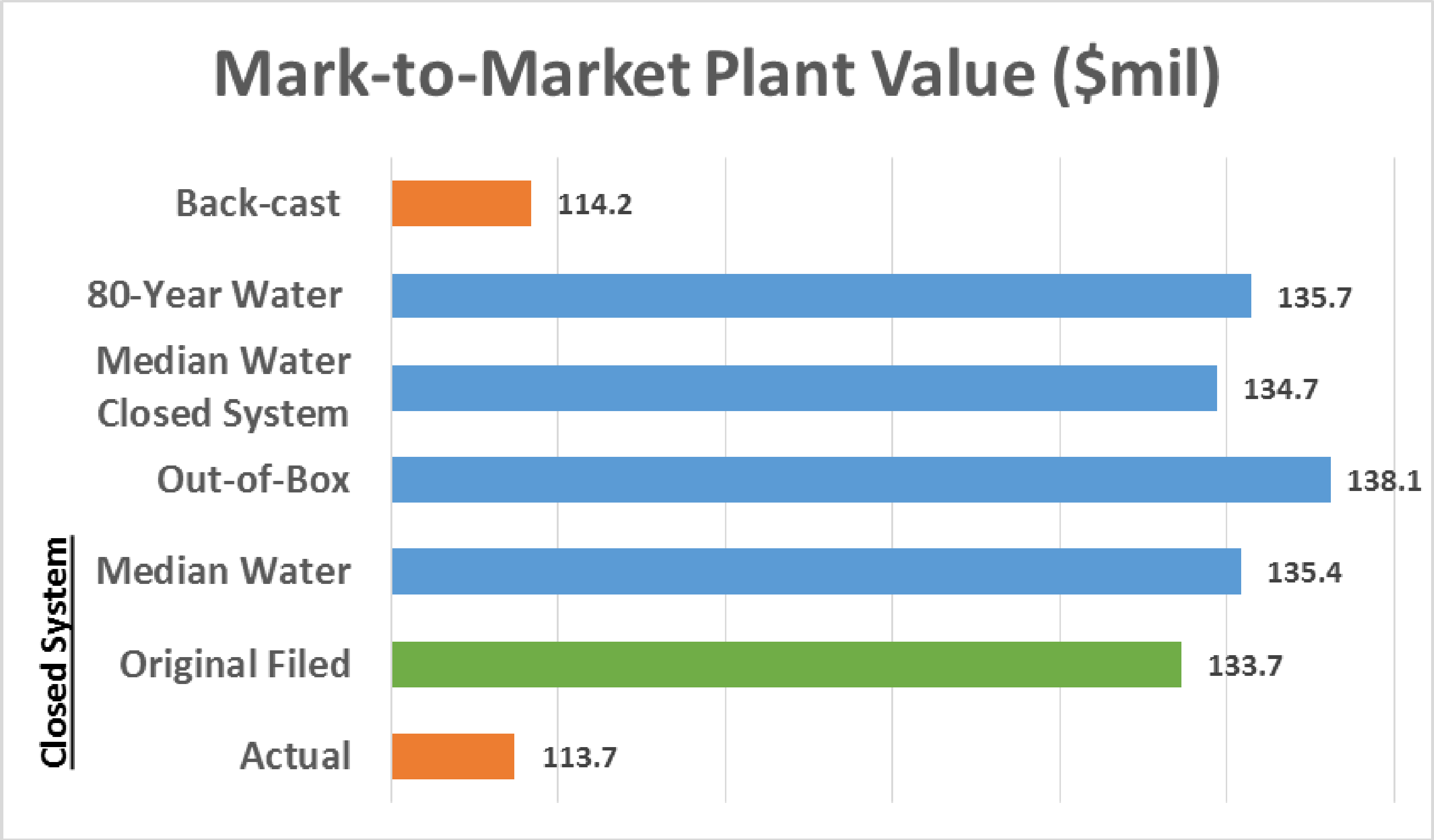
Fuel Costs ($/MWh)



Fuel Costs ($/MWh)

	Actual	Original Filed	Median Water	Out-of-Box	Closed System Median Water	Closed System 80-Year Water	Closed System Backcast
Fuel Cost ($/MWh)							
Company Hydro	-	-	-	-	-	-	-
Mid C Hydro	-	-	-	-	-	-	-
Colstrip	14.21	14.86	14.65	14.91	14.85	15.10	14.51
Kettle Falls	20.22	18.80	18.76	18.65	18.75	18.76	18.97
Coyote Springs 2	18.39	19.53	19.29	19.25	19.38	19.41	18.96
Lancaster	18.89	20.18	19.90	19.85	19.94	19.99	19.48
Boulder Park	26.28	26.18	26.24	25.93	26.23	26.19	25.33
Rathdrum	31.64	34.20	33.62	33.74	32.86	33.57	31.91
Kettle Falls CT	33.02	25.29	25.41	24.61	25.49	25.37	24.74
Northeast	30.67	37.09	#DIV/0!	36.25	36.55	37.03	34.88
Total Thermal	**17.66**	**18.53**	**18.25**	**18.26**	**18.45**	**18.90**	**18.33**
Delta From Filed Case	**-4.7%**		**-1.5%**	**-1.5%**	**-0.4%**	**2.0%**	**-1.1%**

Mark-To-Market (Operating Margin)



Mark-To-Market (Operating Margin, $mil)

Resource	Actual	% Total	Original Filed	% Total	Median Water	% Total	Out-of-Box	% Total	Closed System Median Water	% Total	Closed System 80-Year Water	% Total	Closed System Back-cast	% Total
Clark Fork River	57.8	50.8%	64.6	48.3%	65.4	48.3%	64.3	46.6%	65.5	48.6%	64.6	47.6%	55.2	48.3%
Spokane River	20.3	17.8%	25.2	18.8%	26.3	19.4%	25.5	18.5%	26.2	19.5%	25.2	18.5%	20.3	17.8%
Mid-Columbia	(3.4)	-3.0%	(1.2)	-0.9%	(0.6)	-0.4%	(1.0)	-0.7%	(0.6)	-0.4%	(0.7)	-0.5%	(4.2)	-3.7%
Coyote Springs 2	13.3	11.7%	13.9	10.4%	14.1	10.4%	15.9	11.5%	13.9	10.3%	15.2	11.2%	13.1	11.5%
Lancaster	10.3	9.1%	10.8	8.1%	10.9	8.0%	13.0	9.4%	10.8	8.0%	12.0	8.8%	10.2	8.9%
Colstrip	14.2	12.5%	17.1	12.8%	16.8	12.4%	17.5	12.7%	16.5	12.3%	16.8	12.4%	15.9	14.0%
BP, Rath, NE	1.3	1.2%	0.8	0.6%	0.3	0.2%	0.2	0.2%	0.2	0.2%	0.3	0.2%	1.7	1.5%
Kettle Falls (CT/GS)	(0.0)	0.0%	2.5	1.9%	2.3	1.7%	2.6	1.9%	2.1	1.6%	2.4	1.7%	2.0	1.7%
Total	**113.7**		**133.7**		**135.4**		**138.1**		**134.7**		**135.7**		**114.2**	
Delta from Filed Case	-14.9%		0.0%		1.3%		3.3%		0.8%		1.6%		-14.6%	

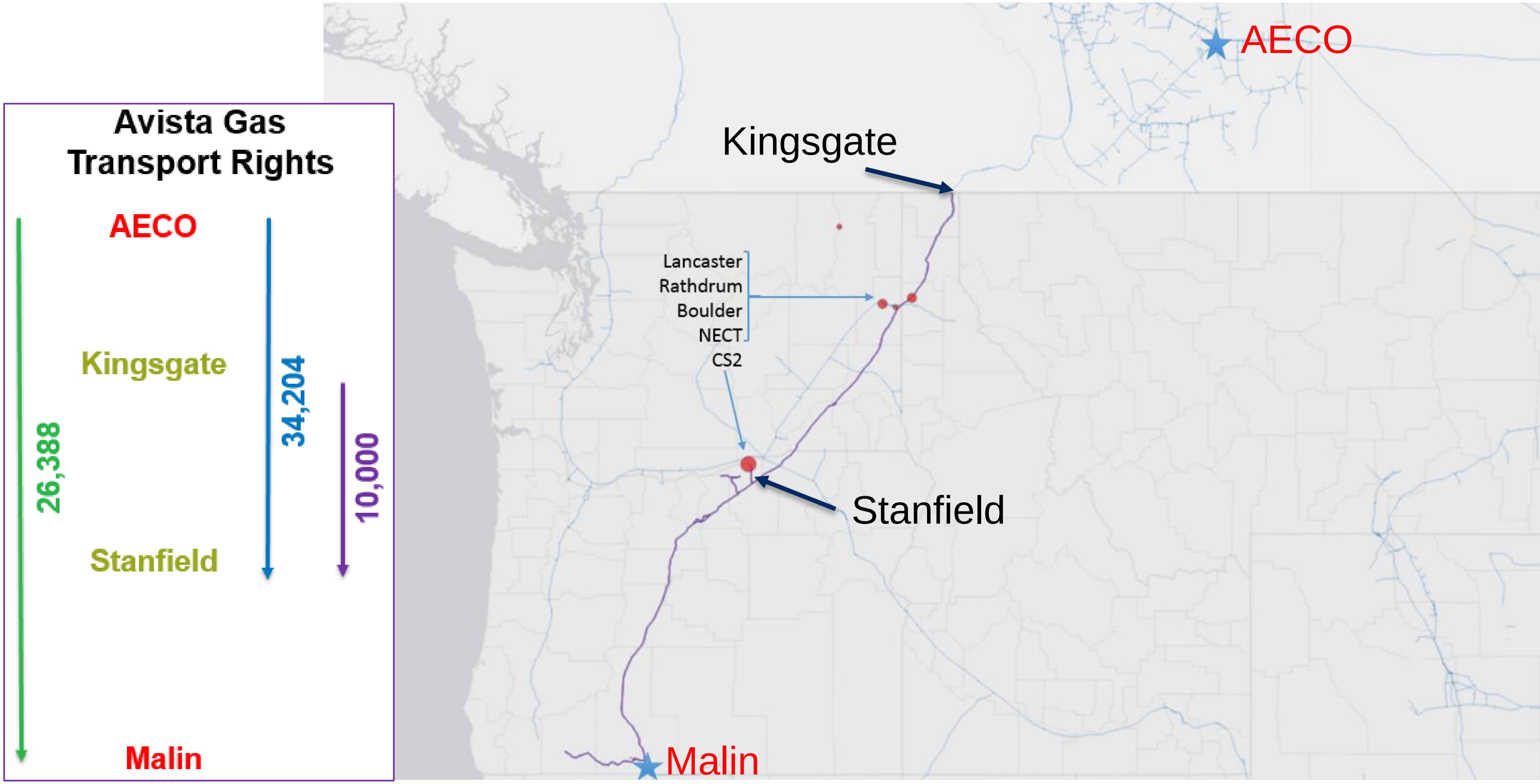
80-Year Averaging For Input Prices

This spreadsheet illustrates how Avista ensures that it's 80-year run for ratemaking ties up to the forward electricity prices. First the concept is to match the forward markets as closely as we can. By this we mean match the 24 periods of the 12-month proforma (12 months, on-peak, and off-peak price in each month). To do this comparision we take the 80-year average of all hourly prices for each period of forward curve (e.g., January on-peak prices) and compare it to that forward curve value. So for January you have 80 years of prices to average into the two periods. To the extent that prices in a run differ significantly from the forwards, we make adjustments to input variables to move prices toward forwards. A simple example is below showing the math if a month was comprised of only one day and I didn't show all modeled years. The actual math from the 2016 filing is provided in the three orange-colored sheets. The on- and off-peak pricing values used in the comparsion are graphed, but also highlighted for reference. In actual case filings we have the AURORA software do the averageing and report out monthly on- and off-peak prices for each water year. We then average these values up to arrive at the 80-year average. This means in our filed cases that we provide a spreadsheet like this one, but instead of averaging up from hourly data we average up the monthly data. But for illustration purposes this spreadsheet also ("see AURORA 80-Year Hourly Output") contains the averaging methodology starting from hourly AURORA output prices. The final tab is the Aurora vendor's own backcast of 2017 adjusting the market after the fact to account for actual fuel prices, loads, outages, etc.

EXAMPLE AVERAGING CALCULATION

		AURORA ESTIMATED PRICES							
Period	**On-Peak?**	**1929**	**1930**	**1931**	**1932**	**...**	**2008**	**Average**	
On-Peak Average		21.63	20.63	22.63	33.94	...	43.25	28.41	this value compared to forward on-peak price
Off-Peak Average		14.25	13.25	15.25	22.88	...	28.50	18.83	this value compared to forward off-peak price
1	0	10	9	11	16.5	...	20	13.3	
2	0	11	10	12	18	...	22	14.6	
3	0	12	11	13	19.5	...	24	15.9	
4	0	13	12	14	21	...	26	17.2	
5	0	14	13	15	22.5	...	28	18.5	
6	0	15	14	16	24	...	30	19.8	
7	1	16	15	17	25.5	...	32	21.1	
8	1	17	16	18	27	...	34	22.4	
9	1	18	17	19	28.5	...	36	23.7	
10	1	19	18	20	30	...	38	25	
11	1	20	19	21	31.5	...	40	26.3	
12	1	21	20	22	33	...	42	27.6	
13	1	22	21	23	34.5	...	44	28.9	
14	1	23	22	24	36	...	46	30.2	
15	1	24	23	25	37.5	...	48	31.5	
16	1	25	24	26	39	...	50	32.8	
17	1	26	25	27	40.5	...	52	34.1	
18	1	25	24	26	39	...	50	32.8	
19	1	24	23	25	37.5	...	48	31.5	
20	1	23	22	24	36	...	46	30.2	
21	1	22	21	23	34.5	...	44	28.9	
22	1	21	20	22	33	...	42	27.6	
23	0	20	19	21	31.5	...	40	26.3	
24	0	19	18	20	30	...	38	25	

Gas Transportation Geography/Rights

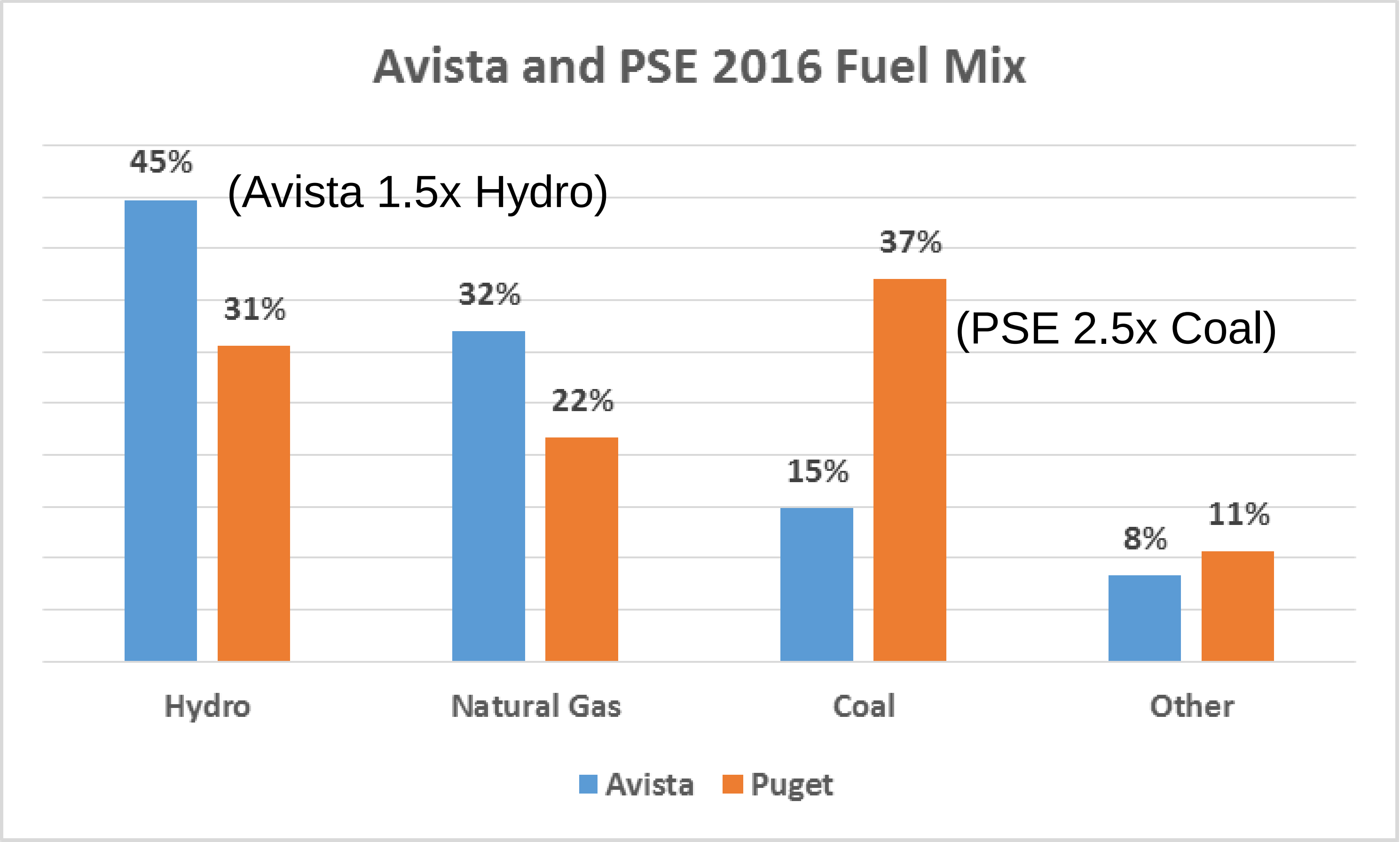


Gas Transport Optimization

- Avista has firm contract rights for its gas plants
  - 60,590 dth/day for $12.9 million
    - 26,388 dth/day AECO to Malin
    - 34,204 dth/day AECO to Stanfield
  - Post-filing GTN rate case lowered cost to $11 million
- Proformed Case (~$9 million system)
  - Executed and open volume positions
  - Open positions valued at forward spreads between AECO and Malin
    - Very volatile year to year, so modeled 5-year average of spreads, adjusted higher in the case because 5-year average was below forward price delta

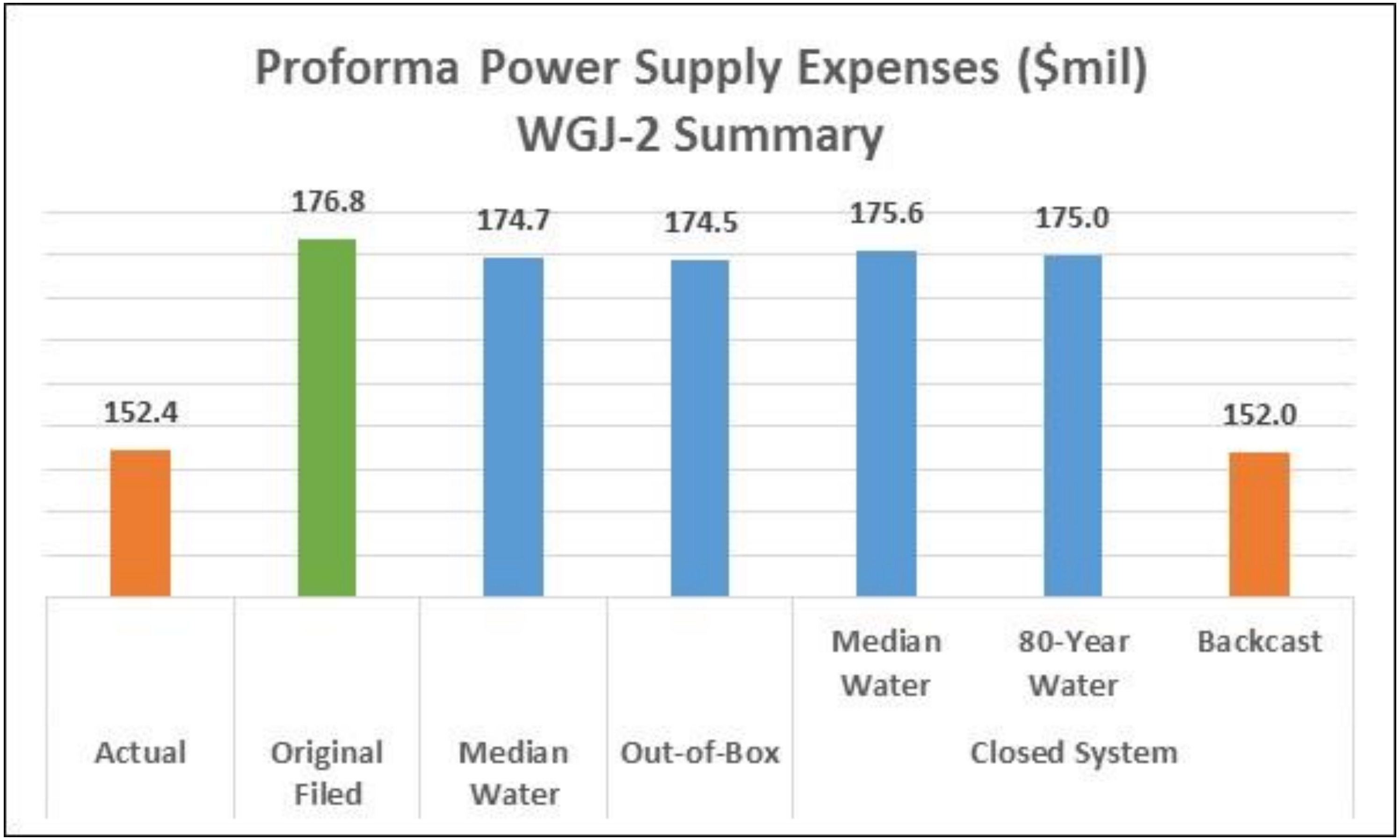
PSE Has Less Volatile Resources

Substantially Less Hydro/More Coal



PSE wholesale net power revenues (FERC 555/447) varied from mean by almost 50% more than Avista from 2003-2017

Power Supply Costs (Exh. WGJ-2)



Summary and Conclusions

- Various methods arrive at similar power cost estimates
- Some methods are easier to run/audit than others
  - PSE (out-of-the-box Aurora) and PacifiCorp (input prices) are much simpler to implement/audit than the Avista method but arrive at similar results
  - At least we can simplify the process
- Near-perfect backcast possible with existing model
  - Do we have agreement here, or are more analyses needed?
- Analyses illustrate prices and hydro drive variation
- But, we can't predict prices/hydro….so what next?

Avista Recommendation

- Closed system, modified (PAC method)
  - Use Aurora model
  - Full hydro record (80 years available now, 90 soon)
  - Input electricity and natural gas prices shaped to forwards
  - Proforma costs equal the average of the individual hydro years
  - No dispatch margin for thermal plants
- Model all power contract costs and energy inside Aurora
- Mark-to-Market gas positions against forward prices
  - Gas purchased for power plants
  - All remaining gas transportation open positions

Recommendation, Cont.

- Continue using 5-year historical averages for long-term contracts, hydro shaping, forced outages, maintenance
  - except Colstrip where we continue to use average of two maintenance cycles (currently two 3-year cycles)

- Prior to rates going into effect, should we rerun Aurora?
  - latest forward prices for electricity and natural gas
  - known contract changes (power and fuel)
  - latest pricing information should lessen proforma-to-actuals delta

Benefits of Recommendation

- Much simpler to understand
  - less need to audit non-Avista data
- Much easier to operate
- Runs fast
- Recognizes impact of hydro variability
- Recognizes impact of oversupply
- Aurora values Avista power contracts
- Updates would allow recent information in rate setting
  - should reduce delta between proforma and actuals

Thank You.

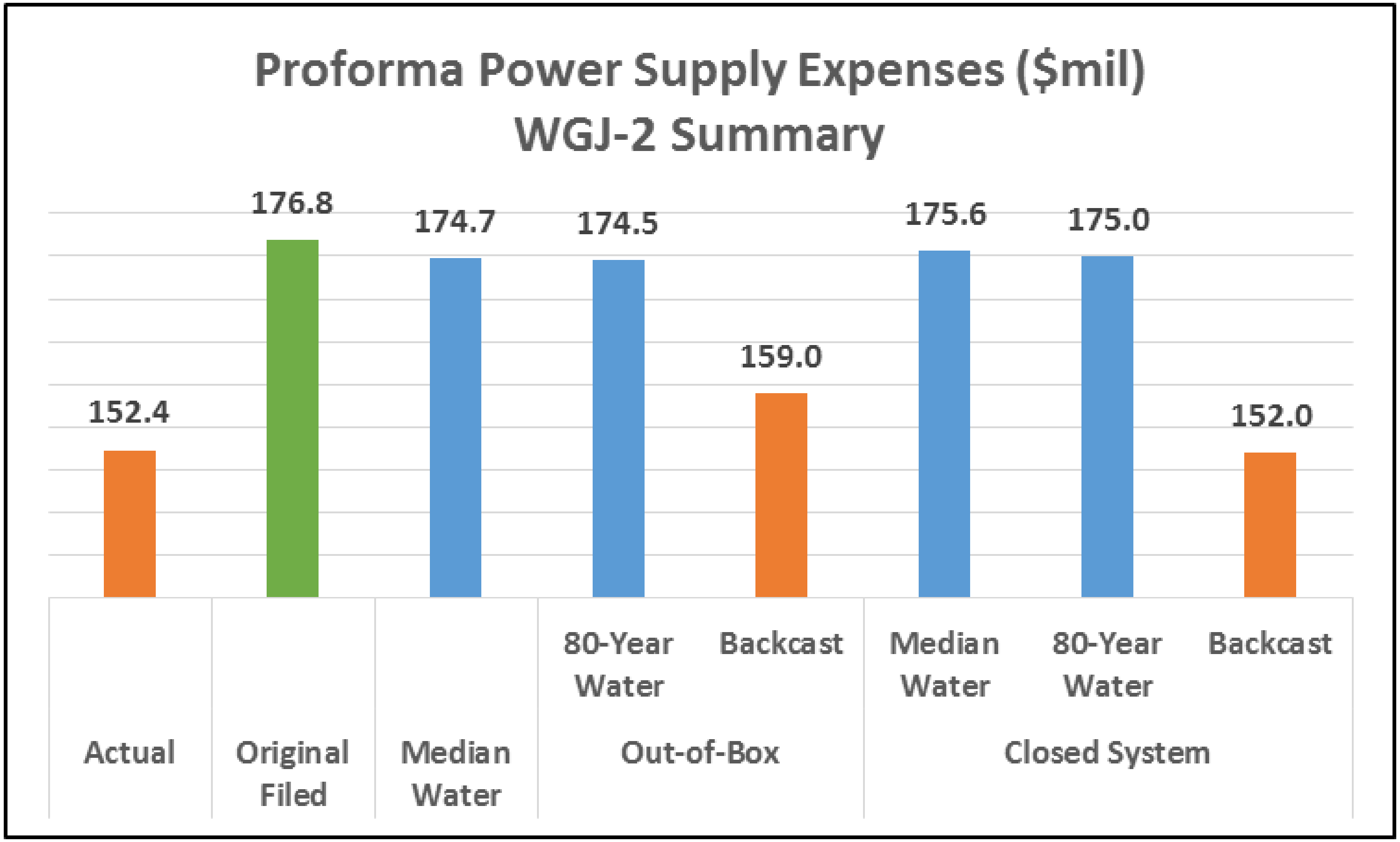
Power Supply Modeling Workshop 4

March 4, 2019

Agenda

Introductions	10:00 – 10:05
Review of Last Meeting/Questions	10:05 – 10:15
Power Trading Overview	10:15 – 12:00
Lunch	12:00 – 1:30
Additional Modeling Results	1:30 – 2:00
Proposed Out-of-the-Box Method	2:00 – 3:00
Other Topic Areas	3:00 – 3:45
Wrap-Up/Adjourn	3:45 – 4:00

Power Supply Costs (Exh. WGJ-2)



Power Supply Costs (Exh. WGJ-2)

Line No.	Item	Actual	Original Filed	Median Water	Out-of-Box 80-Year Water	Out-of-Box Backcast	Closed System Median Water	Closed System 80-Year Water	Closed System Backcast
		$000s	$000s	$000s	$000s	$000s	$000s	$000s	$000s
	555 PURCHASED POWER	130,675	109,783	105,158	105,974	100,465	105,370	106,726	100,241
	447 SALES FOR RESALE	-88,779	-57,504	-65,134	-60,896	-65,873	-67,086	-65,078	-58,162
	557 OTHER EXPENSES	61,870	407	407	407	407	407	407	407
	456 OTHER ELECTRIC REVENUE	-67,200	0	0	0	0	0	0	0
	501 THERMAL FUEL EXPENSE	26,289	29,225	29,791	29,444	31,261	29,376	28,532	26,199
	547 OTHER FUEL EXPENSE	69,528	76,583	86,152	81,247	74,431	89,161	86,052	65,017
	565 TRANSMISSION OF ELECTRICITY BY OTHERS	17,569	17,766	17,766	17,766	17,766	17,766	17,766	17,766
	536 WATER FOR POWER	997	1,029	1,029	1,029	1,029	1,029	1,029	1,029
	453 SALES OF WATER AND WATER POWER	-418	-466	-466	-466	-466	-466	-466	-466
	WNP-3 CONTRACT MID-POINT VS. ACTUAL	1,820	N/A	N/A	N/A	N/A	N/A	N/A	N/A
74	**TOTAL NET EXPENSE**	152,351	176,824	174,703	174,504	159,020	175,556	174,968	152,032
	Delta From Filed Case	-13.8%	0.0%	-1.2%	-1.3%	-10.1%	-0.7%	-1.0%	-14.0%

Market Prices Summary

	Average	Delta	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
Malin Gas Price ($/dth)														
Actual	2.736		3.294	2.649	2.590	2.790	2.842	2.630	2.662	2.681	2.680	2.610	2.748	2.640
Original Filed	2.799	2.3%	2.937	2.939	2.885	2.599	2.592	2.636	2.725	2.755	2.761	2.769	2.914	3.083
Mid-C Electricity 7x24 Prices ($/MWh)														
Actual	20.95	-14.3%	29.60	18.72	12.65	10.04	11.63	8.66	25.48	34.93	25.78	23.93	23.10	26.07
Original Filed	24.44	0.0%	26.96	24.84	23.54	19.53	17.14	16.48	25.13	29.22	27.44	25.03	27.09	30.74
Median Water	24.54	0.4%	26.36	24.68	24.66	20.47	18.85	18.89	24.56	27.78	26.90	24.47	26.44	30.28
Out-of-the-Box - 80-Yr. Water	24.51	0.3%	27.82	26.75	24.96	20.96	15.52	15.84	25.36	28.69	27.84	26.98	27.66	25.75
Out-of-the-Box - Backcast	24.14	-1.2%	29.50	25.32	23.40	21.62	15.98	15.08	24.56	28.32	27.40	25.87	26.52	26.16
Closed System - Median Water	24.54	0.4%	26.36	24.69	24.66	20.47	18.85	18.89	24.57	27.77	26.89	24.47	26.44	30.28
Closed System - 80-Yr. Water	24.45	0.0%	26.96	24.84	23.54	19.53	17.13	16.48	25.13	29.22	27.45	25.04	27.09	30.74
Closed System - Backcast	20.94	-14.3%	29.60	18.72	12.65	10.04	11.63	8.66	25.48	34.93	25.78	23.93	23.10	26.07

Out-Of-Box Strawman 1

- Use Aurora model
- Monthly natural gas prices by basin from 90-day forwards
- Full 80-year hydro record
  - for Avista and regional hydro resources
- Random draws of wind months based on available history
  - for Avista and regional (based on BPA database) wind resources
- 5-year averages of:
  - maintenance, except Colstrip use 6 years
    - Colstrip has 3-year maintenance cycle
  - forced outages
  - hydro shaping
  - long-term contract deliveries

Out-Of-Box Strawman 2

- Avista resource/contract assumptions from position report
  - heat rates, capacities, variable O&M
- Mark-to-market forward gas and power financial (hedging) transactions
  - forward power contracts
  - forward natural gas contracts
  - gas pipeline transportation deals
  - remaining “open” gas transportation contracts
- Model physical power contract costs and deliveries in Aurora
- Model regional oversupply conditions
  - negative variable O&M for wind/solar/hydro

Out-Of-Box Strawman 3

- Update and rerun model before final rates go into place
  - latest forward prices for natural gas
  - latest known contract changes (power, wood and coal fuel)
  - should lessen proforma-to-actuals delta
- Proforma costs equal the average of the individual hydro years

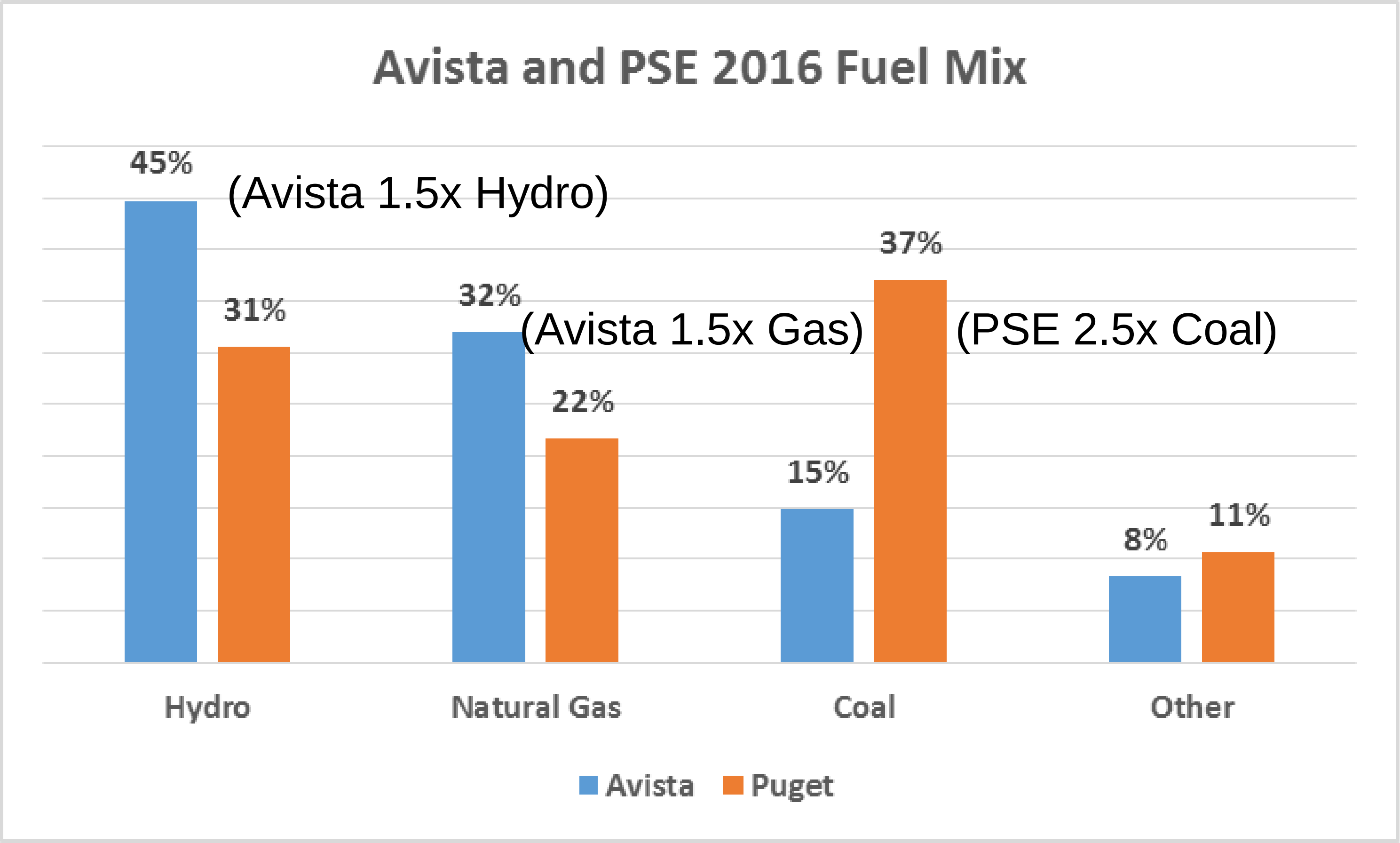
Out-Of-Box Questions

- Potential concerns with other aspects of the model as it comes out of the box to consider (i.e., default settings)
  - 5.0% resource dispatch margin
  - traditional vs optimization commitment
  - EPIS non-Avista resource assumptions
    - ramp rates, minimum down time, maintenance schedules, etc.
    - $500/MWh minimum generation back down penalty
    - 2900% fixed non-commitment penalty
    - “fuel adders” for gas plants, lack of Washington State natural gas tax
  - “phantom” transmission
  - topology

Other Topic Areas

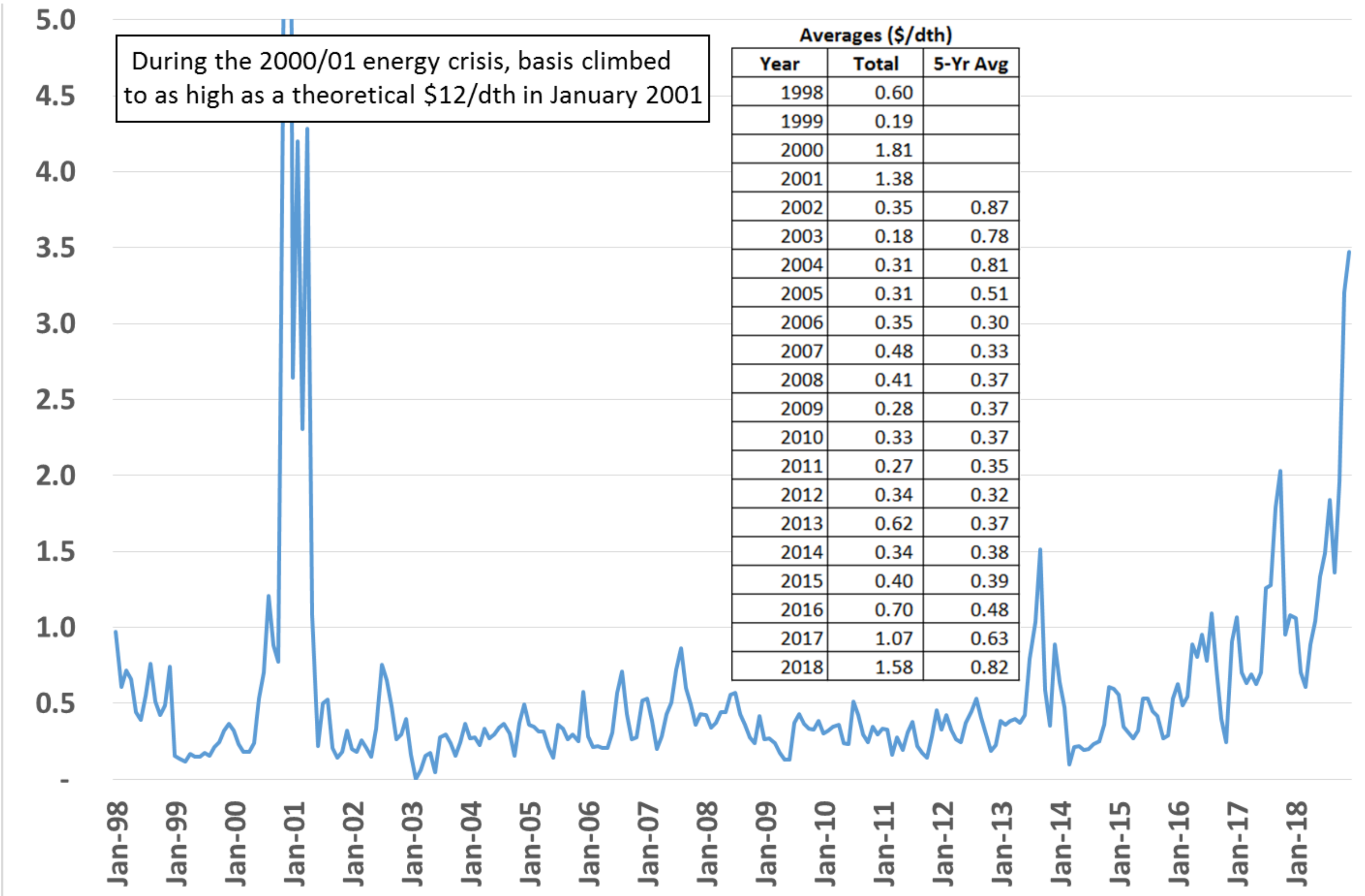
PSE Has Less Volatile Resources

Substantially Less Hydro/More Coal



PSE wholesale net power revenues (FERC 555/447) varied from mean by almost 50% more than Avista from 2003-2017

AECO to Malin Basis History ($/dth)

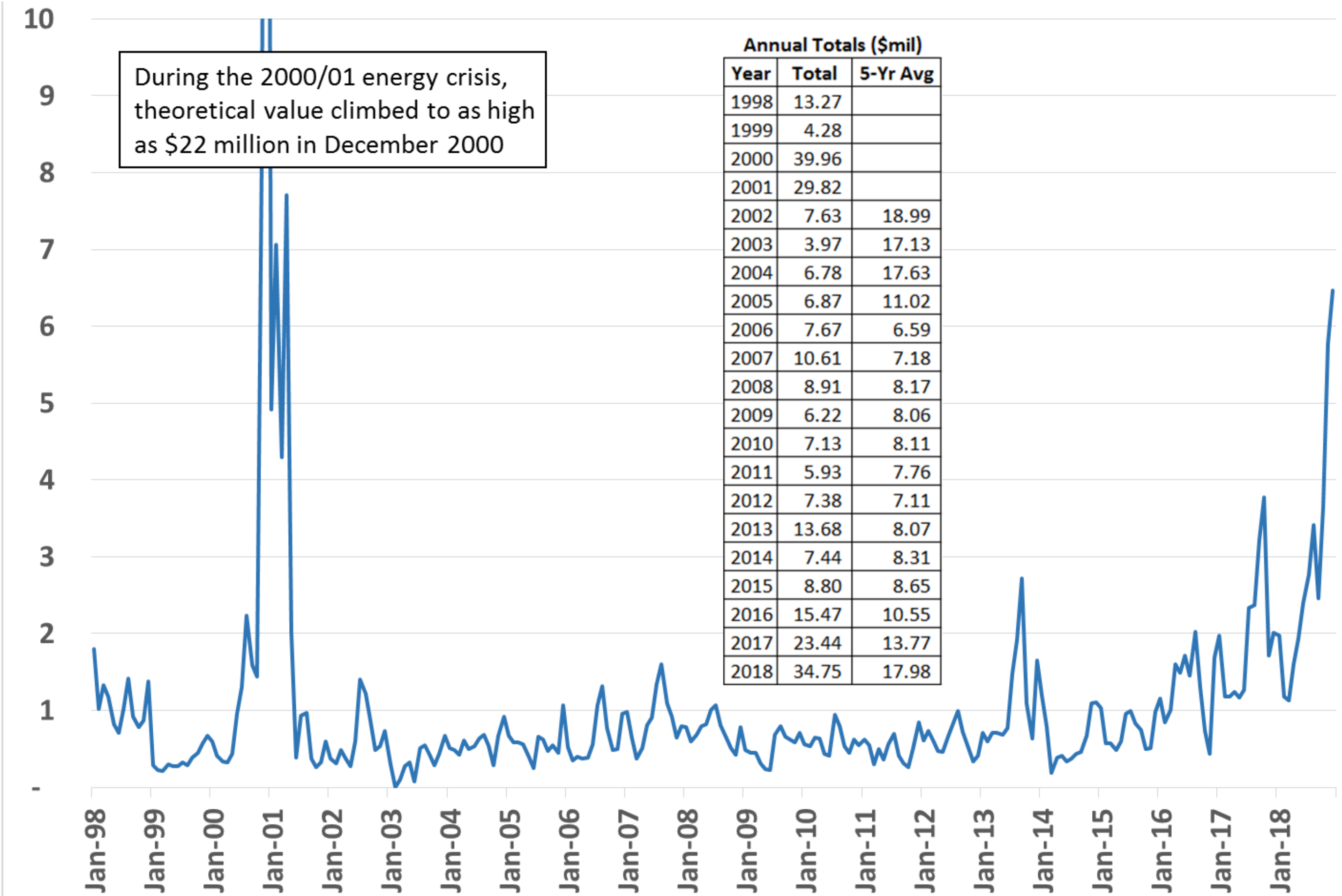


Averages ($/dth)

Year	Total	5-Yr Avg
1998	0.60	
1999	0.19	
2000	1.81	
2001	1.38	
2002	0.35	0.87
2003	0.18	0.78
2004	0.31	0.81
2005	0.31	0.51
2006	0.35	0.30
2007	0.48	0.33
2008	0.41	0.37
2009	0.28	0.37
2010	0.33	0.37
2011	0.27	0.35
2012	0.34	0.32
2013	0.62	0.37
2014	0.34	0.38
2015	0.40	0.39
2016	0.70	0.48
2017	1.07	0.63
2018	1.58	0.82

AECO to Malin Spot Market Basis Value

60,000 dth ($millions)

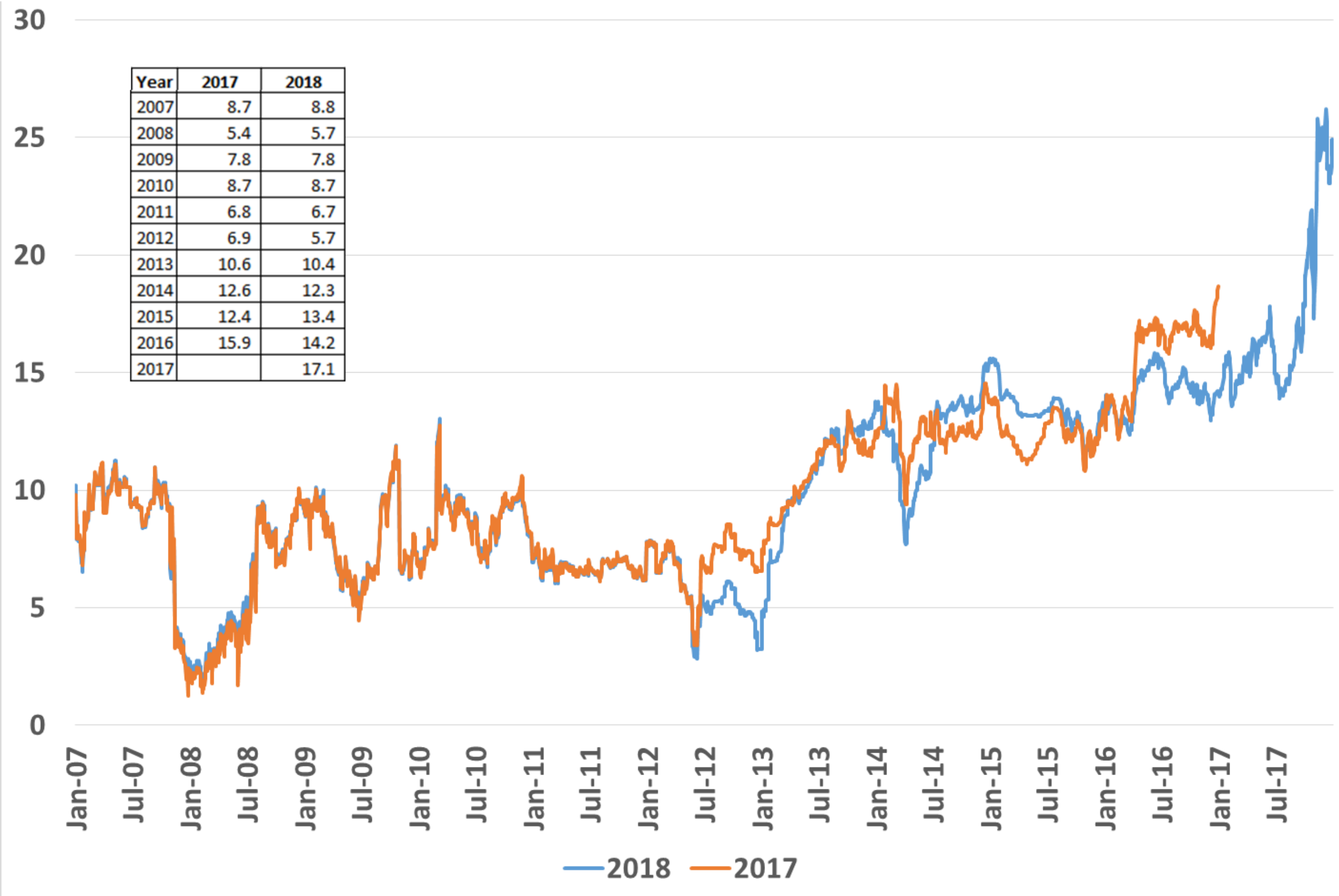


Annual Totals ($mil)

Year	Total	5-Yr Avg
1998	13.27	
1999	4.28	
2000	39.96	
2001	29.82	
2002	7.63	18.99
2003	3.97	17.13
2004	6.78	17.63
2005	6.87	11.02
2006	7.67	6.59
2007	10.61	7.18
2008	8.91	8.17
2009	6.22	8.06
2010	7.13	8.11
2011	5.93	7.76
2012	7.38	7.11
2013	13.68	8.07
2014	7.44	8.31
2015	8.80	8.65
2016	15.47	10.55
2017	23.44	13.77
2018	34.75	17.98

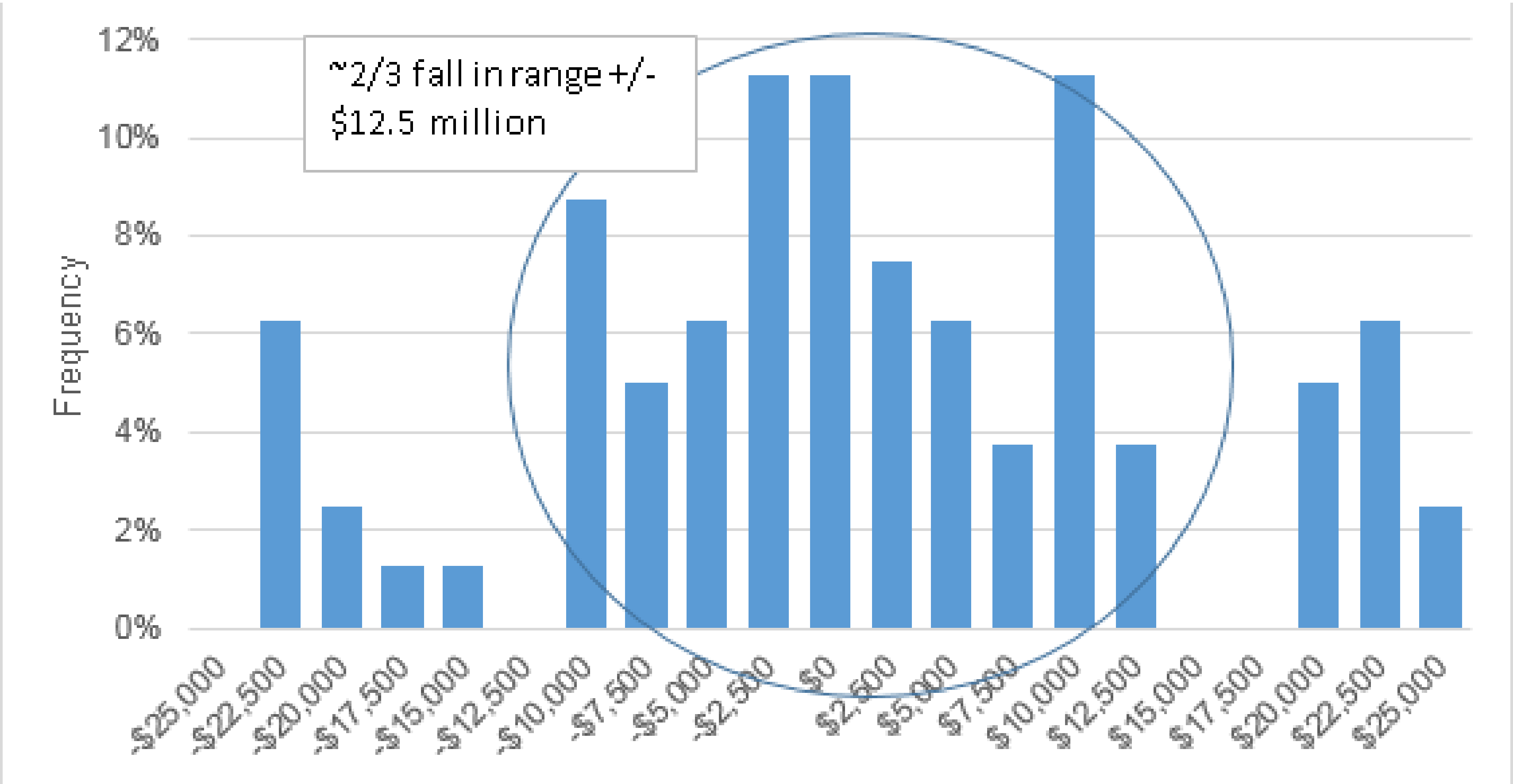
Forward Contract Transportation Value

2017 and 2018 ($millions)



Year	2017	2018
2007	8.7	8.8
2008	5.4	5.7
2009	7.8	7.8
2010	8.7	8.7
2011	6.8	6.7
2012	6.9	5.7
2013	10.6	10.4
2014	12.6	12.3
2015	12.4	13.4
2016	15.9	14.2
2017		17.1

Hydro Variability



ERM Driver Learnings ("The Bias")

- Significant: gas/power price changes (rising prices = higher costs)
  - 2003-09 ~ higher power costs (ERM surcharges)
  - 2010-18 ~ lower power costs (ERM rebates)
  - plant margins (value of thermal plants "converting" their fuel to electricity, aka the "spark spread")
- Significant: AECO to Malin transport spread
  - larger spread = lower costs
  - ~$9.4 million included in authorized for 2018
  - ~$13.5 million benefit in 2017 (+$4.1 million)
  - ~$20.5 million benefit in 2018 (+$11.1 million)
- Hydro variability
- Power model (lower impact)
- Bias drivers significantly outside of Avista control

Thank You.

Commission Power Trading Overview

March 4, 2019

Avista's Power Supply Organization

Time Horizon

1 to 30 Years >

Power Resource Planning

- Integrated Resource Plan
- Rate Cases
- System Modeling

Structured Contracts

- Long-Term Power Contracts (Mid-C)
- PPAs / PURPA / Ancillary Services
- Environmental Attributes
- Transmission Contracts

1 Month to 3 Years >

Power & Fuel Hedging

- Portfolio Hedging
- Heat rate Hedging
- Transport Hedging

1 to 3 Days >

Power Day Ahead Scheduling

- Day Ahead Resource Dispatch Plan
- Day Ahead Purch. & Sales for Balancing
- Day Ahead Power Scheduling

Gas for Thermals Day Ahead Scheduling

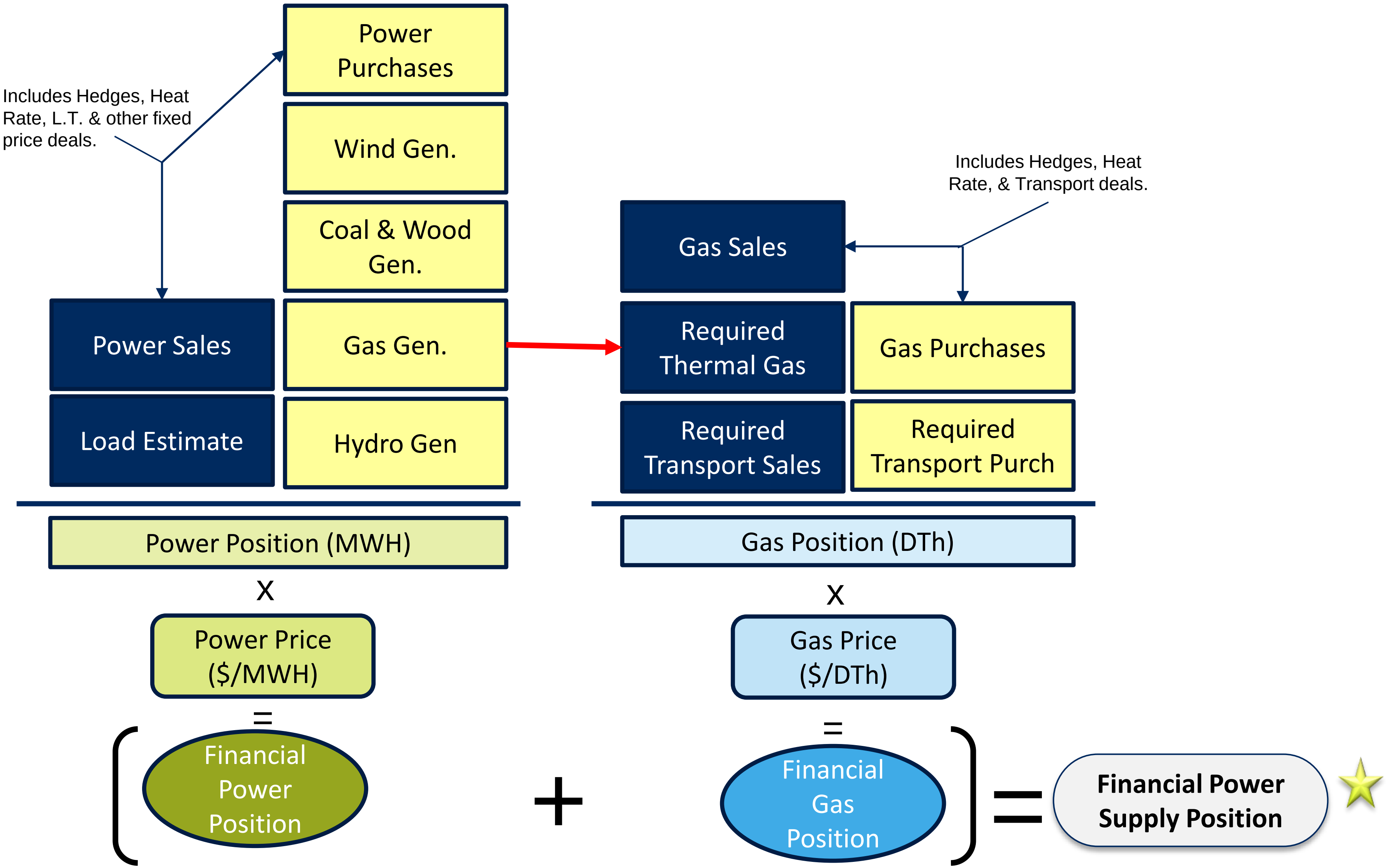
- Day Ahead Purch. & Sales for Thermal
- Day Ahead Gas Scheduling

1 to 24 Hours >

Power Real-Time Scheduling

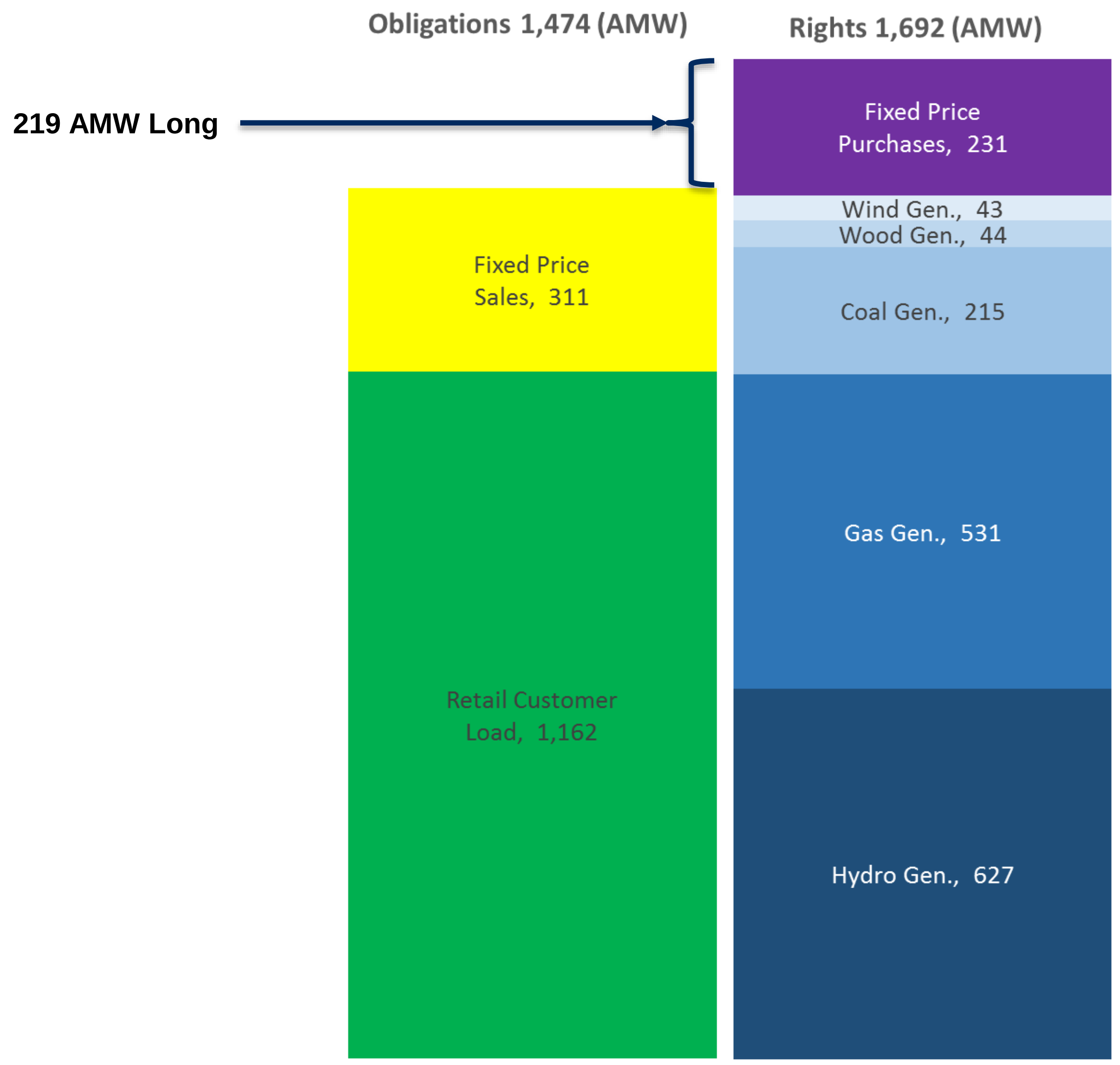
- Hourly Resource Dispatch
- Hourly Purch. & Sales for Balancing
- Hourly Scheduling

Power Supply Forward Position Methodology



Power Physical Position Example Month

Exh. CGK-2



Power Supply Volumetric Heavy Load Power Position Report

	Power Obligations (in AMW's)					Power Rights (in AMW's)							
Month	Native Load	Fixed Price Sales	Swap Sales	Reserves Req.	Forced Outage	Fixed Price Purch.	Swap Purch.	Coal Gen.	Wood Gen.	Wind Gen.	Hydro Gen.	Gas Gen.	Net Position
	HL	HL	HL	HL	HL	HL	HL	HL	HL	HL	HL	HL	**HL**
Mar-18	1,131	68	350	-	28	102	275	215	42	43	703	531	**334**
Apr-18	1,035	57	450	-	20	82	225	202	42	40	962	-	**(10)**
May-18	989	57	450	24	5	39	200	58	-	32	1,122	-	**(73)**
Jun-18	1,033	53	475	24	20	41	200	202	27	27	1,123	-	**15**
Jul-18	1,132	52	300	-	36	31	100	215	41	20	865	650	**403**
Aug-18	1,106	50	275	-	36	29	100	215	44	23	438	649	**31**
Sep-18	993	60	275	-	36	25	100	215	44	29	352	663	**64**
Oct-18	927	62	175	-	29	29	200	215	44	34	447	579	**355**
Nov-18	997	50	175	-	29	113	200	215	44	48	525	586	**481**
Dec-18	1,151	53	175	-	33	114	200	215	44	53	621	625	**460**
Jan-19	1,147	54	250	-	29	118	150	215	44	49	611	600	**308**
Feb-19	1,229	51	250	-	29	121	150	215	44	43	601	590	**206**
Mar-19	1,134	61	250	-	28	81	150	215	44	43	627	531	**219**
Apr-19	1,034	55	250	-	19	85	150	202	13	40	884	-	**15**
May-19	996	54	250	6	16	43	150	108	7	32	1,108	509	**634**
Jun-19	1,037	51	250	24	23	45	150	169	24	27	1,144	555	**728**
Jul-19	1,137	49	250	-	36	37	150	215	44	20	744	649	**387**
Aug-19	1,111	48	250	-	36	37	150	215	44	23	422	648	**94**
Sep-19	998	58	250	-	36	34	150	215	44	29	351	663	**144**
Oct-19	923	58	250	-	29	37	150	215	44	34	447	579	**246**
Nov-19	969	48	250	-	29	33	150	215	44	48	524	586	**305**
Dec-19	1,142	52	250	-	29	33	150	215	44	53	625	600	**248**
Jan-20	1,137	52	100	-	37	20	-	215	44	49	619	706	**328**
Feb-20	1,226	50	100	-	29	23	-	215	44	43	609	596	**126**

Gas Positions Example Month

Gas required for long term gas transport contracts that have value moving gas from a low cost market to a high cost market

Fuel requirements of Gas Plants that are economic to run based on today's prices for the forward period

Transactions executed so far to hedge transport contracts and natural gas themal plants

Net Gas Position

Transport Economic Requirements (in Dth/Day)		Natural Plant Fuel Required (in Dth/Day)	Gas Purchases & (Sales) (in Dth/Day)			Gas Open Positions (in Dth/Day)	
AECO	Malin	Malin	AECO Purch. For Transport	Malin Sales for Transport	Malin Purch. For Plant Fuel	AECO	Malin
(60,592)	60,592	(49,034)	22,500	(22,500)	14,032	(38,092)	3,090

(60,592)
+
22,500

60,592
+
(49,034)
+
(22,500)
+
14,032

Power Supply Volumetric Gas Position Report

February 26, 2018												
	Gas Transport Requirements By Commodity (in Dth/Day)			Natural Gas Generation Requirements By Commodity (in Dth/Day)			Net Gas Purchases & Sales by Commodity (in Dth/Day)			Gas Positions (in Dth/Day)		
Month	AECO Basis	Malin Basis	Henry Hub NYMEX	AECO Basis	Malin Basis	Henry Hub NYMEX	AECO Basis	Malin Basis	Henry Hub NYMEX	AECO Basis	Malin Basis	Henry Hub NYMEX
Mar-18	(60,592)	60,592	-	-	(50,880)	(50,880)	37,500	(17,258)	20,242	(23,092)	(7,547)	(30,639)
Apr-18	(60,592)	60,592	-	-	-	-	52,500	(43,000)	9,417	(8,092)	17,592	9,417
May-18	(60,592)	60,592	-	-	-	-	52,500	(41,258)	11,242	(8,092)	19,334	11,242
Jun-18	(60,592)	60,592	-	-	-	-	52,500	(40,917)	11,500	(8,092)	19,675	11,500
Jul-18	(60,592)	60,592	-	-	(63,018)	(63,018)	52,500	(17,258)	35,242	(8,092)	(19,684)	(27,776)
Aug-18	(60,592)	60,592	-	-	(106,466)	(106,466)	52,500	(17,258)	35,242	(8,092)	(63,132)	(71,224)
Sep-18	(60,592)	60,592	-	-	(107,340)	(107,340)	52,500	(16,917)	35,500	(8,092)	(63,665)	(71,840)
Oct-18	(60,592)	60,592	-	-	(94,385)	(94,385)	47,500	(42,258)	5,242	(13,092)	(76,051)	(89,143)
Nov-18	(60,592)	60,592	-	-	(94,008)	(94,008)	32,500	(26,917)	5,500	(28,092)	(60,332)	(88,508)
Dec-18	(60,592)	60,592	-	-	(102,675)	(102,675)	32,500	(27,258)	5,242	(28,092)	(69,342)	(97,434)
Jan-19	(60,592)	60,592	-	-	(97,773)	(97,773)	22,500	(8,468)	14,032	(38,092)	(45,649)	(83,741)
Feb-19	(60,592)	60,592	-	-	(94,706)	(94,706)	22,500	(8,036)	14,464	(38,092)	(42,150)	(80,242)
Mar-19	(60,592)	60,592	-	-	(49,034)	(49,034)	22,500	(8,468)	14,032	(38,092)	3,090	(35,002)
Apr-19	(60,592)	60,592	-	-	-	-	17,500	(3,333)	14,167	(43,092)	57,259	14,167
May-19	(60,592)	60,592	-	-	(46,909)	(46,909)	17,500	(3,468)	14,032	(43,092)	10,215	(32,877)
Jun-19	(60,592)	60,592	-	-	(51,731)	(51,731)	17,500	(3,333)	14,167	(43,092)	5,528	(37,564)
Jul-19	(60,592)	60,592	-	-	(103,605)	(103,605)	17,500	(3,468)	14,032	(43,092)	(46,480)	(89,572)
Aug-19	(60,592)	60,592	-	-	(106,890)	(106,890)	17,500	(3,468)	14,032	(43,092)	(49,766)	(92,858)
Sep-19	(60,592)	60,592	-	-	(108,017)	(108,017)	17,500	(3,333)	14,167	(43,092)	(50,758)	(93,850)
Oct-19	(60,592)	60,592	-	-	(96,697)	(96,697)	17,500	(3,468)	14,032	(43,092)	(39,572)	(82,664)
Nov-19	(60,592)	60,592	-	-	(96,019)	(96,019)	2,500	11,667	14,167	(58,092)	(23,760)	(81,852)
Dec-19	(60,592)	60,592	-	-	(99,762)	(99,762)	2,500	11,532	14,032	(58,092)	(27,638)	(85,730)
Jan-20	(60,592)	60,592	-	-	(114,417)	(114,417)	2,500	10,000	12,500	(58,092)	(43,825)	(101,917)
Feb-20	(60,592)	60,592	-	-	(99,198)	(99,198)	2,500	10,000	12,500	(58,092)	(28,606)	(86,698)

AVISTA

Financial Position Example Month

POWER

	HL	LL
MWH/Hr	219	(339)
Hours	416	327
Prices	$18.65	$15.65
	$ 1,696,030	$ (1,734,008)
Total Power:		**$ (37,978)**

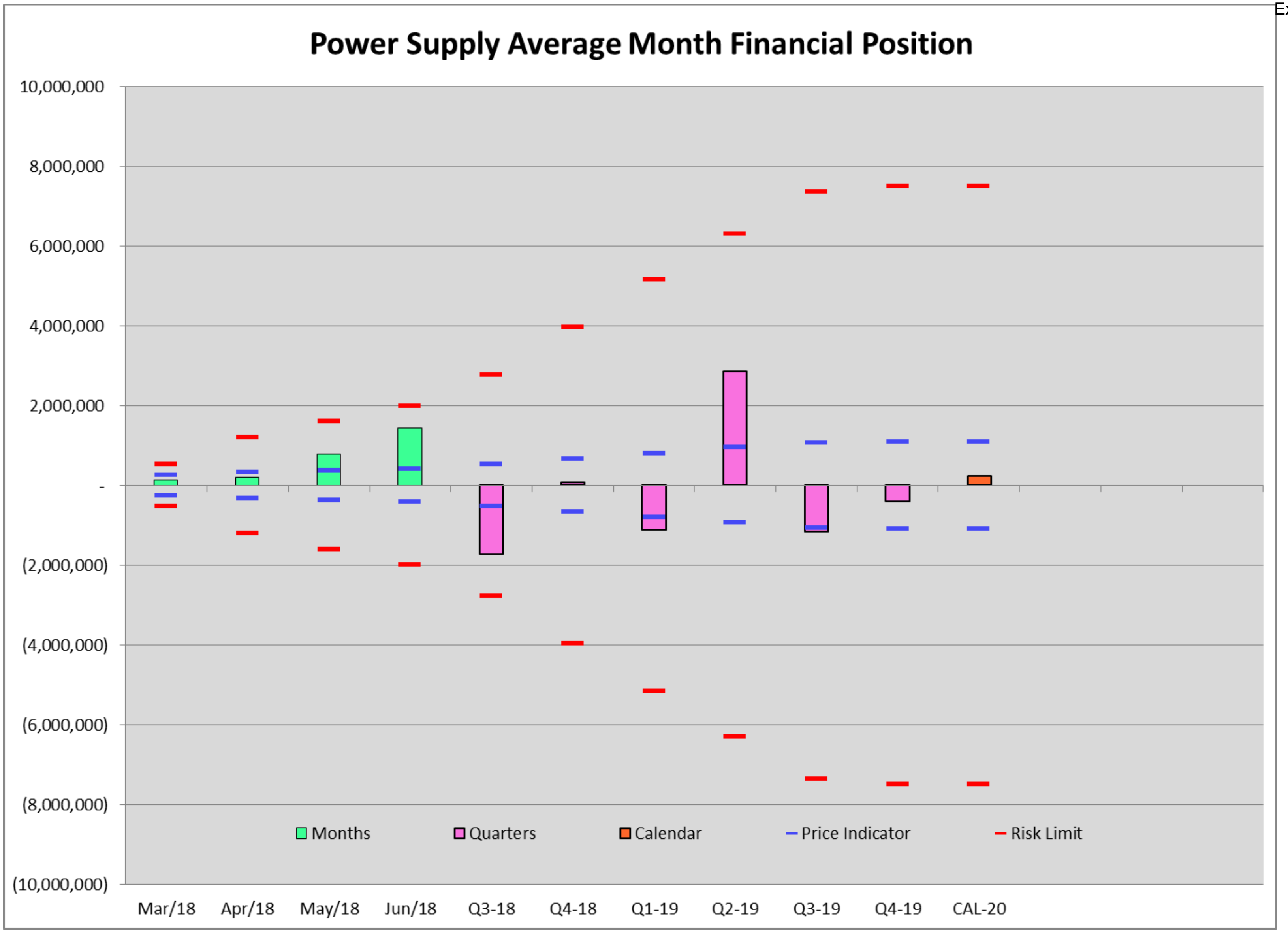
GAS

	AECO	MALIN	HENRY HUB
DTh/Day	(38,092)	3,090	(35,002)
Days	31	31	31
Prices	-$1.48	-$0.65	$2.94
	$ 1,750,613	$ (62,273)	$ (3,185,700)
		Total Gas:	**$ (1,497,360)**

Total Financial Position: **$ (1,535,338)**

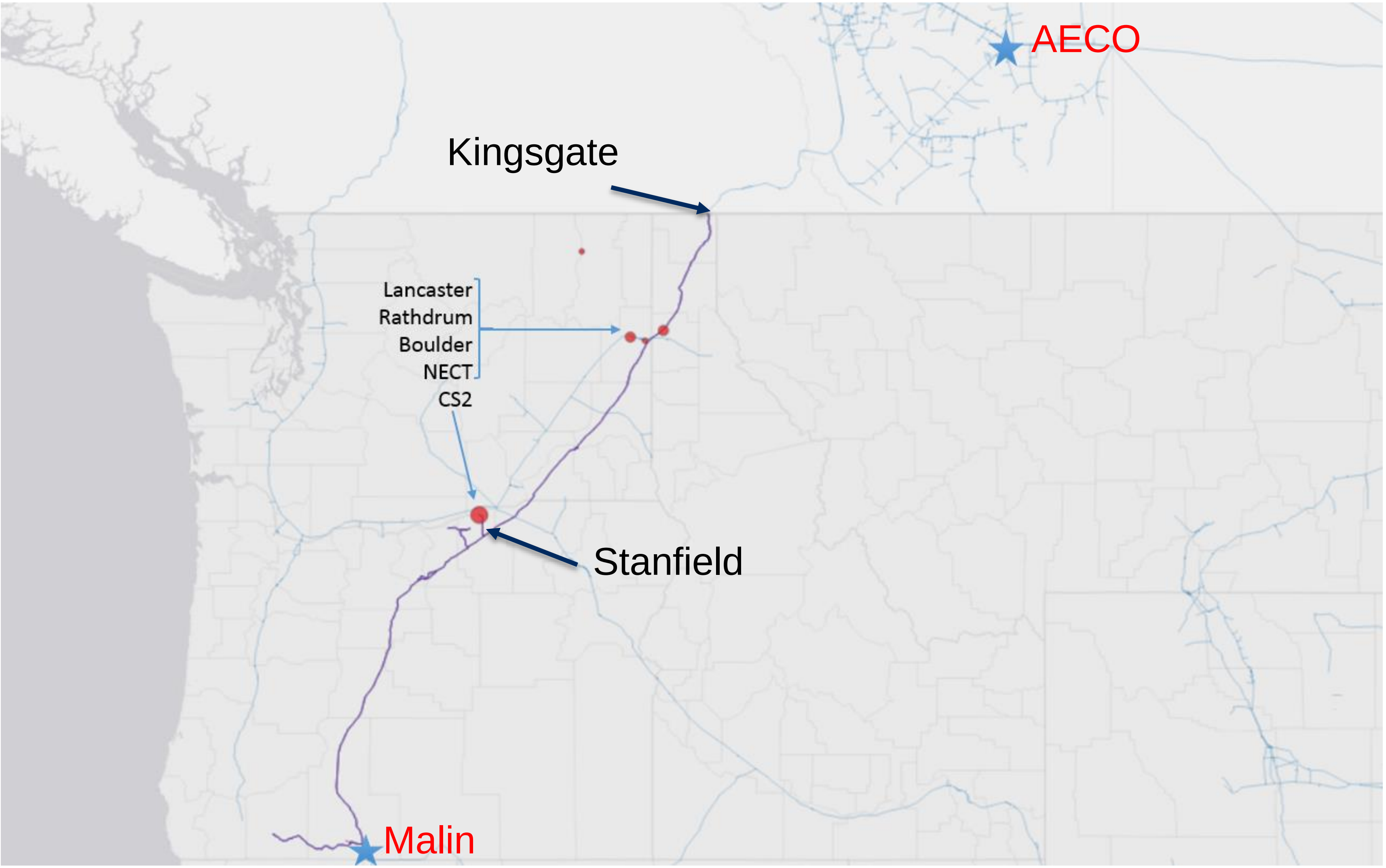
Power Supply Financial Position Report (in thousands)

PERIOD	MID-C HL	MID-C LL	AECO	MALIN	HENRY HUB	Total M2M
Mar-18	2,595	(1,072)	979	143	(2,507)	139
Apr-18	(55)	(633)	411	(288)	759	194
May-18	(376)	137	482	(394)	945	793
Jun-18	89	322	447	(367)	946	1,437
Jul-18	4,283	(1,282)	458	439	(2,396)	1,502
Aug-18	435	343	447	1,316	(6,173)	(3,632)
Sep-18	686	548	416	1,312	(5,994)	(3,032)
Oct-18	3,408	879	654	1,725	(7,727)	(1,061)
Nov-18	4,172	1,688	1,161	1,176	(7,551)	645
Dec-18	5,275	1,941	1,234	1,155	(8,965)	641
Jan-19	3,428	1,924	1,689	832	(7,923)	(50)
Feb-19	1,821	986	1,539	677	(6,794)	(1,772)
Mar-19	1,696	(1,734)	1,751	(62)	(3,186)	(1,535)
Apr-19	82	(670)	1,971	(1,456)	1,134	1,062
May-19	3,838	53	2,037	(231)	(2,693)	3,004
Jun-19	5,243	353	2,010	(99)	(3,009)	4,498
Jul-19	4,294	825	2,104	1,224	(7,506)	942
Aug-19	1,235	656	2,117	1,292	(7,804)	(2,504)
Sep-19	1,506	904	2,030	1,267	(7,602)	(1,895)
Oct-19	2,209	1,286	2,077	1,115	(6,988)	(300)
Nov-19	2,784	1,433	2,200	478	(6,826)	69
Dec-19	2,765	1,239	2,292	523	(7,760)	(942)
Jan-20	4,162	1,454	2,400	845	(9,602)	(741)
Feb-20	1,308	536	2,224	537	(7,583)	(2,977)

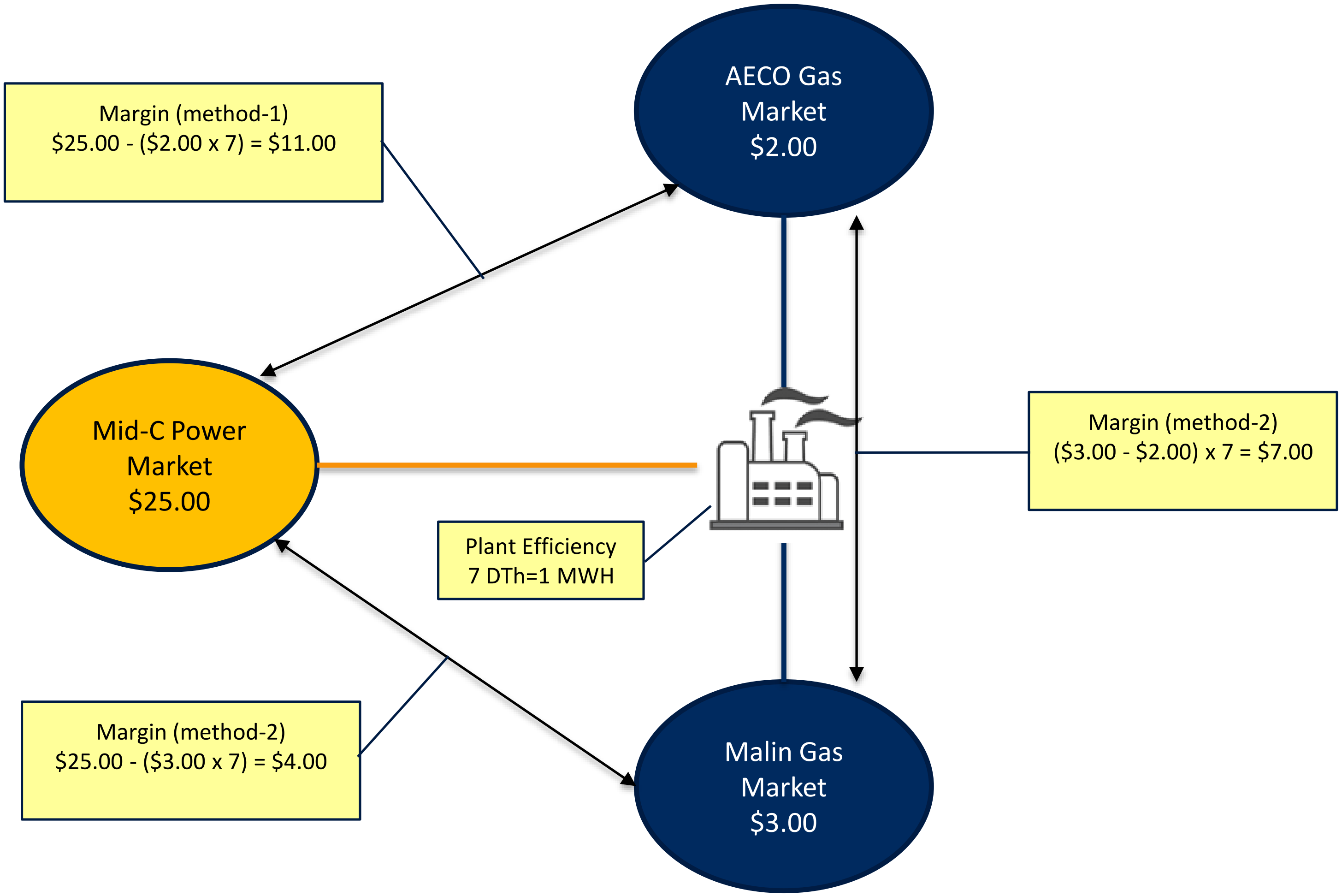


Power Supply Average Month Financial Position
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
-
(2,000,000)
(4,000,000)
(6,000,000)
(8,000,000)
(10,000,000)
Months
Quarters
Calendar
Price Indicator
Risk Limit
Mar/18
Apr/18
May/18
Jun/18
Q3-18
Q4-18
Q1-19
Q2-19
Q3-19
Q4-19
CAL-20

Power Supply Asset Geography



Thermal Asset Hedging Methodology



Method-1

1. Buy 7 DTH of AECO Gas @ $2.00
2. Sell 1 MWH of MID-C Power @ $25.00

Method-2

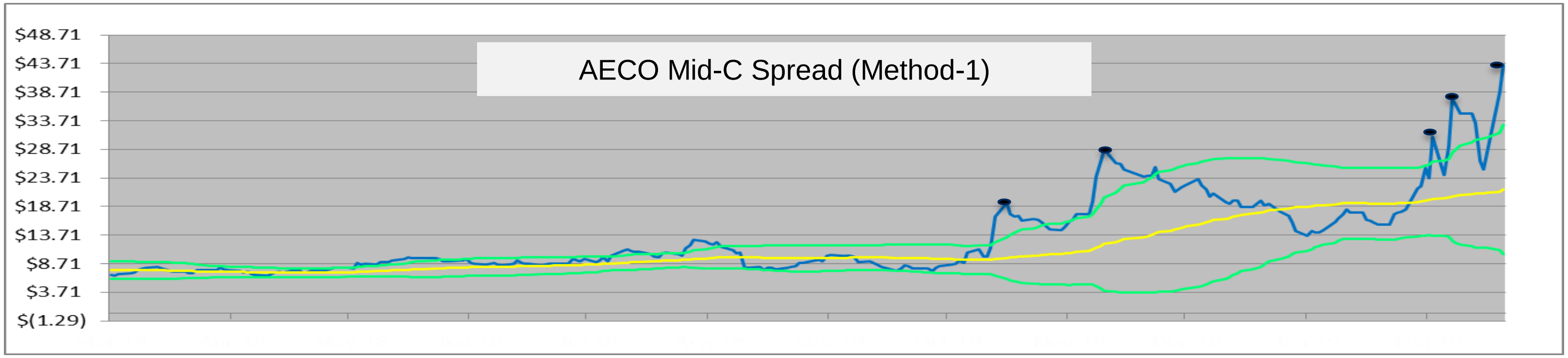
Buy 7 DTH of AECO Gas @ $2.00
~~Sell 7 DTH of Malin Gas @ $3.00~~

~~Buy 7 DTH of Malin Gas @ $3.00~~
Sell 1 MWH of MID-C Power @ $25.00

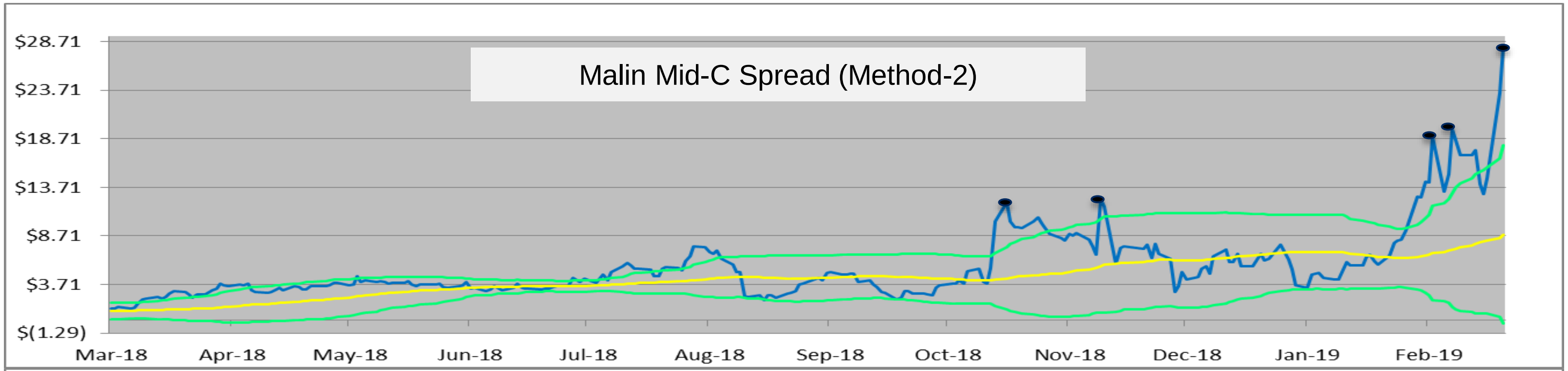
Example Trade Timing Comparison

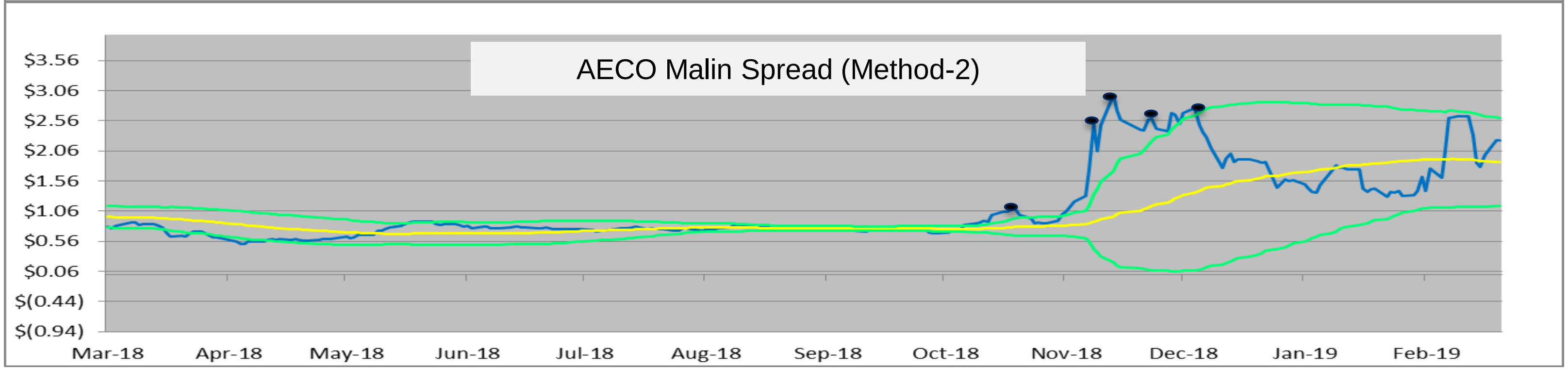
Exh. CGK-2

Method1



Method2





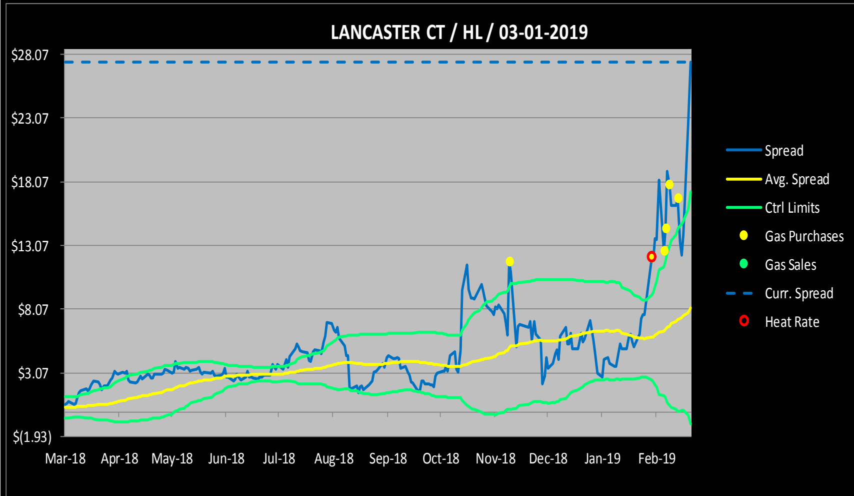
Example Trade Value Comparison

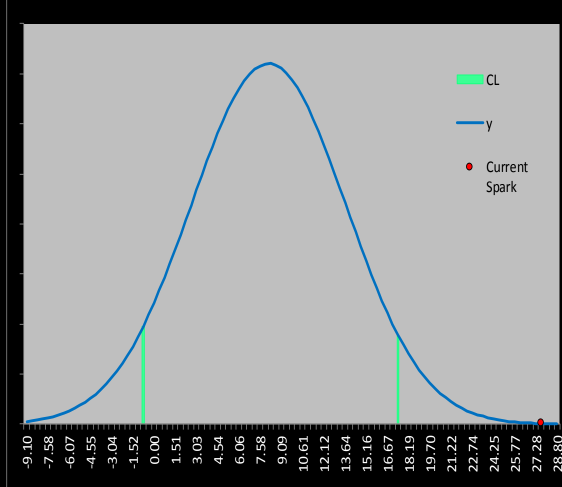
Method-1	Method-2	
AECO Mid-C Value	Malin Mid-C Value	AECO-Malin Value
19.88	12.18	7.7
32.64	11.71	17.36
30.96	18.9	20.93
36.49	18.61	17.01
43.54	28.28	18.83
	$89.68	**$81.83**
Good >> **$163.51**		Better! >> **$171.51**

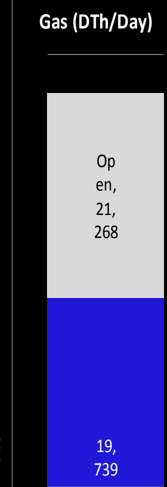
Heat Rate Dashboard

Exh. CGK-2

		Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Q2 19	Q3 19	Q4 19	Q1 20	Q2 20	Q3 20	Q4 20	Q1 21	Q2 21	Q3 21	Q4 21	Q1 22	CAL 20	CAL 21	CAL 22
SETTLE PRICES	MIDC-ON	65.16	56.75	28.25	19.25	26.25	51.15	68.75	40.15	30.15	29.55	40.50	41.40	24.58	53.35	33.40	34.75	22.20	46.63	33.60	36.65	26.78	55.55	38.12	36.80	34.30	39.28	39.47
	MIDC-OFF	56.00	47.00	22.00	11.80	10.90	25.75	36.35	29.25	24.60	24.30	32.70	31.75	14.90	30.45	27.20	27.38	11.98	26.07	27.72	26.67	16.57	35.17	29.45	27.48	23.29	26.96	27.74
	MALIN	4.57	3.91	2.60	2.33	2.38	2.65	2.66	2.64	2.51	2.71	2.89	2.95	2.43	2.65	2.71	2.86	2.03	2.16	2.31	2.49	1.94	2.05	2.23	2.42	2.34	2.18	2.14
YOUR PRICES	MIDC-ON																											
	MIDC-OFF																											
	MALIN																											
	AECO																											
HL SPARK	CS2 CT	32.23	28.28	8.75	1.59	8.24	31.29	48.76	20.35	11.24	9.30	19.22	19.74	6.19	33.47	13.25	13.66	6.67	30.18	16.17	18.01	11.85	39.80	21.21	18.61	16.67	22.72	23.16
	LANCASTER CT	31.40	27.50	8.11	1.00	7.58	30.55	48.02	19.66	10.58	8.63	18.31	18.83	5.56	32.75	12.51	12.78	5.94	29.40	15.41	17.21	11.14	39.04	20.44	17.79	15.88	21.95	22.38
	CS2 DB	27.32	24.33	6.73	-0.01	6.56	29.23	46.69	18.29	9.33	7.09	16.53	17.01	4.43	31.40	10.98	11.09	5.40	28.75	14.47	16.06	10.77	38.58	19.66	16.79	14.93	21.27	21.79
	LANCASTER DB	26.16	23.03	5.16	-1.64	4.94	27.67	45.13	16.72	7.74	5.54	15.01	15.47	2.82	29.84	9.43	9.53	3.67	27.05	12.80	14.40	8.99	36.82	17.94	15.08	13.26	19.54	20.02
	BOULDER	17.42	15.05	-1.31	-7.79	-1.27	21.15	38.59	10.21	1.38	-1.05	8.21	8.64	-3.46	23.32	2.84	2.80	-2.10	21.13	6.70	8.13	3.36	31.06	11.97	8.93	7.13	13.63	14.19
	RATHDRUM	11.83	10.71	-2.79	-8.78	-2.52	19.12	36.50	8.36	0.05	-2.58	6.46	6.81	-4.70	21.33	1.30	1.03	-2.37	20.36	6.06	7.18	3.32	30.57	11.51	8.14	6.24	13.13	13.78
LL SPARK	CS2 CT	23.07	18.53	2.50	-5.86	-7.11	5.89	16.36	9.45	5.69	4.05	11.42	10.09	-3.49	10.57	7.05	6.30	-3.55	9.61	10.28	8.02	1.63	19.42	12.54	9.29	5.66	10.41	11.43
	LANCASTER CT	22.24	17.75	1.86	-6.45	-7.77	5.15	15.62	8.76	5.03	3.38	10.51	9.18	-4.12	9.85	6.31	5.41	-4.27	8.83	9.52	7.22	0.92	18.66	11.78	8.48	4.87	9.64	10.64
	CS2 DB	18.16	14.58	0.48	-7.46	-8.79	3.83	14.29	7.39	3.78	1.84	8.73	7.36	-5.26	8.50	4.78	3.72	-4.82	8.18	8.59	6.08	0.55	18.20	11.00	7.48	3.92	8.96	10.06
	LANCASTER DB	17.00	13.28	-1.09	-9.09	-10.41	2.27	12.73	5.82	2.19	0.29	7.21	5.82	-6.87	6.94	3.23	2.17	-6.54	6.48	6.92	4.42	-1.23	16.44	9.28	5.77	2.26	7.23	8.29
	BOULDER	8.26	5.30	-7.56	-15.24	-16.62	-4.25	6.19	-0.69	-4.17	-6.30	0.41	-1.01	-13.14	0.42	-3.36	-4.56	-12.32	0.56	0.82	-1.85	-6.86	10.68	3.31	-0.39	-3.88	1.32	2.46
	RATHDRUM	2.67	0.96	-9.04	-16.23	-17.87	-6.28	4.10	-2.54	-5.50	-7.83	-1.34	-2.84	-14.38	-1.57	-4.90	-6.34	-12.59	-0.21	0.17	-2.80	-6.90	10.19	2.85	-1.18	-4.76	0.82	2.05
SPREAD	HL - LL	9.16	9.75	6.25	7.45	15.35	25.40	32.40	10.90	5.55	5.25	7.80	9.65	9.68	22.90	6.20	7.37	10.22	20.57	5.88	9.98	10.22	20.38	8.67	9.32	11.01	12.31	11.73
SPREAD	MALIN - AECO	1.69	2.23	1.53	1.27	1.44	1.67	1.70	1.62	1.38	1.14	1.18	1.97	1.41	1.66	1.23	1.14	1.02	1.09	0.97	0.93	0.84	0.88	0.83	0.79	1.06	0.87	0.76

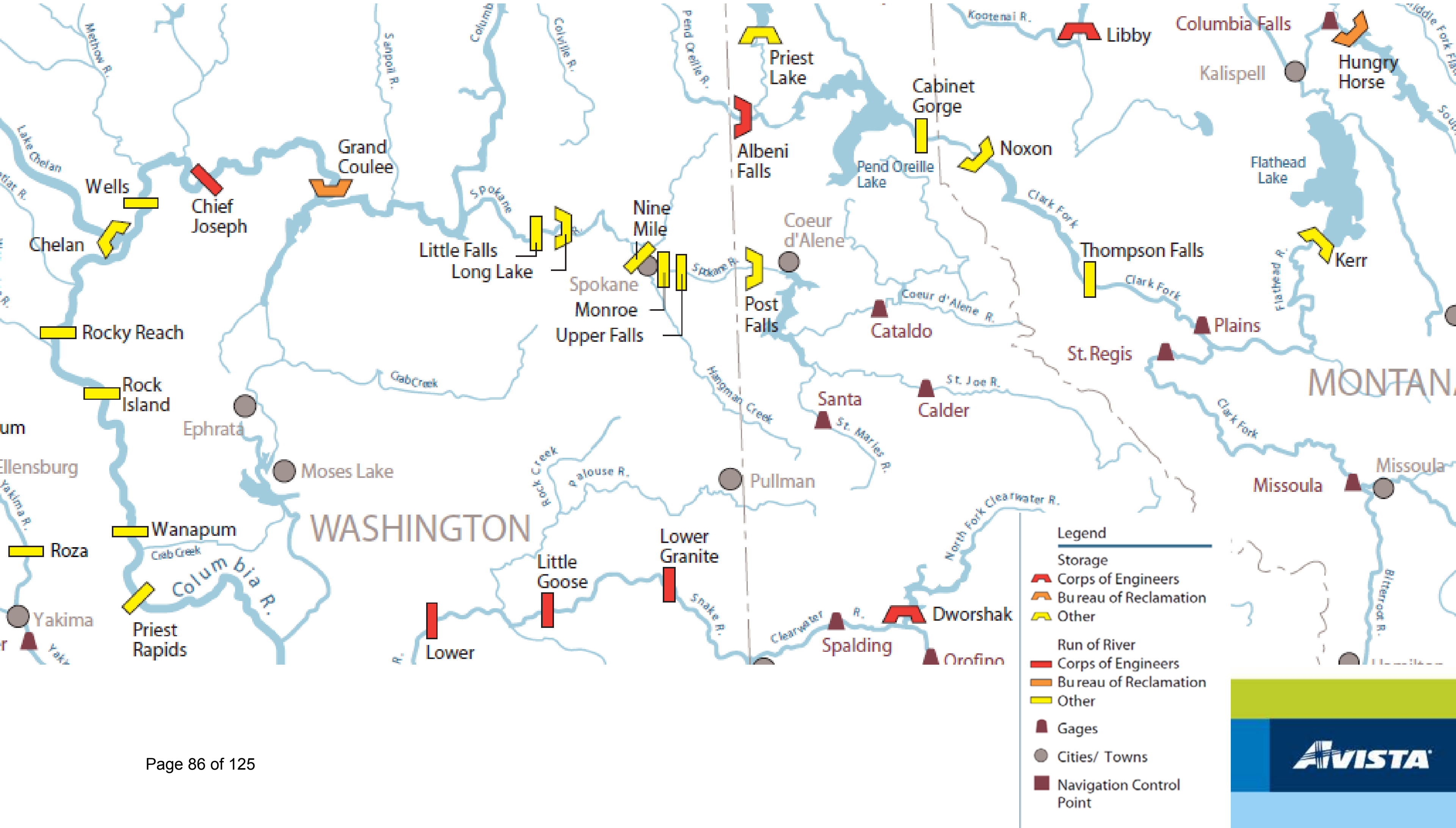






Questions?

Hydro Forecasting
WUTC Staff
3-28-2019


Priest Lake
Libby
Columbia Falls
Hungry Horse
Kalispell
Cabinet Gorge
Albeni Falls
Noxon
Pend Oreille Lake
Flathead Lake
Grand Coulee
Wells
Chief Joseph
Chelan
Little Falls
Long Lake
Nine Mile
Spokane
Monroe
Upper Falls
Coeur d'Alene
Post Falls
Thompson Falls
Kerr
Plains
Cataldo
St. Regis
MONTANA
Rocky Reach
Rock Island
Ephrata
Moses Lake
Santa
Calder
Pullman
Missoula
Ellensburg
WASHINGTON
Wanapum
Roza
Priest Rapids
Yakima
Little Goose
Lower Granite
Lower
Dworshak
Spalding
Orofino
Methow R.
Lake Chelan
Sanpoil R.
Colville R.
Pend Oreille R.
Kootenai R.
Clark Fork
Spokane R.
Coeur d'Alene R.
St. Joe R.
St. Maries R.
Hangman Creek
Crab Creek
Palouse R.
Rock Creek
Columbia R.
Snake R.
Clearwater R.
North Fork Clearwater R.
Flathead R.
Bitterroot R.
Yakima R.
Legend
Storage
Corps of Engineers
Bureau of Reclamation
Other
Run of River
Corps of Engineers
Bureau of Reclamation
Other
Gages
Cities/ Towns
Navigation Control Point

AVISTA HYDRO PROJECTS

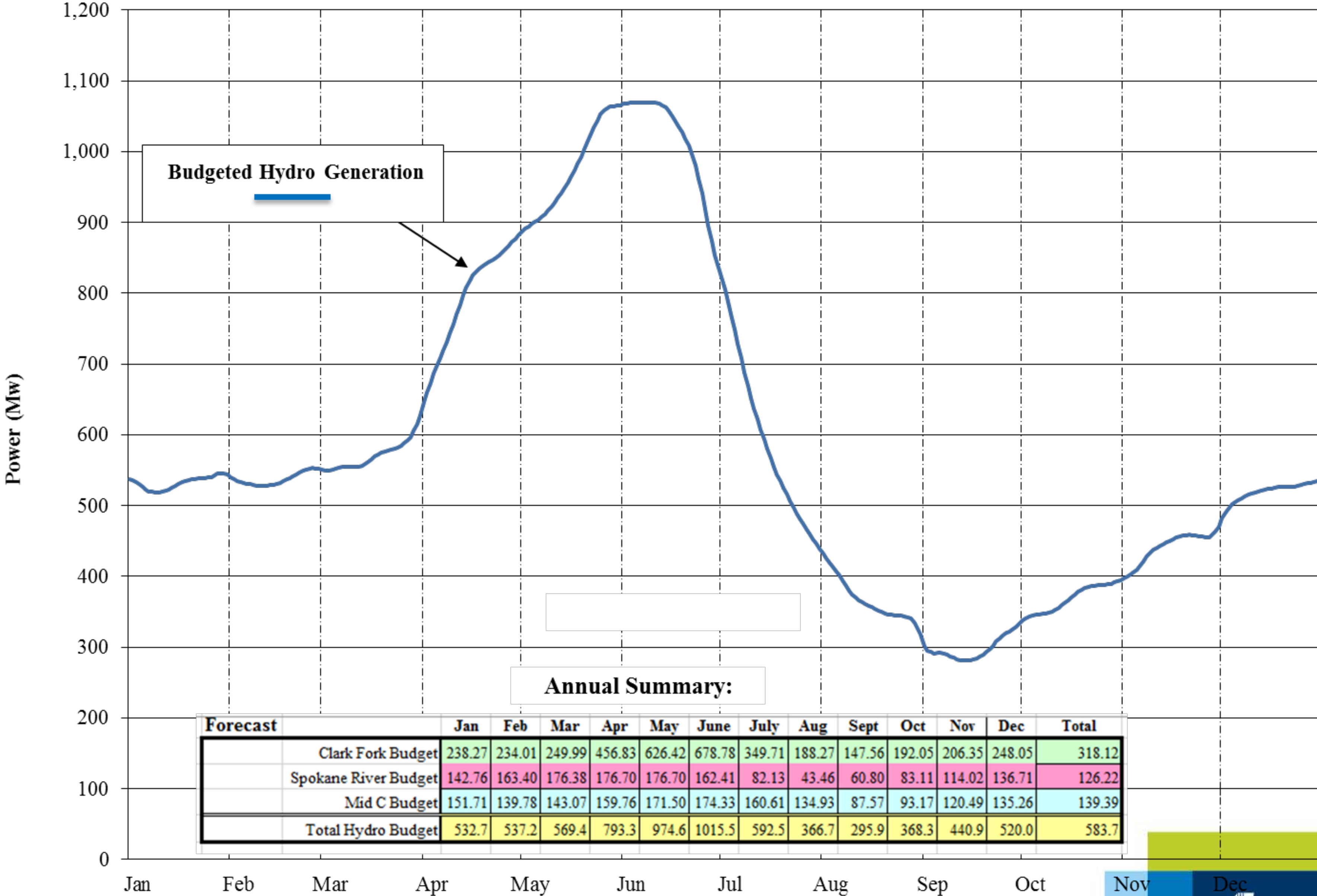
RESERVOIR OR PLANT	RESERVOIR					HOURS TO NEXT PROJECT	YEAR ENERGIZED	AVERAGE ANN. FLOW (CFS)	PLANT CAPACITY		Can Motor?	HEAD
	ELEVATION OF TOP	ELEVATION OF BOTTOM	FEET OF DRAFT	STORAGE CAPACITY SFD	SFD IN TOP FOOT				MAX. CFS	MAX. MW		
NOXON RAPIDS	2331.0	2295.0	36.0	116300	4000	0.50	1959	21160	50000	562	Yes, All	154
CABINET GORGE	2175.0	2160.0	15.0	21560	1600	3 - 5	1953	21160	39600	273	Unit #1	101.5
POST FALLS	2128.0	2120.5	7.5	112500	21400	4 - 6	1906	6328	5400	18	Yes, All	56.3
UPPER FALLS	1870.5	1864.5	6.0	275	100	0.10	1922	6849	2500	10.2	No	60.8
MONROE STREET	1806.0	N/A	N/A	N/A	N/A	3 - 4	1890	6849	2850	15	No	72
NINE MILE	1606.6	1590.0	16.6	2580	200	7 - 11	1908	7996	7710	35	1 and 2	63
LONG LAKE	1536.0	1512.0	24.0	52540	2530	0.25	1915	7996	7000	88	Yes, All	172
LITTLE FALLS	1362.0	1351.0	11.0	1300	100	2 - 3	1910	7996	7200	36	Yes, All	76

			Totals
Noxon Max 195,000 cfs (1894)	Post Falls Max	CF	835
NM includes Sediment Bypass 600 cfs	50,100 cfs Dec 1933	Spokane	202.2

Avista Mid Columbia Contracts Energy				
	Avista Wells Energy	Avista Chelan Energy	Avista Grant PUD Energy	Avista Total Mid C Energy By Month
Jan	49.833	56.84	45.04	151.71
Feb	45.524	53.17	41.08	139.78
Mar	51.619	52.60	38.86	143.07
Apr	59.215	59.33	41.21	159.76
May	64.531	61.63	45.34	171.50
Jun	68.246	59.19	46.89	174.33
Jul	61.190	52.48	46.94	160.61
Aug	51.678	46.26	37.00	134.93
Sep	33.623	32.99	20.96	87.57
Oct	33.987	33.13	26.05	93.17
Nov	42.644	43.50	34.34	120.49
Dec	47.052	49.36	38.85	135.26
Average	50.803	50.03	38.56	139.39

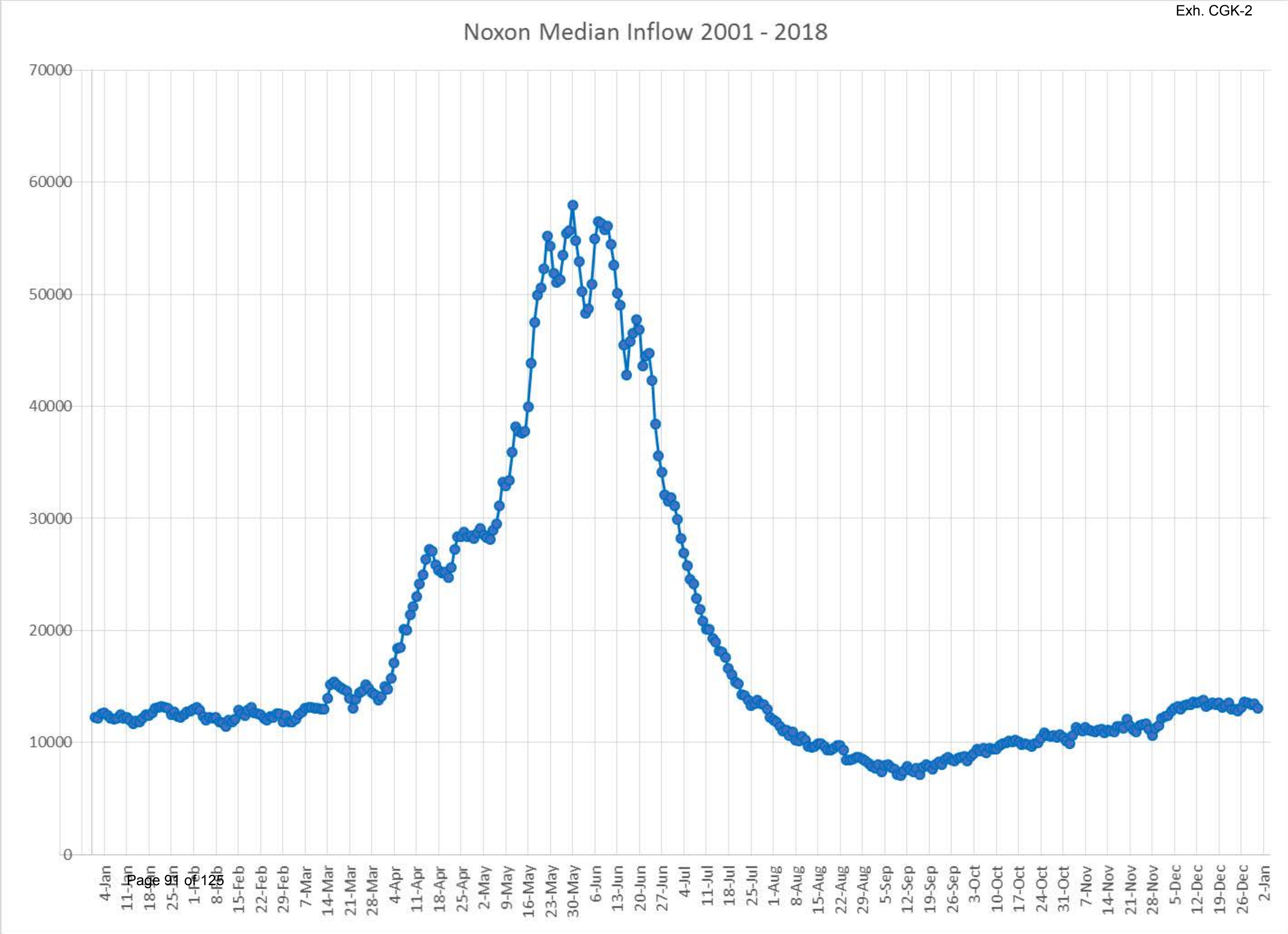
Annual Hydro Budget Process

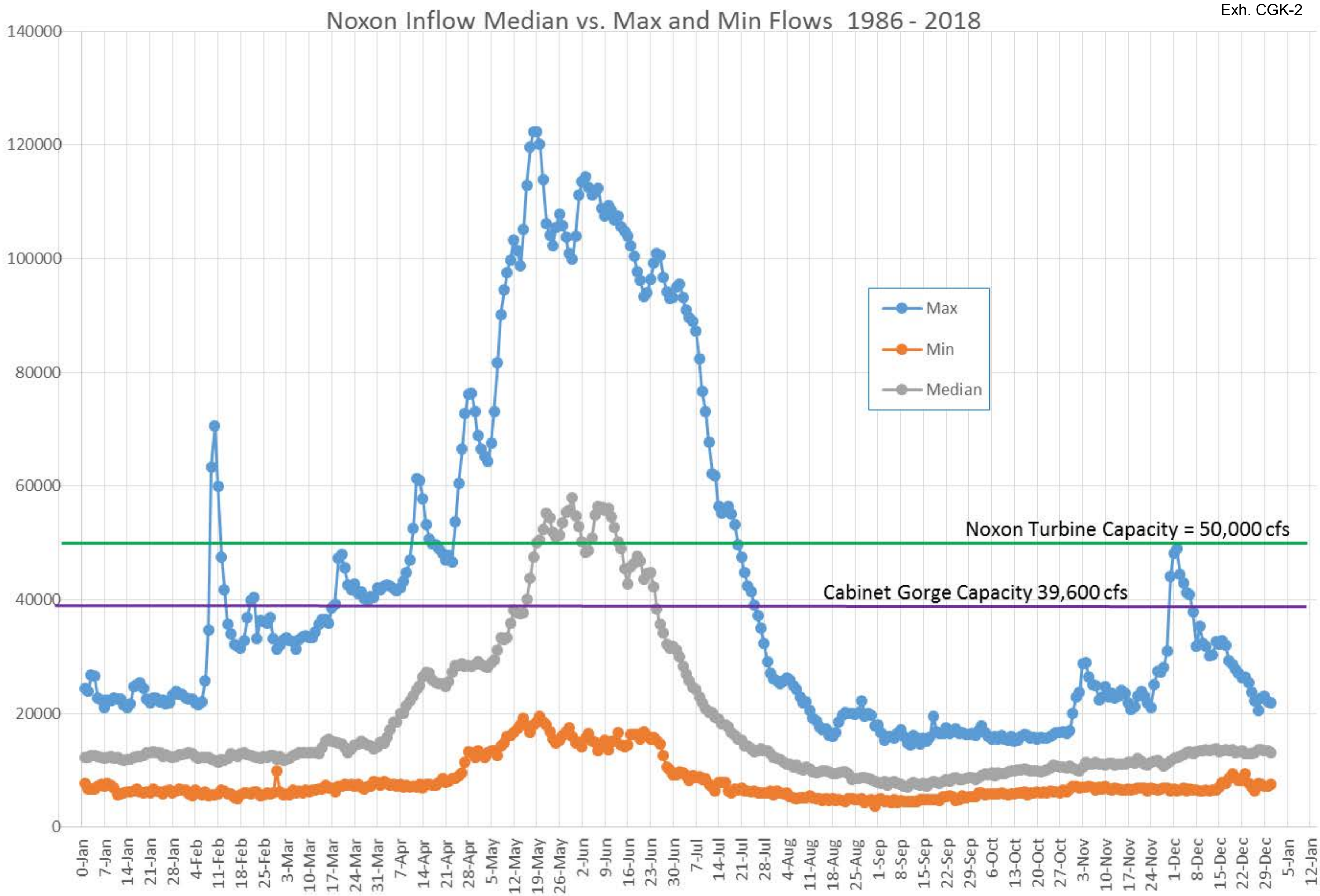
Avista's Total Hydro Generation Summary for 2019

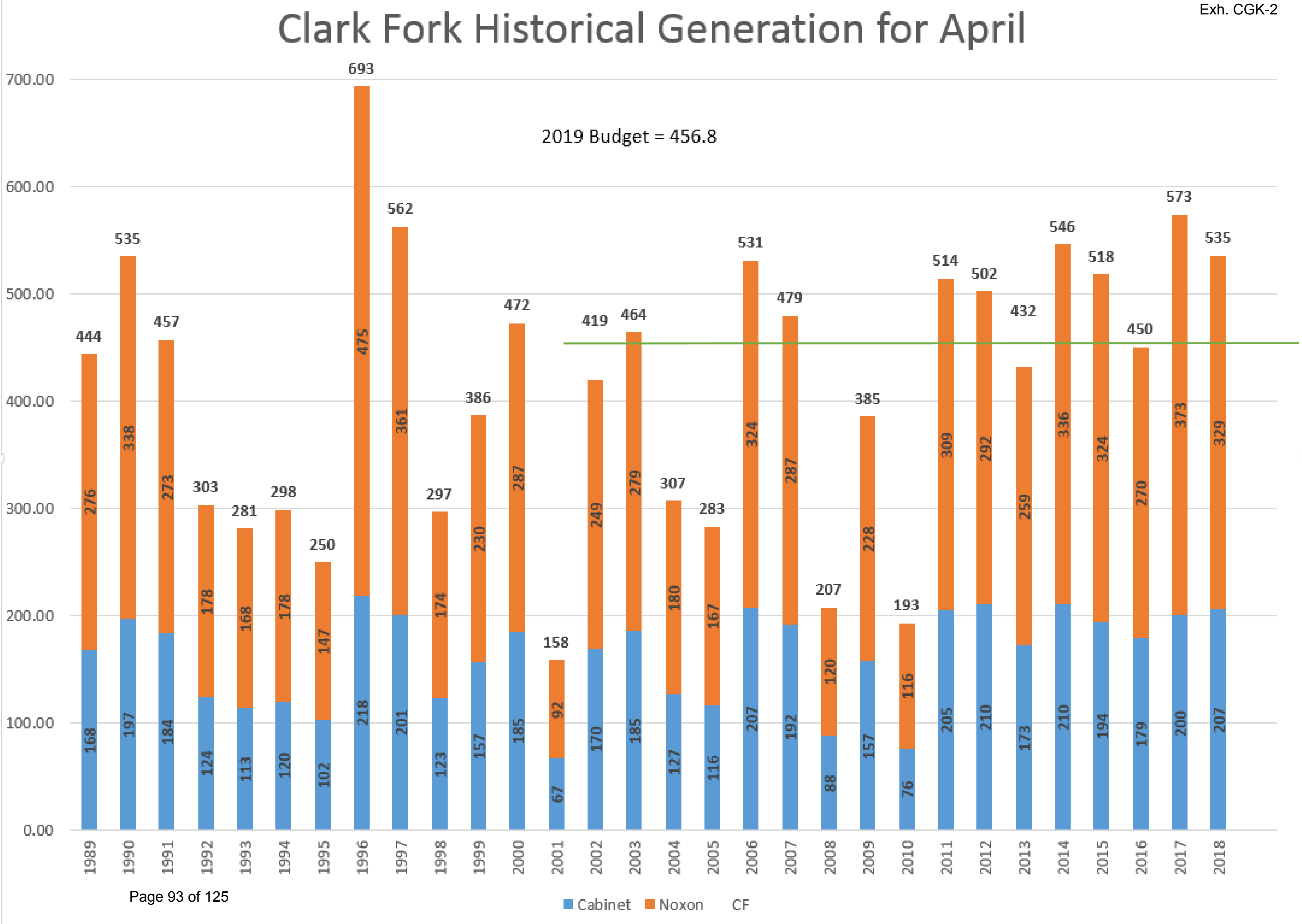


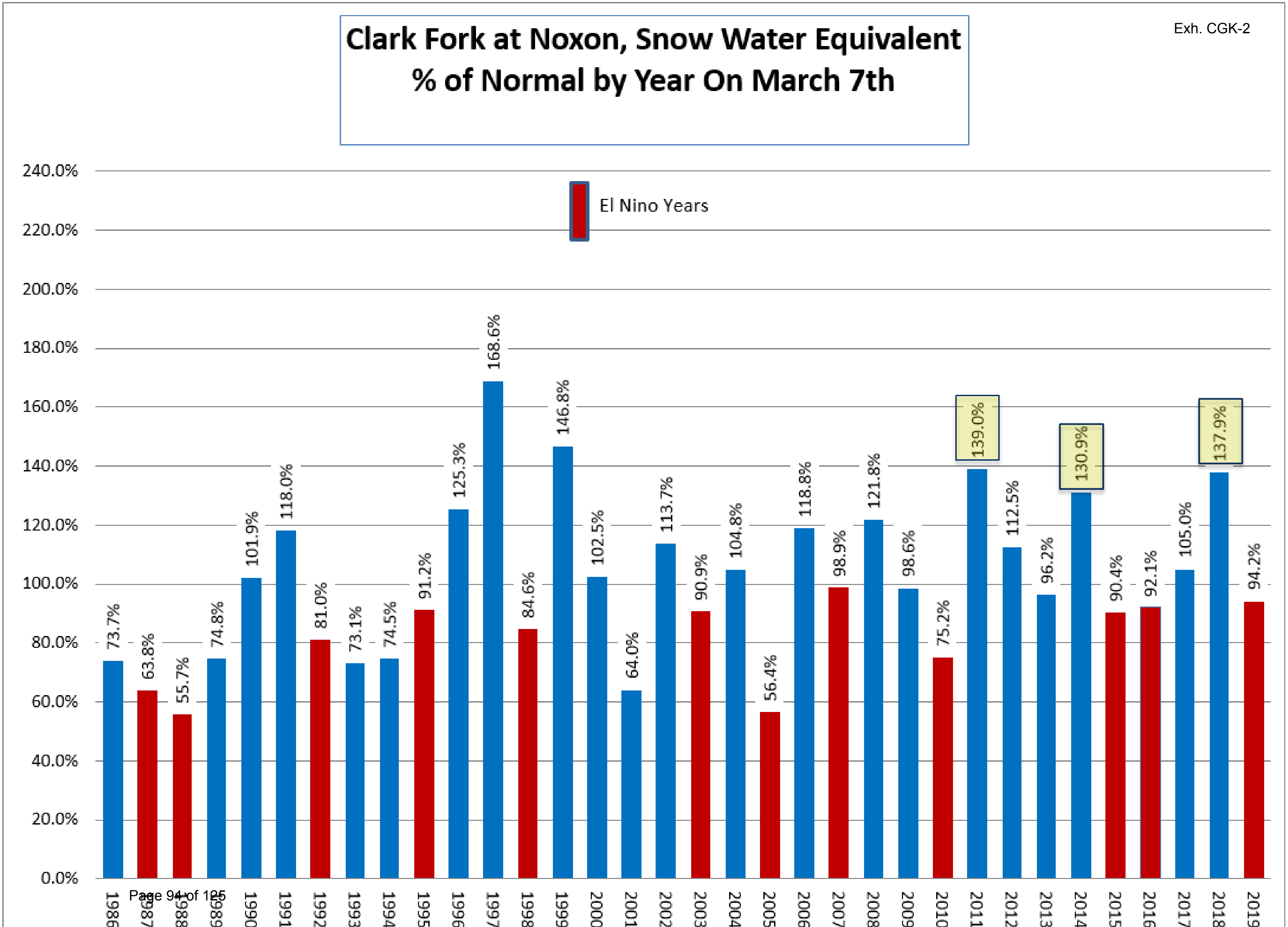
Annual Summary:

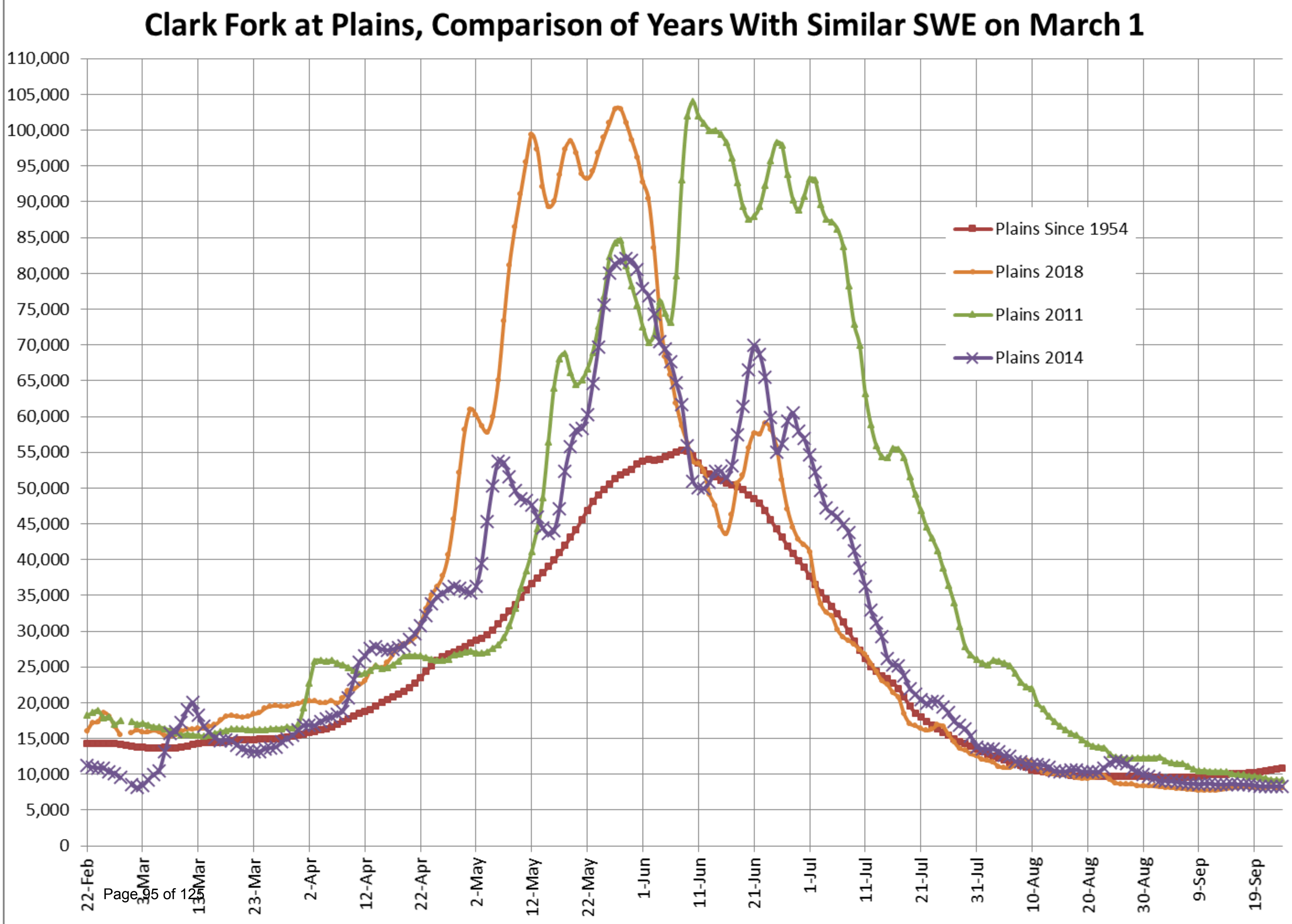
Forecast	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Clark Fork Budget	238.27	234.01	249.99	456.83	626.42	678.78	349.71	188.27	147.56	192.05	206.35	248.05	318.12
Spokane River Budget	142.76	163.40	176.38	176.70	176.70	162.41	82.13	43.46	60.80	83.11	114.02	136.71	126.22
Mid C Budget	151.71	139.78	143.07	159.76	171.50	174.33	160.61	134.93	87.57	93.17	120.49	135.26	139.39
Total Hydro Budget	532.7	537.2	569.4	793.3	974.6	1015.5	592.5	366.7	295.9	368.3	440.9	520.0	583.7

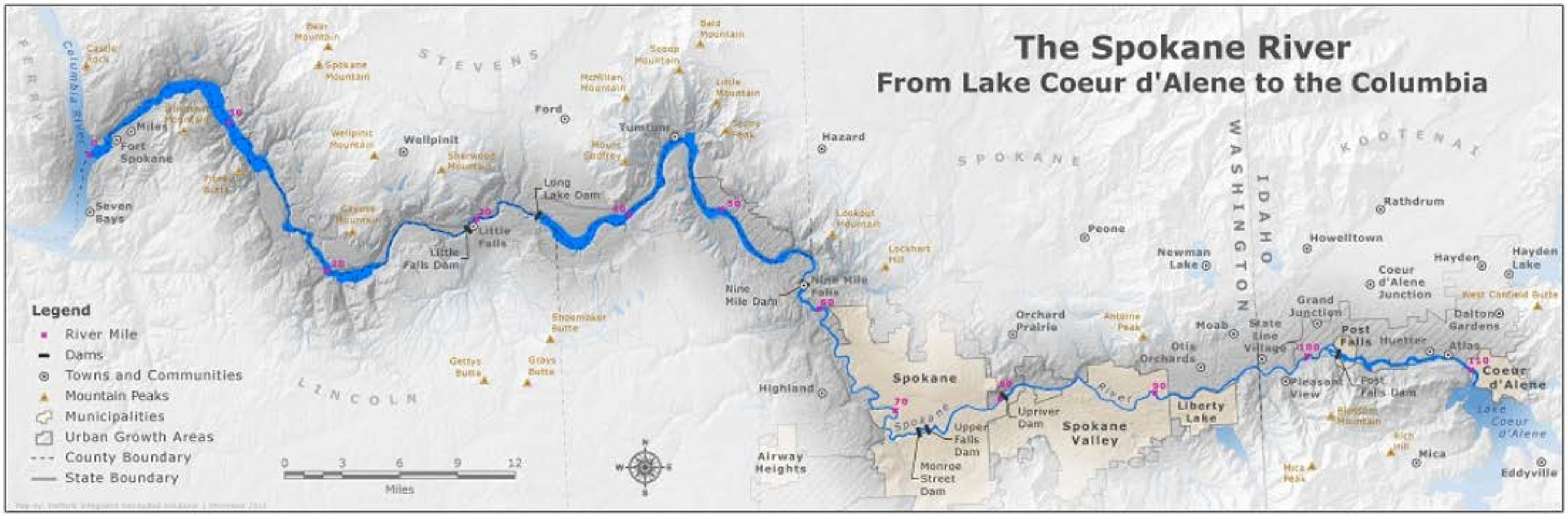

Noxon Median Inflow 2001 - 2018
70000
60000
50000
40000
30000
20000
10000
0
4-Jan
11-Jan
18-Jan
25-Jan
1-Feb
8-Feb
15-Feb
22-Feb
29-Feb
7-Mar
14-Mar
21-Mar
28-Mar
4-Apr
11-Apr
18-Apr
25-Apr
2-May
9-May
16-May
23-May
30-May
6-Jun
13-Jun
20-Jun
27-Jun
4-Jul
11-Jul
18-Jul
25-Jul
1-Aug
8-Aug
15-Aug
22-Aug
29-Aug
5-Sep
12-Sep
19-Sep
26-Sep
3-Oct
10-Oct
17-Oct
24-Oct
31-Oct
7-Nov
14-Nov
21-Nov
28-Nov
5-Dec
12-Dec
19-Dec
26-Dec
2-Jan


Noxon Inflow Median vs. Max and Min Flows 1986 - 2018
Max
Min
Median
Noxon Turbine Capacity = 50,000 cfs
Cabinet Gorge Capacity 39,600 cfs
140000
120000
100000
80000
60000
40000
20000
0
0-Jan
7-Jan
14-Jan
21-Jan
28-Jan
4-Feb
11-Feb
18-Feb
25-Feb
3-Mar
10-Mar
17-Mar
24-Mar
31-Mar
7-Apr
14-Apr
21-Apr
28-Apr
5-May
12-May
19-May
26-May
2-Jun
9-Jun
16-Jun
23-Jun
30-Jun
7-Jul
14-Jul
21-Jul
28-Jul
4-Aug
11-Aug
18-Aug
25-Aug
1-Sep
8-Sep
15-Sep
22-Sep
29-Sep
6-Oct
13-Oct
20-Oct
27-Oct
3-Nov
10-Nov
17-Nov
24-Nov
1-Dec
8-Dec
15-Dec
22-Dec
29-Dec
5-Jan
12-Jan


Clark Fork Historical Generation for April
2019 Budget = 456.8
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
444
276
168
1989
535
338
197
1990
457
273
184
1991
303
178
124
1992
281
168
113
1993
298
178
120
1994
250
147
102
1995
693
475
218
1996
562
361
201
1997
297
174
123
1998
386
230
157
1999
472
287
185
2000
158
92
67
2001
419
249
170
2002
464
279
185
2003
307
180
127
2004
283
167
116
2005
531
324
207
2006
479
287
192
2007
207
120
88
2008
385
228
157
2009
193
116
76
2010
514
309
205
2011
502
292
210
2012
432
259
173
2013
546
336
210
2014
518
324
194
2015
450
270
179
2016
573
373
200
2017
535
329
207
2018
Cabinet
Noxon
CF


Exh. CGK-2
Clark Fork at Noxon, Snow Water Equivalent
% of Normal by Year On March 7th
El Nino Years
240.0%
220.0%
200.0%
180.0%
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
1986 73.7%
1987 63.8%
1988 55.7%
1989 74.8%
1990 101.9%
1991 118.0%
1992 81.0%
1993 73.1%
1994 74.5%
1995 91.2%
1996 125.3%
1997 168.6%
1998 84.6%
1999 146.8%
2000 102.5%
2001 64.0%
2002 113.7%
2003 90.9%
2004 104.8%
2005 56.4%
2006 118.8%
2007 98.9%
2008 121.8%
2009 98.6%
2010 75.2%
2011 139.0%
2012 112.5%
2013 96.2%
2014 130.9%
2015 90.4%
2016 92.1%
2017 105.0%
2018 137.9%
2019 94.2%

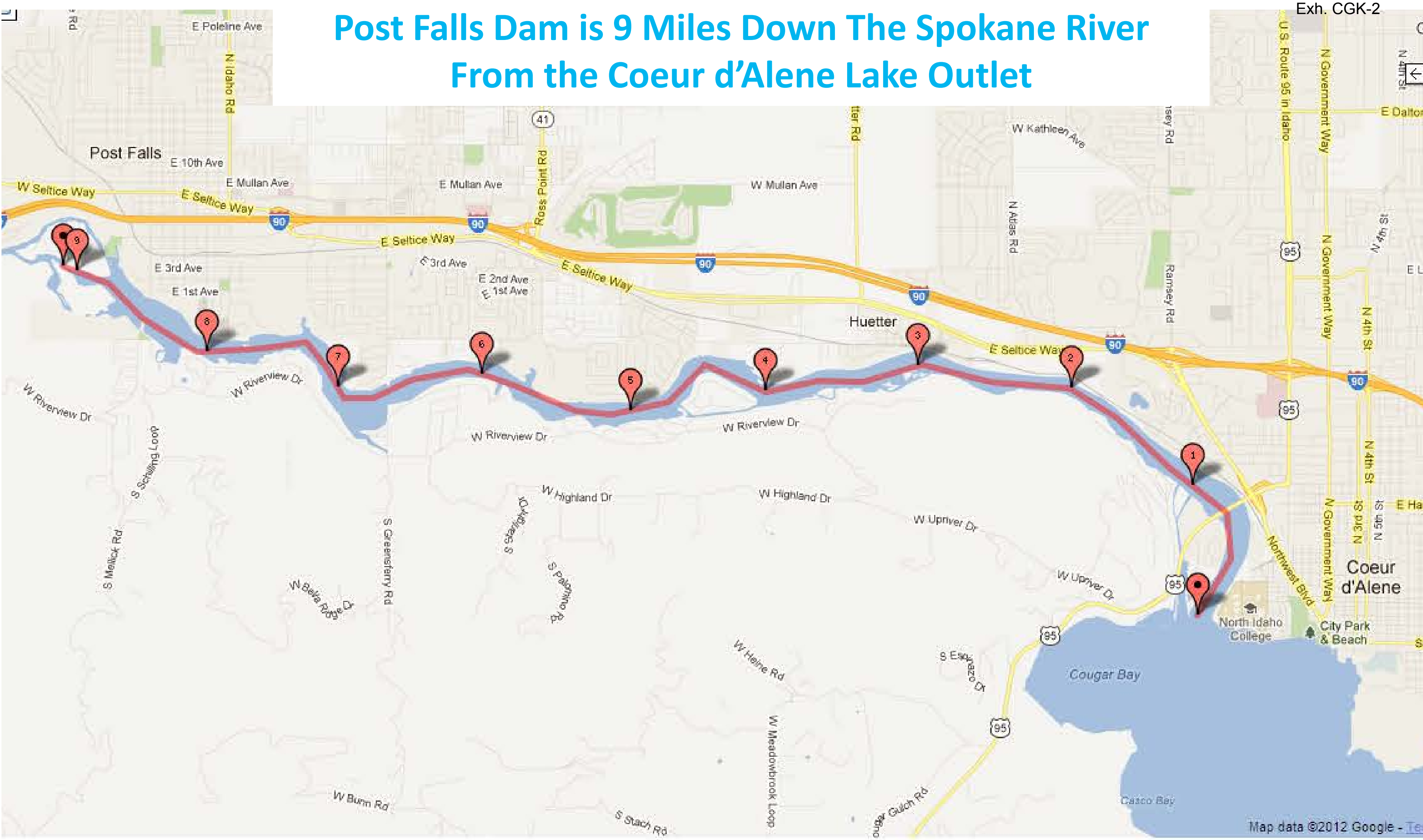

Clark Fork at Plains, Comparison of Years With Similar SWE on March 1
110,000
105,000
100,000
95,000
90,000
85,000
80,000
75,000
70,000
65,000
60,000
55,000
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
22-Feb
3-Mar
13-Mar
23-Mar
2-Apr
12-Apr
22-Apr
2-May
12-May
22-May
1-Jun
11-Jun
21-Jun
1-Jul
11-Jul
21-Jul
31-Jul
10-Aug
20-Aug
30-Aug
9-Sep
19-Sep
Plains Since 1954
Plains 2018
Plains 2011
Plains 2014



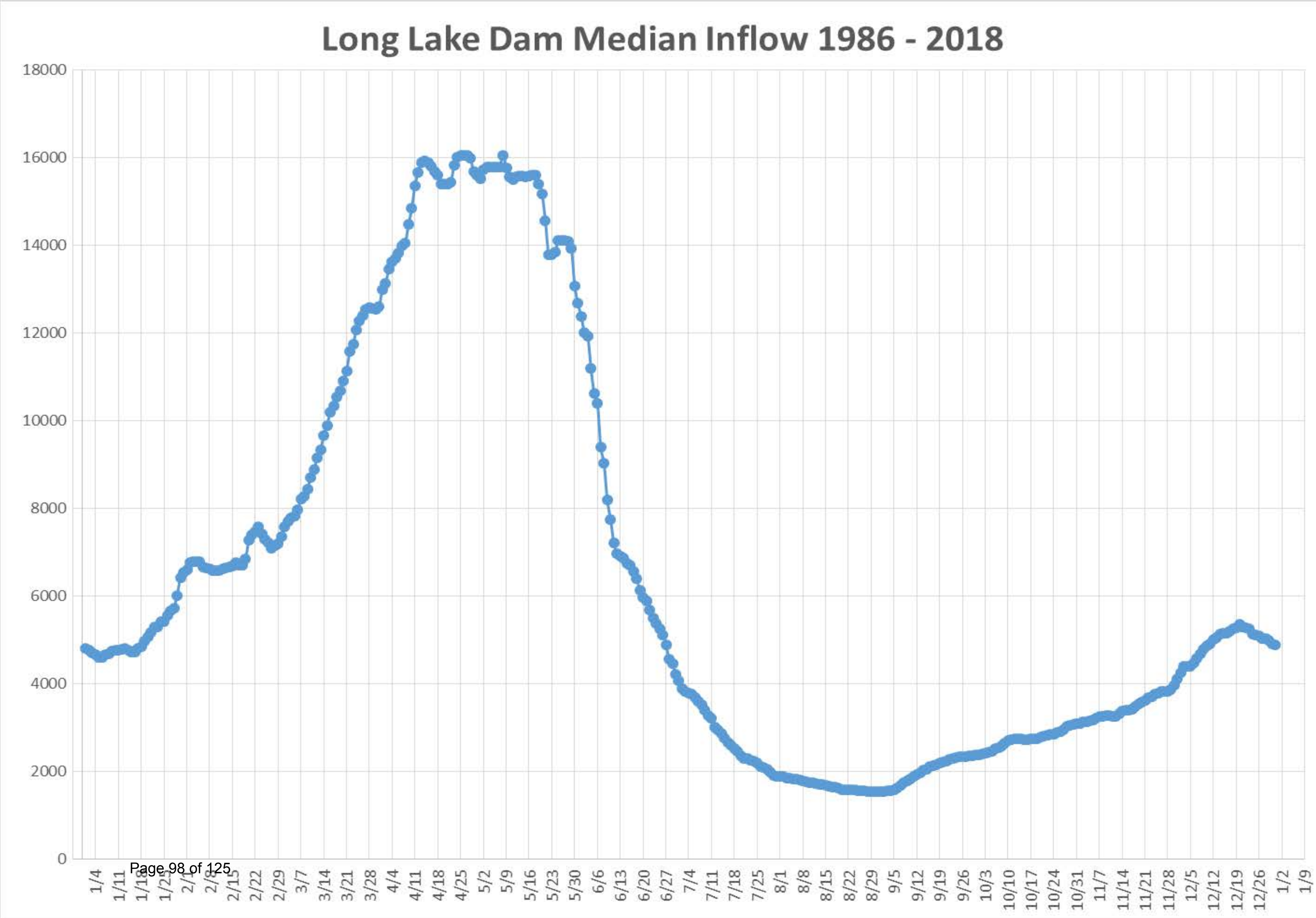
Spokane River: 111 Miles Long

7 Hydro Electric Developments

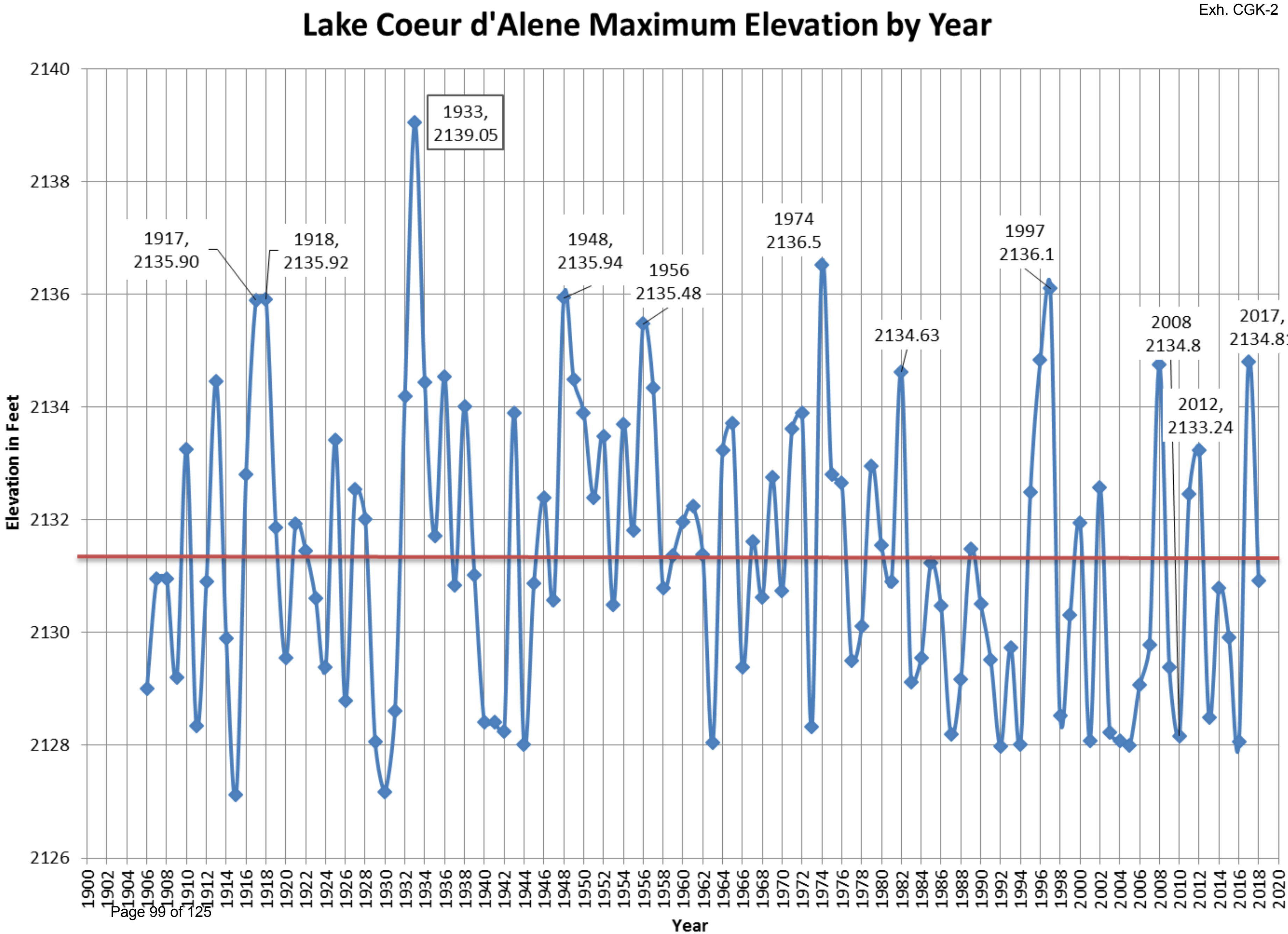
Post Falls Dam is 9 Miles Down The Spokane River From the Coeur d'Alene Lake Outlet



AVISTA


Long Lake Dam Median Inflow 1986 - 2018
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1/4
1/11
1/18
1/25
2/1
2/8
2/15
2/22
2/29
3/7
3/14
3/21
3/28
4/4
4/11
4/18
4/25
5/2
5/9
5/16
5/23
5/30
6/6
6/13
6/20
6/27
7/4
7/11
7/18
7/25
8/1
8/8
8/15
8/22
8/29
9/5
9/12
9/19
9/26
10/3
10/10
10/17
10/24
10/31
11/7
11/14
11/21
11/28
12/5
12/12
12/19
12/26
1/2
1/9

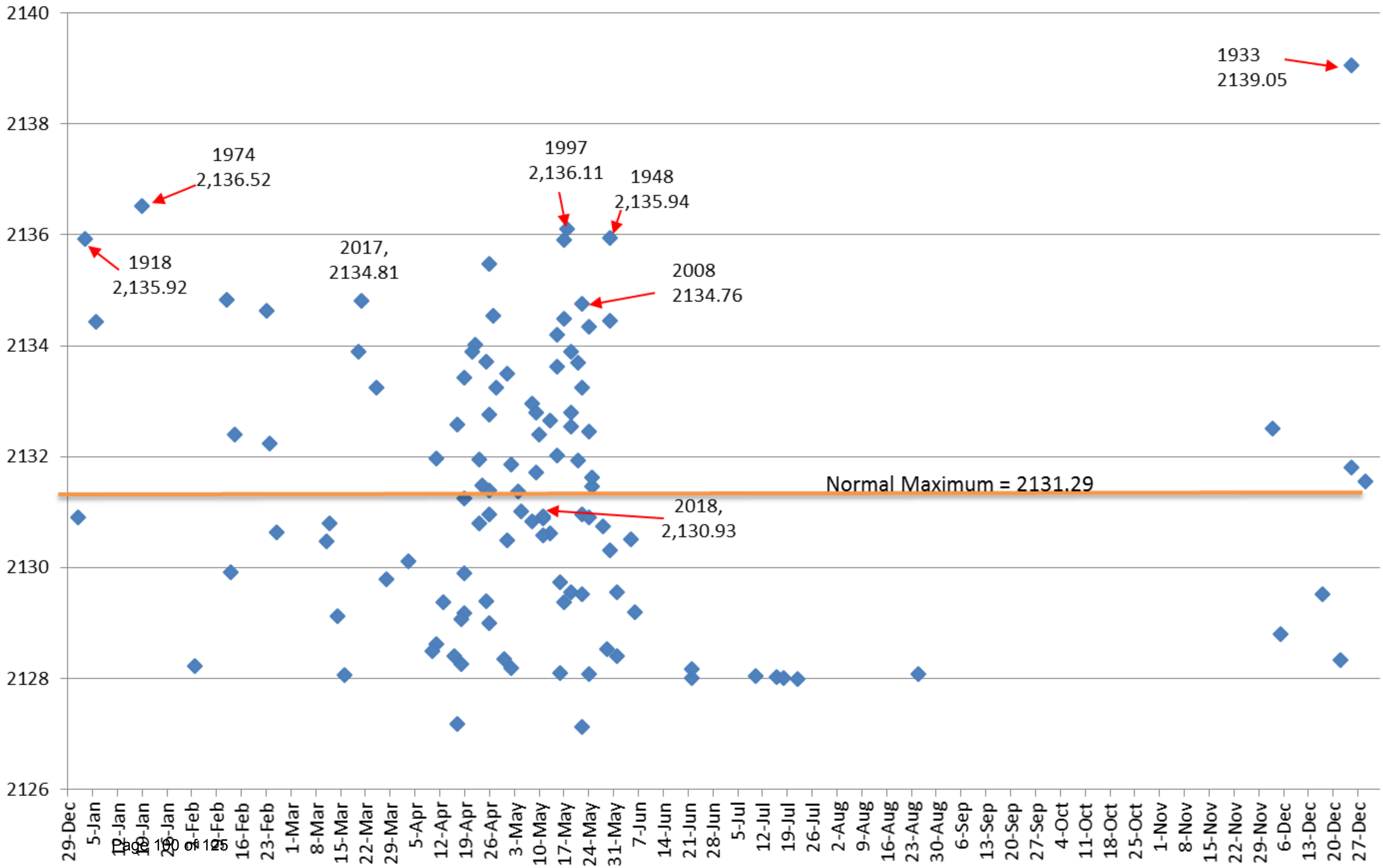
Exh. CGK-2

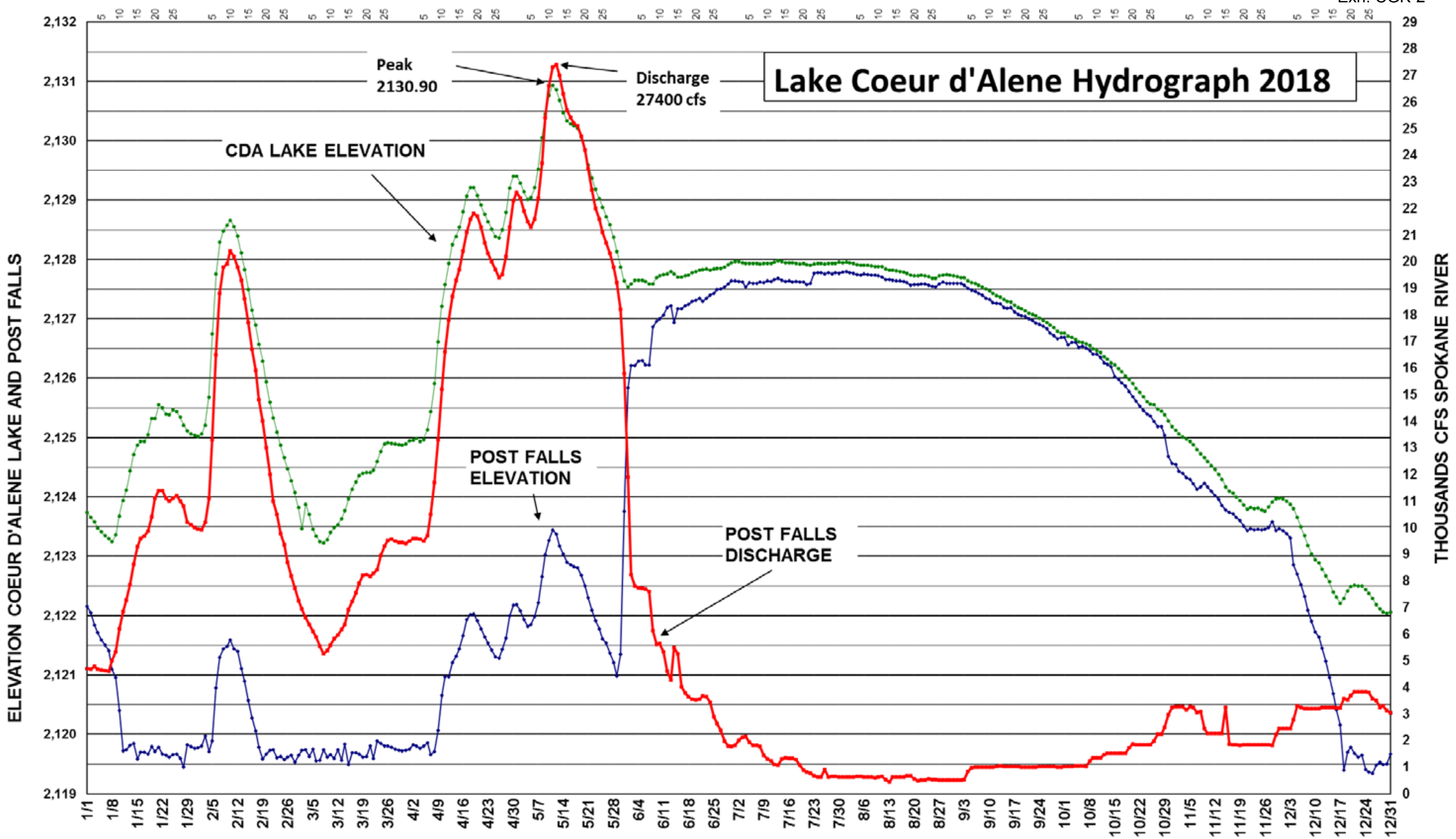


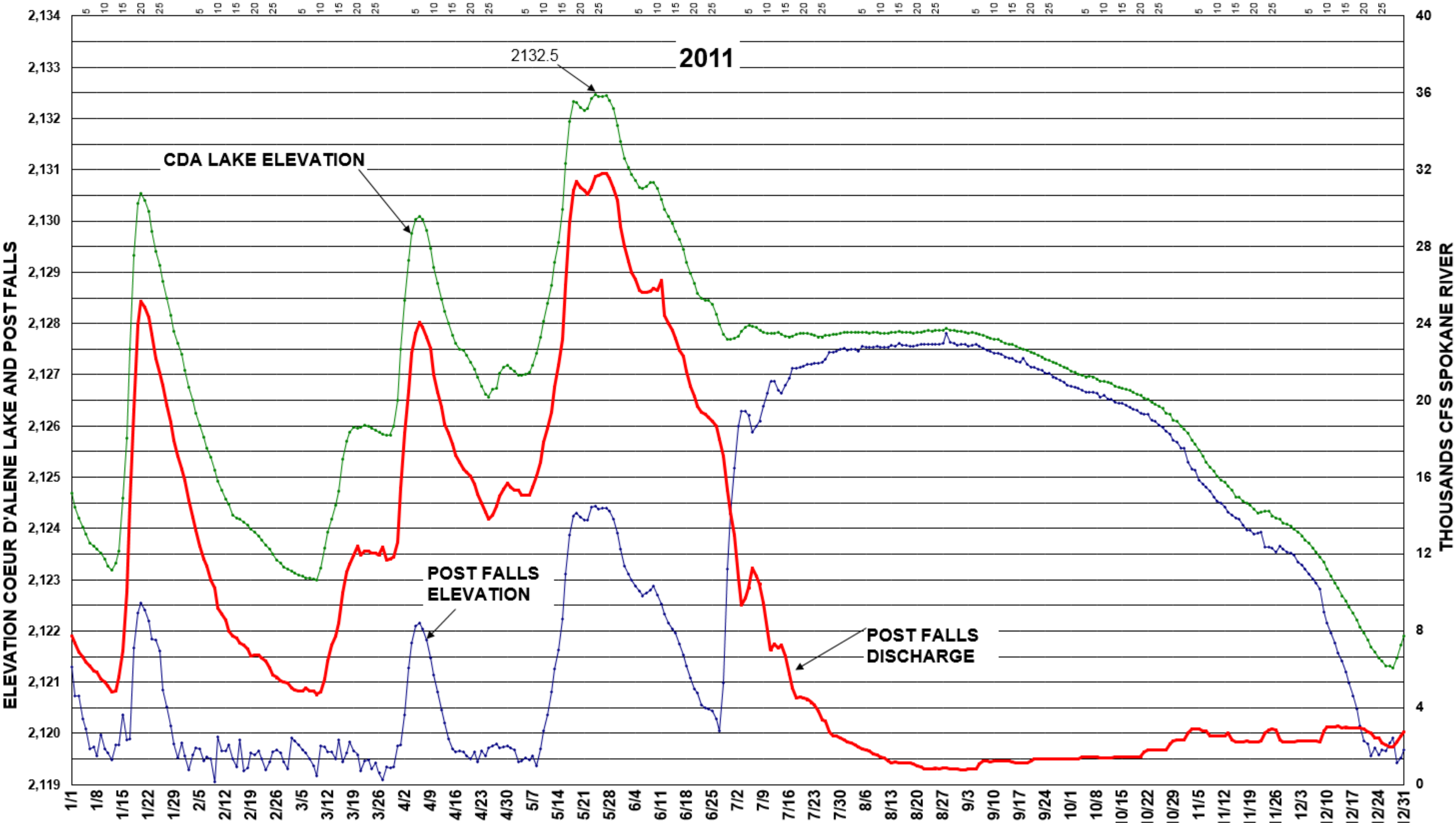
Lake Coeur d'Alene Maximum Elevation by Year
Elevation in Feet
Year
1917, 2135.90
1918, 2135.92
1933, 2139.05
1948, 2135.94
1956 2135.48
1974 2136.5
2134.63
1997 2136.1
2008 2134.8
2012, 2133.24
2017, 2134.81

Exh. CGK-2

Dates for Annual Maximum's
Coeur d'Alene Lake Elevations



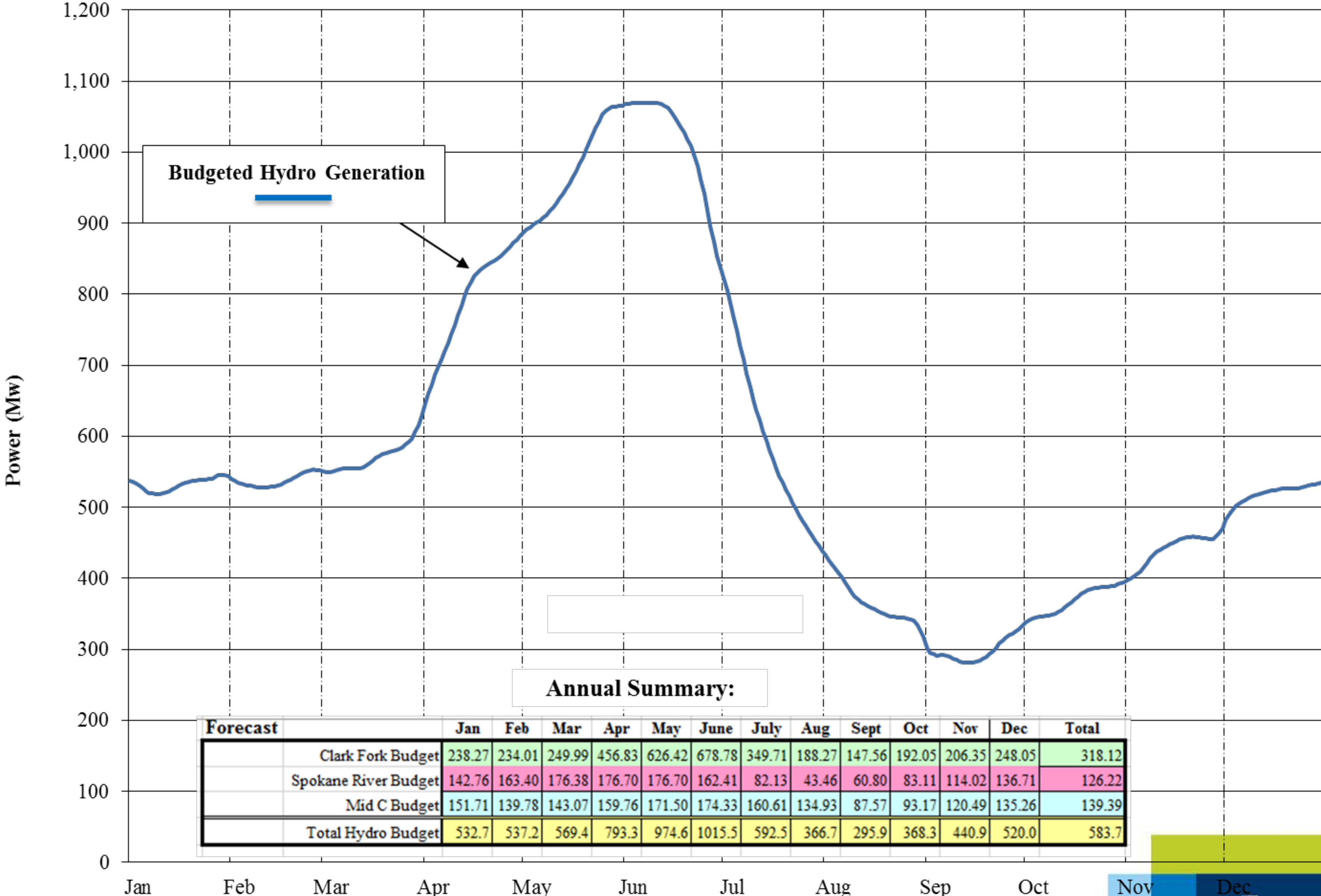

Lake Coeur d'Alene Hydrograph 2018
Peak
2130.90
Discharge
27400 cfs
CDA LAKE ELEVATION
POST FALLS
ELEVATION
POST FALLS
DISCHARGE
ELEVATION COEUR D'ALENE LAKE AND POST FALLS
THOUSANDS CFS SPOKANE RIVER


2011
2132.5
CDA LAKE ELEVATION
POST FALLS ELEVATION
POST FALLS DISCHARGE
ELEVATION COEUR D'ALENE LAKE AND POST FALLS
THOUSANDS CFS SPOKANE RIVER
2,134
2,133
2,132
2,131
2,130
2,129
2,128
2,127
2,126
2,125
2,124
2,123
2,122
2,121
2,120
2,119
40
36
32
28
24
20
16
12
8
4
0
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26
4/2
4/9
4/16
4/23
4/30
5/7
5/14
5/21
5/28
6/4
6/11
6/18
6/25
7/2
7/9
7/16
7/23
7/30
8/6
8/13
8/20
8/27
9/3
9/10
9/17
9/24
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

			CABINET				NOXON						POST FALLS												MONROE						UPPER FALLS					
			107.8				107.8	107.82					8.45	8.23								3.491				58.81										
M	D	J	Cab inflow	Cab conv	Cab max	Cab gen	Cab inflow	Cab-Nox diff	Nox inflow	Nox conv	Nox max	Nox gen	PF natl flow	PF avg dischr	PF input dischrg	PF reg	CdA beg elev	LkUp1	LkUp2	CdA end elev	max flow @	PF conv	PF max	PF gen	PF input dischrg	MS-PF diff	MS dischrg	MS conv	MS max	MS gen	MS avg dischrg	UF-MS diff	UF dischrg	UF conv	UF max	UF gen
1	1	1	13,352	7.104	245	94.8	13,352	62	13,289	11.134	520	148.0	2,675	3,625	4,000	1,326	2,122.50	26,950	25,600	2,122.40	4,114	3.514	13.2	13.2	4,000	402	4,402	5.550	14	14.0	4,402	0	4,402	4.467	9.5	9.5
1	2	2	13,300	7.104	245	94.5	13,300	52	13,248	11.134	520	147.5	2,653	3,518	4,000	1,347	2,122.40	25,600	24,250	2,122.30	3,899	3.514	13.2	13.2	4,000	403	4,403	5.550	14	14.0	4,403	0	4,403	4.467	9.5	9.5
1	3	3	13,192	7.106	245	93.7	13,192	45	13,147	11.133	520	146.4	2,653	3,452	3,600	947	2,122.30	24,250	22,900	2,122.23	3,686	3.538	13.2	12.7	3,600	407	4,007	5.550	14	14.0	4,007	0	4,007	4.425	9.5	9.5
1	4	4	13,074	7.107	245	92.9	13,074	42	13,032	11.131	520	145.1	2,672	3,360	3,500	828	2,122.23	22,900	21,550	2,122.17	3,527	3.544	13.2	12.4	3,500	404	3,904	5.550	14	14.0	3,904	0	3,904	4.414	9.5	9.5
1	5	5	13,015	7.108	245	92.5	13,015	38	12,977	11.131	520	144.4	2,673	3,348	3,400	727	2,122.17	21,550	20,200	2,122.12	3,422	3.550	13.2	12.1	3,400	415	3,815	5.550	14	14.0	3,815	0	3,815	4.405	9.5	9.5
1	6	6	12,868	7.110	245	91.5	12,868	38	12,829	11.129	520	142.8	2,673	3,328	3,300	627	2,122.12	21,550	20,200	2,122.07	3,316	3.556	13.2	11.7	3,300	416	3,716	5.550	14	14.0	3,716	0	3,716	4.395	9.5	9.5
1	7	7	12,691	7.112	245	90.3	12,691	34	12,657	11.128	520	140.8	2,673	3,264	3,200	527	2,122.07	20,200	18,850	2,122.03	3,212	3.562	13.2	11.4	3,200	415	3,615	5.550	14	14.0	3,615	0	3,615	4.386	9.5	9.5
1	8	8	12,560	7.114	245	89.4	12,560	35	12,525	11.126	520	139.4	2,710	3,261	3,100	390	2,122.03	20,200	18,850	2,122.00	3,160	3.568	13.2	11.1	3,100	404	3,504	5.550	14	14.0	3,504	0	3,504	4.378	9.5	9.5
1	9	9	12,441	7.115	245	88.5	12,441	47	12,394	11.125	520	137.9	2,839	3,261	3,100	261	2,122.00	20,200	18,850	2,121.98	3,107	3.568	13.2	11.1	3,100	403	3,503	5.550	14	14.0	3,503	0	3,503	4.378	9.5	9.5
1	10	10	12,366	7.116	245	88.0	12,366	51	12,315	11.124	520	137.0	2,900	3,264	3,000	100	2,121.98	18,850	17,500	2,121.98	3,055	3.574	13.2	10.7	3,000	403	3,403	5.550	14	14.0	3,403	0	3,403	4.372	9.5	9.5
1	11	11	12,414	7.116	245	88.3	12,414	58	12,357	11.125	520	137.5	2,963	3,290	3,000	37	2,121.98	18,850	17,500	2,121.97	3,055	3.574	13.2	10.7	3,000	401	3,401	5.550	14	14.0	3,401	0	3,401	4.372	9.5	9.5
1	12	12	12,495	7.115	245	88.9	12,495	64	12,431	11.125	520	138.3	3,147	3,330	3,000	-147	2,121.97	18,850	17,500	2,121.98	3,055	3.574	13.2	10.7	3,000	404	3,404	5.550	14	14.0	3,404	0	3,404	4.372	9.5	9.5
1	13	13	12,605	7.113	245	89.7	12,605	62	12,543	11.126	520	139.6	3,236	3,332	3,000	-236	2,121.98	18,850	17,500	2,122.00	3,107	3.574	13.2	10.7	3,000	398	3,398	5.550	14	14.0	3,398	0	3,398	4.372	9.5	9.5
1	14	14	12,770	7.111	245	90.8	12,770	62	12,707	11.128	520	141.4	3,370	3,338	3,100	-270	2,122.00	20,200	18,850	2,122.02	3,160	3.568	13.2	11.1	3,100	391	3,491	5.550	14	14.0	3,491	0	3,491	4.377	9.5	9.5
1	15	15	12,866	7.110	245	91.5	12,866	57	12,809	11.129	520	142.6	3,502	3,340	3,100	-402	2,122.02	20,200	18,850	2,122.05	3,212	3.568	13.2	11.1	3,100	380	3,480	5.550	14	14.0	3,480	0	3,480	4.377	9.5	9.5
1	16	16	12,944	7.109	245	92.0	12,944	47	12,897	11.130	520	143.5	3,678	3,357	3,200	-478	2,122.05	20,200	18,850	2,122.09	3,264	3.562	13.2	11.4	3,200	390	3,590	5.550	14	14.0	3,590	0	3,590	4.384	9.5	9.5
1	17	17	12,978	7.108	245	92.3	12,978	45	12,934	11.130	520	144.0	3,887	3,360	3,200	-687	2,122.09	20,200	18,850	2,122.14	3,316	3.562	13.2	11.4	3,200	383	3,583	5.550	14	14.0	3,583	0	3,583	4.384	9.5	9.5
1	18	18	12,963	7.109	245	92.1	12,963	48	12,915	11.130	520	143.7	3,921	3,380	3,300	-621	2,122.14	21,550	20,200	2,122.18	3,422	3.556	13.2	11.7	3,300	385	3,685	5.550	14	14.0	3,685	0	3,685	4.392	9.5	9.5
1	19	19	12,977	7.108	245	92.2	12,977	50	12,927	11.130	520	143.9	3,887	3,380	3,400	-487	2,122.18	21,550	20,200	2,122.22	3,527	3.550	13.2	12.1	3,400	378	3,778	5.550	14	14.0	3,778	0	3,778	4.401	9.5	9.5
1	20	20	12,998	7.108	245	92.4	12,998	55	12,944	11.131	520	144.1	3,840	3,380	3,500	-340	2,122.22	22,900	21,550	2,122.24	3,580	3.544	13.2	12.4	3,500	387	3,887	5.550	14	14.0	3,887	0	3,887	4.412	9.5	9.5
1	21	21	13,011	7.108	245	92.5	13,011	60	12,951	11.131	520	144.1	3,840	3,510	3,500	-340	2,122.24	22,900	21,550	2,122.27	3,633	3.544	13.2	12.4	3,500	391	3,891	5.550	14	14.0	3,891	0	3,891	4.412	9.5	9.5
1	22	22	13,037	7.108	245	92.7	13,037	61	12,976	11.131	520	144.4	3,815	3,700	3,600	-215	2,122.27	22,900	21,550	2,122.29	3,686	3.538	13.2	12.7	3,600	392	3,992	5.550	14	14.0	3,992	0	3,992	4.424	9.5	9.5
1	23	23	13,070	7.107	245	92.9	13,070	63	13,007	11.131	520	144.8	3,901	3,733	3,600	-301	2,122.29	22,900	21,550	2,122.31	3,739	3.538	13.2	12.7	3,600	391	3,991	5.550	14	14.0	3,991	0	3,991	4.423	9.5	9.5
1	24	24	13,081	7.107	245	93.0	13,081	62	13,019	11.131	520	144.9	3,901	3,833	3,700	-201	2,122.31	24,250	22,900	2,122.32	3,792	3.532	13.2	13.1	3,700	390	4,090	5.550	14	14.0	4,090	0	4,090	4.435	9.5	9.5
1	25	25	13,064	7.107	245	92.9	13,064	58	13,006	11.131	520	144.8	3,940	4,013	3,700	-240	2,122.32	24,250	22,900	2,122.34	3,792	3.532	13.2	13.1	3,700	385	4,085	5.550	14	14.0	4,085	0	4,085	4.434	9.5	9.5
1	26	26	13,054	7.108	245	92.8	13,054	55	12,999	11.131	520	144.7	4,084	4,048	3,700	-384	2,122.34	24,250	22,900	2,122.37	3,846	3.532	13.2	13.1	3,700	383	4,083	5.550	14	14.0	4,083	0	4,083	4.434	9.5	9.5
1	27	27	13,060	7.107	245	92.8	13,060	53	13,007	11.131	520	144.8	4,231	4,060	3,800	-431	2,122.37	24,250	22,900	2,122.40	3,953	3.526	13.2	13.2	3,800	370	4,170	5.550	14	14.0	4,170	0	4,170	4.443	9.5	9.5
1	28	28	13,078	7.107	245	92.9	13,078	58	13,020	11.131	520	144.9	4,346	4,083	4,000	-346	2,122.40	25,600	24,250	2,122.43	4,006	3.514	13.2	13.2	4,000	370	4,370	5.550	14	14.0	4,370	0	4,370	4.464	9.5	9.5
1	29	29	13,111	7.107	245	93.2	13,111	71	13,040	11.131	520	145.2	4,515	4,210	4,000	-515	2,122.43	25,600	24,250	2,122.46	4,060	3.514	13.2	13.2	4,000	370	4,370	5.550	14	14.0	4,370	0	4,370	4.464	9.5	9.5
1	30	30	13,151	7.106	245	93.5	13,151	88	13,064	11.132	520	145.4	4,572	4,447	4,100	-472	2,122.46	25,600	24,250	2,122.50	4,168	3.508	13.2	13.2	4,100	372	4,472	5.550	14	14.0	4,472	0	4,472	4.472	9.5	9.5
1	31	31	13,210	7.106	245	93.9	13,210	107	13,103	11.132	520	145.9	4,582	4,760	4,200	-382	2,122.50	26,950	25,600	2,122.53	4,222	3.502	13.2	13.2	4,200	385	4,585	5.550	14	14.0	4,585	0	4,585	4.478	9.5	9.5
2	1	32	13,259	7.105	245	94.2	13,259	127	13,132	11.132	520	146.2	4,572	4,927	4,200	-372	2,122.53	26,950	25,600	2,122.56	4,276	3.502	13.2	13.2	4,200	397	4,597	5.550	14	14.0	4,597	0	4,597	4.478	9.5	9.5
2	2	33	13,271	7.105	245	94.3	13,271	148	13,123	11.132	520	146.1	4,572	4,985	4,300	-272	2,122.56	26,950	25,600	2,122.58	4,330	3.496	13.2	13.2	4,300	401	4,701	5.550	14	14.0	4,701	0	4,701	4.479	9.5	9.5
2	3	34	13,244	7.105	245	94.1	13,244	168	13,077	11.132	520	145.6	4,619	5,017	4,300	-319	2,122.58	26,950	25,600	2,122.60	4,384	3.496	13.2	13.2	4,300	403	4,703	5.550	14	14.0	4,703	0	4,703	4.479	9.5	9.5
2	4	35	13,172	7.106	245	93.6	13,172	179	12,993	11.131	520	144.6	4,713	5,053	4,400	-313	2,122.60	28,300	26,950	2,122.62	4,439	3.490	13.2	13.2	4,400	418	4,818	5.550	14	14.0	4,818	0	4,818	4.475	9.5	9.5
2	5	36	13,074	7.107	245	92.9	13,074	185	12,889	11.130	520	143.5	4,619	5,053	4,400	-219	2,122.62	28,300	26,950	2,122.64	4,439	3.490	13.2	13.2	4,400	422	4,822	5.550	14	14.0	4,822	0	4,822	4.475	9.5	9.5
2	6	37	12,954	7.109	245	92.1	12,954	186	12,768	11.129	520	142.1	4,569	5,020	4,400	-169	2,122.64	28,300	26,950	2,122.65	4,493	3.490	13.2	13.2	4,400	422	4,822	5.550	14	14.0	4,822	0	4,822	4.475	9.5	9.5
2	7	38	12,832	7.110	245	91.2	12,832	183	12,649	11.128	520	140.7	4,514	5,060	4,500	-14	2,122.65	28,300	26,950	2,122.65	4,548	3.485	13.2	13.2	4,500	414	4,914	5.550	14	14.0	4,914	0	4,914	4.465	9.5	9.5
2	8	39	12,748	7.111	245	90.7	12,748	170	12,578	11.127	520	140.0	4,564	5,337	4,500	-64	2,122.65	28,300	26,950	2,122.66	4,548	3.485	13.2	13.2	4,500	414	4,914	5.550	14	14.0	4,914	0	4,914	4.465	9.5	9.5
2	9	40	12,672	7.112	245	90.1	12,672	148	12,524	11.126	520	139.3	4,564	5,310	4,500	-64	2,122.66	28,300	26,950	2,122.66	4,548	3.485	13.2	13.2	4,500	427	4,927	5.550	14	14.0	4,927	0	4,927	4.464	9.5	9.5
2	10	41	12,626	7.113	245	89.8	12,626	126	12,499	11.126	520	139.1	4,377	5,310	4,500	123	2,122.66	28,300	26,950	2,122.65	4,548	3.485	13.2	13.2	4,500	441	4,941	5.550	14	14.0	4,941	0	4,941	4.462	9.5	9.5

The Position Report Takes The Monthly Generation Values From the Hydro Input.

Avista's Total Hydro Generation Summary for 2019



Annual Summary:

Forecast	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Clark Fork Budget	238.27	234.01	249.99	456.83	626.42	678.78	349.71	188.27	147.56	192.05	206.35	248.05	318.12
Spokane River Budget	142.76	163.40	176.38	176.70	176.70	162.41	82.13	43.46	60.80	83.11	114.02	136.71	126.22
Mid C Budget	151.71	139.78	143.07	159.76	171.50	174.33	160.61	134.93	87.57	93.17	120.49	135.26	139.39
Total Hydro Budget	532.7	537.2	569.4	793.3	974.6	1015.5	592.5	366.7	295.9	368.3	440.9	520.0	583.7

Hydro Monitoring Process

Precipitation Report for 3/28/2019 Thu

	Daily	Week	Month to Date			Since Oct 1			Since Jan 1			Since Apr 1			12 Month Total		
			Present	Normal	% of Norm	Present	Normal	% of Norm	Present	Normal	% of Norm	Present	Normal	% of Norm	Present	Normal	% of Norm
Hungry Horse	0.00	0.15	0.84	2.52	33%	15.34	17.96	85%	5.74	7.86	73%	24.13	31.63	76%	24.28	31.90	76%
Kalispell	0.00	0.03	0.59	0.84	70%	6.91	5.98	116%	3.56	2.61	136%	13.10	14.50	90%	13.10	14.59	90%
Cabinet	0.00	0.00	2.01	2.52	80%	17.60	20.67	85%	7.55	9.35	81%	25.07	30.99	81%	25.07	31.26	80%
Spokane	0.14	0.19	0.67	1.40	48%	11.00	10.47	105%	4.80	4.66	103%	15.34	15.64	98%	15.34	15.79	97%
Missoula	0.05	0.35	0.54	0.84	64%	7.95	5.37	148%	3.19	2.61	122%	16.10	13.28	121%	16.10	13.37	120%
Total System Precipitation - Weighted								102%			95%						

Natural Flow Report for 3/28/2019 Thu

	Daily	7 Day Average			Month to Date			Since Oct 1			Since Jan 1			Since Apr 1		
		Present	Median	% of Med	Present	Median	% of Med	Present	Median	% of Med	Present	Median	% of Med	Present	Median	% of Med
Hungry Horse	1709	1683	1614	104%	836	1315	64%	836	975	86%	722	988	73%	4527	2971	152%
Kerr	4773	4502	5908	76%	3094	4880	63%	3348	3781	89%	3080	3816	81%	13097	9992	131%
Noxon	12792	9007	12090	75%	6487	10027	65%	6572	7467	88%	5874	7776	76%	24649	17093	144%
Cabinet	12813	9093	12845	71%	6393	10594	60%	6566	7692	85%	5774	8129	71%	25546	17738	144%
Post Falls	11721	10730	10284	104%	4240	8038	53%	2525	3647	69%	3381	5360	63%	5322	4519	118%
Monroe St	11944	10767	10884	99%	4769	8689	55%	3158	4046	78%	4091	5908	69%	5985	4987	120%
Long Lake	14872	14182	12331	115%	6235	10251	61%	3969	4983	80%	5165	7185	72%	6818	5904	115%
Dalles	0	155260	132036	118%	92015	114897	80%	78976	88289	89%	78167	97049	81%	188566	167524	113%
Total System Natural Flow - Weighted										84%			71%			

Average Temperature Report for 3/28/2019 Thu

			Month to Date			Since Jan 1			Since May 1			Since Oct 1		
	Daily	Week		Greater Than			Greater Than			Greater Than			Greater Than	
			Present	Last Yr	Norm	Present	Last Yr	Norm	Present	Last Yr	Norm	Present	Last Yr	Norm
Hungry Horse	39.5	42.1	29.9	-5.2	-4.2	24.0	-4.8	-4.6	44.4	-1.5	0.0	29.7	-1.5	-1.3
Cabinet	44.0	41.9	32.6	-4.8	-4.6	28.5	-4.7	-3.7	46.3	-1.3	0.1	33.7	-1.6	-0.6
Spokane	43.0	44.1	33.3	-5.7	-6.5	28.6	-5.7	-5.4	48.5	-1.4	0.2	33.9	-1.8	-1.6

	3/28/2019	CDA Lake 2400 =	24.52										
		LL Elevation 2400	29.28										
Yesterday	Present		Fri 29/Mar	Sat 30/Mar	Sun 31/Mar	Mon 1/Apr	Tue 2/Apr	Wed 3/Apr	Thu 4/Apr	Fri 5/Apr	Sat 6/Apr	Sun 7/Apr	Mon 8/Apr
4460	4160	CDA	4200	4500	4200	4100	5400	7800	7700	6000	5200	5000	4800
2660	2580	ST J	2500	2500	2500	2500	3500	5000	6500	6000	5000	4500	4000
1180	1430	ST M	1350	800	800	850	3200	3400	2300	1500	1100	1800	2000
4000		*side flows*	3000	2800	2500	2400	2300	3000	4100	4000	3000	4500	5000
12300	Calculated												
12683	Actual	TOTAL INFLOW	11050	10600	10000	9850	14400	19200	20600	17500	14300	15800	15800
		NOAA forecast	11000	10650	10000	9800	11700	18400	20600	17500	14000	16000	17000
		PF DISCHARGE:	8800	9100	9300	9400	9900	11100	12500	13700	14100	14300	14500
		new channel:	8814	9156	9359	9465	9928	11121	12706	13854	14206	14357	14606
		FORECAST CDA LAKE 2400 ELEVATION:	24.68	24.79	24.84	24.88	25.21	25.79	26.37	26.61	26.62	26.71	26.79
		NOAA Hang at Spo	1600	1350	1000	840	740	1560	1660	1175	930	1350	1200
		NOAA Little Spo at Dart	700	680	670	680	830	1040	920	870	850	890	1100
		DIFF PF to LL:	2500	2230	1870	1720	1770	2800	2780	2245	1980	2440	2500
		sum											
yesterday's PF disch:	*8090*	LL INFLOW:	10945	11180	11070	11070	11420	13300	14580	15345	15880	16640	16900
		LL DISCHARGE:	6650	6650	6650	10000	11420	13300	14580	15345	15880	16640	16900
		offset											
		FORECAST LONG LAKE 2400 ELEVATION:	31.07	32.94	34.76	35.19	35.19	35.19	35.19	35.19	35.19	35.19	35.19
		Feet down from top	4.93	3.06	1.24	1.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
			36	36	36	37	36	36	36	36	36	36	36

2400 elevation =				92.63										
	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
	26/Mar	27/Mar	28/Mar	29/Mar	30/Mar	31/Mar	1/Apr	2/Apr	3/Apr	4/Apr	5/Apr	6/Apr	7/Apr	8/Apr
FH at CF	6530	6530	6530	6325	6200	6075	5975	5875	5775	5675	5575	5475	5375	5275
FH correction														
Swan	1060	1060	1060	1050	1025	1000	975	950	925	900	875	850	825	800
Whitefish	127	127	127	125	123	121	119	117	115	113	111	109	107	105
Stillwater	147	147	147	145	143	142	141	140	139	138	137	136	135	134
Sideflow	-5005	-5005	-5005	-1000	-1000	-1000	-1000	-1000	-1000	-1000	-1000	-1000	-1000	-1000
TOTAL INFLOW	2859	2859	2859	6645	6491	6338	6210	6082	5954	5826	5698	5570	5442	5314
RFC Kerr Inflow				7240	7040	6645	6515	6410	6320	6235	6150	6075	6025	6025
APPROX KERR DISCHARGE:	**7290**	**7290**	**7290**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**
SKQ forecast				**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**	**3,200**
FORECAST 2400 ELEVATION:				92.58	92.52	92.46	92.40	92.34	92.28	92.29	92.22	92.15	92.08	92.09
2400 Elevation	***92.82***	***92.79***	***92.79***											
new channel capacity				*52594*	*52201*	*51792*	*51371*	*50937*	*50490*	*50546*	*50073*	*49588*	*49091*	*49153*
Kerr Discharge with Q Lag			7290	7290	9097	10000	10000	10000	10000	10000	10000	10000	10000	10000
	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
	26/Mar	27/Mar	28/Mar	29/Mar	30/Mar	31/Mar	1/Apr	2/Apr	3/Apr	4/Apr	5/Apr	6/Apr	7/Apr	8/Apr
Pros Creek	67	83	102	100	100	115	155	290	380	300	235	300	475	500
Thom River	300	314	302	300	280	285	295	370	520	510	360	340	575	600
CF at SR	4990	5880	6450	6550	6150	5615	5380	5500	6100	6350	5775	5420	5660	5700
Sideflow	-313	444	1427	519	200	200	200	200	400	200	200	200	200	200
Total Kerr/NR Diff	5044	6721	8281	7469	6730	6215	6030	6360	7400	7360	6570	6260	6910	7000
Actual_forecast		5821	7709	7371	7137	6743	6249	6171	6721	7140	7216	6600	6535	6944
Calc'd for forecast				14660	16233	16743	16248	16170	16721	17139	17216	16600	16534	16943
From Daily Hydro														
CF at Plains	8720	9770	10500	10800										
CF at Thompson Falls	8996	10003	10914											
Noxon Inflow	8387	10064	11614											
RFC Noxon Inflow Forecast														
Missoula	4660	5250	5490	5450										
Th-NR Dif	7 day average													
	14 day ave													
	14 day corr ave													

Clark Fork and Spokane River Inflow Forecast

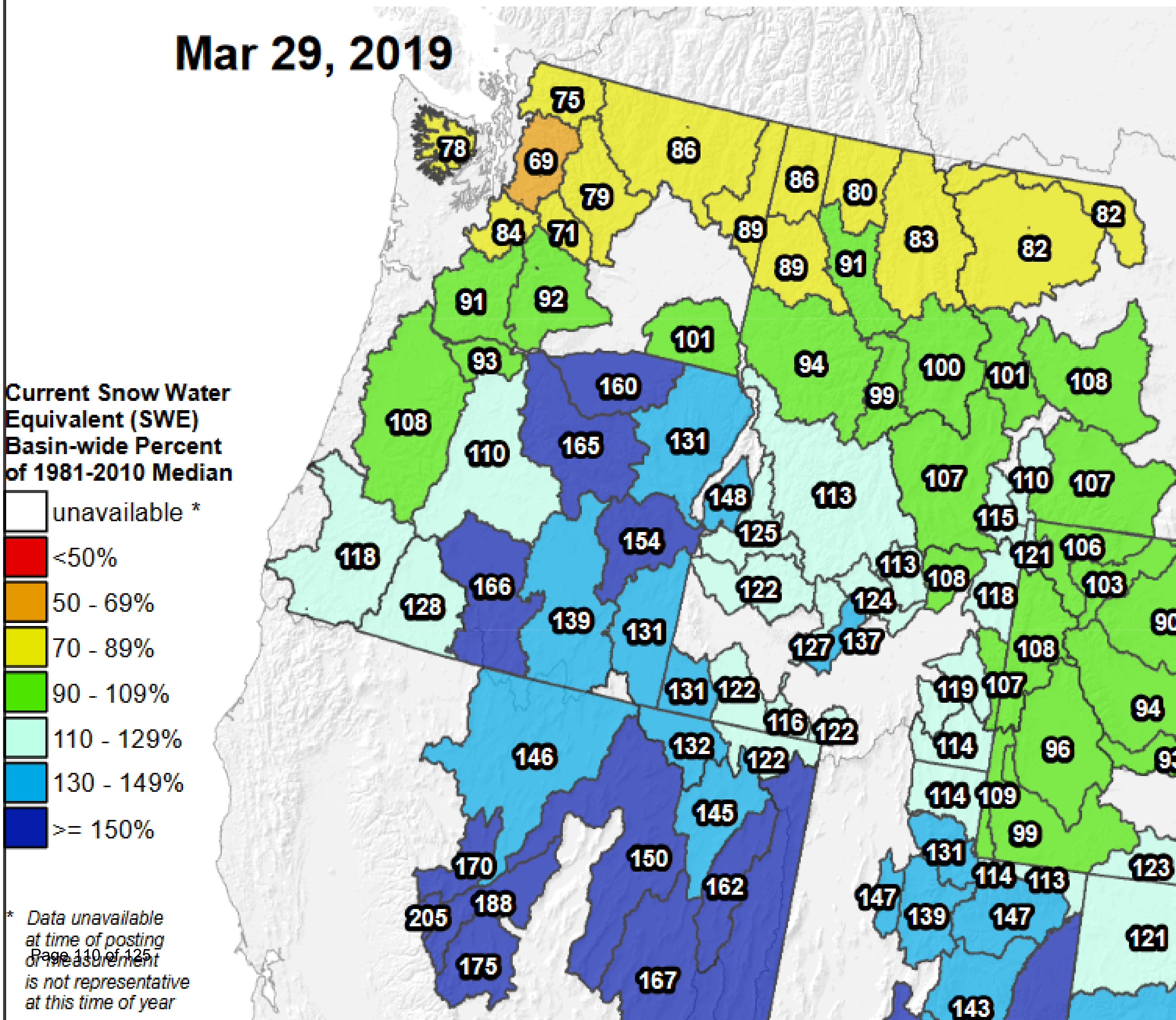
27-MAR-19

			Noxon & Cabinet			LL & LF	
Day	**Date**	**Nox Inflow (cfs)**	**aMW**	**Mwh**	**LL Inflow (cfs)**	**aMW**	**Mwh**
WED	27-MAR-19	9500	**172**	**4128**	10700	**108**	**2592**
THU	28-MAR-19	10500	**190**	**4560**	11400	**108**	**2592**
FRI	29-MAR-19	11000	**199**	**4776**	11800	**108**	**2592**
SAT	30-MAR-19	11300	**204**	**4896**	11700	**108**	**2592**
SUN	31-MAR-19	10800	**195**	**4680**	11500	**108**	**2592**
MON	01-APR-19	10200	**184**	**4416**	11200	**108**	**2592**
TUE	02-APR-19	10200	**184**	**4416**	11100	**108**	**2592**

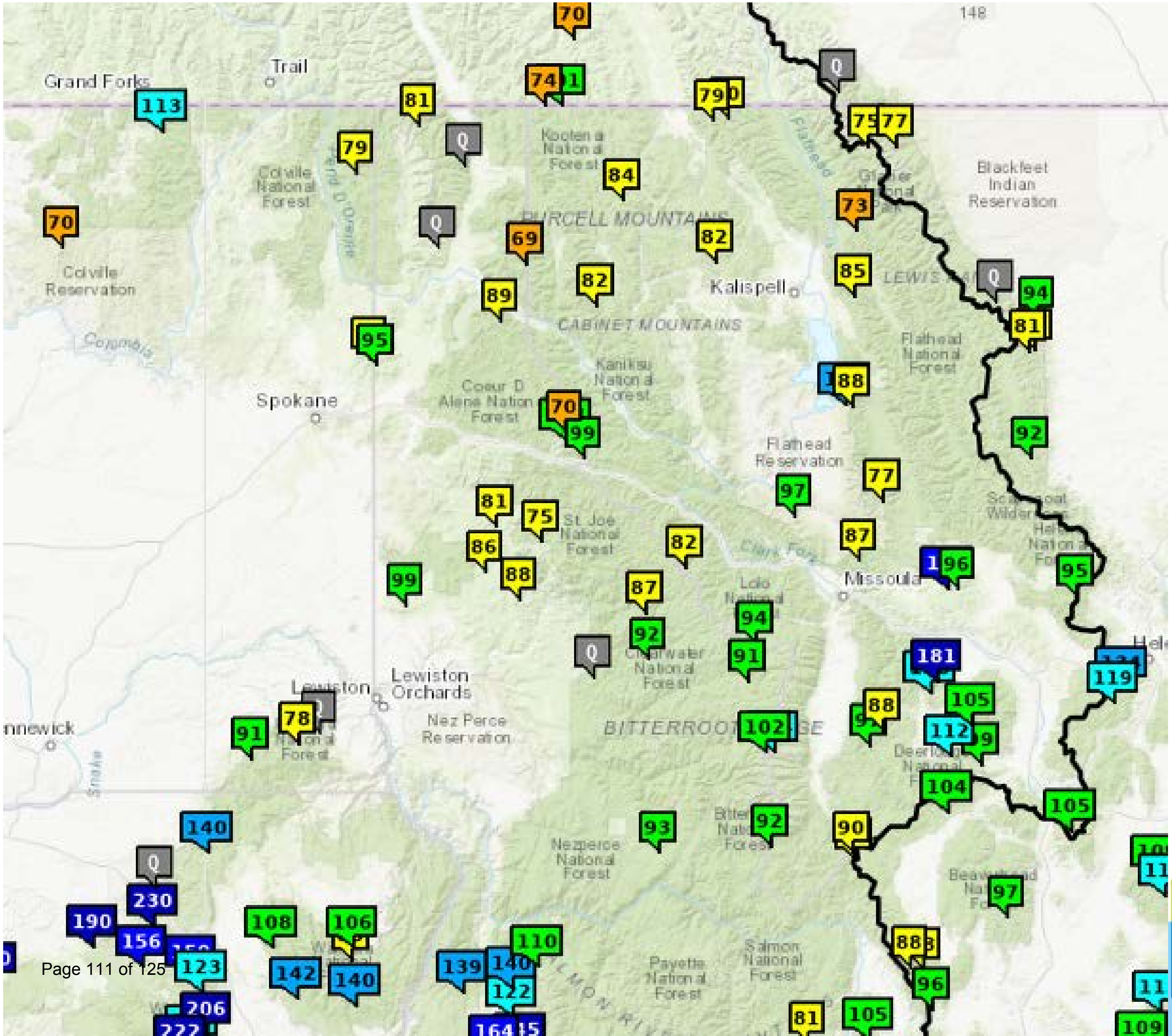
Inputs and Calculations

Day	Day Offset	Date	Kerr Discharge	Kerr Nox Diff	Nox Infl Forecast
SUN	-3	24-MAR-19	3330	3799	7149
MON	-2	25-MAR-19	3350	5027	8364
TUE	-1	26-MAR-19	3340	5044	8387
WED	0	27-MAR-19	3400	6200	9543
THU	1	28-MAR-19	3400	7100	10480
FRI	2	29-MAR-19	3400	7600	11000
SAT	3	30-MAR-19	3400	7900	11300
SUN	4	31-MAR-19	3400	7400	10800
MON	5	01-APR-19	3400	6800	10200
TUE	6	02-APR-19	3400	6800	10200

Westwide SNOTEL Current Snow Water Equivalent (SWE)



Northwest River Forecast Center
Current Station Snow Conditions



Montana SNOTEL Snow/Precipitation Update Report

Based on Mountain Data from NRCS SNOTEL Sites

Provisional data, subject to revision

Data based on the first reading of the day (typically 00:00) for Monday, March 25, 2019

Basin Site Name	Elev (ft)	Snow Water Equivalent Current (in)	Snow Water Equivalent Median (in)	Snow Water Equivalent Pct of Median	Water Year-to-Date Precipitation Current (in)	Water Year-to-Date Precipitation Average (in)	Water Year-to-Date Precipitation Pct of Average
FLATHEAD RIVER BASIN							
Badger Pass	6900	20.3	29.3	69	23.7	30.9	77
Bisson Creek	4920	11.5	9.9c	116	16.6	15.4c	108
Blacktail Mtn	5650	11.8	N/A	*	12.0	N/A	*
Emery Creek	4350	10.1	13.6	74	17.8	22.3	80
Flattop Mtn.	6300	31.7	41.2	77	36.6	44.1	83
Grave Creek	4300	11.5	14.3	80	22.7	29.5	77
Hand Creek	5035	9.2	11.0	84	10.0	15.7	64
Kraft Creek	4750	9.9	N/A	*	23.5	24.6	96
Many Glacier	4900	10.1	12.5	81	19.3	28.7	67
Moss Peak	6780	31.0	34.2	91	33.8	34.1	99
Noisy Basin	6040	32.5	38.0	86	34.7	41.0	85
North Fork Jocko	6330	30.7	39.5	78	40.9	45.3	90
Pike Creek	5930	2.8	N/A	*	23.1	28.3	82
Sleeping Woman	6150	14.7	13.8c	107	21.6	19.4c	111
Stahl Peak	6030	27.4	33.2	83	28.3	35.7	79
Stuart Mountain	7400	26.1	30.0c	87	27.7	29.7c	93
Basin Index (%)				83			86
UPPER CLARK FORK RIVER BASIN							
Barker Lakes	8250	13.3	13.4	99	13.2	15.1	87
Basin Creek	7180	8.0	7.3	110	10.3	9.0	114
Black Pine	7210	12.3	9.4	131	15.1	12.6	120
Combination	5600	7.6	4.4	173	10.5	8.6	122
Copper Bottom	5200	8.0	N/A	*	12.6	15.1	83
Copper Camp	6950	19.9	N/A	*	-M	30.1	*
Lubrecht Flume	4680	4.9	2.2	223	11.8	9.6	123
Nevada Ridge	7020	12.9	13.5c	96	15.4	15.1c	102
N Fk Elk Creek	6250	10.6	10.4	102	14.6	13.0	112
North Fork Jocko	6330	30.7	39.5	78	40.9	45.3	90
Peterson Meadows	7200	10.5	9.4	112	11.0	10.8c	102
Rocker Peak	8000	15.1	12.0	126	14.9	12.9	116
Skalkaho Summit	7250	18.9	20.9	90	19.7	21.3	92
Stuart Mountain	7400	26.1	30.0c	87	27.7	29.7c	93
Warm Springs	7800	20.3	18.6	109	21.0	21.0	100
Basin Index (%)				100			100

Montana SNOTEL Snow/Precipitation Update Report

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Basin Site Name	Elev (ft)	Snow Water Equivalent Current (in)	Snow Water Equivalent Median (in)	Snow Water Equivalent Pct of Median	Water Year-to-Date Precipitation Current (in)	Water Year-to-Date Precipitation Average (in)	Water Year-to-Date Precipitation Pct of Average
BITTERROOT RIVER BASIN							
Daly Creek	5780	9.8	9.7	101	12.1	12.8	95
Lolo Pass	5240	25.3	26.9	94	30.7	32.0	96
Nez Perce Camp	5650	12.0	12.9	93	18.8	19.2	98
Saddle Mtn.	7940	21.0	23.0	91	19.1	22.0	87
Skalkaho Summit	7250	18.9	20.9	90	19.7	21.3	92
Twelvemile Creek	5600	17.7	14.6	121	32.9	29.9	110
Twin Lakes	6400	37.3	34.8	107	38.7	42.6	91
Basin Index (%)				99			96
LOWER CLARK FORK RIVER BASIN							
Hoodoo Basin	6050	32.7	38.4	85	37.2	44.4	84
Humboldt Gulch	4250	10.6	9.0	118	27.3	34.8	78
Lolo Pass	5240	25.3	26.9	94	30.7	32.0	96
Lookout	5190	28.3	26.6	106	28.7	37.6	76
Poorman Creek	5100	28.3	34.4c	82	39.5	51.3c	77
Sleeping Woman	6150	14.7	13.8c	107	21.6	19.4c	111
Stuart Mountain	7400	26.1	30.0c	87	27.7	29.7c	93
Sunset	5540	15.8	21.3	74	20.6	34.8	59
Basin Index (%)				91			82

Montana SNOTEL Snow/Precipitation Update Report

Based on Mountain Data from NRCS SNOTEL Sites

Provisional data, subject to revision

Data based on the first reading of the day (typically 00:00) for Monday, March 25, 2019

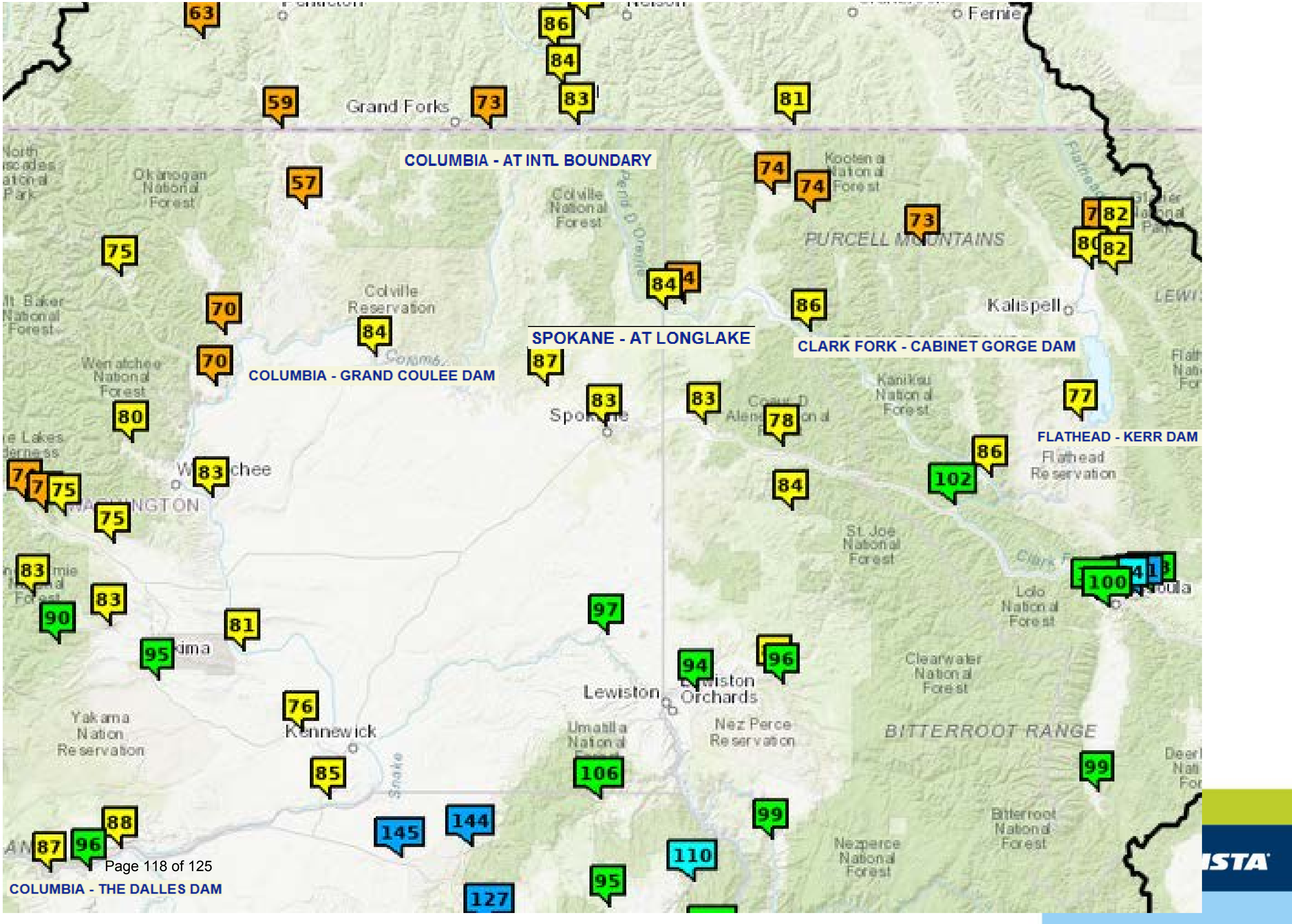
Basin Site Name	Elev (ft)	Snow Water Equivalent Current (in)	Snow Water Equivalent Median (in)	Snow Water Equivalent Pct of Median	Water Year-to-Date Precipitation Current (in)	Water Year-to-Date Precipitation Average (in)	Water Year-to-Date Precipitation Pct of Average
SPOKANE RIVER BASIN							
Hoodoo Basin	6050	32.7	38.4	85	37.2	44.4	84
Humboldt Gulch	4250	10.6	9.0	118	27.3	34.8	78
Lookout	5190	28.3	26.6	106	28.7	37.6	76
Lost Lake	6110	39.6	51.6	77	43.3	56.2	77
Mica Creek	4510	18.7	20.8	90	31.6	39.5	80
Mosquito Ridge	5260	30.3	31.3	97	31.0	42.1	74
Quartz Peak	4700	17.1	19.1	90	29.2	31.7	92
Ragged Mountain	4210	19.0	20.4R	93	27.5	29.4R	94
Sherwin	3200	7.0	7.0	100	-M	27.2	*
Sunset	5540	15.8	21.3	74	20.6	34.8	59
Basin Index (%)				**89**			**79**

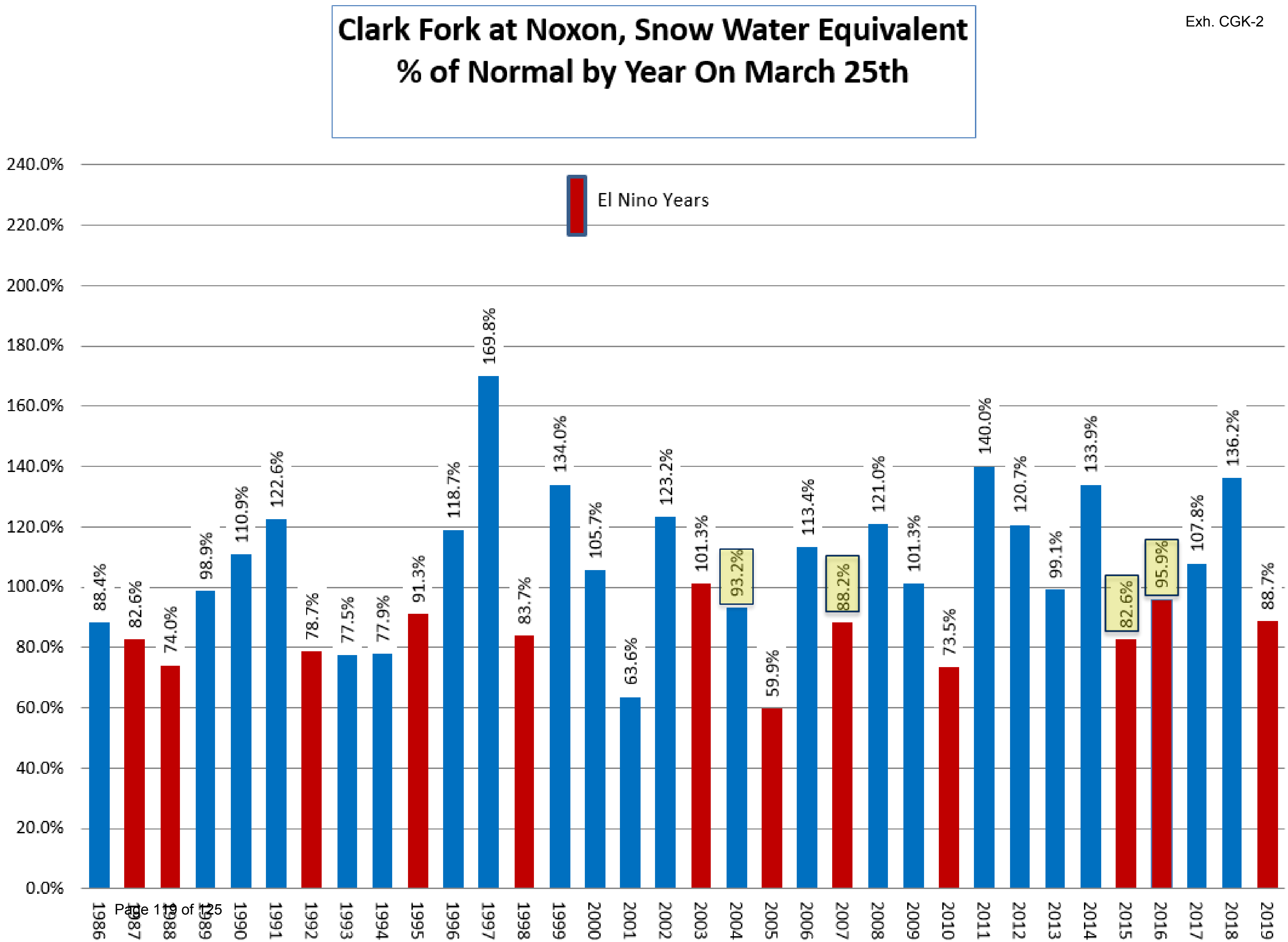
Spokane River	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Above Roland	SC	4347						
Fourth Of July Summit	SC	3140	36	7.8	8.5	92%	7.8	92%
Hoodoo Basin	SNOTEL	6050	104	30.6	32.3	95%	39.8	123%
Humboldt Gulch	SNOTEL	4250	44	11.4	9.8	116%	14.8	151%
Kellogg Peak	SC	5560	45	14.1	23.2	61%	18.6	80%
Lookout	SNOTEL	5190	88	27.1	24.5	111%	23.8	97%
Lost Lake	SNOTEL	6110	108	36.2	43.7	83%	52.6	120%
Lower Sands Creek #2	SC	3179	56	14.2	16.2	88%	19.5	120%
Mica Creek	SNOTEL	4510			19.8		24.2	122%
Mosquito Ridge	SNOTEL	5260	88	28.0	29.8	94%	32.4	109%
Quartz Peak	SNOTEL	4700	62	18.7	19.5	96%	19.1	98%
Ragged Mountain	SNOTEL	4210	64	17.3	21.4	81%	17.8	83%
Ragged Mountain	SC	4200			18.3			
Ragged Ridge	SC	3333	24	6.0	7.9	76%	5.3	67%
Roland Summit	SC	5353	102	30.0	27.0	111%	28.6	106%
Sherwin	SNOTEL	3200	41	10.2	9.1	112%	10.7	118%
Skitwish Ridge	SC	4840	77	21.4	25.0	86%	30.8	123%
Sunset	SNOTEL	5540	58	15.6	19.1	82%	23.7	124%
Twin Spirit Divide	SC	3514	38	10.1	11.9	85%	9.0	76%
Basin Index						**91%**		**108%**
# of sites						16		16

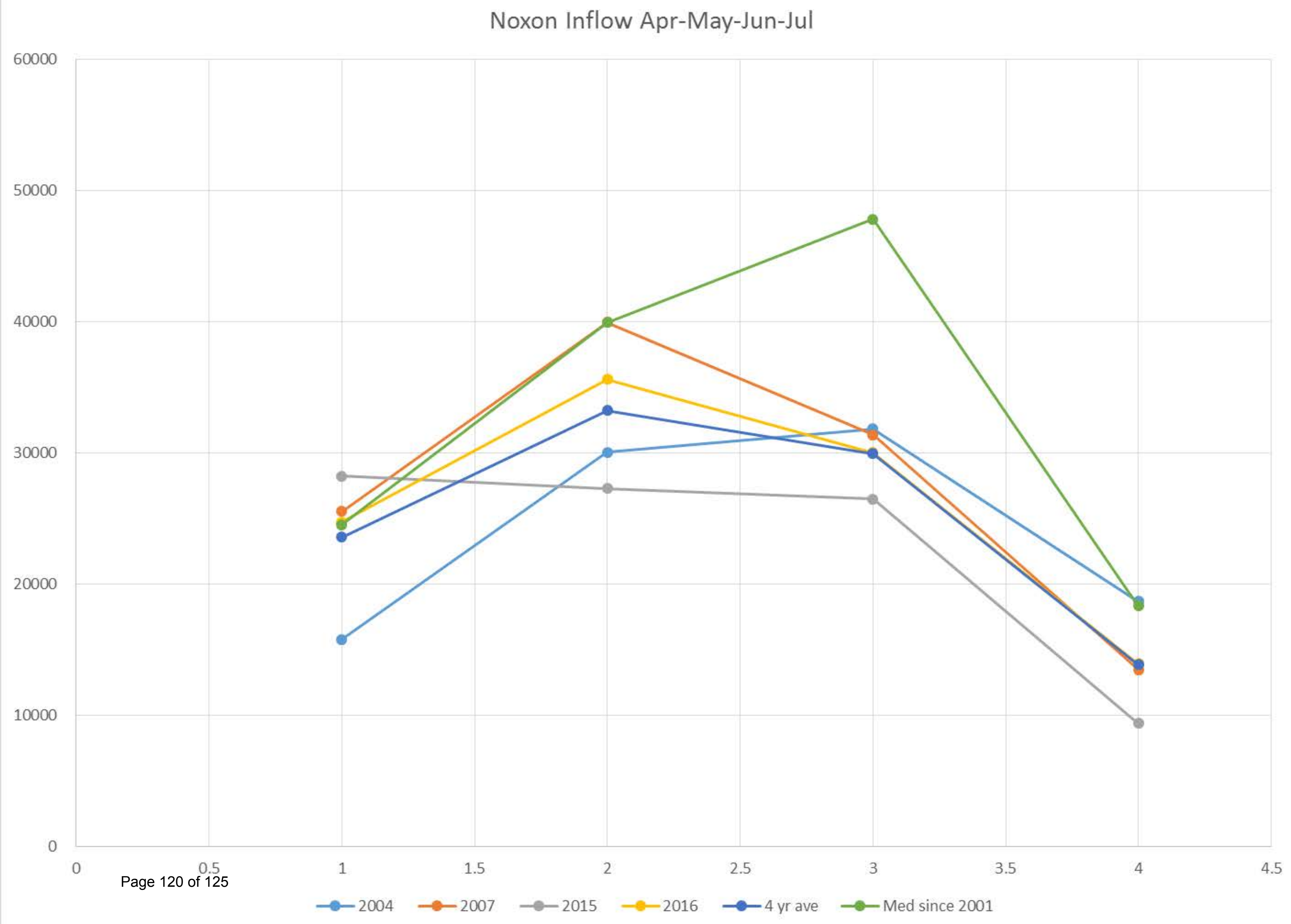
FLATHEAD RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Akamina	SC	5905			17.0		26.9	158
Ashley Divide	SC	4820	28	7.4	5.3	140	5.5	104
Badger Pass	SNOTEL	6900	74	19.7	23.7	83	32.1	135
Bassoo Peak	SC	5150			7.6		9.4	124
Bisson Creek	SNOTEL	4920	47	10.1	8.4	120	11.8	140
Blacktail	SC	5650	44	10.1	11.0	92	11.4	104
Blacktail Mtn	SNOTEL	5650	43	10.5			12.8	
Brush Creek Timber	SC	5000	37	8.7	6.3	138	9.9	157
Chicken Creek	SC	4060	46	11.6	12.8	91	17.3	135
Desert Mountain	SC	5600			10.8		16.1	149
Emery Creek	SNOTEL	4350	44	10.9	12.5	87	18.2	146
Fatty Creek	SC	5500			17.4		24.8	143
Flattop Mtn.	SNOTEL	6300	96	30.3	33.8	90	43.8	130
Grave Creek	SNOTEL	4300	49	12.0	13.5	89	18.7	139
Griffin Creek Divide	SC	5150			8.1		9.4	116
Hand Creek	SNOTEL	5035	41	9.6	9.5	101	12.0	126
Hell Roaring Divide	SC	5770	70	19.2	23.9	80	28.9	121
Herrig Junction	SC	4850	63	17.9	21.2	84	24.6	116
Holbrook	SC	4530	25	5.5	7.6	72	12.6	166
Kishenehn	SC	3890	27	6.2	7.2	86	9.4	131
Kraft Creek	SNOTEL	4750	50	10.6			18.4	
Logan Creek	SC	4300	30	5.6	5.5	102	6.9	125
Many Glacier	SNOTEL	4900	41	10.2	11.5	89	16.7	145
Marias Pass	SC	5250	49	12.0	13.1	92	20.3	155
Mineral Creek	SC	4000			13.9		18.6	134
Moss Peak	SNOTEL	6780	93	27.1	28.1	96	41.7	148
Noisy Basin	SNOTEL	6040	95	28.8	31.5	91	51.2	163
North Fork Jocko	SNOTEL	6330	96	28.2	33.5	84	48.8	146
Pike Creek	SNOTEL	5930	20	5.1			10.3	
Revais	SC	4800	27	6.3	1.8	350	1.7	94
Sleeping Woman	SNOTEL	6150	55	13.4	12.2	110	16.2	133
Spotted Bear Mountain	SC	7000	44	11.7	10.7	109	19.9	186
Stahl Peak	SNOTEL	6030	98	25.4	27.5	92	34.5	125
Stryker Basin	SC	6180	79	24.2	25.0	97	27.0	108
Trinkus Lake	SC	6100		28.6	32.4	88	46.1	142
Truman Creek	SC	4060	26	5.6	4.0	140	4.9	123
Upper Holland Lake	SC	6200		22.8	26.0	88	42.7	164
W.castle (Bush)	SC	4987			11.3			
Weasel Divide	SC	5450	71	23.5	26.2	90	31.4	120
Basin Index						**93**		**137**
# of sites						29		29

Correlation of SWE with Noxon Inflow at Different Dates					
	Jan 15 Snow	Feb 1 Snow	March 1 Snow	April 1 Snow	April 15 Snow
March Inflow	0.35747	0.33927	0.42884	N/A	N/A
April Inflow	0.34367	0.40215	0.52671	0.52422	0.46694
May Inflow	0.6135	0.64997	0.75264	0.78705	0.82528
June Inflow	0.65672	0.73982	0.7828	0.83564	0.86078
July Inflow	0.54601	0.64472	0.6349	0.65938	0.70999
April-July Inflow	0.67688	0.75648	0.83252	0.87181	0.89675

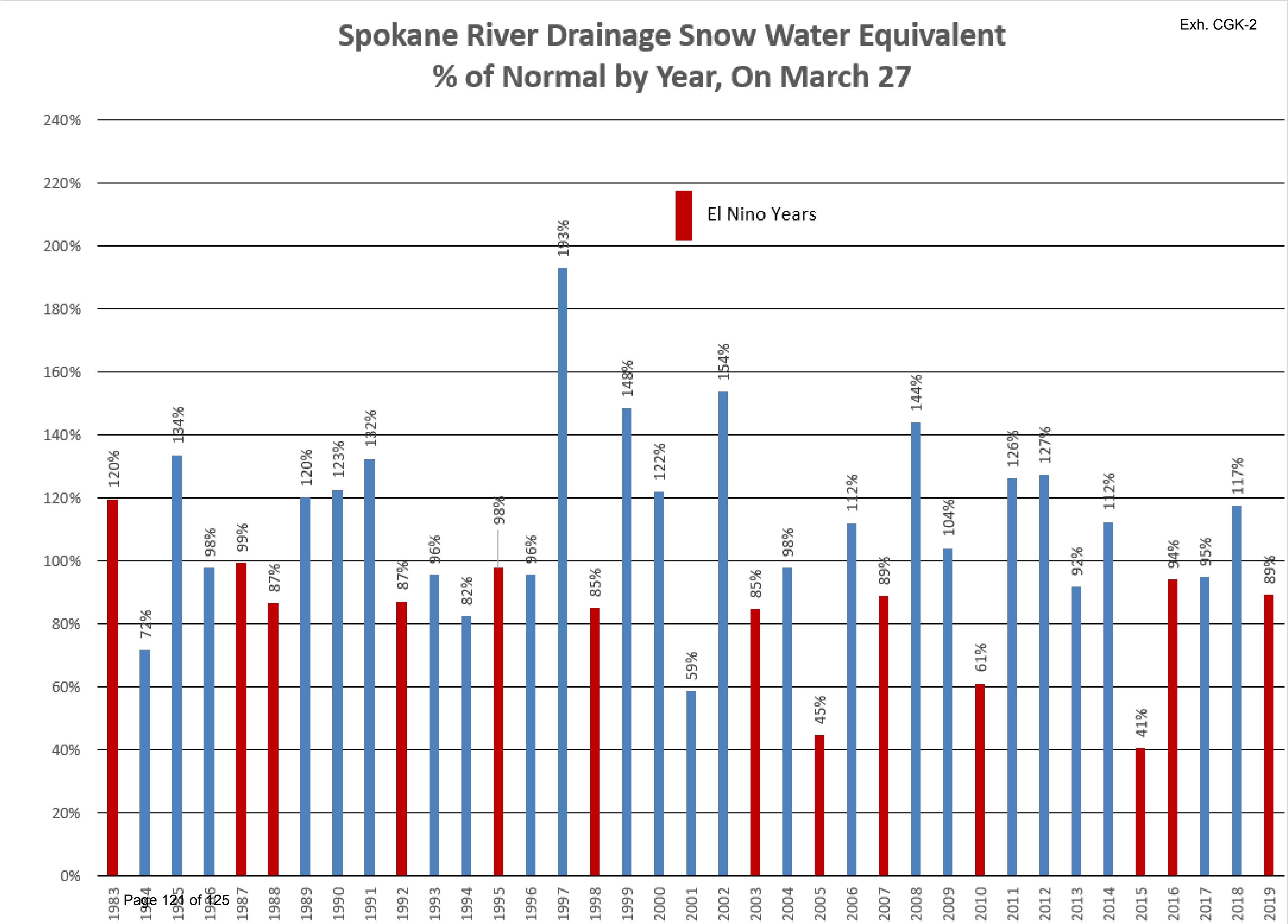
Correlation of SWE with Long Lake Inflow at Different Dates					
	Jan 15 Snow	Feb 1 Snow	March 1 Snow	April 1 Snow	April 15 Snow
March Inflow	-0.08022	0.216882	0.305448	N/A	N/A
April Inflow	-0.29566	0.407281	0.512986	0.591117	0.533807
May Inflow	-0.21314	0.670346	0.746225	0.815435	0.877846
June Inflow	-0.18501	0.612524	0.695465	0.792401	0.821166
July Inflow	-0.16516	0.618768	0.663063	0.749395	0.786223
April-July Inflow	-0.25446	0.669804	0.765418	0.859012	0.882042


COLUMBIA - AT INTL BOUNDARY
SPOKANE - AT LONGLAKE
CLARK FORK - CABINET GORGE DAM
COLUMBIA - GRAND COULEE DAM
FLATHEAD - KERR DAM
COLUMBIA - THE DALLES DAM
Grand Forks
Fernie
Okanogan National Forest
Colville National Forest
Kootenai National Forest
PURCELL MOUNTAINS
Colville Reservation
Kalispell
Wenatchee National Forest
Kaniksu National Forest
Flathead Reservation
St. Joe National Forest
Lolo National Forest
Clearwater National Forest
Lewiston
Orchards
Kennewick
Umatilla National
Nez Perce Reservation
BITTERROOT RANGE
Yakama Nation Reservation
Bitterroot National Forest
Nezperce National Forest


Clark Fork at Noxon, Snow Water Equivalent
% of Normal by Year On March 25th
El Nino Years
240.0%
220.0%
200.0%
180.0%
160.0%
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
1986 88.4%
1987 82.6%
1988 74.0%
1989 98.9%
1990 110.9%
1991 122.6%
1992 78.7%
1993 77.5%
1994 77.9%
1995 91.3%
1996 118.7%
1997 169.8%
1998 83.7%
1999 134.0%
2000 105.7%
2001 63.6%
2002 123.2%
2003 101.3%
2004 93.2%
2005 59.9%
2006 113.4%
2007 88.2%
2008 121.0%
2009 101.3%
2010 73.5%
2011 140.0%
2012 120.7%
2013 99.1%
2014 133.9%
2015 82.6%
2016 95.9%
2017 107.8%
2018 136.2%
2019 88.7%


Noxon Inflow Apr-May-Jun-Jul
60000
50000
40000
30000
20000
10000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
2004
2007
2015
2016
4 yr ave
Med since 2001

Exh. CGK-2



Spokane River Drainage Snow Water Equivalent
% of Normal by Year, On March 27
El Nino Years
240%
220%
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
0%
120%
72%
134%
98%
99%
87%
120%
123%
132%
87%
96%
82%
98%
96%
193%
85%
148%
122%
59%
154%
85%
98%
45%
112%
89%
144%
104%
61%
126%
127%
92%
112%
41%
94%
95%
117%
89%
1983
1984
1985
1986
1987
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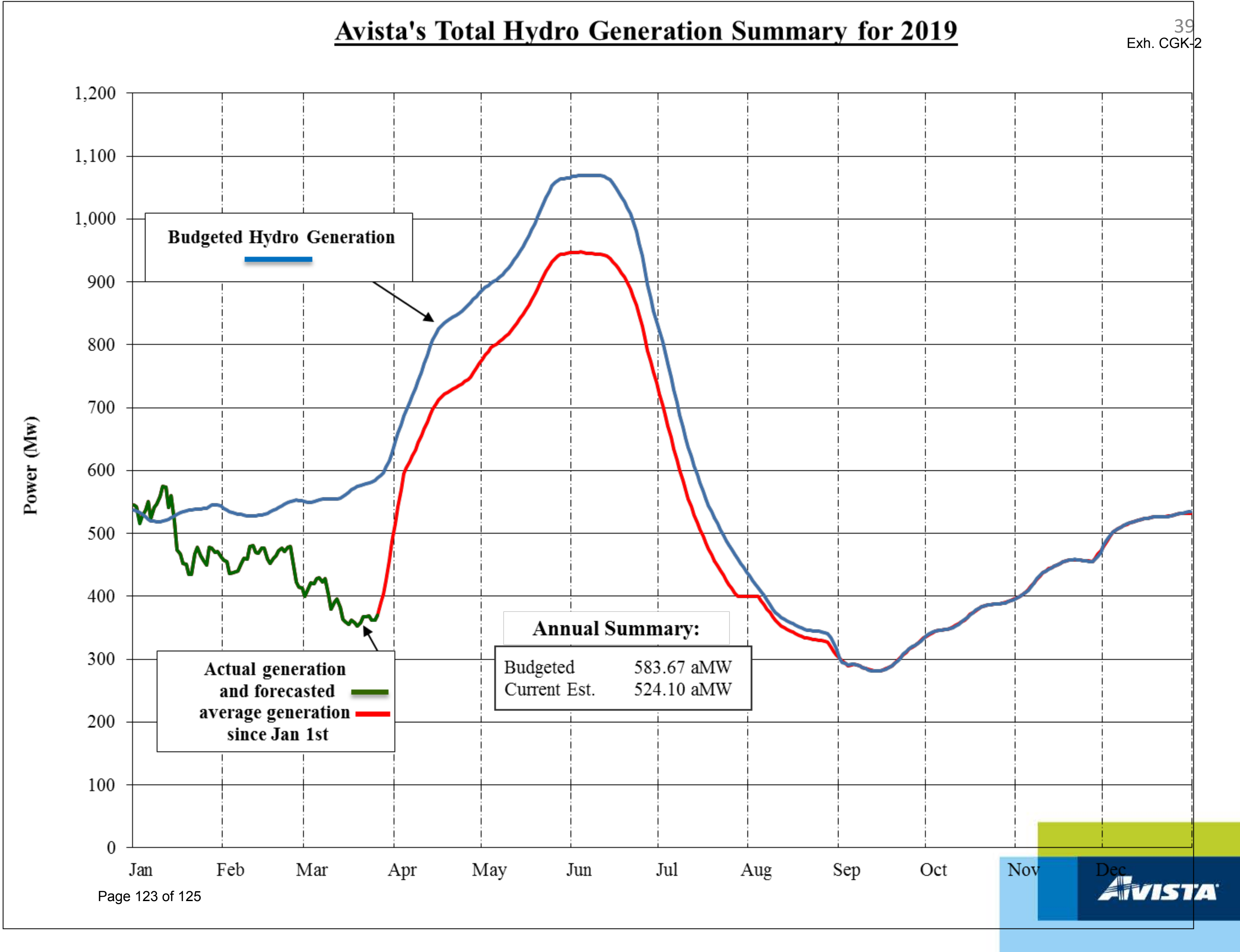
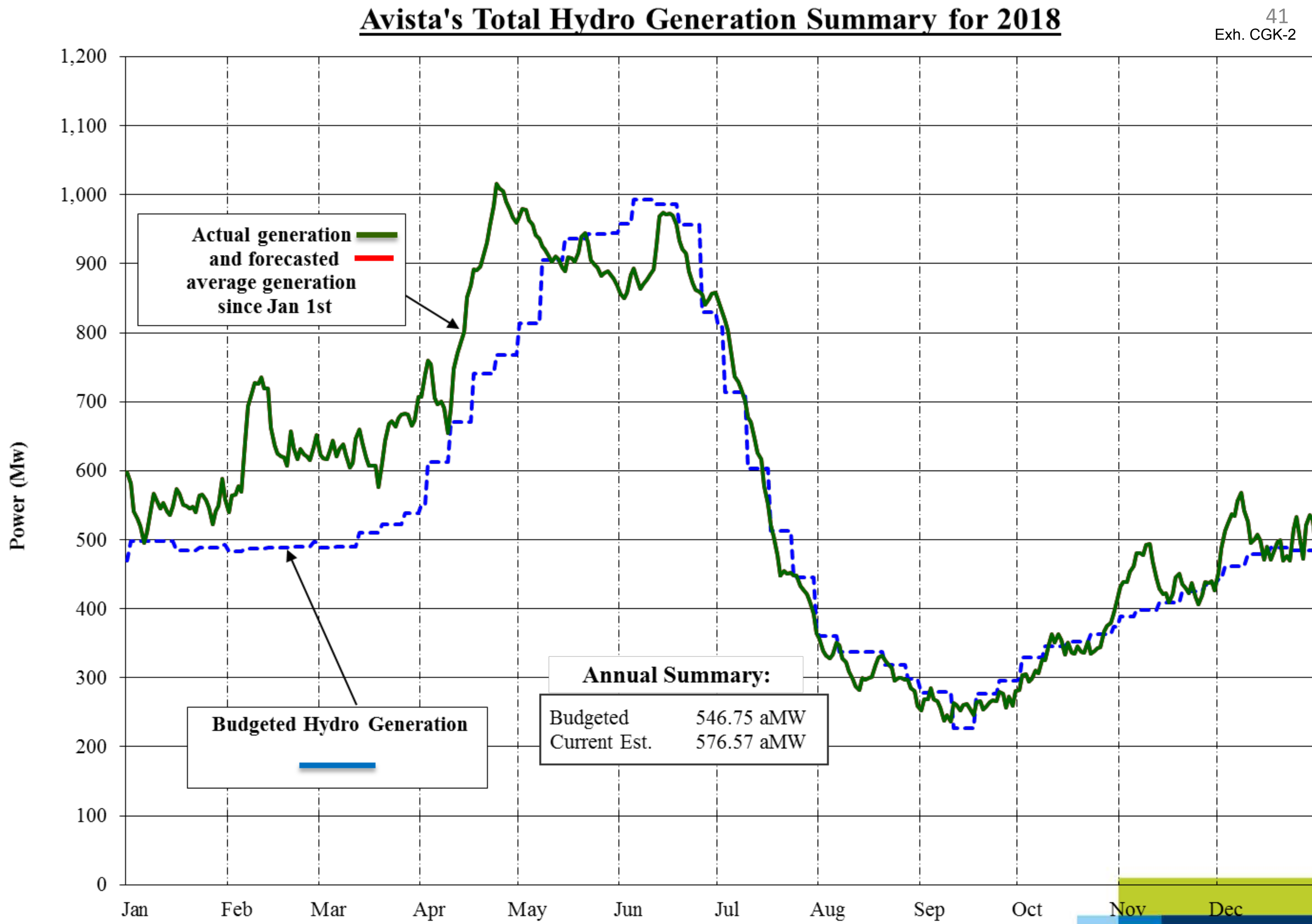
2018
2019

	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19
Cabinet normal	83.29	95.76	91.91	93.38	101.18	172.62	244.23	252.90	140.61	67.70
Cabinet revised normal	83.24	95.88	93.11	91.98	99.27	180.00	244.23	252.90	136.28	73.82
revised as % of normal	99.94%	100.13%	101.30%	98.50%	98.11%	104.28%	100.00%	100.00%	96.92%	109.04%
Energy adjustment	100.00%	100.00%	90.00%	92.00%	60.00%	85.00%	80.00%	80.00%	85.00%	100.00%
Cabinet requested	83.24	95.88	83.80	84.62	59.56	153.00	195.38	202.32	115.84	73.82
Cabinet forecast	83.24	95.88	83.80	84.62	59.56	153.00	195.38	202.32	115.84	73.82
Cabinet avg capacity	245.00	245.00	245.00	245.00	245.00	245.00	250.00	250.00	245.00	245.00
Noxon normal	128.82	148.68	143.28	144.19	153.66	265.46	451.79	501.30	220.24	104.96
Noxon revised normal	131.07	151.86	145.16	142.03	150.74	276.83	451.80	501.30	213.43	114.45
revised as % of normal	101.75%	102.14%	101.31%	98.50%	98.10%	104.28%	100.00%	100.00%	96.91%	109.04%
Energy adjustment	100.00%	100.00%	90.00%	92.00%	60.00%	85.00%	80.00%	80.00%	85.00%	100.00%
Noxon requested	131.07	151.86	130.64	130.67	90.44	235.31	361.44	401.04	181.42	114.45
Noxon forecast	131.07	151.86	130.64	130.67	90.44	235.31	361.44	401.04	181.42	114.45
Noxon avg capacity	500.00	500.00	500.00	500.00	500.00	500.00	540.00	540.00	500.00	500.00
Upper Spo revised normal	45.6	53.1	54.28	60.58	66.38	66.70	66.70	61.64	33.09	15.54
revised as % of normal	96.0%	97.8%	100.0%	100.2%	100.0%	100.0%	100.0%	100.0%	92.7%	89.7%
Energy adjustment	100.0%	100.0%	100.0%	100.0%	100.0%	90.0%	90.0%	90.0%	100.0%	100.0%
Upper Spo requested	45.6	53.1	54.3	60.6	66.4	60.0	60.0	55.5	33.1	15.5
Upper Spo forecast	45.6	53.1	54.3	60.6	64.3	60.0	60.0	55.5	33.1	15.5
Upper Spo avg capacity	75.7	75.7	73.2	73.2	75.0	75.7	75.7	75.7	63.0	64.7
Long Lake	47.1	58.4	62.5	77.1	84.0	84.0	84.0	74.8	34.5	19.2
Little Falls	19.4	24.0	29.9	31.6	33.6	34.0	34.0	30.5	14.5	8.8
LL/LF normal	66.5	82.4	92.4	108.7	117.6	118.0	118.0	105.3	49.0	27.9
Long Lake	44.8	58.4	62.5	77.1	84.0	84.0	84.0	74.8	34.5	19.2
Little Falls	18.4	23.8	26.0	26.0	26.0	26.0	26.0	26.0	14.5	8.8
LL/LF revised normal	63.2	82.2	88.5	103.1	110.0	110.0	110.0	100.8	49.0	27.9
revised as % of normal	95.1%	99.8%	95.8%	94.9%	93.6%	93.2%	93.2%	95.7%	100.0%	100.0%
Energy adjustment	100.0%	100.0%	100.0%	85.0%	95.0%	100.0%	100.0%	90.0%	100.0%	100.0%
LL/LF requested	63.2	82.2	88.5	87.6	104.5	110.0	110.0	90.7	49.0	27.9
LL/LF forecast	63.2	82.2	88.5	86.7	100.7	110.0	110.0	90.7	49.0	27.9
LL/LF avg capacity	104	104	115	115	115	115	115	115	104	104
Tot Spokane, forecast	108.8	135.3	142.8	147.3	165.0	170.0	170.0	146.2	82.1	43.5
AVA Hydro, forecast	239.8	287.2	273.4	277.9	255.4	405.3	531.5	547.2	263.5	157.9
check MWh's	172,929	213,661	203,412	186,782	189,782	291,842	395,414	393,994	196,080	117,488
Mid-C contracts	125.2	137.6	151.7	139.8	143.1	159.8	171.5	174.3	160.6	134.9
Energy adjustment	100.0%	100.0%	100.0%	100.0%	84.0%	80.0%	80.0%	85.0%	85.0%	90.0%
Mid-C requested	125.2	137.6	151.7	139.8	120.2	127.8	137.2	148.2	136.5	121.4
Mid-C forecast	125.2	137.6	151.7	139.8	120.2	127.8	137.2	148.2	136.5	121.4
Mid-C avg capacity	215	215	215	215	215	215	215	215	215	215


Avista's Total Hydro Generation Summary for 2019
Power (Mw)
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Budgeted Hydro Generation
Actual generation
and forecasted
average generation
since Jan 1st
Annual Summary:
Budgeted 583.67 aMW
Current Est. 524.10 aMW
AVISTA

Forecast	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Clark Fork Actual	230.30	199.28	150.30	388.31	556.82	603.32	297.25	188.27	147.56	192.05	206.35	248.05	284.11
Clark Fork Budget	238.27	234.01	249.99	456.83	626.42	678.78	349.71	188.27	147.56	192.05	206.35	248.05	318.12
Clark Fork Difference	-7.97	-34.73	-99.69	-68.52	-69.60	-75.46	-52.46	0.00	0.00	0.00	0.00	0.00	-34.01
Spokane River Actual	144.99	132.95	123.86	170.00	170.00	146.28	82.13	43.46	60.80	83.11	114.02	136.71	117.17
Spokane River Budget	142.76	163.40	176.38	176.70	176.70	162.41	82.13	43.46	60.80	83.11	114.02	136.71	126.22
Spokane River Diff.	2.2	-30.4	-52.5	-6.7	-6.7	-16.1	0.0	0.0	0.0	0.0	0.0	0.0	-9.05
Mid C Actual	129.25	124.07	112.74	127.81	137.20	148.18	136.52	121.44	87.57	93.17	120.49	135.26	122.82
Mid C Budget	151.71	139.78	143.07	159.76	171.50	174.33	160.61	134.93	87.57	93.17	120.49	135.26	139.39
Mid C Difference	-22.46	-15.71	-30.33	-31.95	-34.30	-26.15	-24.09	-13.49	0.00	0.00	0.00	0.00	-16.57
Total Hydro Actual	504.5	456.3	386.9	686.1	864.0	897.8	515.9	353.2	295.9	368.3	440.9	520.0	524.10
Total Hydro Budget	532.7	537.2	569.4	793.3	974.6	1015.5	592.5	366.7	295.9	368.3	440.9	520.0	583.7
Total Hydro Difference	-28.2	-80.9	-182.6	-107.2	-110.6	-117.7	-76.5	-13.5	0.0	0.0	0.0	0.0	-59.63


Avista's Total Hydro Generation Summary for 2018
Power (Mw)
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Actual generation
and forecasted
average generation
since Jan 1st
Budgeted Hydro Generation
Annual Summary:
Budgeted 546.75 aMW
Current Est. 576.57 aMW