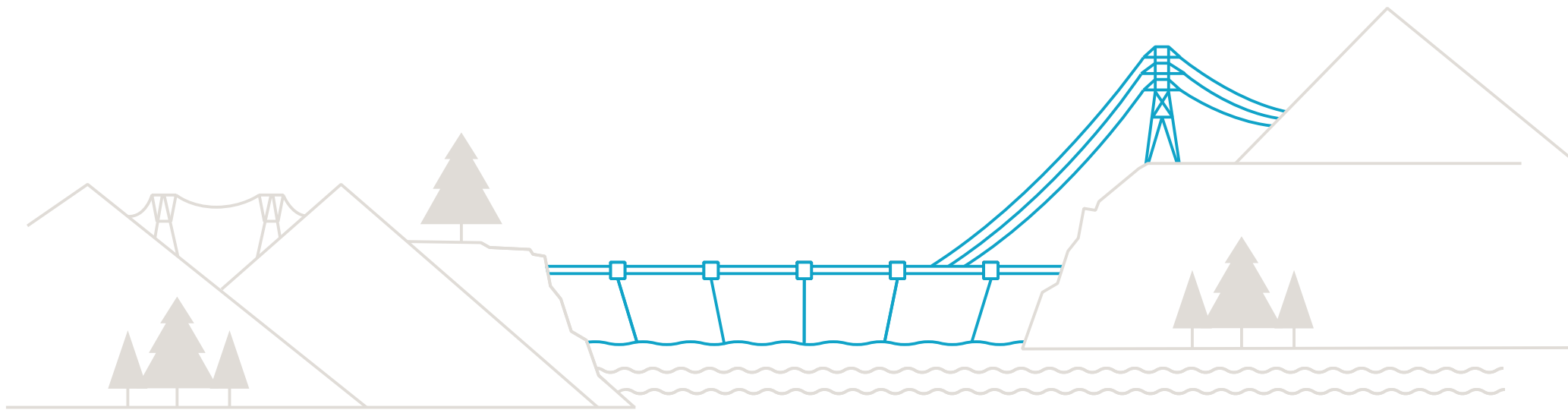


2017 Operations Update Meeting



Castlegar
Monday, June 19, 2017

Welcome & Introductions

- Darren Sherbot, Manager, Operations Planning
- Gillian Kong, Specialist Engineer, Operations Planning
- Chris Egan, Plant Manager, Hugh L. Keenleyside Dam
- Dean den Biesen, Natural Resource Specialist
- Mary Anne Coules, Stakeholder Engagement Advisor, Lower Columbia

Columbia River Basin

- Columbia River is the fourth largest in North America and the “most powerful.”
- Canada has 15% of the basin area. The Canadian portion of the basin is mountainous, with much snow. On average, it produces 30-35% of the run-off for the entire basin. During flood years Canada has produced as much as 50% of the flows recorded at Portland.
- Most hydropower production, and need for flood control is in the USA. The best storage dam sites are in Canada.



Columbia River Treaty

Canada	United States
Required to construct the Mica, Arrow and Duncan storage reservoirs on the Columbia River system.	Required to pay Canada 50% of the estimated value of future flood control benefits in the U.S.
Required to operate these reservoirs for optimum power generation and flood control downstream in both countries.	Required to deliver to Canada 50% of the increased power capability at downstream U.S. plants due to upstream regulation – this is called the ‘Downstream Benefit.’
<i>Canada did not turn over control of its reservoirs to the U.S.</i> Rather, the Treaty requires specific operations for specific conditions.	Permitted to construct and operate the Libby project on the Kootenai River – flooding some Canadian land, but also providing power and flood control benefits for Canada.

Columbia River Treaty Benefits

- Both countries realize significant flood control and power benefits from the Treaty.
- U.S. paid Canada for 50% of the U.S. flood control benefits provided by Treaty reservoirs until 2024.
- Canada receives its 50% share of electricity benefits directly from the U.S., typically worth between \$100 to \$150 million per year depending on the electricity market and water supply. Called the 'Downstream Benefit,' this goes directly to the B.C. government.
- Treaty has a minimum term of 60 years. It can be terminated by either country with 10 years notice.
- Canada will continue to provide a minimum amount of flood protection ("Called Upon Flood Control") for U.S. as long as the Canadian dams exist.

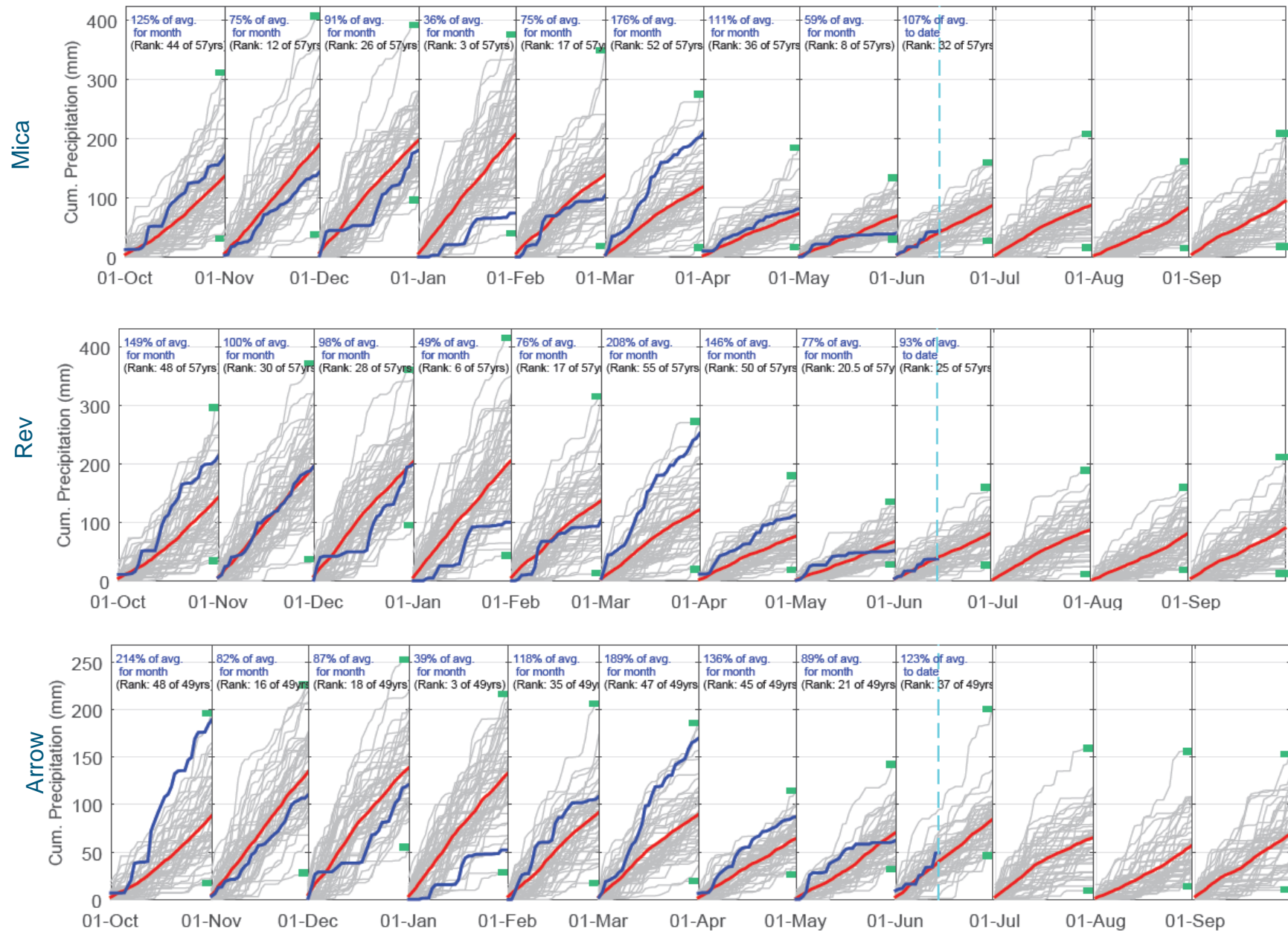
Columbia Operating Agreements

- Periodically, the Treaty Operating Committee negotiates other (supplemental) operating agreements when there are mutual benefits to modify water releases specified by Treaty terms.
- **Non-Treaty Storage Agreement (NTSA)**
 - Non-treaty storage is additional water stored in Kinbasket Reservoir not coordinated under the terms of the Columbia River Treaty.
 - New long-term Non-Treaty Storage Agreement (NTSA) executed April 2012 to coordinate use of 5 million acre feet of non-treaty storage.
 - Agreement expires September 2024 with early termination provisions.

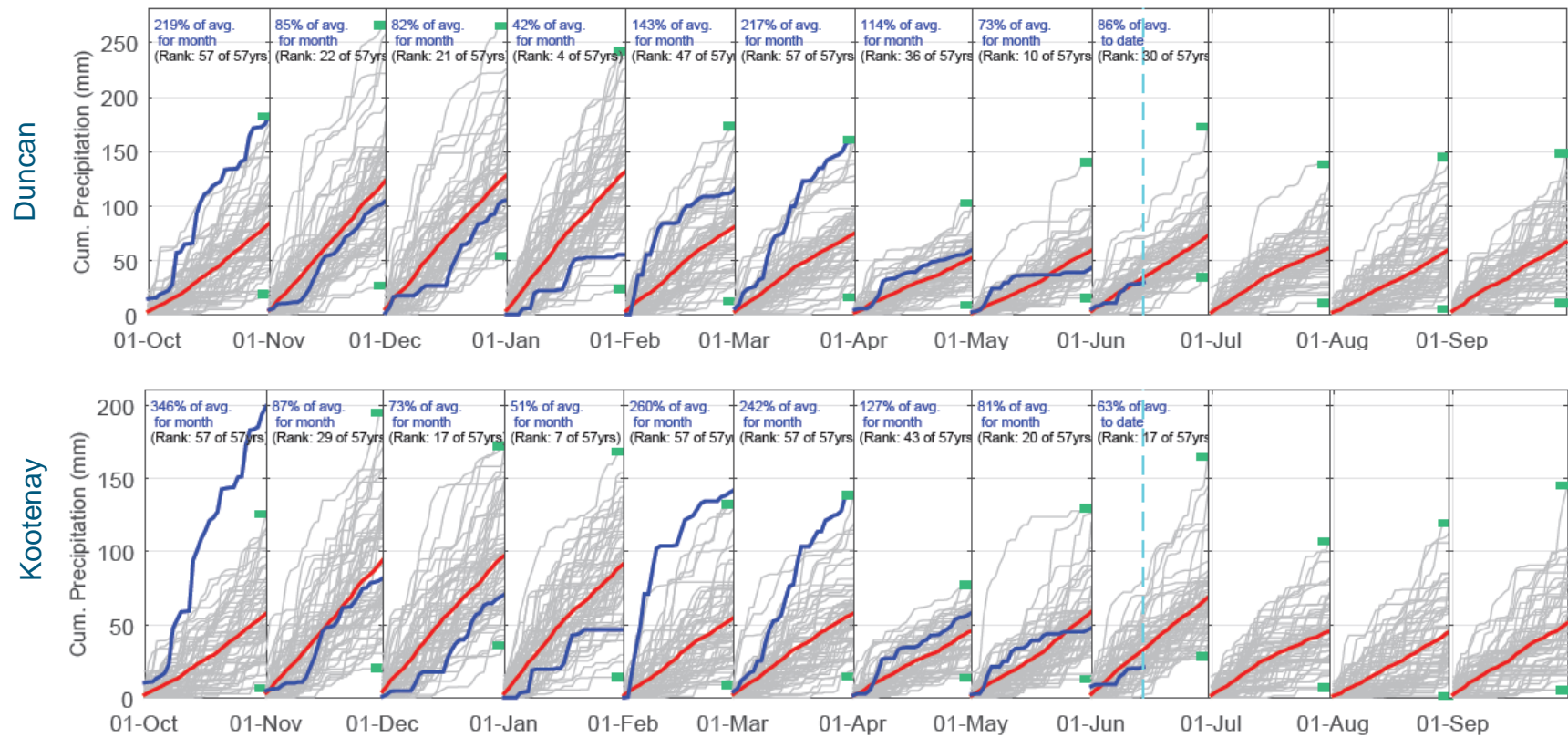
Columbia Operating Agreements (continued)

- **Arrow Summer Storage Agreement (2016)**
 - Short-term agreement to help mitigate local concerns and operational issues associated with low reservoir levels.
 - Without the agreement, Arrow would have been three feet lower by the end of July 2016.
- **Short-Term Libby Agreement**
 - Signed in 2013 to address some of Canada's concerns about the timing of water releases from Libby Dam.
- **Non-Power Uses Agreement**
 - Annual operating agreement that allows Arrow Lakes Reservoir releases from HLK to be altered between January and July to provide fish protection flows.

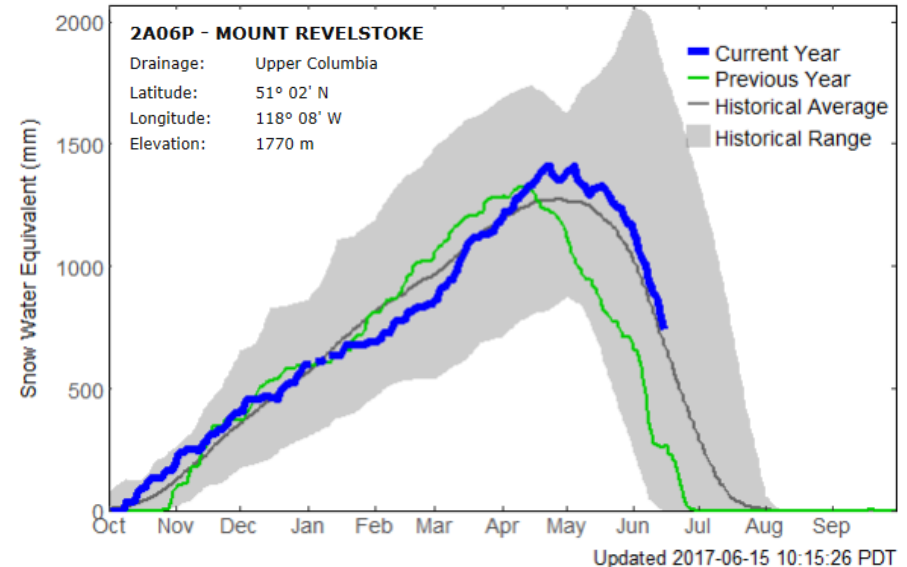
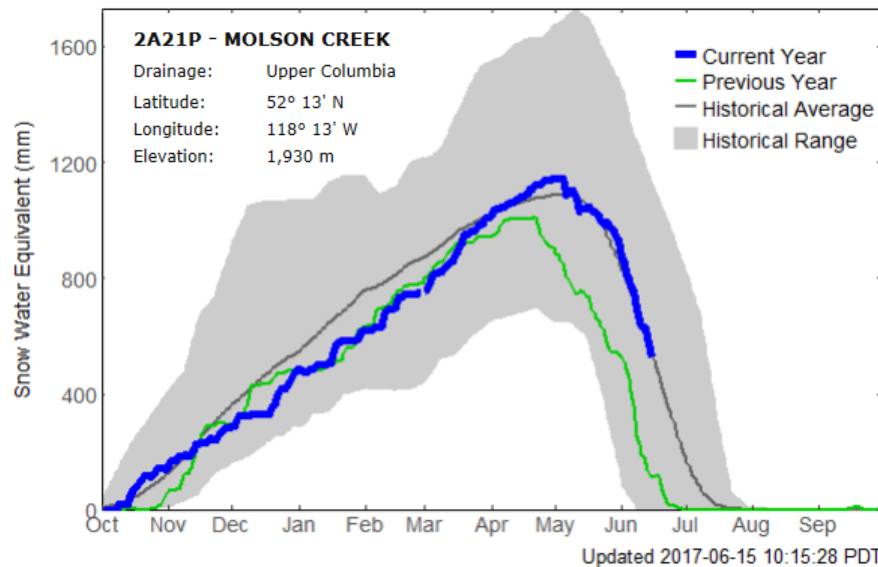
Columbia Precipitation – Dry Winter, Wet Spring



Kootenay Precipitation

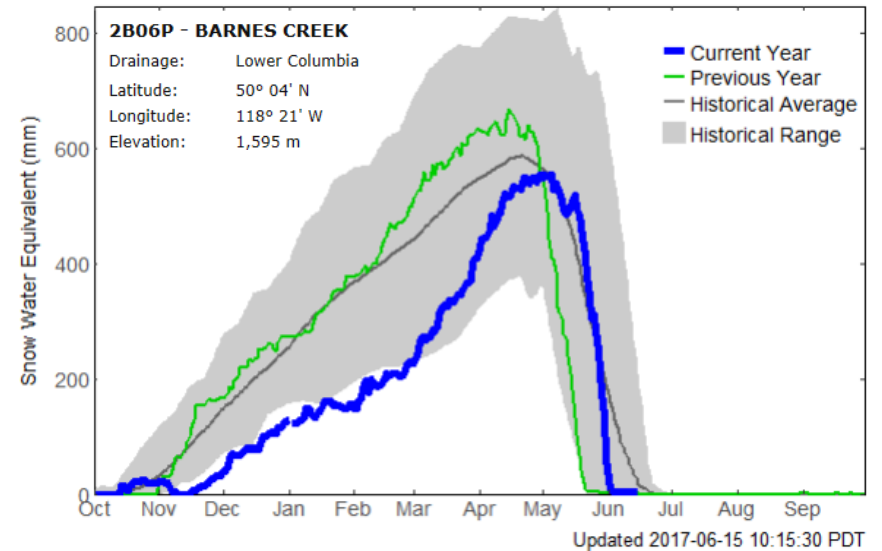
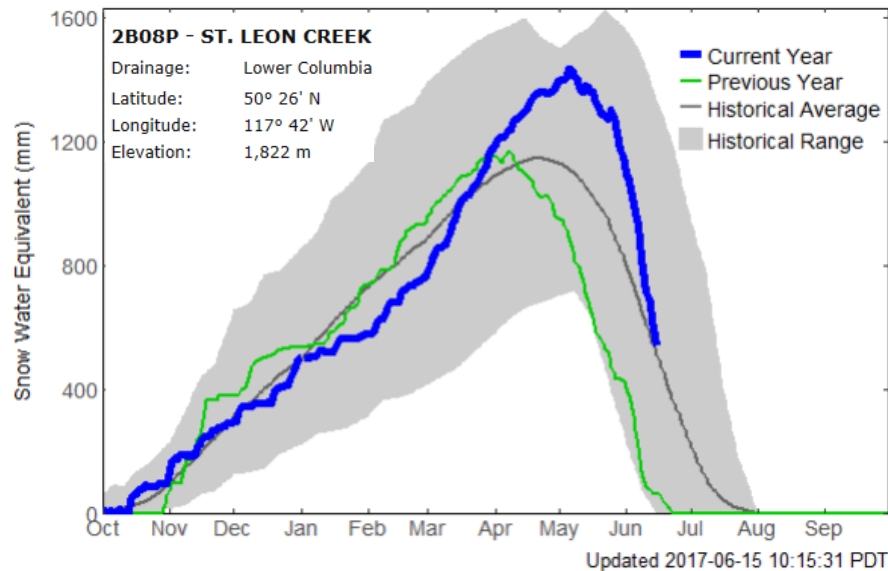


Snowpack (Upper Columbia)



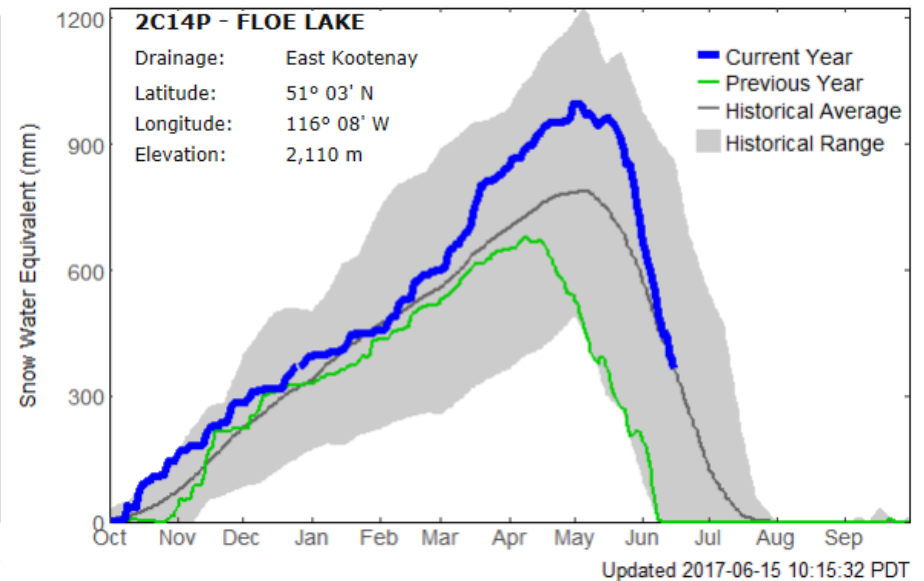
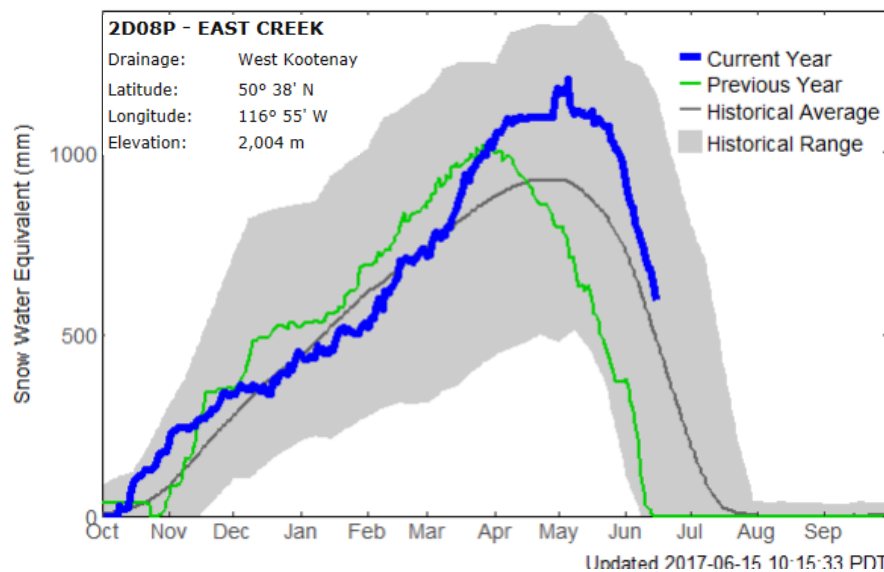
- Snowpack in the Upper Columbia reached its peak accumulation in May.
- Wetter and colder than normal spring led to about average to above average snowpack.
- Hot and dry weather in May/June resulted in intense snowmelt runoff.
- A fair amount of snow still remaining in the Upper Columbia and diminishing at a normal rate.
- Expect snow to completely deplete by the end of July.

Snowpack (Lower Columbia)



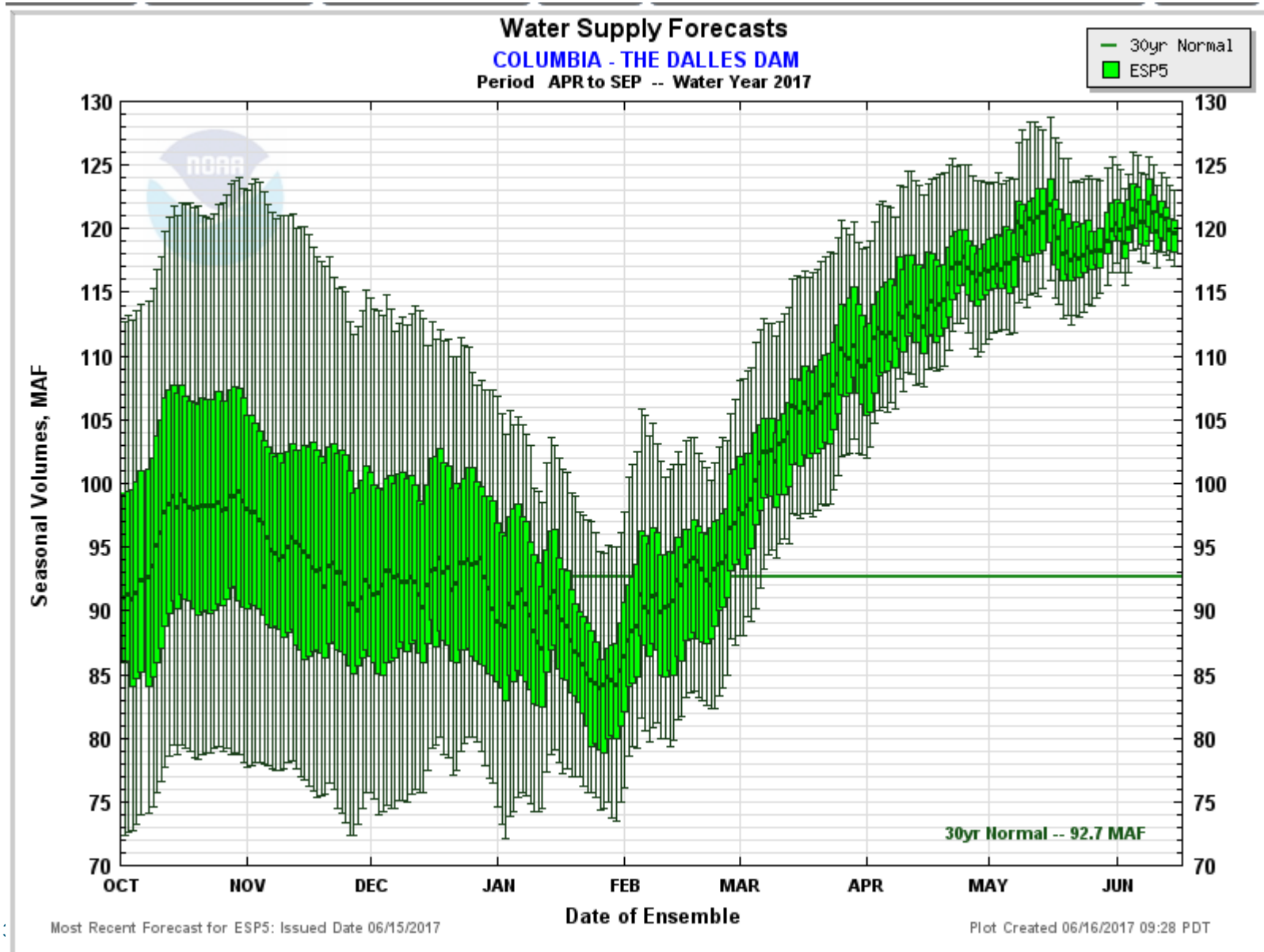
- Lower Columbia basin experienced much wetter conditions than the Upper Columbia resulting in well above average snowpack at higher elevations.
- Still a fair amount of high elevation snow remaining (St. Leon Creek) but depleting faster than average.
- Low elevation snow (Barnes Creek) ran out in early June.

Snowpack (Kootenay)

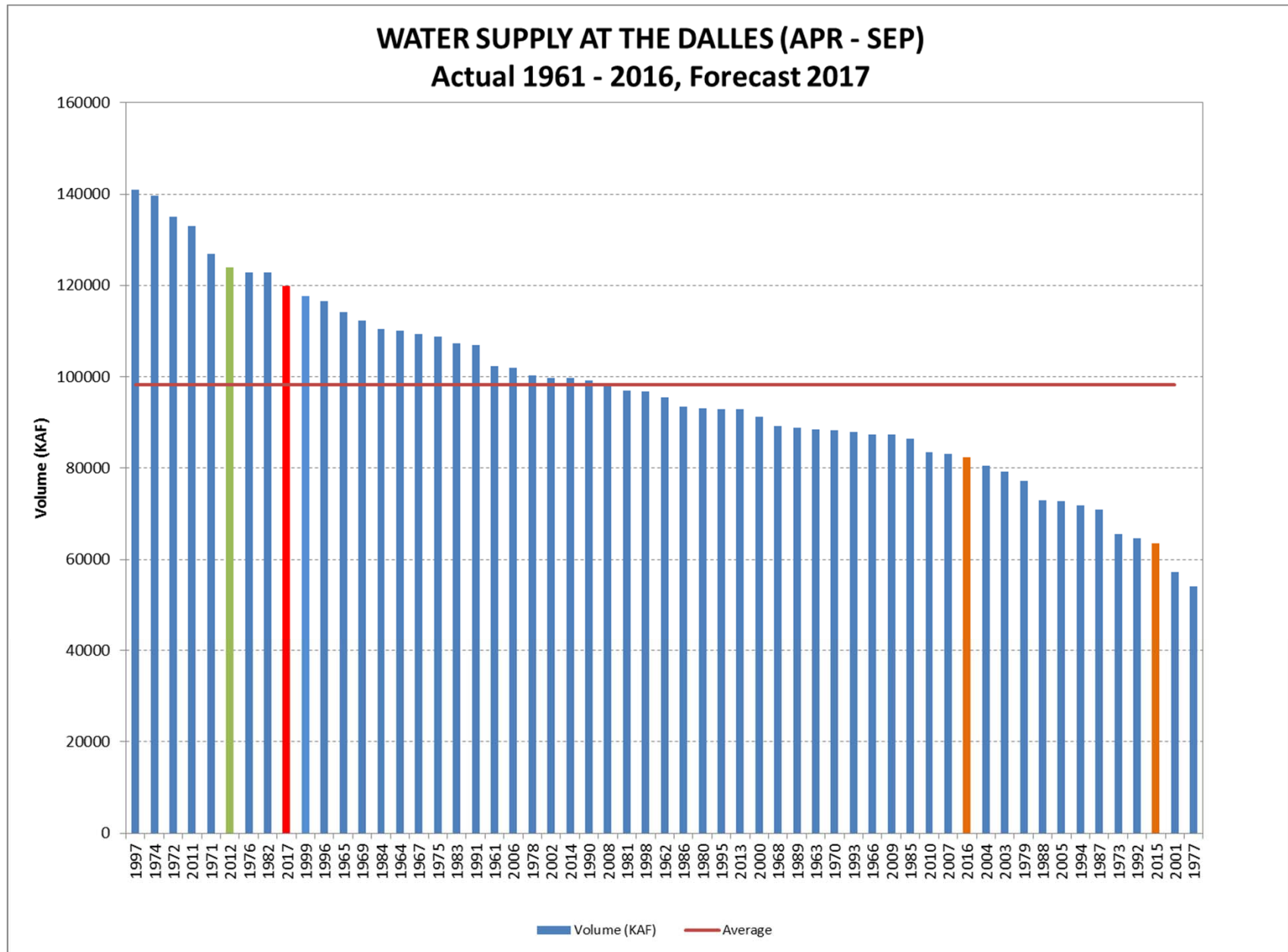


- Three to four record breaking precipitation months in the Kootenay system contributed to well above normal rainfall and snowpack accumulation.
- Snowpack is diminishing but still about average to above average for this date.

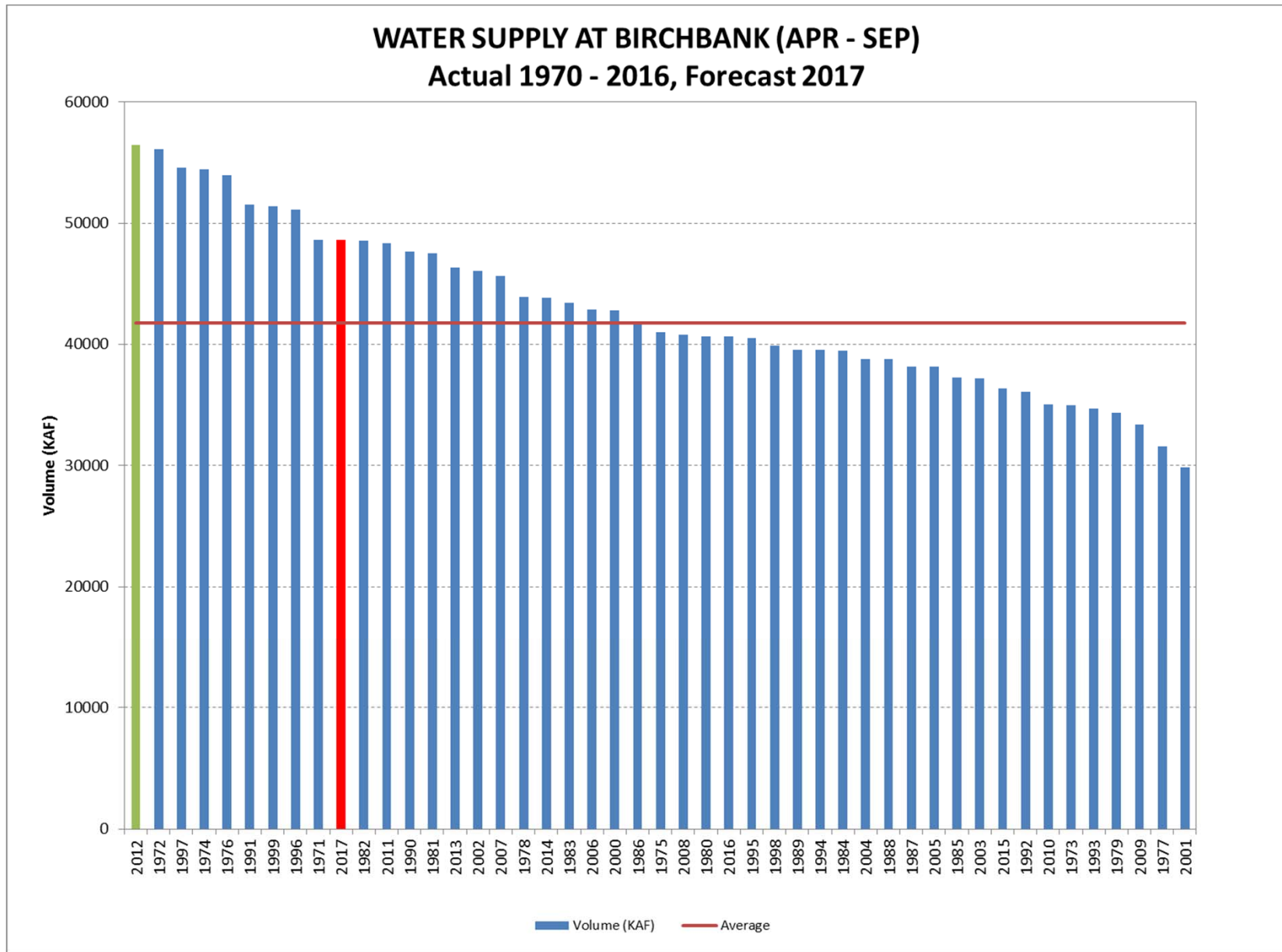
Water Supply Forecast: The Dalles



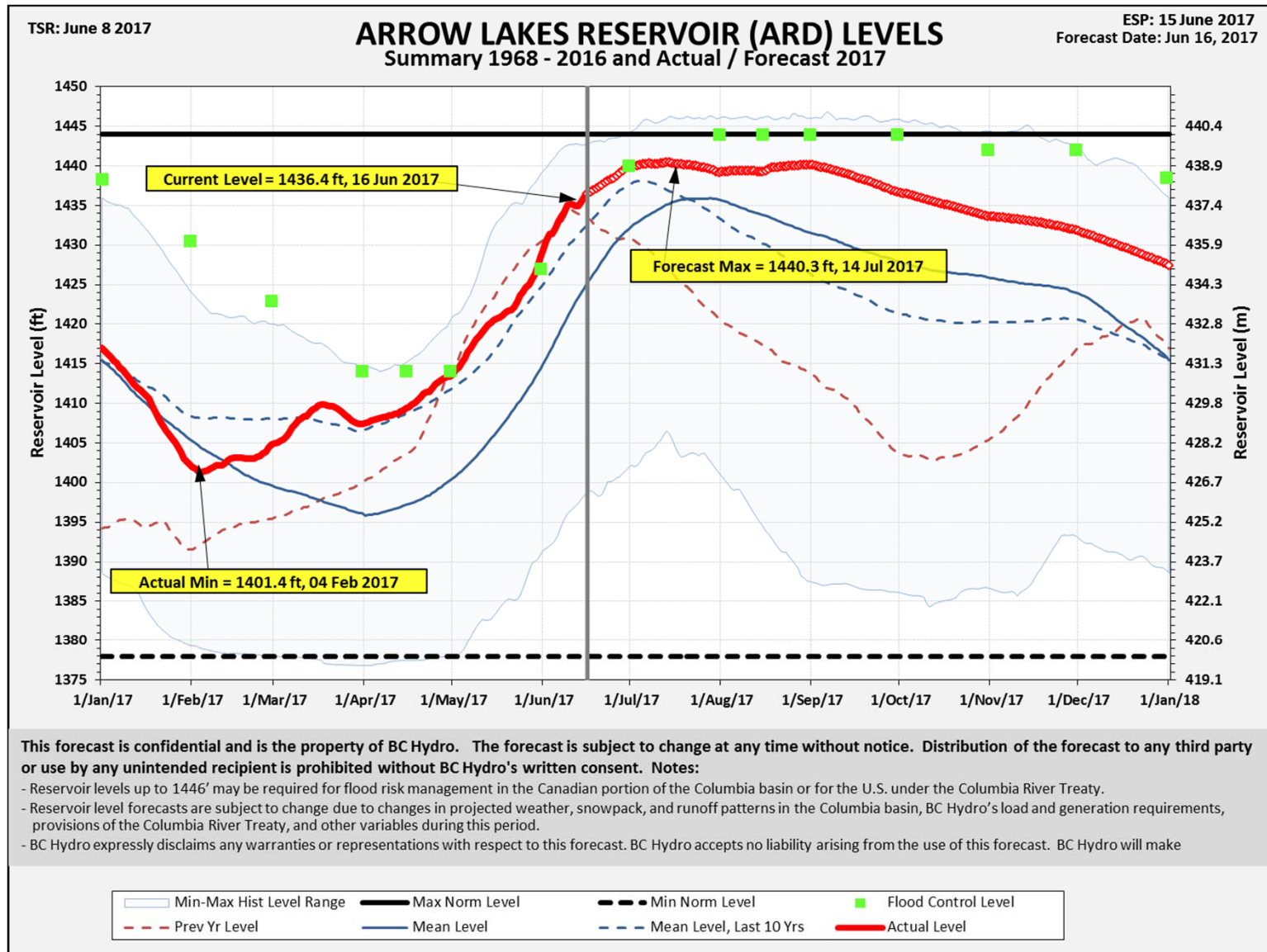
Columbia Water Supply Rankings at The Dalles



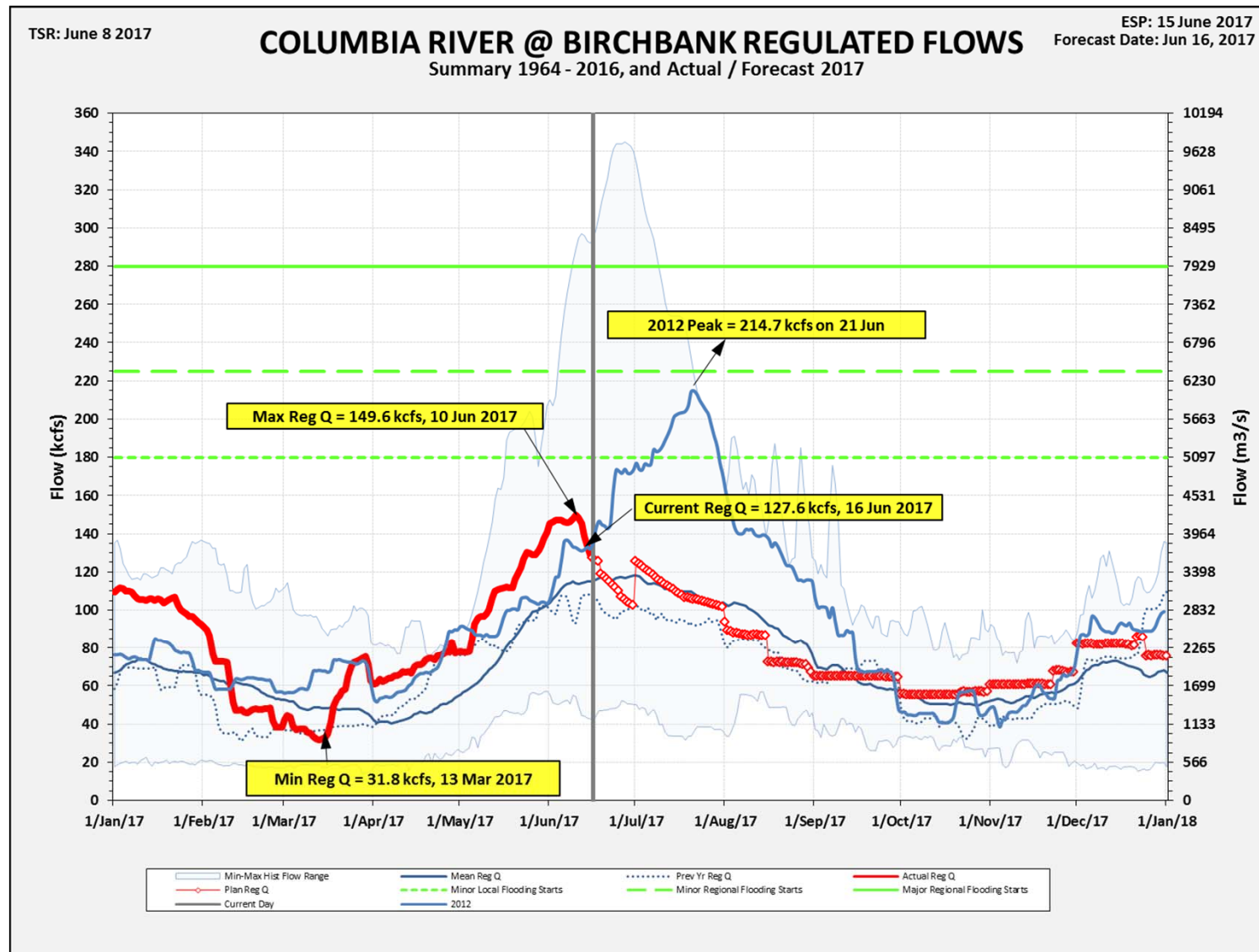
Columbia Water Supply Rankings in Canada at Birchbank – Not Comparable to 2012



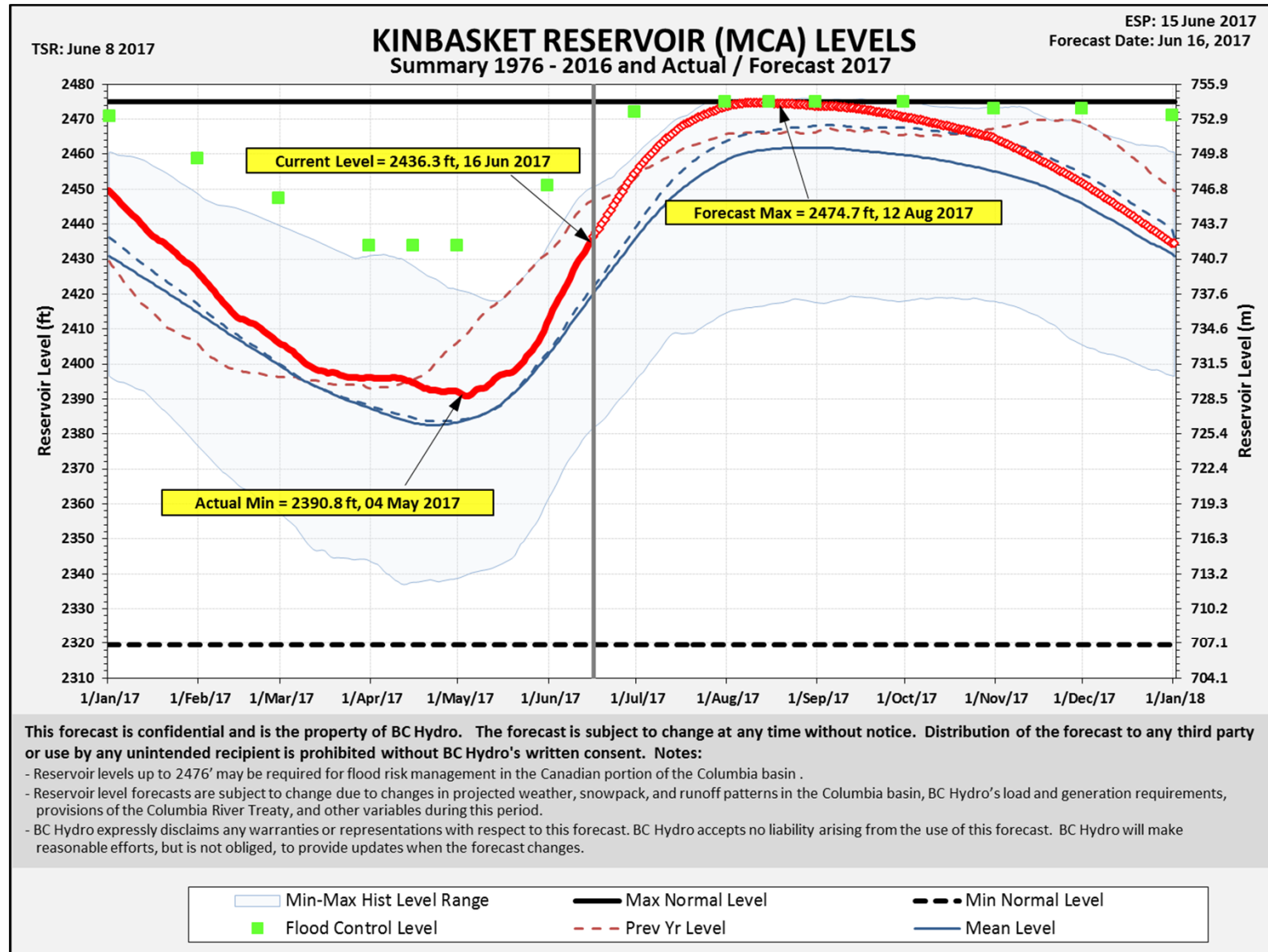
Arrow Lakes Reservoir



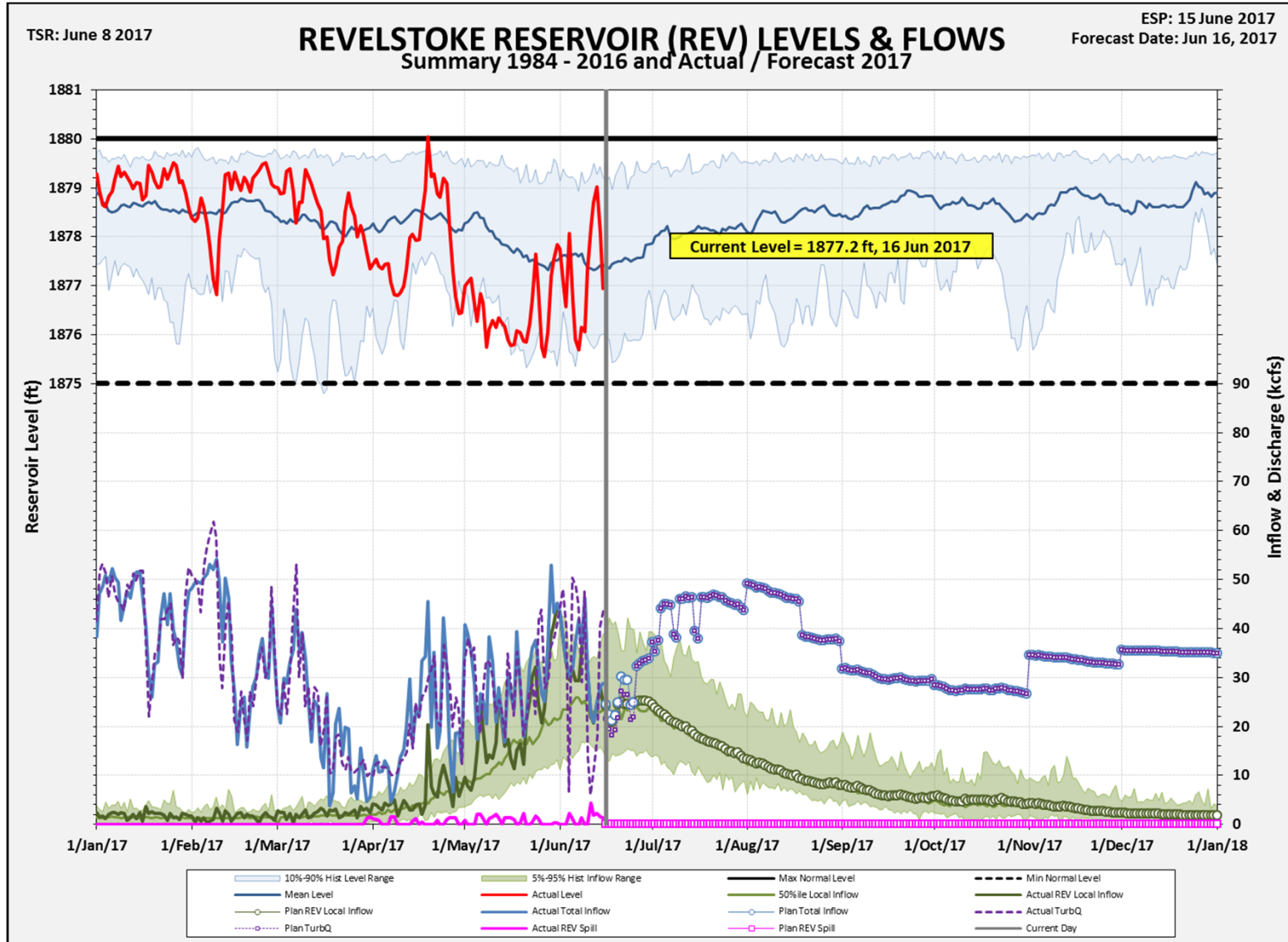
Columbia River Flows at Birchbank



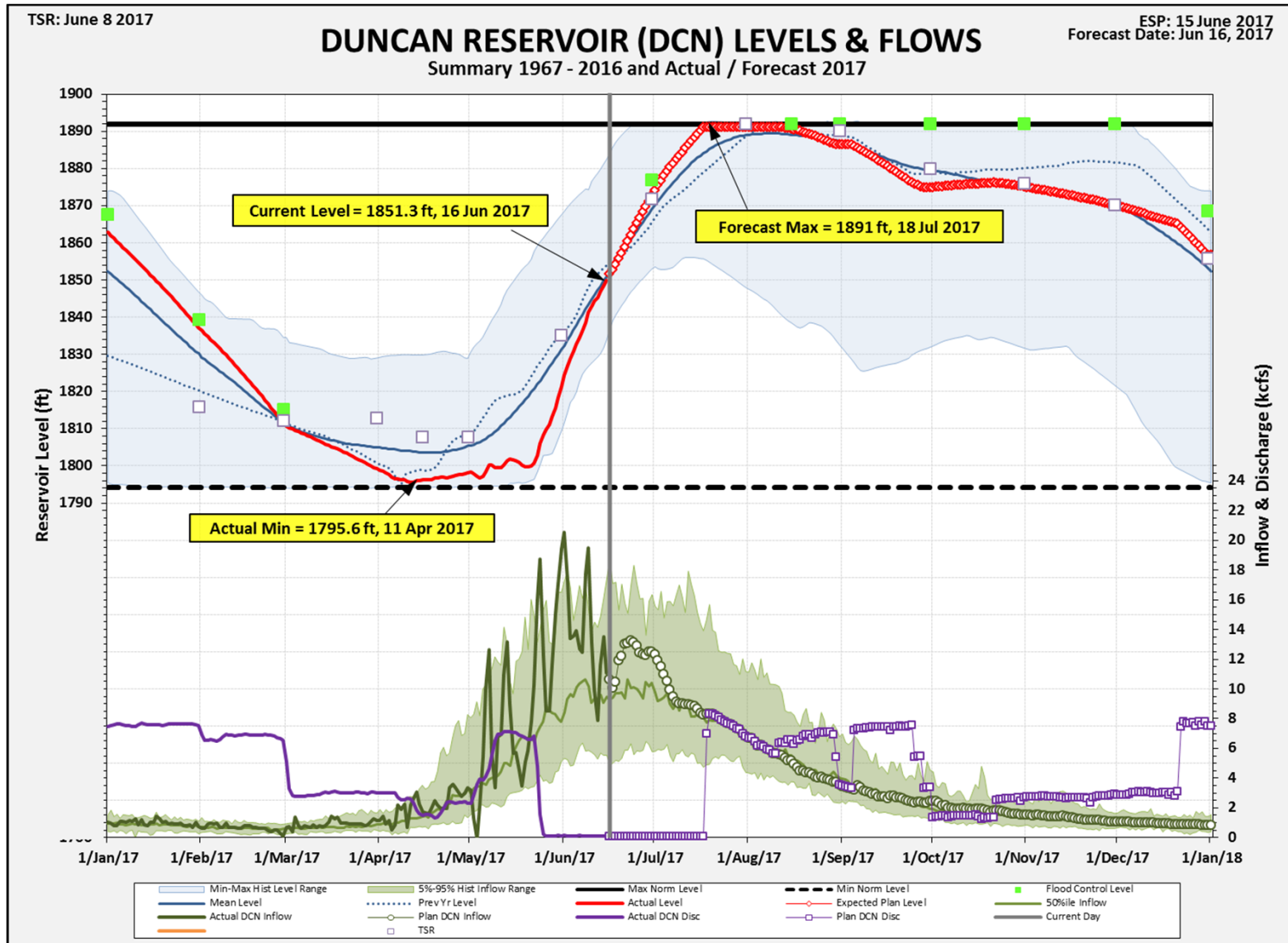
Kinbasket Reservoir



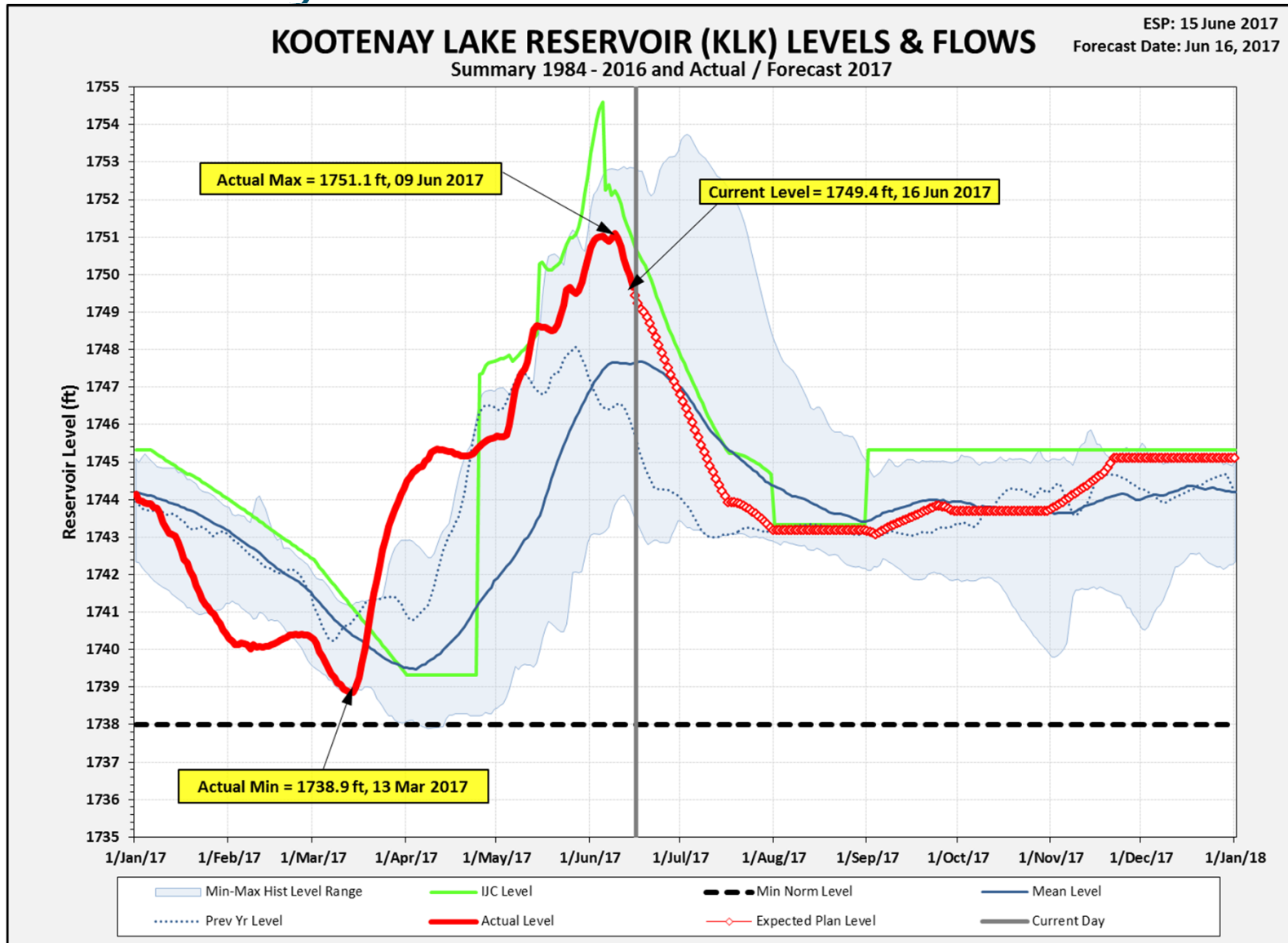
Revelstoke Reservoir



Duncan Reservoir



Kootenay Lake Reservoir



Columbia Basin Operations Information

- Sign up to receive regular reservoir email updates and bi-annual summary of BC Hydro's Columbia Operations
- Reservoir level information through bchydro.com
- Reservoir level phone line: 1-877-924-2444
- Contact :

Mary Anne Coules

Phone: 250-365-4565

email: maryanne.coules@bchydro.com

Water license requirements

Boat ramp upgrades

- In 2016, we completed the final four Arrow Lakes Reservoir boat ramp projects at Anderson Point, Edgewood, Nakusp and Shelter Bay.
- In previous years, we also upgraded the existing ramps at McDonald Creek, Fauquier and Syringa Creek Park, and built a new ramp at Burton.



Water license requirements

Woody debris removal

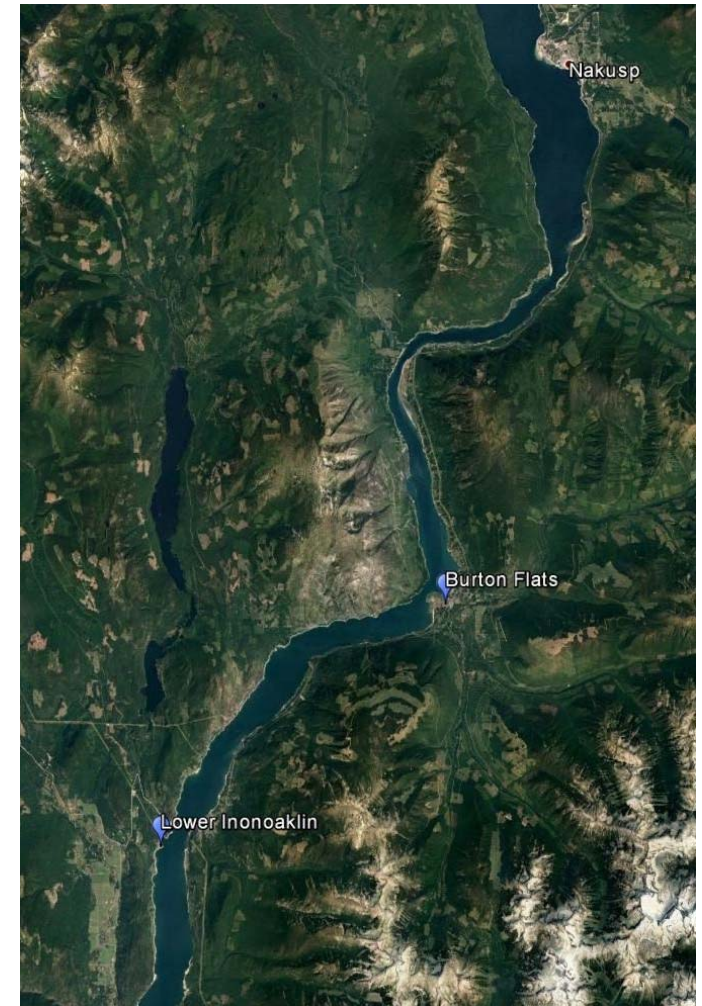
- We continue to remove woody debris from Arrow Lakes Reservoir.
- Annual work plan is guided by the Debris Management Committee.
- Since 2007, we estimate that we have removed over 84,000 cubic metres (m³) of woody debris from Arrow Reservoir
 - 4,200 m³ was removed in 2016
 - Approximately 4000 m³ was removed in 2017
- This year's work will focus on areas near Edgewood.



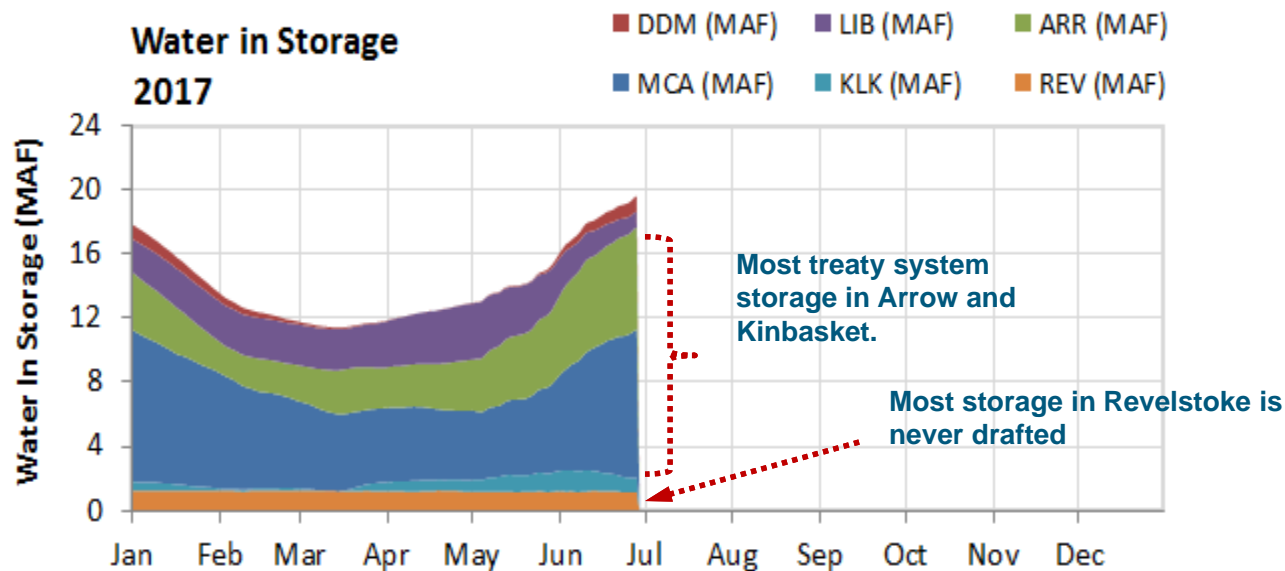
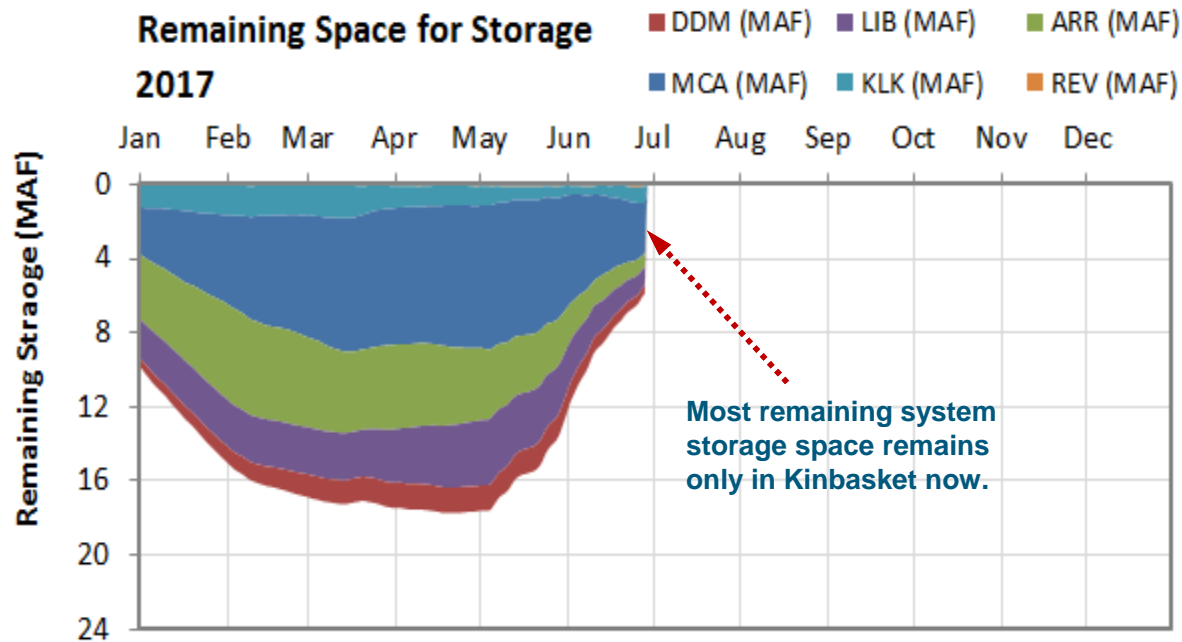
Water license requirements

Wildlife enhancement project

- We are planning to construct a wildlife enhancement project in the drawdown zone of the mid to lower Arrow Lakes Reservoir.
- We are no longer pursuing enhancements to the wetland at Lower Inonoaklin due to a variety of engineering, environmental and archaeological issues.
- We are revisiting the conceptual design at Burton Flats with an aim to do smaller bio-engineered mounds and excavations in a phased approach over the next two years.
- Once the designs for the site are available, we will share them with local government, First Nations, stakeholders and the public



Columbia Basin Storage



Relative Reservoir Draft and Storage: Jan to Jun 2017

