Water Quantity & Water Use in the Athabasca Watershed

Petra Rowell, Athabasca Watershed Council

Outline

- How long is the Athabasca River?
- Where does it originate (i.e. what are its headwaters)?
- How much water is there?
- How much is being used? By who?
- Demand management?
- What does the future look like?

"The Athabasca River is Alberta's longest undammed river."

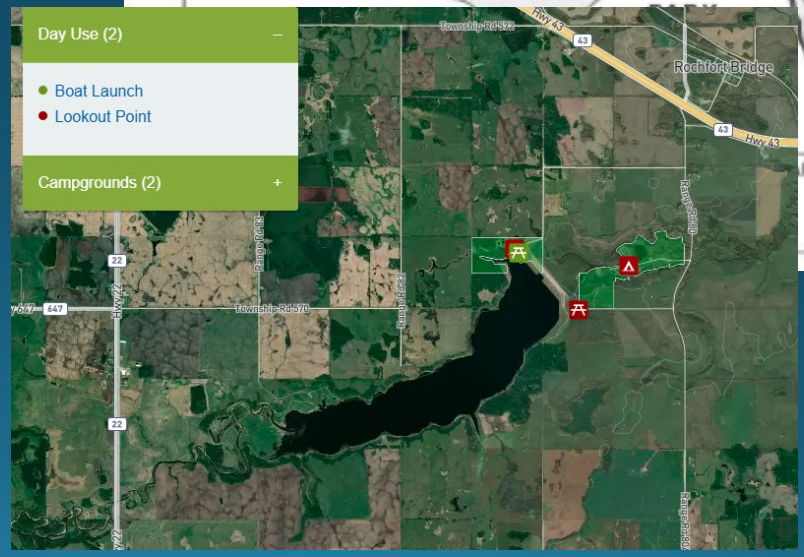
True or False?

The Athabasca River is …

- Athabasca is Canada's 14th longest river
- 1231 km long
- Peace is Canada's 8th longest river
- 1923 km long (BC and AB)

Is the Athabasca River undammed?

- The mainstem yes, but …
- Several control structures
- Lesser Slave Lake outlet weir (3.1 m high)
- Paddle River Dam (34.4 m high)
- Weirs on the outlet flows of Lake Athabasca



More weirs and dams

- 148 (12%) of Alberta's ponds and dams
- for lake stabilization, flood control, municipal water supply, municipal and industrial wastewater
- 12 M dam3 (5 M Olympic swimming pools or 60% of the annual flow)
- EPA Alberta Dam Safety Map
- AER Dam and Pond Map

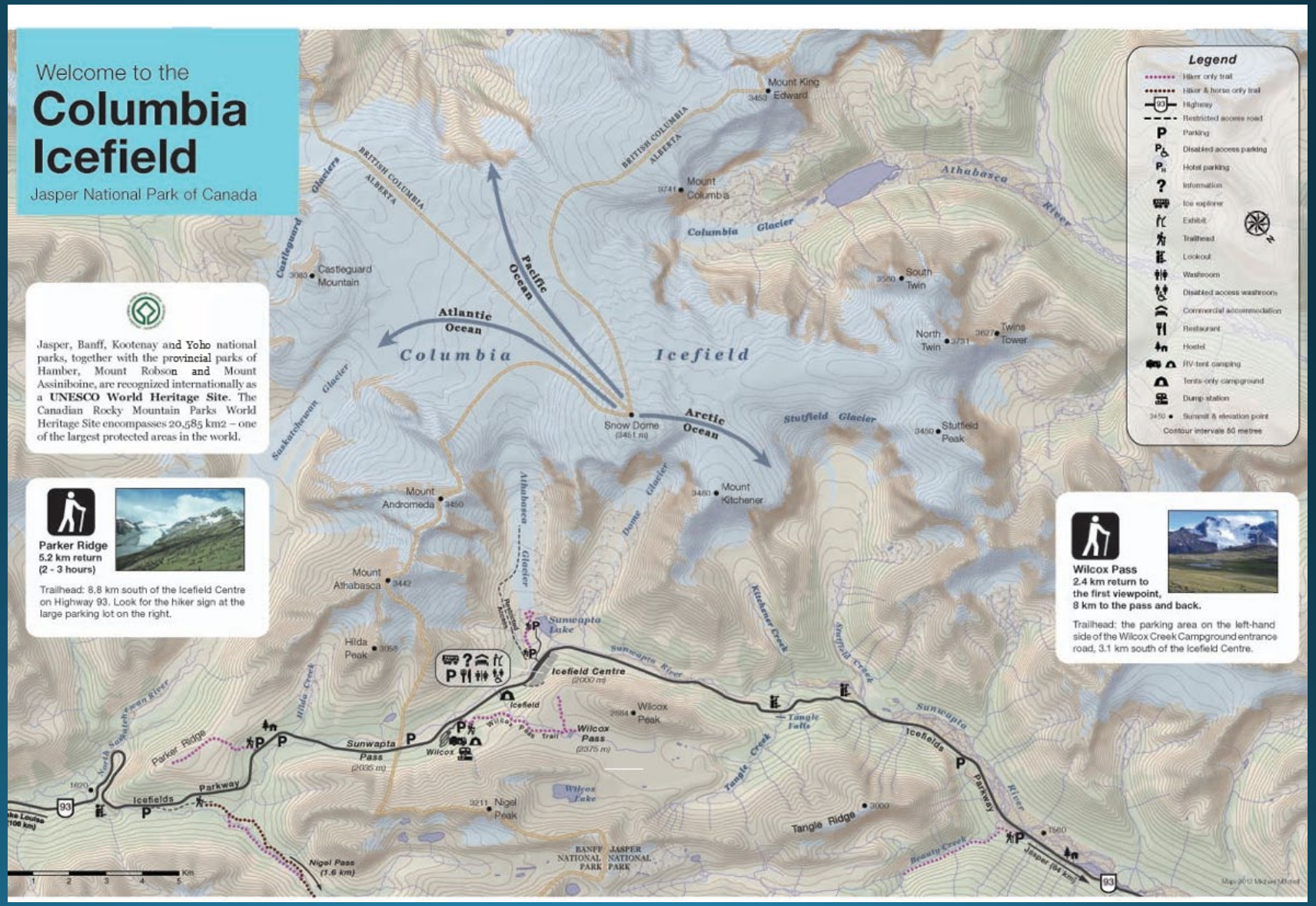
Where does the Athabasca originate?

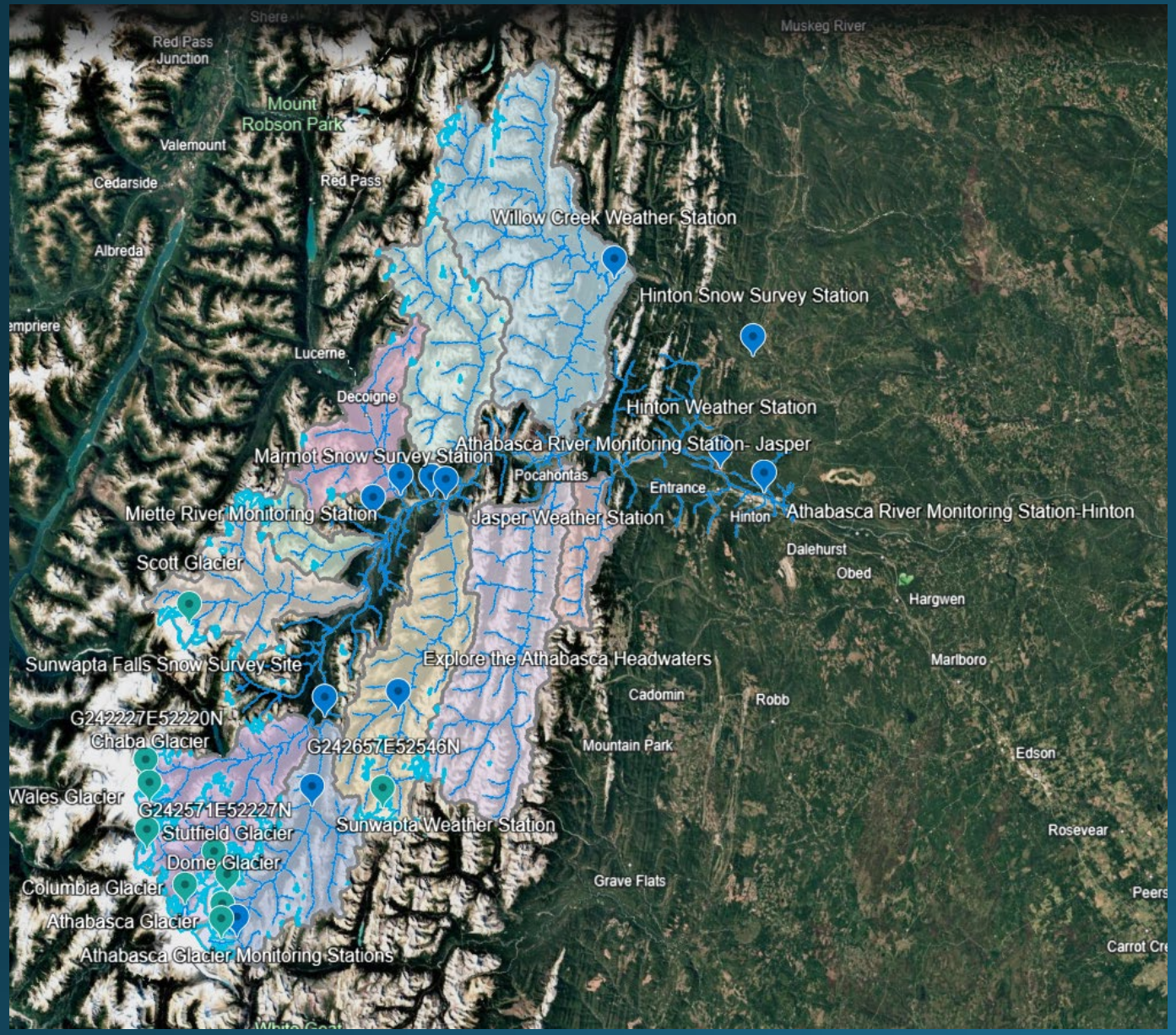
"The Athabasca River headwaters start in the Columbia Icefield, specifically from the Athabasca Glacier."

- True or False?

Athabasca Headwaters

- Athabasca Glacier headwaters of the Sunwapta River
- Columbia Glacier headwaters of the Athabasca River



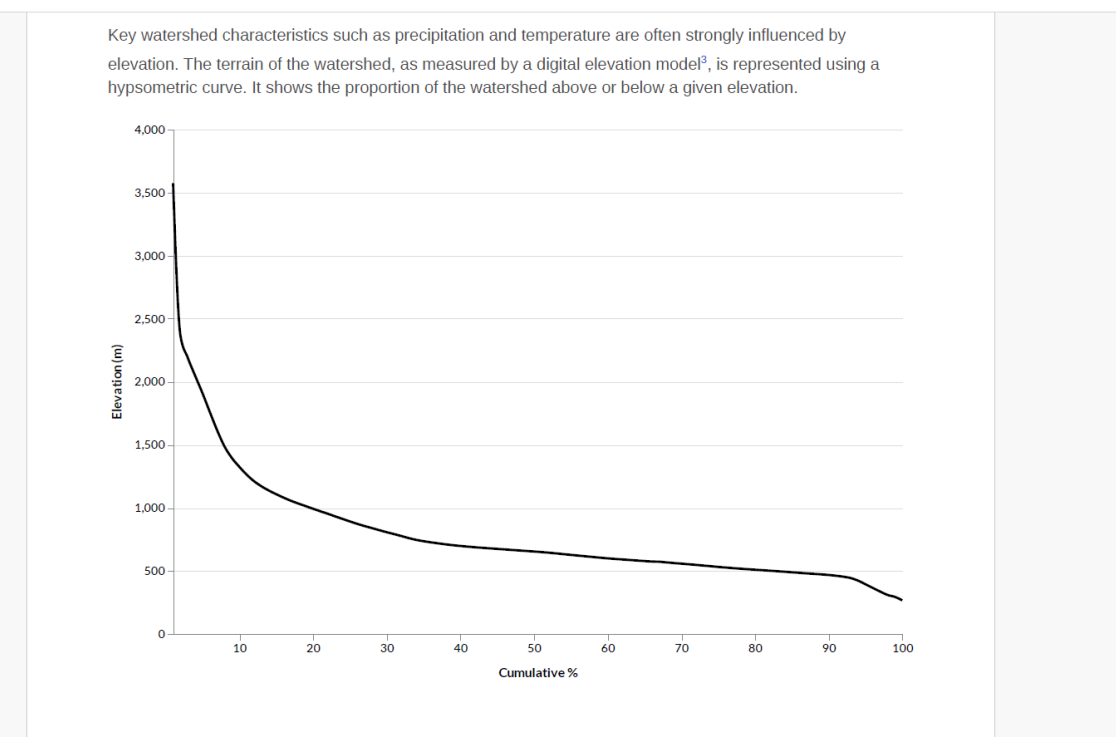


Top 10 Glaciers

- Columbia 29.66
- Scott 20.38
- Stutfield 19.61
- Athabasca 16.15
- Chaba 11.95
- Wales 11.34
- G242657E52546N 9.27
- G242227E52220N 9.06
- Dome 7.85
- G242571E52227N 6.26

GLIMS Glacier Viewer (global land ice measurements from space)

Headwaters Contribution is huge!

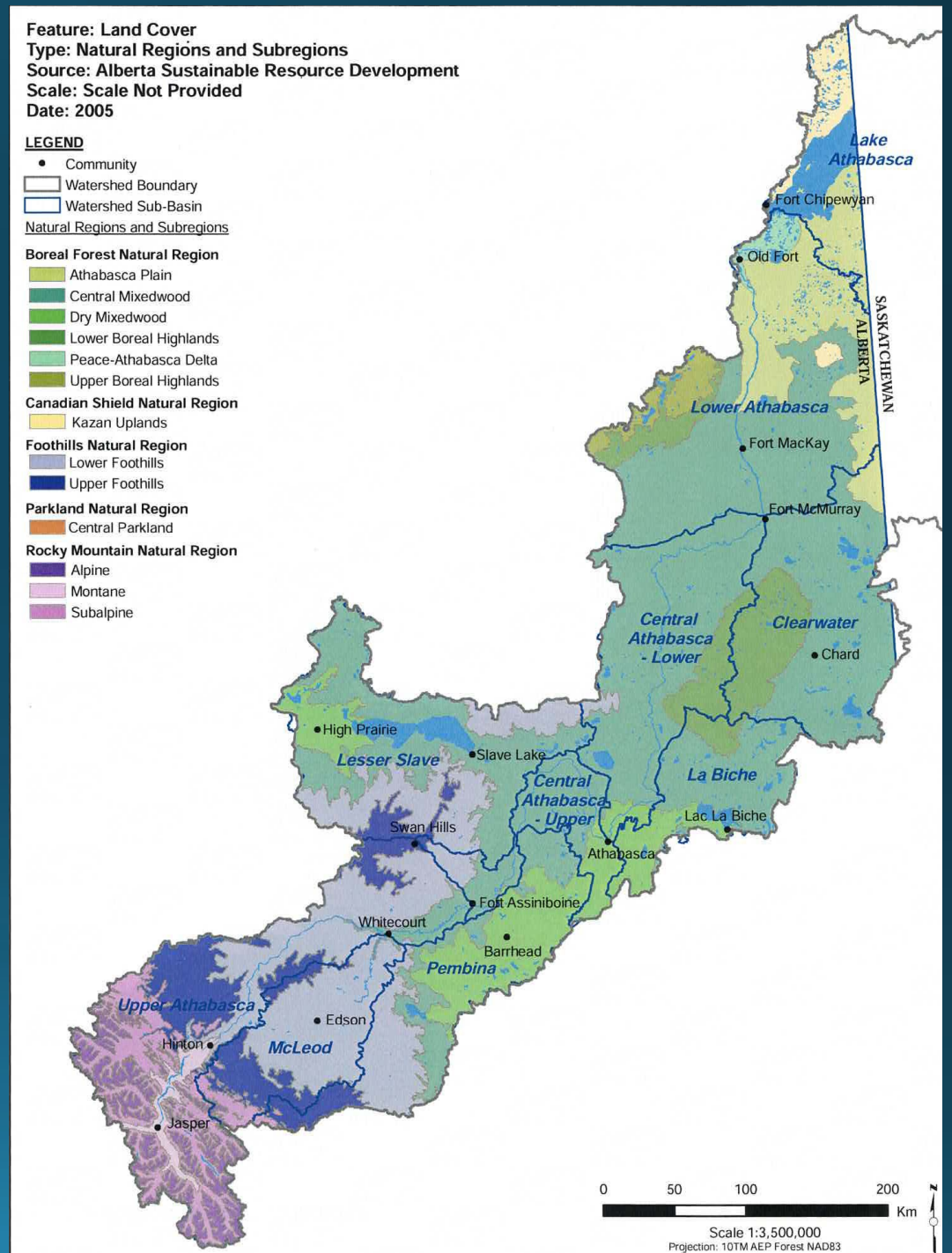


Alberta Water Tool

- Elevation: 3,576 m (max), 794 m (mean), 264 m (min)
- Area above Jasper 3% of the watershed but provides 15% of the flow
- Area above Hinton 7% of the watershed but adds 29% of the annual flow (Newton& Taube 2023)
- Groundwater??

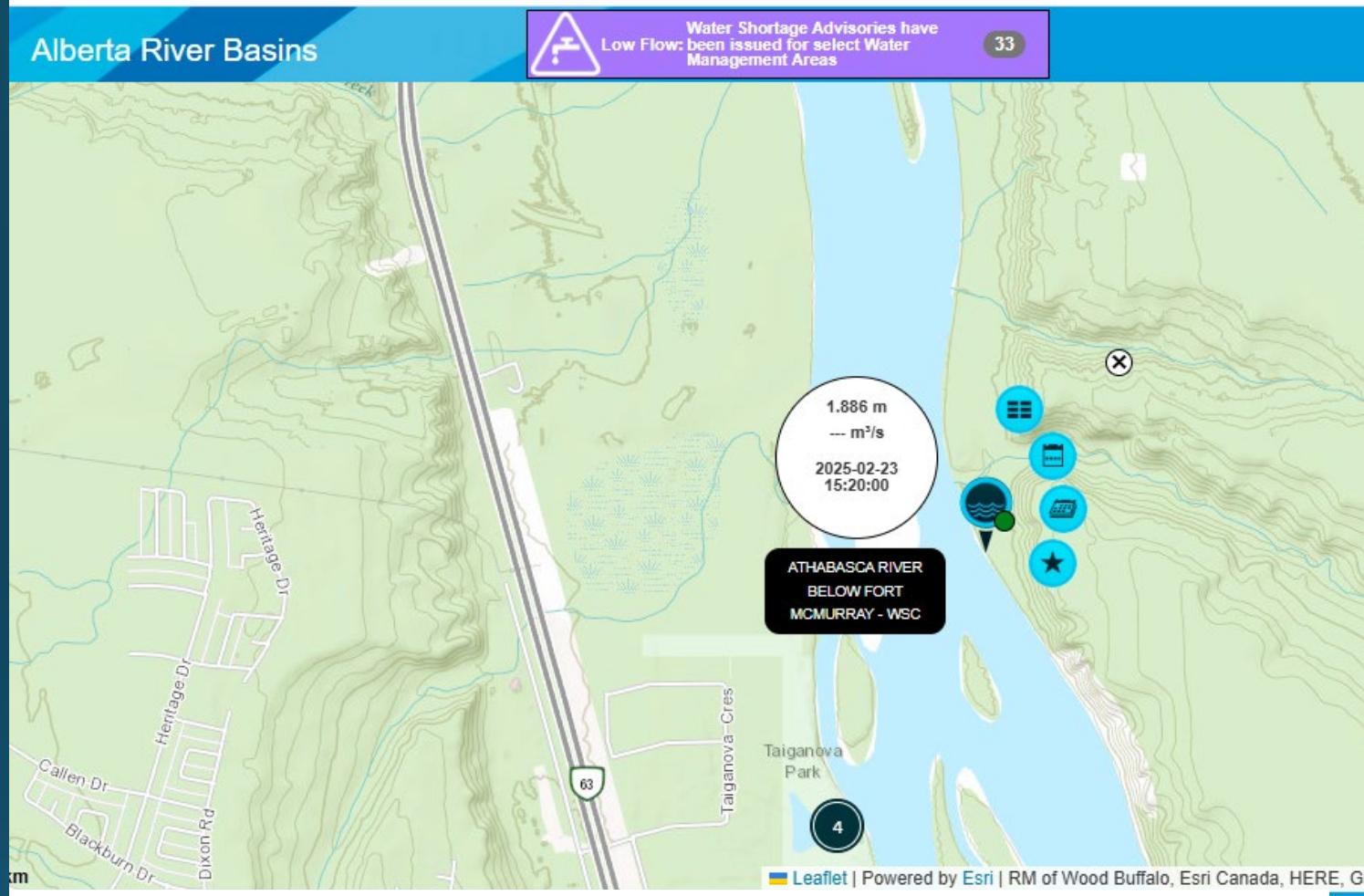
Moving Downstream

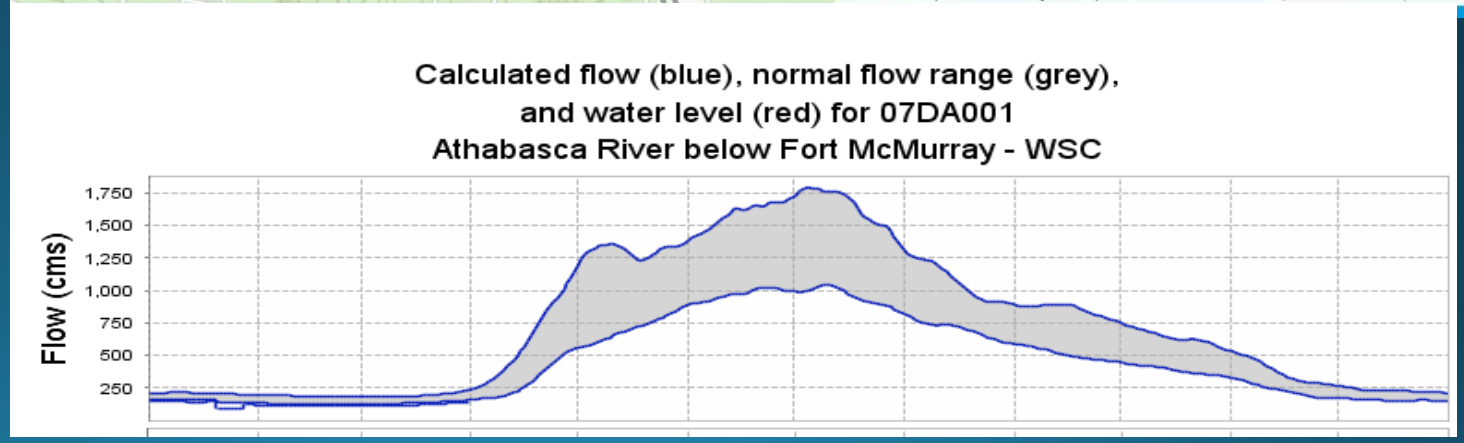
Natural Region	Reach + Tributaries	Contribution to flow
Rocky Mountain - Foothills	Upper Athabasca / McLeod	15%; 35%
Boreal Forest	Upper Central, Lower Central, Lower Athabasca/ Pembina, Lesser Slave, Lac La Biche, Clearwater	50%
Canadian Shield	Lake Athabasca	< 1%



So how much water is there?

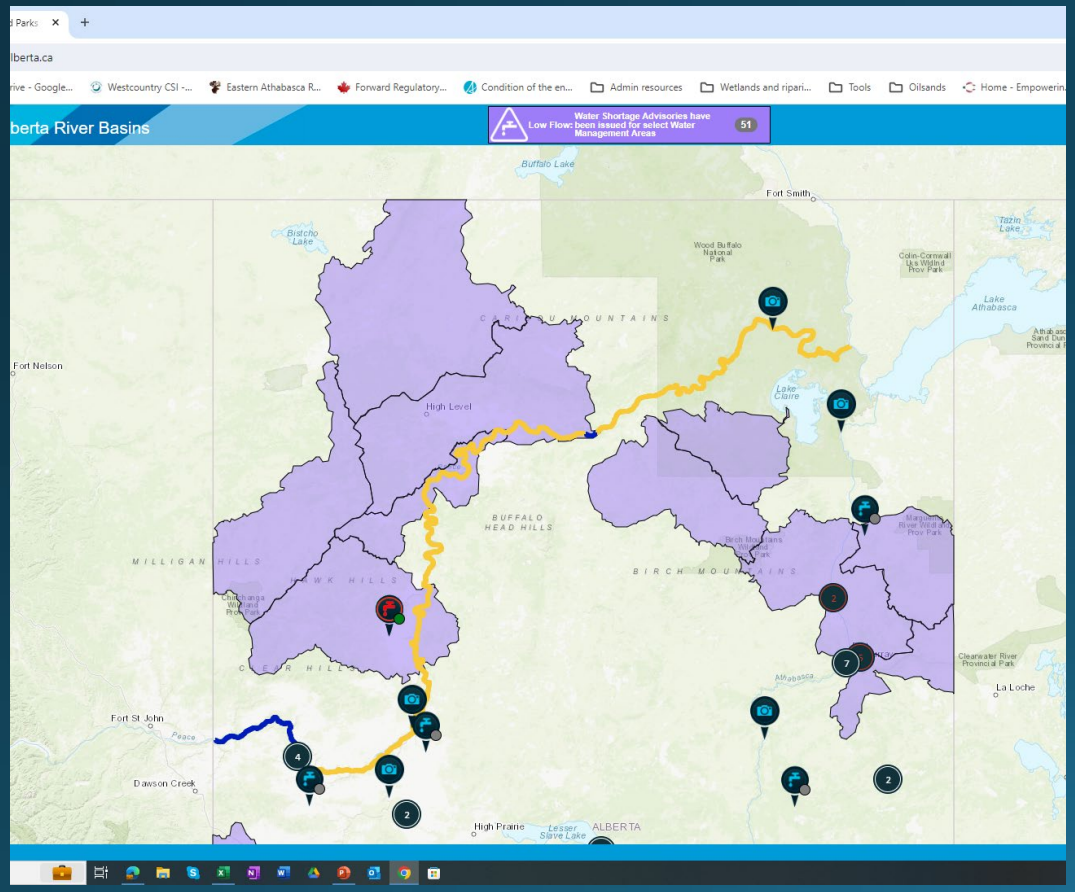
- Mean Annual Discharge at Fort McMurray = 20,860,000,000 m3
- 8.3 million Olympic swimming pools annually
- 106 – 1250 m3/s
- rivers.alberta.ca (Alberta River Basins)

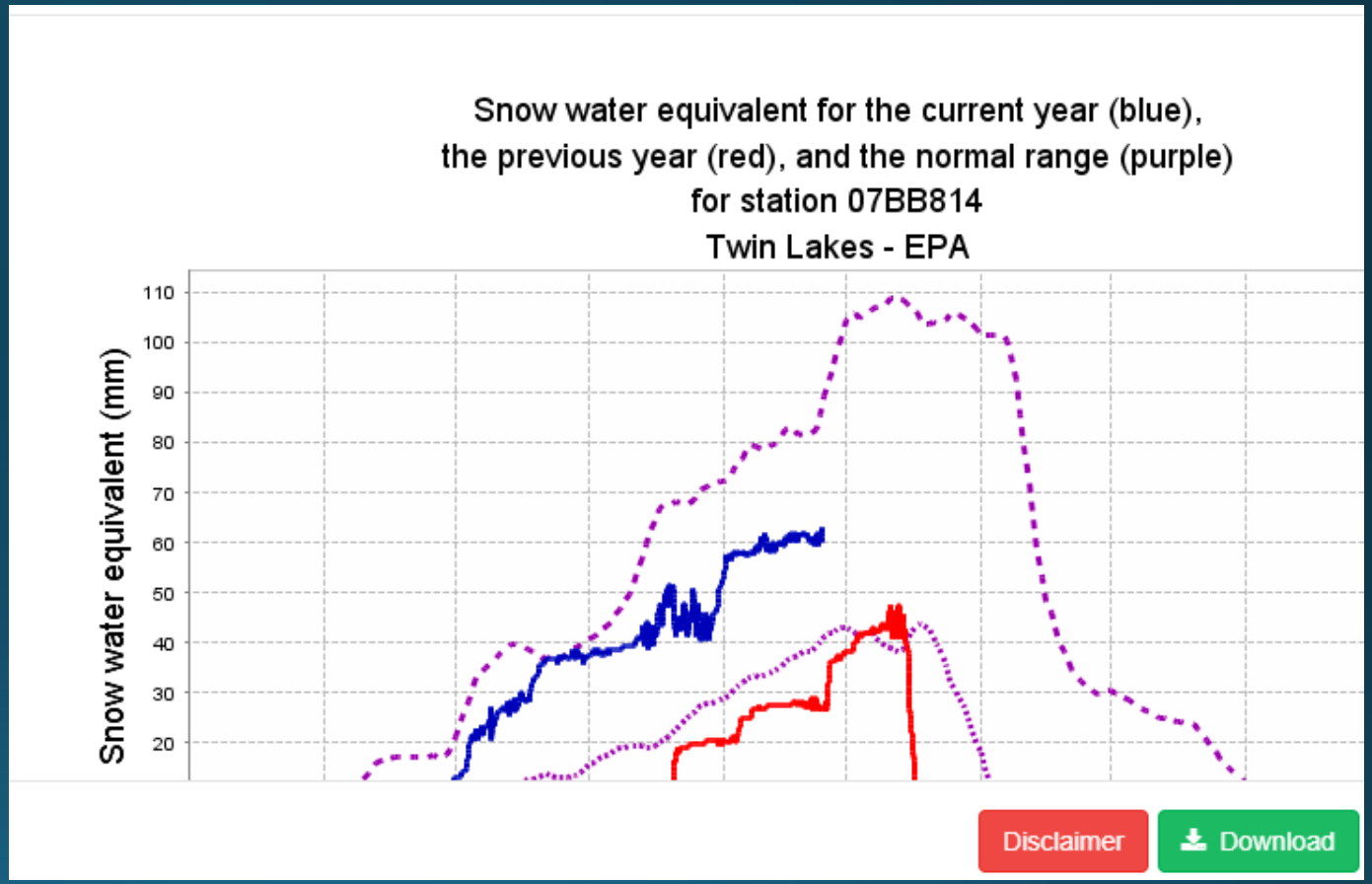




Natural Flows Fluctuate…

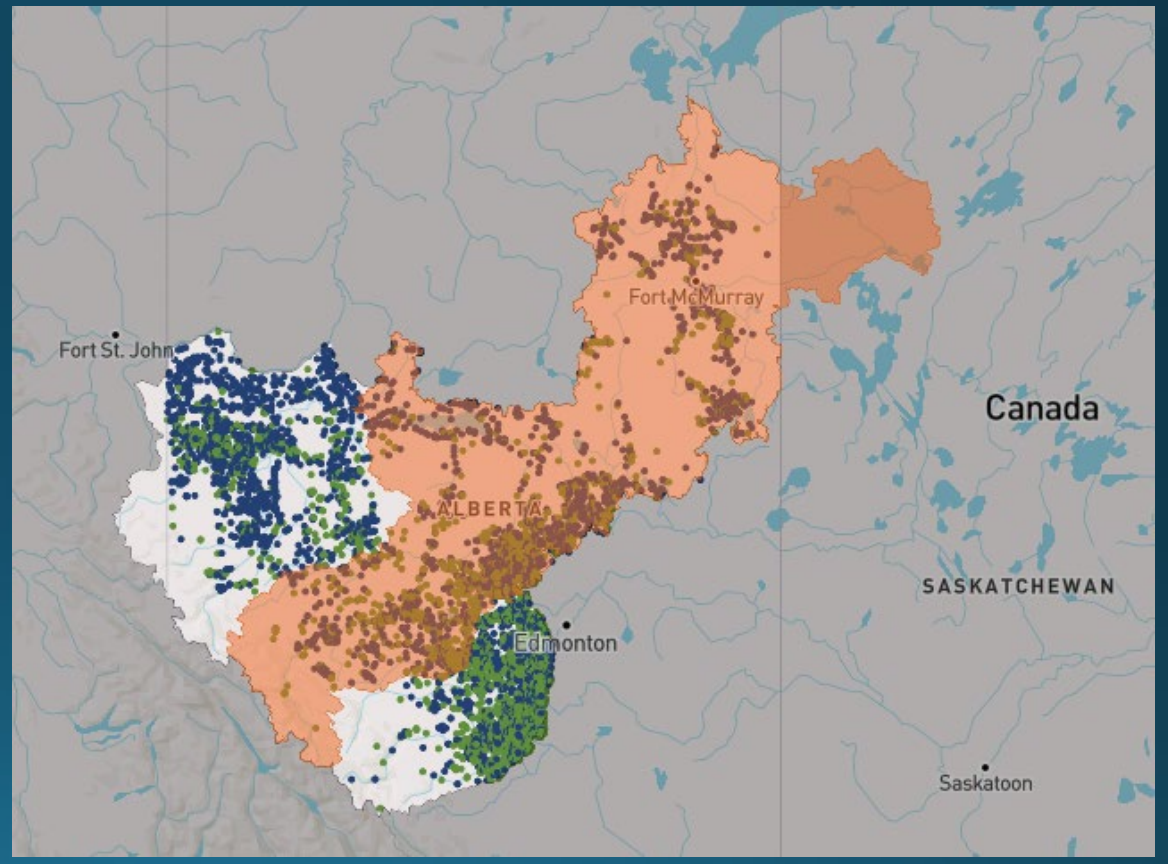
Alberta River Basins Rivers.alberta.ca



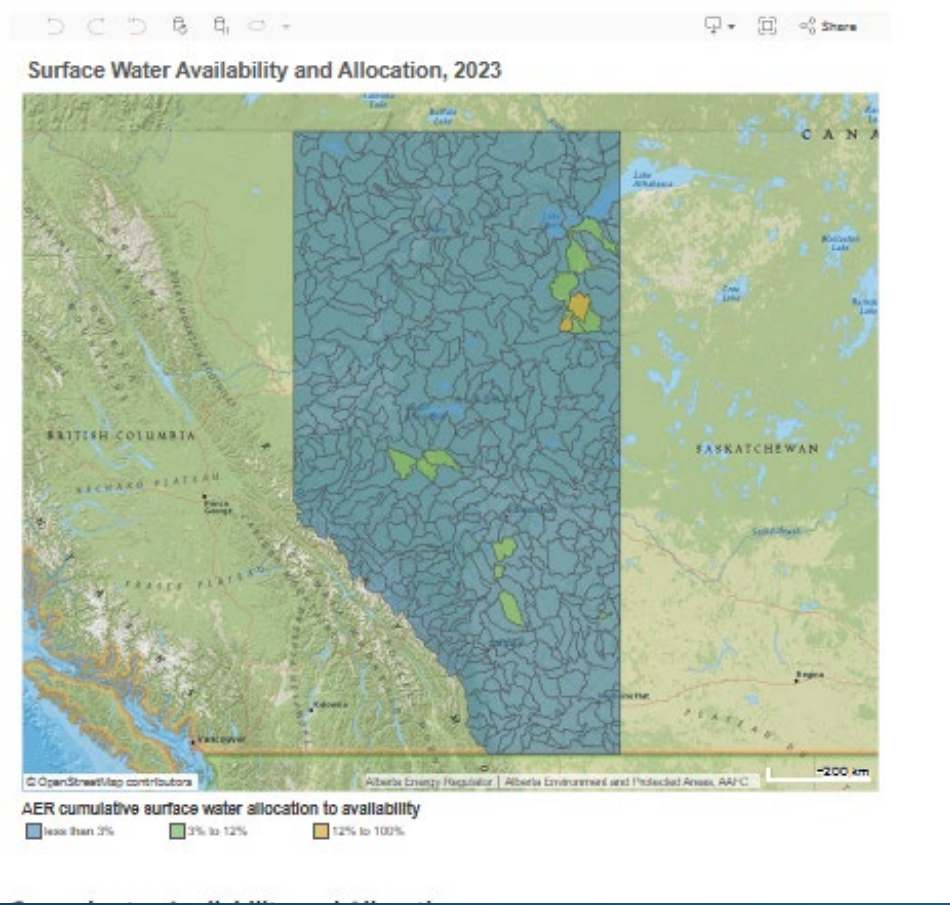


How much do we allocate?

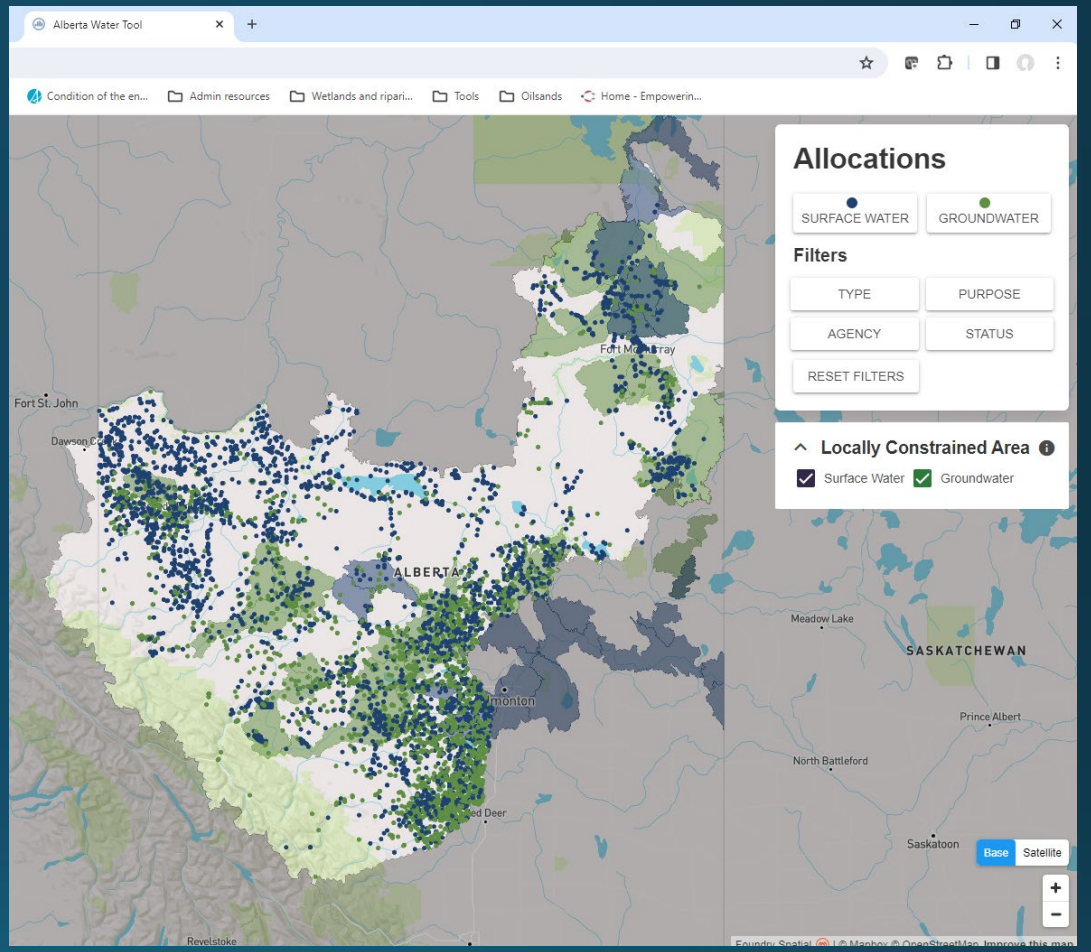
- Alberta Flow Estimation Tool for Ungauged Streams (AFETUW)
- Authorization Viewer (new Environmental Records Viewer)
- Alberta Water Tool (Foundry Spatial)
- It's a very busy landscape!



AER Tools



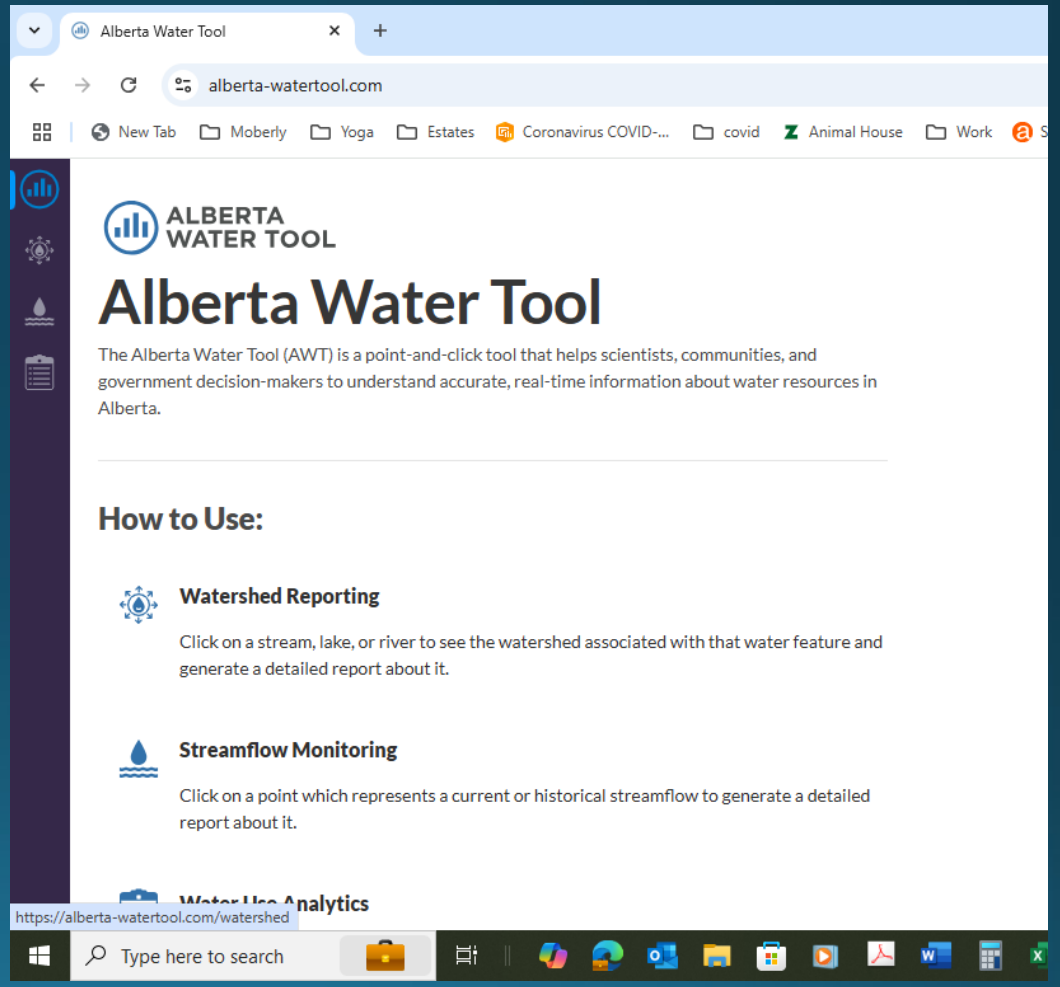
https://www.aer.ca/data-and-performance-reports/industry-performance/water-use-performance/water-availability-and-allocation



Alberta Water Tool showing Locally Constrained Areas under the *Water conservation policy for upstream oil and gas operations*

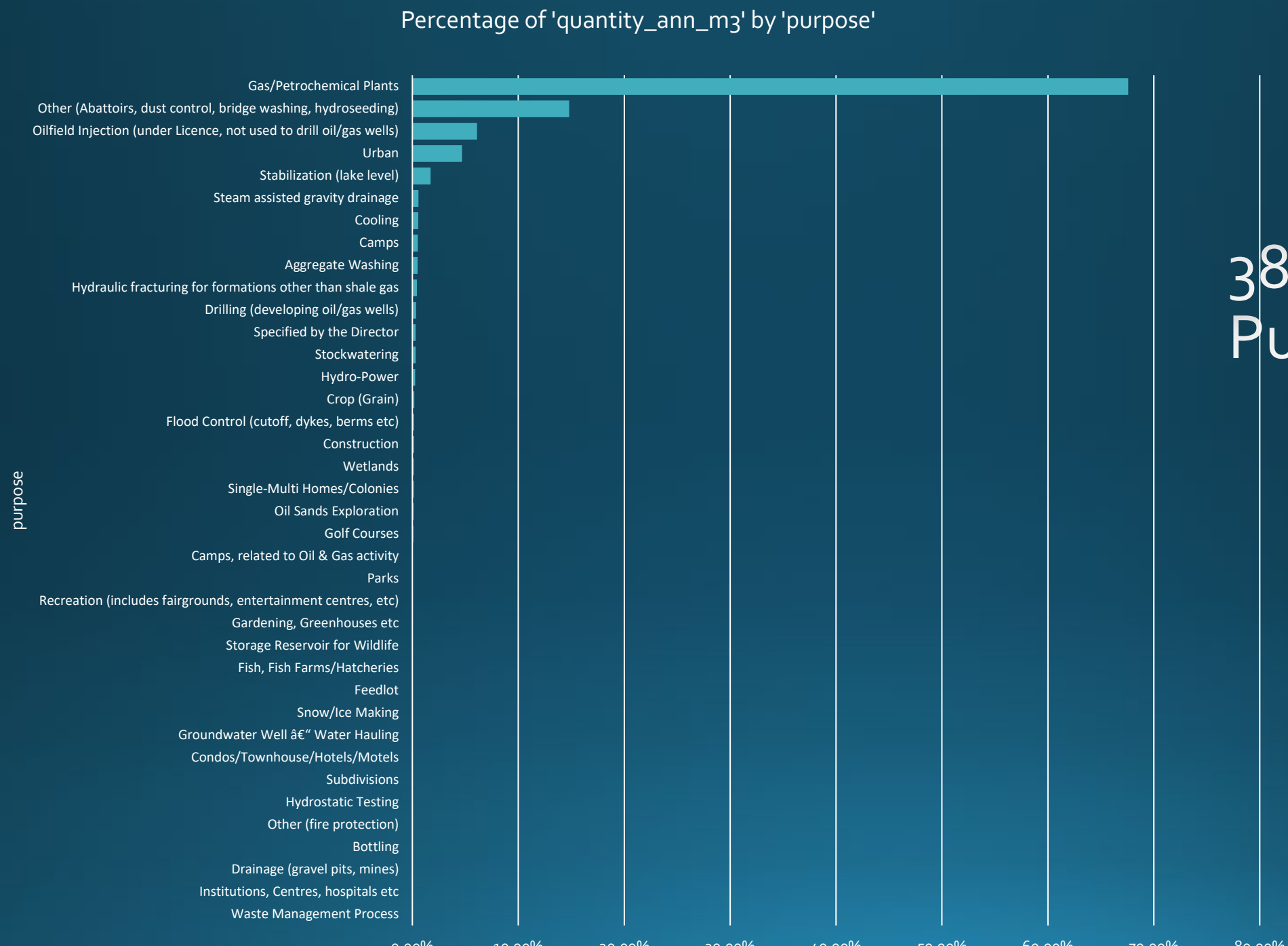
Current Allocations

- Current allocations: 4.05%
- Annual SW allocations:
- 28.9 m3/s (911,390,400 m3)
- Mean Annual Discharge at Fort McMurray = 20,860,000,000 m3



Volume By Sectors

TYPE	Oil & Gas	Other	Municipal	Power	Commercial	Agriculture	Grand Total
SW	679,309,382	169,842,724	47,568,894	8,299,200	4,400,237	2,866,469	912,286,906
GW	108,205,802	10,090,903	8,784,661	346,160	2,724,450	2,615,123	132,767,100
TOTAL	787,515,185	179,933,627	56,353,555	8,645,360	7,124,687	5,481,592	1,045,054,007



38 Different Purposes

241 Different waterbodies (30 > 1M m3 annually)

stream_name	Sum of quantity_ann_m3
Athabasca River	618,929,869
Surface Runoff	130,361,442
Unnamed Aquifer	108,333,317
Tar River	34,749,000
Lesser Slave River	18,371,205
McLeod River	16,513,187
Beaver Creek	13,821,840
Lower Grand Rapids Aquifer	10,053,415
Muskeg River	8,900,000
Empress Aquifer	6,980,394
South Heart River	6,796,615
Freeman Lake	6,506,740
Swan River	4,271,382
Lesser Slave Lake	4,159,412
Freeman River	4,061,865
Paddle River	3,741,827
Pembina River	3,577,624
Unnamed Stream	3,462,658
Carson Creek	3,348,910
Thunder Lake	3,086,120
Unnamed Lake	2,464,384
Mumm Creek	2,399,120
Carson Lake	2,345,620
Lac La Biche	2,200,030
McMurray Aquifer	2,190,000
Coal Creek	1,811,100
Luscar Creek	1,357,505
Clearwater A Aquifer	1,262,657
Flat Creek	1,154,530
Oldman Lake	1,037,350

licensee	Sum of quantity_ann_m3
Canadian Natural Upgrading Limited	206,960,000
Syncrude Canada Ltd	137,434,310
Canadian Natural Resources Limited	131,495,787
Suncor Energy Inc.	99,933,812
Imperial Oil Resources Limited	93,106,280
West Fraser Mills Ltd.	78,411,235
Fort Hills Energy Corporation	52,782,000
Alberta Pacific Forest Industries Inc.	36,388,915
Regional Municipality of Wood Buffalo	25,745,354
Alberta Newsprint Funding Corporation	14,819,384
Razor Energy Corp.	9,746,160
Millar Western Forest Products Ltd.	9,499,857
Cardinal Energy Ltd.	8,632,350
Alberta Environment and Protected Areas	7,167,870
Ducks Unlimited Canada, Edmonton	6,552,850
Slave Lake Pulp Corporation	6,287,630
Conifer Energy Inc.	6,203,205
Cenovus Energy Inc.	5,957,162
Conocophillips Canada Resources Corp.	5,922,798
Water, Central Region - Spruce Grove	4,936,000
Town of Whitecourt	4,810,580
Cardinal River Coals Ltd	4,617,955
Prairie Mines & Royalty Ulc	4,429,240
Cnooc Petroleum North America Ulc	4,216,000
Coalspur Mines (Operations) Ltd.	3,101,550
Town of Slave Lake	2,850,230
Athabasca Oil Corporation	2,828,880
Town of Edson	2,773,001
1653488 Alberta Inc.	2,500,000
Obsidian Energy Ltd.	2,401,505
Rocking Mr Ltd	2,399,120
Meg Energy Corp.	2,348,027
Pgi Processing Ulc	2,256,841
Petrochina Canada Ltd.	2,206,964
Civeo Canada Operations Gp Ltd.	2,100,001
Lac La Biche County	2,033,656

1024 individuals or organizations hold 3637 licences

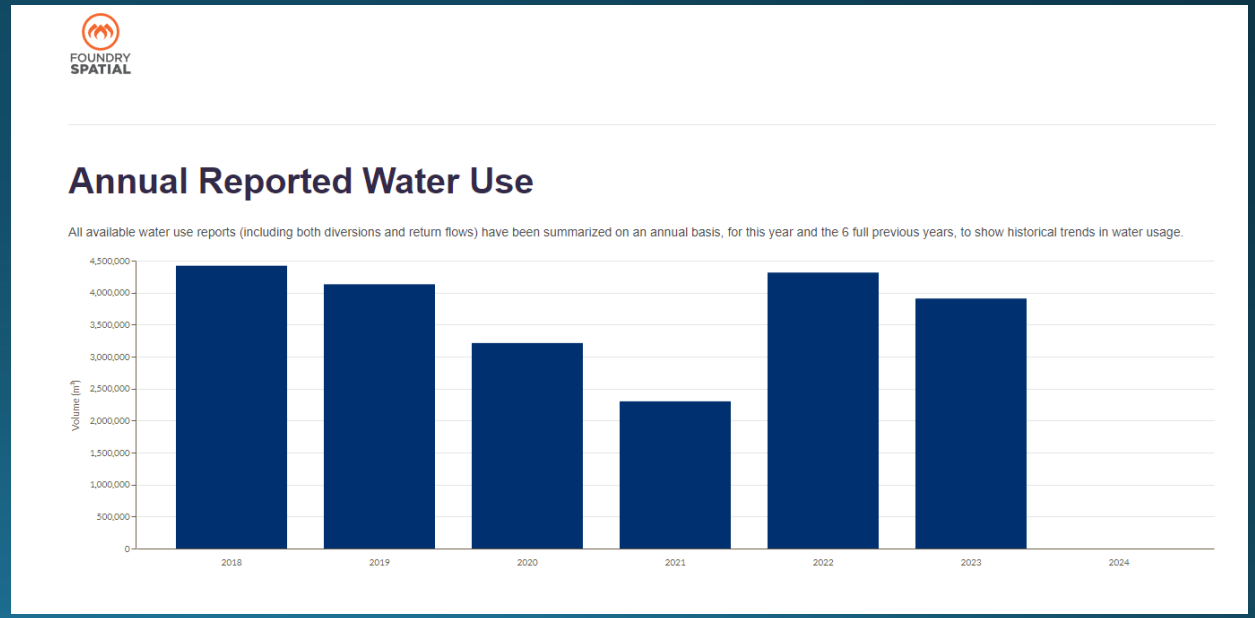
issued since 1911 (oldest priority)

36 licences with allocation >2M m3 annually

Actual Water Use?

- Allocation versus amount diverted, consumed or returned?
- Water Use Reporting System (WURS)
- Move My Licence
- Digital Regulatory Assurance System (DRAS)
- AER Water Use Reports
- AB WaterSmart report for WBNP
- Unreported and unlicensed use?

Alberta Government



Water Use in the Lower Athabasca

Lower Athabasca Surface Water Quantity Management Framework

Athabasca River Conditions and Use

Surface Water Allocation Directive (SWAD)

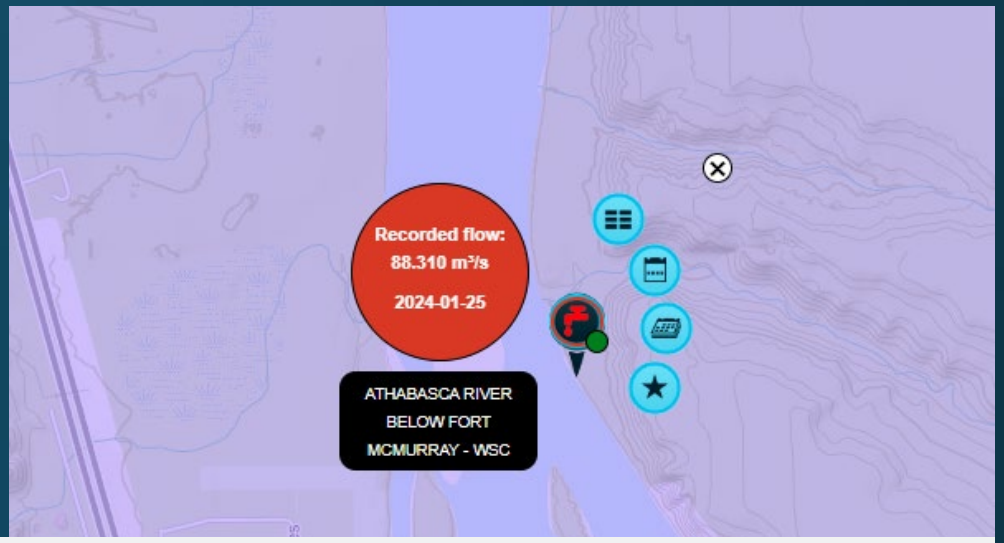
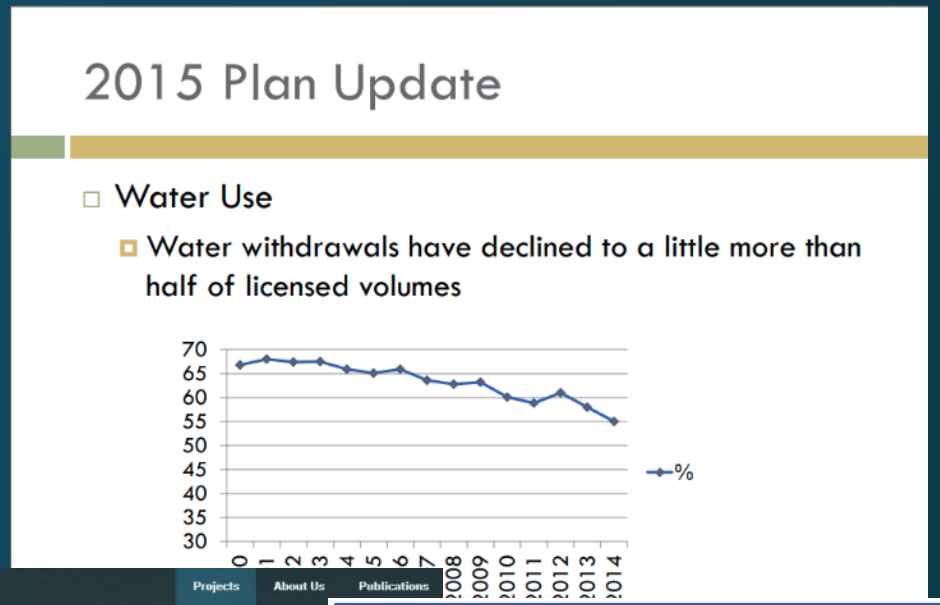


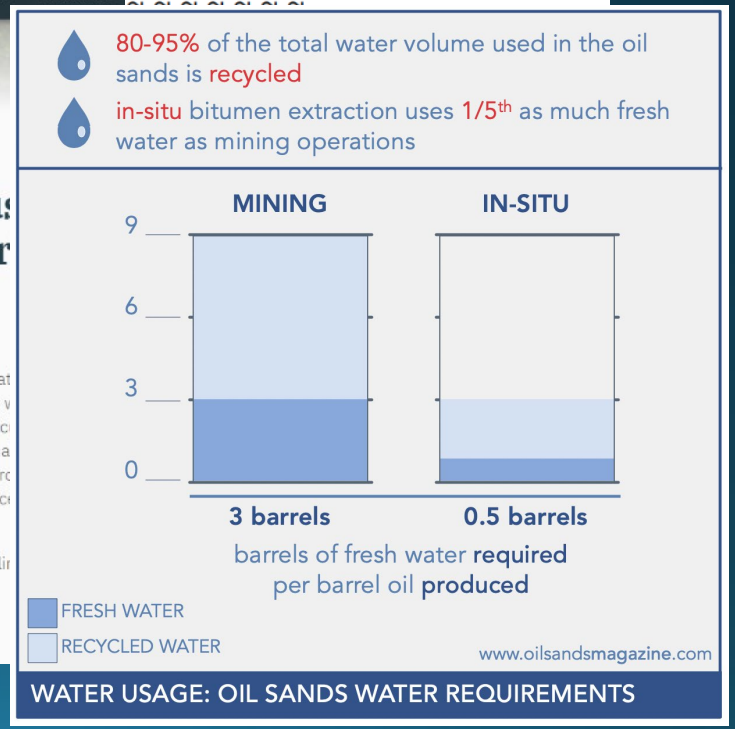
Table 1. Weekly Flow Triggers and Cumulative Water Use Limits on

Mid Winter (January 1 to April 15) Weeks 1-15	
Weekly Flow Triggers (m^3/s)	Cumulative Water Withdrawal Limits
more than 270 m^3/s	16 m^3/s
150 to 270 m^3/s	6% of Weekly Flow
91.6 to 150 m^3/s	9 m^3/s
87 to 91.6 m^3/s	Weekly Flow minus 82.6 m^3/s
less than 87 m^3/s	4.4. m^3/s

Alberta Water Council Water Conservation, Efficiency & Productivity Planning Project

- Urban Municipalities
- Irrigation
- Upstream Oil and Gas
- Forestry
- Downstream Oil and Gas
- Power Generation
- Chemical





Future water supply and demand?

- Climate Change
  - Melting glaciers and snowpack
  - Longer ice-free periods
  - Warmer temps, evaporation
  - Large precipitation events
- Increasing growth and development?
  - Population?
  - Oil sands? Pulp mills? Agriculture?
  - New (nuclear, hydrogen, geothermal, minerals, AI, etc.)

Conclusion?

- The Athabasca River watershed is a large system but like all river systems, fluctuates …
- Currently, we are NOT over-allocated but need to watch for seasonal lows, smaller, sensitive tributaries
- Have a good suite of tools, but will need more precision in the future to inform intentional decision making
- Continue to monitor use in higher allocated waterbodies and provide advice to regional plans, water management frameworks