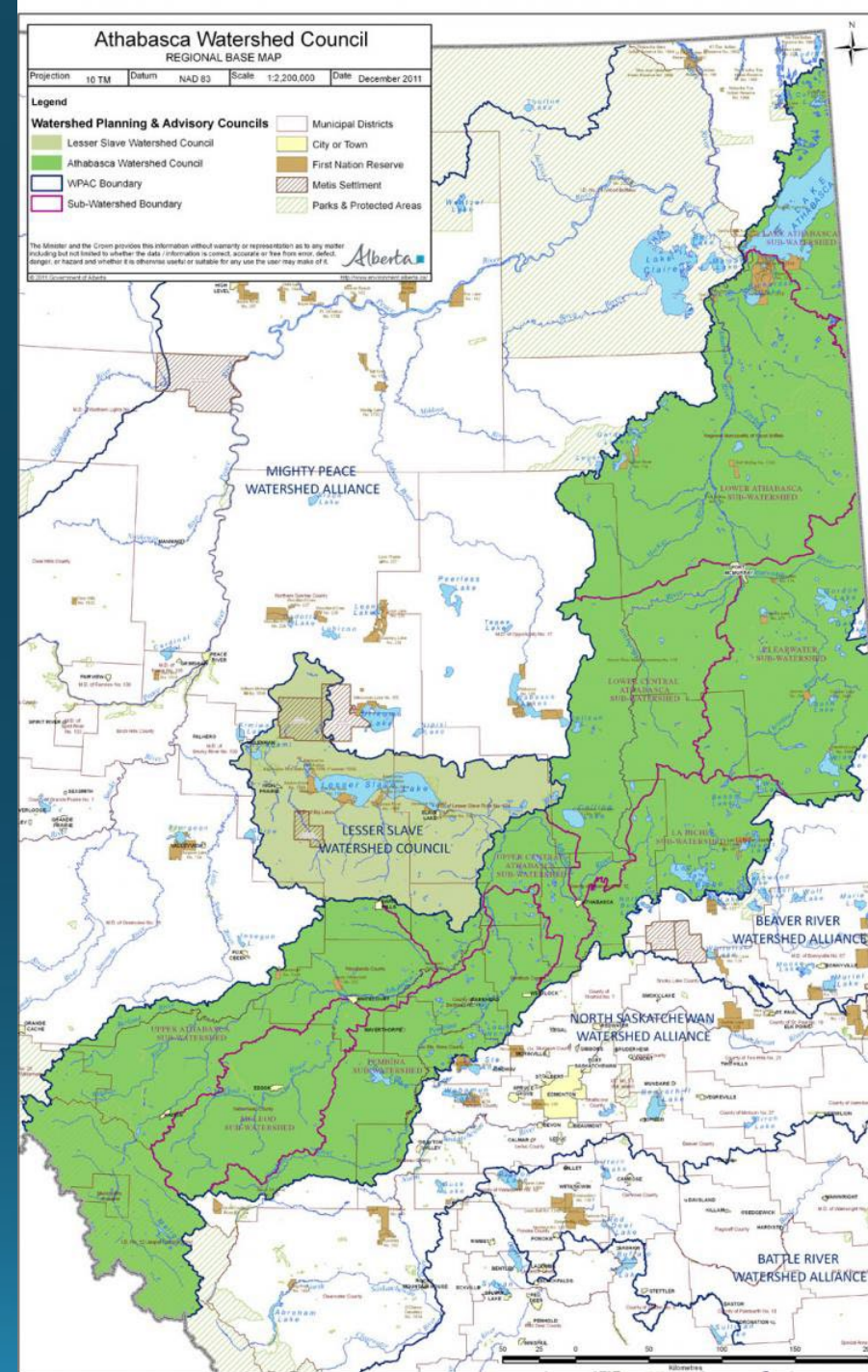




Water Quantity & Water Use in the Athabasca Watershed

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?



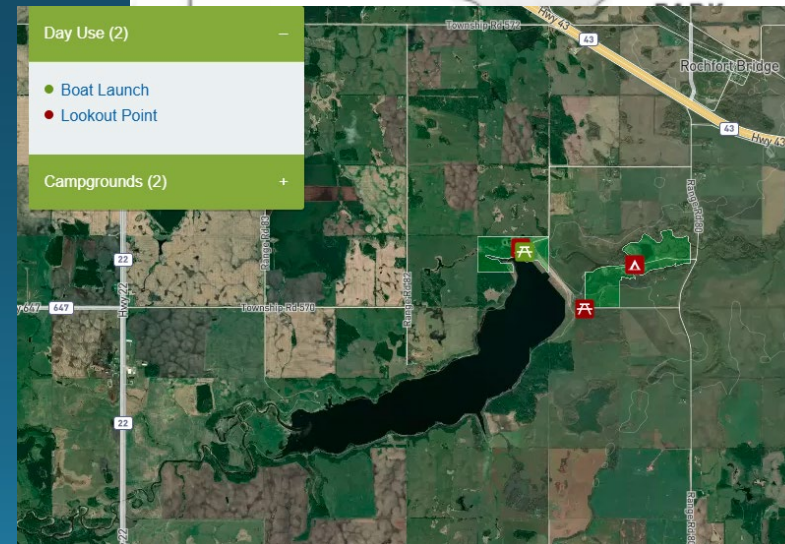
The Athabasca River is ...

- 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?

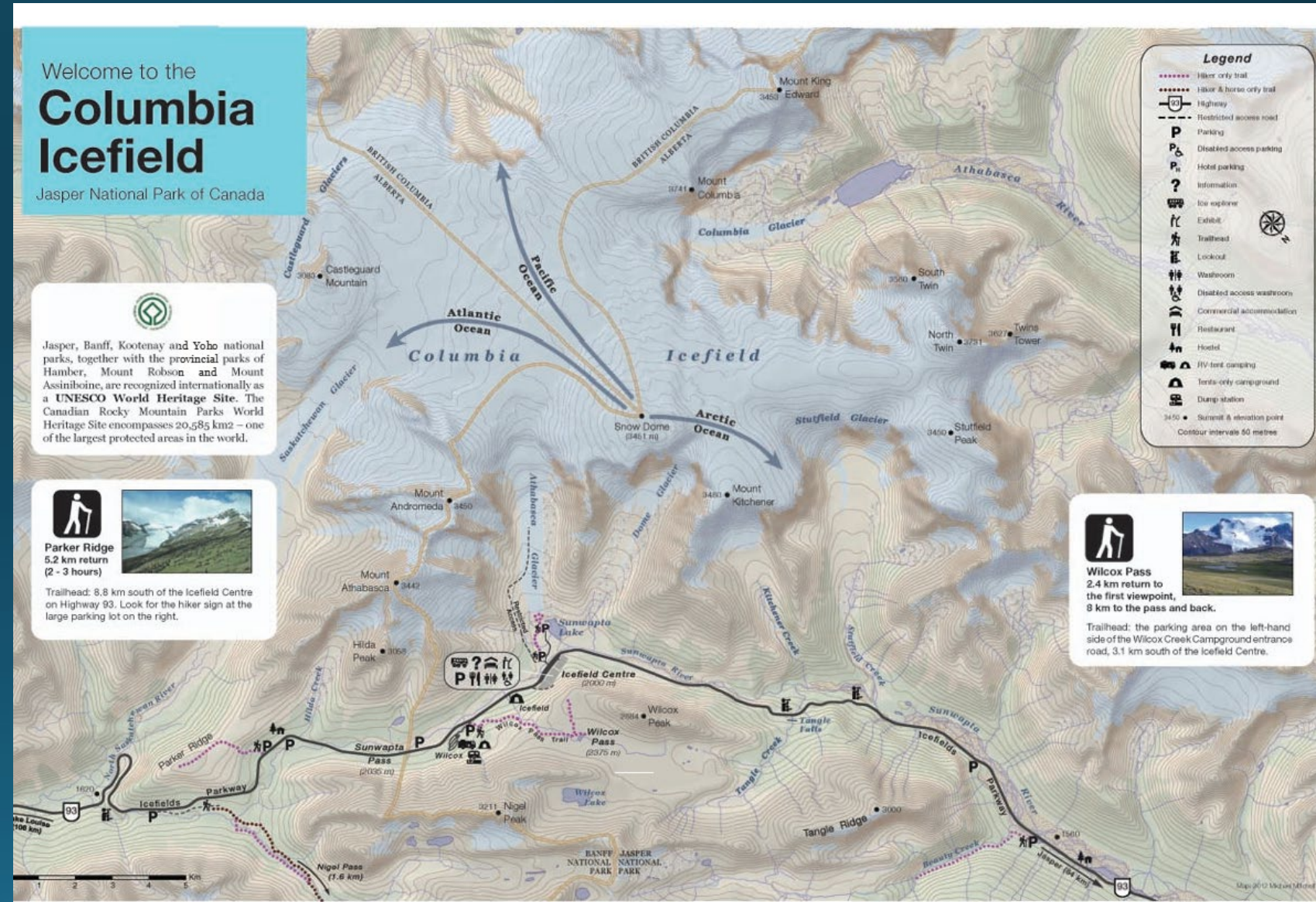
"The Athabasca River headwaters start in the Columbia Icefield, specifically from the Athabasca Glacier."



- True or False?

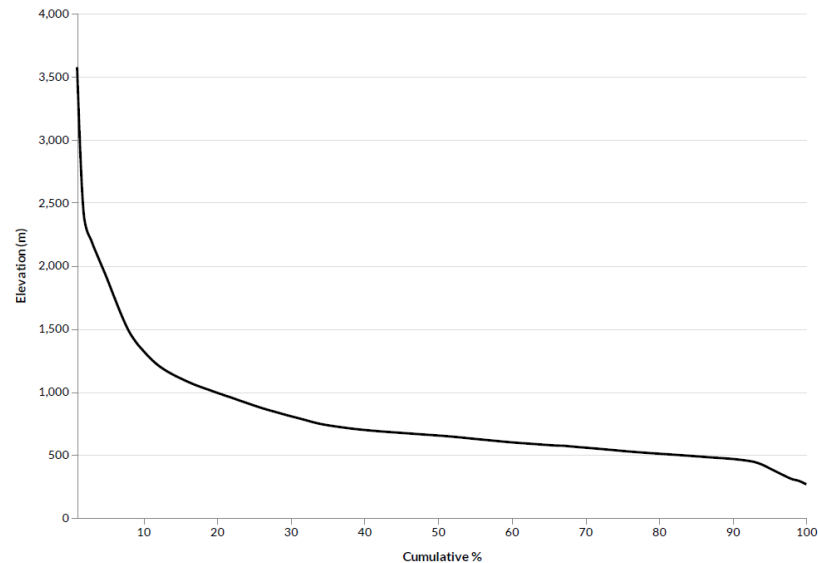
Athabasca Headwaters

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



Headwaters Contribution is huge!

Key watershed characteristics such as precipitation and temperature are often strongly influenced by elevation. The terrain of the watershed, as measured by a digital elevation model³, is represented using a hypsometric curve. It shows the proportion of the watershed above or below a given elevation.



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??

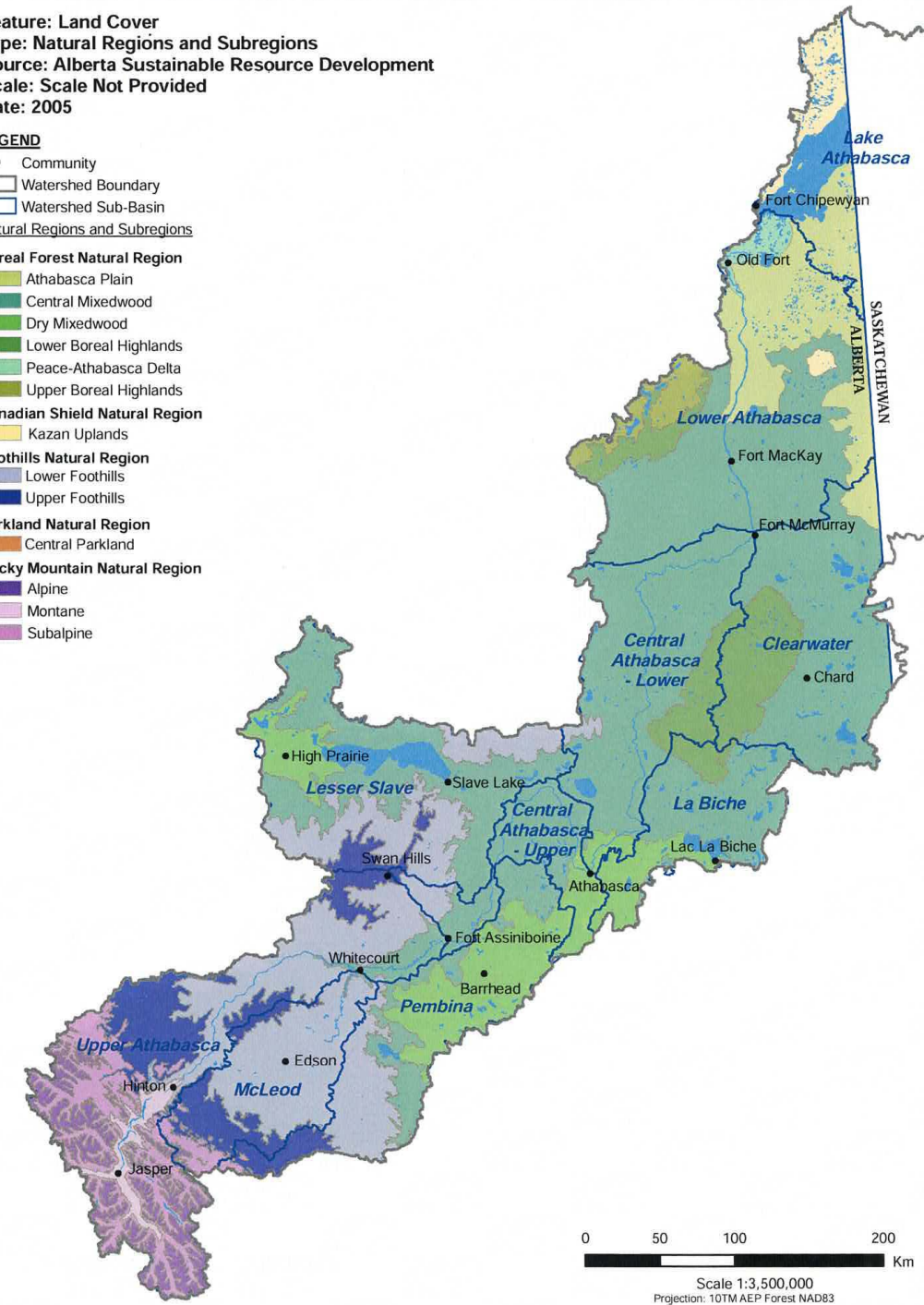
Moving Downstream

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%

Feature: Land Cover
 Type: Natural Regions and Subregions
 Source: Alberta Sustainable Resource Development
 Scale: Scale Not Provided
 Date: 2005

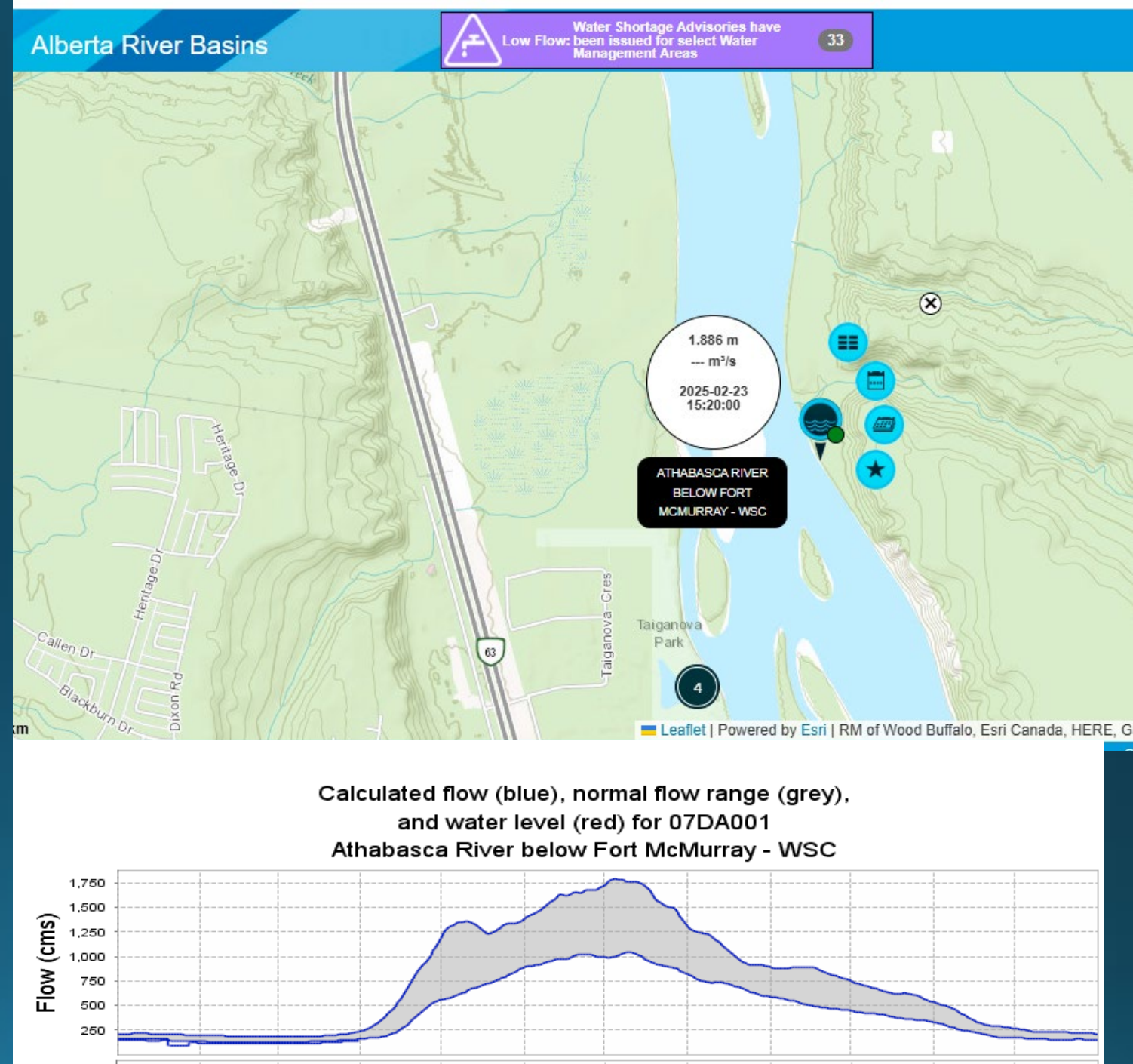
LEGEND

- Community
- ▬ Watershed Boundary
- ▬ Watershed Sub-Basin
- Natural Regions and Subregions
- Boreal Forest Natural Region**
 - Athabasca Plain
 - Central Mixedwood
 - Dry Mixedwood
 - Lower Boreal Highlands
 - Peace-Athabasca Delta
 - Upper Boreal Highlands
- Canadian Shield Natural Region**
 - Kazan Uplands
- Foothills Natural Region**
 - Lower Foothills
 - Upper Foothills
- Parkland Natural Region**
 - Central Parkland
- Rocky Mountain Natural Region**
 - Alpine
 - Montane
 - Subalpine



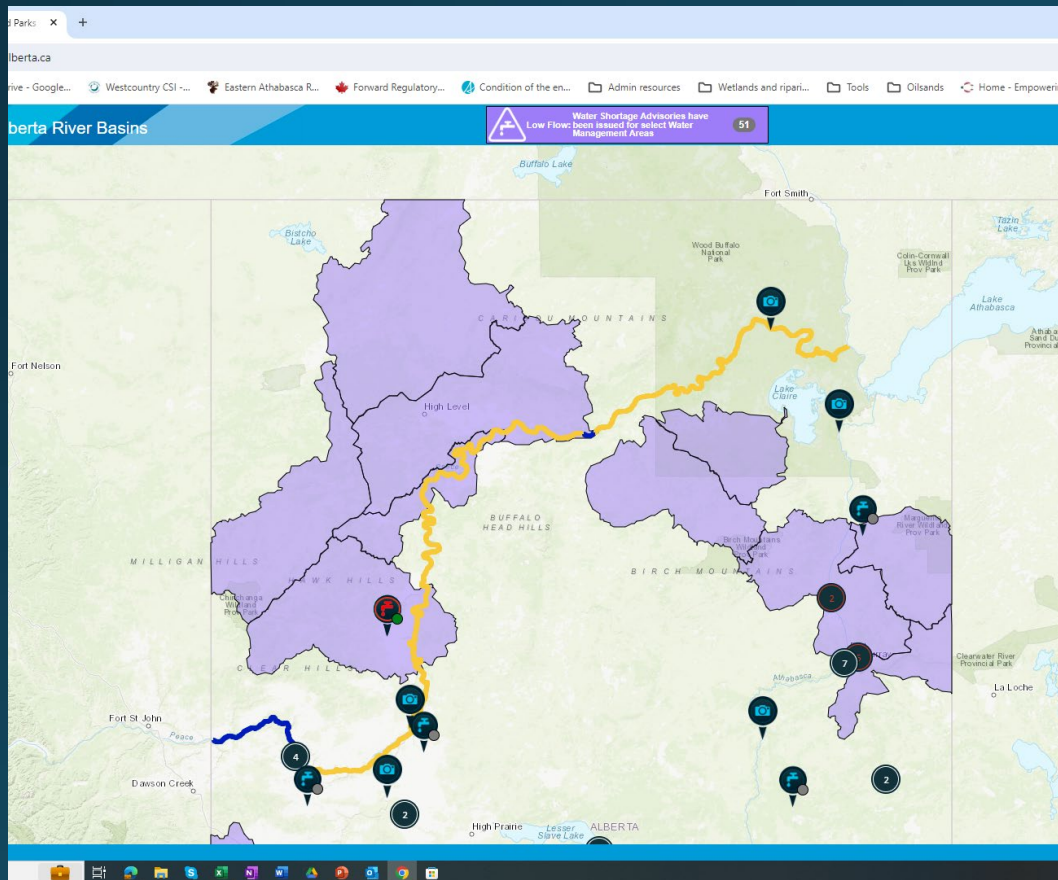
So how much water is there?

- 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)

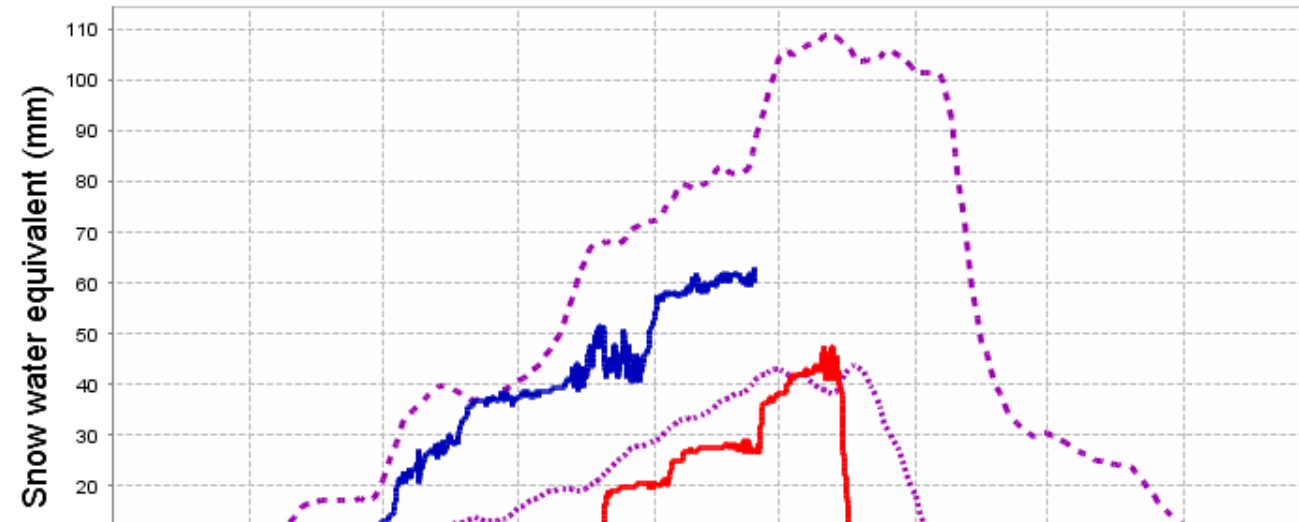


Natural Flows Fluctuate...

Alberta River Basins [Rivers.alberta.ca](https://rivers.alberta.ca)



Snow water equivalent for the current year (blue),
the previous year (red), and the normal range (purple)
for station 07BB814
Twin Lakes - EPA

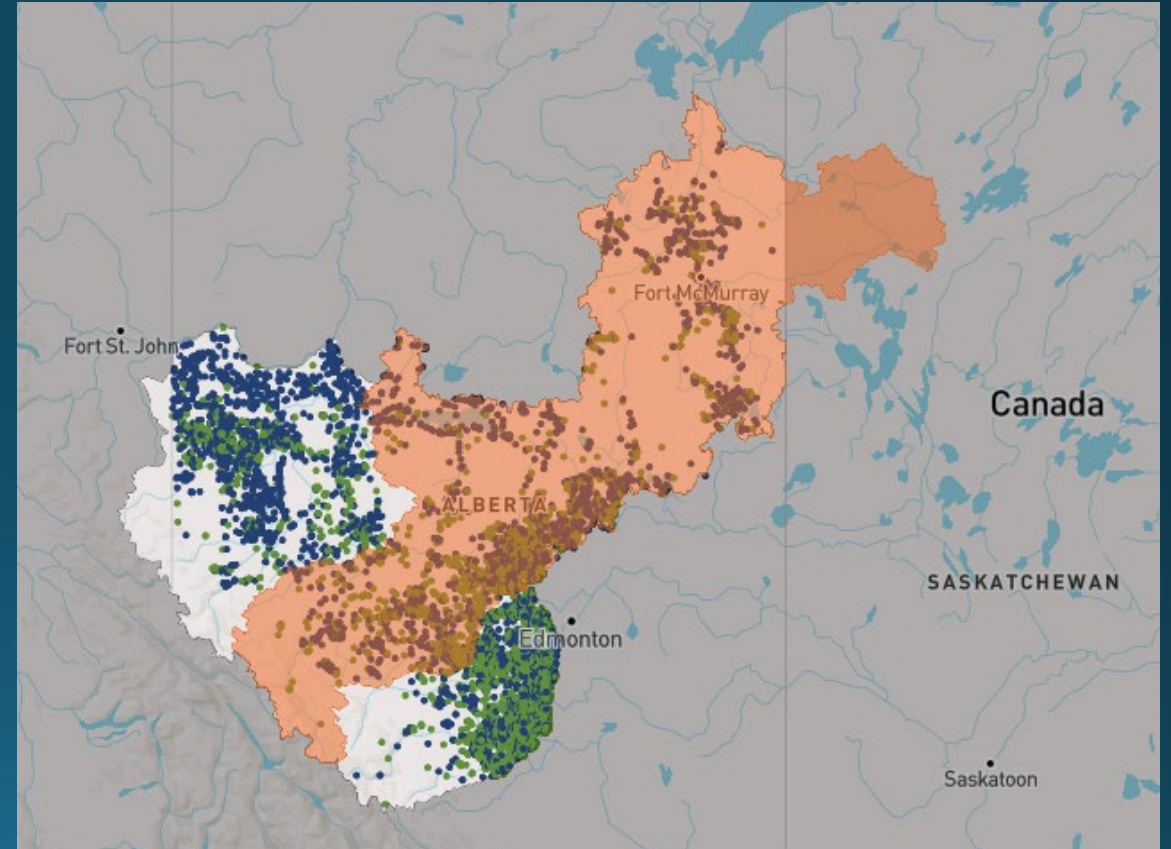


[Disclaimer](#)

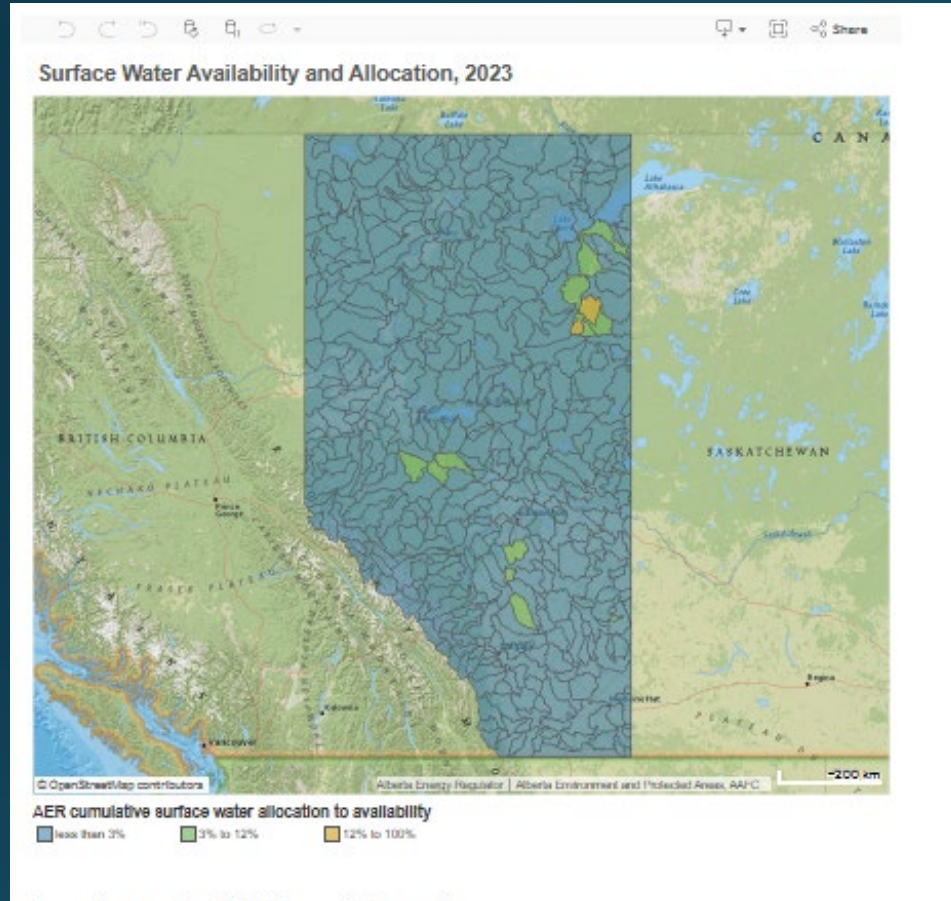
[Download](#)

How much do we allocate?

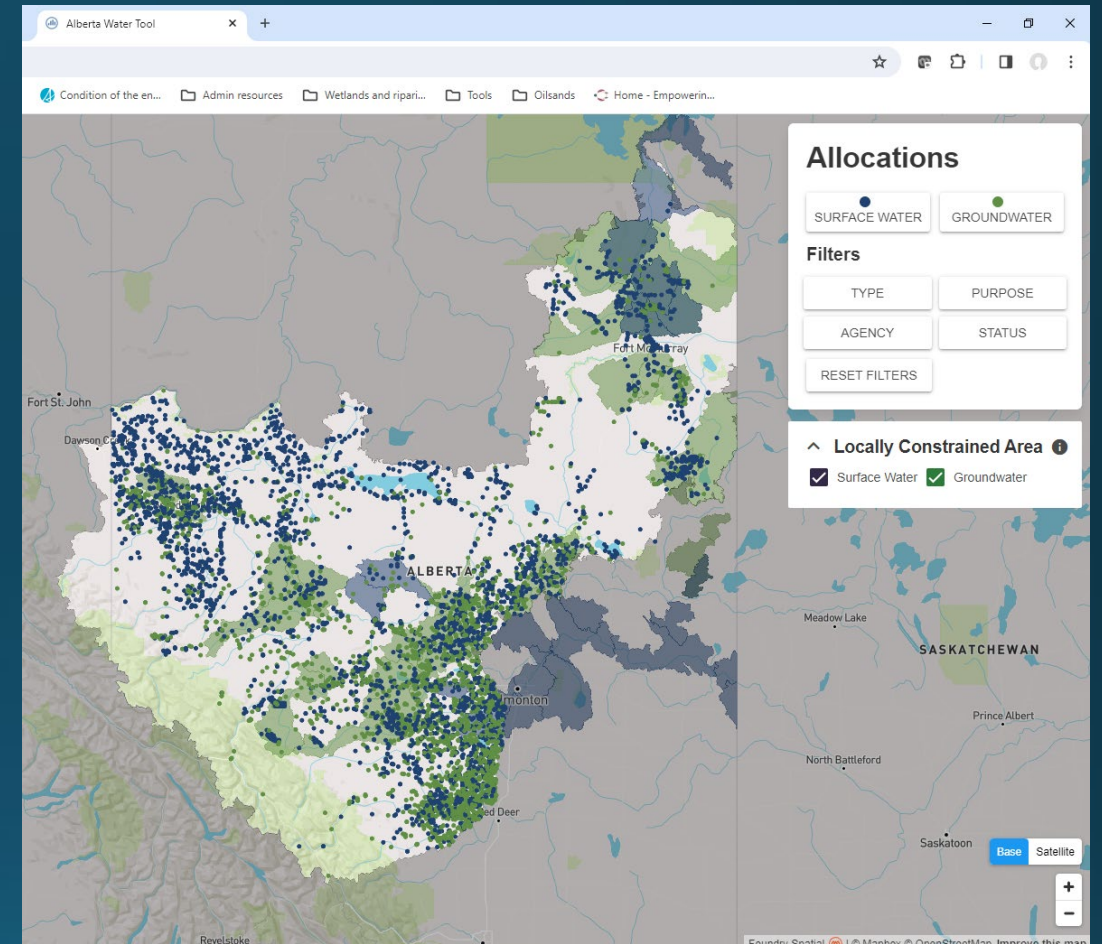
- Alberta Flow Estimation Tool for Ungauged Streams ([AFETUW](#))
- [Authorization Viewer](#) (new Environmental Records Viewer)
- [Alberta Water Tool](#) (Foundry Spatial)
- It's a very busy landscape!



AER Tools



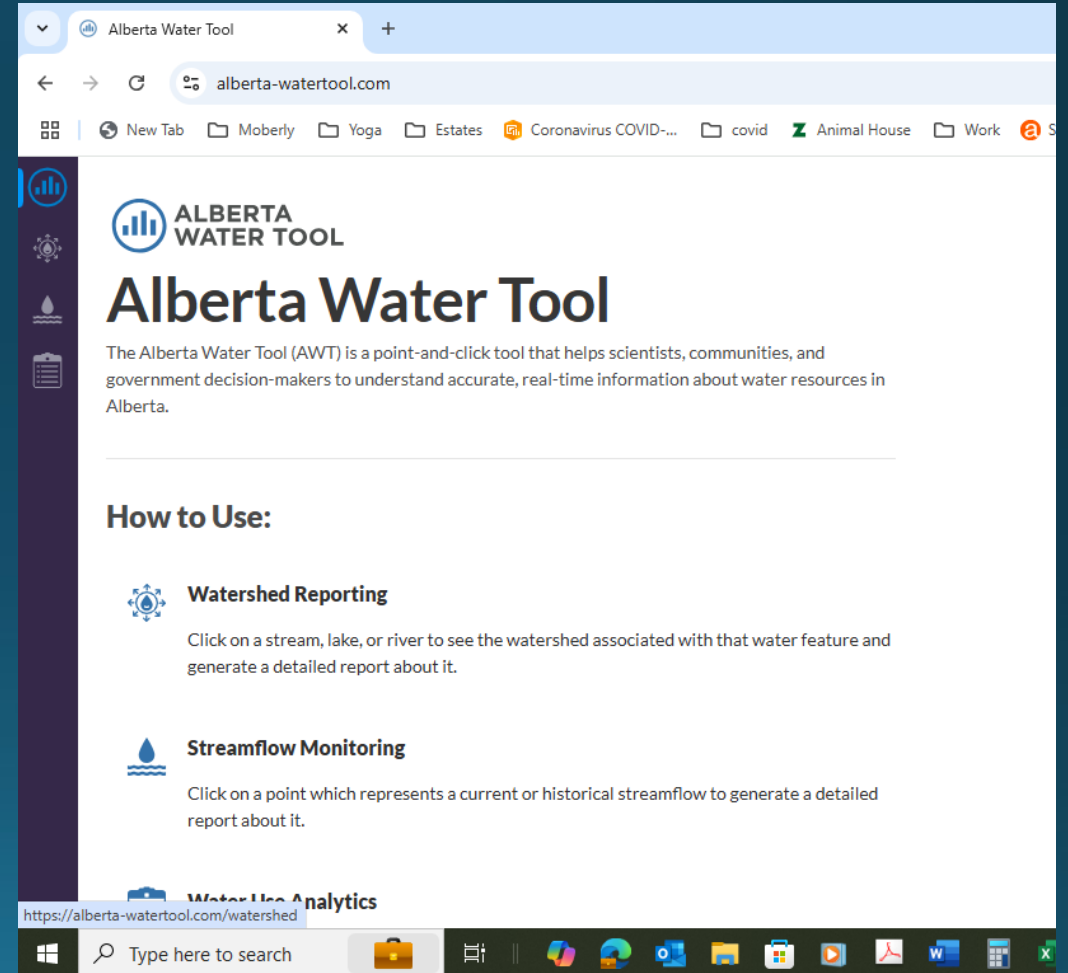
<https://www.aer.ca/data-and-performance-reports/industry-performance/water-use-performance/water-availability-and-allocation>



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

Current Allocations

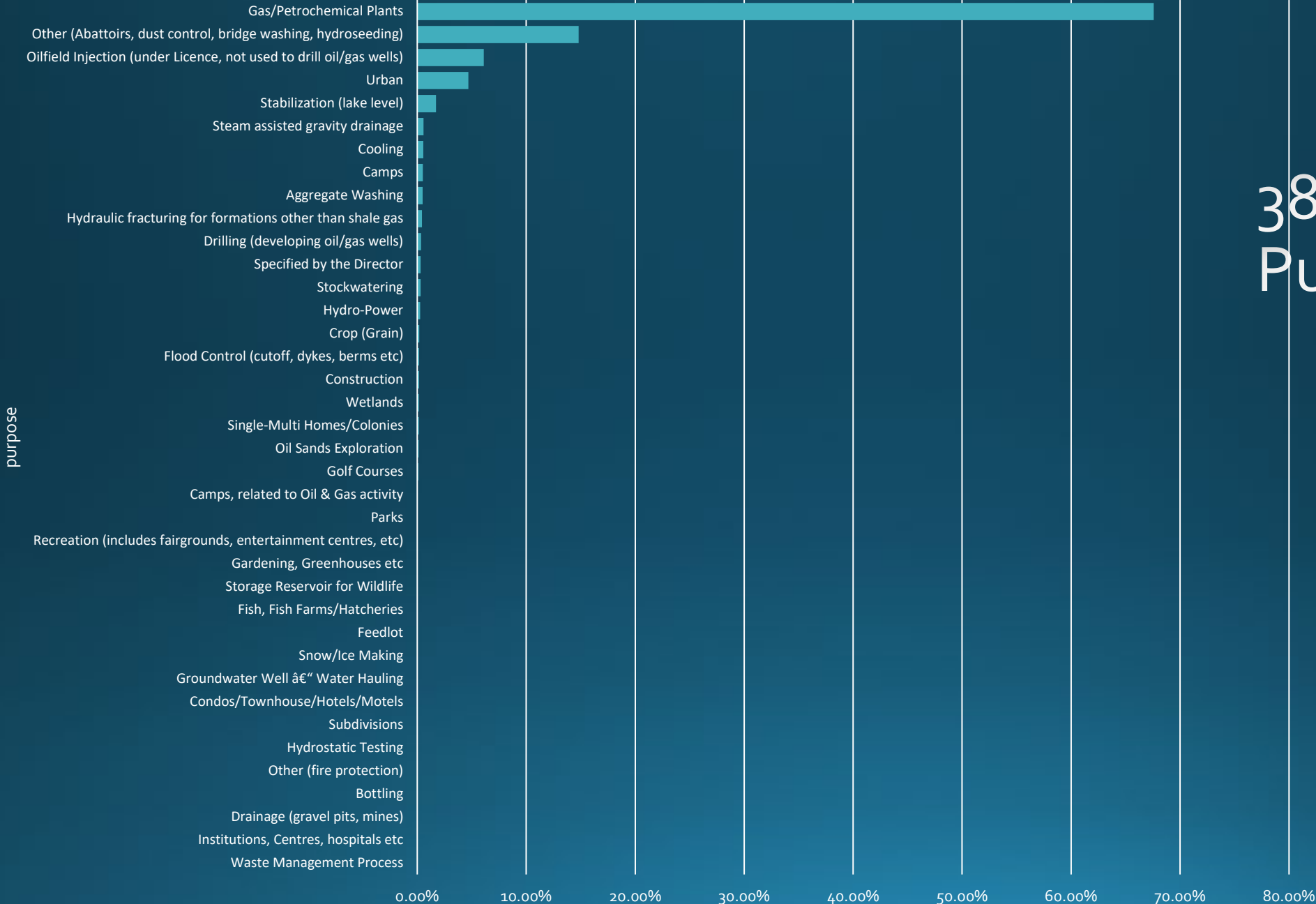
- Current allocations: 4.05%
- Annual SW allocations:
- 28.9 m³/s (911,390,400 m³)
- Mean Annual Discharge at Fort McMurray = 20,860,000,000 m³



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

Percentage of 'quantity_ann_m3' by 'purpose'



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

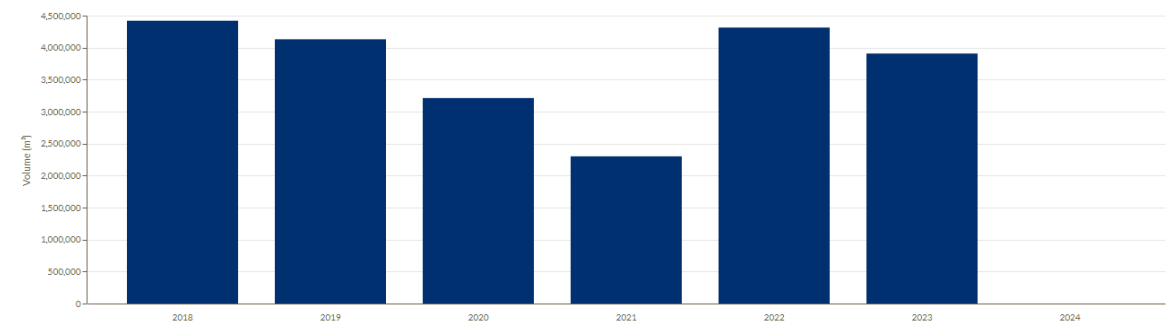
Actual Water Use?

- 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?



Annual Reported Water Use

All available water use reports (including both diversions and return flows) have been summarized on an annual basis, for this year and the 6 full previous years, to show historical trends in water usage.



Water Use in the Lower Athabasca

Lower Athabasca Surface Water
Quantity Management
Framework

Athabasca River Conditions and
Use

Surface Water Allocation
Directive (SWAD)

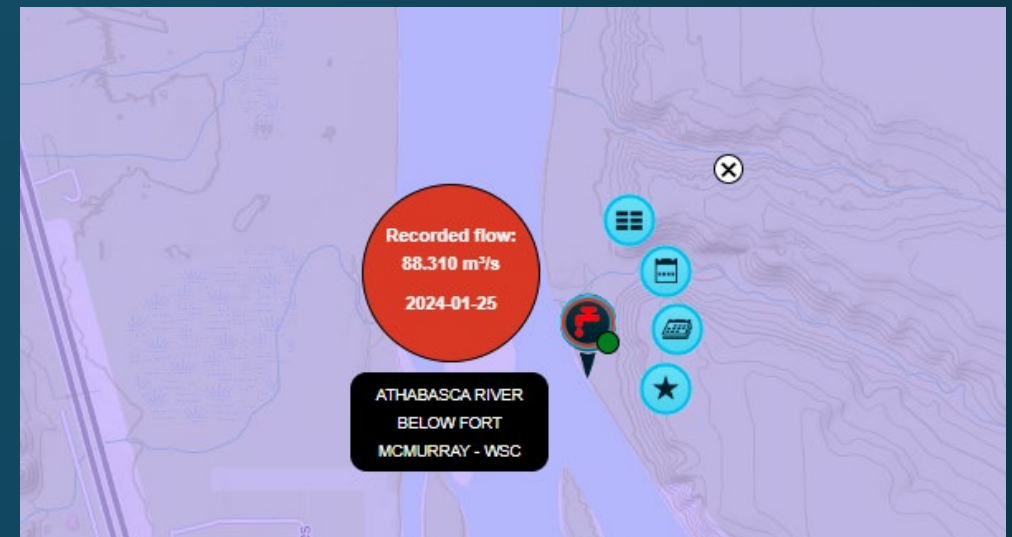


Table 1. Weekly Flow Triggers and Cumulative Water Use Limits on

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

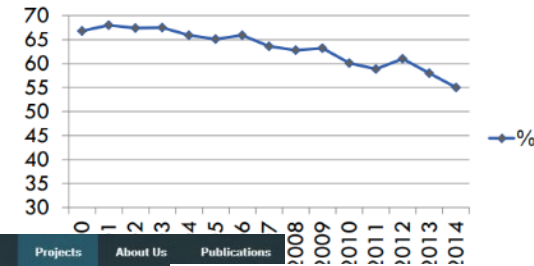
Alberta Water Council Water Conservation, Efficiency & Productivity Planning Project

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

2015 Plan Update

Water Use

- Water withdrawals have declined to a little more than half of licensed volumes



Symposium on Exploring Water Reuse for Household, Municipal and Industrial Applications

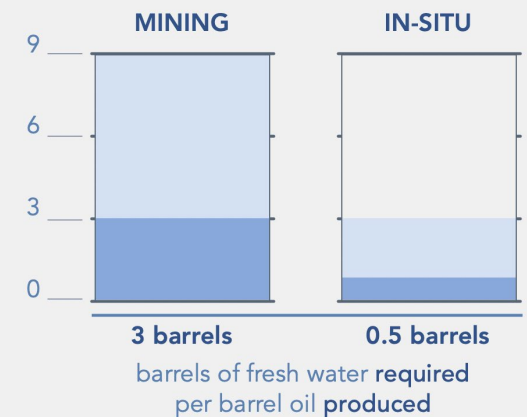
This symposium brought together representatives from water-using sectors to share global water reuse knowledge, challenges and solutions to inform the potential development of responsive water reuse policy in Alberta. Municipalities, industries and other major water-users in Alberta, particularly in water-short areas, are starting to explore alternatives to using potable water when lower quality water is adequate for certain uses. This symposium explored the implications of water reuse from an environmental, social and economic perspective and brought light to the issues, potential concerns and successes related to water reuse.

The event was held in Calgary in June 2014. The proceedings are available below, along with links to the presentations. For more information on this committee or its work, please contact Anuja Hoddinott at ahoddinott@awc-casa.ca.



80-95% of the total water volume used in the oil sands is **recycled**

in-situ bitumen extraction uses **1/5th** as much fresh water as mining operations



FRESH WATER
RECYCLED WATER

www.oilsandsmagazine.com

WATER USAGE: OIL SANDS WATER REQUIREMENTS

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