Alberta Flow Estimation Tool for Ungauged Watersheds (AFETUW)

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Water Management in Alberta's Boreal 2025 Conference
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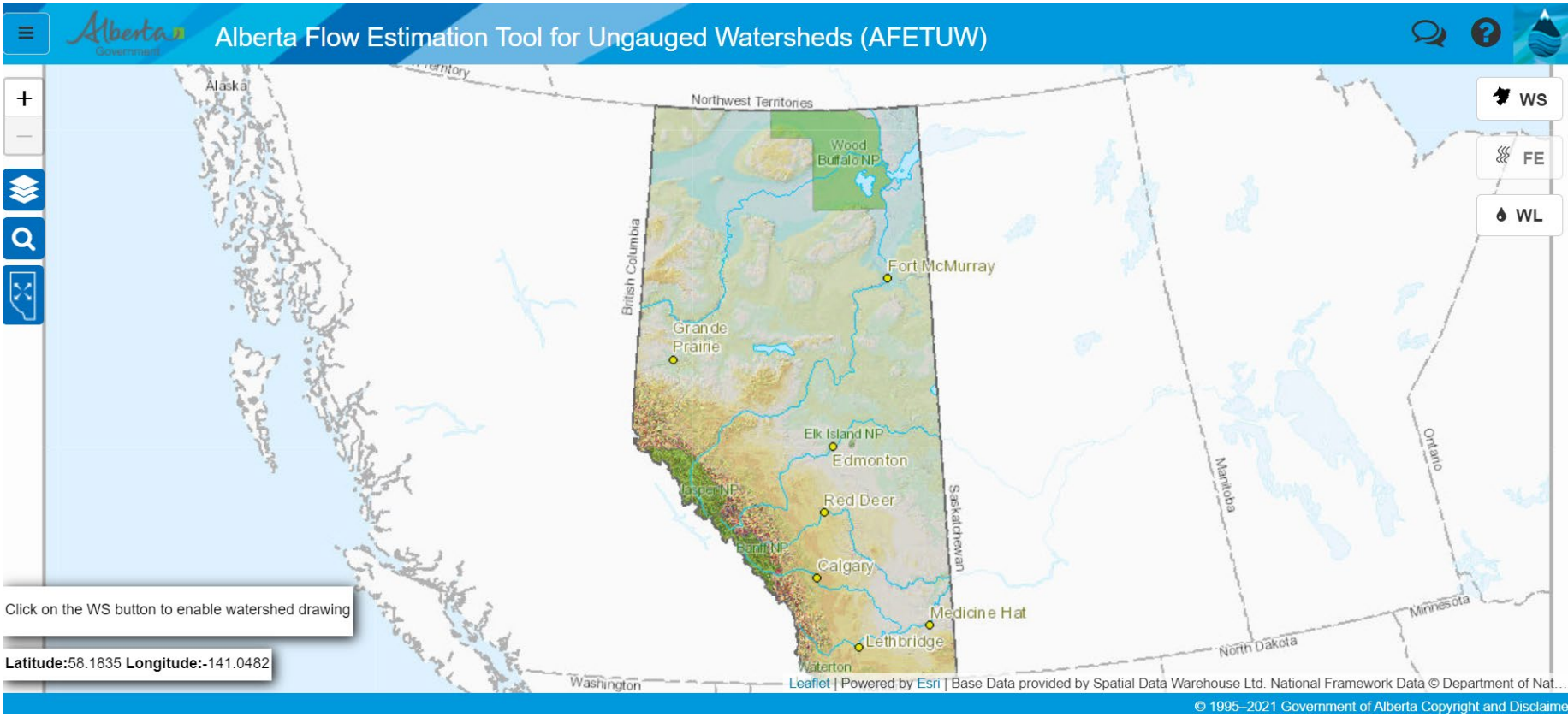
Alberta



https://afetuw.alberta.ca

Outlines of Presentation

- Why?
- What?
- How?
- Who?
- Benefits
- Summary

Why?

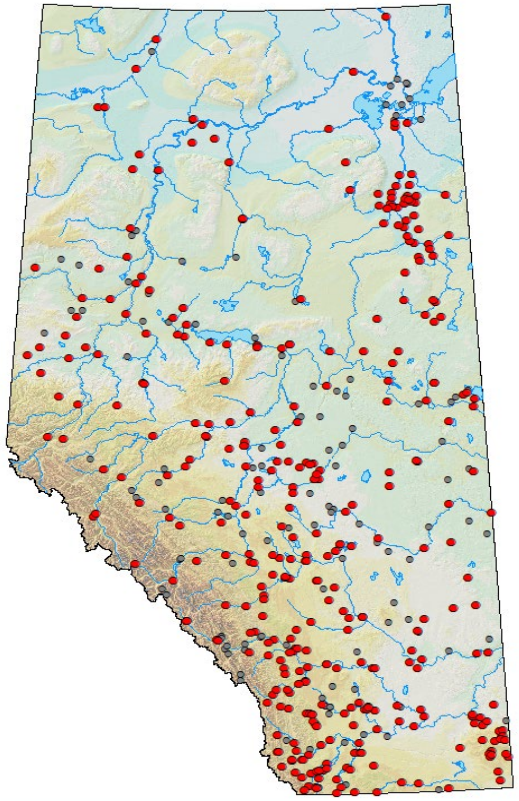
Regulatory Requirements

Government of Alberta's responsibility to manage all streams in Alberta, including ungauged streams:

- Water Act
- Environmental Protection and Enhancement Act
- Water for Life Strategy
- Surface Water Allocation Directive

Rationale for Developing AFETUW

- Hydrometric monitoring stations in many areas in Alberta
- Need for flow information at ungauged watersheds
- Need for water licence information to support water management decisions
- Need for watershed delineation to do any watershed analysis



Active Hydrometric Stations

What?

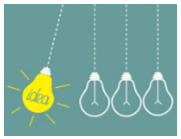
What is AFETUW?

- A public-facing, GIS-enabled provincial web application
- A tool to estimate flows at an ungauged watershed in Alberta
- A set of comprehensive functions to query water licence information
- A ‘rapid-flow-assessment’ tool that is ‘optimized’ regionally to increase accuracy of flow estimation at ungauged locations

What Can AFETUW Provide?

- Watershed delineation
- Water licence query
- Flow estimations
  - Environmental flows (daily) to support the implementation of:
    - Surface Water Allocation Directive and
    - Instream Objective
  - Real-time flows (hourly)
  - Historic daily flows (daily)
  - Flow statistics

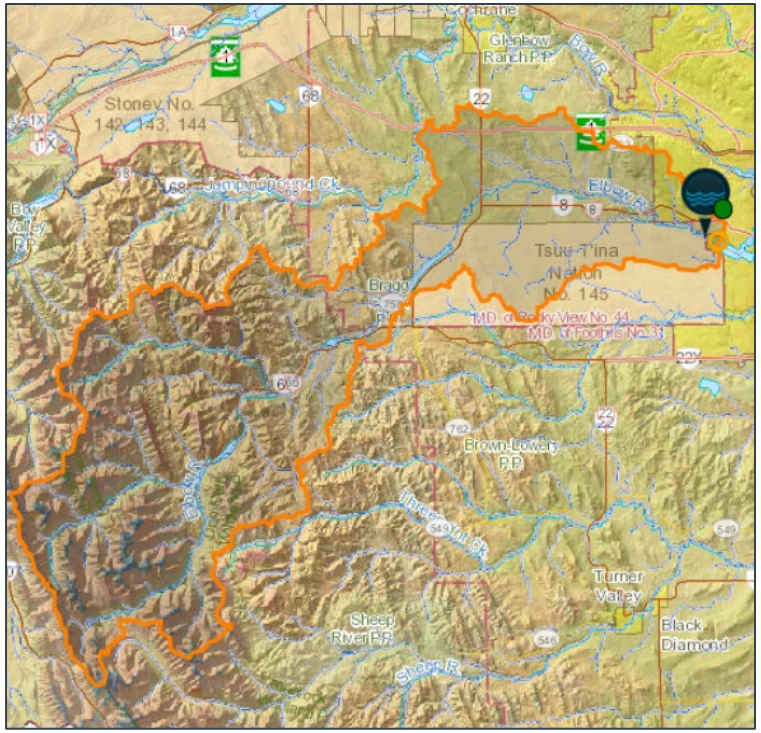
What is Innovative about AFETUW?



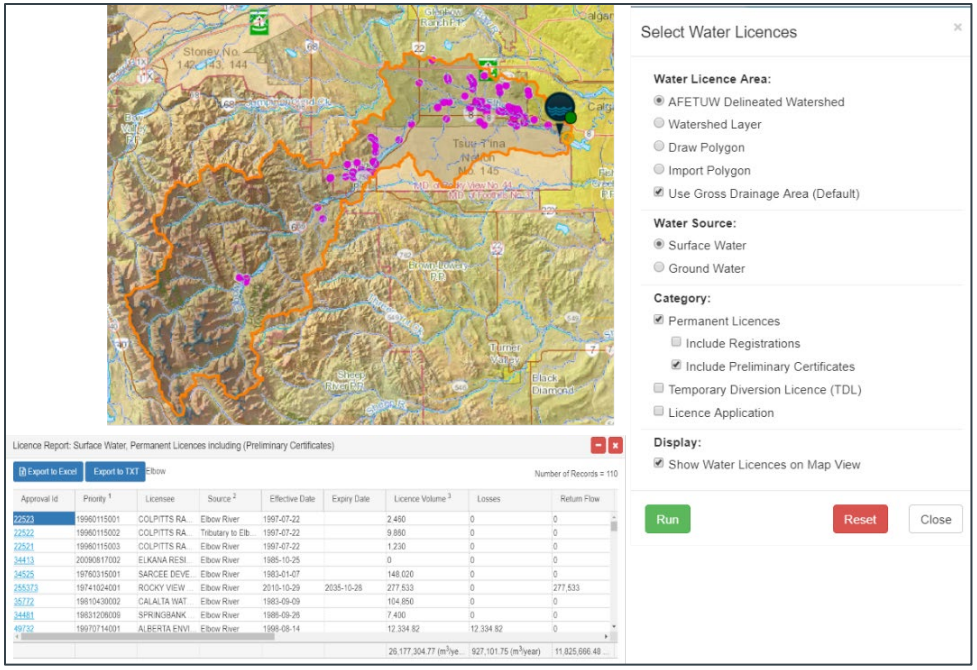
- Never done in Alberta before
- Automation of all the necessary time-consuming processes
- Integration of various state-of-art technologies & databases

AFETUW Sample Output

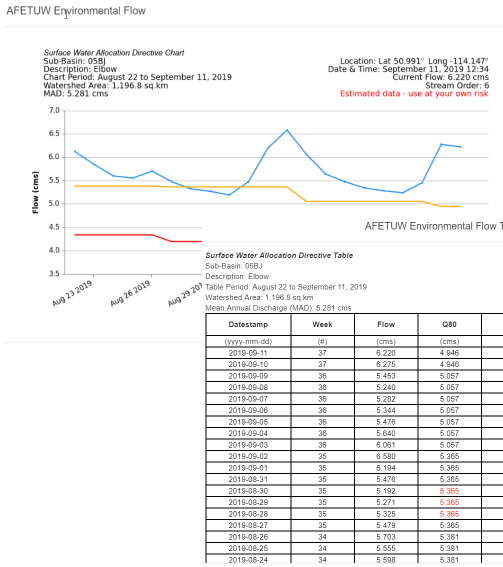
Automate watershed delineation anywhere in Alberta by point & click on the map.



Query for water licence information (surface water and groundwater) for any watershed of interest in Alberta.



AFETUW Sample Output (cont'd)


AFETUW Environmental Flow

Surface Water Allocation Directive Chart
Sub-Basin: 05BJ
Description: Elbow
Chart Period: August 22 to September 11, 2019
Watershed Area: 1,196.8 sq.km
MAD: 5.281 cms

Location: Lat 50.991° Long -114.147°
Date & Time: September 11, 2019 12:34
Current Flow: 6.220 cms
Stream Order: 6
Estimated data - use at your own risk

AFETUW Environmental Flow Table

Surface Water Allocation Directive Table
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Table Period: August 22 to September 11, 2019
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Mean Annual Discharge (MAD): 5.281 cms

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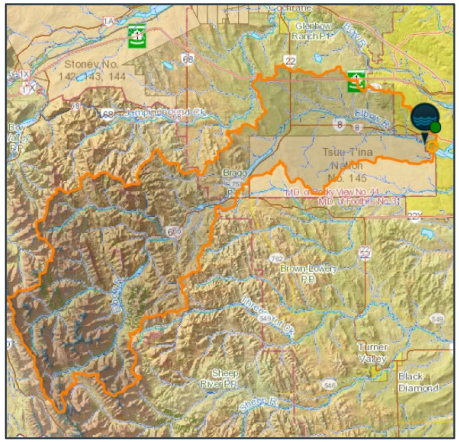
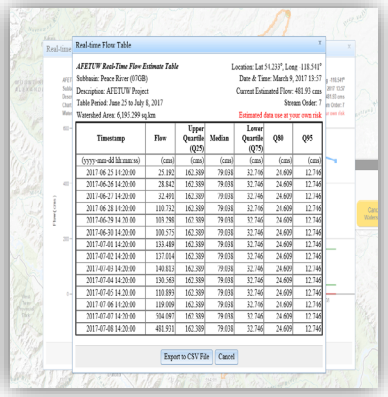
Current Flow: 6.220 cms
Stream Order: 6
Estimated data - use at your own risk

Datestamp	Week	Flow	Q80	Q95	Percent of Flow	Cumulative Diversion
(yyyy-mm-dd)	(#)	(cms)	(cms)	(cms)	(%)	(cms)
2019-09-11	37	6.220	4.946	3.970	15.0%	0.933
2019-09-10	37	6.275	4.946	3.970	15.0%	0.941
2019-09-09	36	5.453	5.057	4.114	7.3%	0.396
2019-09-08	36	5.240	5.057	4.114	5.0%	0.262
2019-09-07	36	5.282	5.057	4.114	5.0%	0.264
2019-09-06	36	5.344	5.057	4.114	5.4%	0.287
2019-09-05	36	5.476	5.057	4.114	7.7%	0.419
2019-09-04	36	5.640	5.057	4.114	10.3%	0.583
2019-09-03	36	6.061	5.057	4.114	15.0%	0.909
2019-09-02	35	6.580	5.365	4.196	15.0%	0.987
2019-09-01	35	6.194	5.365	4.196	13.4%	0.829
2019-08-31	35	5.476	5.365	4.196	5.0%	0.274
2019-08-30	35	5.192	5.365	4.196	5.0%	0.260
2019-08-29	35	5.271	5.365	4.196	5.0%	0.264
2019-08-28	35	5.325	5.365	4.196	5.0%	0.266
2019-08-27	35	5.479	5.365	4.196	5.0%	0.274
2019-08-26	34	5.703	5.381	4.339	5.6%	0.322
2019-08-25	34	5.555	5.381	4.339	5.0%	0.278
2019-08-24	34	5.598	5.381	4.339	5.0%	0.280

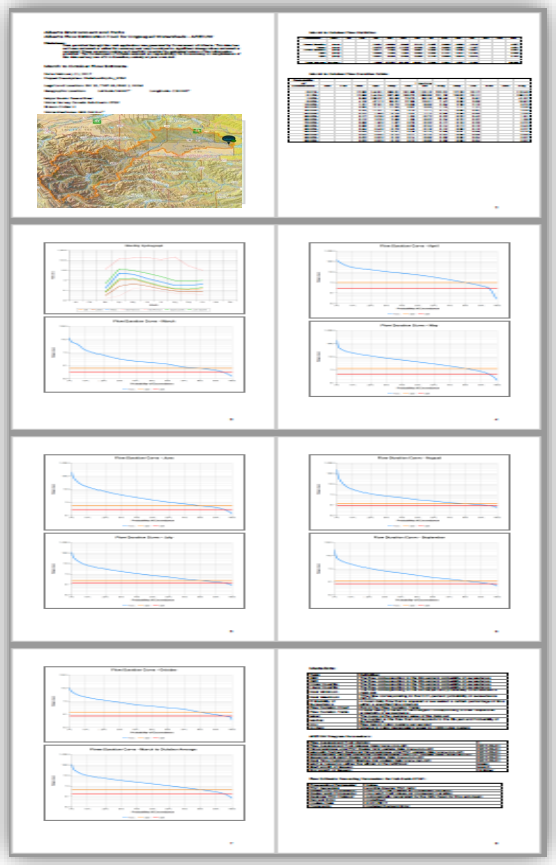
Support implementation of Surface Water Allocation Directive and Instream Objective for any ungagged watershed.





Generate real-time hourly flows and historic daily flows for any ungagged watershed.

Derive flow statistics for an ungauged watershed.



How?

Automation of Time-Consuming Processes

- Watershed delineation (data source: Alberta ArcHydro)
- Flow estimations (data source: WISKI database)
  - Daily environmental flows
  - Real-time hourly flows
  - Historic daily flow
  - Flow statistics
- Water licence query (data source: EMS/DMP)
- GIS analysis (data source: AGSP)
- Presentation of the results including graphics, tables, maps, and summary reports

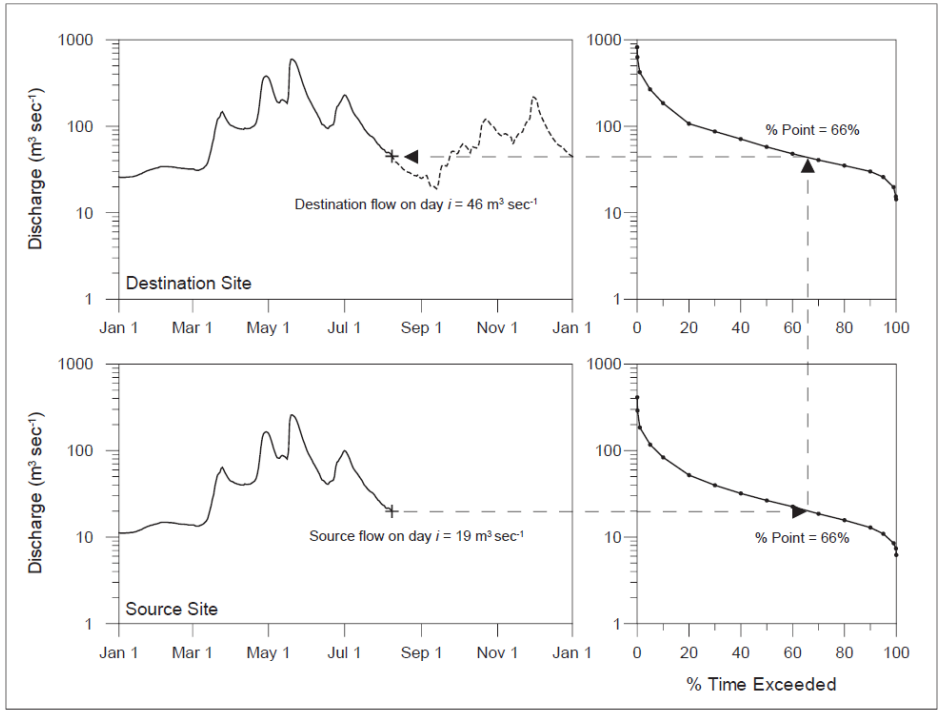
Integration of Various State-of-Art Technologies & Databases

- ArcGIS Enterprise
- Alberta ArcHydro database
- WISKI water database
- EMS/DMP water licence database
- Alberta Geospatial Service Platform (AGSP)
- Scientifically-based, peer-reviewed hydrological methodologies

AFETUW is based on QA/QC data sources, and QA/QC validation and optimization processes.

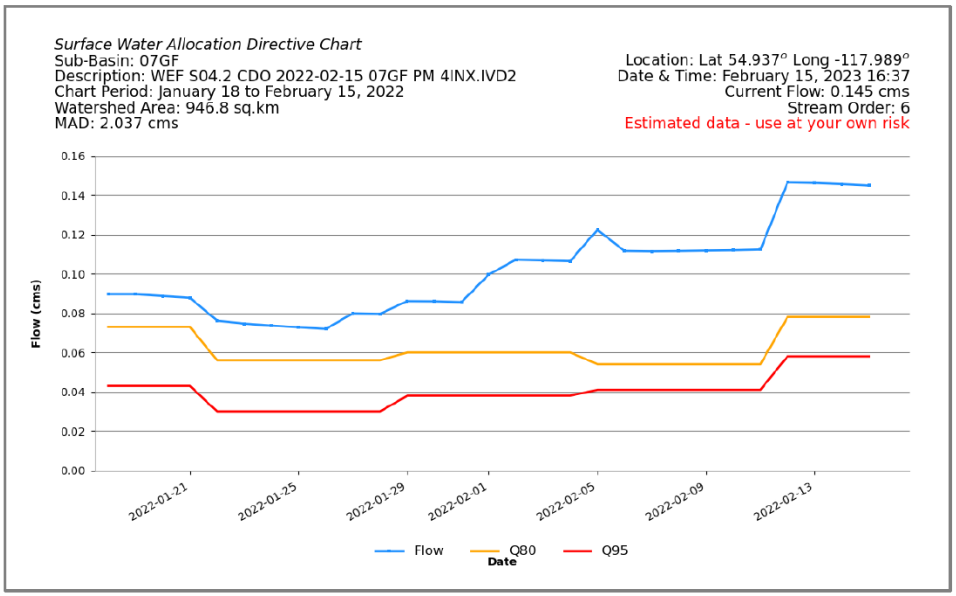
Hydrological Methodologies Used in AFETUW

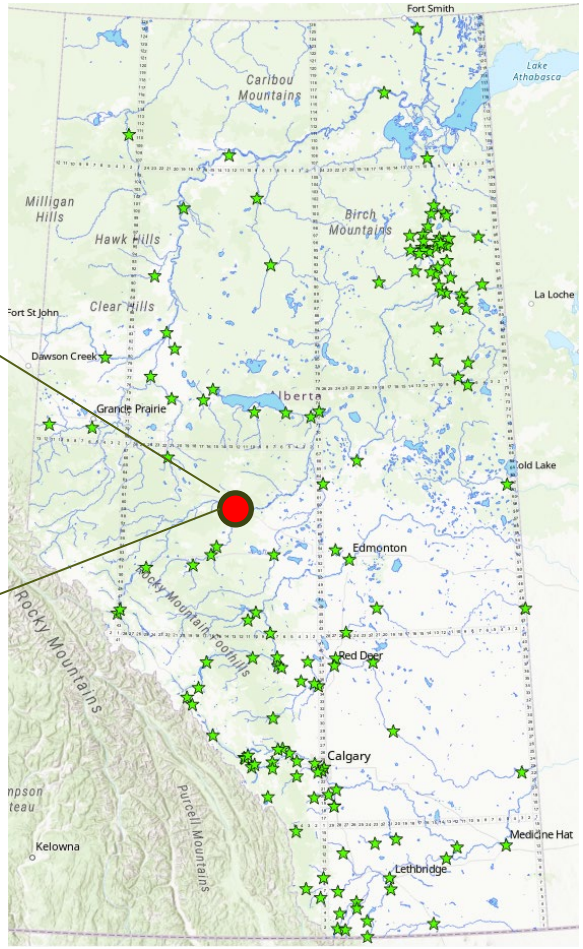
- Pragmatic Method
- Basin Transfer Method



Graphical illustration of the spatial interpolation procedure with one source site.
(R.A. Metcalfe, C. Chang and V. Smakhtin, Canadian Water Resources Journal, Vol. 30(2): 97-110, 2005)

Identify Data Gaps – Ungauged Winter Flow Estimation





How Can AFETUW Support Water Approvals?

- Provide available water supply information for a watershed, e.g., Mean Annual Discharge (MAD) and various flow statistics.
- Provide water allocation information within the watershed.
- Support the implementation of Surface Water Allocation Directive.
- Provide a watershed boundary for other analyses if needed.

Who?

Who are AFETUW Users?

- Regulatory approval agencies for water management in Alberta such as:
  - Environment and Protected Areas (EPA)
  - Alberta Energy Regulator (AER)
- Other governmental agencies dealing with issues related to water resources management and planning in the province:
  - Alberta Agriculture and Irrigation
  - Alberta Indigenous Relations
  - Alberta Transportation and Economic Corridors
  - Alberta Energy
  - Environment Canada and Climate Change (ECCC)
  - Water Survey Canada (WSC)
  - Municipalities
- Watershed Planning and Advisory Councils (WPACs) across the province
- Proponents of development projects, e.g., oil and gas industry
- Academia
- Consulting companies
- General public, e.g., surface water licensees, recreational users, etc.

Benefits

Benefits of AFETUW

- Reducing time **from days to minutes** to obtain the required flow information
- Ensuring **consistency** (e.g., flow estimations, water licence query, watershed delineation)
- Supporting timely decision with **24/7 web-based access from anywhere**
- Achieving significant **cost savings**

Field Testing and Users' Testimonials @ Upper Ghost River in N.W. of Calgary

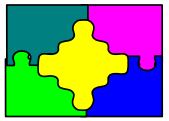
Field Measured Flows			AFETUW Estimated Flows
28 June 2018	6.9 m^3/s	at 15:05	8.179 m3/s
10 July 2018	5.17 m^3/s	at 12:11	5.053 m3/s
20 July 2018	2.64 m^3/s	at 12:24	3.791 m3/s
17 Aug 2018	1.43 m^3/s	at 12:29	1.535 m3/s
27 Sept 2018	1.14 m^3/s	at 11:06	1.806 m3/s

Summary

Lessons Learned

- Building in-house capacity is essential for long-term sustainability.
- Engaging, communicating, and building good relationships with Informatics is important.
- Involving a multidisciplinary project team is critical.
- Forming collaborative partnerships, e.g., with Alberta Energy Regulator (AER).

Summary



- AFETUW provides a decision support tool to GoA, Albertans, industries, etc. to efficiently and effectively manage water resources.

- AFETUW protects the ecological integrity at an ungauged watershed in the province.

- A creative dream has come true indeed.

Questions?

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