PFAS in Source Water: Preparing for New Regulations

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Albanie Douglas, M.Sc., P.Geo. (City of Guelph)
Krista Barfoot, Ph.D., C.Chem., QPRA (SLR)

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Outline

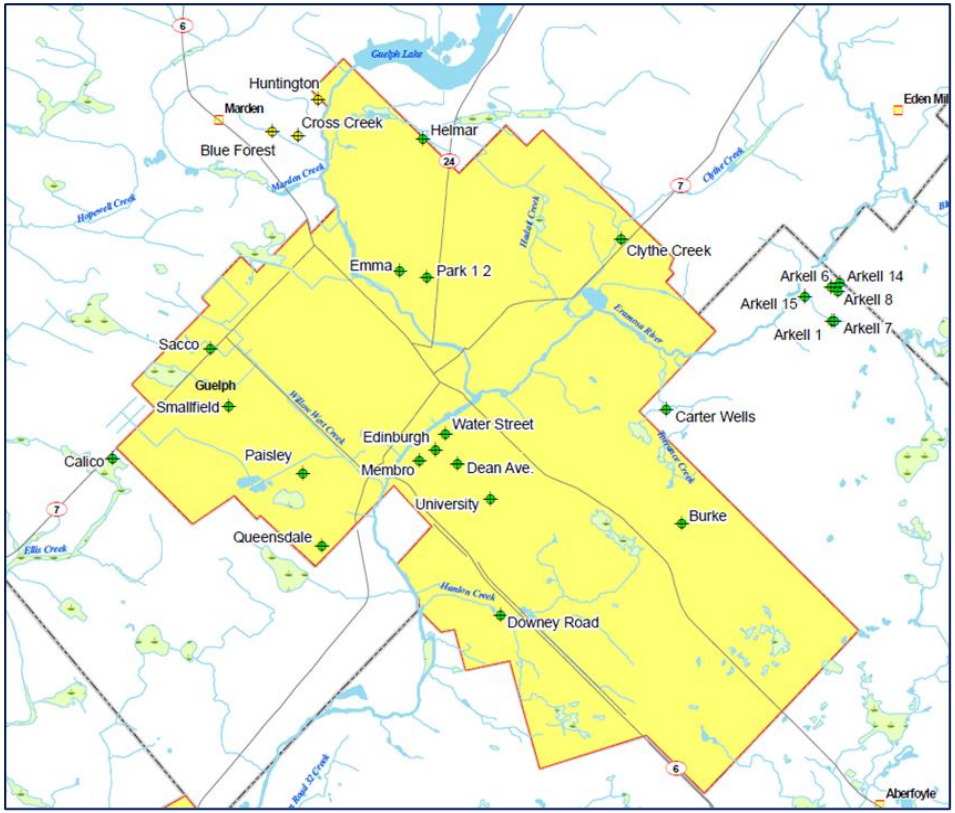
1. Background
2. Risk Screening
3. Sampling Program
4. Conclusions
5. Recommendations

Background

City of Guelph Background

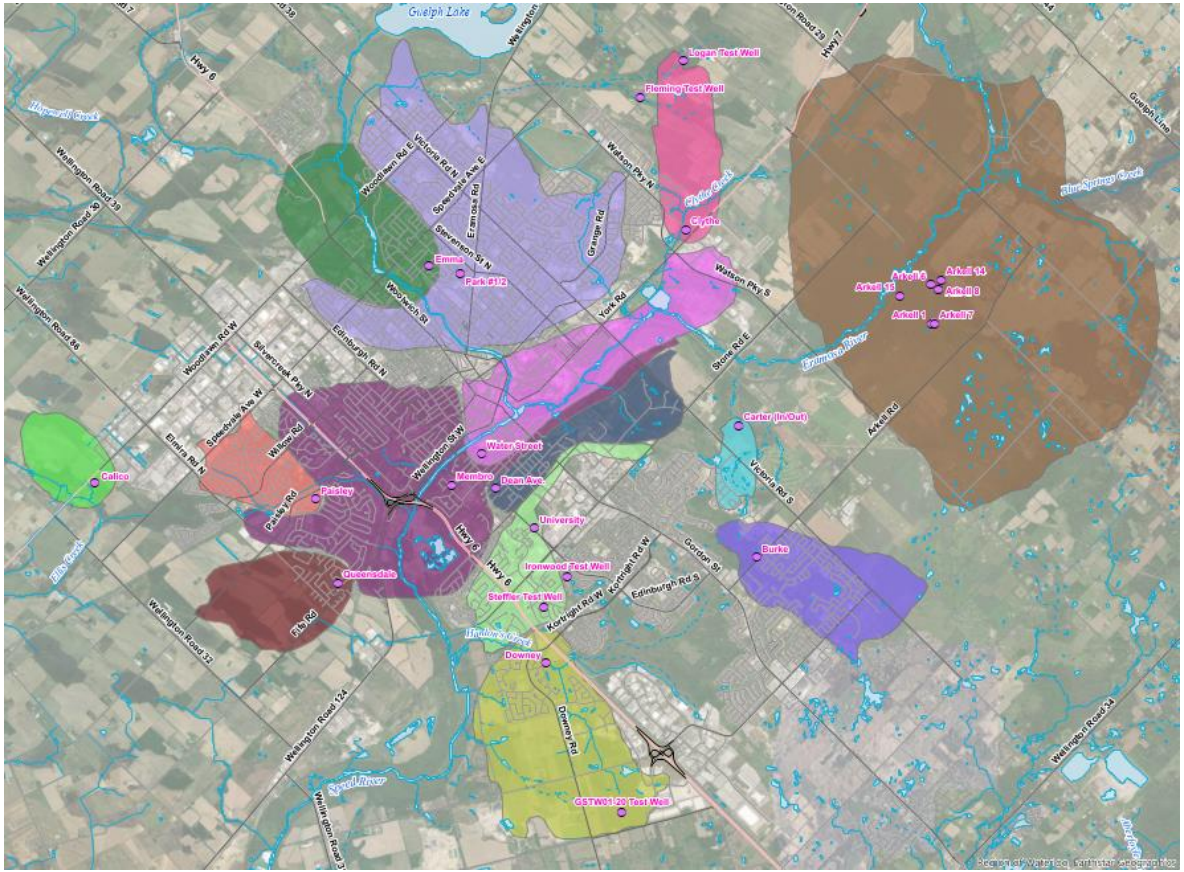
Groundwater-based water supply since 1879

- Water supply system includes production wells in the bedrock aquifer and a shallow groundwater collector system
- 21 wells in continuous operation with 4 not in operation
- Current treatment includes disinfection and greensand filtration at 8.1% of our water supply system in 2024



WHPA-Bs & Test Wells

- 14 WHPA-Bs (Arkell, Carter, Burke, Clythe, Water Street, Park, Emma, Dean, University, Downey, Membro, Paisley, Calico, Queensdale)
- 5 Test Wells (Logan, Fleming, Ironwood, Steffler, Guelph South/GSTW01-20)



PFAS Groundwater Screening Approach

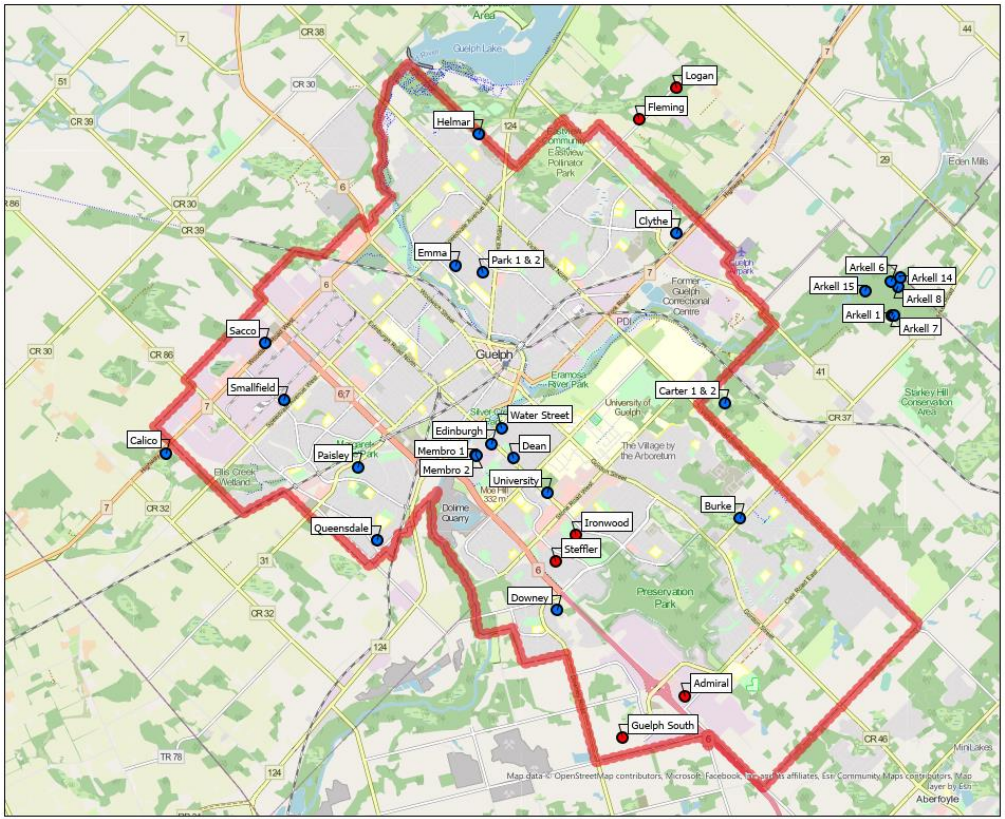
Prescreening of PFAS in groundwater was prioritized using the following steps:

1. Prioritize existing and future water supply wells
2. Review of Current & Historical Potential PFAS sources
3. Identify Risk Criteria for Evaluation
4. Scoring and Evaluation Criteria

Risk Screening

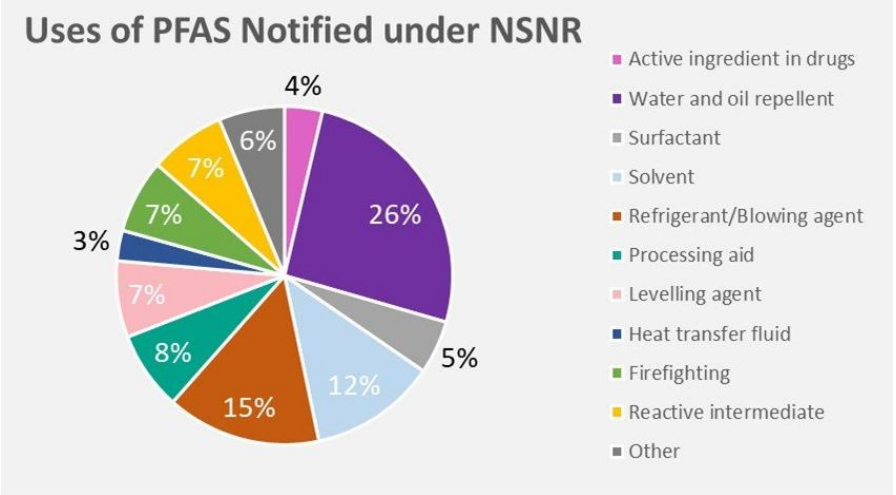
How did we begin the process?

Step 1. Prioritize Existing and Future Water Supply Wells



Step 2. Review of Current & Historical Potential PFAS Sources

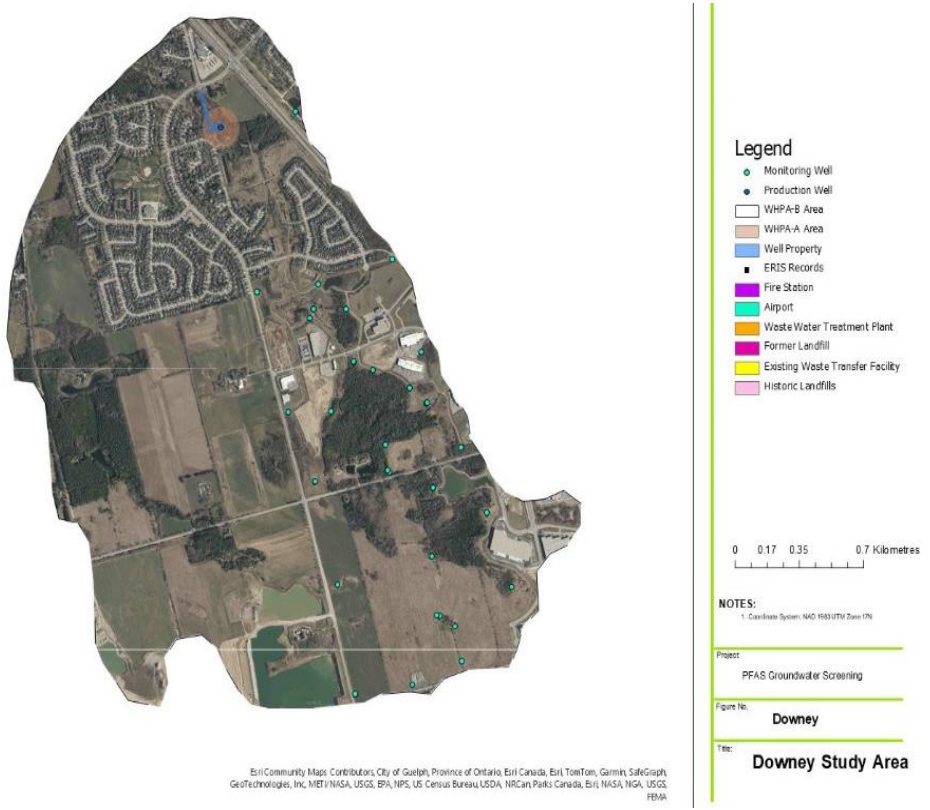
- Review of potential gross PFAS sources included in **Updated Draft State of PFAS Report** (Government of Canada, July 2024)
- Such as:
  - Landfills (current and historic)
  - Waste water treatment plant(s)
  - Areas where large quantities of firefighting foam use (airports and fire stations)
  - Manufacturing facilities of textiles, cosmetics, food packaging, levelling agents in paint, ink and adhesive agents, and refrigerants
  - Review of NPRI Reports via Environmental Risk Information Services (ERIS)
  - Historical review of known properties by City Staff



Updated Draft State of PFAS Report, Environment and Climate Change, Health Canada, July 2024

Step 3. Identify Risk Criteria for Evaluation

1. Potential Gross PFAS Contributing Sources
2. Number of Potential Gross PFAS Contributing Sources
3. Distance from production wells (within WHPA-A or WHPA-B)
4. Identify Monitoring Wells completed in the Gasport Aquifer

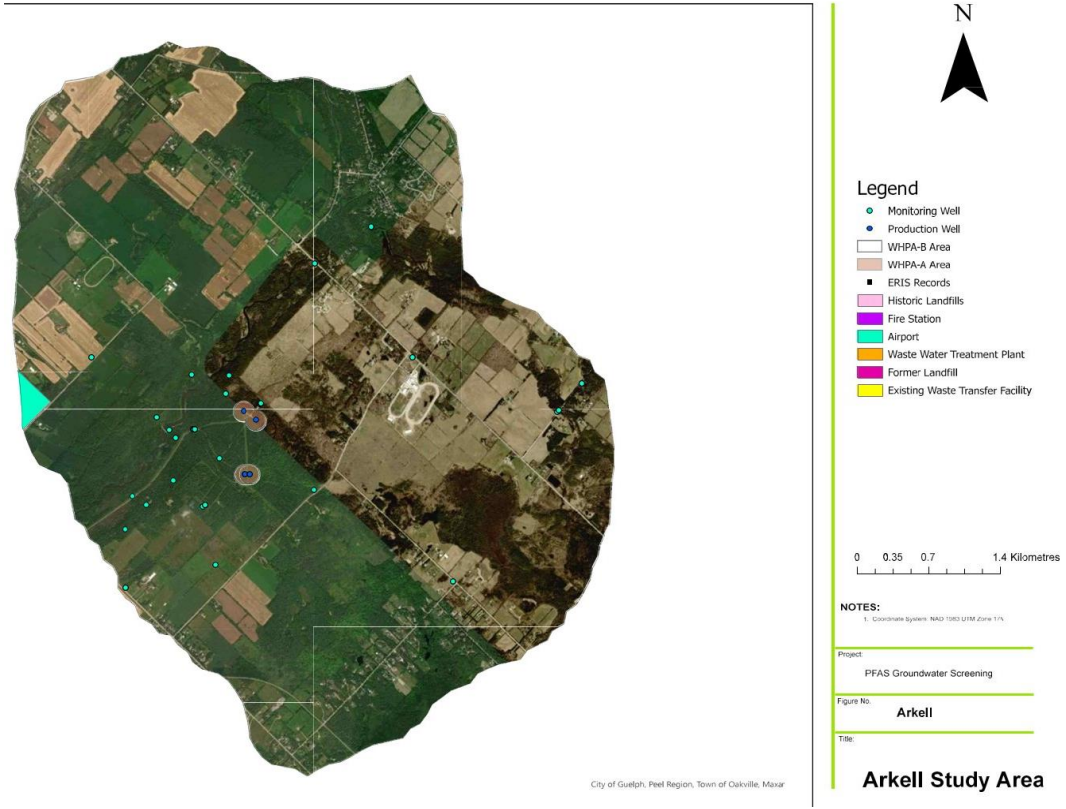


Step 4. Scoring & Evaluation Criteria

Resulting Score	Risk Criteria			Evaluation Criteria	
	Criteria 1: Distance of Closest Record to Production Well	**Criteria 2: Type of Record**	**Criteria 3: Number of Records in Study Area**	**Criteria 4: Number of Monitoring Wells Screened in Same Formation as Production Well**	**Criteria 5: Currently pumping to system?**
1	Outside of the Study Area	None	None	≥3	No
2	Outside of the WHPA-A, but within the WHPA-B	ERIS Report	1-2	2	N/A
3	N/A	Waste Transfer Facility Fire Station Property	3-4	1	N/A
4	Within the WHPA-A	Waste Water Treatment Former Landfill Airport Historic Landfills	>5	None	Yes

Summary of Desktop Review

Property/Record of Interest	Approximate distance and direction	Within the Study Area?
Waste Water Treatment	8,463 m (SW)	No
Waste Transfer Facility	2,023 m (W)	No
Former Landfill	5,424 m (WNW)	No
Nearest Fire Station (Elizabeth Street)	5,074 m (W)	No
Airport	1,431 m (WSW)	Yes (partially within WHPA-B)
Nearest Historic Landfill (South of York Road)	4,545 m (WSW)	No
Monitoring Well Network (46 records within study area)	Four overburden wells: • OW3/03 • OW11S/00 • OW4D/03 • OW8/06S Seven bedrock wells: • OW14D/00 • OW4-06D • OW3-06S • OW5-06I • OW1-06I • OW7-06D • OW8-06D See **Appendix A** for additional details.	Yes (WHPA-A and WHPA-B)
ERIS Records: N/A (no records found)		



Hire the Experts!

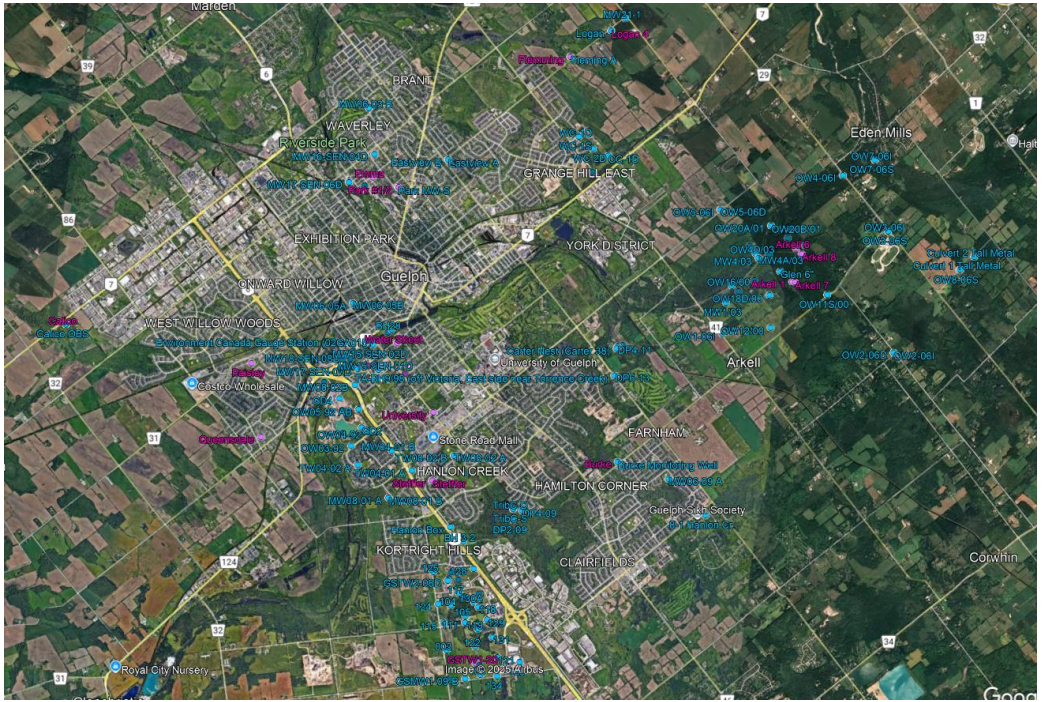
- Ensured the consultant had experience with PFAS sampling and analysis, delineation and within drinking water systems (albeit in Canada or otherwise)
- Required field staff CVs that were committed to the PFAS sampling
- Requested SOPs on sampling of PFAS in monitoring wells
- Analyzed for PFAS identified in the Health Canada Drinking Water Objective and MECP interim guidance value

Sampling Program

How do we collect representative data?

Sampling and Analysis Plan

- Review of supply wells and monitoring well network
  - Target formation/screen depth
  - Proximity to supply wells
  - Distribution (risk ranking, spatial coverage)
- Consideration of guidelines
  - Provincial
  - Federal
- Selection of analytical methodology
  - Suite of PFAS included
  - Detection Limit
- Development of sampling approach
  - Representative samples
  - Avoiding cross-contamination



Monitoring Well Network

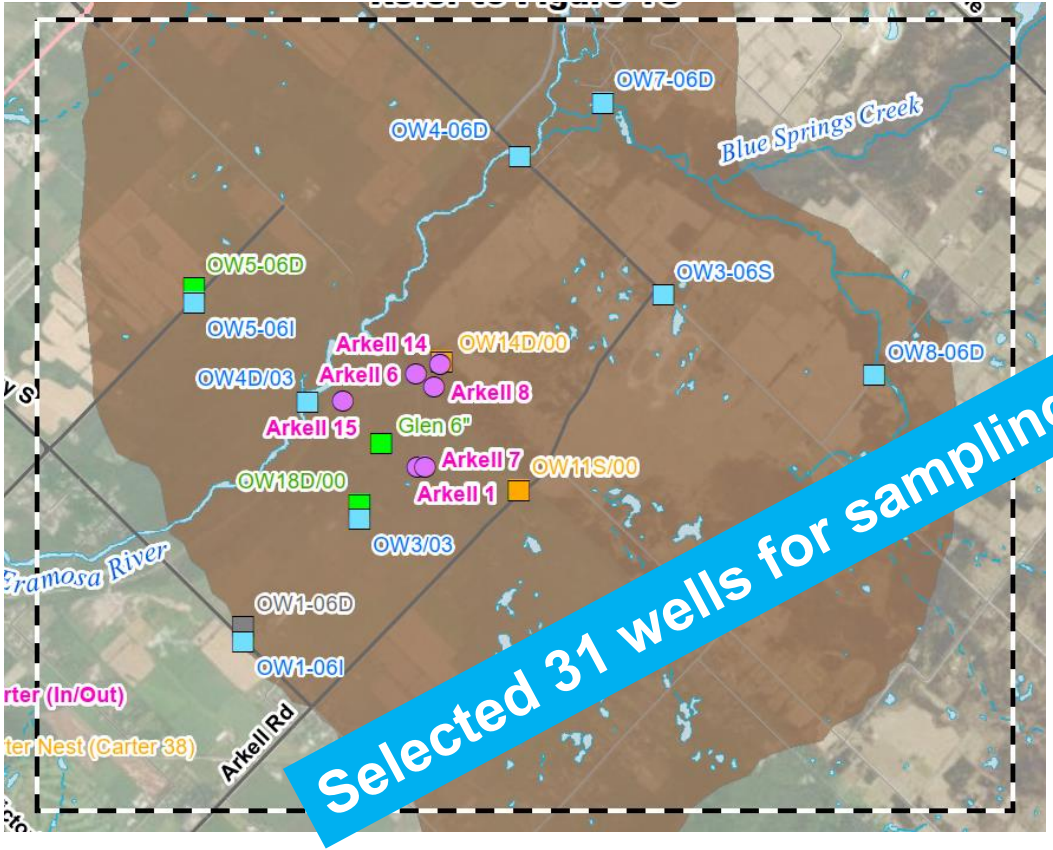
Risk ranking considered 14 WHPA-Bs, 5 Test Wells; 100s of associated monitoring wells:

- Wells have been installed over decades and are screened in multiple formations (Overburden, Guelph, Gasport, Goat Island, Vinemount, Eramosa, Amabel)
- City primarily draws drinking water from Guelph and Gasport formations, with select locations targeting Overburden
- Detailed review of well screen depths and target formations required; in some cases borehole logs were also reviewed

- Confirmed wells did not have tubing or pumps in place
- Identified a short-list of ~70 wells to consider, which included ~11 nested wells
- Screen depths were as shallow as ~5 mbgs to as deep as ~90 mbgs, with the majority ~45 to 65 mbgs

mbgs = metres below ground surface

Monitoring Well Network



- Considered risk ranking of well field
- Identified monitoring wells in proximity to supply wells
- Assessed the spatial distribution

LEGEND:

PRODUCTION WELLS

MONITORING PROGRAM

ADDITIONAL MONITORS RECOMMENDED BY SLR

IDENTIFIED AS SAMPLING OPTION IN CITY MEMO, AGREED UPON BY SLR

IDENTIFIED AS A SAMPLING OPTION IN CITY MEMO

IDENTIFIED AS SAMPLING OPTION OUTSIDE CITY MEMO, BUT NOT INCLUDED IN SAMPLING PROGRAM

Guidelines

The guidelines to be applied have implications for the:

- Required detection limits
- Suite of chemicals required to be analyzed

Agency	Water Criteria	Date Released/Finalized
HC	• Drinking Water Objective (DWO) of 30 ng/L for sum of 25 PFAS	Finalized August 9, 2024
MECP	• Potable groundwater criteria of 70 ng/L for sum of 11 PFAS	Email communication November 26, 2020

HC = Health Canada

MECP = Ontario Ministry of Environment, Conservation and Parks

Guidelines

	Parameter	Acronym	MECP	HC
1	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (C10)	11Cl PF3OUdS		X
2	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (C8)	9Cl-PF3ONS		X
3	4,8-Dioxa-3H-perfluorononanoic acid (C7)	ADONA		X
4	Hexafluoropropylene oxide dimer acid (C6)	HFPO-DAc		X
5	Perfluorobutanesulfonic acid (C4)	PFBS		X
6	Perfluorodecanoic acid (C10)	PFDA	X	X
7	Perfluorododecanoic acid (C12)	PFDoA	X	X
8	Perfluoroheptanoic acid (C7)	PFHpA	X	X
9	Perfluorohexane sulfonic acid (C6)	PFHxS	X	X
10	Perfluorohexanoic acid (C6)	PFHxA	X	X
11	Perfluorononanoic acid (C9)	PFNA	X	X
12	Perfluorooctane sulfonic acid (C8)	PFOS	X	X
13	Perfluorooctanoic acid (C8)	PFOA	X	X
14	Perfluoroundecanoic acid (C11)	PFUnA	X	X
15	Nonafluoro-3,6-dioxaheptanoic acid (C5)	NFDHA		X
16	Perfluorobutanoic acid (C4)	PFBA		X
17	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid (C10)	8:2 FTS		X
18	Perfluoro(2-ethoxyethane) sulfonic acid (C4)	PFEESA		X
19	Perfluoroheptanesulfonic acid (C7)	PFHpS		X
20	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (C4)	4:2 FTS		X
21	Perfluoro-3-methoxypropanoic acid (c4)	PFMPA		X
22	Perfluoro-4-methoxybutanoic acid (C5)	PFMBA		X
23	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (C8)	6:2 FTS		X
24	Perfluoropentanoic acid (C5)	PFPeA		X
25	Perfluoropentanesulfonic acid (C5)	PFPeS		X
26	Perfluorodecane sulfonic acid	PFDS	X	
27	Perfluorooctane sulfonamide	PFOSA	X	

Twenty-seven (27) parameters require analysis:

- Nine (9) parameters are common to both Federal and Provincial criteria
- Two (2) parameters are specific to Provincial criteria
- Sixteen (16) parameters are specific to Federal DWO

Given the number of parameters and low criteria, low detection levels (~2 ng/L) are required

Analytical Methodology

LC = Liquid Chromatography
MS/MS = Tandem Mass Spectrometry
SPE = Solid Phase Extraction
USEPA = United States Environmental Protection Agency

Method	Comments	# of PFAS Analysed
EPA 533	• USEPA approved for use in drinking water • Isotope dilution, anion exchange SPE and LC/MS/MS • Recommended by HC	25
EPA 537.1 (Low Level)	• USEPA approved for use in drinking water • Hydrophobic SPE and LC/MS/MS • Not suitable for hydrophilic shorter carbon chain PFAS	18
EPA 1633	• Not USEPA approved for use in drinking water; however, is performance-based and can be modified and approved for drinking water by other jurisdictions • Isotope dilution, SPE and LC/MS/MS	40

Low detection levels are achievable by each of these methods.

Analytical Methodology

- A modified EPA Method 1633 was selected

Method	Comments	# of PFAS Analysed
EPA 1633m	• Licensed in Ontario for processing drinking water samples • Approach has also been reviewed and approved by US Department of Defense for drinking water	47

- Appropriate detection levels
- Provided data on greatest number of PFAS to support the screening level assessment
- Offered best value in terms of volume and quality of data

Sampling Approach

Unique elements of the project required consideration in the development of the sampling approach:

- Historic use of wells
- Depth of wells
- Well diameters
- Potential for cross-contamination
- Quality assessment and control

Sampling Approach

Developed protocol specific to groundwater sampling of deep monitoring wells in a municipal water supply network for PFAS analysis:

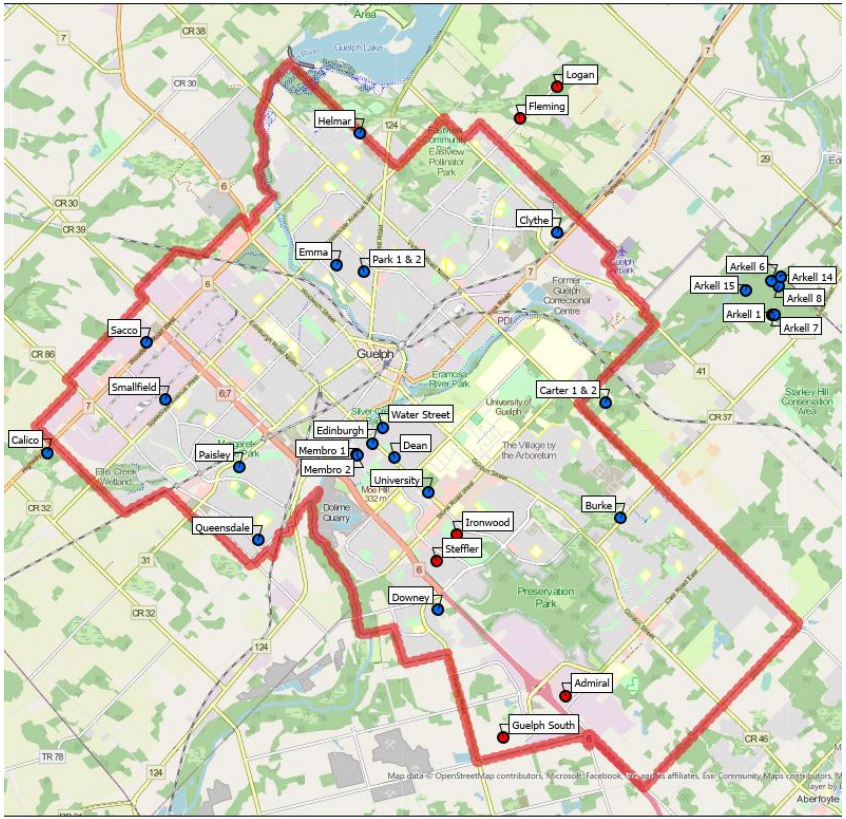
- Field work in accordance with Transport Canada 2017 document *Per-and Polyfluoroalkyl Substances (PFAS) Field Sampling Guidance* and *Guidance for the Assessment and Remediation of PFAS in British Columbia* to minimize potential for cross-contamination
- Developed wells prior to sampling
- Used hydrolift to develop/purge wells (with HDPE tubing), and used bailer to collect samples (to limit sediment entrainment)
- Field duplicates, field blanks, trip blanks, equipment rinsate blanks

Conclusions

What did we learn?

Conclusions

Outcome	Coverage	Comment
Elevated PFAS not identified	▪ 4 WHPA-Bs; 2 Test Wells	▪ Sampling limited in some areas (e.g., 1 or 2 locations only)
Elevated PFAS not identified; further monitoring warranted	▪ 3 WHPA-Bs; 3 Test Wells	▪ Meets, but in proximity to HC DWO ▪ Observed anomalous concentrations (not representative)
Further monitoring warranted	▪ 2 WHPA-Bs	▪ 1 HC DWO exceedance (30.6 ng/L) observed (1 of 3 locations; 1 of 6 samples in Fall 2024 only) ▪ HC DWO exceedances (32.4 to 56.9 ng/L) observed (3 of 6 locations; 4 of 11 samples
No assessment possible	▪ 5 WHPA-Bs	▪ No wells representative of formation water present



Conclusions

- Only 2 WHPA-Bs and no Test Wells indicate limited PFAS concentrations > HC DWO
- Assigned risk ranking did not necessarily align with the results observed (i.e., higher risk rankings did not consistently equate with higher detected concentrations of PFAS)
- Historic well construction (coated pellets, use of Teflon tape) could be impacting results at some locations

Recommendations

Where do we go from here?

Recommended Next Steps

- Consider additional monitoring in select WHPA-Bs and Test Wells
- Consider expansion of well network into areas where no assessment was possible
- Monitor that future well installations exclude the use of coated bentonite pellets, Teflon, and other potential materials containing PFAS
- Consider sampling source raw water
- Communicate to other departments regarding need to reduce use of PFAS-containing items (e.g., fire fighting foam)

Do you have any questions?

Thank You!

Albanie Douglas

Hydrogeologist & Risk Management Inspector

M 226 821 3055

E albanie.douglas@guelph.ca

Krista Barfoot

Infrastructure Sector Leader & PFAS Specialist

M 519 362 1428

E kbarfoot@slrconsulting.com

SLRCONSULTING.COM