Drinking Water Quality: The Path Towards Water Treatment

2023 Municipal Symposium

Deneen Spracklin

Environment and Climate Change

May 4, 2023

Drinking Water – General Overview

471 public water supplies servicing 366 communities

- 175 groundwater
- 296 surface water

Most common water quality issues:

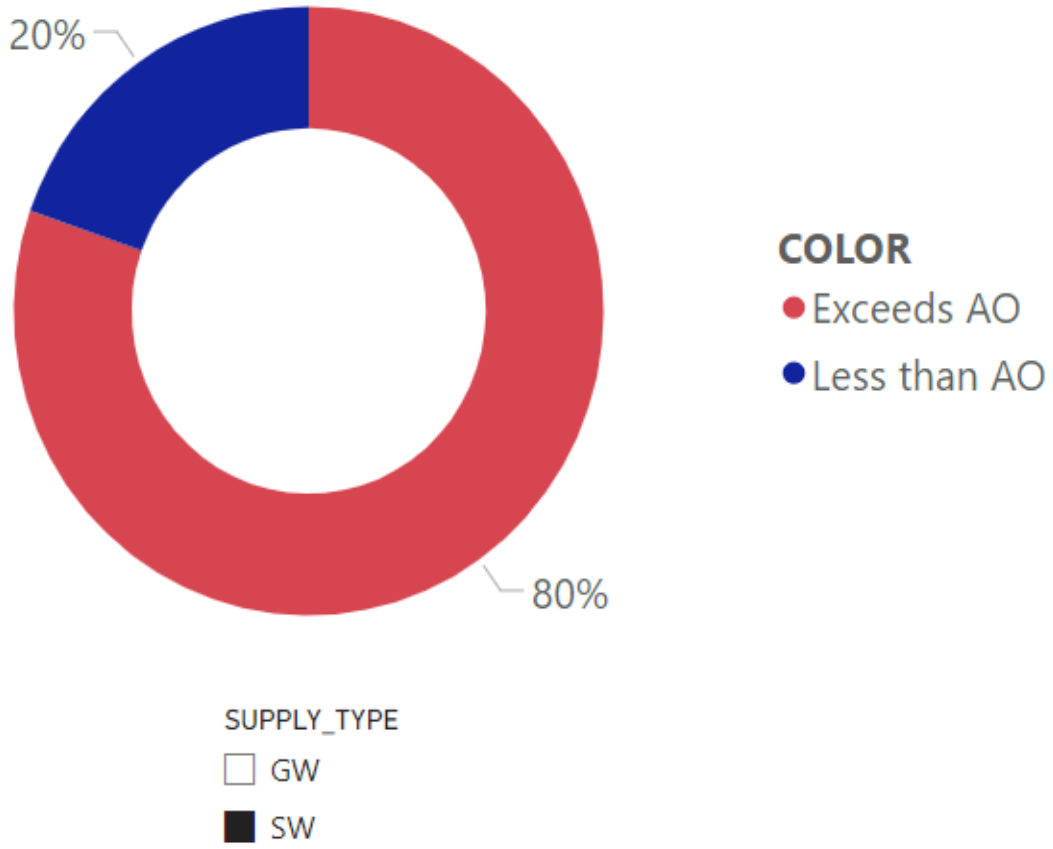
- Colour, DOC, DBPs, iron, manganese, arsenic
- BWAs

Chlorination is the only form of treatment for most systems; especially small systems

Water quality data publically available on Department's website

Newfoundland Labrador

SOURCE WATER SAMPLES 2020-2022



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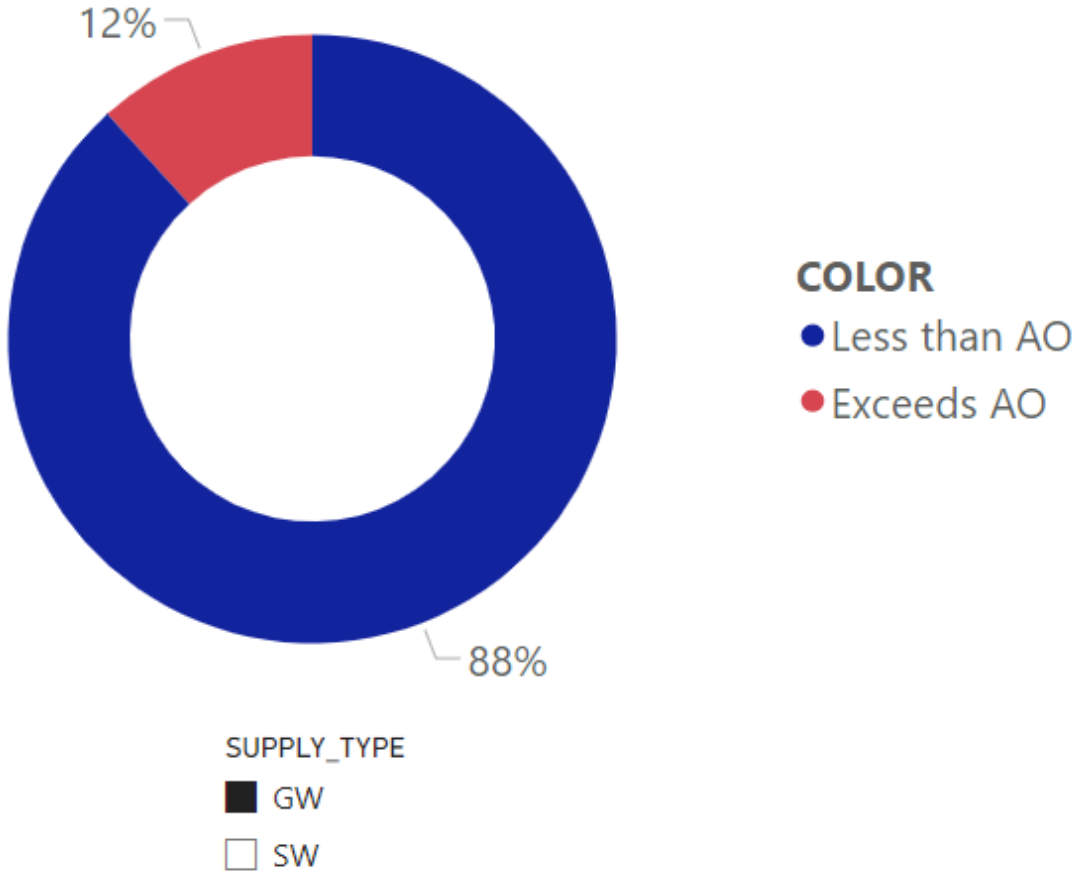
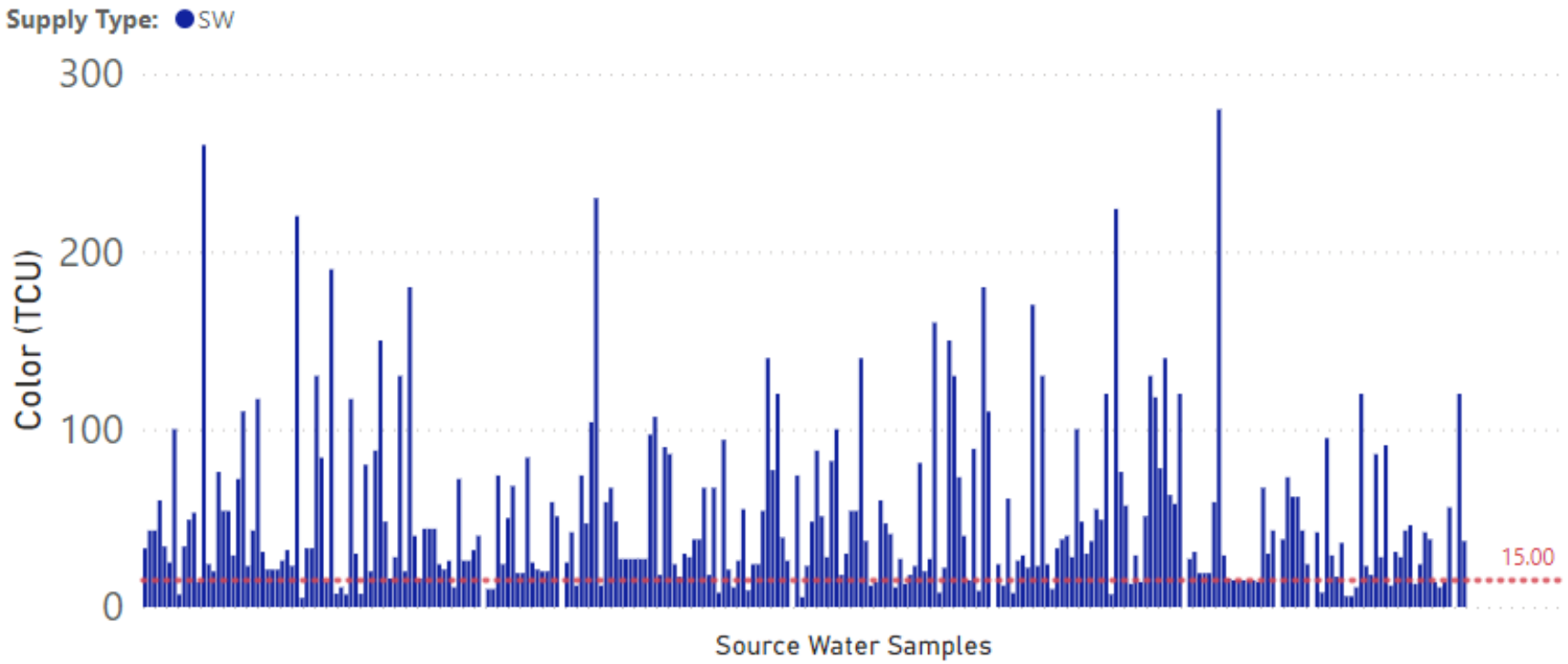


COLOR

Source Water Samples 2020-2022



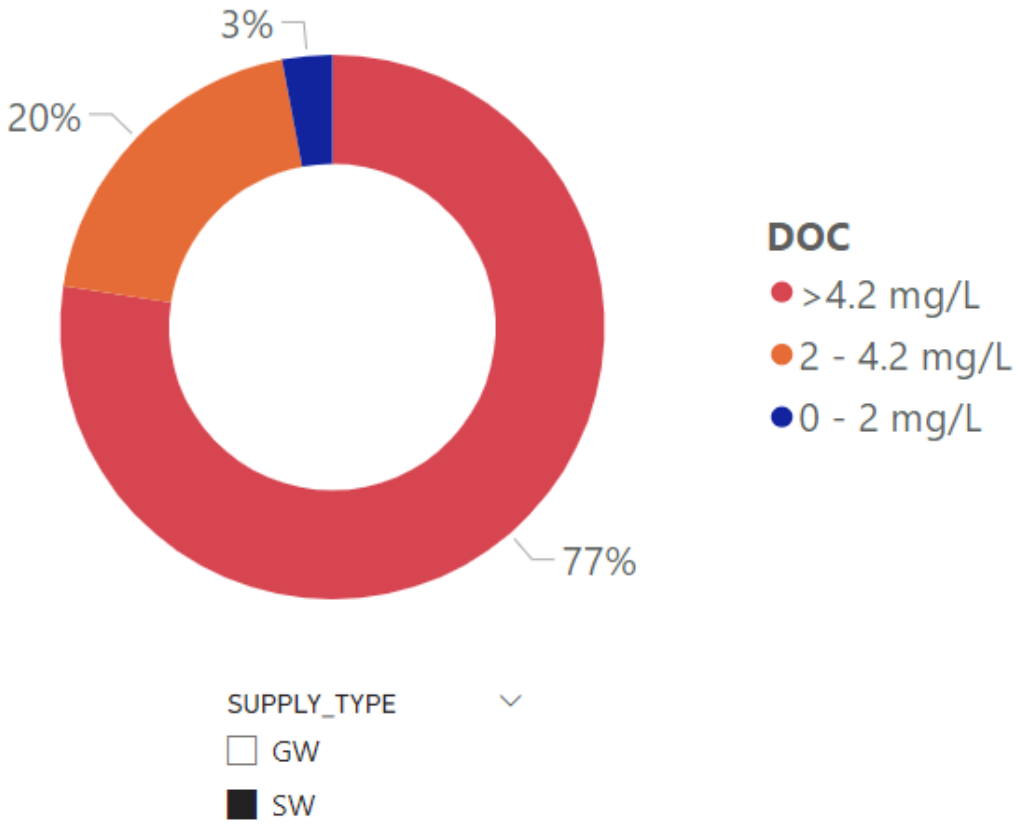
49	31	0	280	80%
Average of COLOR	Median of COLOR	Min of COLOR	Max of COLOR	EXCEEDS AO

SUPPLY_TYPE

- ☐ GW
- ■ SW

COLOR

SOURCE WATER SAMPLES 2020-2022



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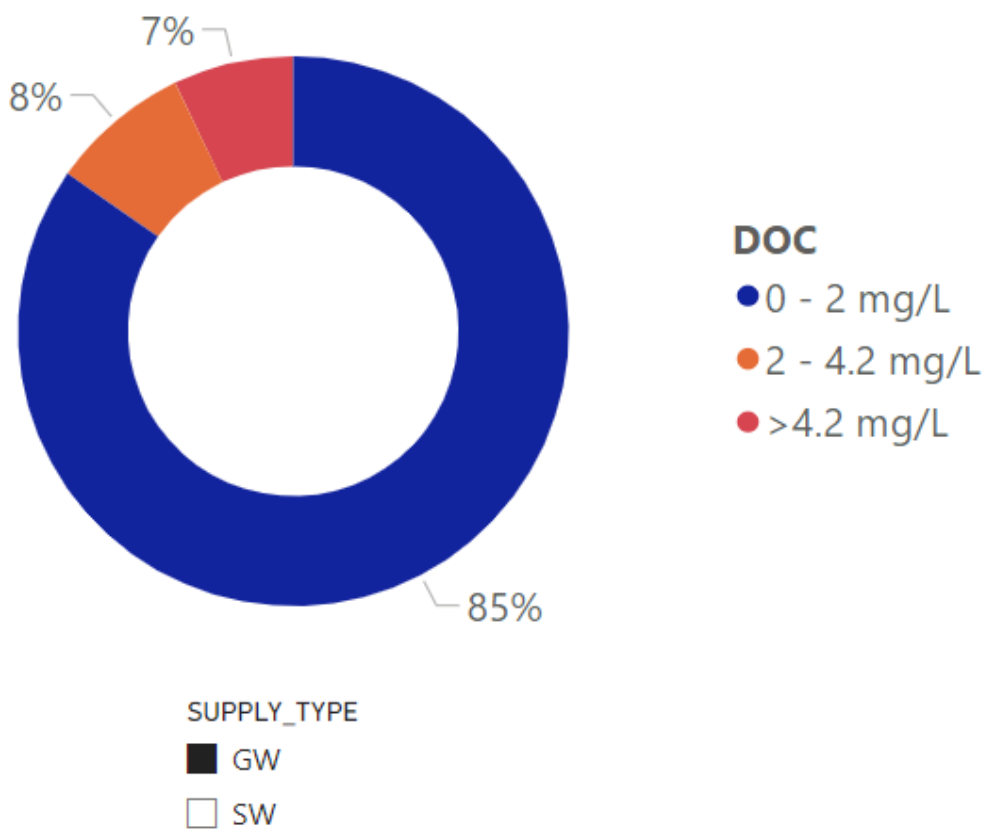
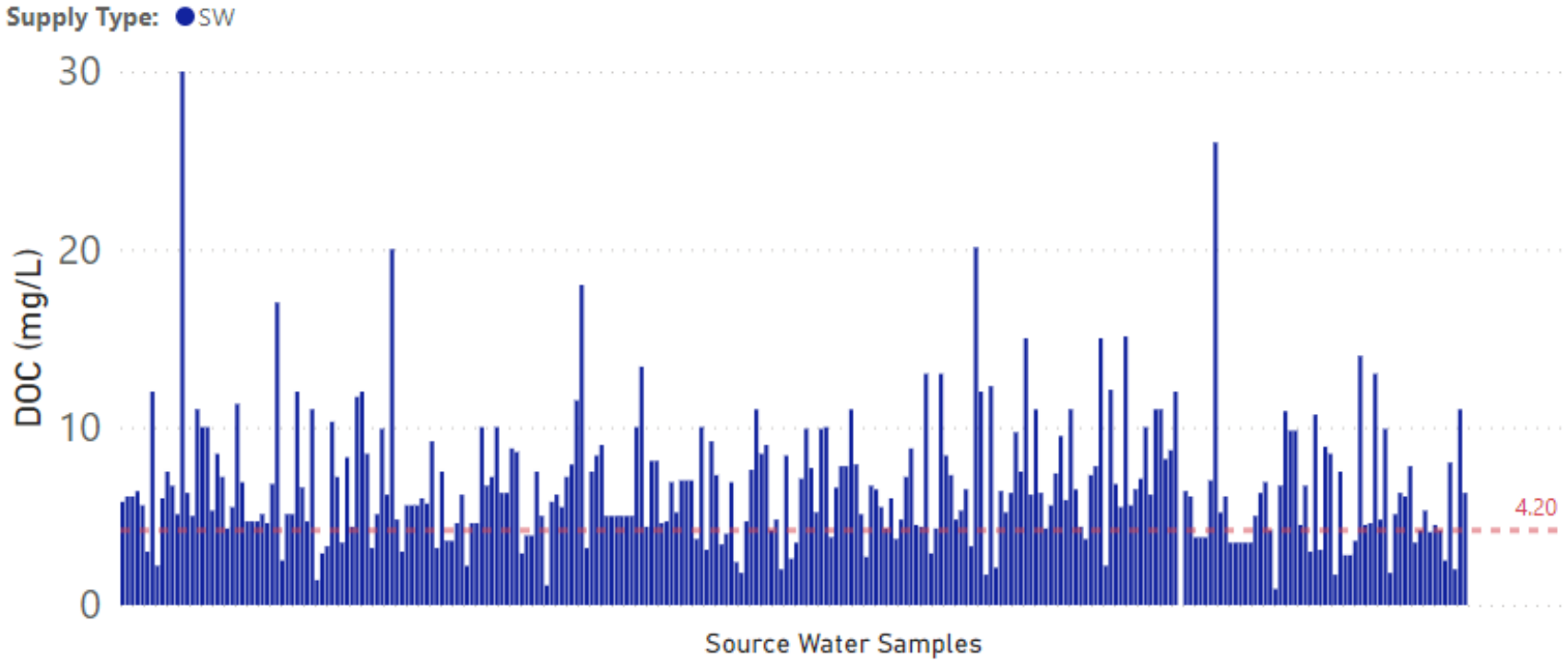


DOC

Source Water Samples 2020-2022



7	6	0	30	77%
Average of DOC	Median of DOC	Min of DOC	Max of DOC	EXCEEDS 4.2 mg/L

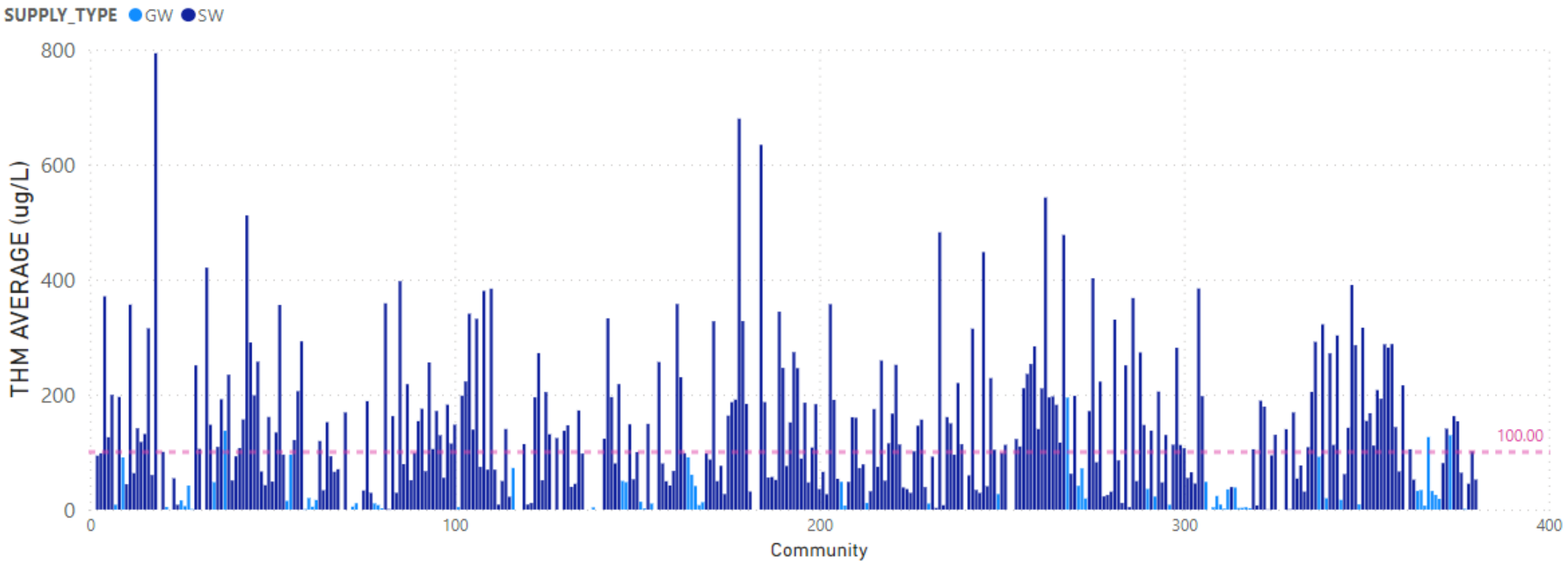
SUPPLY_TYPE

- [ ] GW
- [x] SW

DOC

THM AVERAGE

Summer 2022



123
Average of THM AVG.

794
Max of THM AVG.

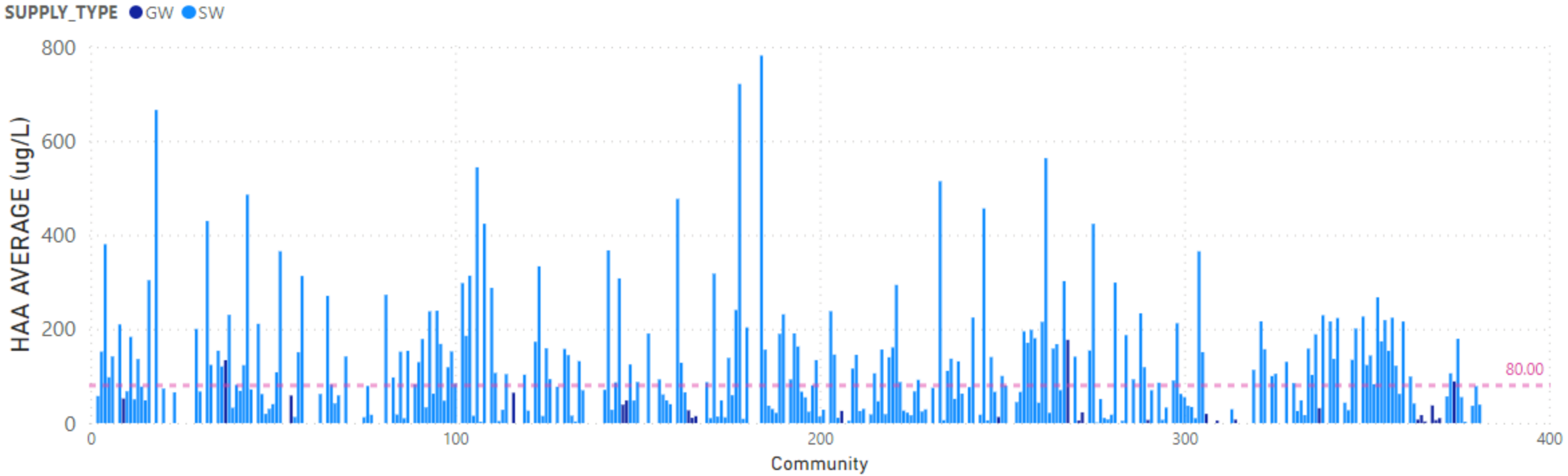
48%
Exceeds 100 ug/L

SUPPLY_TYPE
GW
SW

THM

HAA AVERAGE

Summer 2022



93
Average of HAA AVG.

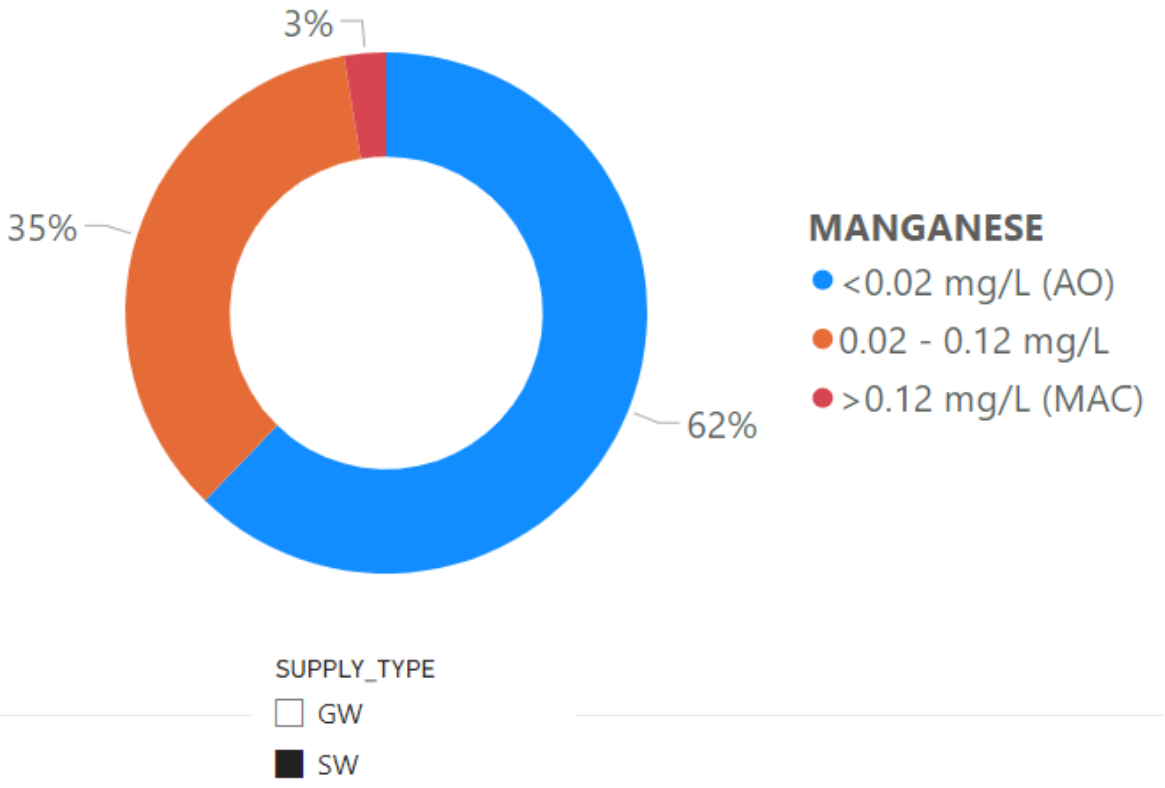
782
Max of HAA AVG.

40%
Exceeds 80 ug/L

SUPPLY_TYPE
- GW
- SW

HAA

SOURCE WATER SAMPLES 2020-2022



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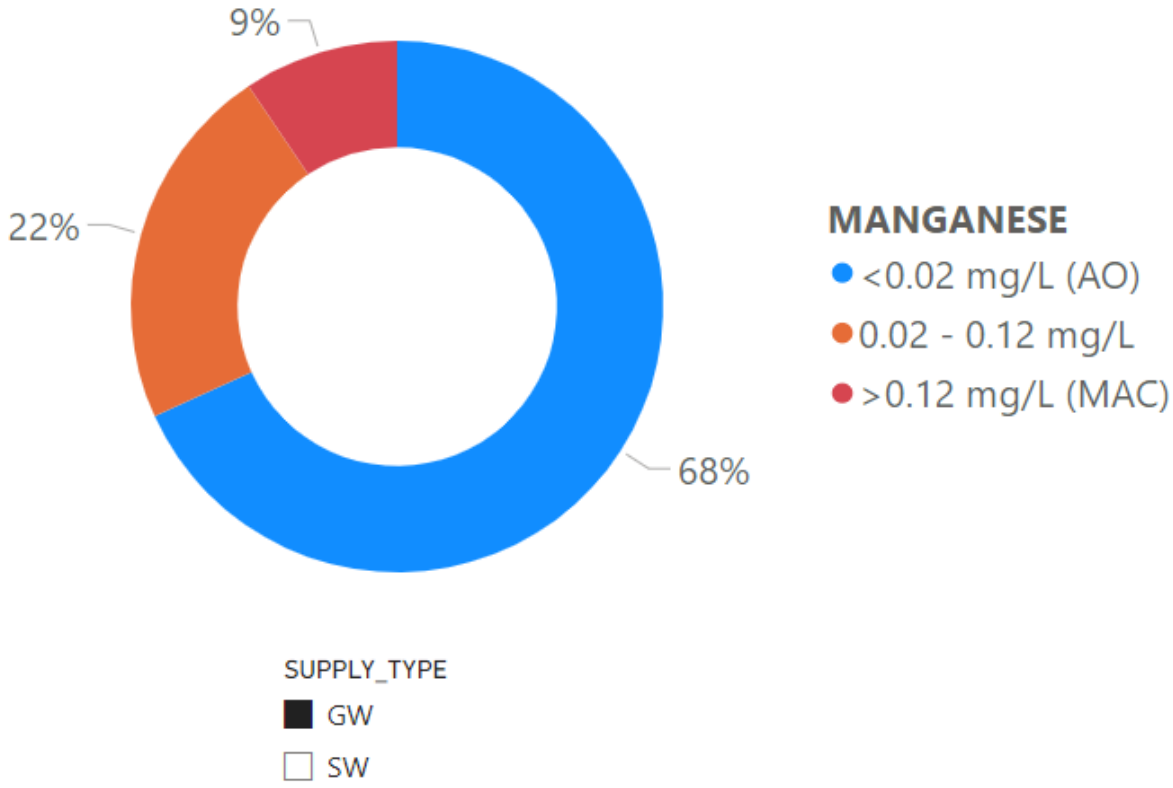
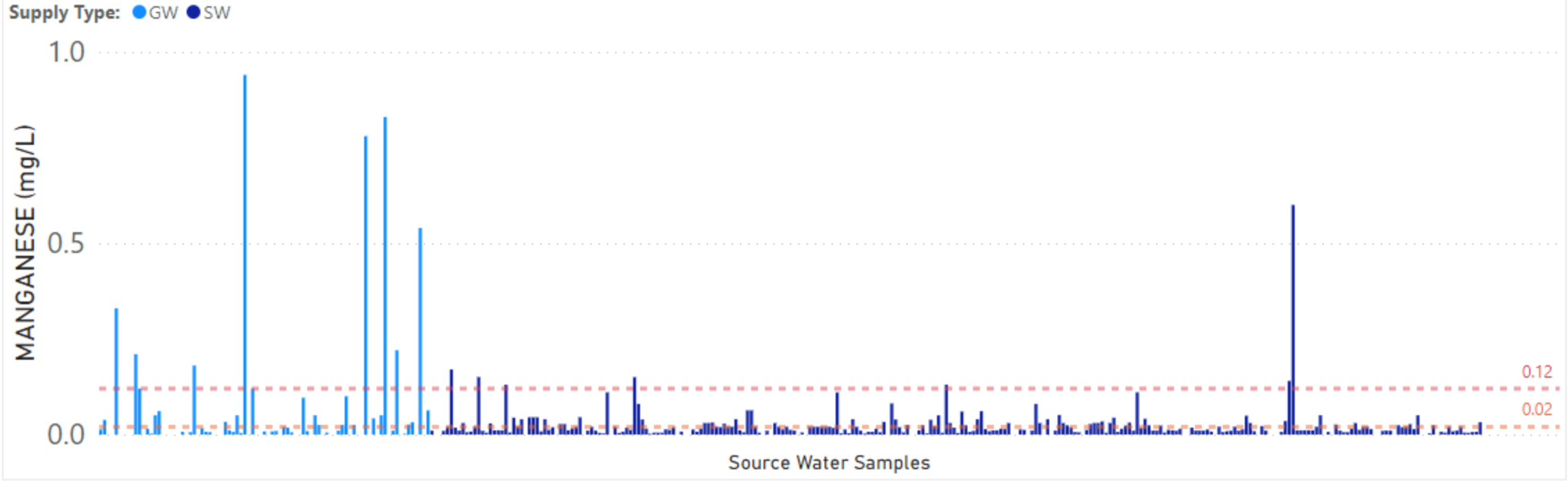


MANGANESE

Source Water Samples 2020-2022



0.03	0.01	0.00	0.94	28%	4%
Average of MANGANESE	Median of MANGANESE	Min of MANGANESE	Max of MANGANESE	EXCEEDS 0.02 mg/L	EXCEEDS 0.12 mg/L

SUPPLY_TYPE
- GW
- SW

MANGANESE

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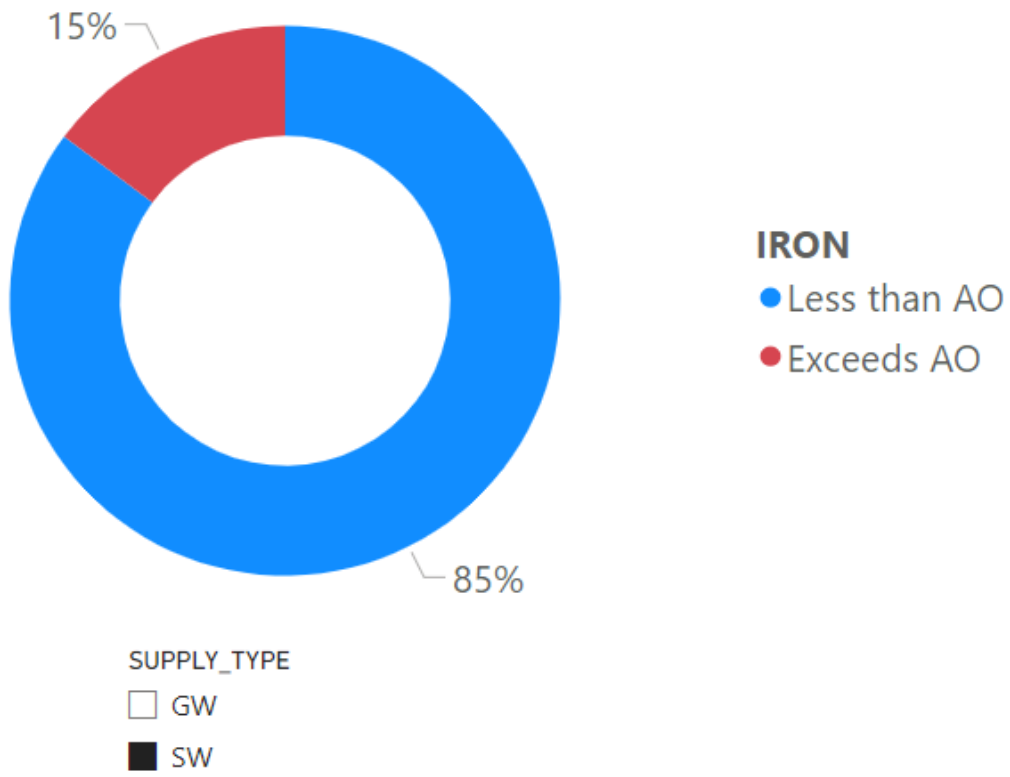

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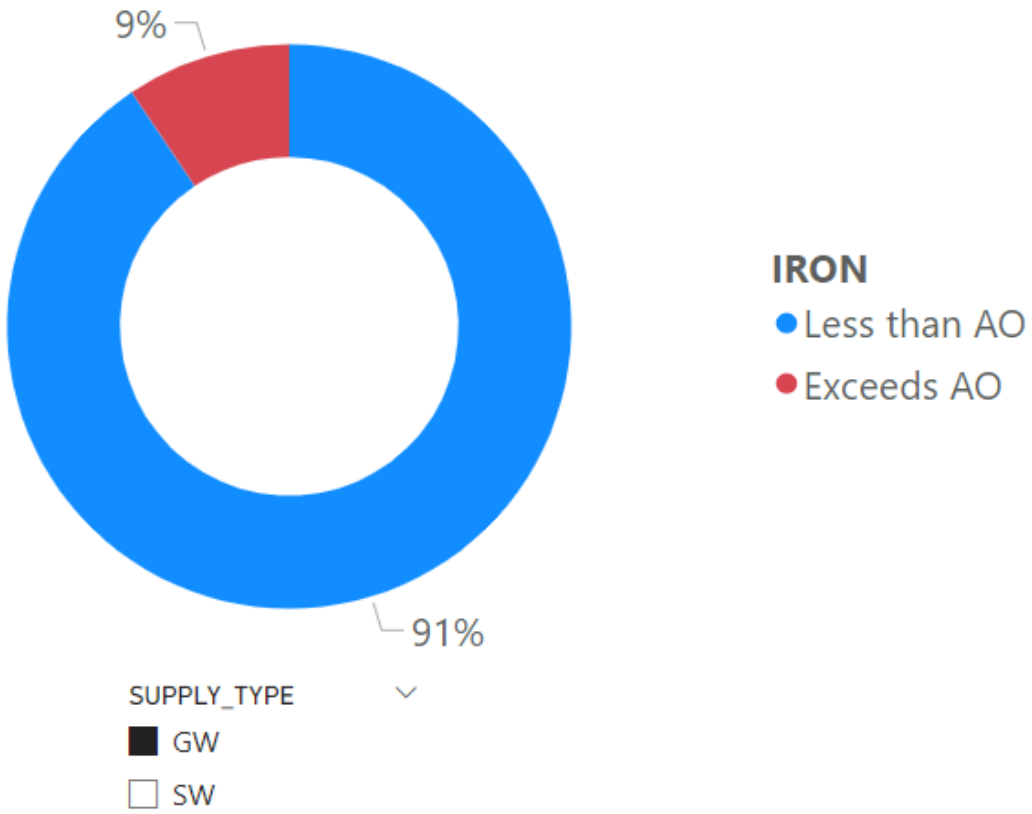
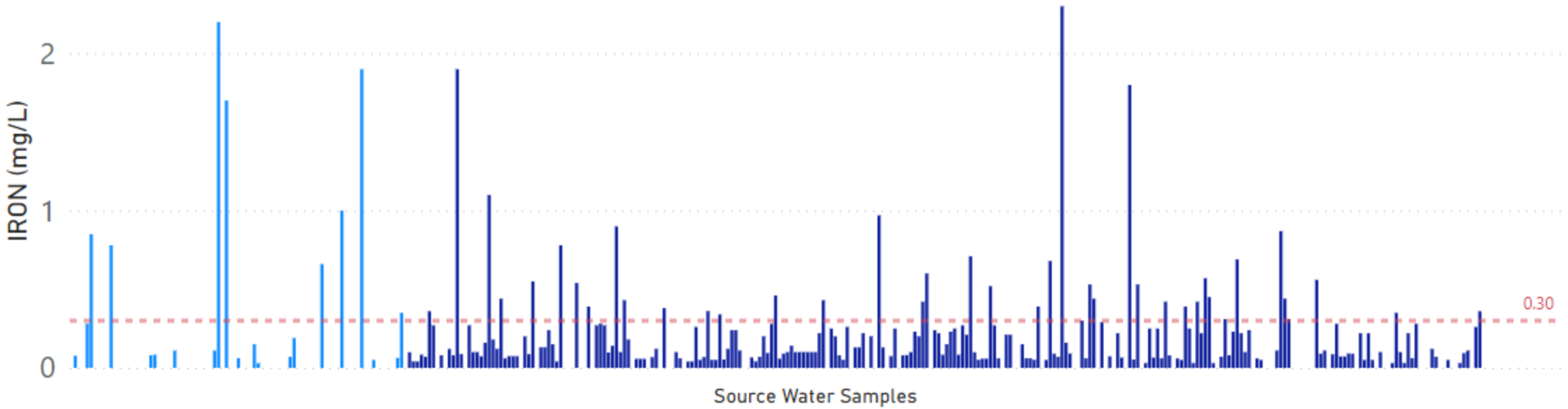


IRON

Source Water Samples 2020-2022

Supply Type: GW SW



0.16	0.07	0.00	2.30	14%
Average of IRON	Median of IRON	Min of IRON	Max of IRON	EXCEEDS AO

SUPPLY_TYPE

- GW
- SW

IRON

Newfoundland Labrador

Water Resources Management Division

Source Water Quality for Public Water Supplies in Newfoundland and Labrador
Physical Parameters and Major Ions

Serviced Area(s)	Source Name	Sample Date	Alkalinity	Colour	Conductivity	Hardness	pH	TDS	TSS	Turbidity	Boron	Bromide	Calcium	Chloride	Fluoride	Potassium	Sodium
	Units		mg/L	TCU	µS/cm	mg/L		mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Guidelines for Canadian Drinking Water Quality			15			6.5 - 8.5	500		1.0	5.0			250	1.5		200
	Aesthetic (A) or Contaminant (C) Parameter			A			A	A		C	C			A	C		A
Admirals Beach																	
Admiral's Beach	2 Well Fields	Sep 01, 2022	90.00	LTD	290.0	100.00	8.22	160		0.14	LTD	LTD	24.00	15	0.210	0.770	16
Admiral's Beach	2 Well Fields	Sep 01, 2022	110.00	LTD	310.0	130.00	7.99	170		0.34	LTD	1.70	28.00	15	LTD	1.200	10
Admiral's Beach	2 Well Fields	Sep 01, 2022	110.00	LTD	290.0	120.00	8.14	160		0.48	LTD	2.00	30.00	13	0.100	1.400	10
Admiral's Beach	2 Well Fields	Sep 01, 2022	110.00	19	290.0	110.00	8.25	160		0.24	LTD	1.90	26.00	16	0.190	1.600	18
Badger																	
Badger	Well Field, 2 wells on standby	Aug 17, 2022	39.00	LTD	310.0	56.00	7.65	170		0.28	LTD	LTD	20.00	65	0.220	0.280	26
Badger	Well Field, 2 wells on standby	Aug 17, 2022	12.00	LTD	75.0	16.00	7.06	42		0.36	LTD	LTD	5.10	12	LTD	0.240	8
Badger	Well Field, 2 wells on standby	Sep 02, 2022	13.00	LTD	79.0	17.00	6.66	44		LTD	LTD	LTD	5.30	12	LTD	0.290	9
Badger	Well Field, 2 wells on standby	Sep 02, 2022	27.00	LTD	150.0	52.00	7.18	86		0.40	LTD	LTD	18.00	22	0.130	0.310	23
Bauline																	
Bauline	#1 Brook Path Well	Aug 30, 2022	56.00	24	400.0	100.00	7.51	220		0.25	LTD	LTD	31.00	74	LTD	0.770	29
Blaketown																	
Blaketown South	#1 Selby Mercer Well	Aug 26, 2022	42.00	LTD	180.0	40.00	6.95	100		0.77	LTD	LTD	11.00	24	LTD	1.200	20
Blaketown	#2 Daphne Pincent Well	Aug 26, 2022	100.00	LTD	340.0	47.00	8.02	190		0.28	0.13	LTD	12.00	39	0.210	1.900	51
Blaketown North	#4 Hilda Barrett Well	Aug 26, 2022	88.00	LTD	260.0	70.00	8.16	150		LTD	0.10	LTD	19.00	20	0.170	1.600	25
Blaketown Centre	#3 Fred Osborne Well	Aug 26, 2022	110.00	5	260.0	20.00	8.98	150		LTD	0.11	LTD	5.80	17	0.170	1.900	51
Brigus South																	
Dunphey's Hill area	#2 Well Dunphey's Hilll	Sep 15, 2022	100.00	LTD	340.0	120.00	8.11	190		0.50	LTD	LTD	43.00	31	LTD	0.590	20
Forge Hill area	#1 Well Forge Hill	Sep 15, 2022	130.00	7	480.0	150.00	8.15	270		0.27	LTD	LTD	55.00	53	LTD	1.100	30

Centralized Water Treatment

Distribution System

Newfoundland Labrador

Centralized Water Treatment

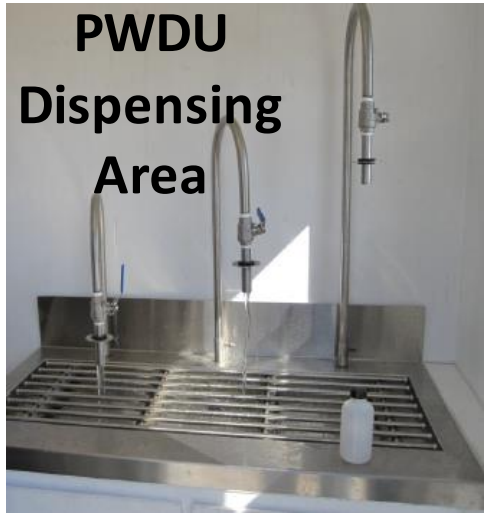
22 Water Treatment Plants in NL

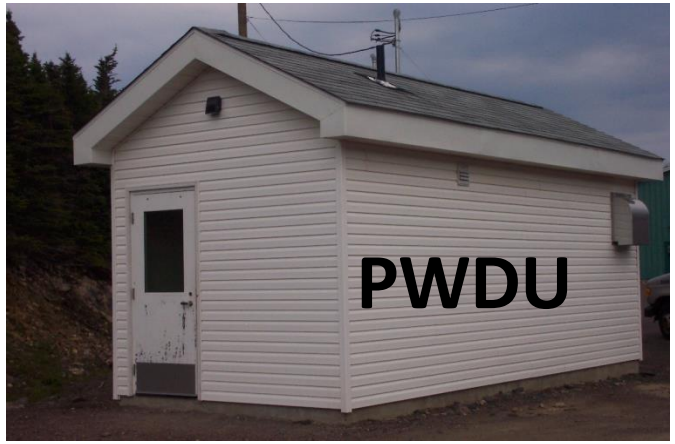
- Conventional (coagulation/flocculation/clarification/filtration)
- Membrane Filtration
- Direct Filtration (coagulation/flocculation/filtration)
- Ozonation and Filtration

Additional Parameter Specific Systems

- Arsenic
- Iron & Manganese
- Strontium
- Softening (calcium/magnesium)

Potable Water Dispensing Units (PWDUs)

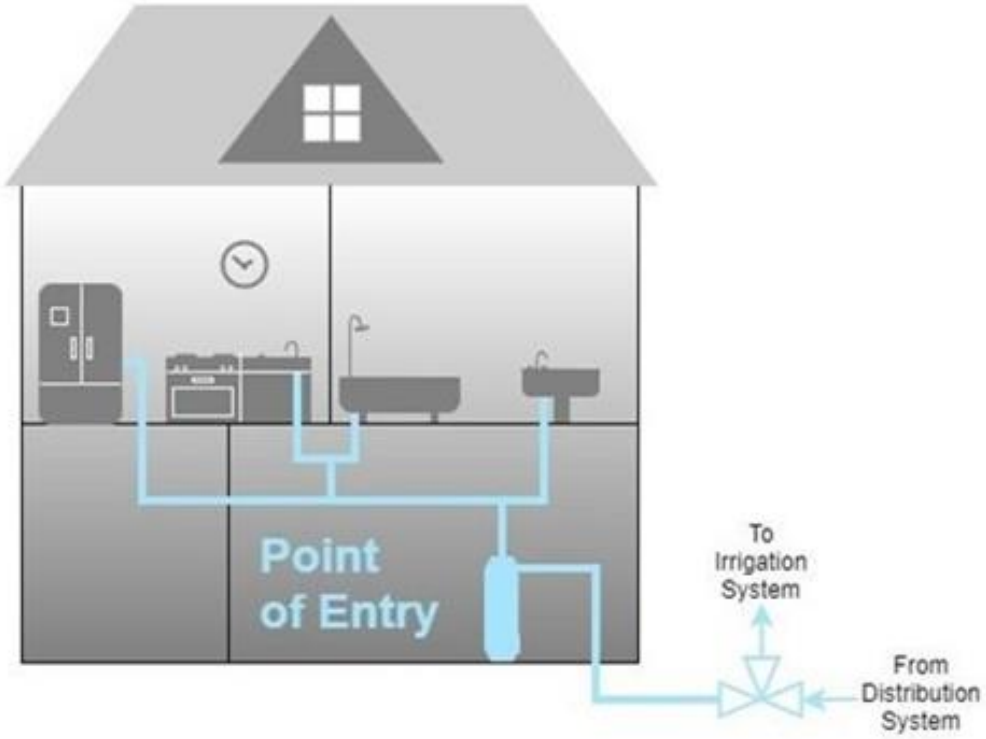




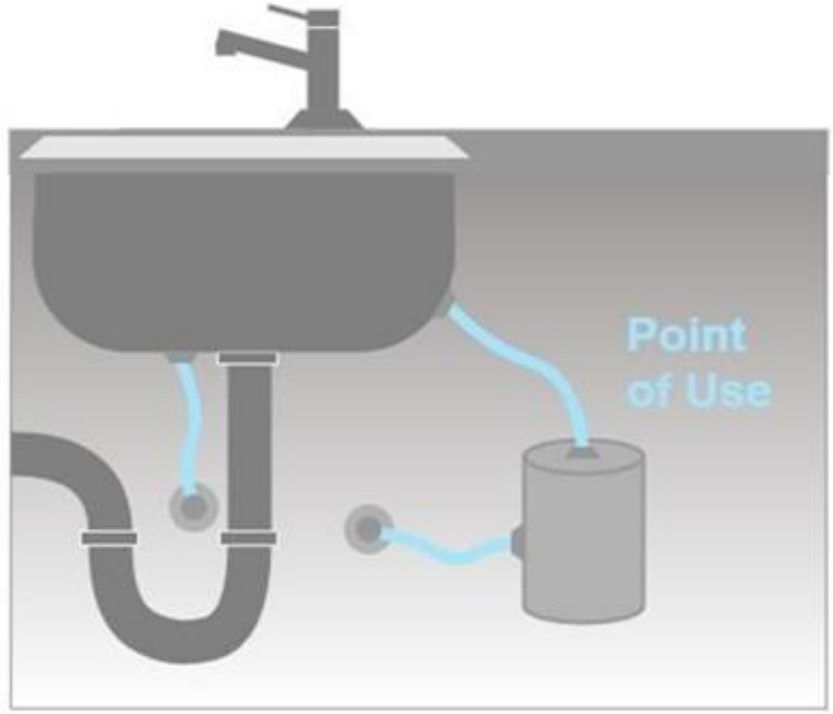
PWDUs

- 33 PWDUs across the province
- 3 more planned in 2023-24
- Treats water used for drinking/cooking
- Water to distribution system needs to be disinfected

Point of Entry/Point of Use



Point of Entry (POE) Treatment



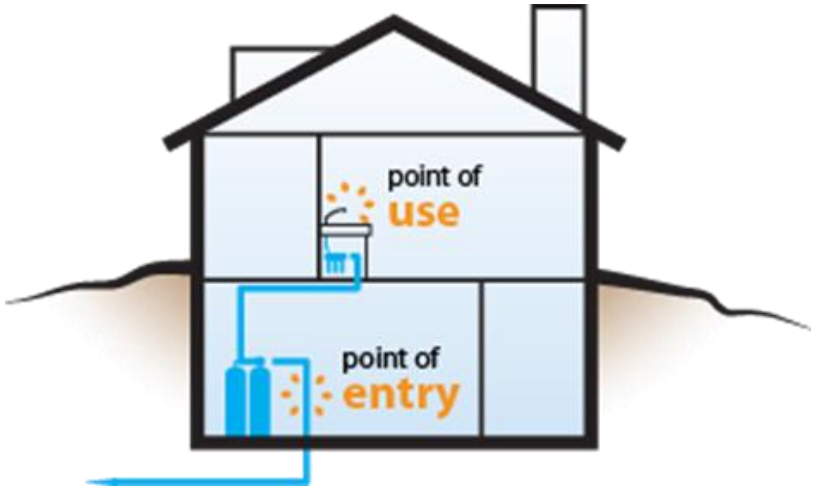
Point of Use (POU) Treatment

Newfoundland Labrador

Point of Use/Point of Entry

POU/POE treatment methods

- Granular activated carbon
- Reverse osmosis (membrane filtration)
- UV disinfection



Need to consider:

- Who will pay for installation
- Who will pay for replacement units and when to replace

Need to ensure:

- Systems are NSF certified
- Selected system will treat parameters of concern – not all filters are equal

Newfoundland Labrador

Full Cost Accounting Assessment Tool

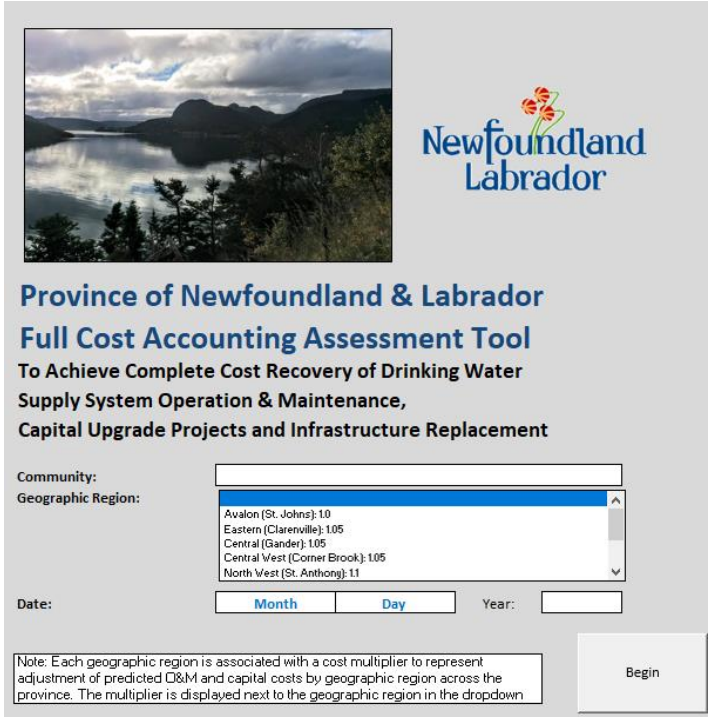
Help owners predict costs associated with

- Operating water systems and to identify rate of water tax that will fund proper operation
- Upgrading their water system
- Replacement of infrastructure

Assessment tool is an Excel spreadsheet

- User manual and instructional video
- Small system questionnaire

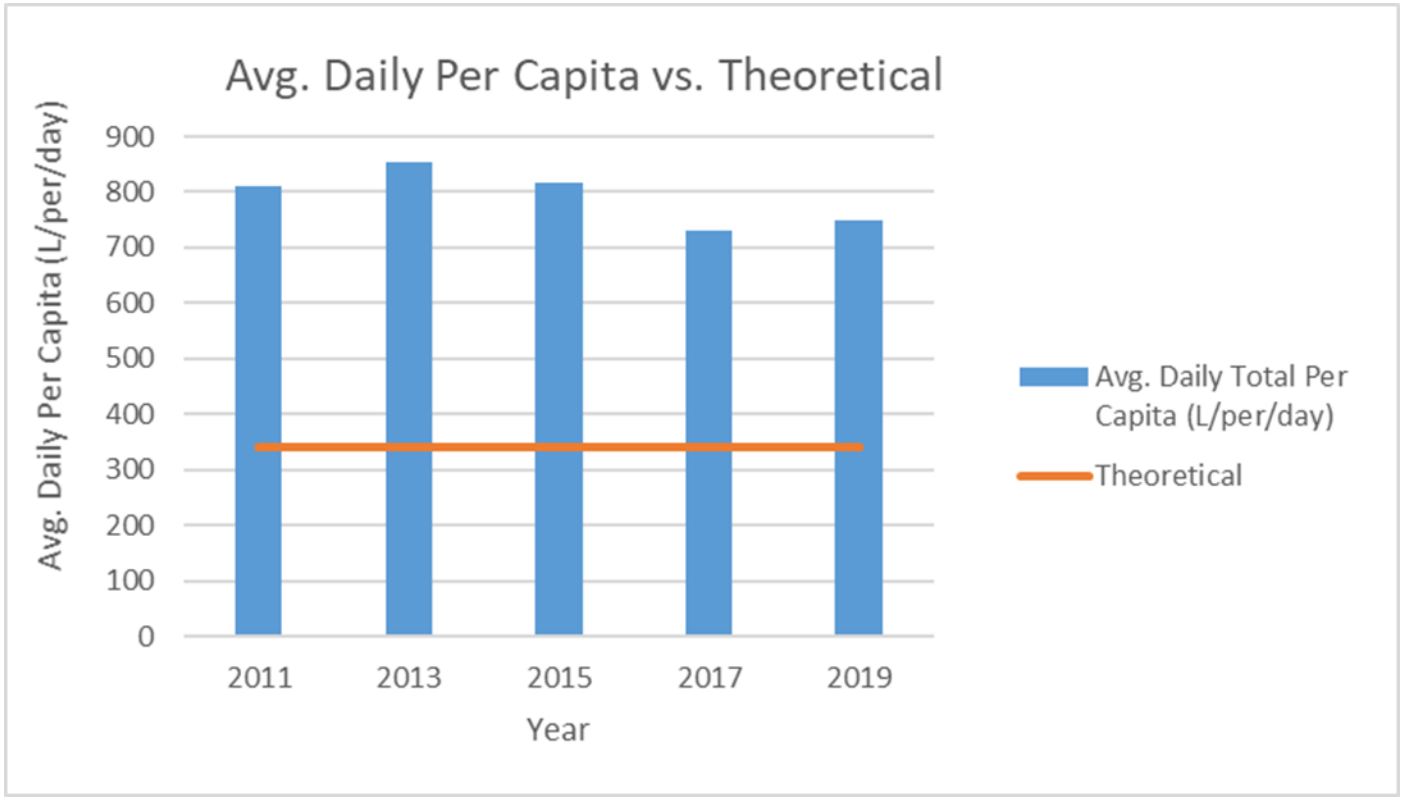
www.gov.nl.ca/ecc/waterres/quality/drinkingwater/sopbwa/



Water Usage

Average Daily Per Capita Water Usage

- Theoretical
  - 340 L/per/day
- Data submitted by NL communities
  - 1018 L/per/day



*From Statistics Canada

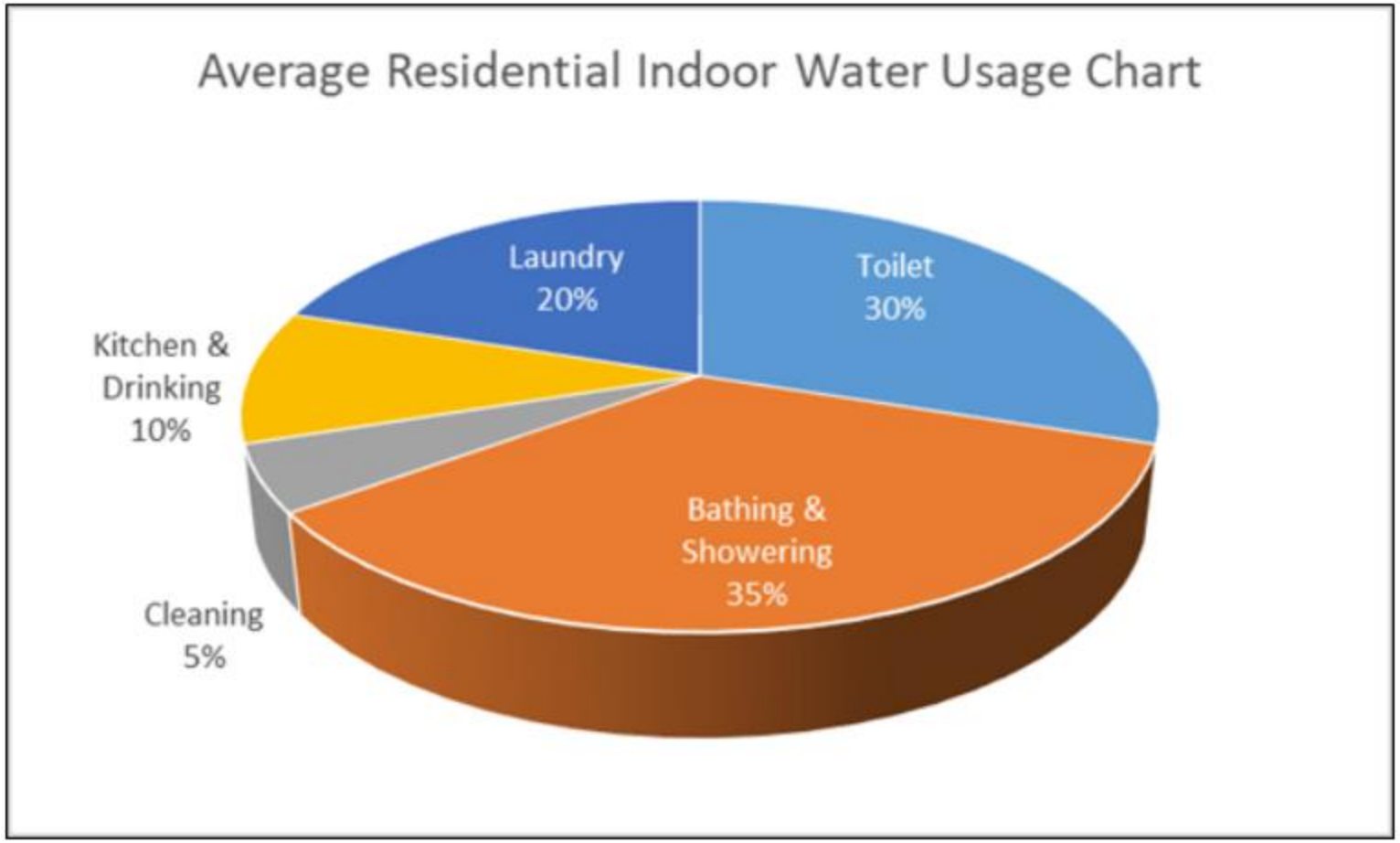
Newfoundland Labrador

Water Usage – Where does it go?

Very little of the water we use is for drinking/cooking

Still need to treat for other uses when using centralized treatment

This doesn't how outdoor uses



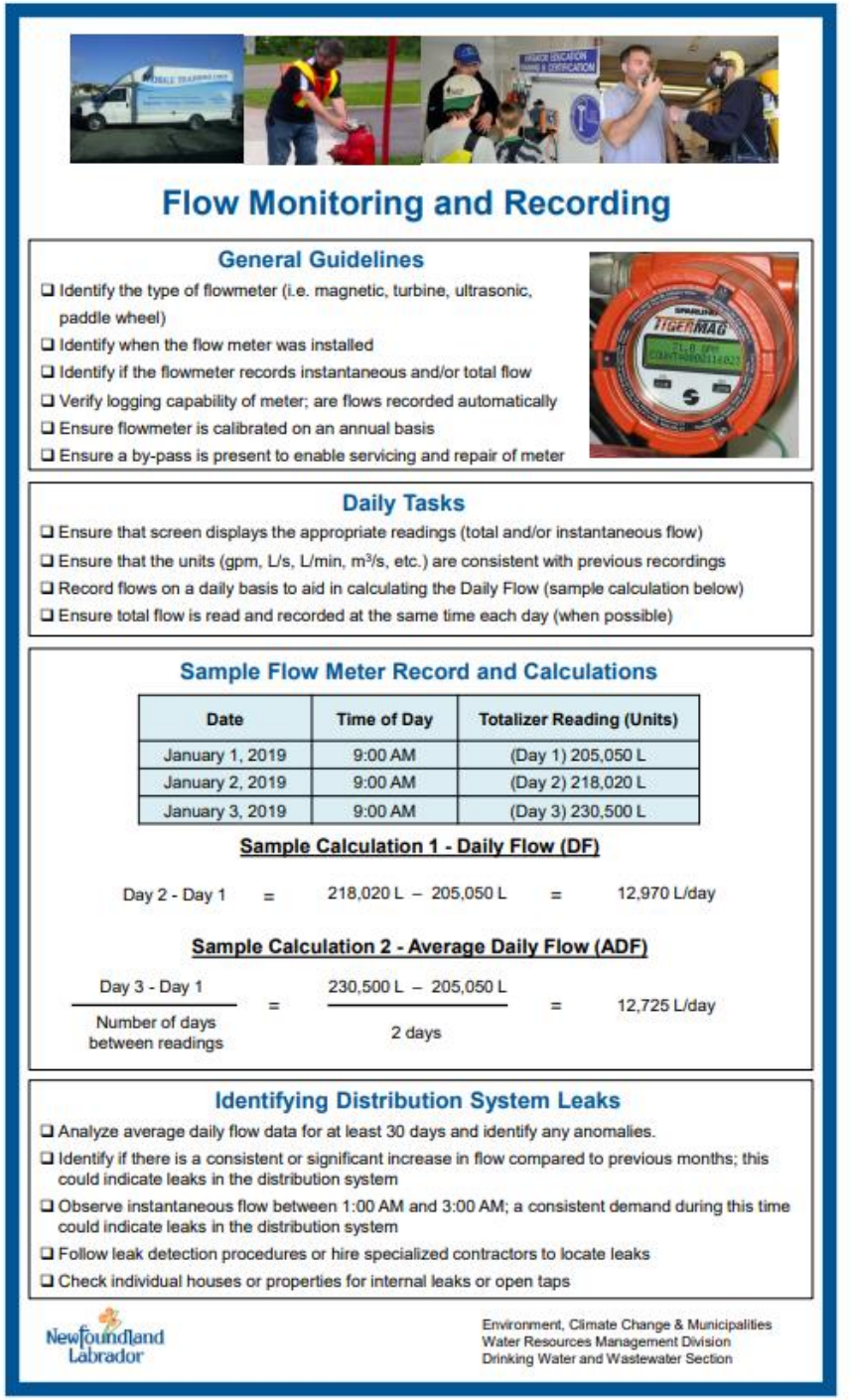
Flow Monitoring Records

For design of centralized treatment, flow record

- Min one year of good quality data; more is better
- Daily totalized flow
- Maximum day flow
- Peak flow

WRMD offers training and other resources

- On-site training (Flow Meters, Leak Detection)
- SOP – Flow Monitoring & Recording
- Record keeping templates



Flow Monitoring and Recording

General Guidelines

- ❑ Identify the type of flowmeter (i.e. magnetic, turbine, ultrasonic, paddle wheel)
- ❑ Identify when the flow meter was installed
- ❑ Identify if the flowmeter records instantaneous and/or total flow
- ❑ Verify logging capability of meter; are flows recorded automatically
- ❑ Ensure flowmeter is calibrated on an annual basis
- ❑ Ensure a by-pass is present to enable servicing and repair of meter

Daily Tasks

- ❑ Ensure that screen displays the appropriate readings (total and/or instantaneous flow)
- ❑ Ensure that the units (gpm, L/s, L/min, m^3/s, etc.) are consistent with previous recordings
- ❑ Record flows on a daily basis to aid in calculating the Daily Flow (sample calculation below)
- ❑ Ensure total flow is read and recorded at the same time each day (when possible)

Sample Flow Meter Record and Calculations

Date	Time of Day	Totalizer Reading (Units)
January 1, 2019	9:00 AM	(Day 1) 205,050 L
January 2, 2019	9:00 AM	(Day 2) 218,020 L
January 3, 2019	9:00 AM	(Day 3) 230,500 L

Sample Calculation 1 - Daily Flow (DF)

Day 2 - Day 1 = 218,020 L – 205,050 L = 12,970 L/day

Sample Calculation 2 - Average Daily Flow (ADF)

$$\frac{\text{Day 3 - Day 1}}{\text{Number of days between readings}} = \frac{230{,}500\ \text{L} - 205{,}050\ \text{L}}{2\ \text{days}} = 12{,}725\ \text{L/day}$$

Identifying Distribution System Leaks

- ❑ Analyze average daily flow data for at least 30 days and identify any anomalies.
- ❑ Identify if there is a consistent or significant increase in flow compared to previous months; this could indicate leaks in the distribution system
- ❑ Observe instantaneous flow between 1:00 AM and 3:00 AM; a consistent demand during this time could indicate leaks in the distribution system
- ❑ Follow leak detection procedures or hire specialized contractors to locate leaks
- ❑ Check individual houses or properties for internal leaks or open taps

Newfoundland Labrador

Environment, Climate Change & Municipalities
Water Resources Management Division
Drinking Water and Wastewater Section

Water Conservation

Climate Change may impact water availability and sustainability

Resources/tools to guide water conservation practices:

- Department's water conservation website (www.gov.nl.ca/ecc/waterres/waste/water-conservation/)
- Other jurisdictions
- Water meters
- Leak Detection

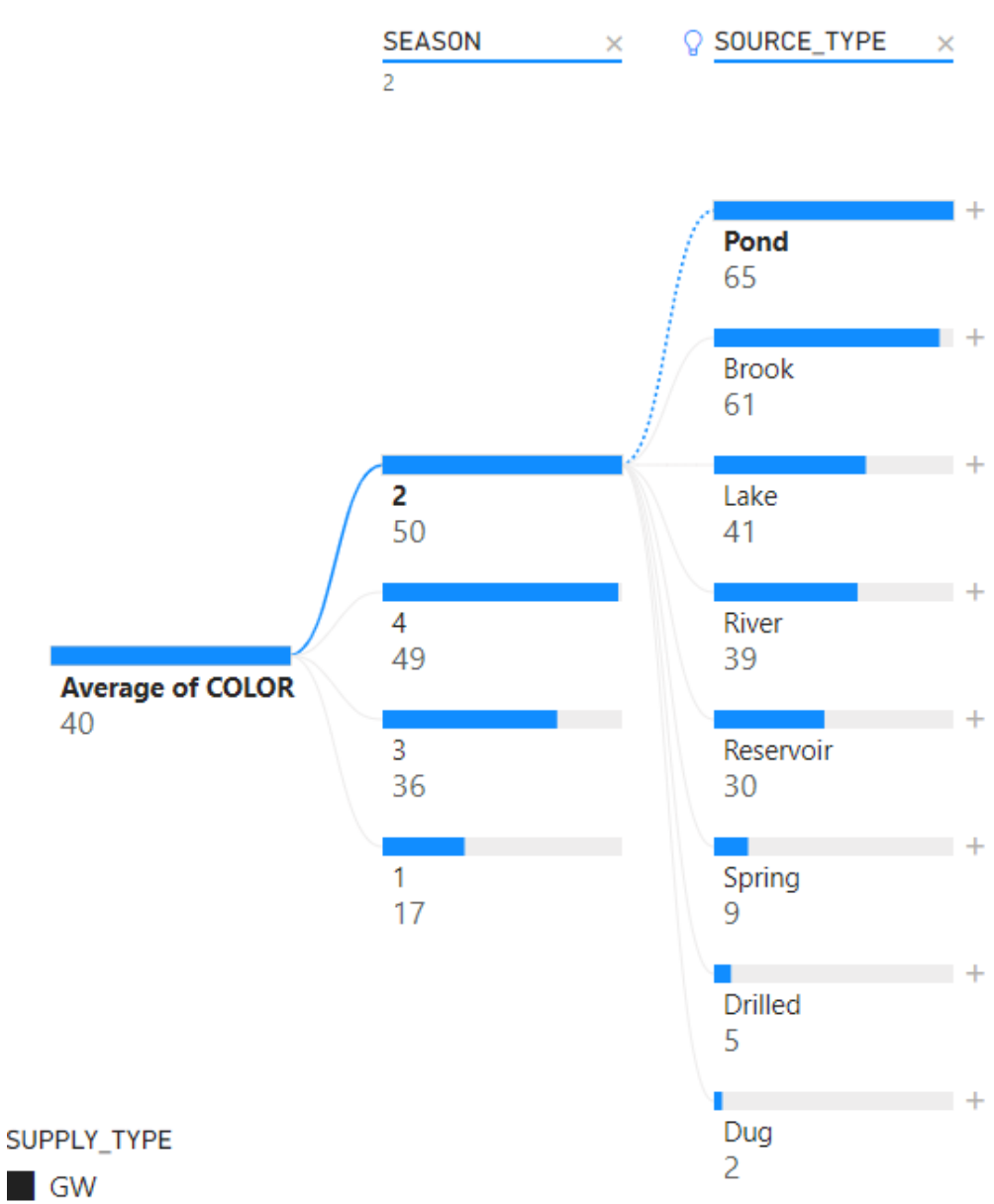
Water Quality Data

Existing systems

- Historical data available from WRMD
- May need additional data to capture worst case

New Water Systems

- Min of 4 samples (SW) or 2 samples (GW)
- The more representative data the better
- Want to capture worst case scenario



SUPPLY_TYPE

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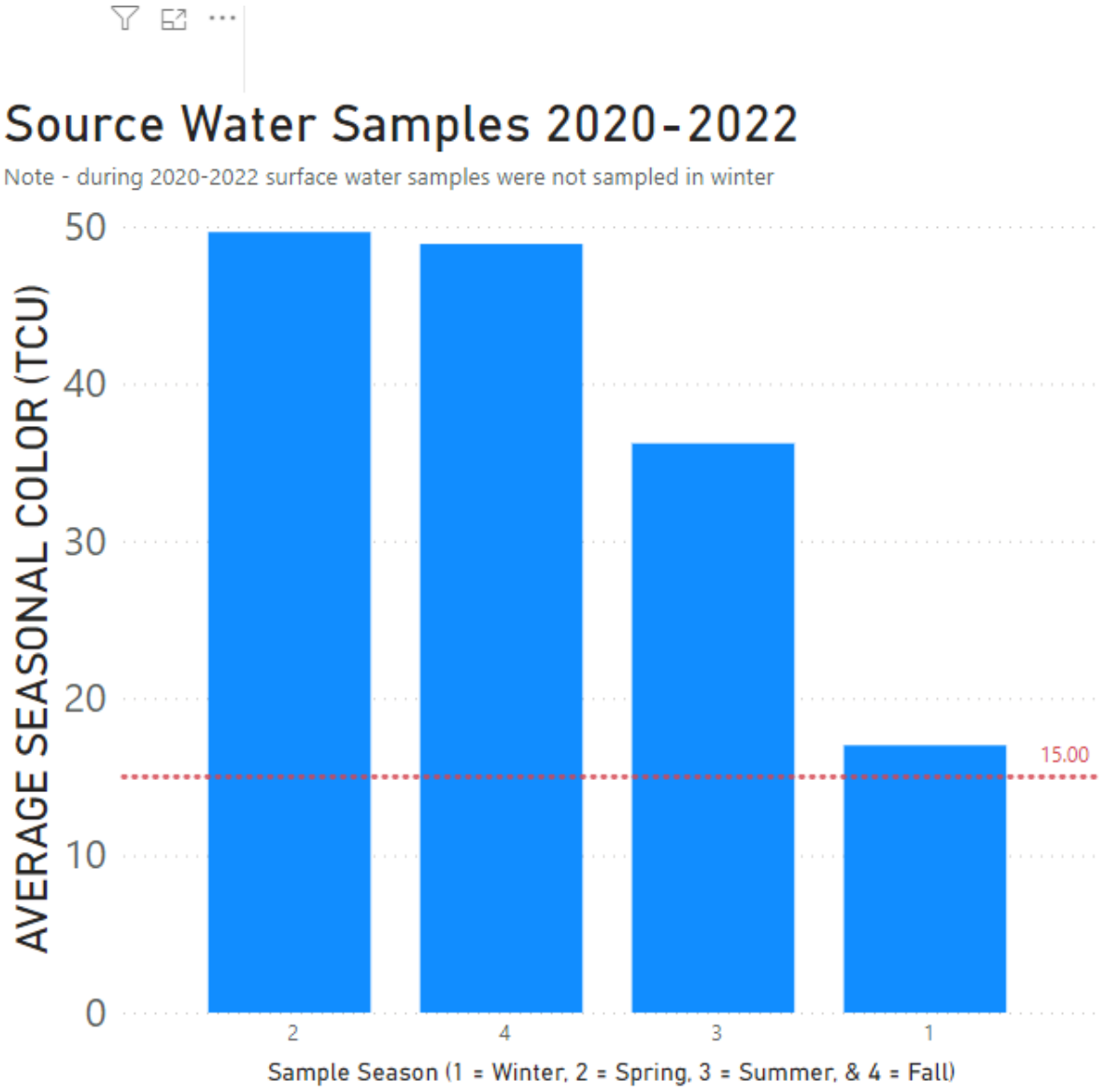

COLOR

Questions or Further Discussion

water@gov.nl.ca

Newfoundland Labrador