

# Groundwater Chemistry Test Kit Pilot Program

Preliminary results

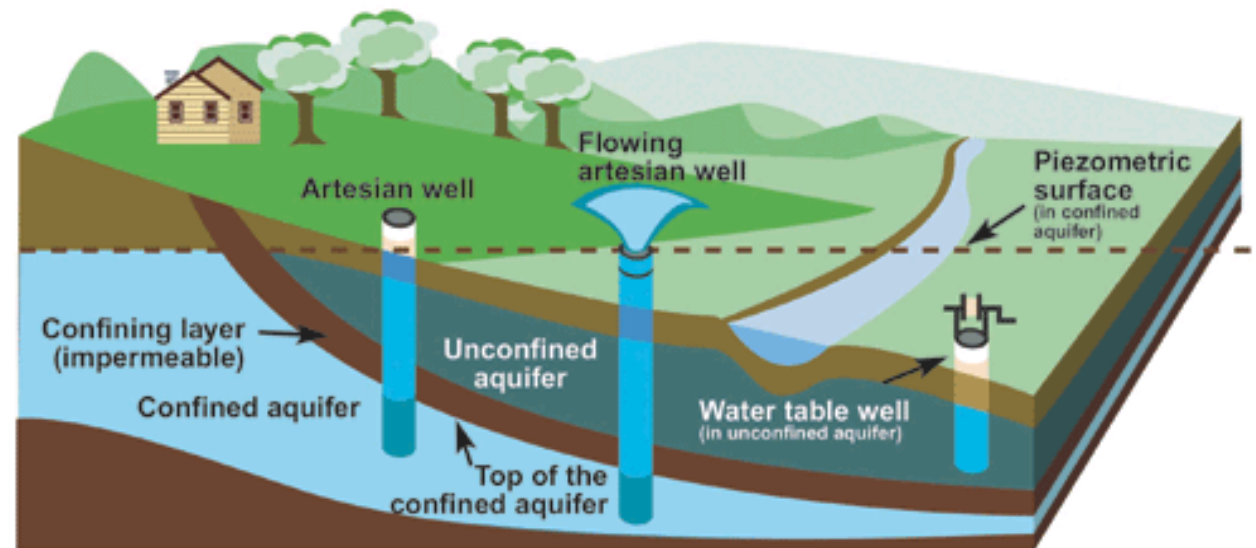
# Outline

- What is Groundwater?
- Basics of Groundwater
- Responsibilities of a Well Owner
- Groundwater in Newfoundland and Labrador
- Groundwater Chemistry in NL
- Conclusions

# What is Groundwater?

- Water found underground in the cracks and spaces in soil, sand and rock.
- It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

## Aquifers and wells



Credit: Government of Canada

# What is Groundwater?

Main types of porosity:

**Primary:** Porosity of the rock or sediment that formed at the time of deposition

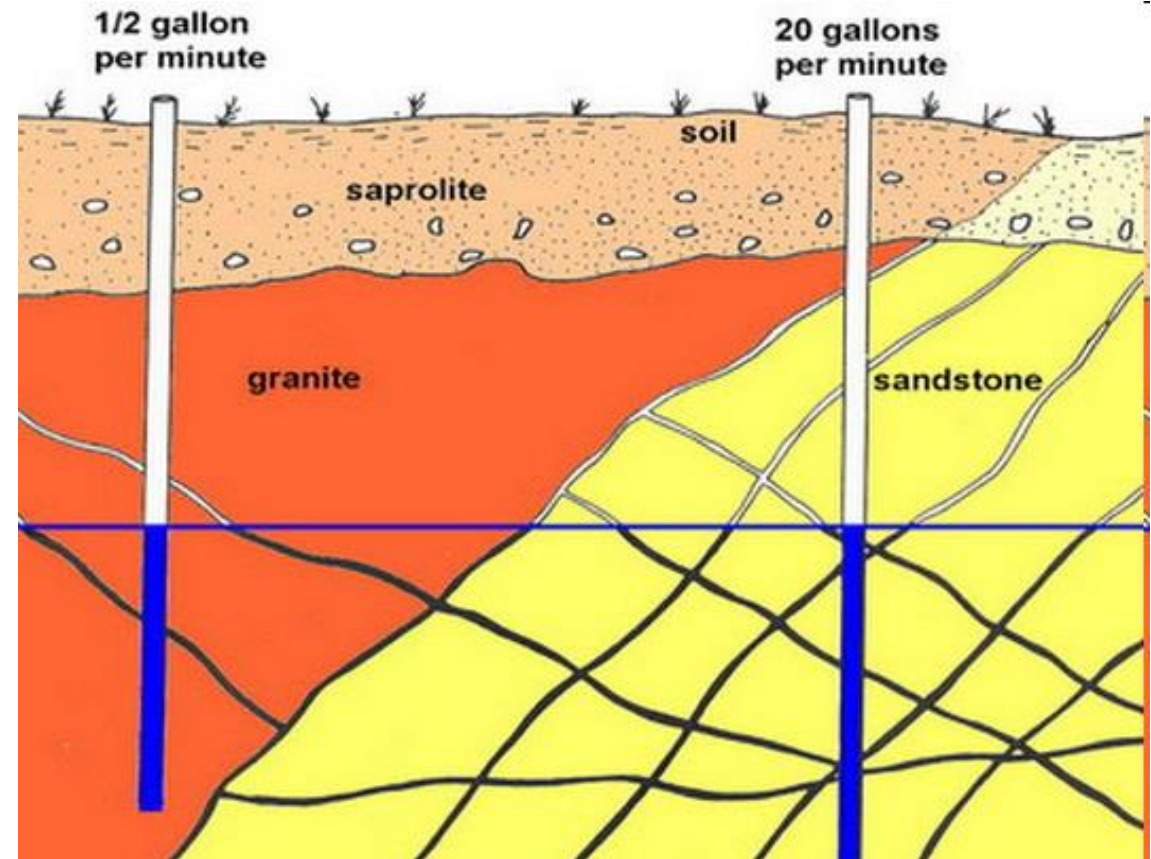
**Secondary:** Develops after the deposition of rock or sediment, for example fractures



Main type in NL

# Basics of Groundwater

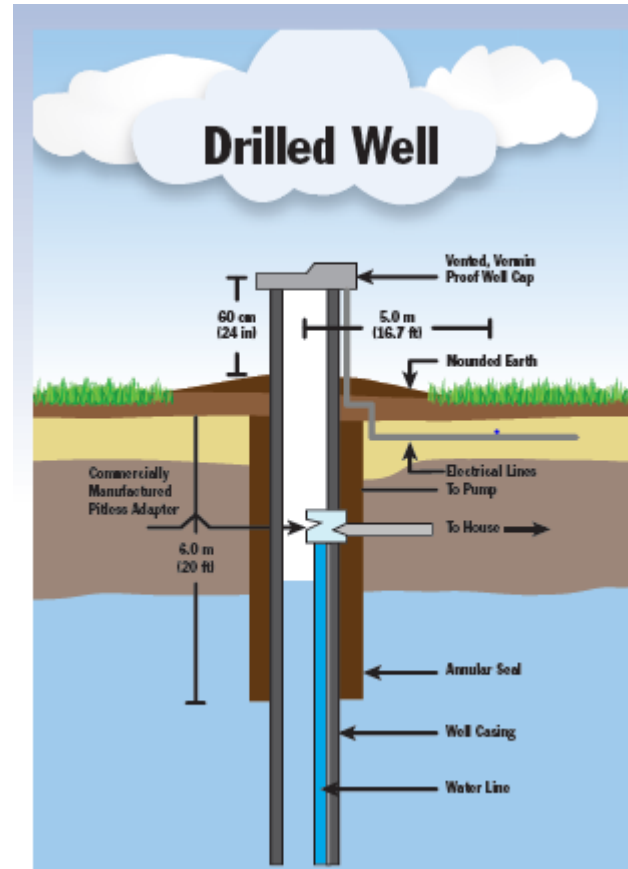
Fractures can be highly variable due to different bedrock geology and structures



Credit: Center for Sustainable Groundwater

# Basics of Groundwater

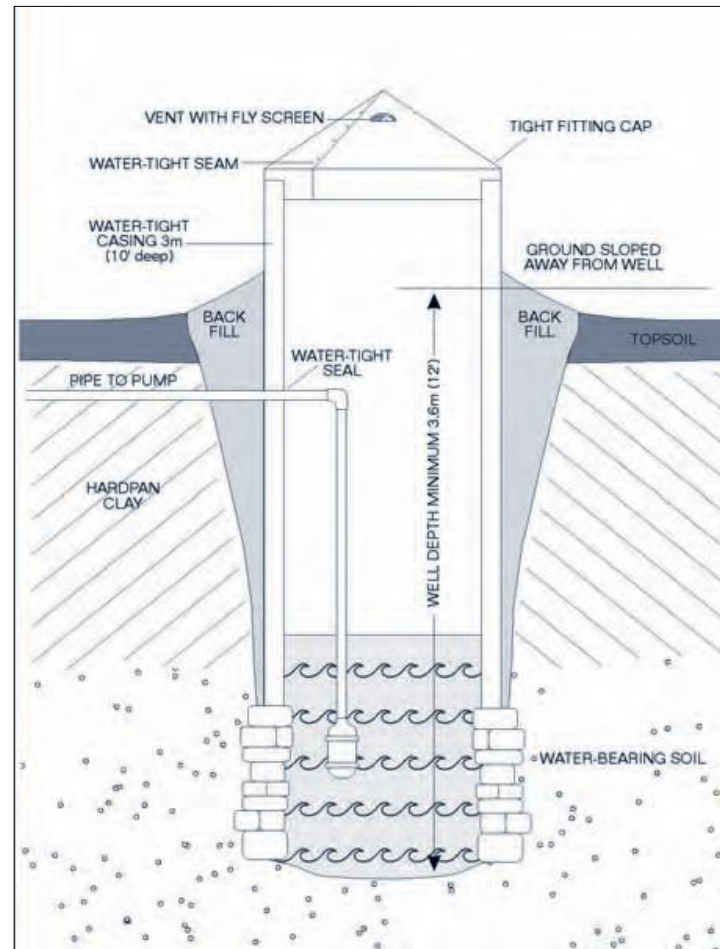
- Usually 6 inch diameter
- Deeper
- Less susceptible to contamination from surface water
- More likely to have metal contaminants like arsenic (water interacts with bedrock)



# Basics of Groundwater

- Larger diameter
- Shallow
- Susceptible to contamination from surface water
- Less likely to have metal contaminants, like arsenic, less interaction with the bedrock

Dug well



# Responsibilities of Well Owners

It is the well owner's responsibility to regularly test the well for bacteria and chemistry

Well Drilling Regulations under The *Water Resources Act SNL 2002 CW 4.01*.

- The owner of a well shall maintain the well at all times after its completion date in a manner sufficient to prevent the entry of surface water and other foreign materials into the well.

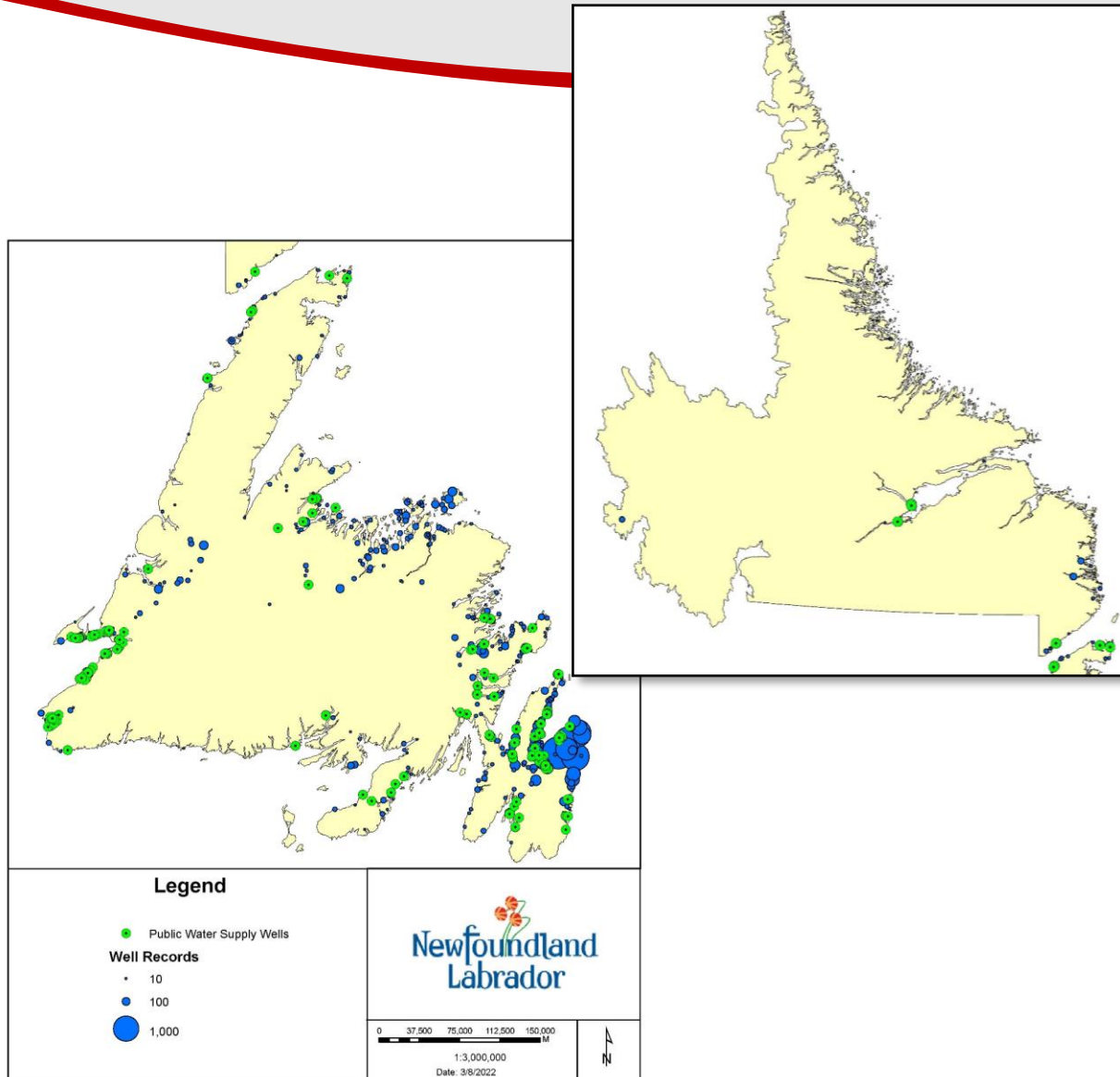




## Responsibilities of Well Owners

- Test for bacteria every 6 months or more (especially important for dug wells).
- Test for chemistry every 2 to 3 years or if there is a change (colour, smell, taste etc.)

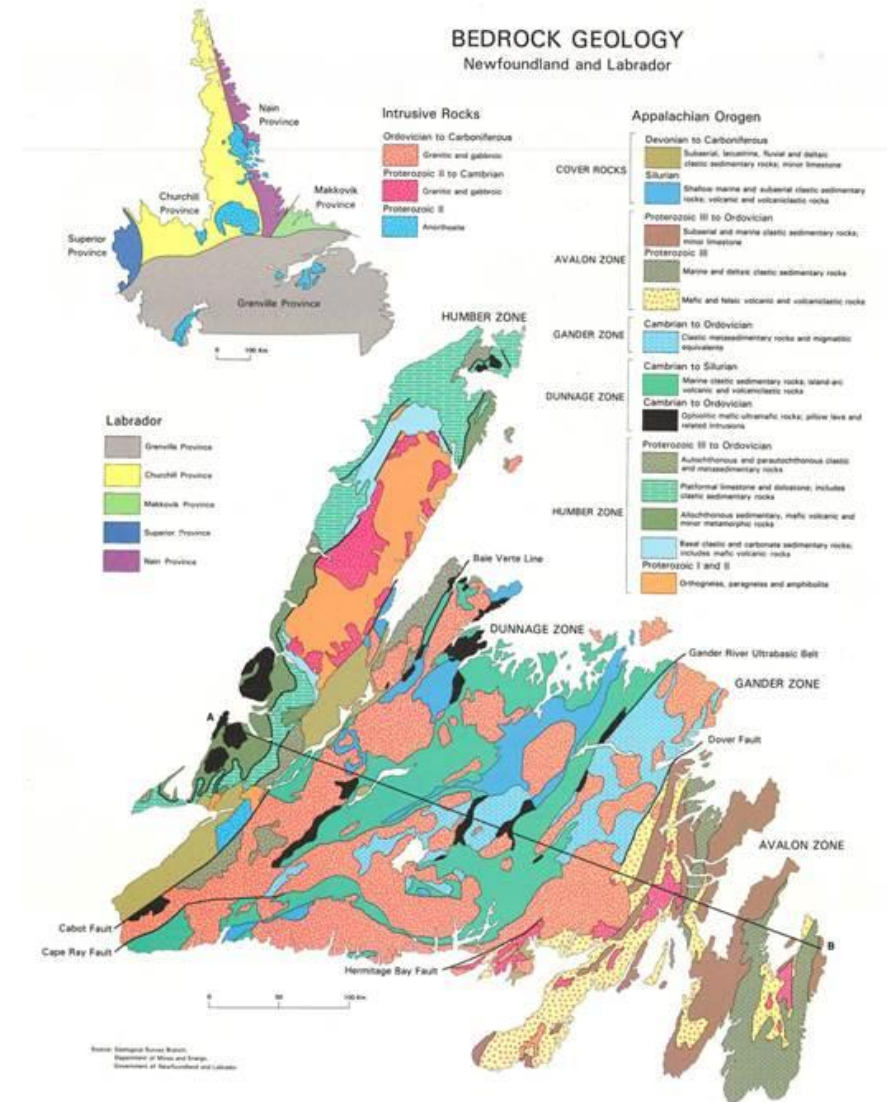
# Groundwater in Newfoundland and Labrador



- Source of drinking water to nearly 30% of the population
- Preferred water supply in rural areas – sometimes the **ONLY** water supply in rural areas
- Used in most community and cottage areas
- 264 public wells in the province servicing 94 communities
- More than 24,000 drilled wells and at least that many dug wells in the province

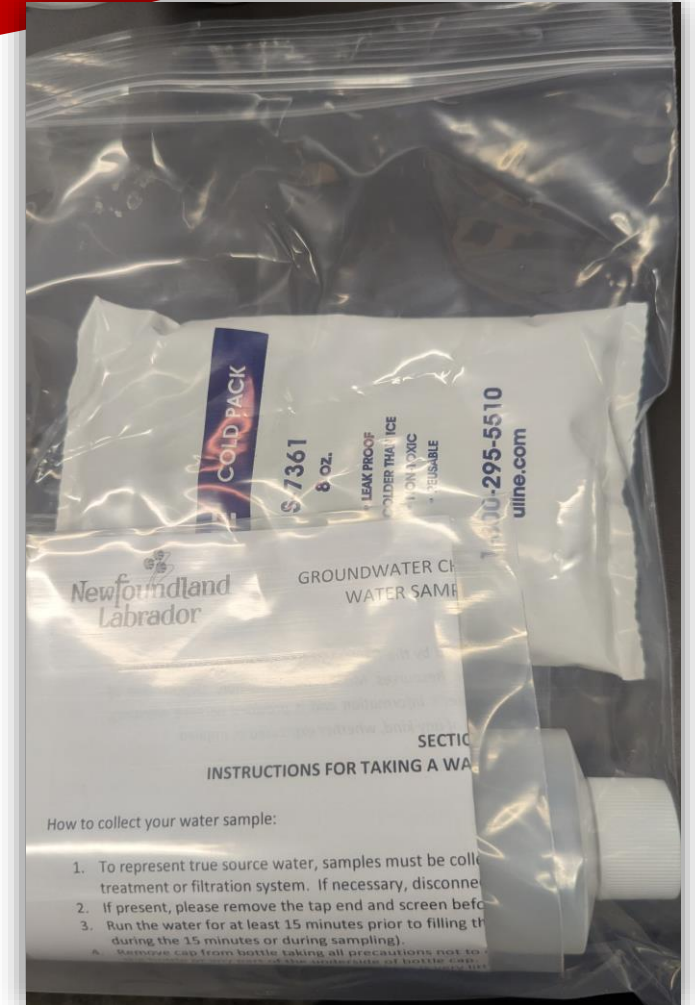
# Groundwater in Newfoundland and Labrador

Geology in Newfoundland and Labrador is very complex



## Groundwater in Newfoundland and Labrador

- Starting in December 2022, Water Resources Management Division, collaborated with Service NL, Health and Community Services and the Geological Survey Laboratory to distribute chemical test kits at no cost to well owners from Government Service Centers
- Tests for major ions and metals including arsenic, manganese, lead and uranium



# Groundwater Chemistry in NL

## Preliminary results from the Groundwater Test Kit Pilot program

5144 kits have been distributed and 2108 water samples have been analyzed (as of early Jan 2024)

Type of Water Sample	Number
Drilled	1443
Dug	610
Drilled/Dug	3
Driven	10
Spring	17
Surface Water	4
Town Water	8
Other/Unknown	5
Blanks	8

# Groundwater Chemistry in NL

## Preliminary results from the Groundwater Test Kit Pilot program

The two main types of exceedances focused on for the pilot program, based upon the Guidelines for Canadian Drinking Water Quality:

- 1) Aesthetic exceedances** which are for parameters which may affect consumer acceptance of drinking water, such as taste, odour and colour
- 1) Contaminant exceedances** which are exceedances which may affect health.

There is considered to be an exceedance if the result is greater than or equal to the Guidelines for Canadian Drinking Water Quality for the selected parameter.

# Groundwater Chemistry in NL

## Preliminary results from the Groundwater Test Kit Pilot program

### Contaminant exceedances

- 1 aluminum
- 5 antimony
- 220 arsenic
- 2 cadmium
- 36 lead
- 356 manganese
- 21 selenium
- 1 strontium
- 25 uranium
- 1 zinc



### Aesthetic exceedances

- 174 iron
- 782 manganese
- 43 sodium

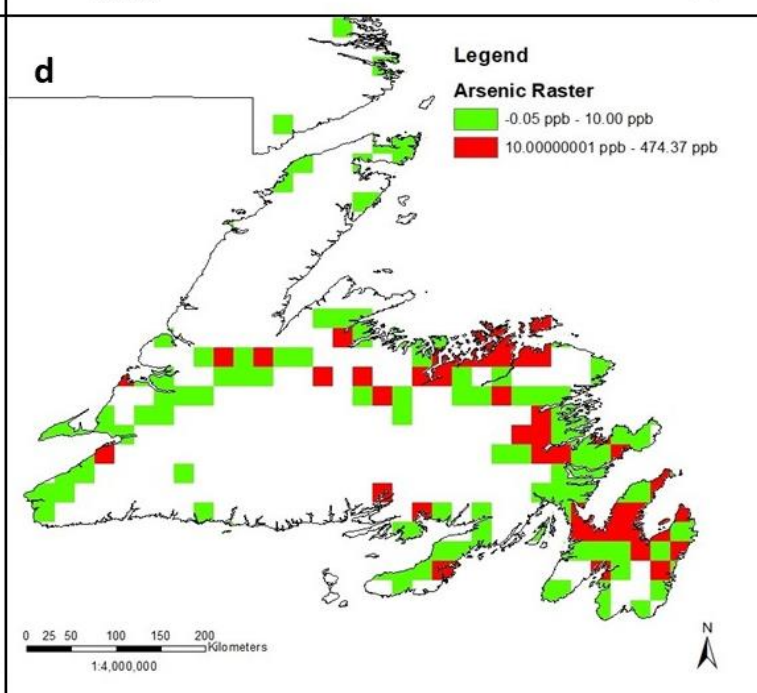
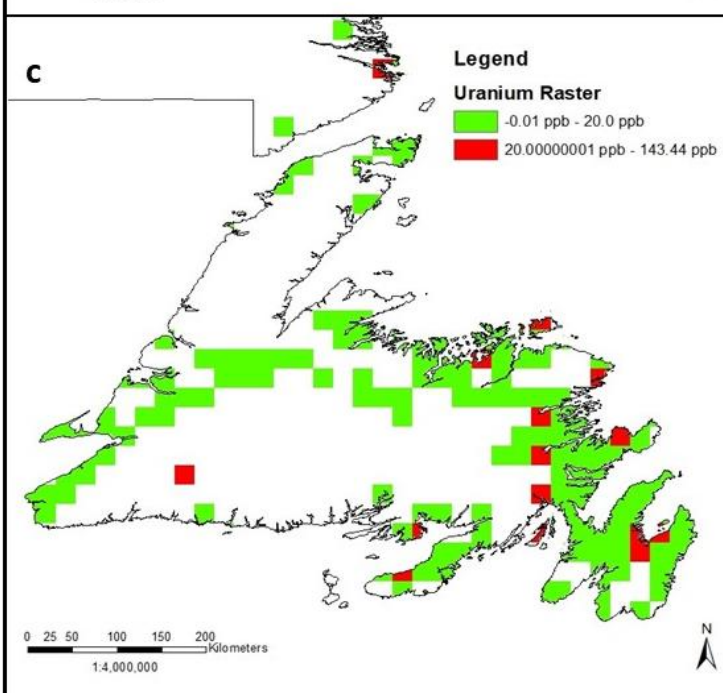
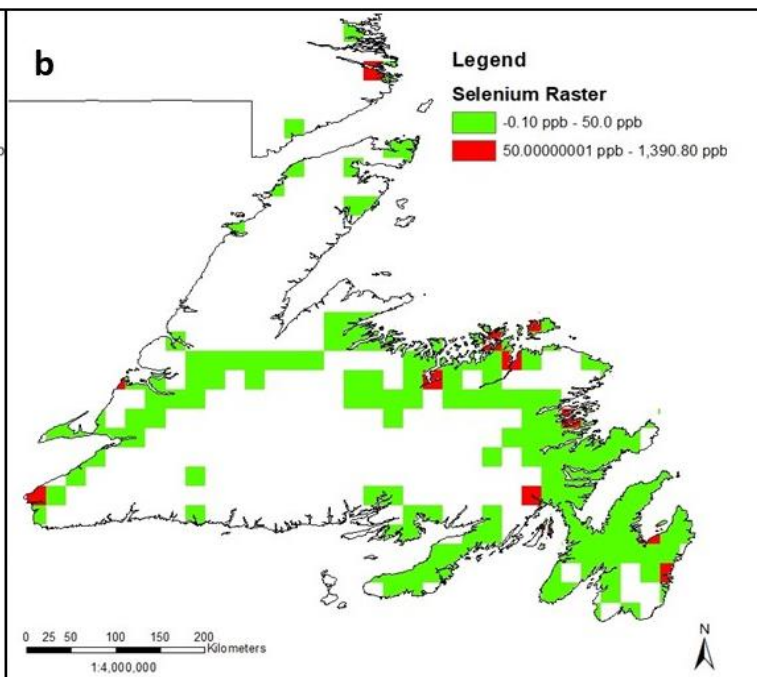
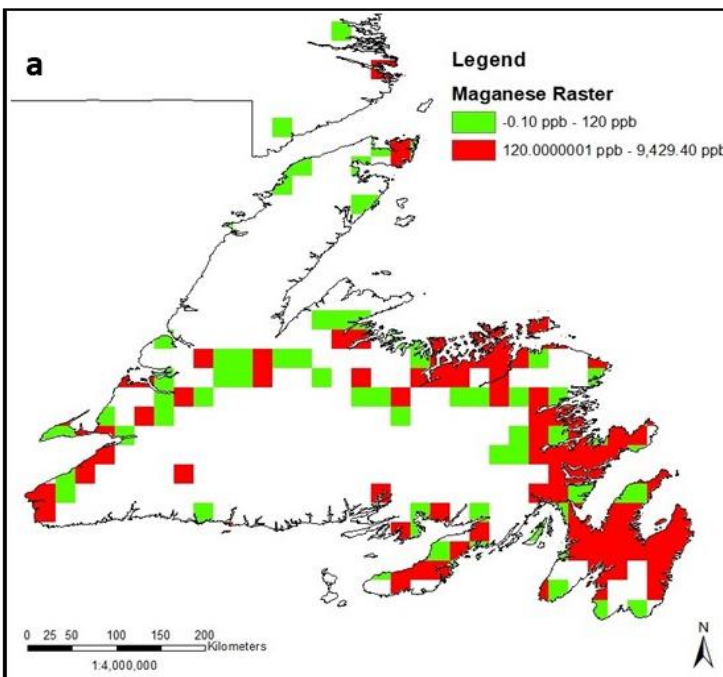
# Groundwater Chemistry in NL

## Preliminary results from the Groundwater Test Kit Pilot program

Contaminant Parameters				
Exceedance	Quantity	Range (of Exceedances)	% Drilled	% Dug and other
Aluminum (2900 ppb)	1	28500 ppb	100	
Antimony (6 ppb)	5	6.63 - 17.19 ppb	80	20
Arsenic (10 ppb)	220	10.01 - 476.24 ppb	98	2
Cadmium (7 ppb)	2	10.80 - 43.18 ppb	100	
Lead (5 ppb)	36	5.14 - 94.37 ppb	61	39
Manganese (120 ppb)	356	120.8 - 9429.4 ppb	70	30
Selenium (50 ppb)	21	59.9 - 1390.8 ppb	100	
Strontium (7000 ppb)	1	7025.5 ppb	100	
Uranium (20 ppb)	26	21.18 - 143.44 ppb	100	
Zinc (5000 ppb)	1	17802 ppb		100

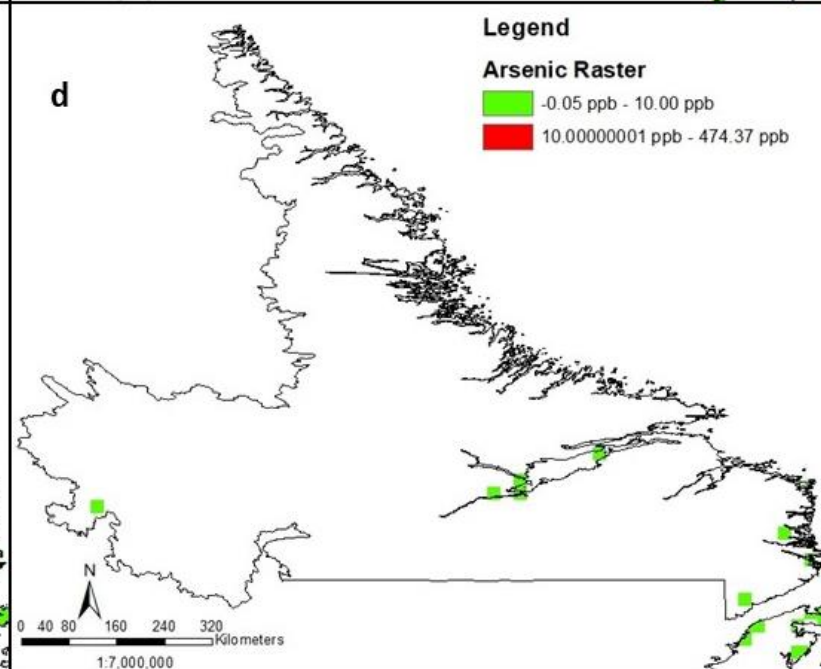
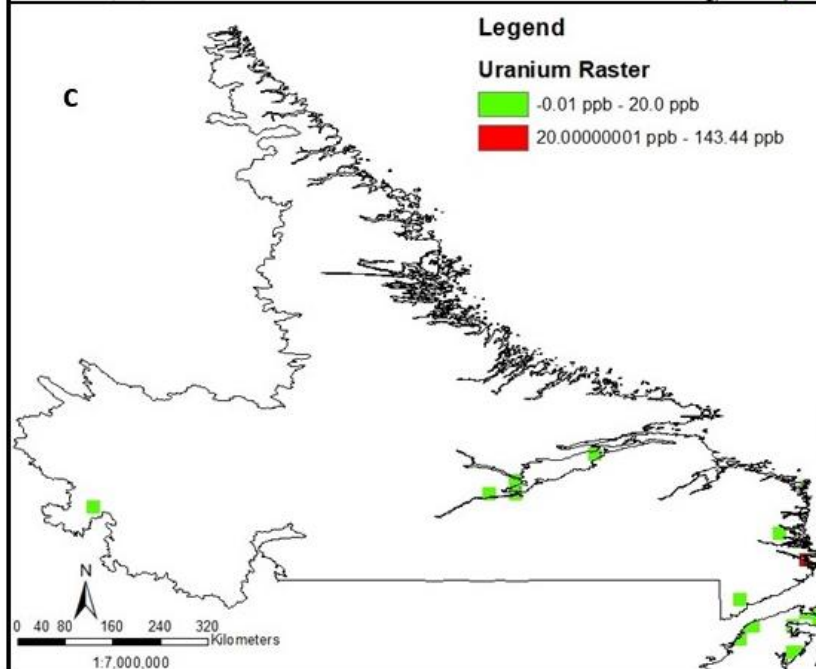
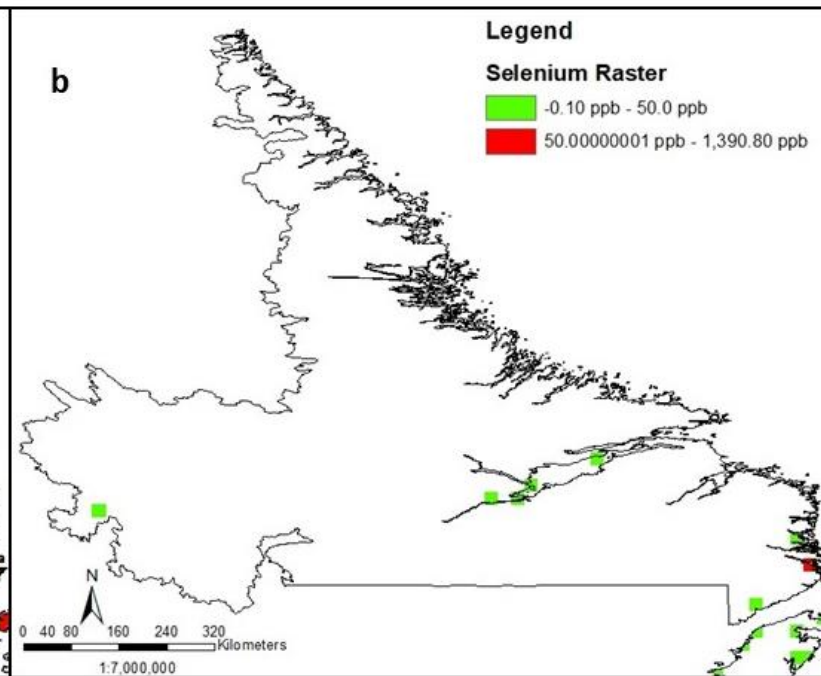
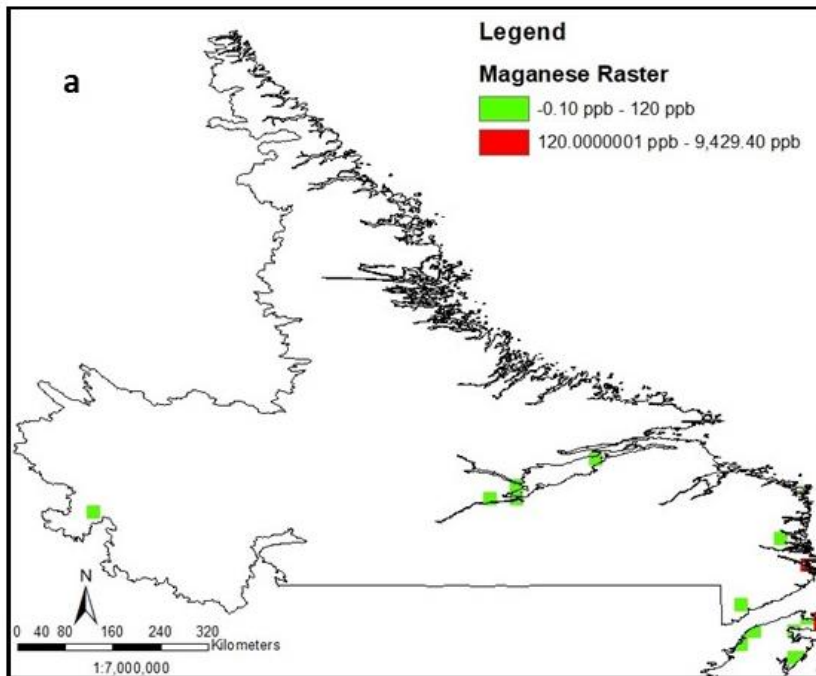
Aesthetic Parameters					
Exceedance	Quantity	Range (of Exceedances)	% Drilled	% Dug	Other
Iron (300 ppb)	174	301 - 8999 ppb	70	28	2
Manganese (20 ppb)	782	20.0 - 9429.4 ppb	70	29	1
Sodium (200 ppm)	43	200.33 - 6023.2 ppm	91	9	





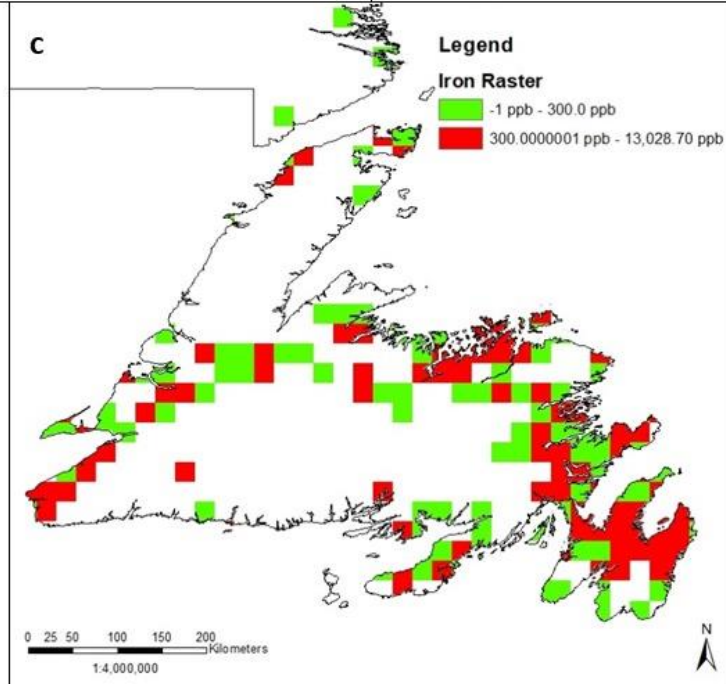
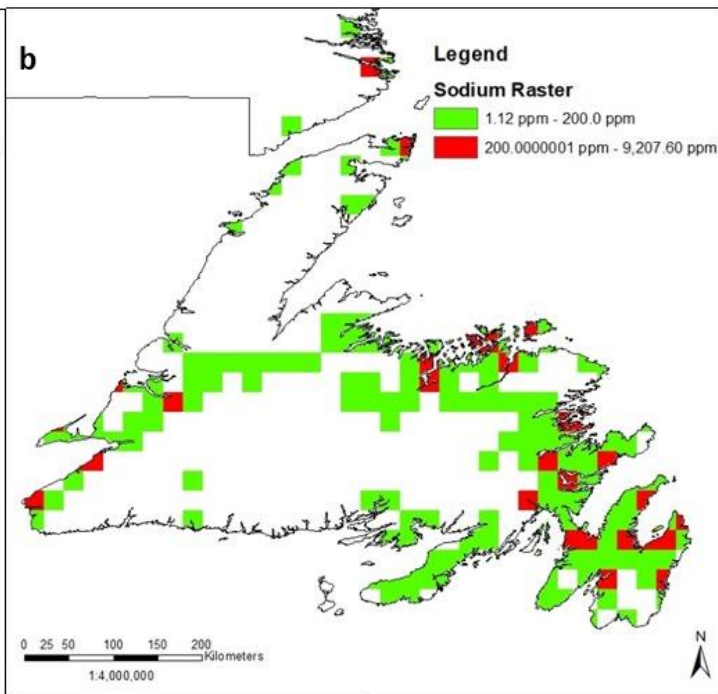
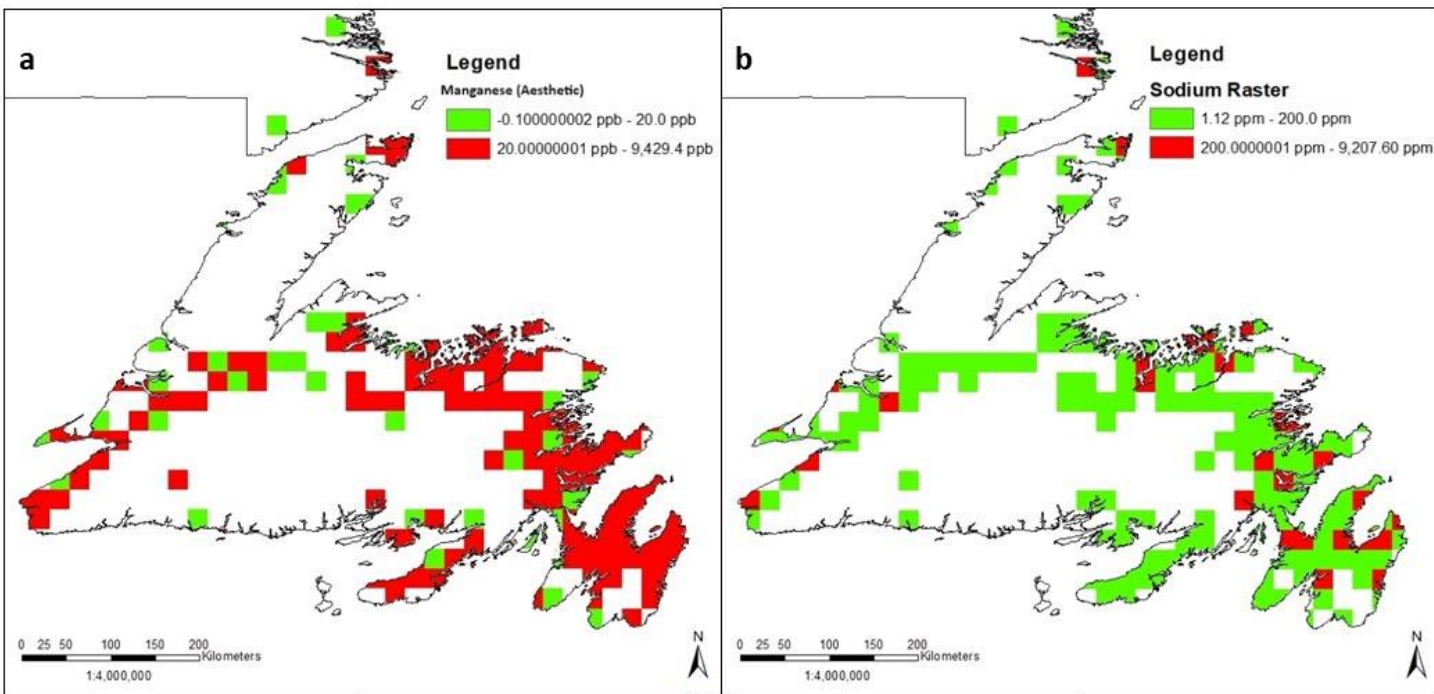
## Contaminant exceedances

- Naturally occurring contaminants in well water are due to the groundwater interacting with the bedrock and soils in the area where the well is located.
- Groundwater chemistry can vary from well to well
- Well chemistry can even vary from neighbour to neighbour because the bedrock geology is variable



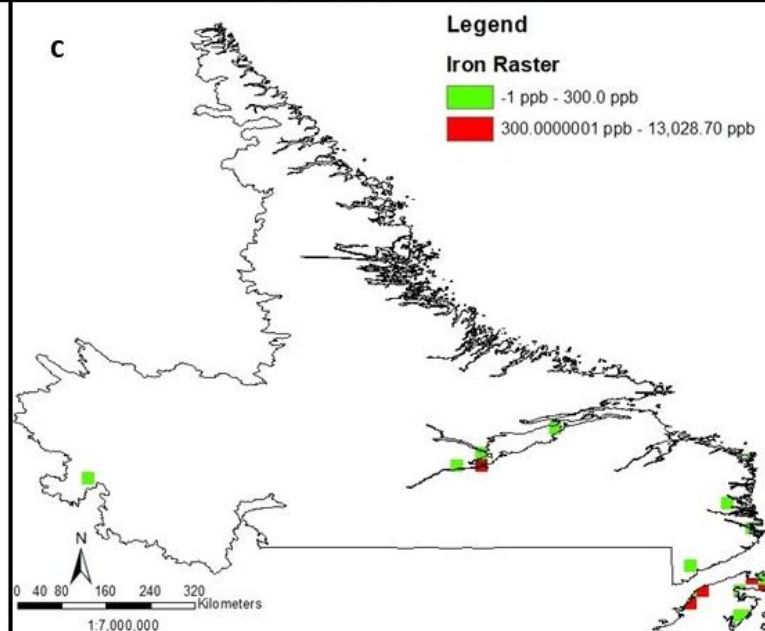
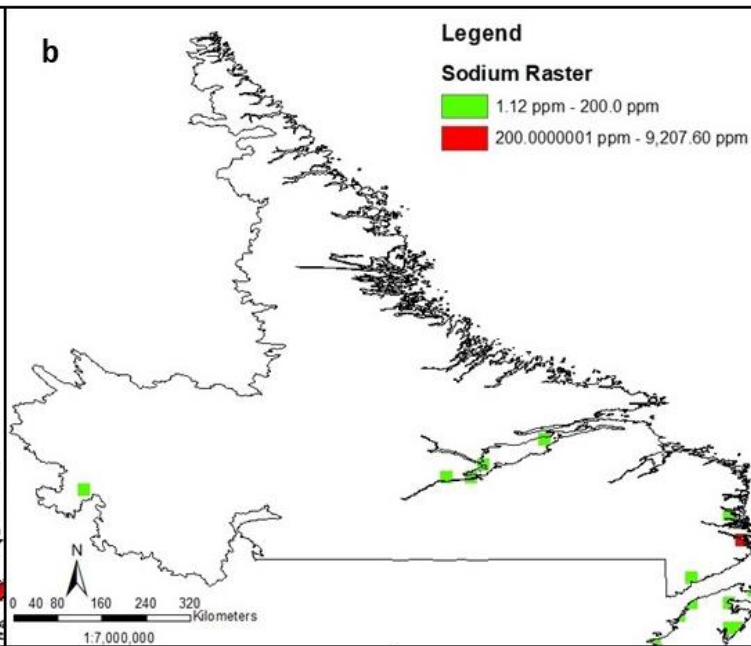
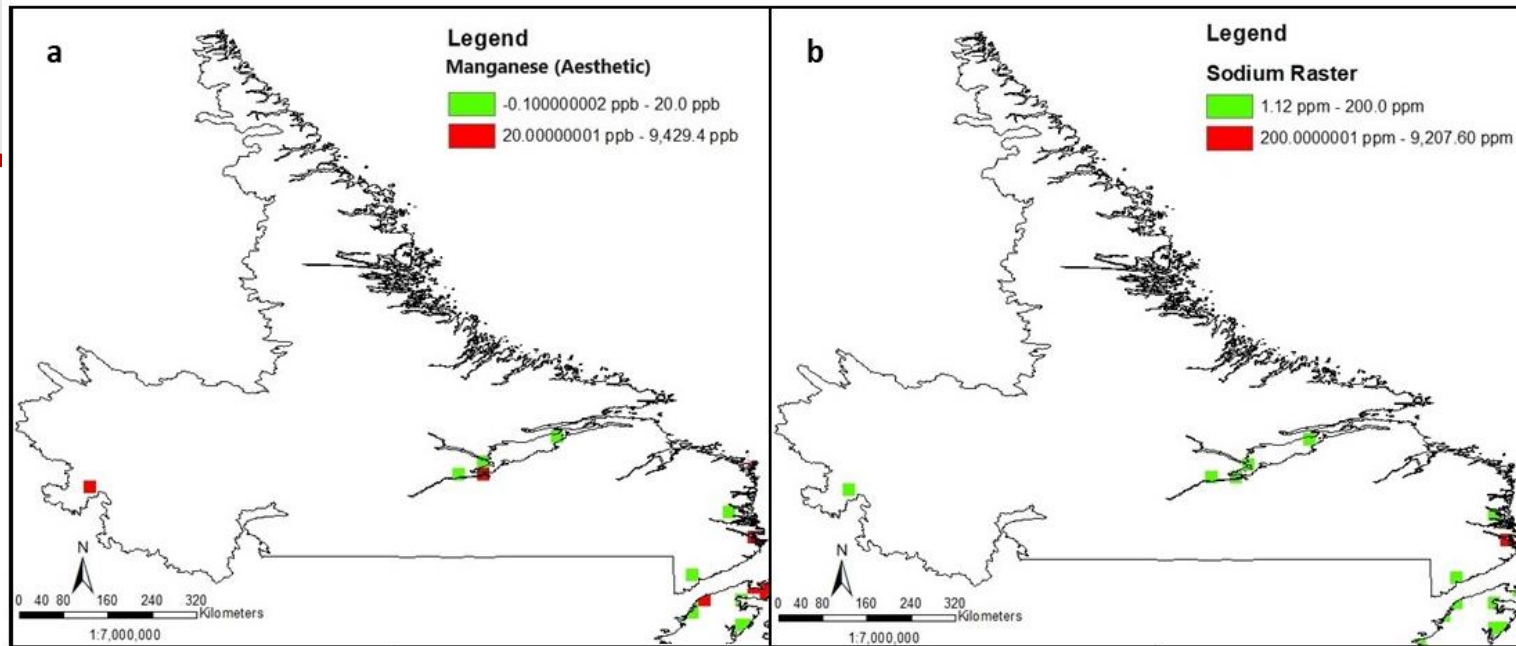
## Contaminant exceedances

- Factors like saltwater intrusion can change the original groundwater chemistry and potentially increase the groundwater's ability to dissolve naturally occurring contaminants into the groundwater.
- Groundwater chemistry can also change over time from over-pumping, changes in recharge (the amount of water replenishing the groundwater), land use changes, developments etc.



## Aesthetic exceedances

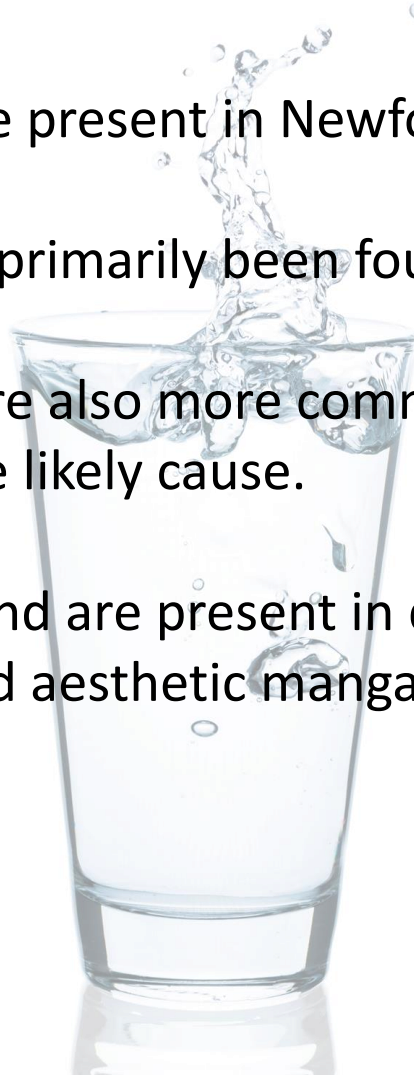
These may affect consumer acceptance of drinking water, such as taste, odor and colour



Aesthetic exceedances

# Conclusions

- Naturally occurring contaminants are present in Newfoundland and Labrador's groundwater
- Arsenic, uranium and selenium have primarily been found in the deeper drilled wells.
- The aesthetic sodium exceedances are also more common in the drilled wells. This may point to saltwater intrusion being the more likely cause.
- Manganese and iron on the other hand are present in drilled and dug wells and pose a risk to both for contaminant manganese and aesthetic manganese and iron.



# Conclusions

The Groundwater Test Kit pilot program has highlighted the importance of testing well water for chemistry

If you haven't tested your well yet, please do! Kits are still available at the registration desk and Government Service Centers across the province.

## Groundwater Contacts:

- Angela Buchanan, Groundwater Manager, [angelabuchanan@gov.nl.ca](mailto:angelabuchanan@gov.nl.ca) or 729-1671.
- Leah Power, Groundwater Environmental Scientist, [leahpower@gov.nl.ca](mailto:leahpower@gov.nl.ca) or 729-2539



Questions?

