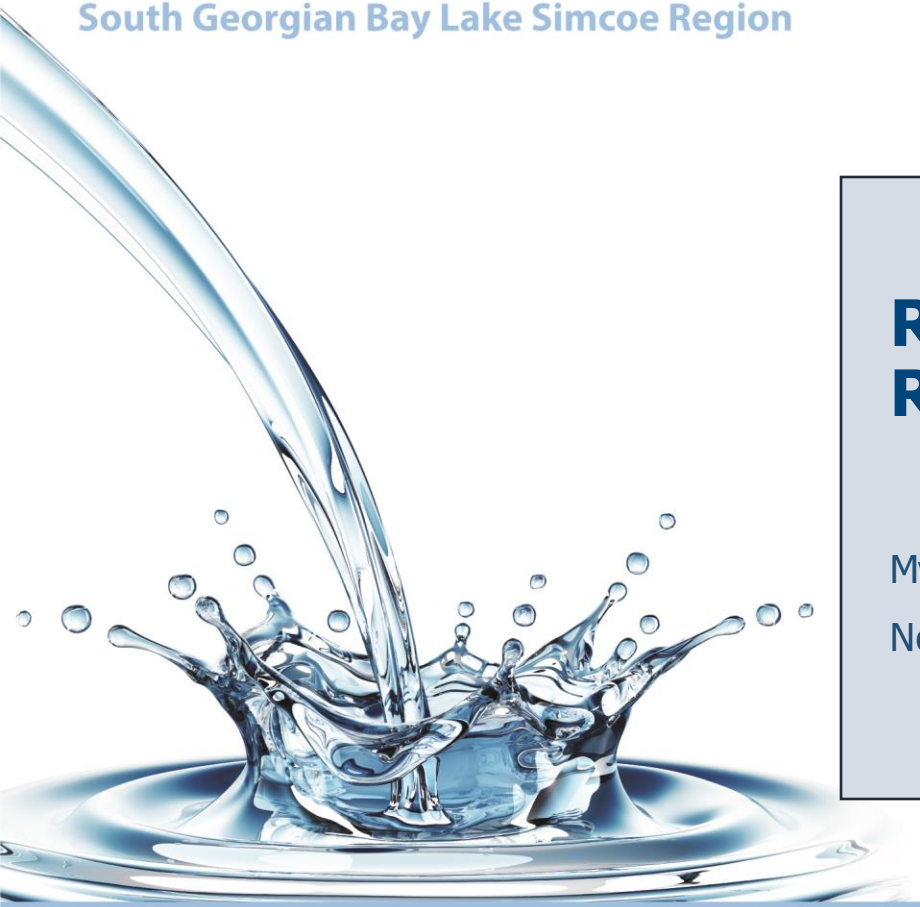
Source Water Protection
South Georgian Bay Lake Simcoe Region

LATORNELL
CONSERVATION SYMPOSIUM



Reviewing the Continued Relevancy of Water Budgets

Mystaya Touw, Sourcewater Protection Specialist, LSRCA

November 4, 2025

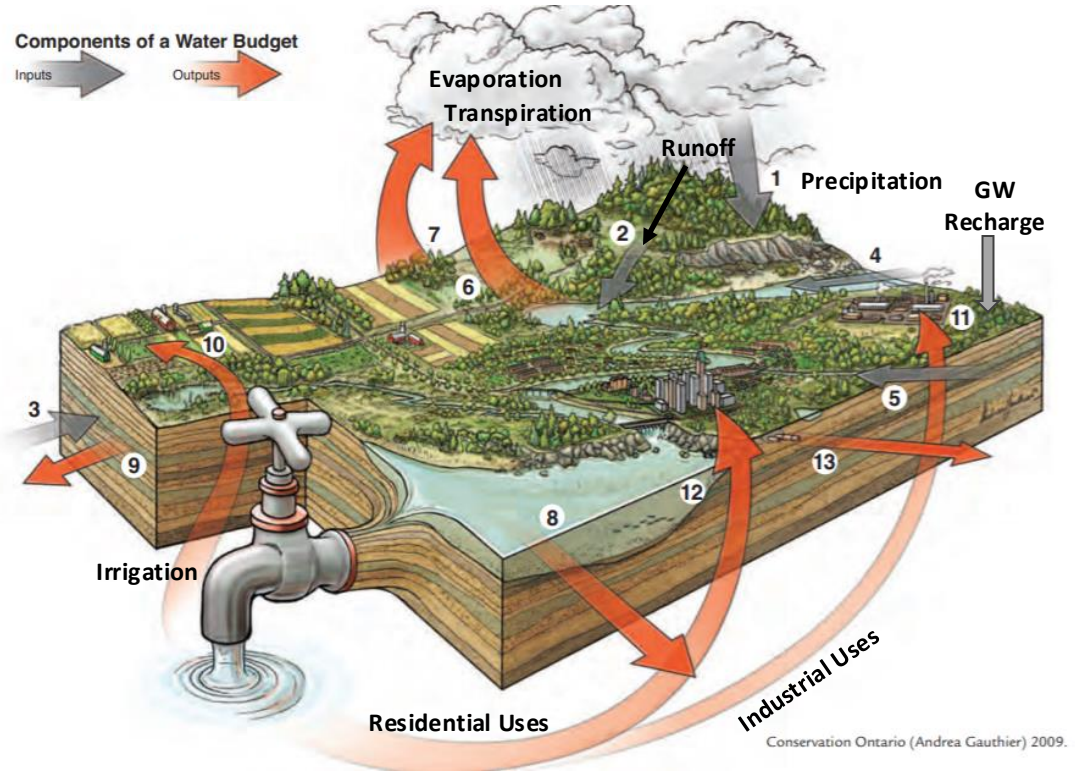
Water is life. Protect Yours.

Presentation Outline

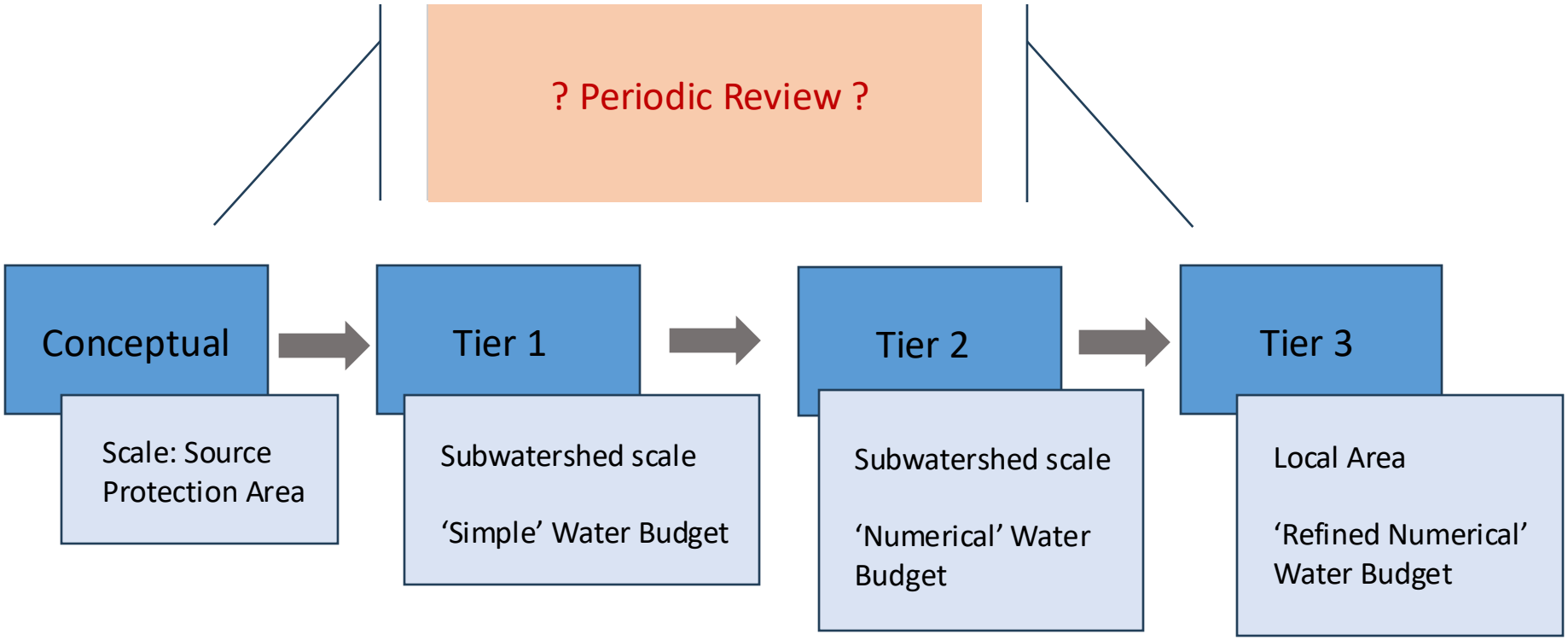
- Overview of Water Budgets - Groundwater
- Water Budget Review Process
- Municipal Well Climate Vulnerability

Water Budgets – Clean Water Act

- An accounting of the hydrologic cycle
- How much water enters/leaves the system (natural processes and human consumption)
- If more water is used than is available (long term) - you have a water quantity stress



Review of Tiered Water Budget Approach



Overview of Tier 1 'Simple' Water Budgets

All subwatersheds

Usually based on permitted takings, rather than actual takings

Permitted takings are usually much higher than actual takings

Looks at 'current' and 'future' annual demand

Stress threshold - Moderate:

- **Avg. day >10%** groundwater stress

Overview of Tier 2 'Numerical' Water Budgets

Similar to Tier 1, but a bit more in depth

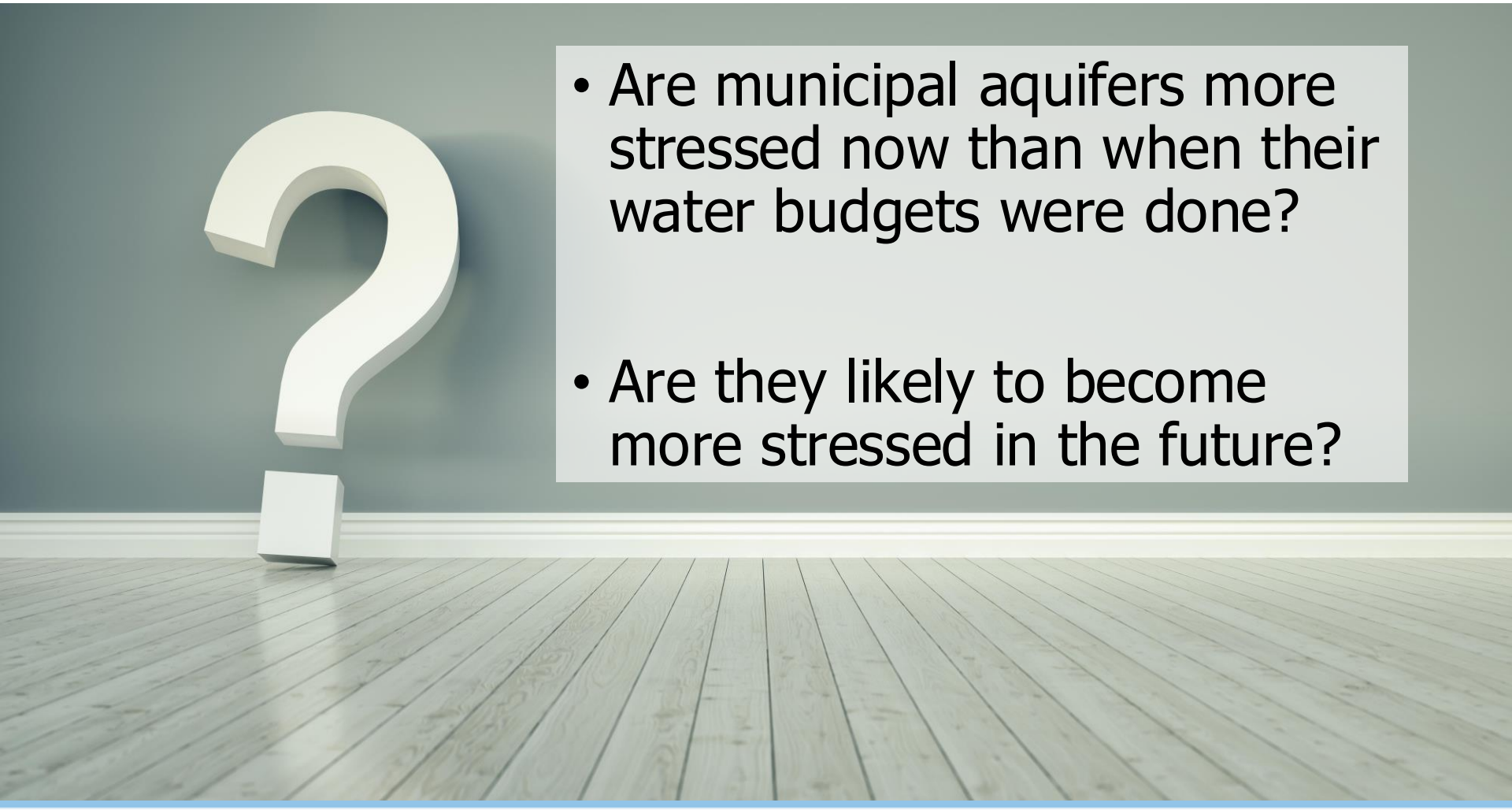
Uses actual taking wherever possible

Looks at 'current' and 'future,' 'average' and 'max' demand

Stress threshold - Moderate:

- **Avg. day >10%** groundwater stress
- **Max. day >25%** groundwater stress

Questions



- Are municipal aquifers more stressed now than when their water budgets were done?
- Are they likely to become more stressed in the future?

What 'new' information do we have?

- 2020 actual groundwater takings for all permitted uses including municipal groundwater (Permit to Take Water program data: https://data.ontario.ca/dataset/water-taking)
- 2021 census population data
- 2051 population projections for all municipalities
- This is enough information to create new average demand estimates

Allocating wells and water takings to subwatersheds

- Permitted takings
  - https://data.ontario.ca/dataset/water-taking
  - Data contains coordinates, therefore can be used for GIS analysis
  - Combine with layer file of subwatershed boundaries
  - Subwatershed boundaries may differ between Tiers of water budgets
  - Will likely require some data checking and cleaning, including removing surface water takings

- **Future population and demand:** Assumed population growth will be proportional to existing population distribution

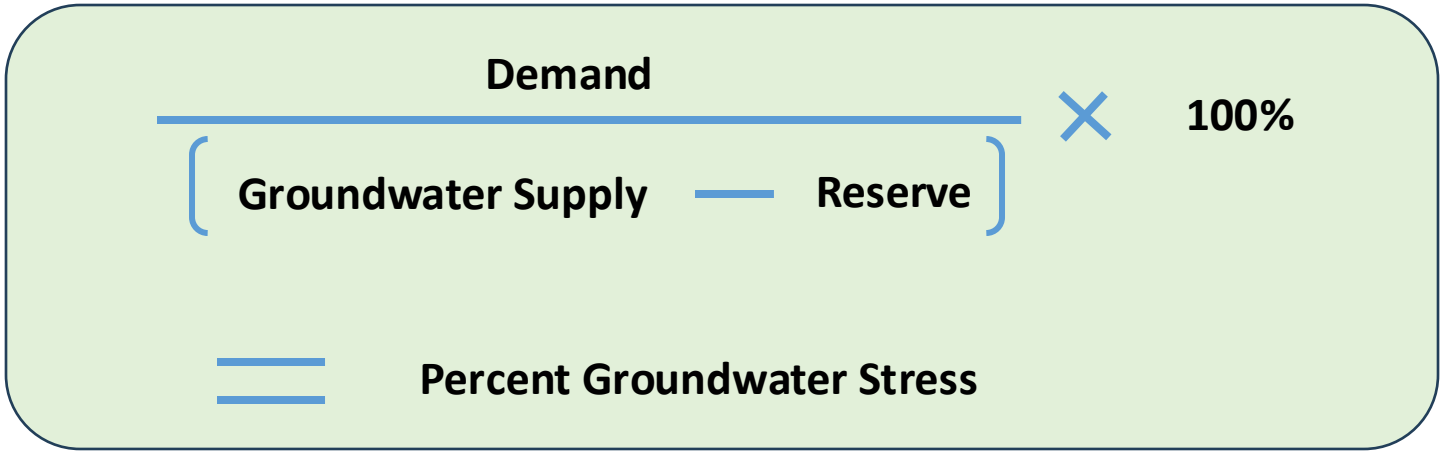
Example: Future Municipal Demand Estimate

Municipality	2021 Population	2051 Population	% Pop. Change	Drinking Water System / Well	Tier 1 Subwatershed	Tier 2 Subwatershed	m^3/yr 2020	m^3/day 2020	Estimate m^3/yr 2051	Estimate m^3/day 2051
Town A	10,000	12,500	25%	Well 1	Creek A	N/A	9,125	25	11,406	31
Town A	10,000	12,500	25%	Well 2	Creek A	N/A	9,125	25	11,406	31
Town A	10,000	12,500	25%	Well 3	Creek A	Creek 2	7,300	20	9,125	25
Town A	10,000	12,500	25%	Well 4	Creek B	Creek 1	10,950	30	13,688	38
Town B	20,000	30,000	50%	Well 1	Creek B	Creek 1	18,250	50	27,375	75
Town B	20,000	30,000	50%	Well 2	Creek B	Creek 1	3,650	10	5,475	15
Town B	20,000	30,000	50%	Well 3	Creek C	Creek 2	3,650	10	5,475	15
Town C	5,000	7,000	40%	Well 1	Creek C	Creek 2	1,825	5	2,555	7
Town C	5,000	7,000	40%	Well 2	Creek A	Creek 2	5,475	15	7,665	21

Example: Other Permitted Takings

Permit #	Other descriptive details	Municipality	Tier 1 subwatershed	Tier 2 Subwatershed	Purpose	Specific Purpose	m^3/yr 2020	m^3/day 2020
EX-1234	Well 1	Town A	Creek A	N/A	Agriculture	Field and Pasture Crops	3,650	10
EX-1234	Well 2	Town A	Creek A	N/A	Agriculture	Field and Pasture Crops	1,825	5
EX-2454	Well 1	Town B	Creek B	Creek 2	Industrial	Aggregate Washing	4,380	12
EX-2457	Well 2	Town B	Creek B	Creek 1	Industrial	Aggregate Washing	2,920	8
EX-2457	Well 3	Town B	Creek B	Creek 1	Industrial	Aggregate Washing	1,095	3
EX-5568	Well 1	Town C	Creek C	Creek 2	Commercial	Snowmaking	4,745	13

Percent Groundwater Stress Calculation



Demand= all groundwater takings in the subwatershed

**assumed all permitted takings were 100% consumptive in our review*

***assumed no change in groundwater supply, groundwater reserve, and small water takings that do not require permits (i.e. domestic wells)*

Example: Future Municipal Demand Estimate

Municipality	2021 Population	2051 Population	% Pop. Change	Drinking Water System / Well	Tier 1 Subwatershed	Tier 2 Subwatershed	m^3/yr 2020	m^3/day 2020	Estimate m^3/yr 2051	Estimate m^3/day 2051
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Town A	10,000	12,500	25%	Well 4	Creek B	Creek 1	10,950	30	13,688	38
Town B	20,000	30,000	50%	Well 1	Creek B	Creek 1	18,250	50	27,375	75
Town B	20,000	30,000	50%	Well 2	Creek B	Creek 1	3,650	10	5,475	15
Town B	20,000	30,000	50%	Well 3	Creek C	Creek 2	3,650	10	5,475	15
Town C	5,000	7,000	40%	Well 1	Creek C	Creek 2	1,825	5	2,555	7
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Example: Tier 1 Groundwater Stress Re-Calculation

Subwatershed	Groundwater Supply (m^3/yr)	Groundwater Reserve (m^3/yr)	Non-Permitted Takings (m^3/yr)	2020 Municipal (m^3/yr)	2020 Other (m^3/yr)	2051 Municipal (m^3/yr)	2020 Avg. Day % Stress	2051 Avg. Day % Stress
Creek A	1,000,000	100,000	500	31,025	5,475	39,603	**4%**	**5%**
Creek B	200,000	20,000	700	32,850	8,395	46,538	**23%**	**31%**
Creek C	100,000	10,000	365	5,475	4,745	8,030	**12%**	**15%**

Example: Tier 2 Groundwater Stress Re-Calculation

Subwatershed	Groundwater Supply (m^3/day)	Groundwater Reserve (m^3/day	Non-Permitted Takings (m^3/day)	2020 Municipal (m^3/day)	2020 Other (m^3/day)	2051 Municipal (m^3/day)	2020 Avg. Day % Stress	2051 Avg. Day % Stress
Creek 1	600	60	2	90	11	127.5	**19%**	**26%**
Creek 2	300	30	1	50	25	68	**28%**	**35%**

Additional Steps

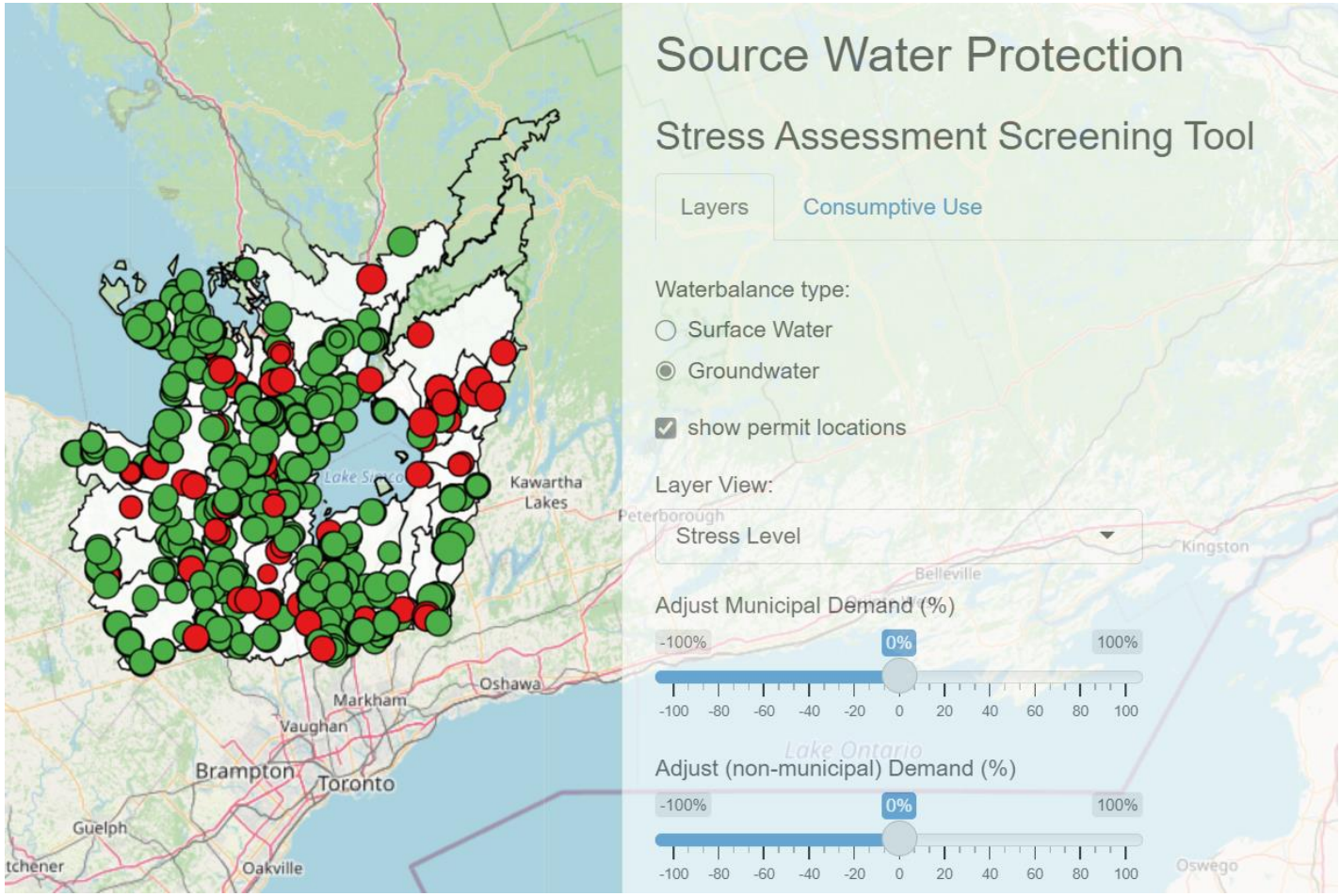
- Verification
  - Do the estimates generated make sense?
    - If not, double check work, further investigate recent changes in the drinking water systems, request further information
    - See what types of permitted water takings there are and if they are likely to be 100% consumptive or not
  - Are recently proposed wells/amendments in line with expected growth and expected per capita water use?
    - Example: Midhurst/Willow Creek

What to do with results – Tiers 1 and 2

- If a subwatershed was deemed low stress by their original water budget, and now the numbers suggest the subwatershed may be in the moderate or significant stress zone – consult a Qualified Person and consider the next Tier of water budget

- If a subwatershed does not seem to have moved into the moderate or significant stress zone, but the demand and stress are increasing over time, flag that subwatershed as a priority to revisit and to track demand from any S.34 amendments

Oak Ridges Moraine Groundwater Program: Screening Tool (in-development)



Overview of Tier 3 'Refined Numerical' Water Budgets

Tier 3 evaluates the risk that a community may not be able to meet it's current or planned water demands from a water source

Uses actual takings wherever possible

Several modelled risk scenarios are completed

Where risk scenarios identify a potential that wells will not be able to supply their allocated rates the Local Area is assigned a Moderate or Significant water quantity risk level and potential threats are identified.

Tier 3 review approach – demand, supply, and risk

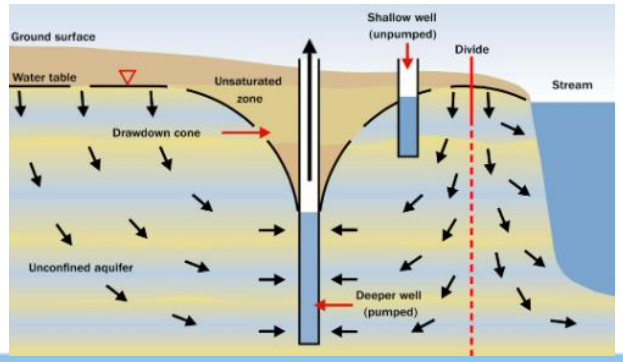
$$\text{Percent Water Demand} = \frac{Q_{DEMAND}}{Q_{SUPPLY} - Q_{RESERVE}} \times 100\%$$

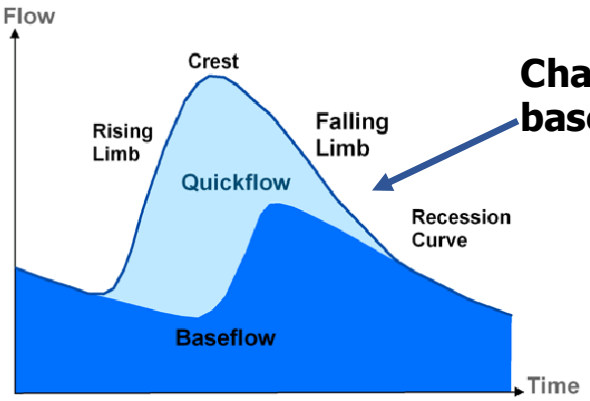
Pre-development

Post-development

Impervious area increases in SGRAs

Changes in safe additional drawdown





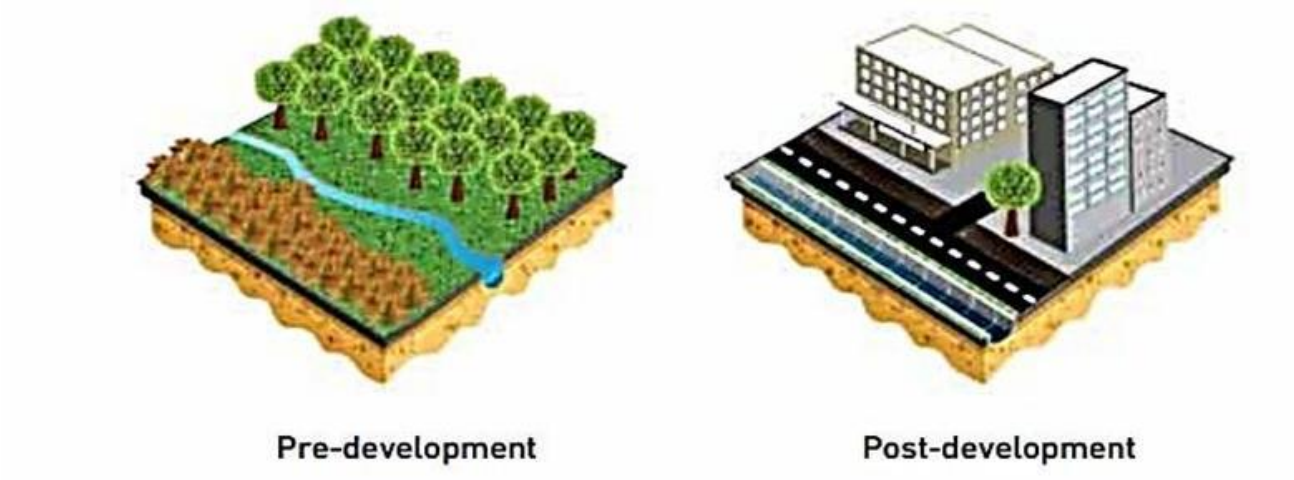
Changes in baseflow

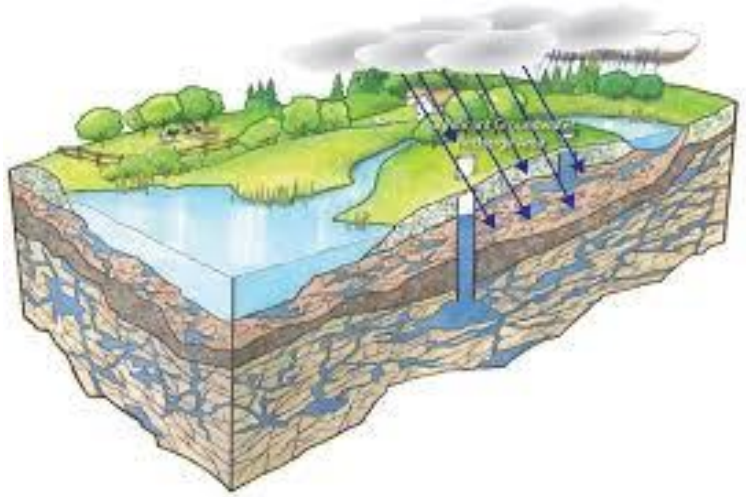
Percent Water Demand Check

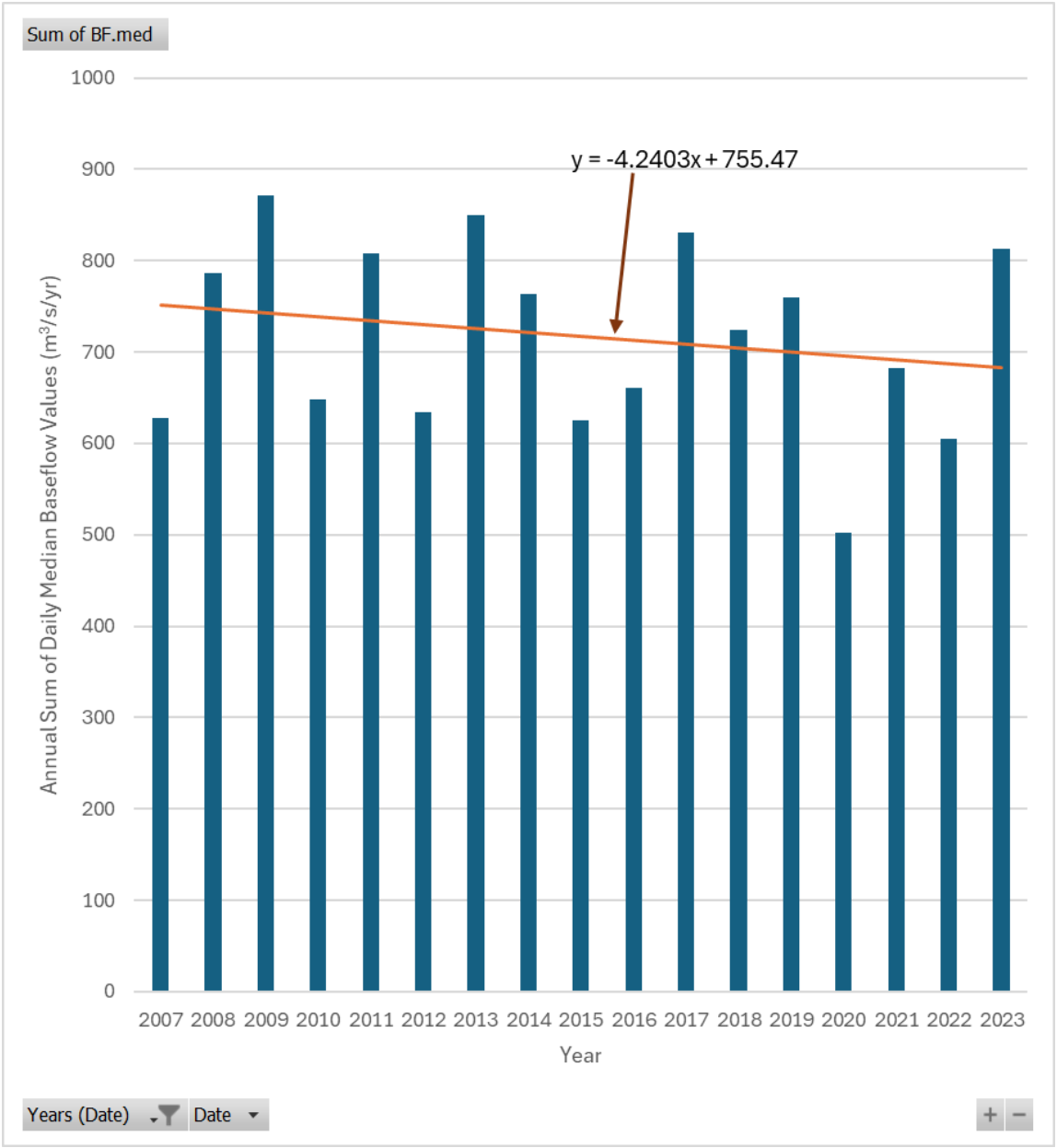
$$\text{Percent Water Demand} = \frac{Q_{DEMAND}}{Q_{SUPPLY} - Q_{RESERVE}} \times 100\%$$

- First step is the same as Tier 2 and uses the Tier 2 water balance equation
- In this case, we are expecting results to be over the Tier 2 stress thresholds because the subwatershed already required a Tier 3 study
- So, instead we can ask:
  - Has the average percent groundwater stress moved up a stress level (i.e. from moderate to significant)?
  - Has the average percent groundwater stress increased by 10% or mor?

Changes in impervious area, within significant groundwater recharge areas







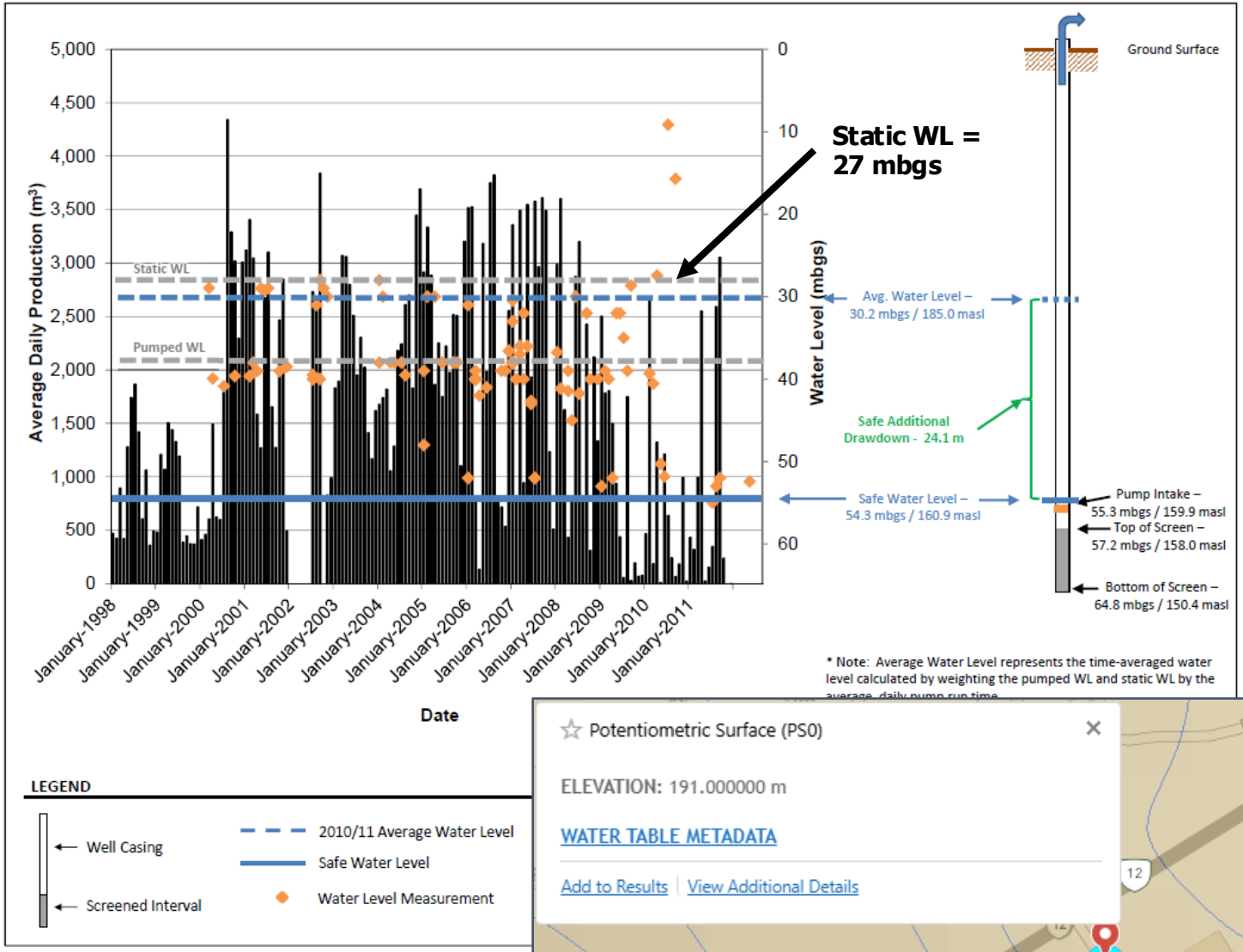
Changes in coldwater stream baseflow

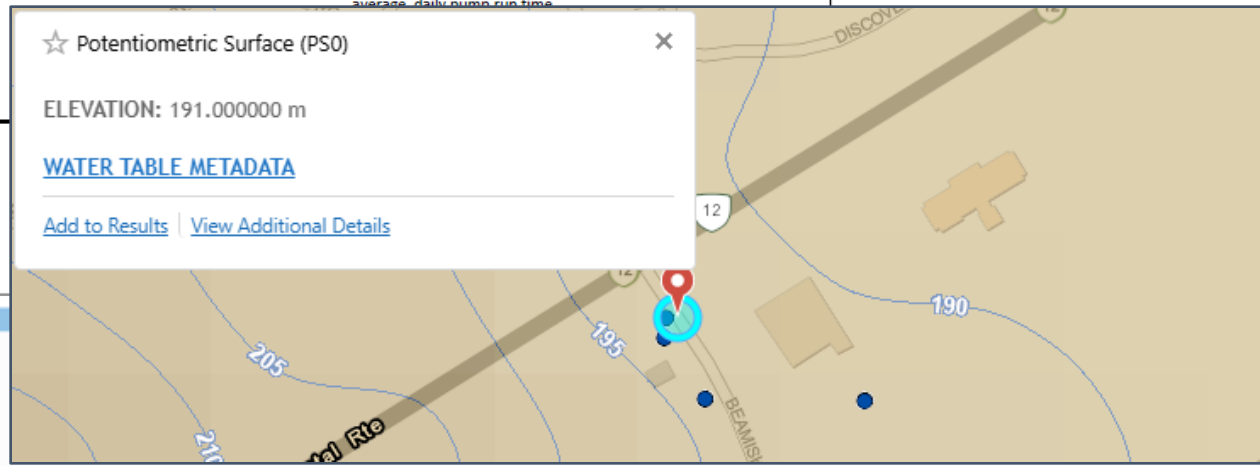
- Example: Willow Creek, Minesing
- Data obtained from the Oak Ridges Moraine Groundwater Program website

Changes in baseflow

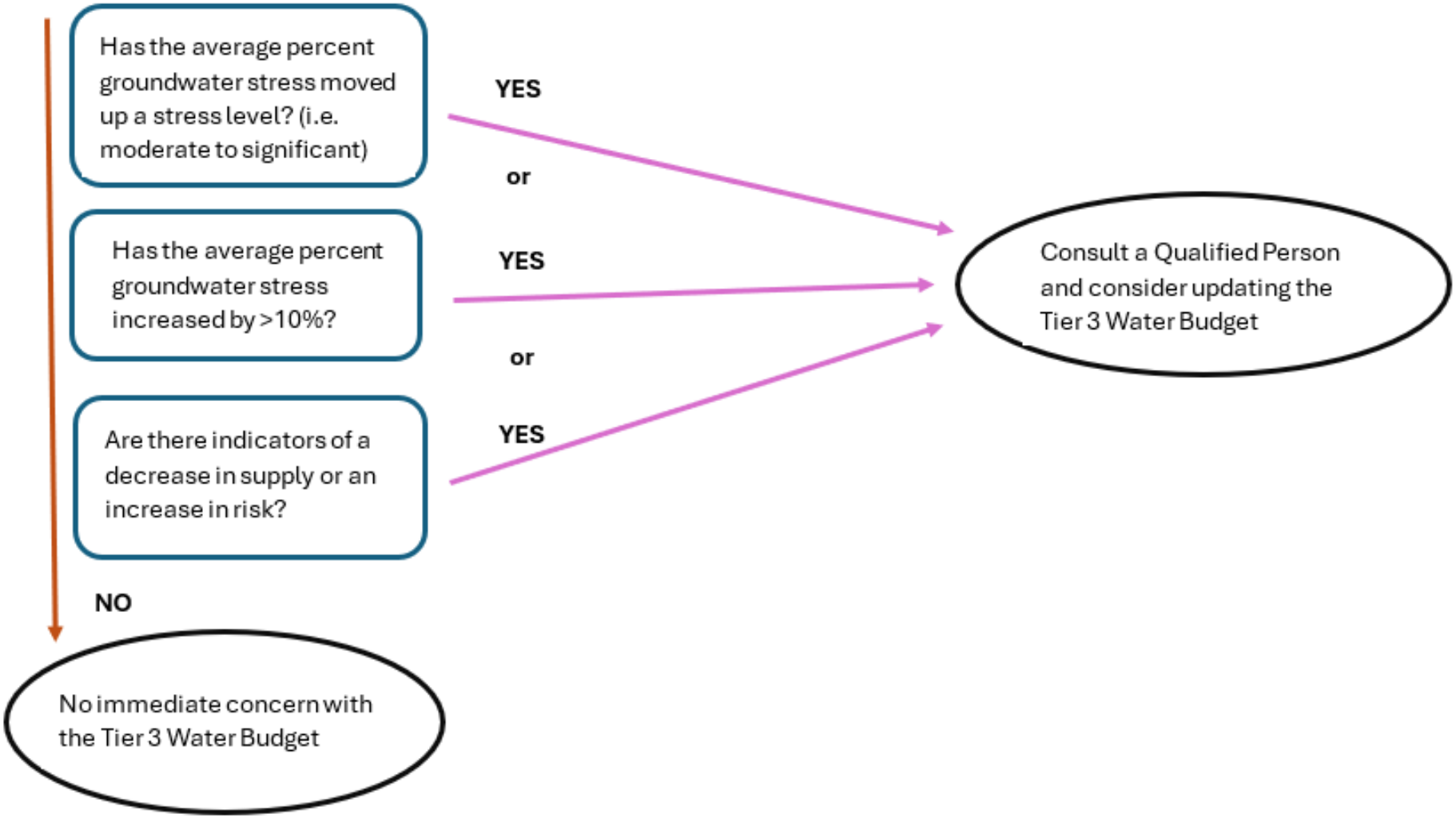
- Using Technical Rules 104 and 106 as a guide, the following results may be considered cause for concern (if the trend is statistically significant):
  - A 10% or greater decrease (moderate) in coldwater stream baseflow where the water budget did not predict one;
  - A 20% or greater decrease (significant) in coldwater stream baseflow where the water budget did not predict one; or
  - Or if already significant, then if there is even more of a decrease in coldwater stream baseflow than the water budget predicted.

Changes to safe additional drawdown

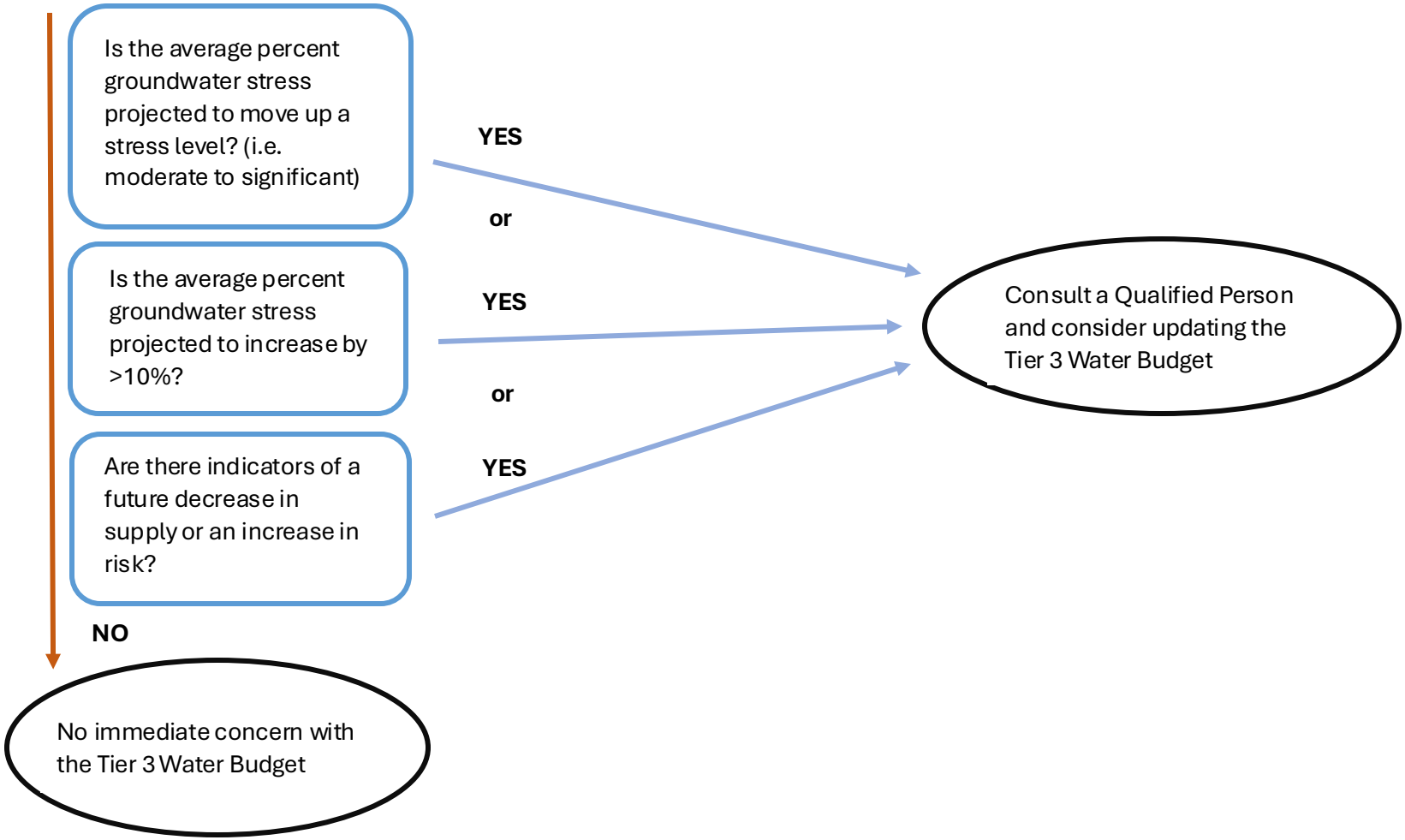




Tier 3 Review – Current Conditions



Tier 3 Review – Future Conditions



Summary of Results for SGBLS

- No new red flags emerged
- Some areas to watch over the next decade or two
- Many Tier 3 water budgets in the region have been or are in the process of being updated, independently of our review process

Some preliminary thoughts on climate change

Questions

- Is climate change affecting municipal water supply and demand?
- How will the climate change in the future?
- Which wells and drinking water systems are most vulnerable to water supply issues as a result of climate change?

Short-term weather vs. water takings: City of Barrie

Year	Groundwater Takings (MCM/day)	Total Water Takings (MCM/day)
2010	15,060	15,159
2011	11,875	14,863
2012	7,873	13,757
2013	7,649	13,873
2014	7,411	13,534
2015	7,632	13,754
2016	7,355	13,591
2017	7,245	13,155
2018	7,118	13,478
2019	6,817	13,288
2020	6,993	13,717

MCM = million cubic meters

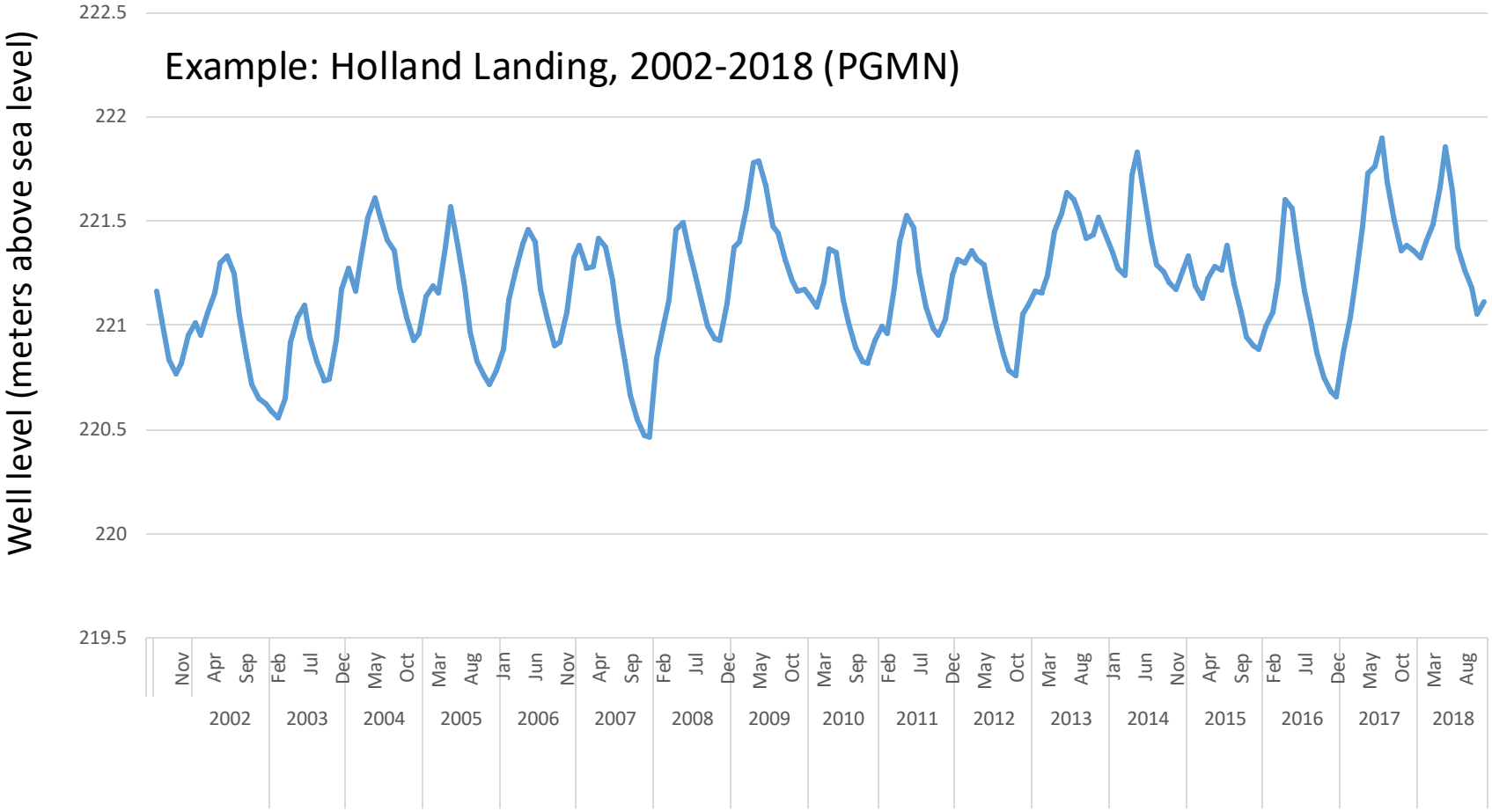
Hottest year

Coolest year

High precipitation year

Low precipitation year

Monitoring Well Levels Over Time



Future Climate Prediction for SPR

- More very hot days
- More flash flooding events
- Longer droughts
- Longer heat waves
- Less precipitation falling as snow
- More freeze thaw events
- Maybe slightly less precipitation in the south and slightly more to the north
- Less recharge as a result

Source: climateatlas.ca

Climate Risk Matrix

- Percent groundwater stress vs. well depth and aquifer confinement

- **Well depth and aquifer confinement**
  - **High** = <20m deep and/or unconfined
  - **Medium** = 20-50m deep and confined
  - **Low** = >50m deep and confined

- **Percent groundwater stress** (from water budgets)
  - **Significant** = average day >25%, or max. >50%
  - **Moderate** = average day >10%, or max. >25%
  - **Low** = average day <10%, max. <25%

Well Climate Vulnerability

	Aquifer / Screen Depth →	Unconfined **or** <20m	20-50m	>50m
WB% groundwater stress		**High**	**Medium**	**Low**
>25%	**Significant**	**10+** wells		
10-25%	**Moderate**		**100+** wells	
<10%	**Low**			**170+** wells

What can we do with this information

- Wells and drinking water systems with high vulnerability to climate change can be flagged to municipalities during their master planning processes

- Recommend any future water budgets including wells with high vulnerability to climate change include an updated climate future scenario

Next steps

- Continue to monitor demand through Section 34 Amendments
- Complete similar reviews on a 5-year cycle moving forward

Water is life. Protect Yours.

DRINKING WATER SOURCE PROTECTION
SOUTH GEORGIAN BAY LAKE SIMCOE REGION

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Thank you