South Georgian Bay Lake Simcoe Source Protection Region Source Protection Committee Meeting

Orangeville and Mono Tier Three Water Budget and Source Protection Update Study

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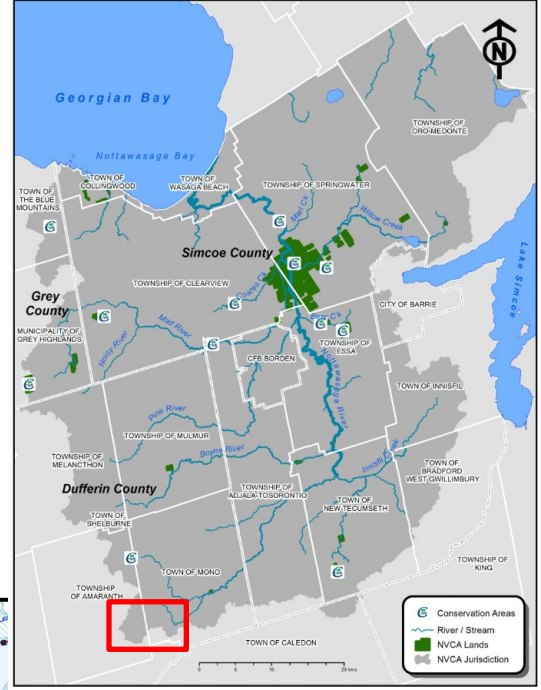
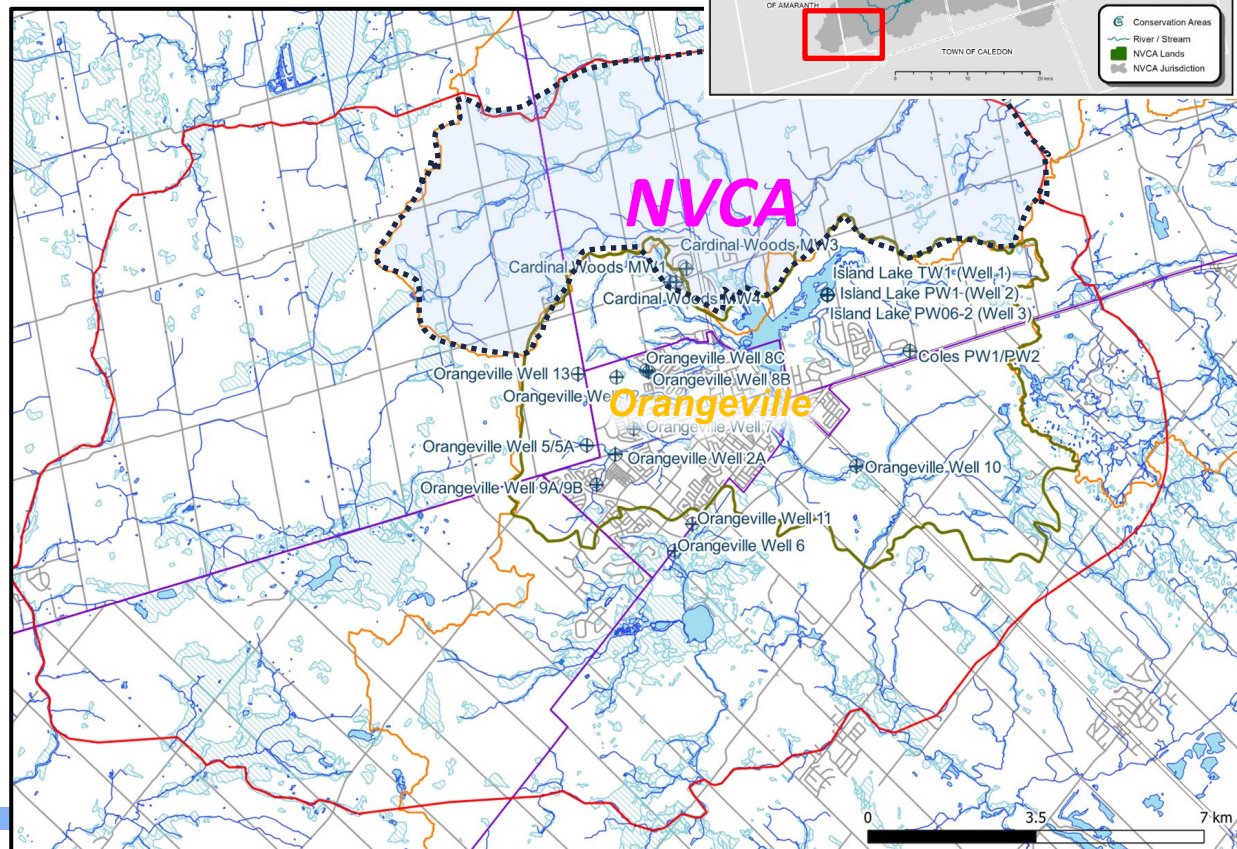
June 11; 1 to 4 pm

Aqua Insight

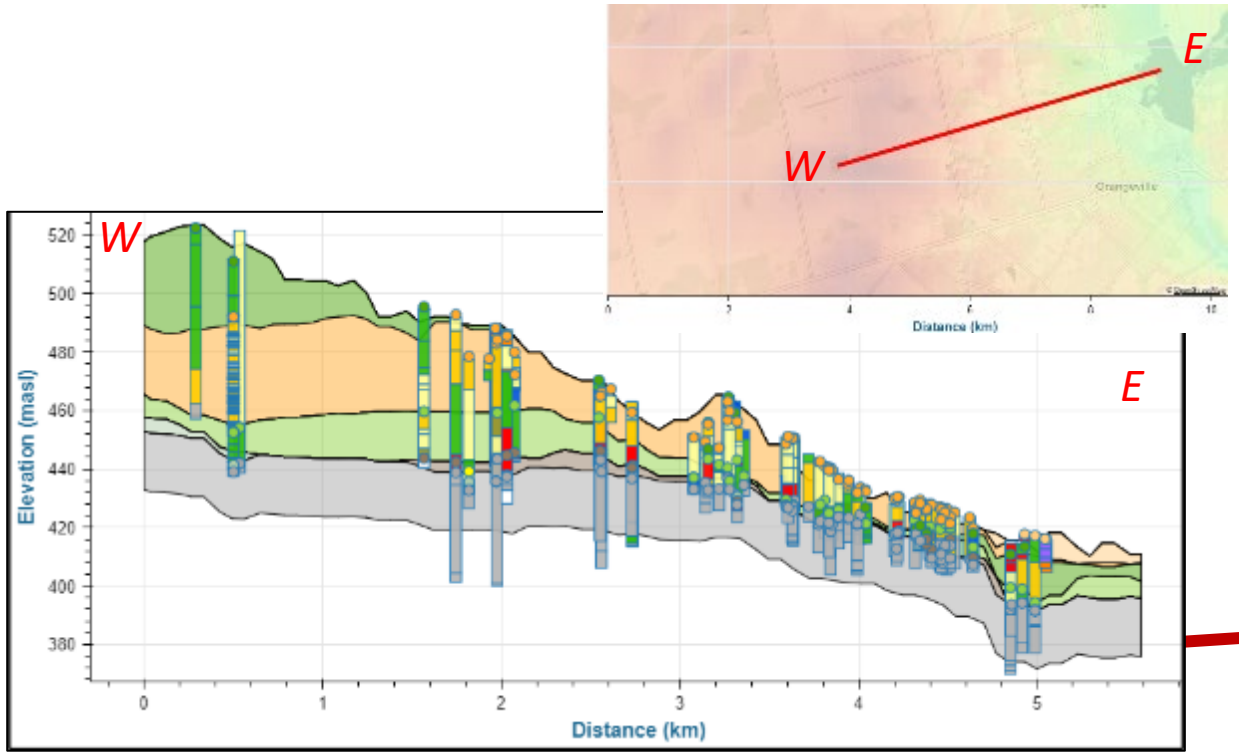
Project Objectives

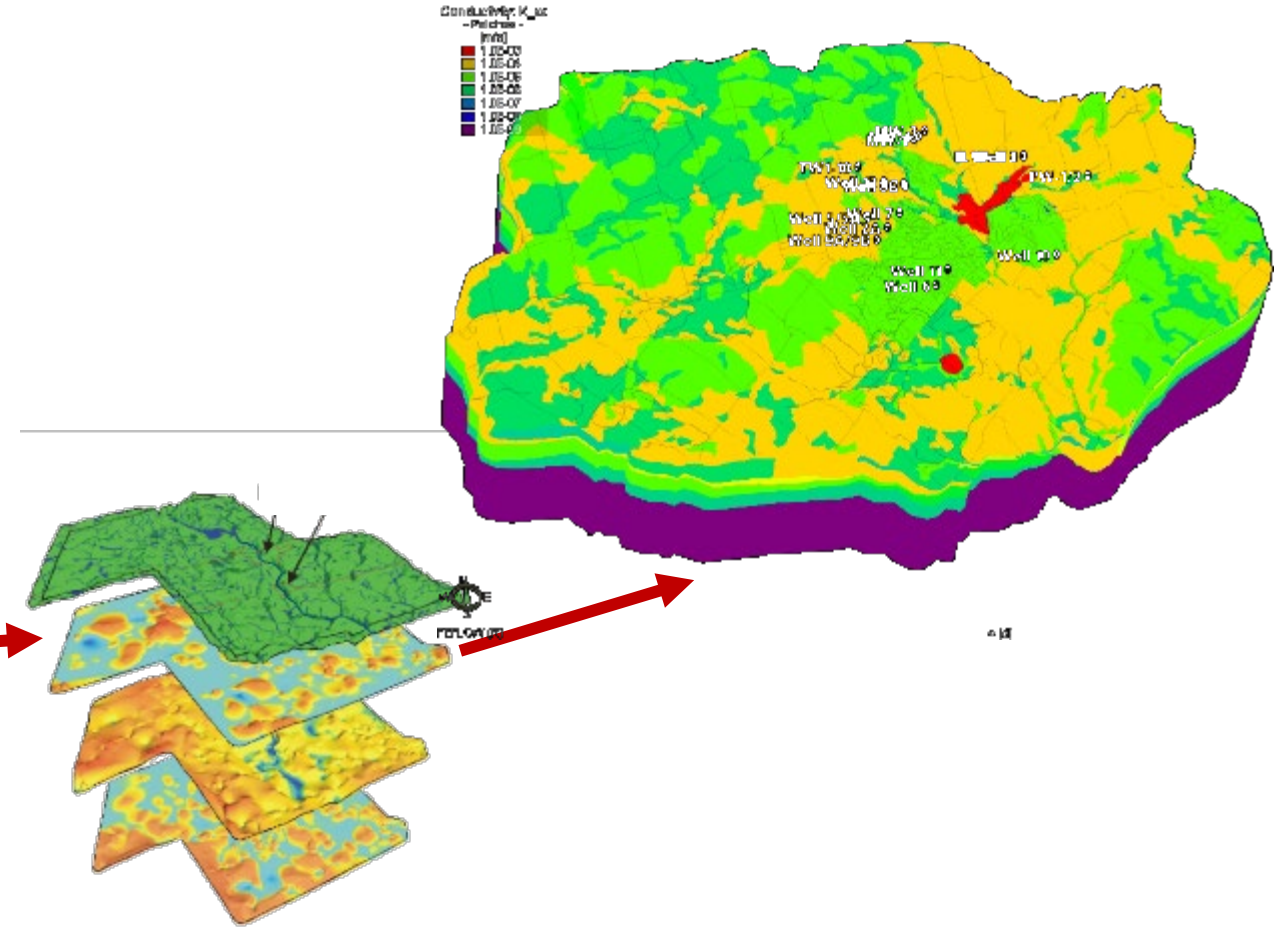
- Two studies completed
  - Water ***Quantity*** Study to protect/ safeguard the current and future **quantity** of water
  - Water ***Quality*** Study to protect/ safeguard the current and future **quality** of water
    - Wellhead Protection Area Delineation
    - Identification of water quality threats
  - Study began - March 2024





Groundwater Flow Model Development





Overburden Borehole Geology

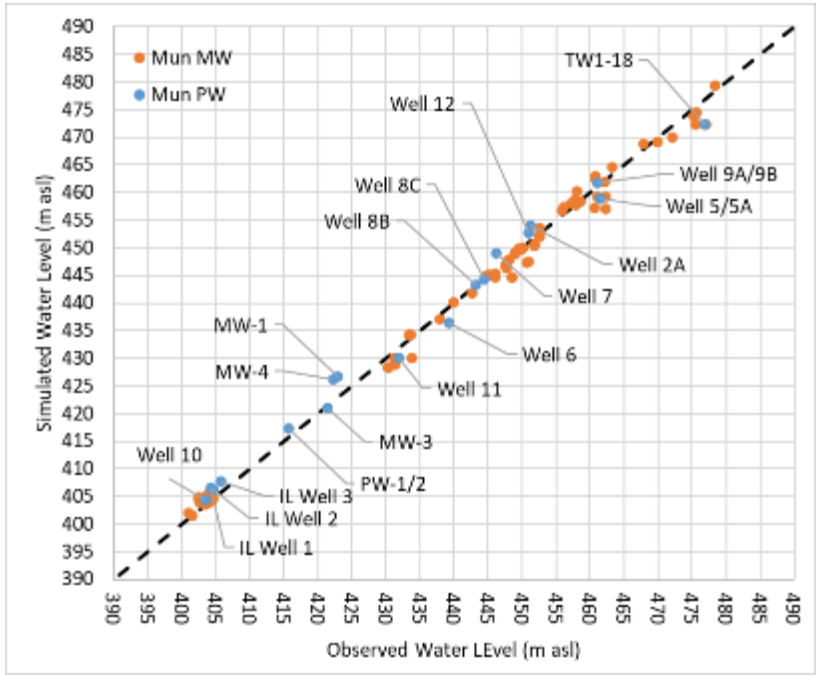
- Organics
- Till
- Sandy Till
- Clay
- Clay with Gravel
- Silt
- Gravel
- Sand and Gravel
- Sand
- Silty Sand
- Bedrock
- Shale
- Well Screen/ Open Hole

Conceptual Model → Hydrostratigraphic Model Layers → Numerical Groundwater Flow Model

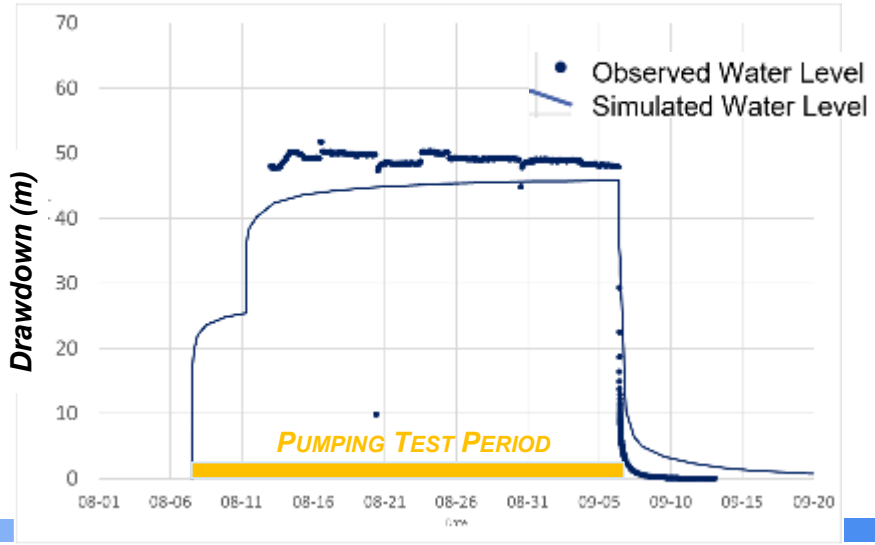
Model Calibration

- Iteratively changed model inputs until the simulated values were a close match to observed values
  - Static water levels
  - Time varying water levels collected during
    - 30-day pumping test at TW1-18 (Orangeville Well 13)
    - 3 well pumping test (Wells 8C, 12 and Pullen)
  - Baseflow estimates in streams
- Calibrated groundwater model was applied to
  - Conduct a Tier Three Water Budget Assessment
  - Delineate Wellhead Protection Areas
  - Delineate Issues Contributing Areas

High Quality Data: Municipal Wells and Monitoring Wells

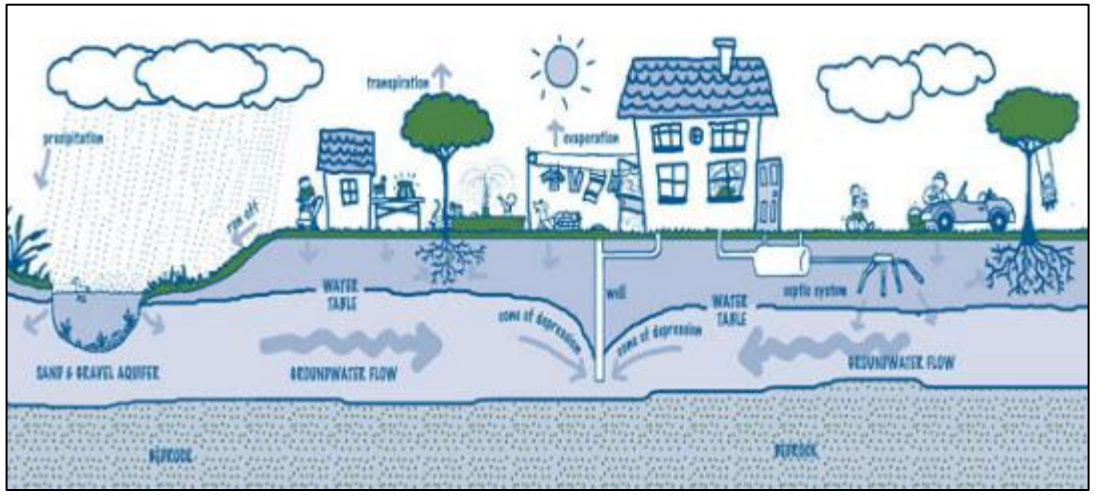


Calibration at TW1-18/ Well 13



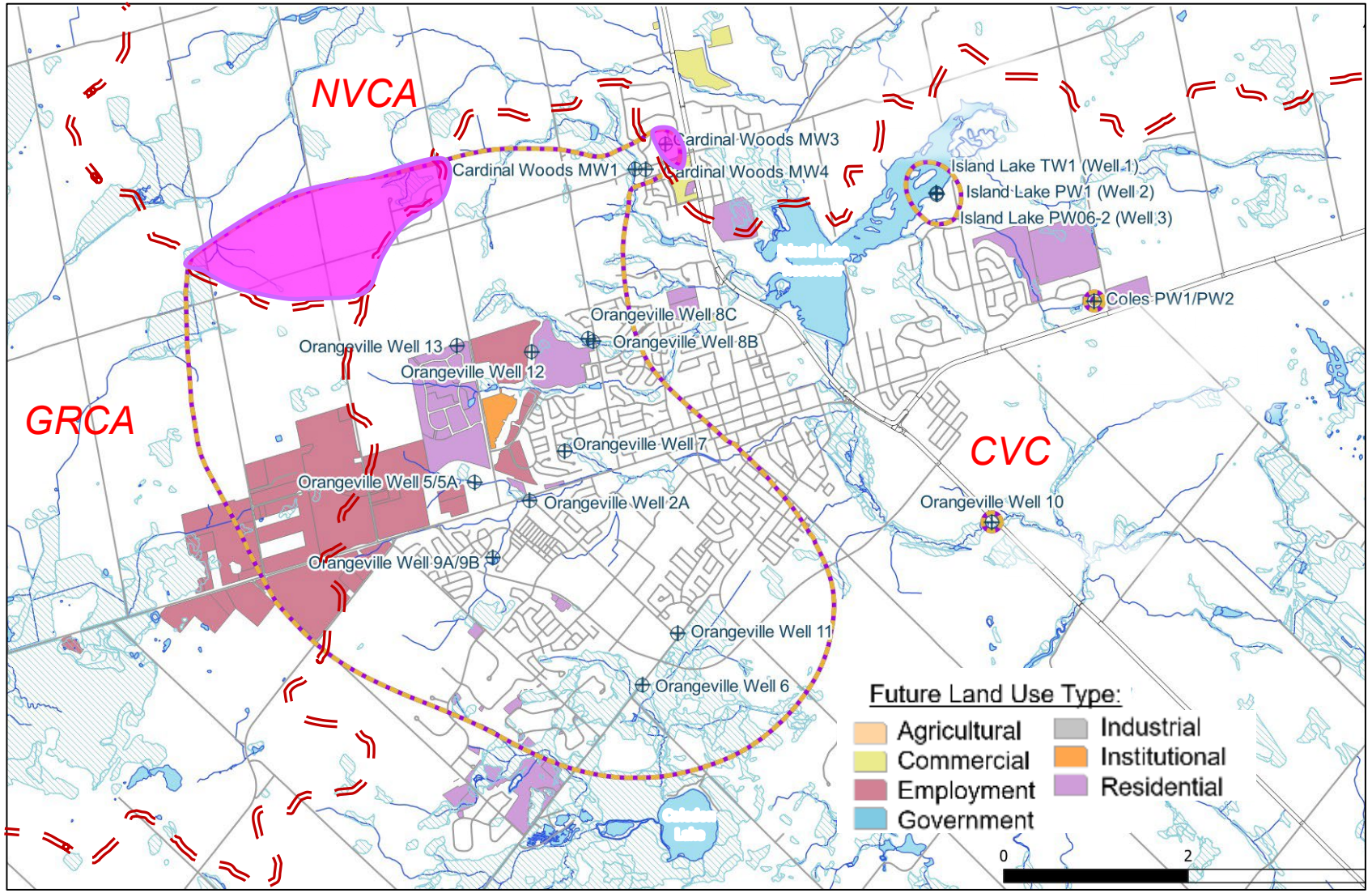
Tier Three Risk Assessment

- Will the water levels in municipal wells remain above operational thresholds:
  - Under **future municipal pumping** demand conditions?
    - What is the impact of increased municipal pumping on other water uses (i.e., coldwater streams, Provincially Significant Wetlands)?
  - Considering reductions in recharge due to **land use development**?
  - Under long-term **drought conditions**?
  - Under all the above stressors



Tier Three Assessment – Model Application

- Delineated vulnerable areas
  - WHPA-Q1 – drawdown cone for wells
  - WHPA-Q2 – drawdown cone + areas where development may impact supply wells
  - Local Area (WHPA-Q1 and WHPA-Q2)
- 4 Local Areas – A to D
- Run prescribed scenarios in the model to evaluate how the wells respond to the stressors



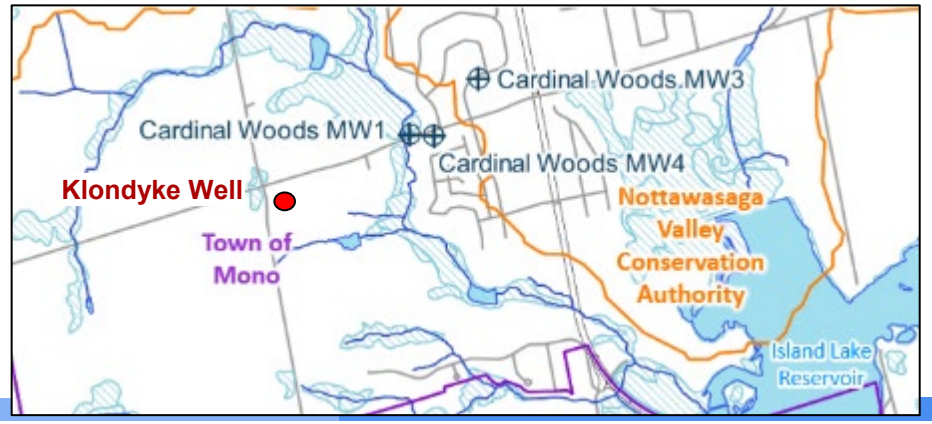
Tier Three Assessment – Orangeville Results

Wells predicted to not be able to meet future demand:

- Well 2A
  - Operates only a few months of the year due to permit restrictions;
  - Predicted to have issues meeting future municipal water demands, with and without drought
  - Future land use change will impact the water level at the well, but not as much as increased demand
- Wells 5/5A
  - Shallow unconfined to semi-confined wells; ~ 6.1 m of available drawdown at the wells
  - Future development upgradient of the wells on the Moraine = 2 m decline in water level
  - Future pumping = 4.5 m decline in water level
  - Long term drought = 2.5 m decline
- Wells 9A/9B and 11
  - Predicted challenges under future long-term drought

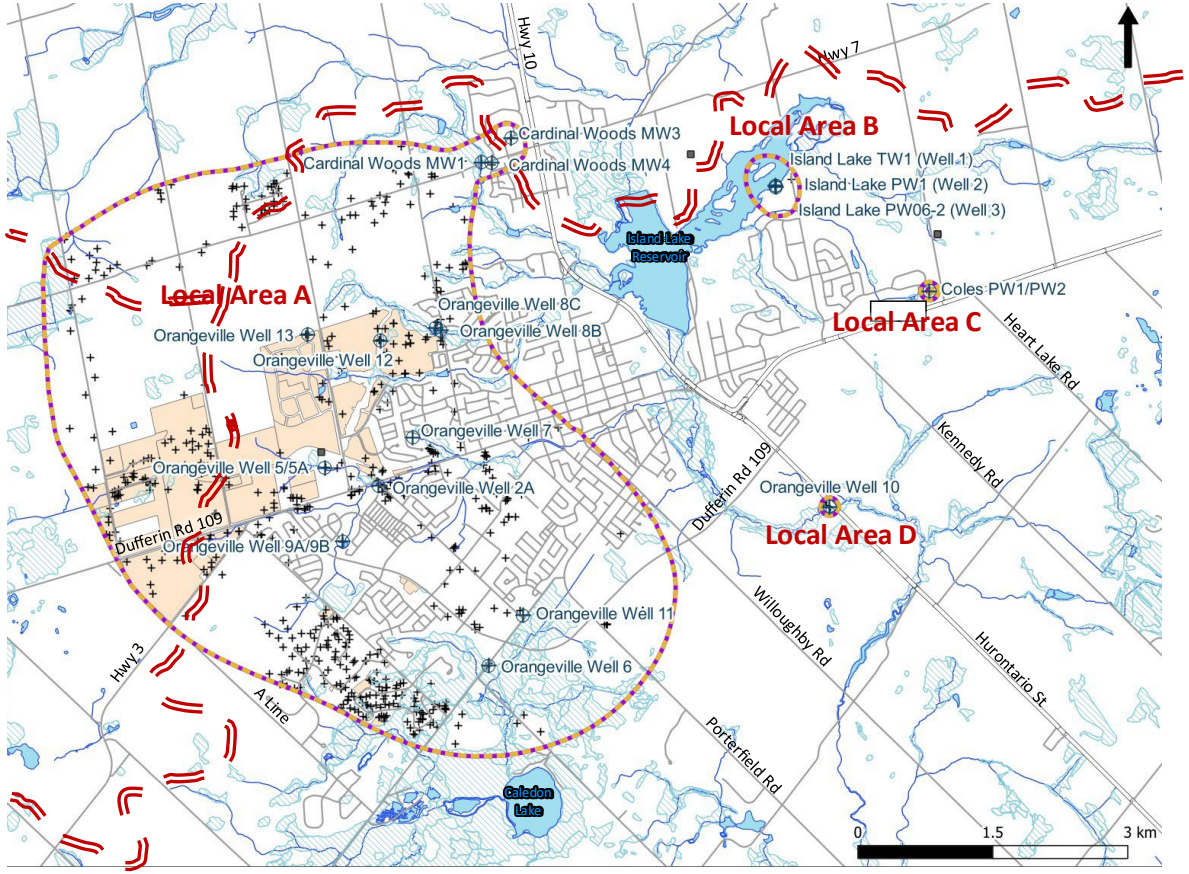
Tier Three Assessment – Mono Results

- The only wells that are predicted to not be able to meet future demand are those at the Cardinal Woods Well Field (including the future potential Klondyke Well):
  - Wells are predicted to be able to sustain future pumping only if the Klondyke Well is used to repartition the future rates amongst the wells under average annual conditions.
  - All Cardinal Woods Wells, and the Klondyke Well predicted to have challenges under the future drought scenario when wells pump at future rates.
  - Uncertainty Case 3 – bedrock hydraulic conductivity at the Cardinal Woods wells increased from 1×10^{-5} m/s to 5×10^{-5} m/s → no exceedances of available drawdown
  - Future model updates should include transient calibration of the model to the pumping test conducted at the Klondyke Well



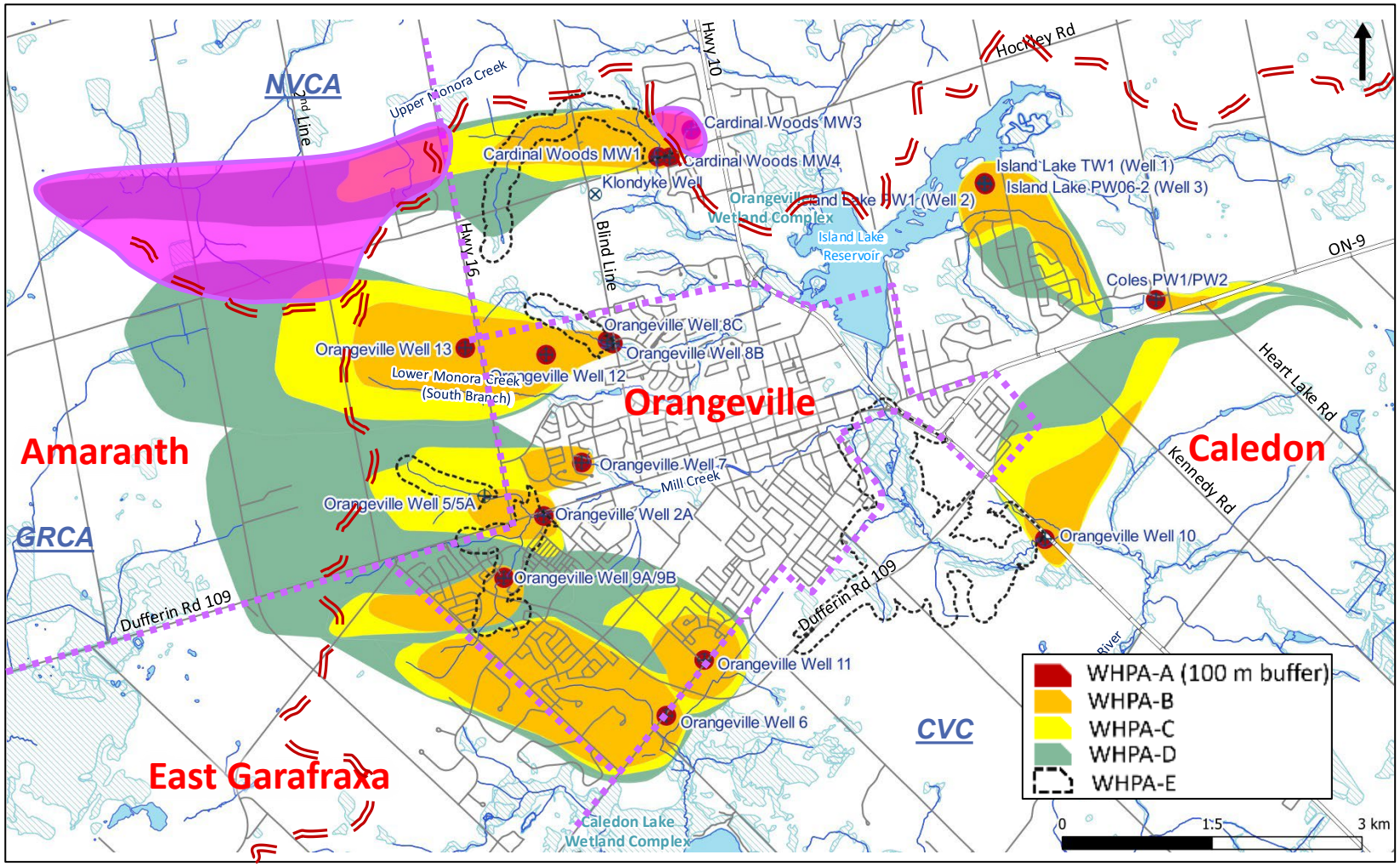
Tier Three Assessment – Risk Levels

- Local Area B, C and D = **Low** risk level
  - All wells were able to pump under the base case and uncertainty case model scenarios.
- Local Area A = **Significant** risk level
  - Orangeville and Mono wells unable to pump in several risk asst. scenarios.
  - Impact on coldwater streams (Monora Creek) was >20% in the base case and uncertainty cases
- Significant water quantity threats - pumping wells, and activities that reduce groundwater recharge within Local Area A



WHPA Delineation

- WHPAs delineated using calibrated groundwater flow model
  - WHPA-A: 100 m radius around the well
  - WHPA-B: 2-year time of travel (TOT; excl WHPA-A)
  - WHPA-C: 2- to 5-year TOT
  - WHPA-D: 5- to 25-year TOT
- Water pumped by Orangeville and Mono is sourced from within and outside municipal boundaries



Aquifer Vulnerability

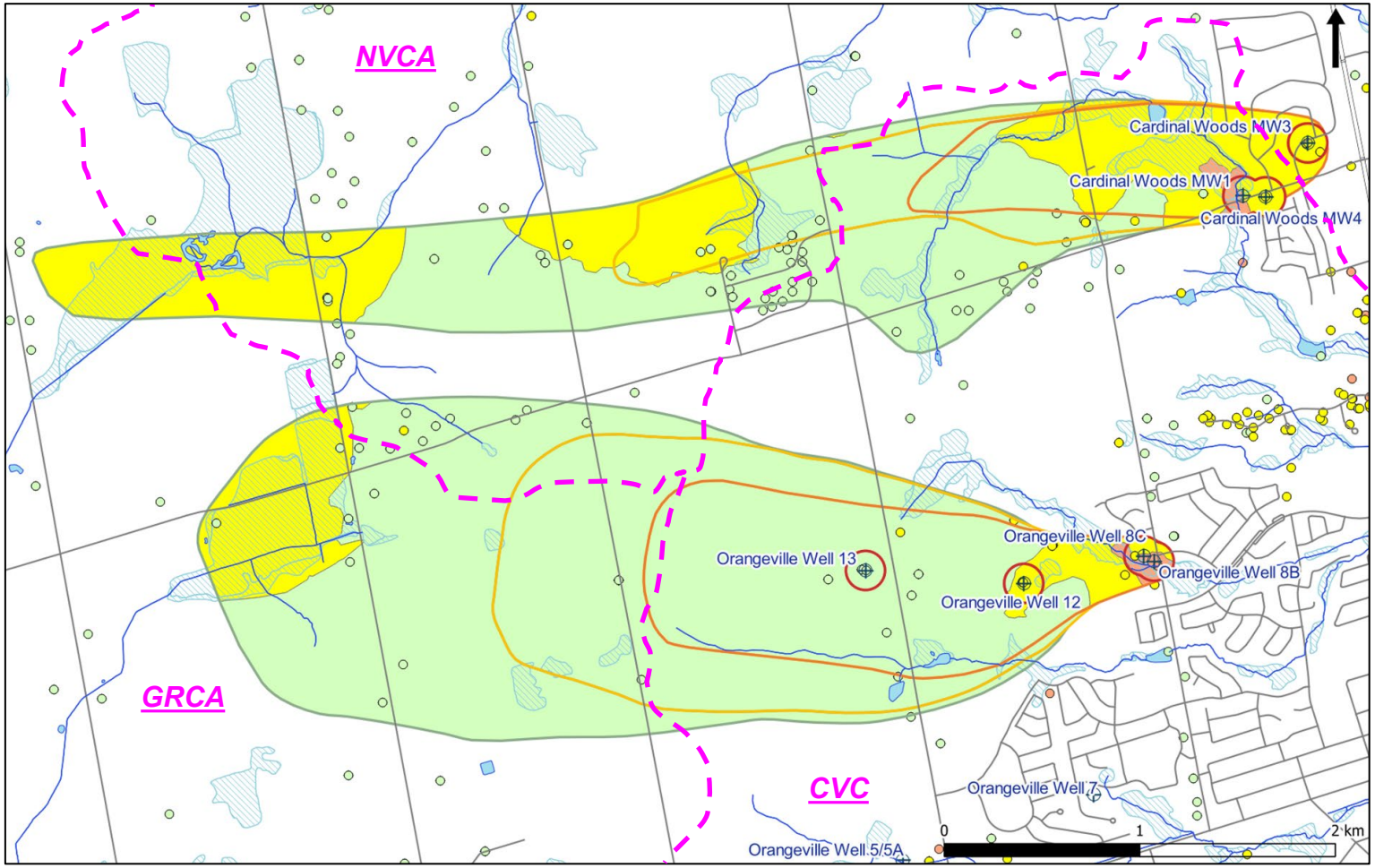
- Identify areas in the WHPAs that are more, or less, vulnerable to surficial sources of contamination
- Modified Intrinsic Susceptibility Index method
  - ISI calculations at points using groundwater flow model layers and vertical K values
  - Calculated vulnerability to top of each production aquifer
  - Classified vulnerability as High, Moderate, or Low Vulnerability

Production Aquifer	Wells
Upper Overburden Aquifer	Wells 5/5A
Lower Overburden Aquifer	Well 10, Coles and Island Lake Wells
Bedrock Aquifer	Wells 2A, 6, 7, 8B, 8C, 9A, 9B, 11, 12, 13, **Cardinal Woods Wells**

Aquifer Vulnerability Results

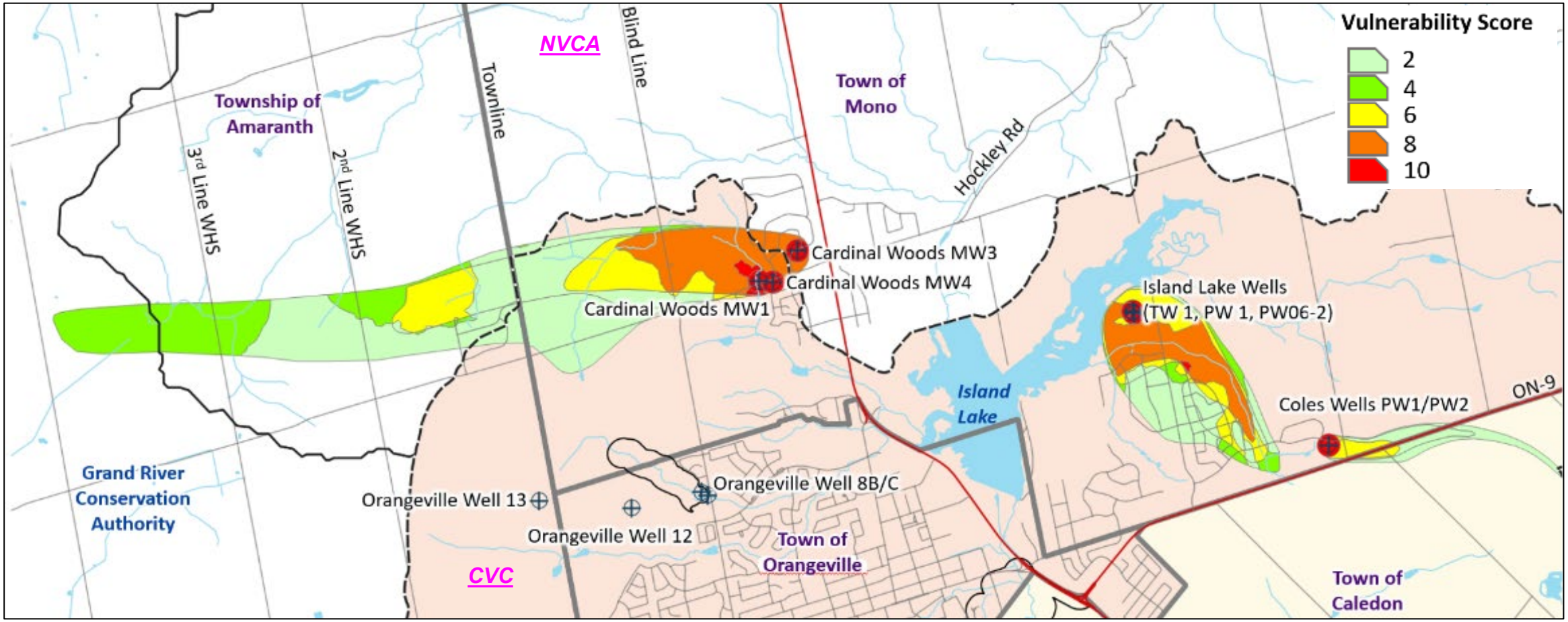
- Considered transport pathways (quarries, clusters of boreholes, stormwater ponds)

Bedrock

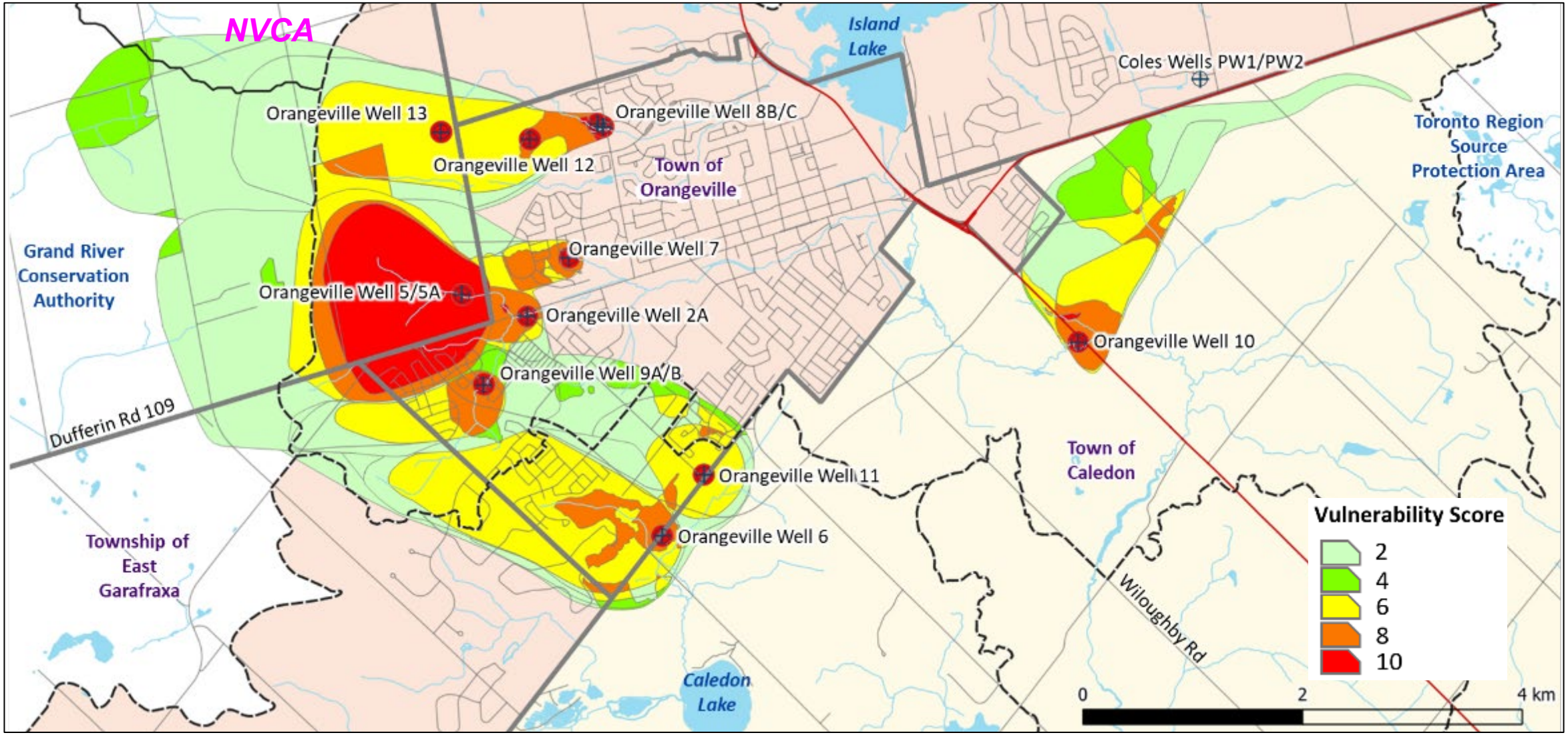


Aquifer Vulnerability- Vulnerability Scores- Mono

- Vulnerability scores (2 to 10) based on the vulnerability category and the WHPA area (WHPA-A to -D)



Aquifer Vulnerability- Vulnerability Scores- Orangeville

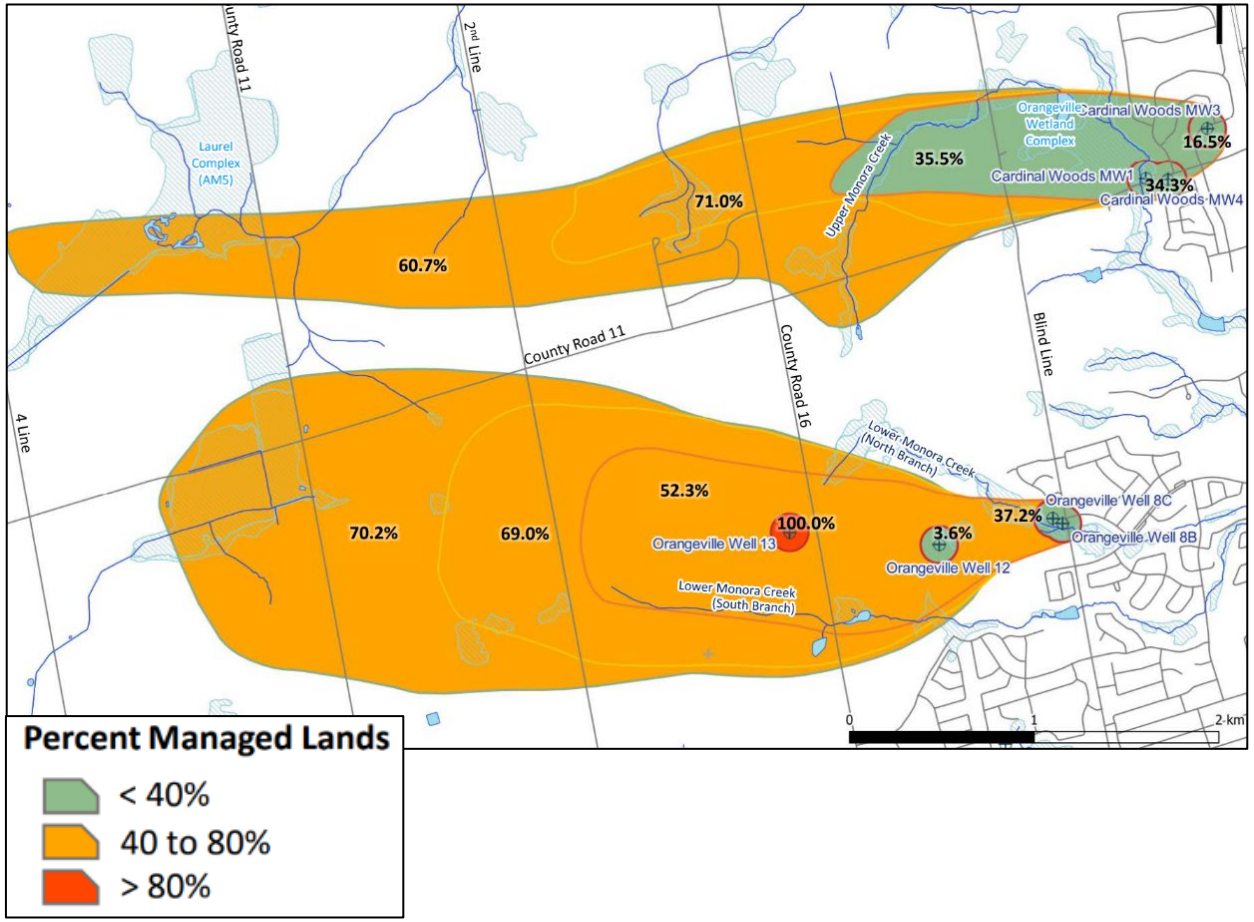


Non-Point Source Threats

- Evaluated non-point source threats within WHPAs;
  - Managed Lands (fertilizer application)
  - Livestock Density (storage, generation, and application of agricultural source material)
  - Impervious Cover (road salt application)
- Also identified potential point source threats

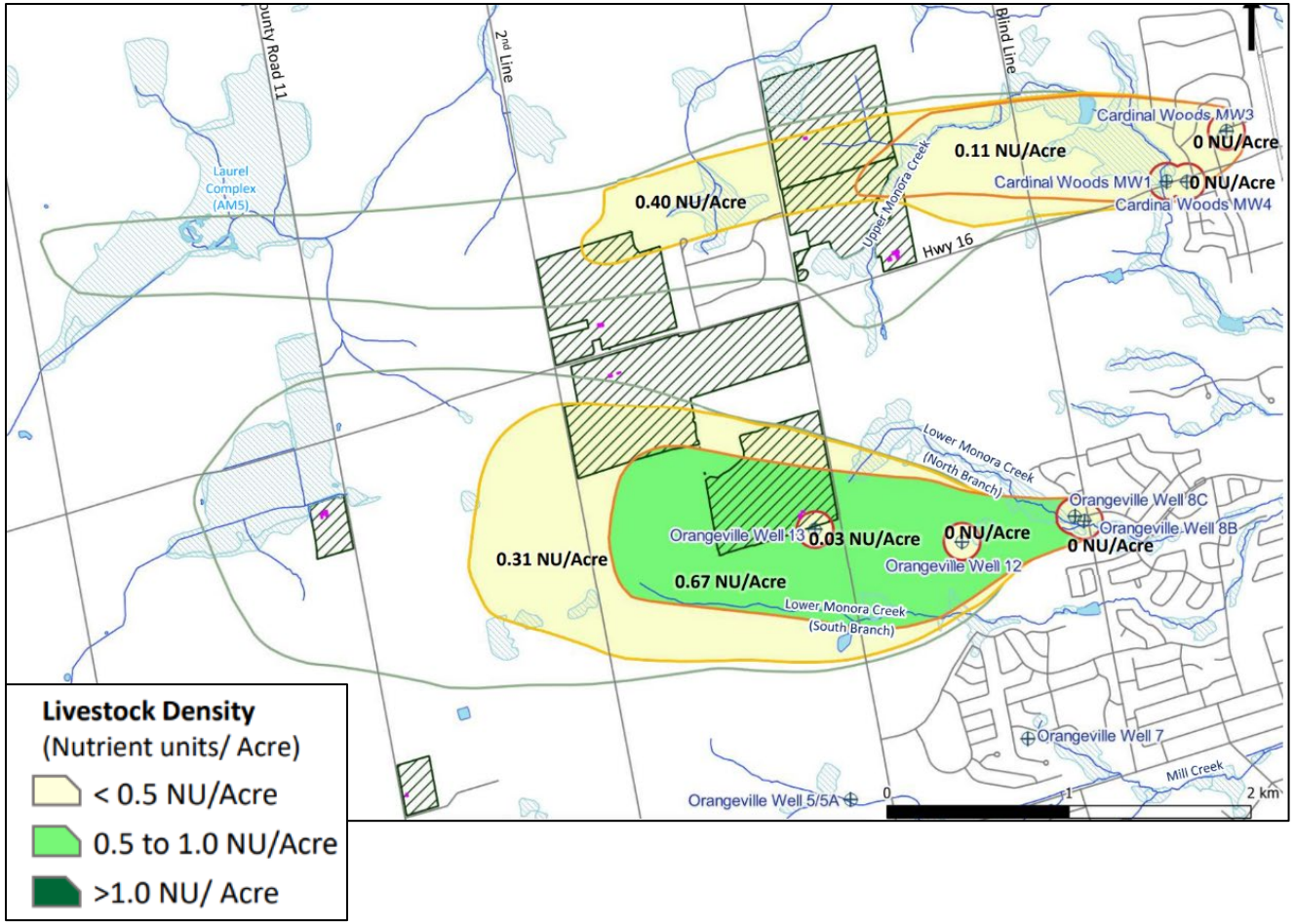
Managed Lands

- Methodology
  - Mapped areas where agricultural and non-agricultural source material may be applied
  - estimated and mapped total percentage Managed Land within the WHPA-A and –B
- Results
  - Predominately 40 to 80% range
  - exceed 80% threshold in only 2 WHPA areas outside Nottawasaga Valley Conservation Authority



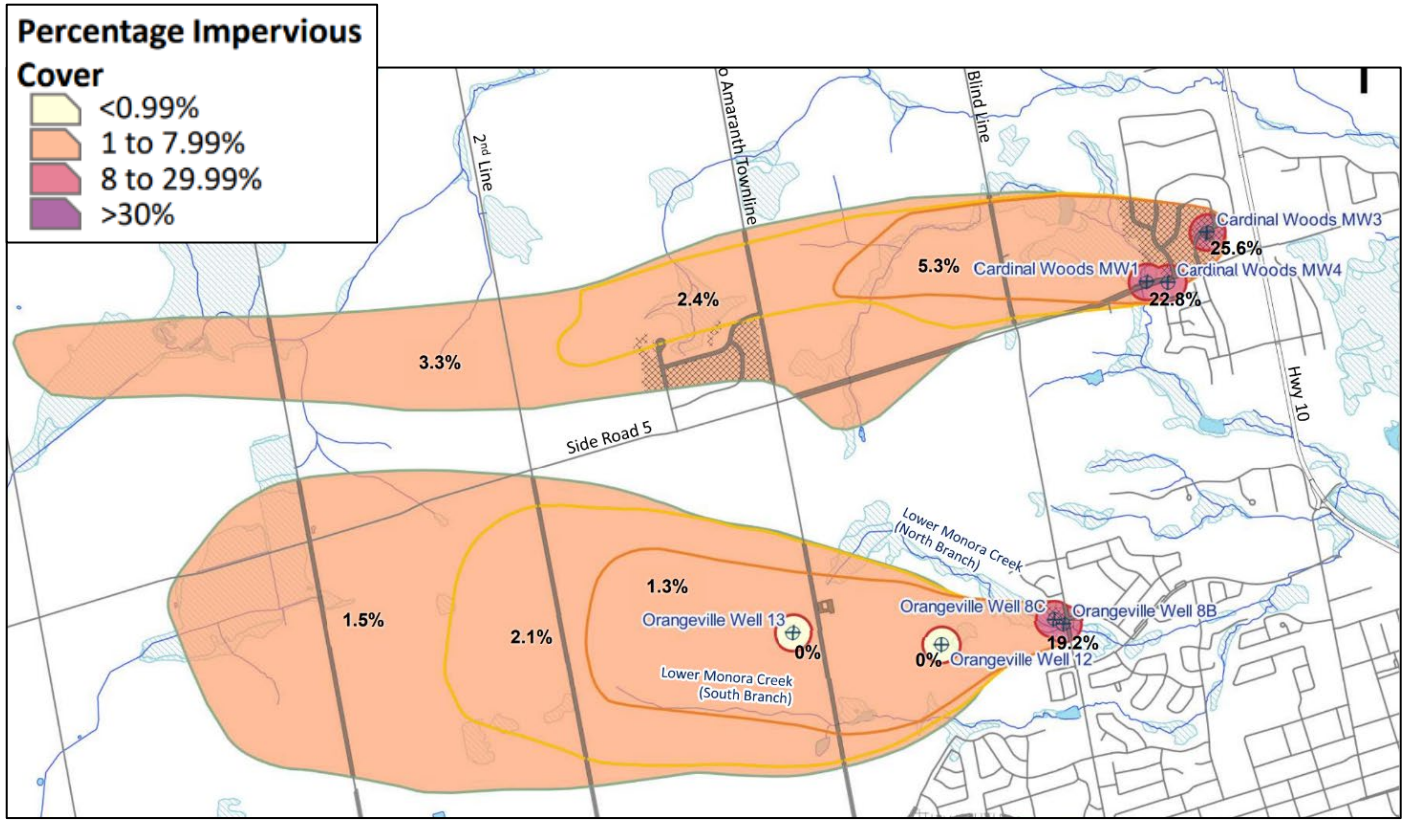
Livestock Density

- Methodology
  - Areas with vulnerability score > or = 6 (WHPA-A, -B)
  - estimated nutrient units based on size of barns + interpreted livestock type
  - Calculated nutrient units per acre of managed lands
- Results
  - Predominately low - few barns with livestock and no areas with > 1.0 Nutrient Units per Acre



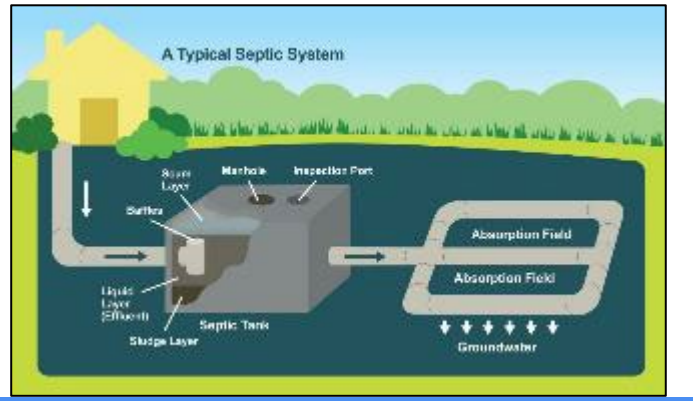
Impervious Cover

- Mapped the percentage of impervious surfaces in WHPAs
- Results
  - Most WHPAs are a mix of urban and rural land uses – most range from 8 to 30% impervious cover.
  - > 30% impervious cover
    - Coles WHPA-A and –B
    - Well 11 WHPA-A, -B and -C
    - Wells 7 WHPA-A and –B
    - Well 2A WHPA-A



Significant Drinking Water Threats

- Total of 3,391 water quality threats enumerated; 196 new threats that were not previously identified
  - 86% are Road Salt Application
  - 7% are Snow Storage and Handling of Road Salt
  - 4% are SWM Ponds, Septic systems, etc.
  - 91% of all threats are in Orangeville
- **There are 0 new threats in the Nottawasaga Valley Conservation Authority area / Source Protection Region**
- Draft list of threats- count will be refined through site visits by the local Risk Management Officials



Summary

- The source of municipal drinking water supplies does not align with municipal boundaries. The water supply is a shared groundwater resource that crosses municipal boundaries between Orangeville, Mono, Caledon, Amaranth and East Garafraxa
- Orangeville and Mono have water ***quantity*** challenges
  - need to preserve the groundwater recharge rates in the WHPA-Q to maintain the water levels in the municipal supply aquifers and long-term water supply for the Towns
- Orangeville has water ***quality*** challenges – some wells have elevated sodium and chloride concentrations
  - need to use salt wisely and manage water quality threats in the WHPAs


QUESTIONS