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Township of Tiny Georgian Sands and Lafontaine Water Supply System

Wellhead Protection Area Modelling and Vulnerability Scoring Updates

May 14, 2026

SLR

1. Georgian Sands and Lafontaine Water Supply System Background

Well	Permitted Rate (m^3/day)	Source Aquifer
Well 1-1	328	A1/A2
Well 2-1	982	A1/A2
Well 2-2	524	A1/A2
Well 14-1	1,310	A1/A2
Well 23-1	648	A2
Well 23-4	393	A2
Total	**4,186**	

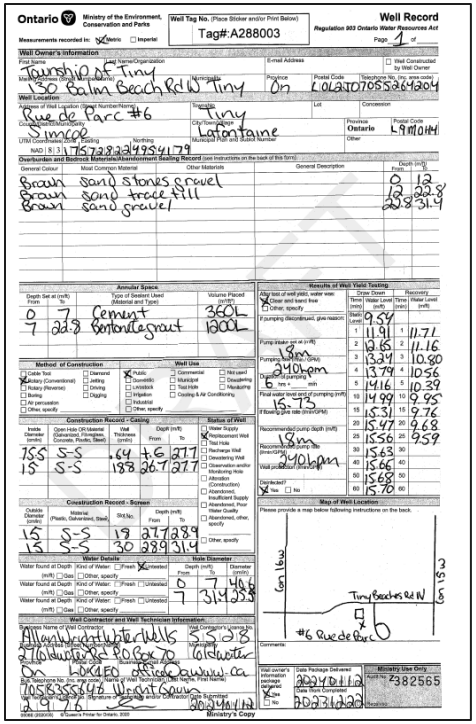
1. Georgian Sands and Lafontaine Water Supply System Background

- Water supply system comprised of four wells in Georgian Sands and two wells in Lafontaine.
- Township of Tiny (Township) completed project in 2013 to treat nitrate-impacted water at Lafontaine via dilution water from Georgian Sands. As such, two systems were connected, operating as “Lafontaine Water System”.
- Licensed under the Ministry of the Environment, Conservation & Parks (“Ministry”) Permit To Take Water (PTTW) 8620-CLEQ8W.
  - Wells authorized to operate concurrently, 365 days a year, 24 hours a day.
  - System permitted to withdraw a total of approximately 4,186 m^3/day.
- Total water taking in 2024 was approximately 376,000 m^3, average of 1,030 m^3/day, or ~25% of permitted water taking.

1. Georgian Sands and Lafontaine Water Supply System Background

- Georgian Sands Well 1-1 constructed 1967.
- By 2020, performance was deteriorating and rehabilitation was unsuccessful.
- Georgian Sands Well 14-2 was constructed in 2023 to replace Well 1-1.
- Wells are 12 m apart and screened at a similar depth within the same aquifer.
- Variable rate pumping test was conducted on Well 14-2 (Burnside, 2024). While specific capacity was reported, transmissivity was not determined. Burnside indicated that Well 14-2 shared similar aquifer properties to Well 1-1.
- Well 14-2 has yet to come online pending agency / permit approvals.

Image used with permission from Township of Tiny.



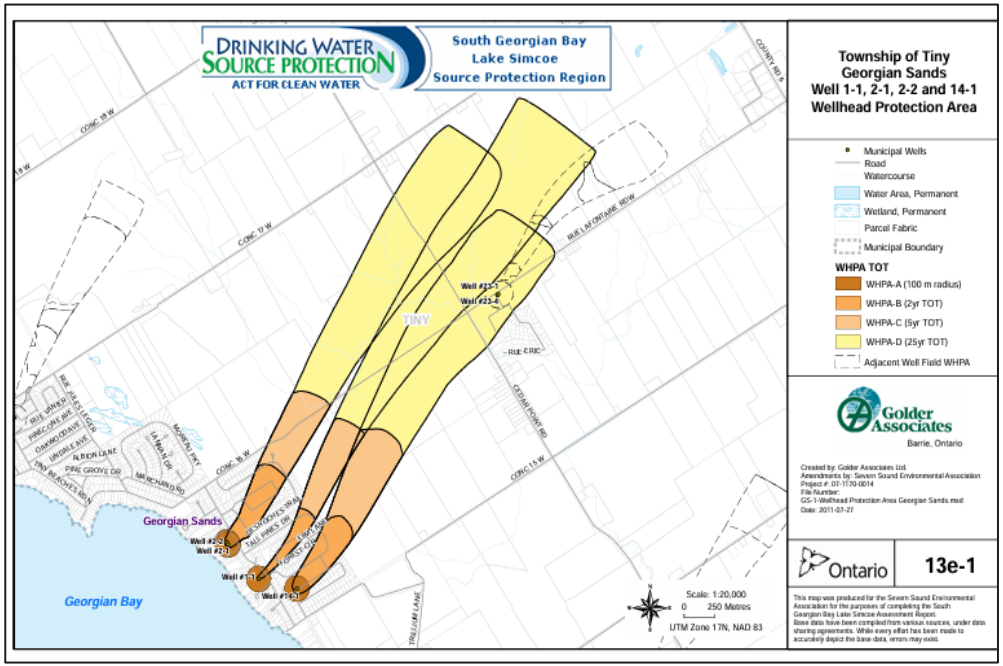
2. Modelling Objectives

- Updated Well Head Protection Area (WHPA) modelling and vulnerability scoring undertaken by SLR in 2024 – 2025 was prompted as a result of the new municipal well at Georgian Sands (new Well 14-2 to replace old Well 1-1) and increasing water demand relative to previous source water protection modelling work.
- The modelling results are intended to assist the Township in deciding future pumping rate allotments at municipal wells and support an application to Lake Simcoe Region Conservation Authority and the Ministry to amend the South Georgian Bay Lake Simcoe Source Protection Plan (Section 34 Update).

3. Approved Assessment Report

- Township's currently approved WHPAs, vulnerability scoring, transport pathways, issues evaluation and drinking water threats described in *Approved Assessment Report: Severn Sound Source Protection Area (*South Georgian Bay Lake Simcoe Source Protection Committee, 2015).

- First approved in 2015, Assessment Report was most recently amended in 2025.



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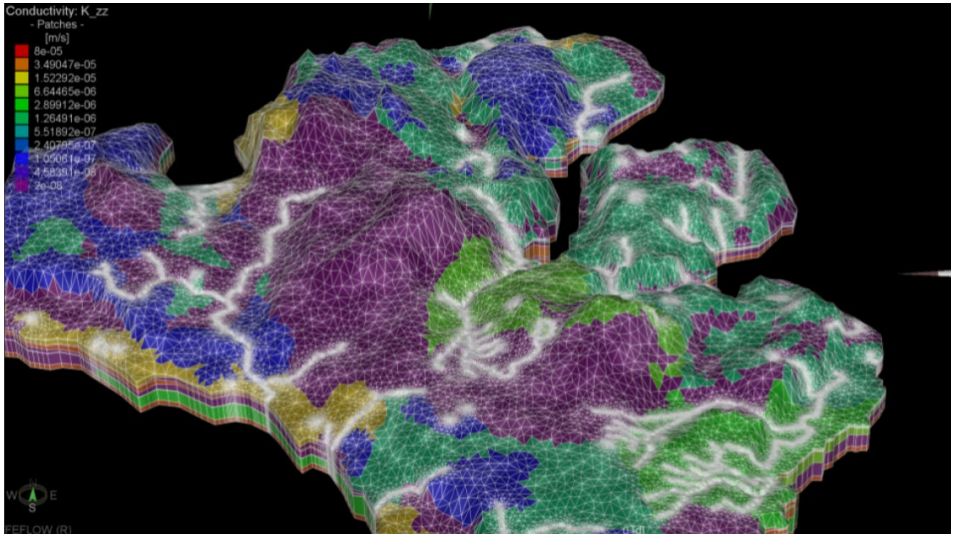
3. Approved Assessment Report

- Township water supply systems have undergone several iterations of modelling in support of source water protection initiatives, including:
  - 2007 – Tiny West and East Models: Hydrostratigraphic surfaces and hydraulic conductivity distributions are developed and paired with recharge estimates to construct the 3D MODFLOW Tiny West and East models (Golder 2007). WHPAs are later adopted within the Assessment Report. Pumping rates based on forecasted community build-out plans from the early 2000s.
  - 2010 – South Georgian Bay Lake Simcoe Tier 2 Model: Hydrostratigraphic surfaces and inputs from Tiny West and East models used in development of coupled FEFLOW groundwater + HSPF surface water Tier 2 model (Aqua Resource and Golder 2010; Nottawasaga Valley Conservation Authority, 2010). Model used to assess sustainability of water supplies within Severn Sound and other subwatersheds. Includes significant refinements to recharge distribution.
  - 2014 – Midland and Penetanguishene Tier 3 Model: "Cut-out" of Tier 2 model is used to construct coupled FEFLOW groundwater + MIKE-SHE surface water Midland and Penetanguishene Tier 3 (MPT3-2014) model (Golder 2014). Original focus of model is water budgeting and water quantity risk assessment for Midland, Penetanguishene, and Whip-Poor-Will; however, Tiny peninsula and its municipal wells are included in the model. MPT3-2014 model carried forward much of the 2007 and 2010 work, but with refinements to recharge, hydraulic conductivity, storage, and boundary conditions.
- Based on the modelling developments to-date, the steady-state **MPT3-2014 FEFLOW model** is considered the most appropriate model for updating WHPAs, aquifer vulnerability, and vulnerability scoring for Township of Tiny municipal water supply systems, including Georgian Sands and Lafontaine.

4. Model Updates

- SLR obtained MPT3-2014 model from its owner, Lake Simcoe Region Conservation Authority, via the Oak Ridges Moraine Groundwater Program.
- Several checks undertaken to confirm MPT3-2014 model as-received aligned with previous reporting. Layering, hydraulic conductivity, recharge, and pumping rates were confirmed as correct.
- MPT3-2014 model was run using the 2007 WHPA rates with resultant WHPAs compared to those in the Assessment Report. WHPAs were similar, although MPT3-2014 WHPA-D were shorter in length due to recharge and hydraulic conductivity refinements.
- Model hydrogeology and hydrostratigraphic elevations for Aquifer A1 and A2 were compared to Well 14-2 well record and found to be closely aligned, with no adjustments to model needed.
- As Well 1-1 and Well 14-2 are screened within same aquifer and are close by, Well 14-2 simply shared the same node as Well 1-1 in the model.



4. WHPA Modelling

Modelled Pumping Rates (m^3/day)

Scenario Name	Well 1-1 / Well 14-2	Well 2-1	Well 2-2	Well 14-1	Well 23-1	Well 23-4	TOTAL
2007-1	82	246	0	603	157	0	1,088
2024-1	328	700	400	603	54	62	2,147
2024-2	328	550	310	603	54	62	1,907
2024-3	328	400	400	400	54	62	1,644
PTTW[1]	328	982	524	1,310	648	393	4,186

Note 1: Permit to Take Water Maximum Allowable Daily Water Taking was not modelled and is listed for comparison only

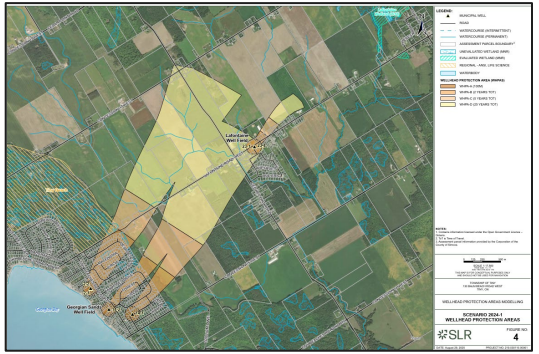
- Model scenarios consider current water use and future subdivision build-out, maximum allowable pumping rates, well capacity, and potential long-term nitrate concentrations.
  - 2024-1: optimum flexibility in pump operation, Well 14-1 operating at pre-nitrate impact rates and Well 14-2 operating at maximum permitted rate of Well 1-1.
  - 2024-2: simulates recent pump operation, but with Well 14-1 operating at pre-nitrate impact rates and Well 14-2, operating at maximum permitted rate of Well 1-1.
  - 2024-3 simulates pump operation if Wells 2-1 and 2-2 continue to experience rising nitrate levels, but with Well 14-2 continuing to operate at maximum permitted rate of Well 1-1.

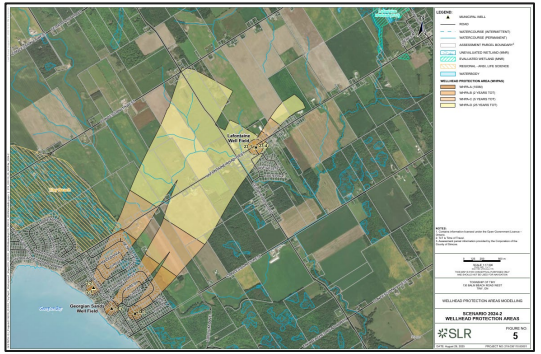
5. WHPA Modelling

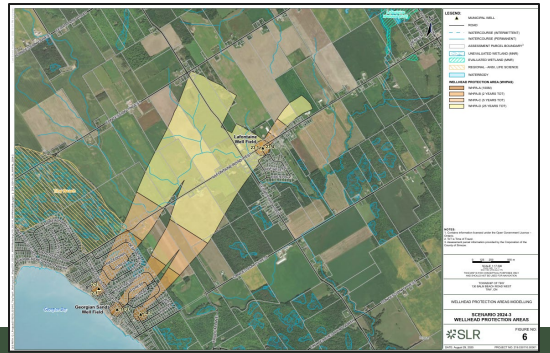
- Similar to previous modelling, the current simulations considers long-term, steady-state conditions.
- Capture zones determined in FEFLOW by releasing cluster of ‘particles’ around well nodes, backward-tracking’ pathlines through groundwater flow system, and projecting to surface to create basis for 2-year (WHPA-B), 5-year (WHPA-C), and 25-year (WHPA-D) time of travel. WHPA-A is a 100 m radius around well.
- Pathline shape function of pumping rates, aquifer thickness, hydraulic conductivity, effective porosity, and hydraulic gradients.
- Capture zones post-processed in GIS with “shape factor” envelopes following method used in the Approved Assessment Report (20% area increase, +/- 5 degrees rotation).
- Resultant increase in WHPA size using shape factor approach is considered sufficient to encapsulate uncertainty and/or moderate variability in hydraulic conductivity, porosity, and/or flow direction.

5. WHPA Modelling

- 2024 Scenario results are similar to those in the Assessment Report, but:
  - Overall capture zone size for Georgian Sands Well 2-1/2-2 and Well 14-2 are larger owing to increased pumping.
  - Overall capture zone size for Lafontaine 23-1/23-4 has decreased owing to decreased pumping.
- Although differences in 2024 Scenario WHPAs is small, 2024-1 produces largest capture zones due to highest pumping rates.

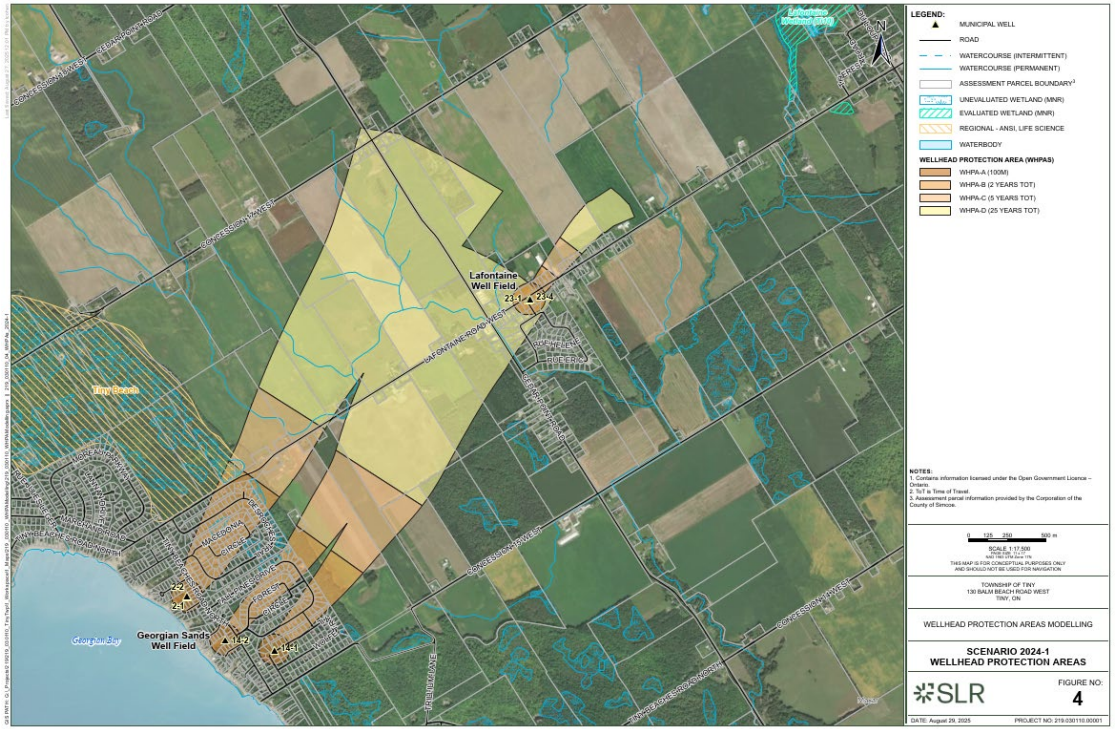






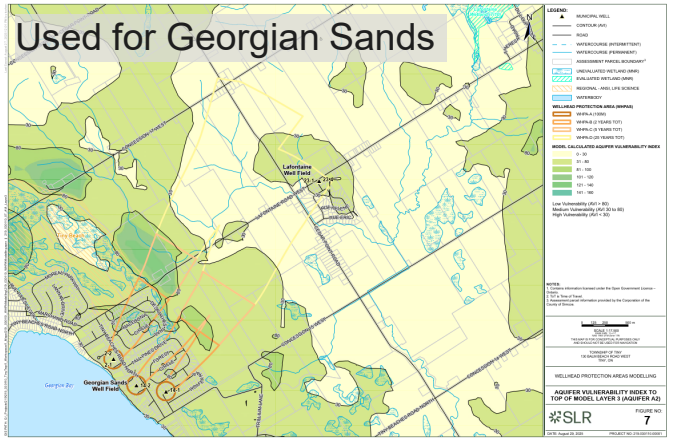
5. WHPA Modelling

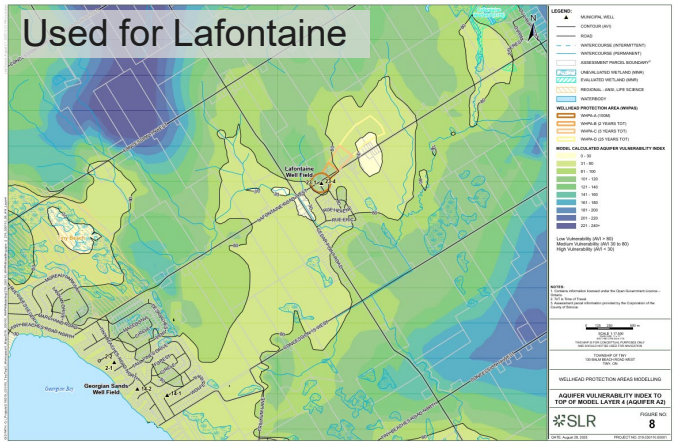
Scenario 2024-1 is preferred option for optimal flexibility in future pumping rate allotments.



6. Groundwater Vulnerability Assessment

- Similar to Assessment Report, current work uses Aquifer Vulnerability Index (AVI) to quantify relative susceptibility of Aquifer A2 to contamination.
- AVI calculated by summing product of thickness of each geologic unit overlying the aquifer with corresponding “K-factor” (MOE 2006).
  - Thickness of each geologic unit overlying aquifer derived from MPT3-2014 model surfaces.
  - K-factor of 2 applied to aquifer material, K-factor of 5 applied to aquitard material.
- AVI within Georgian Sands WHPA-A, B, and C mostly in low to medium vulnerability range, transitioning to high within most of WHPA-D.
- AVI within Lafontaine WHPA-A, B, C, and D mostly in the low to medium vulnerability range.





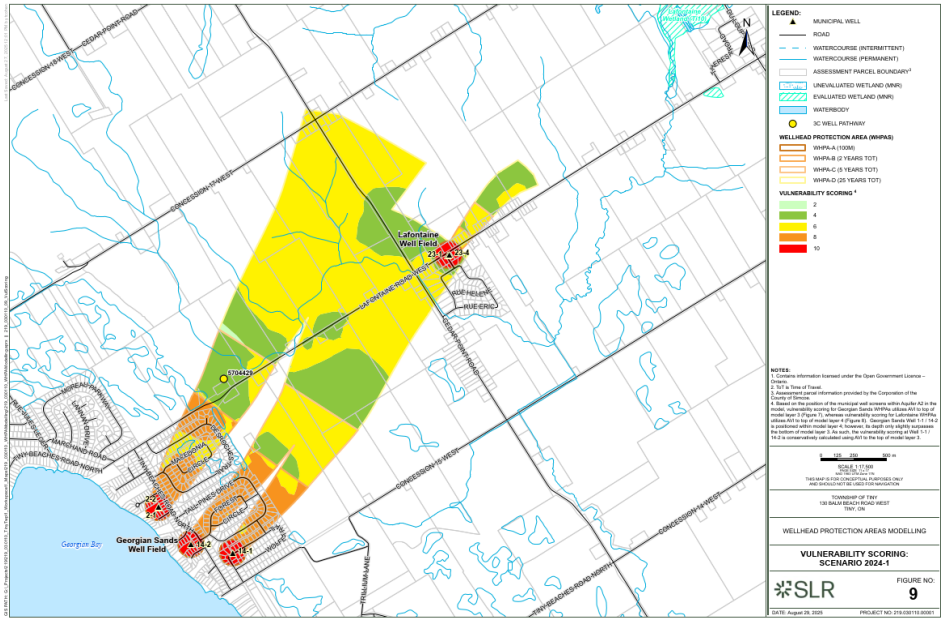
6. Groundwater Vulnerability Assessment

Vulnerability scores are assigned within each WHPA per the Assessment Report approach:

AVI Value	Intrinsic Vulnerability	WHPA-A Score	WHPA-B Score	WHPA-C Score	WHPA-D Score
<30	High	10	10	8	6
30 – 80	Medium	10	8	6	4
>80	Low	10	6	4	2

6. Groundwater Vulnerability Assessment

- Both Georgian Sands and Lafontaine WHPA-A have a vulnerability score of 10.
- Georgian Sands WHPA-B have vulnerability scores from 8 to 6, while the WHPA-C and D have scores mostly ranging from 6 to 4.
  - A small section of the Well 2-1 / 2-2 WHPA-D has a score of 2.
  - Previously identified “3C Well Pathway” was found to be located within the Georgian Sands Well 2-1 / 2-2 WHPA-B for Scenario 2024-1. Per Assessment Report, score was increased by one level within a 30 m buffer around well.
- Lafontaine WHPA-B and C vulnerability scores are mostly 6, with small portion of WHPA-C scoring 4. The WHPA-D score is mostly 4, with small portion scoring 6.



7. Closing

- SLR's slides were prepared and reviewed by:
  - Devin Hannan, P.Eng. (BC), Senior Environmental Engineer
  - Nick Schmidt, P.Geo. (ON), Senior Hydrogeologist
- SLR acknowledges the support of the following organizations during this project:
  - Township of Tiny (SLR Client)
  - Severn Sound Environmental Association
  - Lake Simcoe Region Conservation Authority
  - Oak Ridges Moraine Groundwater Program
  - Tatham Engineering

8. References

- Aqua Resource and Golder, 2010. *South Georgian Bay – West Lake Simcoe Study Area Tier Two Water Budget and Stress Assessment.*
- Burnside, 2024. *Replacement of Well No 1, Lafontaine Water System.*
- Golder, 2014. *Midland and Penetanguishene Tier Three Water Budget and Local Area Risk Assessment.*
- Golder, 2007. *Numerical Groundwater Modelling and Updated Wellhead Protection Areas*.
- Ministry of Environment, 2006. *Assessment Report: Draft Guidance Modules. Draft Guidance Module 3 Groundwater Vulnerability Analysis.*
- NVCA, 2010. *The Report on the HSPF Model NVCA and SSEA Watersheds: Tier 2 Water Budget Source Water Protection.*
- SGBLS SPC, 2015. *Approved Assessment Report: Severn Sound Source Protection Area.*

Do you have any questions?