



**Project Name:** River Mill Residential Subdivision  
Phase 4 & Phase 5

**MTE File No.:** 45244-104

**To:** Jason Cabral – MTE

**Date:** October 16, 2020

**cc:**

**From:** Kevin Kocken, Sophia Pan

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## Re: Chloride Impact Assessment

### 1.0 Introduction

MTE Consultants Inc. (MTE) was retained by River Mill Development Corporation, to complete a Chloride Impact Assessment in support of a Planning Act Application for the proposed River Mill Residential Subdivision in the City of Cambridge. The proposed development site is referred to herein as the 'Subject Lands'. River Mill West (Phase 4) consists of 45.38ha and River Mill East (Phase 5) consists of 4.05ha. The Subject Lands are generally bounded by Maple Grove Road to the north, Speedsville Road to the west, Equestrian Way to the south and Briardean Road to the east. Further east of Briardean Road is an existing residential development. The Subject Lands are located along Middle Creek and are regulated by the Grand River Conservation Authority. The location of the proposed development is presented in **Figure 1.1**.

The Subject Lands are proposed to be developed as a mixed residential community. The Draft Plans of Subdivision have been prepared by T. Johns Consulting Group (dated September 23 and 25, 2020) and forms the basis for this study. The Draft Plan comprises of low density residential blocks, medium density multiple residential blocks, high density mixed use blocks, stormwater management facility block, community park, open space blocks, and municipal right-of-ways.

In the Region of Waterloo, the assessment of road salt and its implications on groundwater quality must be made for any proposed developments within Wellhead Protection Areas prior to any development. The Subject Lands are partially located within Wellhead Protection Area D (refer to **Figures 1.2 and 1.3**), which requires the assessment of potential impacts on the local groundwater quality as a result of the development. This memorandum presents the preliminary findings and work completed to date by MTE related to the chloride impact assessment for the River Mill Subdivision. The assessment requires the calculation of the salt loading from de-icing operation to the groundwater so as to ensure that groundwater chloride concentrations will remain within the Reasonable Use Guidelines established by the Ministry of the Environment, Conservation and Parks (MECP). The purpose of this study is to assess impacts to the groundwater system, and if necessary, mitigate the impacts by proposing enhanced development and construction techniques.

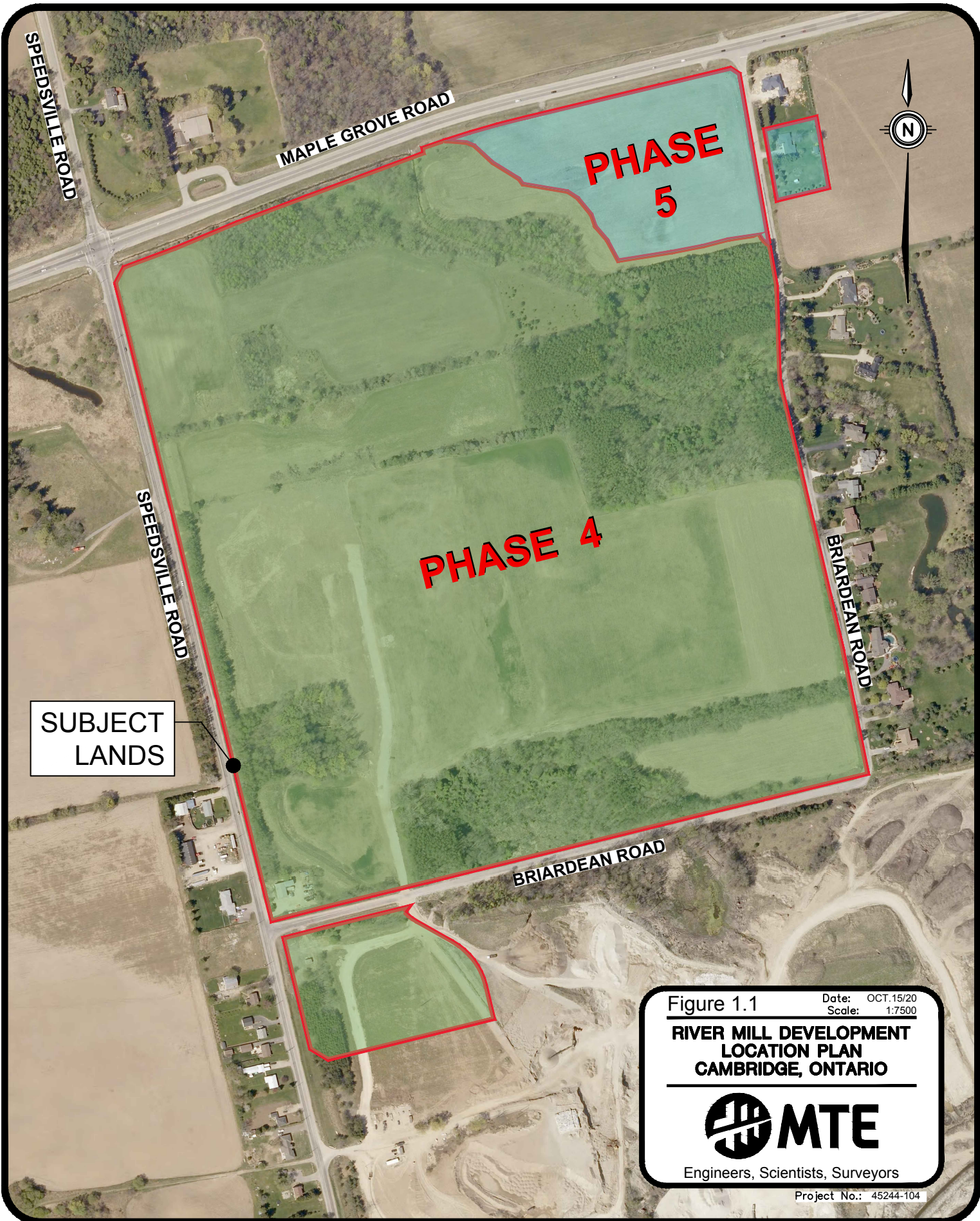


Figure 1.1 Date: OCT.15/20  
Scale: 1:7500

**RIVER MILL DEVELOPMENT  
LOCATION PLAN  
CAMBRIDGE, ONTARIO**



Engineers, Scientists, Surveyors

Project No.: 45244-104



## 1.1 Reasonable Use Concept

The assessment of road salt and its implications on groundwater can be made by estimating the total chloride levels under post-development conditions due to road salting activities and comparing the estimated value with specific target criteria for chloride concentrations. Although the Region of Waterloo has yet to establish groundwater quality criterion for chlorides, the Ontario Drinking Water Standard (ODWS) for chloride of 250mg/L, generally defines the upper limit of acceptability. The MECP's Reasonable Use Concept (RUC) has been adopted for various studies conducted in the Region to assess the impact of road salt on groundwater quality per the Region's document entitled *Draft Protocol for Evaluating Road Salt Impacts to Groundwater Using the Reasonable Use Concept*, dated January, 2008.

The RUC establishes limits for the allowable concentrations of contaminants based on background groundwater quality and the reasonable use of groundwater on an adjacent property. The limits are set such that there would not be any significant effect on the use of the groundwater on the adjacent property. Since the reasonable use of groundwater is commonly drinking water, the Reasonable Use limits are typically set on this basis. As a result, the quality of groundwater may not be degraded by an amount in excess of:

- 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters (e.g. chloride), or
- 25% of the difference between background and the Ontario Drinking Water Objectives for health related parameters (e.g. lead).

The RUC has been incorporated in Regulation 232/98. The reasonable use requirements have been included directly as performance specifications for the site specific design approach. In cases where the reasonable use of groundwater is other than drinking water, for example where background groundwater quality is poor, the RUC guideline allows alternative concentration limits to be set. These alternative limits would be determined on a case-by-case basis.

For development-scale chloride impact assessments in the Region of Waterloo the background chloride level is considered to be the concentration in the groundwater prior to anthropogenic impacts, i.e. 2.5mg/L (Draft Protocol for Evaluating Road Salt Impacts to Groundwater Using the Reasonable Use Concept. ROW, DOCs #409317, Version 1.0 January, 2008). Thus, given the Ontario Drinking Water Standard for chloride is 250mg/L and the background anthropogenic chloride concentration in the groundwater is approximately 2.5mg/L, the maximum RUC concentration of chloride in groundwater should not exceed **126mg/L**.

## 2.0 Chloride Impact – Mass Balance Analysis

To quantify the potential impacts to the existing groundwater quality as a result of future winter salt application related to the development of the proposed River Mill Subdivision, a conservative mass balance analysis was completed. Both municipal roads and private parking areas within mixed use, and multi-residential have been included in this analysis.

This mass balance approach, although basic, is considered a conservative evaluation since it does not include any dilution from groundwater already present in the system, any flow through dilution effects, or any off-site effects. All of these effects would result in additional dilution of the chloride concentrations. It should be noted that the salt application rates used in this analysis also do not include the expected 25% reduction in average salt application rates and the Best Management Practices recommended in previous studies for the Region.

Refer to **Figure 1.4** (attached) for the proposed road layout and classification used in the analysis.

## 2.1 Road Lengths, Parking Areas, Salt Application Rates and Infiltration

### 2.1.1 Road Lengths (Municipal)

The road lengths used in the analysis are based on the current Draft Plans for the River Mill Subdivision (T. Johns Consulting Group – September 23 and 25, 2020). There are no existing or proposed Regional or Collector roads within the development area.

### 2.1.2 Parking Areas/Private Roads

Though not explicitly shown in the Draft Plans, the areas of private parking (for all hard surfaces; such as asphalt surfaces and concrete sidewalks) within the multi-residential/mixed-use blocks have been considered to assess the corresponding total annual salt application. The multi-residential/mixed-use blocks include Phase 4 Blocks 1, 2, 4, 8, 9, 20, 21, and 26, and Phase 5 Block 1 and 2. The private parking area within each of the above mentioned blocks was assumed 50% of the overall block area. For the proposed condominium blocks, the length of private roads ways was used.

### 2.1.3 Salt Application Rates

The annual salt application rates used for this analysis were based on a 2003 Region of Waterloo Study entitled: *Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options*, Stantec Consulting Ltd., 2003. The study detailed local application rates observed over a 14-year period and found the following results:

- Primary roads 44tonnes/2-lane km
- Secondary roads 22tonnes/2-lane km
- Local roads 1tonne/2-lane km

The annual salt application rate for private parking areas was suggested by Regional staff based on recent studies/analysis completed. This suggested application rate is 15tonnes/ha.

### 2.1.4 Infiltration Volume

A detailed water balance analysis has been completed for the development and is included in the *Preliminary Stormwater Management Report* (MTE – October, 2020). This analysis was undertaken to ensure pre-development annual infiltration rates are maintained or enhanced. The annual infiltration rate of the Subject Lands was determined to be approximately 222.9mm/yr, which equates to an annual infiltration volume of 61,991m<sup>3</sup>/yr.

## 2.2 Mass Balance Analysis

Based on the assumptions above, a mass balance analysis was completed for the River Mill Subdivision. For a complete breakdown of detailed calculations refer to the attached spreadsheet found in **Appendix 1**.



### 3.0 Mitigative Measures

The estimated post-development groundwater chloride concentration of **74.5mg/L** is below the corresponding RUC limits of **126mg/L**. As a best management practice, Salt Management Plans for all blocks within the development lands subject to site plan approval or plan of condominium approval should be completed to address potential groundwater quality impacts relate to winter de-icing operations.

#### 3.1 Salt Management Plans

For the multiple residential/mixed use blocks within the River Mill Subdivision, it is likely that snow removal and ice control will be undertaken by a private winter maintenance service provider. As such, it is recommended that a site specific Salt Management Plan be implemented as part of the future development of these sites. The purpose of the Salt Management Plan will be to reduce the impact of all winter maintenance activities involving salting practices on the surface water and groundwater resources. The Salt Management Plan should outline operational practices and strategies for three main areas of concern: general salt use, salt storage, and snow storage/disposal. With respect to snow storage, it is recommended that the snow be stored on impervious surfaces that are connected to a storm sewer system, or if impervious surfaces are not available that the snow is stored in open spaces that are clay lined to prevent chloride impacted water from infiltrating into the groundwater system.

### 4.0 Conclusions and Recommendations

Based on the foregoing analyses, it is concluded that:

1. Based on a simple conservative mass balance analysis, the estimated increase of groundwater chloride concentration to 74.5mg/L under post-development condition is below the Ontario Drinking Water Standard of 250mg/L and the Reasonable Use Concept limit of 126mg/L.
2. The mass balance analysis performed in this study is considered to be a conservative evaluation since it does not include any dilution from groundwater already present in the system, any flow through dilution effects, or any off-site effects, all of which would result in additional dilution of the chloride infiltration.

It is recommended that:

1. Salt Management Plans be prepared for all blocks subject to site plan approval and/or a plan of condominium approval.

# Appendix 1

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## **Chloride Impact Assessment Calculations and Figures**

# MASS BALANCE (CHLORIDE IMPACT) ANALYSIS

## River Mill Subdivision

Cambridge, Ontario

Project Number: 45244-104

Date: October 16, 2020

Design By: KXX/XSP

File: Q:\45244\104\SWM\Chloride Impact\45244-104 Chloride Mass Balance.xlsx



### Legend

User inputs value

Excel calculates

### Reasonable Use Concept Calculations

$$C_m = C_b + x(C_r - C_b) \quad \text{Maximum Allowable Concentration beneath the adjacent property}$$

Where:

$C_b = 2.5$  (mg/L) Background Cl- Level Prior to Anthropogenic Impact<sup>1</sup>

$C_r = 250$  (mg/L) Ontario Drinking Water Standard (ODWS) Cl<sup>-</sup>

$x = 0.5$  Constant for Non-Health Related Parameter

$C_m = 126$  (mg/L)

| Calculation Factors                                    |   | Length of Road <sup>2</sup> | Parking Areas | Annual Salt Application <sup>3</sup> | Total Annual Salt Weight | Infiltration Volume | Chloride Concentration | RUC Check |
|--|---|-----------------------------|---------------|--------------------------------------|--------------------------|---------------------|------------------------|-----------|
|  |   | (km)                        | (ha)          | (tonne/2-lane km)<br>(tonne/ha)      | tonnes                   | m <sup>3</sup>      | mg/L                   |           |
| Road Salt  | Primary Road (km)   | 0.00                        |               | 44                                   | 0.00                     |                     |                        |           |
|  | Secondary Road (km)   | 0.00                        |               | 22                                   | 0.00                     |                     |                        |           |
|  | Local Road - Municipal (km)   | 2.04                        |               | 1                                    | 2.04                     |                     |                        |           |
|  | Local Road - Private (km)   | 2.64                        |               | 1                                    | 2.64                     |                     |                        |           |
|  | Private Parking Areas (ha) <sup>4</sup>   |                             | 4.21          | 15                                   | 63.15                    |                     |                        |           |
|  | Total weight of salt applied  |                             |               |                                      | <b>67.83</b>             |                     |                        |           |
|  | Roads - Salt infiltration rate into subsurface <sup>5</sup>   |                             |               |                                      | 28%                      |                     |                        |           |
|  | Parking Areas - Salt infiltration rate into subsurface <sup>6</sup>   |                             |               |                                      | 10%                      |                     |                        |           |
| <b>Annual amount of salt infiltrated to subsurface</b> |   |                             |               |                                      | <b>7.63</b>              |                     |                        |           |
| RUC Calculations                                       | Total (passive & active) surface water infiltration <sup>7</sup>  |                             |               |                                      |                          | 61,991              |                        |           |
|  | Additional Cl <sup>-</sup> input into subsurface from proposed development based on total surface water infiltration <sup>8</sup> |                             |               |                                      |                          |                     | 74.5                   | OKAY      |









### NOTES:

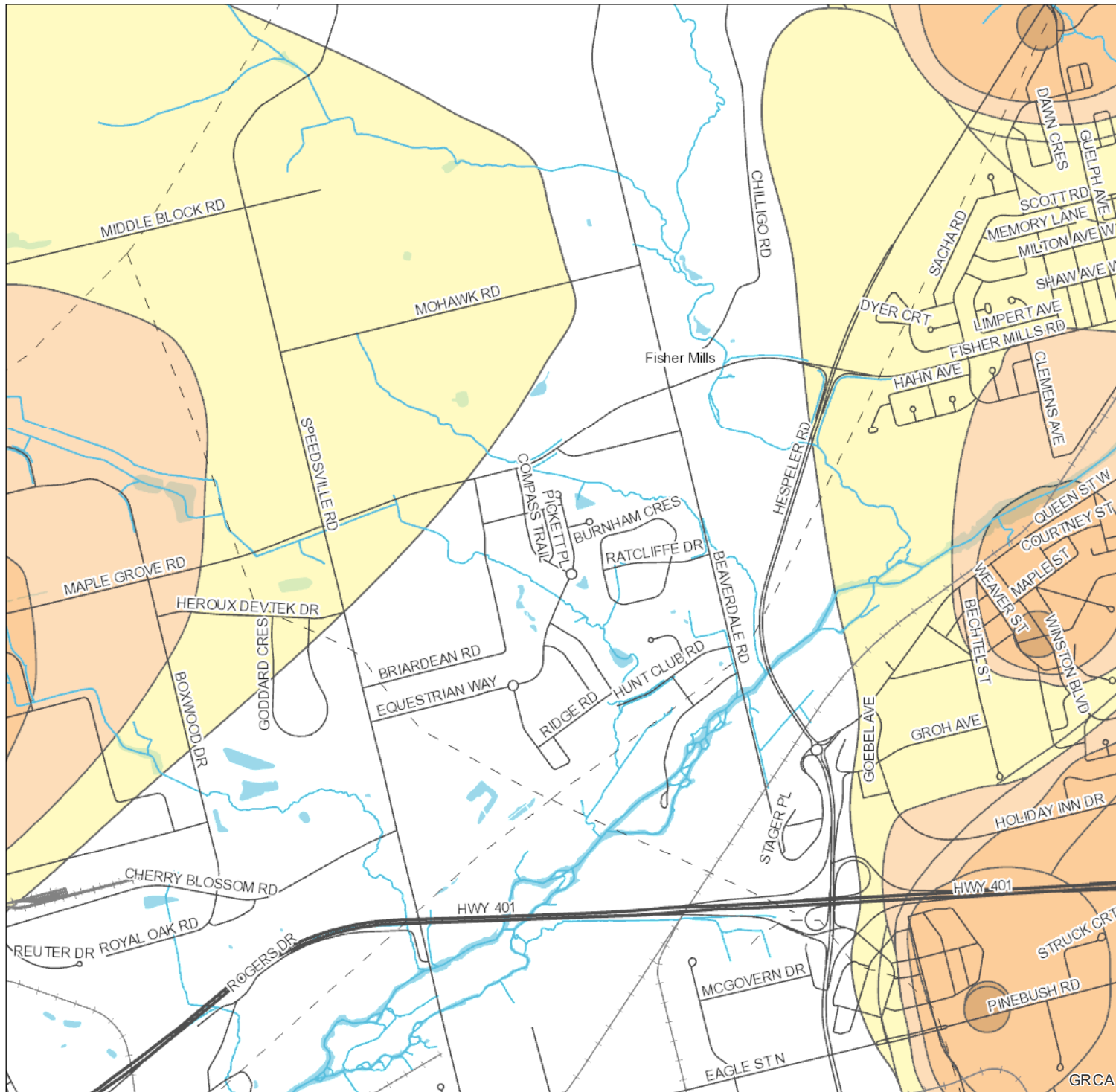
- For the development-scale assessment, the background level would be the concentration in the groundwater prior to anthropogenic impacts (2.5mg/L). (Draft Protocol for Evaluating Road Salt Impacts to Groundwater Using the Reasonable Use Concept. Region of Waterloo, DOCs:409317, Version 1.0, Jan, 2008)
- The road lengths used in the analysis were based on the current Draft Plan (Conceptual Block Plan for the River Mill Subdivision Phase 4 and Phase 5 (T. Johns Consulting Group, September 23, & 25, 2020).
- The salt application rates are based on values presented in the Region of Waterloo Report: "Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options", Stantec Consulting Ltd., 2003 and does not include the 25% target reduction.
- Private parking areas assumed to be 50% of the site block area
- The percentage of salt infiltrating into the subsurface (i.e. 28%) is based on the Region of Waterloo Report: "Road Salt Management and Chloride Reduction Study Phase 2: Evaluation of Chloride Reduction Options", Stantec Consulting Ltd., 2003.
- The value of 10% of salt that will infiltrate into the subsurface is based on an assumption that the majority of snow storage from private parking areas will be stored on an impervious surface.
- Based on the water budget analysis completed by MTE "River Mill Subdivision - Preliminary Stormwater Management Report" (October, 2020), the dilution available is 61,991 cu.m.
- On a simple dilution basis, this is the amount of additional chloride input based on the molecular weight ratio of Sodium to Chloride in the total volume of salt (0.606).



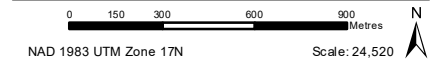
**Figure 1.2 Wellhead Protection Area Map**

**Legend**

-  Municipal Boundary (GRCA)
-  Watercourse - Local (GRCA)
- WHPA-Wellhead Protection Area (GRCA)**
-  WHPA-A
-  WHPA-B
-  WHPA-C
-  WHPA-D
-  Waterbody - Local (GRCA)
-  Great Lakes - Local (GRCA)

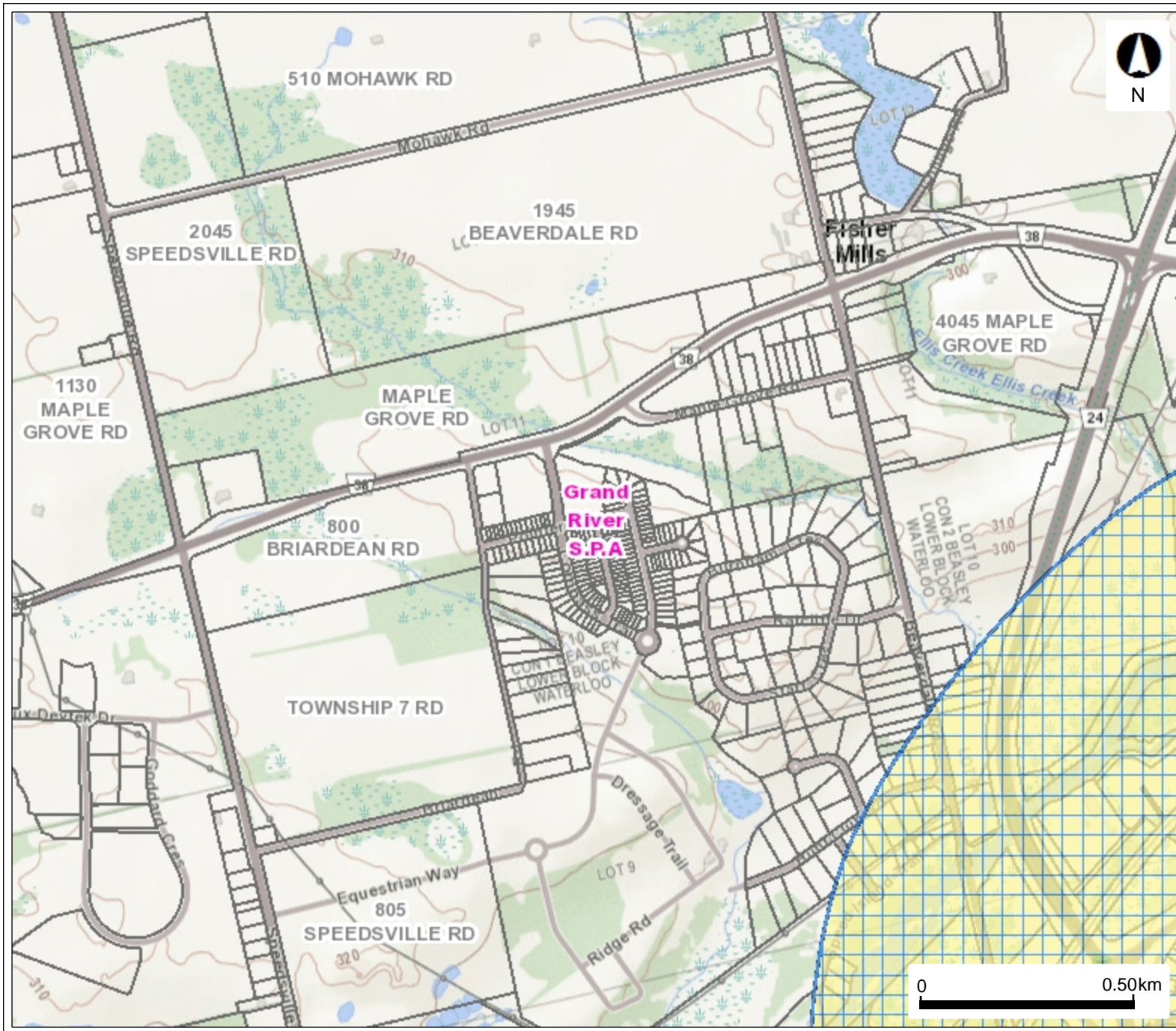


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The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: <https://maps.grandriver.ca/Sources-and-Citations.pdf>





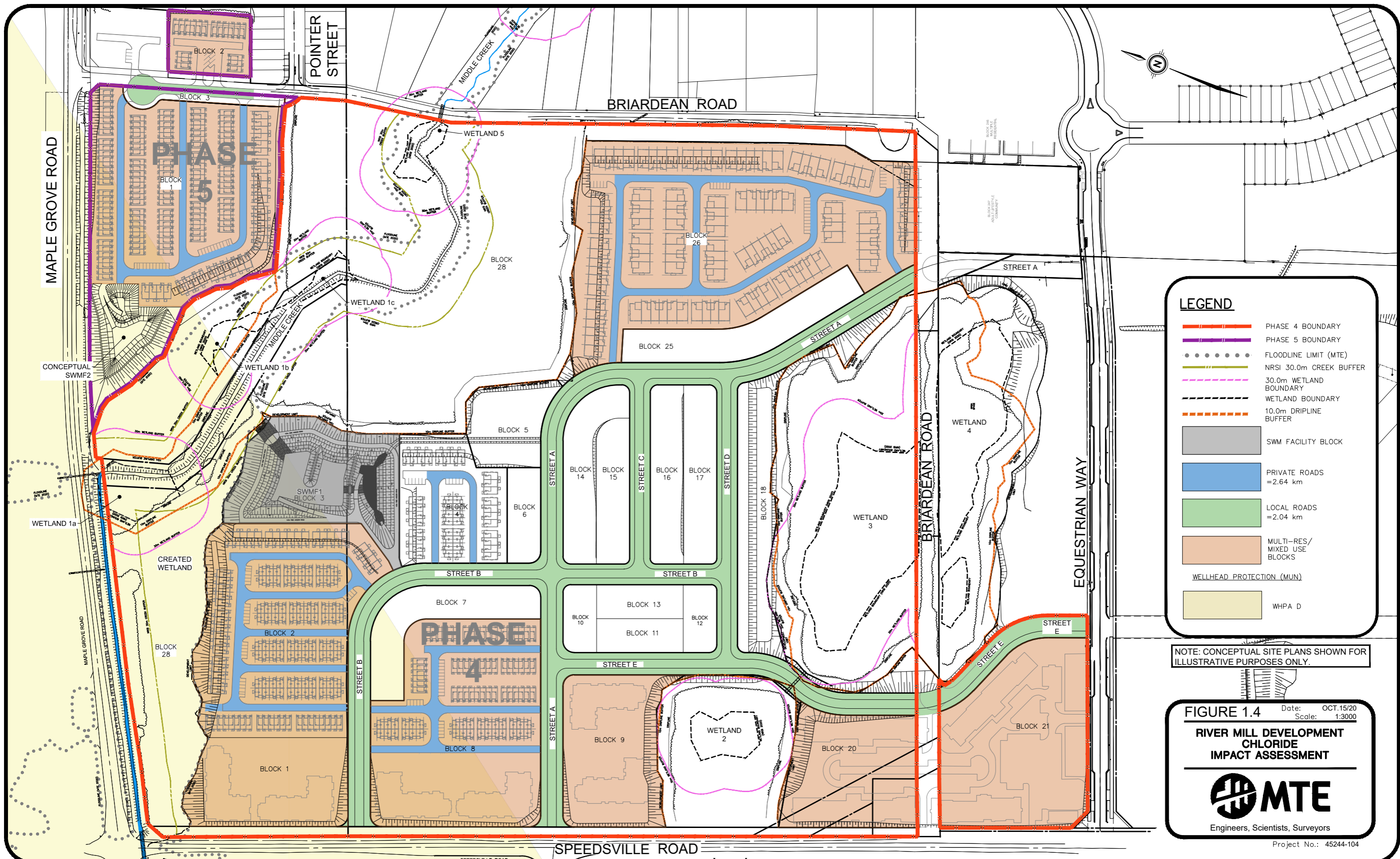
# Figure 1.3 Source Protection Information Atlas



## Legend

- Source Protection Areas
  - Issue Contributing Areas
  - WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
- A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
  - Event Based Areas
  - Intake Protection Zone 2
  - Assessment Parcel

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**LEGEND**

- PHASE 4 BOUNDARY
- PHASE 5 BOUNDARY
- ..... FLOODLINE LIMIT (MTE)
- NRSI 30.0m CREEK BUFFER
- 30.0m WETLAND BOUNDARY
- WETLAND BOUNDARY
- 10.0m DRIPLINE BUFFER
- SWM FACILITY BLOCK
- PRIVATE ROADS = 2.64 km
- LOCAL ROADS = 2.04 km
- MULTI-RES/MIXED USE BLOCKS
- WELLHEAD PROTECTION (MUN)
- WHPA D

NOTE: CONCEPTUAL SITE PLANS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.

**FIGURE 1.4** Date: OCT.15/20  
Scale: 1:3000

**RIVER MILL DEVELOPMENT  
CHLORIDE  
IMPACT ASSESSMENT**

**MTE**  
Engineers, Scientists, Surveyors

Project No.: 45244-104