4.2.8 Street Lighting

Where practical it is recommended that light standards be oriented so as to direct light away from the ESPA to reduce potential impacts on wildlife including reproduction, foraging, predator interactions and social interactions. Layout of streetlights should consider the type of light as well as the side of the street on which the lights are installed so that illumination is downward and directed away from woodlands.

It is also recommended that information on the impacts of residential lighting, including security and garden lighting, be incorporated into the educational brochure noted in **Section 4.2.7** above that is recommended to be provided to each new resident.

4.2.9 Mitigating Impacts from Road Salt

In order to reduce the need for road salt in the community, it is recommended that road grades be designed to maintain road grades less than 4% where possible. If required, road grades up to a maximum of 6% will be used but minimized. The active infiltration of road drainage will not be used. To minimize infiltration of snow stored on boulevards it is recommended that the use of soils with higher clay content be investigated for use under the road right-of-ways.

It is further recommended that salt impacts be reduced using the following measures:

1. Use open space and park blocks to enhance infiltration of clean water.
2. Apply impervious cover limits through zoning by-laws.
3. Use engineering measures to promote and enhance infiltration of clean water (e.g. soakaway pits and pervious pipes) to minimize surface runoff from roadways.
4. Utilize improved de-icing techniques, such as liquid salt, and salt management practices throughout the area.
5. Avoid roads on steeper slopes.
6. Lower winter speed limits.
7. Reduce salt use region-wide.

It is also recommended that the City investigate means to provide a “City-wide” policy to minimize the mix of salt to sand and limit use of salt only to specific critical areas of the community, if necessary.

4.3 Monitoring

4.3.1 Background

As required by the Laurel Creek Watershed Study, any development within the watershed requires an environmental monitoring program. The requirements for the Pre-Development Monitoring (PDM)

Program are outlined in the SSWS and include terrestrial, surfacewater, and groundwater monitoring. Detailed PDM Terms of Reference for the proposed development have been prepared, and are provided in **Appendix E**. During-Construction and Post-Construction monitoring Terms of Reference will be prepared at the detailed design stage once Draft Plan Approval has been obtained. A brief overview of each component of the PDM program is provided below.

4.3.2 Terrestrial Monitoring

The terrestrial monitoring will be composed of an annual visual inspection of the areas adjacent to the development, including:

- Woodland buffers;
- Community trail areas outside the ESPA;
- The Monastery Tributary including riparian buffers; and
- Any additional buffers as specified in this EIS.

The visual inspection report will be used to observe obvious changes occurring within the Greenspace system buffers.

4.3.3 Surfacewater Monitoring

The south tributary branch of Monastery Creek is the receiver of runoff from the proposed subdivision. It is a coldwater stream that joins the main branch of Monastery Creek just south of Wideman Road at the northern limit of the subject lands (refer to attached figure). The SSWS identified six parameters that will be monitored as per the Laurel Creek Watershed Plan (1993):

- Stream flow (discrete measurements);
- Water temperature;
- Phosphorus;
- Dissolved oxygen;
- Suspended sediment; and
- Bacteria (total and fecal coliforms).

4.3.4 Groundwater Monitoring

Groundwater levels will be taken three times per year at three existing monitoring wells on site. Measures will be required to protect and maintain the existing wells during and following site construction. Sampling for groundwater is also required at one of the wells, and will be undertaken once annually for the general chemistry of the groundwater, which includes the following scans:

- ICAP (metals, including sodium);

    - pH;
    - Conductivity;
    - Alkalinity;
    - Anions (e.g., chloride, etc.);
    - Total dissolved solids;
    - Hardness; and
    - Ammonia Nitrogen.

4.3.5 Timing and Reporting

The results on the monitoring are summarized in an annual Report, which is to be submitted to the City of Waterloo and the Grand River Conservation Authority.

5.0 PROPOSED CONSTRAINTS AND OPPORTUNITIES FOR DEVELOPMENT

5.1 Road Pattern

The elongated configuration and the limited width of the property together with the various recommended buffers from the ESPA and wetland and proposed conservation easement define the lands that can be considered for development and also dictates the final road pattern. Through the review of the subject property various concepts were evaluated based on the environmental findings and recommendations. Consideration also was given to the existing laneway to the McNally lands and how this would be coordinated in the future. The Laurel Creek Village development also provided the opportunity for two road extensions into the subject property.

The recommendations outlined in the previous sections of this report conclude that development can occur on this property provided various mitigation measures are implemented. This includes maintaining as much of the existing forest cover as possible in the southern plantation in order to maximize the existing groundwater recharge function, provide reasonable protection for the regionally significant plant species, provide habitat and forage opportunities for wildlife, as well as retain some of the secondary linkage function between ESPAs 19 and 17. Measures such as minimizing road widths and maintaining the existing topography to the greatest extent possible to reduce grading requirements, utilizing a cul-de-sac design to reducing traffic and noise on the site, as well as increasing lot sizes to minimize the number of dwellings and maximize tree saving opportunities will promote the maintenance of habitat, linkage and groundwater recharge functions on the site. On this basis it is recommended that the road pattern within the southern plantation take the form of a single centrally located cul-de-sac with an entrance at the north end of the plantation (see **Figure 2**). Large single-family residential lots have been proposed for this portion of the property.

In the northern portion of the property, it is recommended that the road be located along the eastern property boundary to accommodate site servicing and avoid interference with groundwater seepage areas. Street fronting townhouses are proposed for this portion of the property. The road connection to Wideman Road should be graded to remain outside of the Regulatory floodplain for Monastery Creek.

5.2 Conceptual Stormwater Management Strategy

5.2.1 Background Information Review

The SSWS set the targets for stormwater management on the Owen Property, and included three main goals:

1. To maximize infiltration across the subwatershed;
2. To protect the quality of the surfacewater and the groundwater in the subwatershed; and

3. To minimize the impact of post-development conditions on downstream areas.

The following management techniques were recommended in the SSWS for implementation through the Stormwater Management Plan for the development:

- Provide water quantity control to ensure that post development peak flows are less than or equal to existing flows as per Table B4.3 of the SSWS (See **Appendix F**);
- Provide water quality controls for Enhanced (formerly Level 1) receiving habitat with storage volumes as per the most recent MOE SWM Manual;
- Provide additional extended detention storage for volume and erosion control as per Table B4.3 of the SSWS;
- Assess the thermal impact of stormwater management discharges to Monastery Creek;
- Maintain existing infiltration rates for water quantity and quality control; and
- Implement appropriate stormwater management practices. The specific management practices will be determined at the design stage, but may include:

  Lot-level controls

  - Subsurface soakaway pits
  - Foundation drains to soakaway pits instead of storm sewer

  Conveyance controls:

  - Perforated pipe systems
  - Grassed swales
  - Infiltration trenches

  End-of-pipe controls:

  - Wet pond/wetlands with forebay
  - Dry pond with forebay
  - Sand filter
  - Vegetated filter strip
  - Oil/grit separators

Based on these recommendations, the SSWS provided for a single stormwater management pond in the form of a constructed wetland to provide water quantity and quality control for the entire developing area. The pond was to be located at the north end of the site adjacent to Wideman Road.

5.2.2 Revised Stormwater Management Approach

Based on a review of the preliminary concept within the context of site topography, grading requirements and groundwater recharge/discharge characteristics, the following revised stormwater management approach is proposed for the site development to meet the above goals:

- Two dry ponds within the northern plantation area to provide water quantity control to reduce peak flows to required levels;
- Routing of road runoff to the stormwater management ponds;
- Two oil/grit separators in a treatment train configuration to provide water quality control for road runoff;
- Active infiltration of roofwater and foundation drain water to maintain water quality and recharge to groundwater, stream baseflow and for stormwater quantity control;
- A cooling/exfiltration trench outlet from the stormwater management ponds to provide diffuse water discharge along the trenches, additional water treatment through soil filtration and to reduce thermal impacts to the receiving watercourse and wetland;
- All stormwater management facilities will remain outside of the established buffers for the site; and
- A small area at the southeast portion of the site will continue to drain toward Subwatershed #309 to the east, where stormwater management will be provided in the existing pond located on the Laurel Creek Village development to the east.

A Preliminary Stormwater Management Report will be prepared in support of the Draft Plan application for this development, and will include the design details of the stormwater management approach outlined above. An overview of each component is provided below.

Water Quantity Control

The water quantity component of the Stormwater Management Plan requires the controlled release of runoff volumes up to the 1:100 year storm over an extended period of time (48 hours) to reduce the impact of the development on the receiving watercourse. Additionally, the control of the 1:2 year to the 1:100 year post-development peak flows to pre-development levels (as recommended in the SSWS) is required. These requirements combine to address the erosion and peak flow concerns for the receiving watercourse. To accomplish this, end-of-pipe stormwater facilities are required.

Two facilities are recommended to provide water quantity control as shown in **Figure 4**. Minor flows will be routed to the ponds via a storm sewer network, and major flows will be routed to the ponds via the roads. The first facility (Pond A) should be sized to provide quantity control for the south portion of the site. Based on preliminary modelling and calculations, the pond is required to provide approximately 2,200 m^3 of storage. The second facility (Pond B) should be sized to provide quantity control for the north portion of the site. This facility will be required to provide approximately 1,500 m^3 of storage. Both facilities will be dry ponds, since the drainage area to each facility is too small to support the use of constructed wetlands for quality control. Quality control will be provided using oil/grit separators for road runoff and stone outlet structures/exfiltration trenches from the ponds and is outlined below.

The use of two facilities has several advantages over the single-pond concept proposed in the SSWS. First, two facilities allows the discharge from the development to be diffuse through the exfiltration trenches, and avoids a point source flow at the downstream (north) portion of the site. This will distribute baseflow to the wetland and the Monastery Creek tributary along the western limit of the development and will mimic existing drainage and seepage conditions to a greater extent. Secondly, the use of two ponds minimizes grading by using the natural drainage topography of the site as much as possible. Both facilities should be designed to meet stormwater management targets and be in accordance with standard practices at the time of the development application submission (Stormwater Management Planning and Design Manual, MOE, 2003), the Laurel Creek Watershed Study, and the City of Waterloo's Aesthetic Guidelines.

The stormwater management ponds should be landscaped in accordance with City of Waterloo and MOE Guidelines. Landscaping should include water tolerant species within the active storage areas and native tree and shrub species, including conifers, on the upper bank areas. These plantings will provide water quality and aesthetic benefits, and will also enhance the connectivity function through the site by providing additional linkage areas and buffers.

Water Quality Control

As noted above, the drainage area to each facility is less than the minimum 5 to 10 ha recommended in the MOE 2003 design manual for sustaining a permanent pool for water quality control. Therefore, water quality control will be provided by routing road runoff through oil/grit separators sized to provide Enhanced (formerly Level 1) water quality control, with additional polishing of runoff through extended detention within the quantity ponds (treatment-train approach) and diffuse discharge of the water via stone outlet structures/exfiltration trenches from the ponds. The diffuse discharge of the water will help to provide additional water treatment through filtration within the soil profile as the water drains to the wetland and the creek.

Overall water quality benefits will also be provided by minimizing the amount of surface runoff generated on site. The concept will provide for relatively large lots, with an average impervious coverage of approximately 25 to 40 percent for the entire developing area. A portion of the lots will remain un-graded, which will allow for passive infiltration of rainfall. Additionally, active infiltration measures and permeable fill materials will be utilized to further reduce surface runoff.

Infiltration

The developable area has a recharge function for both the deep regional aquifer and the local shallow groundwater flow system that provides baseflow to the Monastery Creek tributary and/or the wetland complex. Therefore, maintaining the existing recharge rate and its spatial distribution is necessary to

protect this recharge/discharge function. The existing recharge rate for the study area is 192 mm/year as provided in the SSWS. Based on preliminary calculations, the existing infiltration rate can be matched to within approximately 84 percent of existing levels by accounting for passive and active infiltration. The difference is due to the routing of road runoff from the developable area to the stormwater ponds, rather than allowing this water to infiltrate, to minimize impacts to groundwater quality. The implications of this reduction are outlined below.

The soils in the southern portion of the site are relatively sandy and are appropriate for active at-source infiltration practices. Structural fill will be required for the townhouse lots in the northern portion of the site. This is necessary because excavation into the seepage area (relatively tight impervious soils) would not allow for the installation of basements or the use of soakaway pits. The fill material will be granular so that it will be suitable to allow for active infiltration practices in this area of the site, and to continue to provide groundwater seepage toward the Provincially Significant Wetland west of the site. As noted above, the surface runoff will be collected in one of two stormwater management ponds, and discharged to the wetland via stone outlet structures/exfiltration trenches.

Although the existing infiltration rate for the entire area will not be matched to 100 percent, the proposed stormwater management concept will continue to mimic the existing subsurface drainage characteristics with a combination of infiltration and shallow subsurface/surface flow. Therefore, baseflow to the Monastery Creek tributary will be maintained by a combination of passive and active infiltration practices, and the discharge of treated and distributed runoff from the stormwater management facilities. Recharge to the regional aquifer will be provided utilizing at-source soakaway pits for rooftop runoff and foundation drainage, as well as passive infiltration on the southern portion of the development site.

Each rooftop within the developing area will be routed to a soakaway pit. Soakaway pits are required to infiltrate the first 20 to 25 mm of runoff from rooftops to maximize the amount of groundwater recharge. Based on the City of Waterloo requirements, these facilities must be located on public property in order to ensure access for monitoring and maintenance activities. Any rooftop infiltration techniques implemented within the recharge area will be designed with a factor of safety of 1.25.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The recommended environmental constraints and opportunities outlined in this report provide the framework for draft planning and development of the subject property. Various mitigation measures have been provided to protect all Constraint Level 1 features and maintain the habitat, linkage and groundwater recharge functions of the Constraint Level 2 features identified in the SSWS.

6.1 Confirming ESPA Boundary and Buffers

The Wetland/ESPA boundary at the northwest corner of the property and associated buffers established in the SSWS have been confirmed in the field by Dougan & Associates and are shown on **Figure 2**. Additional field investigations were undertaken to assess the appropriateness of the ESPA boundary with respect to breeding birds and the contiguous southern plantation. From these studies it was revealed that the southern plantation is providing ecological functions that were not previously identified. Based on the assessment of the Region of Waterloo ESPA Criteria, consideration of future impacts from adjacent developments, and the fact that the Region of Waterloo does not routinely include plantations in ESPAs particularly where active harvesting is taking place, it is concluded that the southern plantation does not merit ESPA designation as it does not fulfill the Regional criteria and policy. Therefore the existing boundary of ESPA 19 is appropriate.

Various mitigation measures have been recommended including a 15-metre wide conservation easement along the east and west boundaries of the southern plantation in which no development is to occur and tree saving. These measures will enhance the established buffers adjacent to the ESPA and will also serve to retain habitat, linkage and groundwater recharge functions on the property.

6.2 Maintaining Groundwater Recharge and Discharge

The EIS demonstrates that groundwater recharge and discharge can be maintained by using soakaway pits infiltrating roofwater and foundation drain water, and two stormwater management ponds. Soakaway pits together with passive infiltration from pervious surfaces will continue to provide recharge to the deep regional aquifer. Active and passive infiltration and discharge from the stormwater management ponds will continue to provide baseflow to the Monastery Creek tributary and the Provincial Significant Wetland located to the west of the development.

6.3 Stormwater Management Impacts and Impact Mitigation on Monastery Creek

Stormwater management facilities can be designed to meet the water quantity, quality, and erosion targets outlined in the SSWS. Two dry stormwater management ponds, illustrated on **Figure 4**, will provide quantity and erosion control. Water quality control will be provided by routing road runoff through oil/grit separators sized to provide Enhanced (formerly Level 1) water quality control, with additional

polishing of run-off through extended detention within the quantity ponds (treatment train approach) and diffuse discharge of the water via stone outlet structures/exfiltration trenches from the ponds. The ponds will be located to remain outside the buffers for the Constraint Level 1 lands.

In conclusion, it is our opinion that the Scoped EIS addresses the accepted Terms of Reference as well as the Environmental Policies of the City of Waterloo, the Regional Municipality of Waterloo and the Grand River Conservation Authority. The recommendations within this report provide direction to the submission of the draft plan of subdivision.

7.0 REFERENCES

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