



NATURAL RESOURCE SOLUTIONS INC.

Aquatic, Terrestrial and Wetland Biologists

June 29, 2015

Project 976

Prachi Patel
City of Guelph
1 Carden Street
Guelph, ON N1H 3A1

Dear Ms. Patel,

**Re: 44, 56, 66 & 76 Arkell Road Proposed Residential Development
Environmental Implementation Report – Terms of Reference**

On behalf of Natural Resource Solutions Inc. (NRSI), I am pleased to provide the following Terms of Reference (TOR) to prepare an Environmental Implementation Report (EIR) for the proposed residential development at 44, 56, 66 and 76 Arkell Road (i.e., the “Arkell Woods” development) in the City of Guelph.

The subject property is currently zoned as (R.1B) Single Detached, (UR) Urban Reserve Zone and (WL) Wetland Zone. The 18.8 ha subject property is dominated by a portion of the Torrance Creek/Hamilton Corners Provincially Significant Wetland (PSW) complex and associated significant woodland. Outside of the woodland/wetland complex the subject property primarily comprises 2.39 ha of meadow habitat that is periodically (i.e., once every few years) mown and/or tilled. The proponent seeks the re-zoning of the property to (R.3A) Specialized Cluster Townhouse zone, (WL) Wetlands and (P.1) Conservation Lands. Lands within the subject property zoned WL and P.1 will be conveyed to the City. Due to the presence of Grand River Conservation Authority (GRCA) regulated lands associated with the PSW, and the location of the proposed development adjacent to a City-designated Significant Natural Area, an Environmental Impact Study (EIS) was prepared by NRSI to identify development constraints and recommend measures such that the proposed development will not negatively impact the adjacent natural features and ecological functions. The October 2014 EIS was the second EIS submission by the proponent and represented the culmination of multiple years of design revisions made in consultation with City and GRCA staff. An EIS addendum was submitted to the City and GRCA in February 2015, followed by a second EIS addendum in May 2015.

An EIR will be completed to satisfy the City of Guelph’s Environmental Advisory Committee (EAC) conditions of draft plan approval (June 10, 2015) for the EIS prepared by NRSI. The following Draft TOR outlines the steps required to complete the EIR.

Sincerely,
Natural Resource Solutions Inc.



Ryan Archer
Terrestrial and Wetland Biologist

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GRCA, Resource Planner
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**44, 56, 66 and 76 Arkell Road Proposed Residential Development
Environmental Implementation Report
Terms of Reference
June 26, 2015**

Introduction

The subject property is legally described as Part of Lot 6, Concession 8 (Geographic Township of Puslinch) & Lots 3, 4 and 6, Registered Plan 514, City of Guelph. The subject property is bordered to the south/southeast by residential development, to the south/southwest by the Salvation Army parking lot and to the east/northeast by a portion of the Torrance Creek/Hamilton Corners Provincially Significant Wetland (PSW) and locally significant woodland. The majority of the 18.8 ha subject property is comprised of a portion of the PSW complex and Significant Woodland, which is mapped as a Significant Natural Area in the City of Guelph's Official Plan Amendment (OPA) 48. A 2.39 ha section of the subject property, comprising a periodically tilled goldenrod forb meadow, is proposed for residential development by the proponent (Map 1). This 2.39 ha area is therefore referred to as the "development area". The remainder of the subject property, comprising the Significant Natural Area and associated buffers, will be conveyed to the City.

Natural Resource Solutions Inc. (NRSI), along with MTE Consultants Inc. and GM BluePlan Engineering were retained by Moshi Holdings to complete an Environmental Implementation Report (EIR) to satisfy the City of Guelph's Environmental Advisory Committee (EAC) conditions of draft plan approval of the October 2014 Environmental Impact Study (EIS), and the EIS addendums prepared in February and May 2015 by NRSI.

Among draft conditions of approval that were identified by EAC (June 10, 2015):

- *"That an Environmental Implementation Report is prepared and include:*
 - *A spring and summer vascular plant survey;*
 - *A refined water balance based on a detailed SWM design and detailed design of the outlet for the SWM system and its interface with the natural environment;*
 - *Design of the trail layout as required by Parks Planning supported by mitigation measures and an analysis confirming no impacts to the Natural Heritage System;*
 - *Education and Stewardship materials including sign designs and an insert to the EnviroGuide for future residents as well as detailed education information for construction activities;*
 - *A Salt Management Plan and recommendations with respect to it being included into the Declaration of Condominium;*
 - *Restoration landscape plans including any required clean up or debris removal and invasive species management;*
 - *An up to date and detailed tree inventory be conducted for the trail alignment, by adopting a risk assessment standard as approved by City staff, as well as a compensation plan;*
 - *Baseline information; and,*
 - *Additional groundwater monitoring through the use of data loggers to inform the SWM detailed design; and,*
 - *Consideration for pre-treatment directly upstream of bio-retention units.*

- *That the TOR of the EIR contains the monitoring plan design details”.*

Proposed Undertaking

The proposed development fronting on Arkell Road is approximately 2.39 ha in area and will comprise 93 cluster townhouse units complete with a looped common element roadway that is accessed off of Arkell Road. The proposed development will also include a common amenity area, visitor parking and a stormwater management facility. Various lot-level, conveyance and end-of-pipe Low Impact Development (LID) measures are proposed for installation throughout the development to maximize on-site stormwater infiltration capacity and reduce off-site discharge volumes. A total of 16.41 ha of land or over 87% are located outside the proposed area of the Draft Plan of Condominium.

The proposed development has been designed to respect protective buffers to the adjacent woodland and wetland feature edges, of 10 m and 30 m respectively, as recommended in the EIS. A 10 m wide open corridor will also be maintained along the north end of the subject property to preserve an existing deer movement corridor between the Torrance Creek PSW and the nearby Hanlon Creek PSW west of Gordon Street. This wildlife movement corridor will comprise half of an additional 10 m corridor recommended by North-South Environmental in the EIS completed for the adjacent property to the north. These buffers and wildlife movement corridor will be ecologically restored through the planting of native tree species as specified in a Restoration Planting Plan.

The proposed development also incorporates the construction of a pedestrian trail through the woodland/wetland buffers and a portion of the adjacent woodland, from the north subject property boundary to Arkell Road. This conceptual trail alignment was designed to meet the requirements of the City’s Trail Master Plan as mapped in OPA 48. The trail will comprise a 2.5 m wide graded stone dust base along most of its length outside of the woodland, while the southernmost segment from the SWM facility to Arkell Road will comprise a 1.5 m wide light-duty design wooden boardwalk (Map 1). The trail will be conveyed to City ownership.

Background

The current application represents the third submission put forward by the proponent. The existing application represents the culmination of multiple years of project team consultation with City and GRCA staff, and several design iterations and revisions, to achieve a design that will be considered satisfactory to all parties. NRSI prepared an EIS in September 2013 as part of a previous application submission to the City. Based on regulatory agency comments, NRSI prepared and submitted a revised EIS in October 2014 in association with a revised development concept for the site as described above. In response to EIS review comments provided by the GRCA and City, an EIS addendum was prepared by NRSI in February 2015. The EIS and addendum were reviewed by City of Guelph EAC, which provided comment during the EAC meeting of March 11, 2015. During the March 11 meeting, EAC voted to defer acceptance of the EIS pending the completion of an additional EIS addendum to address outstanding concerns regarding stormwater management design and discharge impacts to the adjacent natural features. A second EIS addendum dated May 11, 2015 was submitted to address these outstanding concerns. Following review of the second EIS addendum at the June 10, 2015 EAC meeting, EAC carried a motion to conditionally support the EIS. The

requirements for the EIR were also identified by EAC as a condition of EIS acceptance, as listed above.

Associated Studies

To satisfy the requirements of the City of Guelph and EAC in completion of an EIR, and to address recommendations identified in the EIS, the following associated reporting and mapping will be completed as part of the overall EIR submission. Reports and mapping to be summarized and appended to the EIR include:

- Stormwater Management Report – MTE Consultants Inc.
- Landscape and Restoration Planting Plans, and Pedestrian Trail Design – McKinnon and Associates
- Detailed Grading and Site Plan – MTE Consultants Inc.
- Salt Management Plan – MTE Consultants Inc.
- Groundwater Monitoring Plan and baseline data – GM BluePlan Engineers

Environmental Implementation Report - Field Surveys

To supplement the field findings from the EIS (NRSI 2014) and the February 2015 EIS addendum, and to satisfy conditions of approval for the EIR, NRSI will undertake additional field surveys as part of the EIR. Surveys will include an updated tree inventory and assessment associated with the pedestrian trail alignment, and spring and summer vegetation inventories. Field studies associated with the proposed long-term monitoring plan will also be implemented, as described separately below.

Updated Tree Inventory and Preservation Plan

A Tree Inventory and Preservation Plan was previously completed by NRSI for the subject property and proposed pedestrian trail alignment, and was submitted as part of the October 2014 EIS. As recommended in the EIS, an NRSI Certified Arborist will complete an updated inventory and assessment of all trees ≥ 10 cm diameter-at-breast-height (DBH) in and within 30 m of the refined trail alignment. This updated inventory and assessment will be completed during the leaf-out period. A site walk will be completed with City staff to review identified future hazard trees and determine which of these trees require removal to accommodate the trail, versus retention with necessary pruning. The updated assessment of future hazard trees will be completed using the International Arboricultural Society Tree Risk Assessment Qualification procedure.

Tree compensation requirements associated with trail construction will be updated as necessary based on this inventory and assessment work. The updated Tree Inventory and Preservation Plan will be appended to the EIR.

Vegetation Inventories

A full spring-based vegetation inventory of the woodland/wetland communities within the subject property was not previously completed as part of the EIS. Therefore, a comprehensive inventory of spring ephemeral species was completed for these natural feature communities on May 22, 2015, for inclusion in the EIR. This survey included assessment of any federally, provincially, County or City-significant vegetation species that occur, for inclusion in EIR mapping and for assessment as potential development constraints to supplement EIS results. Where necessary, recommendations will be made within the EIR to avoid, minimize or mitigate impact to any additional observed

significant species (e.g., transplantation to restoration planting zones or other adjacent areas of suitable habitat).

A summer-based inventory will be completed targeting the locally rare Rough Avens (*Geum lacinatum*), which was inventoried by NRSI staff within the MEFM1-1 Goldenrod Forb Meadow in 2009. Because an updated vegetation inventory of the MEFM1-1 community has not been completed since 2009, an inventory of this community and the adjacent FOCM4-1 Fresh-Moist White Cedar Conifer Forest community will be completed as part of the EIR as recommended in the February 2015 EIS addendum. These communities represent the areas of suitable habitat for the species on the subject property (see Map 2). Any observed Rough Avens, or other significant species, will be photographed and identified in EIR mapping. Potential for impact from the proposed residential development or the pedestrian trail will be assessed and reported in the EIR. Recommendations for transplanting Rough Avens, where necessary, will be detailed in the EIR.

Environmental Implementation Report

The following is an outline of the components to be included and discussed in the EIR:

1. **Introduction** – will provide information on the natural features recorded, overview of Terms of Reference and background information and the proposed undertaking from the EIS.
2. **Relevant Policies, Legislation and Planning Studies** – provide an overview of the relevant policies that have been reviewed in preparation of the EIR and how each applies to the subject property.
3. **Natural Feature Characterization** – summary of existing conditions based on EIS. This section will also provide detailed information on the methods and findings from the additional vegetation inventories required as part of the EIR.
4. **Refined Trail Layout** – Detailed drawings of the refined pedestrian trail alignment and design. The final trail alignment is to be completed by an Ontario Landscape Architect (McKinnon and Associates) with NRSI input.
5. **Tree Inventory and Preservation Plan** – summary of field work and findings gathered from the updated tree inventory and assessment of future hazard trees along the refined trail alignment using a City-accepted risk assessment standard. This will include recommended mitigation measures, and the tree compensation strategy will be updated as necessary based on the outcome of this updated inventory. The Tree Preservation Plan will be appended to the EIR.
6. **Buffer Design and Restoration Plan** – provide input to Ontario Landscape Architect to develop restoration and planting plans for the natural feature buffers and wildlife corridor, comprised of suitable native plant species as recommended in the EIS. Summarize approach to buffer/wildlife corridor enhancement and naturalization, including invasive species management and garbage/debris removal.
7. **Educational/Stewardship Materials** – provide an insert to the EnviroGuide for future homeowners that outlines importance of the adjacent natural features and sensitive wildlife and provide recommendations for the protection of natural features; designs for educational/interpretative signs to be installed along the pedestrian trail; and information to be provided to construction personnel on significant species and measures to follow upon encountering these.

8. **Details of Fencing Design and Location** – text and mapping of fencing to be implemented throughout the site (e.g., permanent chain-link fencing, temporary construction limit fencing).
9. **Stormwater Management Report** – summary of the refined water balance and stormwater management plan based on the appended report prepared by MTE.
10. **Salt Management Plan** – will summarize recommendations to mitigate salt-based impacts to groundwater and adjacent natural features; will be provided by MTE and appended to the EIR.
11. **Timing of Development** – Outline of development schedule and construction timing constraints (e.g., scheduling of trail construction to avoid impacts to deer movements and nesting birds).
12. **Monitoring** – will summarize the pre-, during- and post-construction monitoring plan described below, and will summarize the results of baseline pre-construction data collected in 2015, including baseline groundwater monitoring initiated by GM BluePlan.

Monitoring Plan

A monitoring program is recommended through the pre-, during- and post-construction periods of the project in accordance with recommendations made in the EIS and February 2015 EIS addendum. The following monitoring requirements are recommended:

1. **Construction Monitoring:** Monitoring of construction activities and associated mitigation measures (i.e. sediment and erosion control/tree protection fencing, etc.) prior to and during construction to ensure construction activities are compliant with recommendations set-out in the EIR.
2. **Success of Vegetation Relocations and Restoration Plantings:** This includes monitoring the successful establishment and survival of any transplanted significant species, and restoration plantings, within the ecological buffers and wildlife corridor arising from EIS recommendations and restoration planting warranty.
3. **Mitigation Effectiveness Monitoring:** This includes monitoring to ensure proper functioning of the stormwater management system to maintain the local water balance, and monitoring associated with post-construction use of the pedestrian trail. Water balance monitoring within the natural feature will include surface water and hydrogeological monitoring, and vegetation plot monitoring during the pre-, during- and post-construction periods. The post-construction monitoring will be completed for 2 years following 75% build-out of the development.

Construction Monitoring

Construction monitoring is the responsibility of the proponent and is tied to the specific undertaking. Generally, construction monitoring must occur to ensure compliance with the conditions of various permits, including permit(s) from the GRCA under Ontario Regulation 150/06. This monitoring is to be conducted to ensure that natural features are being adequately protected and mitigation measures are functioning effectively. It is recommended that construction monitoring include inspection/consideration for the following during the construction phase of the project:

- Monitor sediment and erosion control measures a minimum of once per month to ensure that silt fencing remains properly keyed-in and has not been damaged by equipment or felled trees.
- Inspect construction fencing along the limits of natural feature buffers to ensure these are properly installed along accepted limits.
- Should any tree removal be required to occur within the migratory bird core nesting period (May 1-July 31) within non-forested habitats (CWS 2012), a qualified biologist will be notified 48 hours in advance to conduct a search for active nests. Each nest search will remain valid for a period of 48 hours after which an additional nest search will be required. Bird nest impacts will be avoided through nest searches when the May 1-July 31 window cannot be adhered to.
- Monitor for areas of bare soil that present a risk of erosion hazards to natural features, and recommend that they be re-vegetated with a suitable seed mix within 30 days of being cleared and/or inactive to prevent erosion of soils.
- Monitor trees and other areas of vegetation to be retained and ensure areas identified and delineated with temporary fencing as identified on associated plans described in the EIR, to ensure that vehicle movement or material storage does not disrupt vegetation, especially root zones.
- Note any damage to limbs or roots of trees to be retained so that they can be pruned using proper arboricultural techniques.
- Ensure maintenance of machinery during construction occurs at a designated location away from the natural area and associated buffer and wildlife corridor.
- Ensure no storage of equipment, materials or fill will occur within the natural areas or buffers.
- Prior to installation of construction limit fencing and tree protection fencing, Certified Arborist to identify any hazard trees not already identified or removed prior to construction of the residential development or pedestrian trail.

Success of Vegetation Relocations and Restoration Plantings

Transplantation of Significant Species

As stated above, any significant vegetation that is observed as part of EIR-stage vegetation inventories will be transplanted, where feasible, wherever there is potential for impact associated with the proposed residential development or the pedestrian trail. This includes any individuals of Rough Avens that may be observed through the summer-based vegetation inventory. Transplanted individuals will be relocated to suitable habitat within the proposed buffers or wildlife corridor. Each transplanted individual will be GPS-georeferenced and mapped to facilitate relocation during subsequent monitoring. Transplanted individuals will not be flagged so as not to draw attention to them from members of the public. All individuals will be transplanted prior to the initiation of site grading and construction.

Transplanted individuals will be monitored after one full growing season in the new location. Each individual will be assessed for signs of healthy growth or negative effects such as evidence of stress or die-back. Detailed notes and photographs will be taken for each monitored individual or group of individuals. If individuals are observed showing signs of poor health, mitigative actions will be recommended based on assessment of what may be causing the negative effects. Mitigative actions may include removal of adjacent out-competing vegetation, installation of measures to mitigate deer browse, or increases in the frequency of watering.

Inspection of Restoration Plantings

Native tree species installed within the buffers and wildlife corridor will be inspected at the end of the 2-year warranty period. Each planted tree will be assessed by an Ontario Landscape Architect for health condition and success of establishment.

If planted trees are observed showing signs of poor health, mitigative actions will be recommended based on assessment of what may be causing the negative effects. Mitigative actions may include, but not be limited to, removal of adjacent out-competing vegetation, installation of measures to mitigate deer browse, or periodic watering during dry periods. Any planted trees that die within the warranty period will be replaced at a 1:1 ratio.

Mitigation Effectiveness Monitoring

Natural Feature Water Balance Monitoring

A monitoring program will be initiated to ensure that the proposed development does not negatively impact the adjacent natural features or ecological functions through an alteration of the water balance caused by water discharge from the stormwater management (SWM) facility. This monitoring program will focus on measures of groundwater, surface water, and biotic responses of vegetation and amphibian breeding across pre-, during- and post-construction periods of the project. The post-construction period will be considered initiated at 75% build-out of the development and will extend for a 2-year period. At least 1 year of baseline data will be collected during the pre-construction period, against which during- and post-construction data will be compared to identify evidence of potential natural feature impact. Comparisons to baseline data will also consider the limitations of the data and confounding variables, such as meteorological conditions that may influence the results. The following describe the sub-components of this water balance monitoring program.

Groundwater Monitoring

A groundwater monitoring program will be conducted to assess baseline conditions and the potential for influence to the groundwater levels associated with development, with focus on the wetland, and areas downgradient of the proposed stormwater management system. Currently, baseline information includes measurements from 18 events between 2010 and 2013 at nine existing monitoring locations.

To supplement the existing monitoring locations, three (3) piezometers have been installed approximately 1 to 2 m deep in the vicinity of the GRCA wetland boundary to provide information regarding background groundwater and surface water levels (Map 2). The elevations of the piezometers have been tied into the existing monitoring network using an elevation survey. Water level measurement will be completed by collecting temporal water levels at multiple locations, for comparison to both baseline and historical information, as well as correlation between locations, and surface water levels. To record water levels on a continuous basis, four (4) logging pressure transducers have been installed at locations monitoring well locations MW-3S, and the three (3) new piezometers.

Based on the existing information, additional baseline information is proposed to be collected and reported in conjunction with the surface water monitoring program beginning in April 2014. Following this baseline period, pressure transducers can be utilized to collect information year-round, unless freezing conditions force removal.

Surface Water Monitoring

Surface water monitoring will be completed to track any observations of changing hydrologic regime within the cedar forest and wetland communities that may be caused by stormwater discharge, in conjunction with hydrogeological monitoring. For example, changes in amount of surface water ponding or evidence of increased flow channelization within the features over time, and in comparison to reference plots, will be considered as evidence of potential water balance impacts caused by the stormwater management system. Increased duration and frequency of surface water ponding within the natural features, relative to baseline conditions, may negatively impact existing vegetation including regenerating seedlings within the swamp community. These results will also therefore be considered in conjunction with the results of vegetation plot monitoring, described below.

One surface water logger will be installed within the cedar forest community, along with a groundwater piezometer, immediately downstream of the spreader berm. This logger will be installed in one of the depressional features common within this forest community where any surface runoff from the spreader berm is likely to collect. Data will be downloaded periodically from this unit by GM BluePlan staff in conjunction with groundwater data collection.

Surface water measurements will also be taken from various selected measurement points down-gradient of the spreader berm as well as within reference locations outside of the potential zone of influence of the spreader berm discharge (Map 2). Each point will be selected as locations of anticipated or known surface water collection (e.g., surface depressions) within the cedar forest and wetland. At each measurement point, a wooden stake will be installed against which water level measurements will be taken, in order to ensure that measurements are taken at a consistent location each time. Each stake will be surveyed for elevation such that each water level measurement can be recorded in terms of its elevation. Photographs at standardized angles will be taken at each stake location for comparison across monitoring events. Surface water measurements will be made through use of a metre stick or tape measure set against a reference line on each stake to ensure measurements are taken in a standardized fashion at each measurement point across visits. Surface water measurements will be made on a regular basis between at least April-September of each monitoring year, starting with pre-construction monitoring in 2015. On-site monitoring staff will also visually characterize, photograph and map the general extent of surface water ponding within the buffer, cedar forest and wetland communities both down-gradient of the spreader berm and elsewhere within these features on the subject property. Evidence of channelized surface water flow will also be recorded, mapped and photographed.

Vegetation Plot Monitoring

Vegetation plot monitoring will be completed within the zone of influence down-gradient of the spreader berm to assess vegetation health across pre-, during- and post-construction periods. Spring and summer-based monitoring will be completed within these plots each monitoring year. Spring plot-based monitoring was completed on May 22, 2015. This monitoring is required to determine whether vegetation survivorship and health is being impacted by any changes to the natural feature water balance caused by post-construction stormwater management discharge. The results of this monitoring will therefore be considered in conjunction with the results of hydrological and hydrogeological monitoring completed by GM BluePlan as described above.

Three permanent 10x10 m vegetation sampling plots have been established as shown on Map 2: two within the potential stormwater discharge zone of influence, while one additional reference plot has been established outside of the potential zone of influence. Within each of these sampling plots, subsamples will be monitored for trees, shrubs and herbaceous vegetation. The permanent sample plots will be returned to each monitoring event, while the smaller subsampling quadrants within the plots will be selected randomly within the larger plot. The corner of each plot will be marked with a steel bar to permanently mark its location. A photograph of each plot will be taken each year at the same time of year, same location, in the same direction, for comparison over time.

Within each plot the following vegetation sampling will be carried out:

Trees – all trees (live), greater than 10 cm DBH will be marked with a permanent numbered tag, unless already tagged through earlier NRSI tree inventory work. The species, size and general health of each tree will be recorded. Any tree that dies during the monitoring period will be recorded. In the initial survey all standing dead trees greater than 10 cm DBH will be identified to establish a current baseline.

Trees <10 cm DBH – four random 2x2 m subplots will be established to inventory trees <10 cm DBH, including seedlings. Within these plots, all individuals are to be counted and categorized by species and height: <2 m, 2-5 m, >5 m. Dead trees will be recorded as such.

Shrubs – two random 2x2 m subplots will be established to inventory shrubs, including seedlings.

Herbaceous Flora – five 1x1 m random subplots are to be established. Within each of these plots, all species of vascular flora will be recorded including the percent cover by each.

Physical Characteristics – Depth of water at the corner bar will be measured (if any), indicators of high water levels will be recorded (i.e. high water marks on trees, elevated root systems, etc.). Soil texture, depth of organic matter, presence of mottles, gleying and depth to water table will be recorded.

Data will be analyzed and summarized to report standard measurement parameters for each vegetation plot, including the following:

- Inventoried species, including Coefficient of Conservatism and Wetness Index, federal/provincial/local status ranking, and number of individuals and % cover within each subplot
- Average Coefficient of Conservatism, Floristic Quality Assessment Index, and Wetness Index for each plot
- Species richness, and number of non-native species
- Dominant species, by individual count or % cover
- Summary tables for each individual tagged tree ≥ 10 cm DBH by plot, including the following information:
 - DBH
 - crown radius (m)
 - canopy surface area (m²)
 - basal area (m²/ha)
 - physical condition description (e.g., mature, actively growing, declining, dead)
- Plot-wide summaries of total number of trees ≥ 10 cm DBH, tree density, number of dead trees, and total tree surface area (m²) and basal area (m²/ha).

The flood tolerance classification for each inventoried species will be identified in the compiled species list table where data is available based on the US Environmental Protection Agency *National Database of Wetland Plant Tolerances* (Adamus and Gonyaw 2000). As identified within the database, inventoried species will be classified as “Tolerant”, “Moderately Tolerant”, “Somewhat Tolerant” or “Intolerant” to increased flooding duration. Plot-based monitoring summaries will include the proportion of inventoried species that are considered flood tolerant according to this database (Adamus and Gonyaw 2000).

If down-gradient changes in species composition, richness or health are observed over time, mitigative actions will be recommended based on assessment of what may be causing the negative effects. Mitigative actions may include evaluation of LID and stormwater management facility performance and consideration of additional measures to alleviate observed water balance impacts.

Amphibian Call Surveys

Amphibian call surveys will be completed to monitor the occurrence and relative abundance of anuran (frog and toad) breeding within the PSW. As amphibians are sensitive to changes in their habitat (e.g., water quality, hydroperiod changes), amphibian breeding may be indicative of the relative health of the wetland system as a functional ecological community. This monitoring is recommended as another biotic response parameter to ensure that no post-construction water balance changes occur that could negatively impact existing amphibian breeding habitat functions of the wetland. The results of amphibian monitoring will be compared against other water balance monitoring measures described above to assess whether any observed changes in amphibian breeding may be attributed to the post-construction residential development and stormwater management facility.

Three night-time surveys during each of April, May and June will be completed annually during the pre-construction, construction and post-construction periods. Surveys will be completed in accordance with the Marsh Monitoring Program protocol (Bird Studies Canada 2009). It is anticipated that two unlimited distance monitoring stations will be established to monitor the PSW from within the subject property. Baseline pre-construction data has been collected during spring 2015, and will be reported on in the EIR.

Buffer Disturbance Monitoring

Annual visual inspections of the buffers and wildlife corridor will be completed to document evidence of natural or anthropogenic disturbances. Inspections will be completed across pre-, during- and post-construction periods and will consist of assessments of the following components:

- Soil Compaction: Identifies any area that exhibits soil compaction (increasing bulk density and reducing total porosity), such as during construction;
- Soil Erosion: Identifies areas that are eroding or may be prone to erosion such as slopes;
- Damage to Trees and Vegetation: Identifies damage caused by natural sources and vandalism;
- Presence of Unauthorized Structures and Activities: Identifies non-permitted uses;
- Unauthorized dumping of Landscape Refuse, Household Garbage, Casual Littering and Building Materials: Identifies illegal activity;

- Non-native Invasive Species: Identifies the non-native/invasive species present within the buffers and wildlife corridor, and their relative abundance within these features (e.g., abundant, occasional, rare) and their mapped locations; and,
- Hazardous Tree Conditions: Identifies trees that pose a hazard to people or property.

The visual inspection will be supplemented with a photographic inventory to ensure a record of previous conditions is established. Pre-construction baseline data will be collected against which construction and post-construction stage results will be compared. The results of these inspections will be summarized in annual reporting for the comprehensive monitoring program. Recommendations will be made to address or mitigate observed impacts where necessary.

Post-Construction Breeding Bird Surveys

This monitoring will be completed to evaluate the effectiveness of post-construction stage measures to mitigate impacts to breeding birds caused by public use of the woodland pedestrian trail segment. The focus of these surveys will be to assess the presence of provincially and locally significant species documented within the woodland/wetland complex during EIS field studies, including Wood Thrush (*Hylocichla mustelina*), Eastern Wood-Pewee (*Contopus virens*), Black-and-white Warbler (*Mniotilta varia*), Northern Flicker (*Colaptes auratus*), and Veery (*Catharus fuscescens*). Surveys will also assess the presence of Eastern Kingbird (*Tyrannus tyrannus*) within the buffer and wildlife corridor areas.

Early morning breeding bird surveys will be completed during each of the two years of the post-construction period, and will be completed in accordance with Ontario Breeding Bird Atlas protocol (OBBA 2001). The results of these surveys will be compared against the results of pre-construction breeding bird surveys completed on the subject property for the EIS. Surveys will be completed through a combination of 10-minute point counts and area searches, and will be targeted to assess areas in proximity of the pedestrian trail versus more interior areas of the woodland/wetland complex. Surveys will also be completed within the restored woodland/wetland buffer and the wildlife corridor.

Monitoring Program Timeline

The following is a summary of the timing of monitoring program components, specific to the pre-, during-, and post-construction periods of development. The following timeline assumes a 2-year construction period; this timing is an estimate and may vary. The post-construction period is considered to begin at 75% build-out and as noted above is considered to be a 2-year period. The year 2015 represents the 1-year pre-construction period. This monitoring program timeline is subject to revision based on variations in development period durations (e.g., timing of construction initiation and duration).

Pre-Construction Period (2015)

- Baseline data collection for the following within the natural feature
 - Groundwater levels
 - Surface water levels
 - Vegetation, based on plot-based monitoring parameters
 - Natural and anthropogenic disturbances within the buffer and wildlife corridor

- Breeding amphibian species presence and relative abundance, based on call surveys
- Spring and summer-based vegetation inventories to identify any significant vegetation requiring transplantation or other mitigation measures

Construction Period (2016-2017)

- Health assessment of any transplanted significant vegetation 1 year following relocation to restoration areas
- Natural feature monitoring for comparison to baseline conditions, including the following:
 - Groundwater levels
 - Surface water levels
 - Vegetation, based on plot-based monitoring parameters
 - Natural and anthropogenic disturbances within the buffer and wildlife corridor, including ensuring maintenance of construction activities and storage outside of these areas except where required for grading
 - Breeding amphibian species presence and relative abundance, based on call surveys
- Construction monitoring including the following:
 - Installed sediment and erosion control measures
 - Construction limit and tree protection fencing inspections
 - Breeding bird nest searches, where necessary
 - Monitoring of bare soil areas that may present erosion/sedimentation potential
 - Pruning of damaged tree limbs

Post-Construction Period (2018-2019)

- Health assessment of tree plantings within restoration areas at the end of the 2-year warranty period
- Natural feature monitoring for comparison to baseline conditions, including the following:
 - Groundwater levels
 - Surface water levels
 - Vegetation, based on plot-based monitoring parameters
 - Natural and anthropogenic disturbances within the buffer and wildlife corridor
 - Breeding amphibian species presence and relative abundance, based on call surveys
 - Breeding bird surveys, for comparison against EIS-stage field data

Reporting Structure

It is recommended that reporting be completed annually for the proposed monitoring program. However, details of the monitoring program will be refined based on discussions between the landowner, City of Guelph and GRCA. This will include confirming the monitoring protocol and reporting relationships, as well as monitoring duration.

An annual comprehensive monitoring report process will facilitate effective monitoring by integrating data from the various monitoring components to address trends and effects,

where appropriate. The reporting process will result in the production of an annual Consolidated Monitoring Report, which will include the following components:

1. A **Summary of Findings** of each monitoring discipline provides the reader with a synopsis of all the information and highlights any substantive changes in the methodologies.
2. **Individual Reports** from the past year for each discipline (e.g., hydrogeological, biological) are appended to provide the reader with the opportunity for a more detailed review, to facilitate referencing in the main body of the report, and to file all monitoring information together by year.
3. **Construction Inspection Reports** are appended to ensure they are filed with the other monitoring data, and to facilitate referencing as needed in the main body of the report.
4. **Reporting on Effects** from the past year stemming from observations of concern (if any) is appended and summarized.
5. **Trends and Effects** (either positive or negative) are identified and addressed in detail. All known causes related to each trend or effect are included in the discussion. The discussion is based on all applicable monitoring data, and can also make use of construction inspection reports and/or effects reporting.
6. **Recommended Actions** are provided to deal with negative trends or effects. They should also indicate the severity of the issue and provide a timeframe for action.
7. **Corrective Measures** that have taken place in the previous year are documented. The associated discussion clearly indicates whether the recommendation has been implemented and the situation corrected.
8. **A review of future monitoring needs** will summarize recommendations from the individual reports, and provide any clarification required to ensure continued coordination of the monitoring disciplines.

References

- Adamus, P.R. and A. Gonyaw. 2000. National Database of Wetland Plant Tolerances. Prepared for the USEPA. <http://www.epa.gov/owow/wetlands/bawwg/publicat.html>
- Bird Studies Canada. 2009. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. 2009 Edition. Published by Bird Studies Canada in Cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.
- City of Guelph. 2015. Environmental Advisory Committee Draft Meeting Minutes. Wednesday March 11, 2015.
- Natural Resource Solutions Inc. (NRSI). 2014. Arkell Woods, 44, 56, 66 and 76 Arkell Road, City of Guelph Environmental Impact Study. October 2014.
- Natural Resource Solutions Inc. (NRSI). 2015a. 44, 56, 66 and 76 Arkell Road, Guelph Addendum to the Arkell Woods Environmental Impact Study (October 2014 Submission). February 2015.
- Natural Resource Solutions Inc. (NRSI). 2015b. 44, 56, 66 and 76 Arkell Road, Guelph 2nd Addendum to the Arkell Woods Environmental Impact Study (October 2014 Submission). May 11, 2015.
- Ontario Breeding Bird Atlas (OBBA). 2001. Guide for Participants. Atlas Management Board, Federation of Ontario Naturalists, Don Mills.

Maps

Arkell Woods EIR Proposed Development

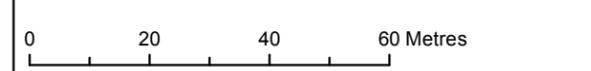
Legend

- Property Boundary
 - Future Subject Property Boundary
 - ▭ Proposed Pedestrian Trail
 - Development Area Limit
 - Proposed Development
 - Dripline (NRSI December 2012)
 - Wetland Boundary (Reviewed by GRCA - July 26, 2010)
 - - - 30m Wetland Buffer
 - - - 10m Dripline Buffer
 - Ecological Land Classification (ELC)
- (FOCM4-1) Fresh-Moist White Cedar Conifer Forest Type
 (MEFM1-1) Goldenrod Forb Meadow Type
 (SWDM3-3) Swamp Maple Mineral Deciduous Swamp Type
 (SWMM1-1) White Cedar-Hardwood Mineral Mixed Swamp Type
 (TAGM1) Coniferous Plantation
 (THDM2-6) Buckthorn Deciduous Shrub Thicket Type



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Arkell Woods EIR Monitoring Locations

Legend

- Property Boundary
- Future Subject Property Boundary
- Development Area
- Proposed Development
- Spreader Berm
- Vegetation Monitoring Plot
- Piezometer Location
- ▲ Surface Water Monitoring Locations
- ▲ Anuran Monitoring Station
- ▭ Proposed Pedestrian Trail
- Dripline (NRSI December 2012)
- - - Wetland Boundary (Reviewed by GRCA - July 26, 2010)
- - - 30m Wetland Buffer
- - - 10m Dripline Buffer
- ▭ Ecological Land Classification (ELC)
 - (FOCM4-1) Fresh-Moist White Cedar Conifer Forest Type
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