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Ecological Land Classification and Terrestrial Environment Effects Assessment for the Port Hope and Port Granby Projects.

ABSTRACT

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The Ecological Land Classification system was developed to provide a standardized methodology for describing plant communities and wildlife habitat in southern Ontario. The method employs a hierarchical classification system. It can be applied at different levels of accuracy, i.e., at regional, sub-regional, and local scales with an increasing differentiation of vegetation communities.

The standardization of the approach permits a comparison of vegetation communities from different sites and an evaluation of the rarity of these communities within the province. Further, the approach facilitates the monitoring of changes in terrestrial communities with time. These characteristics make Ecological Land Classification mapping a useful tool for environmental assessment such as the ones undertaken for the Port Hope and Port Granby Long-Term Waste Management Projects, which were conducted pursuant to the *Canadian Environmental Assessment Act 1992*.

In the context of the Environmental Assessment for the Port Hope and Port Granby Projects, an Ecological Land Classification study was undertaken to characterize the terrestrial environment at regional, local and site levels. Vegetation patches (polygons) were delineated on the basis of air photo interpretation. The individual polygons were then visited for detailed inventory and classified to the most detailed level; that is to the vegetation type. Plant communities were then compared with those listed in the Ontario Natural Heritage Information Centre database to determine their rarity and to determine where they rank as Valued Ecosystem Components.

Ecological Land Classification mapping results were used in the assessment of effects to Valued Ecosystem Components. A spatial analysis of the digitized vegetation maps showed the geographic extent of habitat losses and impairments due to various project works and activities. Landscape rehabilitation strategies and concepts were subsequently developed based on Ecological Land Classification inventory data and predicted effects.

Introduction.
Waste materials from a refinery operated by Eldorado Gold Mines Limited were disposed of in three primary disposal sites as well as at a number of other sites (remediation sites) around Port Hope (Figure 1). The Port Hope and Port Granby projects are initiatives to collect low-level radioactive waste (LLRW) and marginally contaminated soil (MCS) that were deposited at sites in the Port Hope area over the past 60 years for containment in long-term waste management facilities (LTWMFs).

The federal government represented by Natural Resources Canada (NRCan), Fisheries and Oceans Canada (DFO) and the Canadian Nuclear Safety Commission (CNSC) together with the Municipalities of Port Hope and Clarington initiated projects to clean up these sites and manage the LLRW in two above ground facilities designed to last for several hundred years. The projects are a federal undertaking and are proceeding under the *Canadian Environmental Assessment Act 1992* (CEAA).

As a part of the environmental assessment (EA), it is necessary to describe the terrestrial environment that is associated with the existing sites and the proposed LTWMFs, to ascertain whether there are any vulnerable, threatened or endangered (VTE) species that might be affected by the undertaking and whether there are any rare or unusual plant communities that should be protected and avoided.

The EA process also requires an assessment of the effects of the project on the terrestrial environment. Amec Earth and Environmental (AMEC) and the Low-Level Radioactive Waste Management Office (LLRWMO) decided that the Ecological Land Classification (ELC) system[9] should be used to undertake this inventory of the terrestrial environment and the assessment of effects. This classification system uses a hierarchical approach to describe plant communities at several levels of detail and generates reproducible results.

The ELC System was developed from a number of previous systems for land classification in Canada.[6], [7], [8], [11], [13] The broadest level of classification is the site region (ecoregion), which is driven largely by climate and results in different types of plant communities on comparable physiographic sites. The Port Hope area occurs within the Great Lakes St Lawrence Ecoregion and is characterized by deciduous forests of oak, maple, basswood and elm with white pine on drier sites and eastern white cedar on moist to wet sites. The majority of the land in the area was cleared of forests in the nineteenth century and is now agricultural, industrial, residential or commercial with forest patches remaining in river valleys, in some residential areas and as the occasional farm woodlot.

The area is traversed by a number of small creeks, and the Ganaraska River, that drain into Lake Ontario. Since the period of European settlement, land uses have changed and many fields that were once cleared have been allowed to revert to plant communities that include, meadows, thickets and woodland.

Methods

Study areas for the Port Hope and Port Granby were delineated as either site study areas or local study areas. Site study areas were delineated to include the immediate construction sites and adjacent lands as the immediate zone of influence of the projects. Local study areas were larger and extend beyond the site study area to include all areas, where there is a reasonable expectation for obvious, easily understood and mitigable environmental effects related to the activities being undertaken within the site study area. Extended local study areas were delineated along roads designated for the transportation of construction and waste materials. These extended local study areas were used to characterize terrestrial components along the transport routes and to assess the extent of potential transportation-related effects.

Recent air-photos of the study area were obtained and used to delineate all vegetation patches. This information was transferred to digital maps of the area based on the 1:10,000 Ontario Base Maps (OBMs). Fieldwork was undertaken to identify and classify the vegetation communities using the methodology described in the ELC handbook[9]. The results of the fieldwork were used to refine the boundaries of the vegetation patches and the classified patches were then converted into a Geographic Information System (GIS) map layer that could be superimposed on selected Natural Resources and Values Information System (NRVIS) map layers provided by the Ontario Ministry of Natural Resources (OMNR).

It was then possible to calculate the proportion of all plant community types within the defined study areas. The plant community information was compared with that of the Ontario Natural Heritage Information Centre (NHIC) database to determine whether there were any rare or distinct plant communities. The NHIC was also used to determine whether the plant species identified during the fieldwork included any VTE species. Habitats and species that should be considered as Valued Ecosystem Components (VECs) were then proposed to facilitate a focused environmental assessment.

In accordance with the ELC survey methodology, wildlife sightings and signs were recorded within each polygon. This information was supplemented with an amphibian count and a breeding bird survey and utilized to characterize the wildlife that is associated with the study areas.

The Plant Communities of the Port Hope and Port Granby Project Areas

The results of the ELC survey, which are documented in a comprehensive baseline characterization study[1], are briefly summarized below.

<u>Port Hope Ward 1 Local Study Area</u>

The Port Hope Ward 1 site comprises the existing WMF as well as a part of the Ganaraska River, Monkey Mountain Wooded Ravine and Highland Drive Wooded Ravine. The area of the Port Hope local study area is 96.2 ha (Figure 2) of which 29% is mixed forest, 15.5% is deciduous forest, 20.7% is coniferous forest, 3.4% is 'other woodland' and 0.4% is plantation forest. The cultural meadow communities represent

the next largest areas with 29.7% and there is about 0.7% of shallow marsh and a small pond area that is 0.5% of the area.

Non-native species are common throughout the area representing about 37.7% of the 251 species recorded. This is typical of disturbed plant communities in Southern Ontario.[10] Each vegetation patch was evaluated as to its significance based upon plant species richness, presence of rare species, the proportion of native to non-native species and the maturity of the vegetation community. The majority of the local study area is considered to be of low to moderate importance. Only two patches were considered to be of high importance and they were part of the Ganaraska River floodplain that is a designated Environmentally Significant Area (ESA).

Port Hope Remediation Sites

There are 18 remediation sites in Port Hope that contain LLRW and MCS. Twelve of the remediation sites are separate from each other and they all occur within the largely urban and industrial areas of the town of Port Hope (Figure 2). The area of the Port Hope remediation site local study area remediation site is 53.9 ha.

Port Hope Ward 2 Local Study Area

The Ward 2 site is located in the northwest corner of the Town of Port Hope approximately 3 km north of Lake Ontario. The area of the Port Hope Ward 2 local study area is 212.8 ha. The existing licensed site is 38 ha and the proposed LTWMF will include the existing WMF as well as an additional 13 ha. The majority of the study area land is either agricultural (35%) or cultural meadows and old fields (42.2%). There is approximately 7.9% of mixed forest, 6.5% of deciduous forest and 3.4% of coniferous forest. Plantations comprise 1.4% of the area and cultural woodlands and thickets each comprise 1.8% of the area. There is a very small area of marsh (0.2%).

Port Granby Local Study Area

The area of the Port Granby local study area is 422 hectares. The ELC map (Figure 3) shows the large proportion of agricultural fields that occur as a mixture of arable, hay and pasture fields and cover approximately 44% of the area. Industrial and residential areas including rural settlements cover approximately 7.5% of the local study area and the remainder of approximately 50% can be classified into "natural" vegetation types using the ELC methodology.

Cultural meadows are difficult to classify and while some may be cut irregularly for hay, others are grazed periodically or kept in a grassland condition by spring flooding and water levels. Likewise the various types of thicket and old old-field are also difficult to differentiate. There were 26% grasslands (meadow), 2.2% thickets and 0.7% cultural savannahs in the local study area.

Forested areas are comprised of 7.3% of mixed forests, 4.4% of deciduous forest and 10% coniferous forest. The most distinctive communities are those of the open bluffs fronting onto Lake Ontario and these include open, shrub and treed bluffs (3.6%). The bluffs are the most significant communities within the study area, which are relatively

poorly represented in the province and were therefore proposed as a VEC. The other vegetation communities are common within the province, though the occurrence of shoreline deciduous forests is uncommon[3] and represents an important habitat for staging passerines on migration.

Importance of Vegetation

The importance of the vegetation within the study area was determined based on plant species richness (i.e., the number of species per site), the presence of rare species, the naturalness (proportion of native species to non-native species) and the maturity of the plant community.

Species Richness

The plant species richness provides an indication of biodiversity. Generally the older and more mature a plant community, the greater the biodiversity. The highest number of species was recorded in the mixed forest habitats, but the specialized fen habitats that occurred both in Port Granby and in Port Hope also provided areas of high species richness.

Vulnerable, Threatened and Endangered (VTE) Species

Any EA carried out under CEAA has to take into consideration VTE species that might be affected by the project. Such species are either listed federally by the Committee on the status of endangered wildlife in Canada (COSEWIC) or provincially under the Committee on the status of species at risk in Ontario (COSSARO). A number of species that are rare locally or regionally were discovered but none that are VTE species under provincial or federal regulations.

Proportion of Native Species

The proportion of native to non-native species provides a good indication of the degree of naturalness of a plant community. A high proportion of native species in a plant community is an indication that it is relatively undisturbed and is therefore more valuable than one which has many non-native species and is usually highly disturbed. In southern Ontario, the average proportion is about 70% native species.

Maturity of Plant Community

Generally, the older a plant community is the greater is its biodiversity. This applies particularly to woodlands where mature treed communities have a richer ground flora and a greater structural diversity than a young treed community. The age of other plant communities such as grasslands and wetlands is also important.

Location of Plant Communities - Corridors

While individual patches of vegetation may be evaluated using the previous criteria; the location of the patch within the overall landscape plays an important role in its importance. If the patch is isolated from other natural communities it is less important than if it is connected to other patches. This corridor function is an additional factor that was used in evaluating habitats and where a patch that may not have a high value by

itself, serves to connect other patches, it may have a value as a corridor and thus elevate its overall ranking.

The importance of each mapped vegetation patch is represented as high, medium or low depending on the sum of the importance factors. In Port Granby, the majority of lands are agricultural and do not support natural plant communities. About 4% of the area has a high level of importance and is comprised of patches of mixed forest, coniferous forest, swamp and treed bluff and these should be protected. There is about 7% of the area that has a moderate value ranking and 89% has a low ranking. The values were compared with the rarity of communities based on the NHIC's database and were generally found to be in agreement.

The Wildlife Habitats and Communities in the Port Hope and Port Granby Project Areas

The ELC surveys also generated information on wildlife within the project areas. Since the information collected was polygon-specific, analysis of the data and observations provided indications on habitat utilization by individual species as well as indications for certain habitat features. The supplementary data obtained from the amphibian call counts and breeding bird surveys further assisted in characterizing habitat qualities and wildlife communities.

Habitat for wildlife in the Port Granby local study area ranges from open fields to densely wooded areas. This habitat mosaic is typical for the cultural landscape of the regional study area. Specialized habitats are limited and include cavity trees, open bluff faces along the lakeshore, and pockets of interior forest habitat and interior grassland habitat. Wildlife associated with these habitats was surveyed with particular emphasis on birds, and amphibians. As part of the fieldwork, 11 mammal species, 65 bird species, five amphibians and one reptile (Painted Turtle – *Chrysemys picta*) were recorded. All of the species represent common species.

Specialized habitats in the Port Granby local study area are indicated by the occurrence of species such as Bank Swallows (*Riparia riparia*), Northern Flicker (*Colaptes auratus),* Ruffed Grouse (*Bonasa umbellus)*, and Eastern Meadowlark (*Sturna magna).* There were few amphibian species present and they occurred in low numbers probably due to the absence of many suitable breeding habitats. Species encountered included, American Toad (*Bufo americanus americanus*), Gray Tree Frog (*Hyla versicolor*), Wood Frog (*Rana sylvatica*) and Spring Peeper (*Pseudacris crucifer crucifer*). Mammals recorded during the fieldwork included: White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*); Raccoon (*Procyon lotor*); Red Fox (*Vulpes vulpes*); Eastern Cottontail (*Sylvilagus floridanus*); Eastern Chipmunk (*Tamias striatus*); Red Squirrel (*Tamiasciurus hudsonicus*); Gray Squirrel (*Sciurus carolinensis*); Meadow Vole (*Microtus pennsylvanicus*); Masked Shrew (*Sorex cinereus*); and Meadow Jumping Mouse (*Zapus hudsonius*).

In a cultural landscape, habitat corridors are of particular significance for wildlife conservation. They provide valuable linkages between otherwise isolated habitat,

offering opportunities for wildlife migration, genetic exchange between populations, seed dispersal and repopulation of biologically impoverished areas. As part of the baseline inventory, Primary, Secondary, or Tertiary Corridor habitat was determined based on the geographic distribution and connectedness of the individual vegetation patches in the Local Study Area. Both the Lake Ontario shoreline and Port Granby Creek valley were considered to be Primary Corridors. Port Granby East Ravine was classified as a Tertiary Corridor.

To further characterize wildlife habitat in the Port Granby local study area, five habitat complexes were delineated based on the level of importance established for the individual habitats, boundaries of designated protection areas, and other functional considerations. These habitat complexes were considered to be of particular importance as wildlife habitats in the local study area and were selected to be VECs for the purpose of the subsequent environmental effects assessment.

The approach to the characterization of habitat and wildlife communities for the Port Hope project was identical to that followed for Port Granby. Given the high degree of development and small habitat patches, species numbers within individual areas were generally lower than for the Port Granby site study area. Species recorded were representative of an urbanized landscape and common in the province with no affiliation to specialized habitat. Specialized habitat was limited to a pocket of interior forest bird habitat and a few amphibian pools.

Assessment of Effects of the Projects on Vegetation Communities and Wildlife

In order to identify and evaluate potential effects of the projects on the terrestrial environment, the following methods were applied[2]:

- Ecological Risk Assessment (ERA);
- Interpretation of effect predictions for non-terrestrial environment components; and
- Spatial analysis.

Ecological Risk Assessment (ERA)

An ERA was conducted to determine the potential exposure and dose levels that terrestrial biota may experience through the construction and development phase and subsequent operation of the LTWMFs. Root uptake, foliar deposition, ingestion, and inhalation were considered to be the pathways through which plants and animals could be subjected to elevated levels of Contaminants of Potential Concern (COPCs). Deposition rates for soil and plant surfaces were calculated based on predicted emission contours generated by the atmospheric environment consultant (SENES Consultants Limited). Root uptake factors were employed to calculate exposure and internal dose levels for plants. Exposure levels for soil invertebrates and small mammals were calculated based on ingestion rates and time of residency in the potentially contaminated area.

The ERA demonstrated that the increases in concentrations of COPCs in soils at the Port Granby site perimeter were within 10% of background concentrations. At the perimeter of the Port Hope Ward 2 site, concentrations of thorium-230, arsenic and cobalt were

elevated by ≤20%. For all terrestrial biota, the resulting increases in exposure and dose for radionuclides and non-radioactive COPCs were calculated to remain well below the established benchmark values of 1 MGy/kg. Consequently, it was concluded that project-related changes in air quality will have no measurable adverse effects on terrestrial biota. As predicted concentrations of COPCs are lower at the Port Hope Ward 1 and the Port Hope remediation sites, no risk calculations were conducted for these locations.

Interpretation of Effect Predictions for Non-terrestrial Environment Components

Noise contours were obtained from SENES[12a, 12b] for the baseline conditions, construction, and operation phases. Noise levels are generally predicted to increase above existing levels during the construction period due to the use of heavy on-site machinery and increased truck traffic for haulage of construction and waste materials. Given the general urban/rural character of the habitats and wildlife communities at the project sites, the existing traffic levels, and the temporary character of the project activities, no measurable changes in wildlife communities were predicted.

Contaminant transport and fate modeling conducted by Conestoga-Rovers and Associates Ltd [5a, 5b], predicted changes in the groundwater regime as a result of the excavations and the operations of the engineered containment systems of the LTWMF. Clearly, potential for interactions between the projects and the groundwater regimes exist as the containment systems are designed to prevent surface waters from infiltrating into the LTWMFs and exfiltrating through the facilities' base liner systems. The results of the model demonstrated that the overall groundwater regime near the LTWMFs will not be altered. Groundwater quality is anticipated to improve where waste material is excavated and sites are remediated. No measurable groundwater impairments are predicted at the engineered LTWMF sites.

Spatial Analysis

Spatial analysis was the key analytical tool used in the effects assessment for the terrestrial environment. Of all of the project works and activities, only the (temporary) removal of the vegetation cover was considered to cause likely and measurable change in vegetation communities, habitats and wildlife.

The footprints of the various remediation sites in Port Hope and the LTWMFs in Port Hope and Port Granby were overlaid with the ELC mapping to determine the spatial extent of the projects' works and activities (Figures 2 and 3). To facilitate the assessment of the significance of the effects, the analysis determined the type of the vegetation communities affected and their level of ecological importance, i.e., the degree to which high, moderate, and low ranked vegetation communities may be affected (Figure 4). The results are summarized in Table 1.

Table 1: Affected Vegetation by Levels of Importance

Port Granby Project	**High (total area 64ha)**	**Moderate (total area 96ha)**	**Low (total area 263ha)**
In % of Total Affected	4%	7%	89%

Area (58 ha)	(2.5 ha)	(4 ha)	(52ha)
In % of Total of Respective Rank	4%	4%	20%
Port Hope Project (Wards 1, Ward 2 & Remediation Sites)	**High (total area 20ha)**	**Moderate (total area 100ha)**	**Low (total area 80ha)**
In % of Total Affected Area (50ha)	0.2% (0.1ha)	20% (10ha)	80% (40ha)
In % of Total of Respective Rank	0.5%	10%	50%

The effects of the projects on highly ranked vegetation communities are very low, both in percentage of the total affected area, but also in percentage of all of the vegetation within the study area, that received a high ranking. Most of the highly ranked vegetation communities therefore will remain unchanged by the project activities. The highly ranked vegetation community types that are likely to be temporarily affected are:

Port Granby
- Treed bluff (0.9 ha out of 14.7 ha); and
- Mixed forest with Fen Ecosite (1.7 out of 1.9 ha);

Port Hope
- Fen (0.08 ha out of 0.8 ha); and
- Sea Rocket beach (0.02 out of 3.9 ha).

Effects on vegetation communities were considered to also reflect the effects on wildlife habitat. The spatial analysis that was specifically conducted for wildlife included an analysis of effects on wildlife complexes and wildlife corridors and distinguished between effects on Primary, Secondary or Tertiary Corridors. The analysis revealed that the Port Granby and the Port Hope projects will temporarily affect a very small portion of the mapped habitat complexes and corridors (i.e., less than 10% habitat complexes and less than 7% of the existing corridors in the respective local study areas). Most importantly, these effects will occur along the margins of habitat complexes and corridors. Existing corridors will not be disrupted or transected, i.e., habitats will not be further fragmented.

Effects Management Features and Mitigation

The projects include numerous and extensive design and management features developed to reduce adverse environmental effects as much as possible. These entail, for example, efforts to minimize suspension of COPCs into the air during excavation, waste transport, and placement into the final storage cells. Measures include, dust suppression at excavation sites, tight covering of transport trucks, washing of waste transport trucks prior to entering public roads, and daily covering of exposed work faces at the LTWMF, where the waste is being placed for permanent storage.

As part of the effects assessment for the terrestrial environment, the project-inherent effect management features were reviewed. AMEC identified a suite of supplementary

mitigation measures to further reduce and avoid adverse effects on vegetation communities, habitats and wildlife. The emphasis of these mitigation measures was to ensure the successful and immediate rehabilitation of vegetation and habitats upon completion of the excavation and construction activities.

The general provisions of the engineering concepts on the site rehabilitation made only general reference to the re-seeding and re-planting of the site. As part of the effects assessment, site specific recommendations were formulated as to what vegetation communities should be established. This was of particular importance, where re-establishing pre-construction conditions was considered inappropriate i.e., where pre-construction conditions represent intensely disturbed sites. This provided for opportunities to increase the ecological value of vegetation communities in large parts of the project sites.

It was suggested that site-specific landscape plans be developed to specify rehabilitation objectives, planting schemes, plant species, initial vegetation maintenance, and opportunities for habitat enrichment. It was recognized that developing these landscape plans requires community involvement to ensure buy-in by municipal agencies, neighbours, and future users.

To protect the fen communities at the Port Hope and the Port Granby Project sites, AMEC proposed to verify the extent of waste removal at and near the fen communities. Detailed site surveys are recommended to delineate the limits of the contaminated area and of the fen community. In the event that the removal of most of the fen communities is unavoidable, it was proposed that soil plugs containing representative plants of the fen community be removed for temporary storage and be re-introduced during site rehabilitation. Fen communities are dependent on groundwater flow. Should the excavation at the project sites result in a permanent disruption of the groundwater seepage areas, rehabilitation of the fen vegetation community will fail. It was therefore stipulated, that all reasonable efforts should be made to preserve or rehabilitate the current hydrologic regime. Should this be impossible without compromising the projects' objectives, rehabilitation to a diverse shrub community is suggested. As long as native plant material that is typical for these site locations is used, it is expected that the restored communities will be of high ecological value.

Residual Adverse Effects, Follow up Programs, Conclusion

It was concluded that, upon successful implementation of the effects management and supplementary mitigation measures, the effects of both projects on vegetation communities, habitat and wildlife would have no residual adverse effect on the terrestrial environment. The fen plant community may be reduced or converted into a shrub vegetation type; however, the value of the vegetation communities in both project areas would be maintained. Through rehabilitation of portions of the affected sites into vegetation communities of high ecological value, beneficial effects on vegetation and wildlife are anticipated.

To verify the predicted effects and the success of the mitigation and rehabilitation measures, follow-up programs were described. During the short-term (construction period) these programs are suggested to ensure the implementation of the proposed protection and rehabilitation measures. For the intermediate-term (2013-2025) and the long-term (2025-2500) the monitoring will again employ the ELC survey methodology to document the growth of the rehabilitated vegetation communities. In addition, concentrations of COPCs in surface soils will be monitored at the site perimeters during the short-term and the initial years of the intermediate term. This will permit verification of key assumptions of the ERA.

The conclusion on the effects assessment and the final recommendations on ELC methodology show that the ELC approach is a useful tool for application in the context of the EA process. This includes its use for the characterization of baselines conditions, the qualitative and quantitative assessment of effects and its application for monitoring as part of the follow up measures during project implementation.

References

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Figures

Figure 1. Map of the Port Hope Area Showing the Existing and the Proposed New Sites for Management of the Low-Level Radioactive Waste, as well as the Port Hope Remediation Sites.

Figure 2. Ecological Land Classification of the Port Hope Project.

Figure 3. Ecological Land Classification of the Port Granby Project.

Figure 4: Ecological Importance of Vegetation Patches of the Port Granby Project.

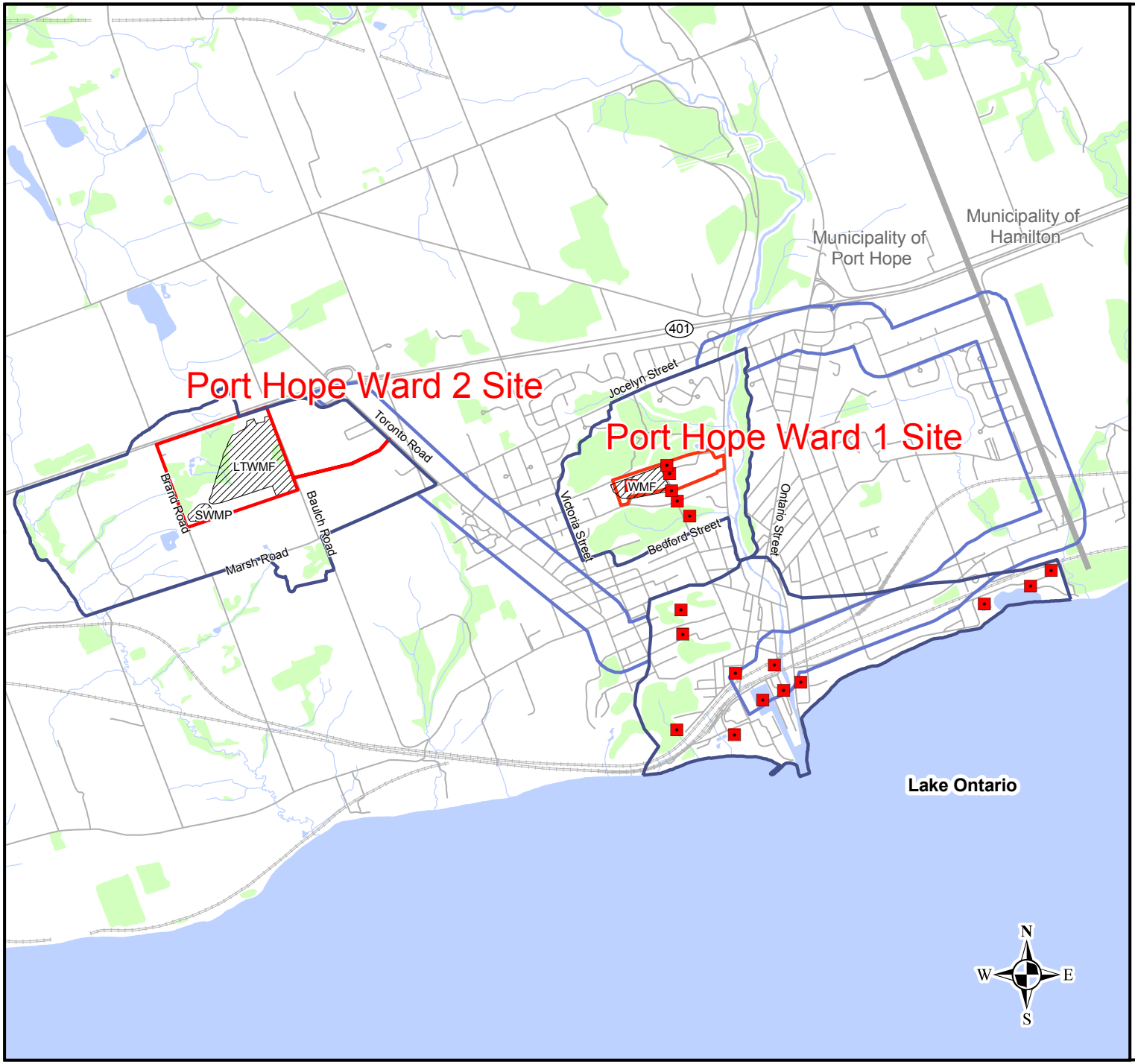


Figure 1

Local and Site Study Areas

Port Hope Project
Environmental Assessment

Legend

- Remediation Sites
- Municipal Boundary
- Local Study Areas of Terrestrial Baseline Characterization Studies
- Extended Local Study Area
- Site Study Areas
- Waste Management Facility Site Footprint
- Wooded Area

0 500 1,000 1,500

Metres

1:40,000

REFERENCE

NRVIS Base data supplied by MNR (1998)
Data reprojected to UTM NAD83, Zone 17
Produced by AMEC E&E

Date: February 2005

amec

Port Hope Area Initiative

Figure 2

Ecological Land Classification and Footprint of Proposed Works and Activities within the Port Hope Project

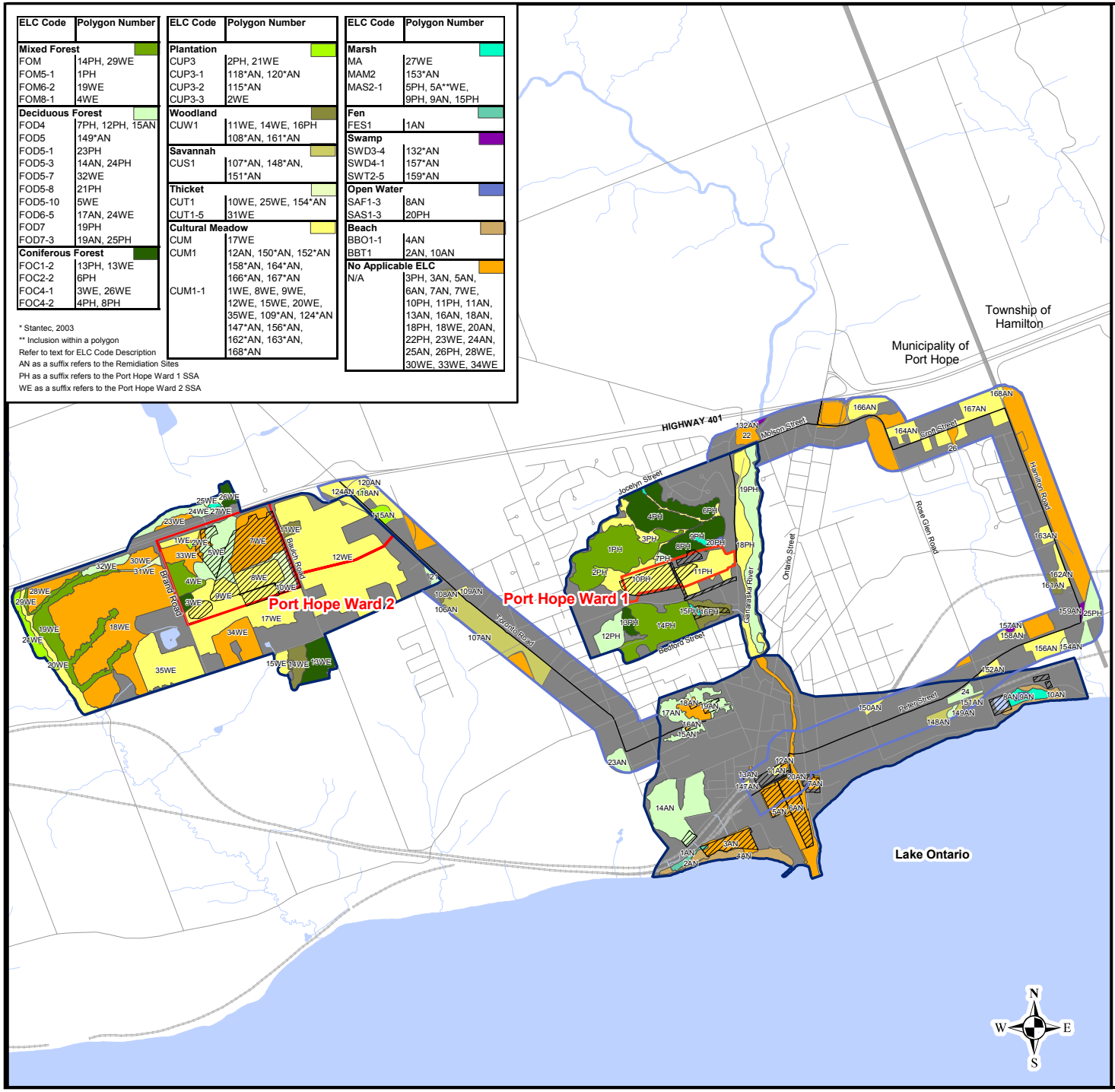
Port Hope Project Environmental Effects Assessment

ELC Code	Polygon Number
Mixed Forest	
FOM	14PH, 29WE
FOM5-1	1PH
FOM6-2	19WE
FOM8-1	4WE
Deciduous Forest	
FOD4	7PH, 12PH, 15AN
FOD5	149*AN
FOD5-1	23PH
FOD5-3	14AN, 24PH
FOD5-7	32WE
FOD5-8	21PH
FOD5-10	5WE
FOD6-5	17AN, 24WE
FOD7	19PH
FOD7-3	19AN, 25PH
Coniferous Forest	
FOC1-2	13PH, 13WE
FOC2-2	6PH
FOC4-1	3WE, 26WE
FOC4-2	4PH, 8PH

ELC Code	Polygon Number
Plantation	
CUP3	2PH, 21WE
CUP3-1	118*AN, 120*AN
CUP3-2	115*AN
CUP3-3	2WE
Woodland	
CUW1	11WE, 14WE, 16PH 108*AN, 161*AN
Savannah	
CUS1	107*AN, 148*AN, 151*AN
Thicket	
CUT1	10WE, 25WE, 154*AN
CUT1-5	31WE
Cultural Meadow	
CUM	17WE
CUM1	12AN, 150*AN, 152*AN 158*AN, 164*AN, 166*AN, 167*AN
CUM1-1	1WE, 8WE, 9WE, 12WE, 15WE, 20WE, 35WE, 109*AN, 124*AN 147*AN, 156*AN, 162*AN, 163*AN, 168*AN

ELC Code	Polygon Number
Marsh	
MA	27WE
MAM2	153*AN
MAS2-1	5PH, 5A**WE, 9PH, 9AN, 15PH
Fen	
FES1	1AN
Swamp	
SWD3-4	132*AN
SWD4-1	157*AN
SWT2-5	159*AN
Open Water	
SAF1-3	8AN
SAS1-3	20PH
Beach	
BBO1-1	4AN
BBT1	2AN, 10AN
No Applicable ELC	
N/A	3PH, 3AN, 5AN, 6AN, 7AN, 7WE, 10PH, 11PH, 11AN, 13AN, 16AN, 18AN, 18PH, 18WE, 20AN, 22PH, 23WE, 24AN, 25AN, 26PH, 28WE, 30WE, 33WE, 34WE

* Stantec, 2003
** Inclusion within a polygon
Refer to text for ELC Code Description
AN as a suffix refers to the Remidiation Sites
PH as a suffix refers to the Port Hope Ward 1 SSA
WE as a suffix refers to the Port Hope Ward 2 SSA



Legend

- Local Study Area of Terrestrial Environmental Baseline Characterization Studies
- Extended Local Study Area
- Transportation Routes (PHAI)
- Railway
- Municipal Boundary
- Site Study Areas
- WMF & Remediation Sites Footprints

Polygon Type

- Mixed Forest
- Deciduous Forest
- Coniferous Foret
- Plantation
- Woodland
- Savannah
- Thicket
- Cultural Meadow
- Marsh
- Fen
- Swamp
- Open Water
- Beach
- No Applicable ELC
- Developed

0 400 800 1,200

Metres

1:40,000

REFERENCE

NRVIS Base data supplied by MNR (1998)
ELC data produced from field information reported in AMEC, 2004 [1600]. Supplemented by Stantec, 2003 [1859]
Data reprojected to UTM NAD83, Zone 17
Produced by AMEC E&E

Date: February 2005

amec

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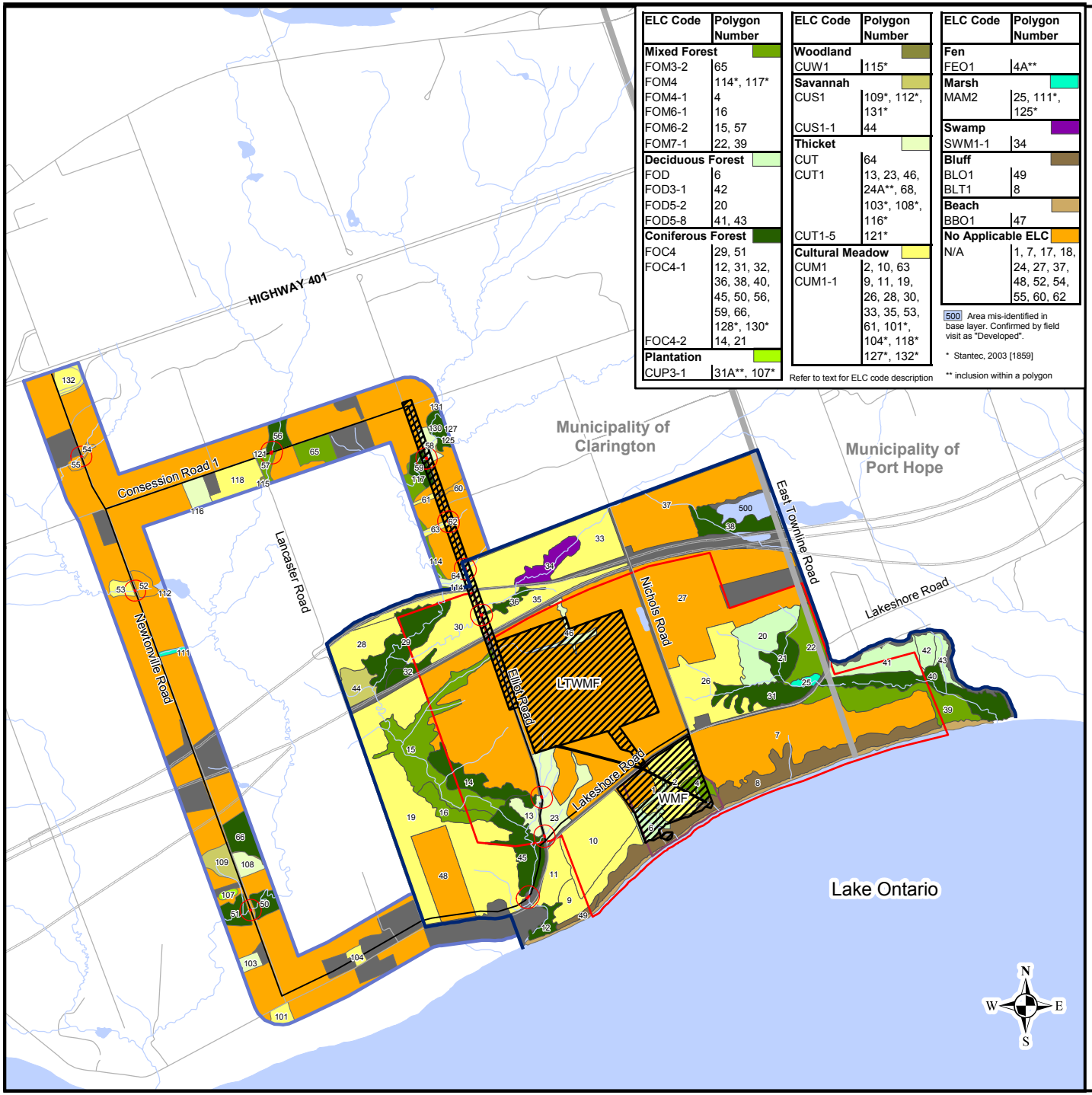
Figure 3

Ecological Land Classification and Footprint of Proposed Works and Activities

Port Granby Project Environmental Effects Assessment



ELC Code	Polygon Number
Mixed Forest	
FOM3-2	65
FOM4	114*, 117*
FOM4-1	4
FOM6-1	16
FOM6-2	15, 57
FOM7-1	22, 39
Deciduous Forest	
FOD	6
FOD3-1	42
FOD5-2	20
FOD5-8	41, 43
Coniferous Forest	
FOC4	29, 51
FOC4-1	12, 31, 32, 36, 38, 40, 45, 50, 56, 59, 66, 128*, 130*
FOC4-2	14, 21
Plantation	
CUP3-1	31A**, 107*

ELC Code	Polygon Number
Woodland	
CUW1	115*
Savannah	
CUS1	109*, 112*, 131*
CUS1-1	44
Thicket	
CUT	64
CUT1	13, 23, 46, 24A**, 68, 103*, 108*, 116*
CUT1-5	121*
Cultural Meadow	
CUM1	2, 10, 63
CUM1-1	9, 11, 19, 26, 28, 30, 33, 35, 53, 61, 101*, 104*, 118* 127*, 132*

Refer to text for ELC code description

ELC Code	Polygon Number
Fen	
FEO1	4A**
Marsh	
MAM2	25, 111*, 125*
Swamp	
SWM1-1	34
Bluff	
BLO1	49
BLT1	8
Beach	
BBO1	47
No Applicable ELC	
N/A	1, 7, 17, 18, 24, 27, 37, 48, 52, 54, 55, 60, 62

500 Area mis-identified in base layer. Confirmed by field visit as "Developed".

* Stantec, 2003 [1859]

** inclusion within a polygon

Legend

- Local Study Area of Terrestrial Environmental Baseline Characterization Studies
- Extended Local Study Area
- Railway
- Municipal Boundary
- Waste Management Facility (Fenced Area)
- Port Granby Site Study Area (Cameco Lands)
- LTWMF & WMF Footprint
- Culvert Crossing

Polygon Type

- Mixed Forest
- Deciduous Forest
- Coniferous Forest
- Savannah
- Thicket
- Cultural Meadow
- Marsh
- Swamp
- Bluff
- Beach
- No Applicable ELC
- Developed

0 400 800 1,200

Metres

1:30,000

REFERENCE

NRVIS Base data supplied by MNR (1998)
ELC data produced from field informaiton collected in the Fall 02, Winter 02, Spring 03, Summer 03, Spring 04 and Summer 04. Supplemented by Stantec 04.
Data reprojected to UTM NAD83, Zone 17
Produced by AMEC E&E

Date: February 2005

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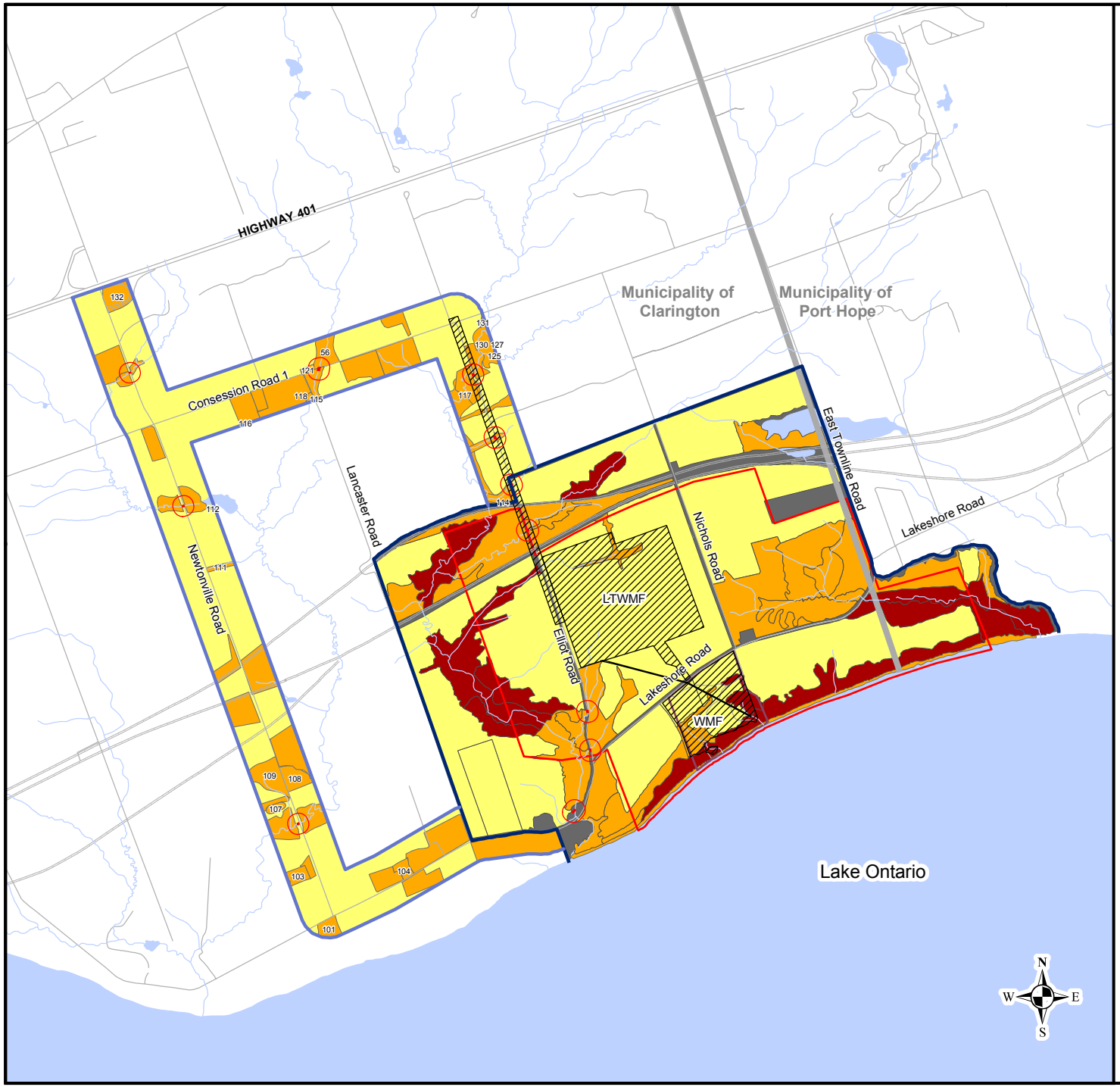
Figure 4

Affected Vegetation Communitites by Level of Importance

Port Granby Project
Environmental Effects Assessment



Legend

- Local Study Area of Terrestrial Environmental Baseline Characterization Studies
- Extended Local Study Area
- Railway
- Municipal Boundary
- Waste Management Facility (Fenced Area)
- Port Granby Site Study Area (Cameco Lands)
- LTWMF &WMF Footprint
- Culvert Crossing

Level of Ecological Importance

- High
- Moderate
- Low
- Developed

0 400 800 1,200

Metres

1:30,000

REFERENCE

NRVIS Base data supplied by MNR (1998)
ELC data produced from field informaiton collected in the Fall 02, Winter 02, Spring 03, Summer 03, Spring 04 and Summer 04. Supplemented by Stantec 04.
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