Submitted to:

The City of Hamilton

SCUBE SUBWATERSHED STUDY:

PHASE 3: IMPLEMENTATION

Aquafor Beech Limited

May 15, 2013

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1.0 INTRODUCTION

The City of Hamilton is in the process of preparing the Fruitland-Winona Secondary Plan in support of future urban development within the Stoney Creek Urban Boundary Expansion (SCUBE) area. The overall Secondary Plan study area is illustrated in Figure 1.1, together with the four parcels of land identified for urban boundary expansion, namely SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B).

The SCUBE Subwatershed Study was undertaken in support of the Secondary Plan and is being completed in three phases:

Phase1: Investigate and define existing environmental conditions, including environmental constraints and opportunities for development;

Phase 2: Evaluate future land use impacts and develop a Subwatershed Strategy, comprised of recommended works and measures to address stormwater management and the maintenance, protection and enhancement of the study area's significant natural heritage features and ecological functions;

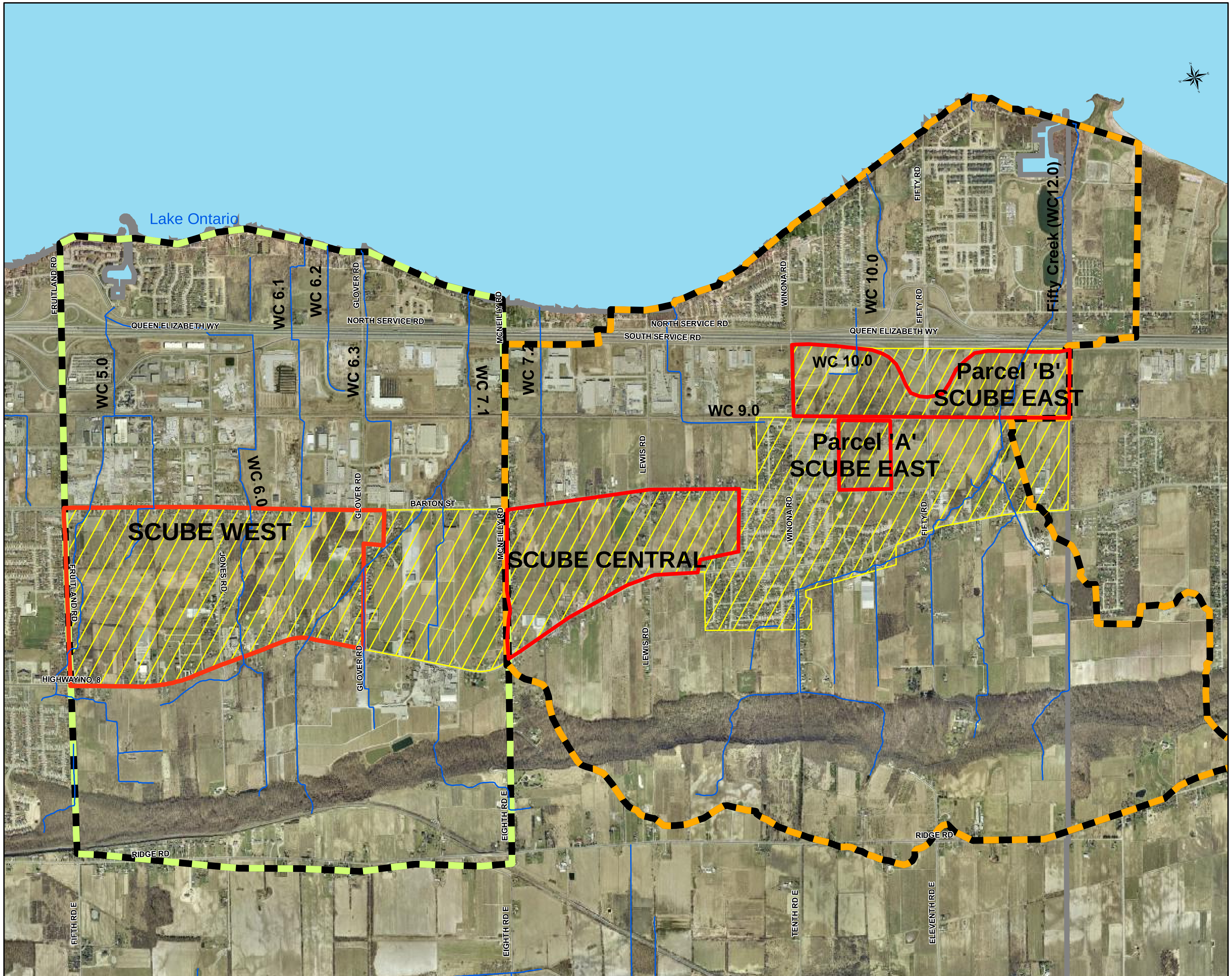
Phase 3: Develop an implementation plan to guide future work by the City of Hamilton and development proponents.

1.1 Study Area

Separate Phase 1 and Phase 2 Subwatershed Study reports were completed for the lands on the east and west sides of McNeilly Road (Figure 1.1). The SCUBE *West* Subwatershed Study addresses lands within the drainage boundaries of the watercourses which drain the SCUBE West lands, namely Watercourses 5.0, 6.0 and 7.0. The SCUBE *East* Subwatershed Study addresses lands within the drainage boundaries of the watercourses that drain the SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) lands, namely Watercourses 7.2, 9, 10, and Fifty Creek.

This Phase 3 Report addresses *both* the SCUBE East and SCUBE West study areas. Collectively, this encompasses roughly all of the lands between Fruitland Road in the west to the City of Hamilton's boundary with Niagara Region in the east from Lake Ontario in the north to just above the Niagara Escarpment in the south (Figure 1.1).

1.2 Proposed Land Uses



KEY MAP

LEGEND:

- SCUBE Development Lands
- SCUBE EAST Subwatershed Studay Area
- SCUBE WEST Subwatershed Study Area
- Fruitland-Winona Secondary Plan Area
- ROAD

NOTES:

0 150 300 600 900 1,200 1,500
Meters

Hamilton

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SCUBE SUBWATERSHED STUDY
Phase 3

Fruitland-Winona Secondary Plan
and
SCUBE Subwatershed Study Area

FIGURE No. 1.1

DATE: March, 2011

Proposed future development within the four SCUBE blocks of land includes primarily residential land uses within SCUBE West, SCUBE Central, and SCUBE East (Parcel A). SCUBE East (Parcel B) will be developed as an employment area with a mix of industrial and commercial land uses. Outside of the urban boundary expansion areas, the lands bound by Barton Street and the QEW west of Winona Road are designated as employment lands and are already partially developed. These lands will continue to experience future urban development as the remaining vacant/agricultural lands are converted to urban land uses.

1.3 Objectives

The purpose of this Phase 3 Report is to guide the future work required to implement successfully the components of the recommended Subwatershed Strategies which were developed during Phase 1 and Phase 2 of the SCUBE West and SCUBE East Subwatershed Studies. Key objectives of this Phase 3 Report include:

- Review of the key Subwatershed Strategy components;
- Identify who is responsible for each of the Subwatershed Strategy components;
- Provide direction as to the types of future studies required for the successful implementation of the Subwatershed Strategy;
- Provide recommendations with respect to the phasing of proposed works;
- Provide additional design guidance and policy considerations for key Subwatershed Strategy components
- Review of approvals considerations

1.4 Report Outline

Provided below is a brief overview of the content of this Phase 3 report:

Section 2 of the report reviews the findings of Phase 1 and Phase 2 of the SCUBE West and SCUBE East Subwatershed Studies, including a summary of the recommended Subwatershed Strategy components.

Section 3 lists and describes the basic elements of a successful implementation plan that are covered in this report.

Section 4 reviews the implementation elements for those Subwatershed Strategy components which do not relate directly to future development, and are instead the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority.

Section 5 reviews the implementation elements for those works and measures that are either directly related to future urban development or are expected to provide a direct benefit to the developing lands.

Section 6 provides additional design guidance and policy considerations for various types of recommended stormwater and stream works.

Section 7 provides further discussion regarding policy considerations for Low Impact Development (LID) measures. LID is a relatively new concept that is just now beginning to be implemented in many southern Ontario municipalities.

Section 8 provides a summary of conclusions and recommendations.

Section 9 provides a list of references.

2.0 BACKGROUND – PHASE 1 AND PHASE 2 REPORTS

The Phase 1 and Phase 2 Reports of the SCUBE East and SCUBE West Subwatershed Studies characterize existing environmental conditions and identify opportunities and constraints to development based on background review, field investigations, and modelling. This included the following:

- Hydrologic and hydraulic modeling to define flood hazards over most of the study area watercourses;
- Identification of terrestrial resources, including vegetation communities, flora and fauna;
- Identification of aquatic resources, including fish habitat;
- Fluvial geomorphologic field investigations to characterize select study area streams;
- Review of background information and select field investigations to define the soils and groundwater characteristics within the study area.

The Phase 1 and Phase 2 Reports also assess potential land use impacts on the natural resources of the study areas and review alternative management measures to mitigate these impacts. Each of the Phase 1 and Phase 2 Reports (i.e. one report for SCUBE West and one for SCUBE East) concludes with a recommended Subwatershed Strategy that consists of a series of stormwater management controls, stream works, and management measures to maintain, protect and enhance the study area's significant natural heritage features and ecological functions, including the identification of a recommended Natural Heritage System (NHS). Figures 2.1, 2.2, 2.3 and 2.4 illustrate the Subwatershed Strategy for the SCUBE West and SCUBE East study areas. The recommended works and measures which comprise each Subwatershed Strategy can be classified into five general categories:

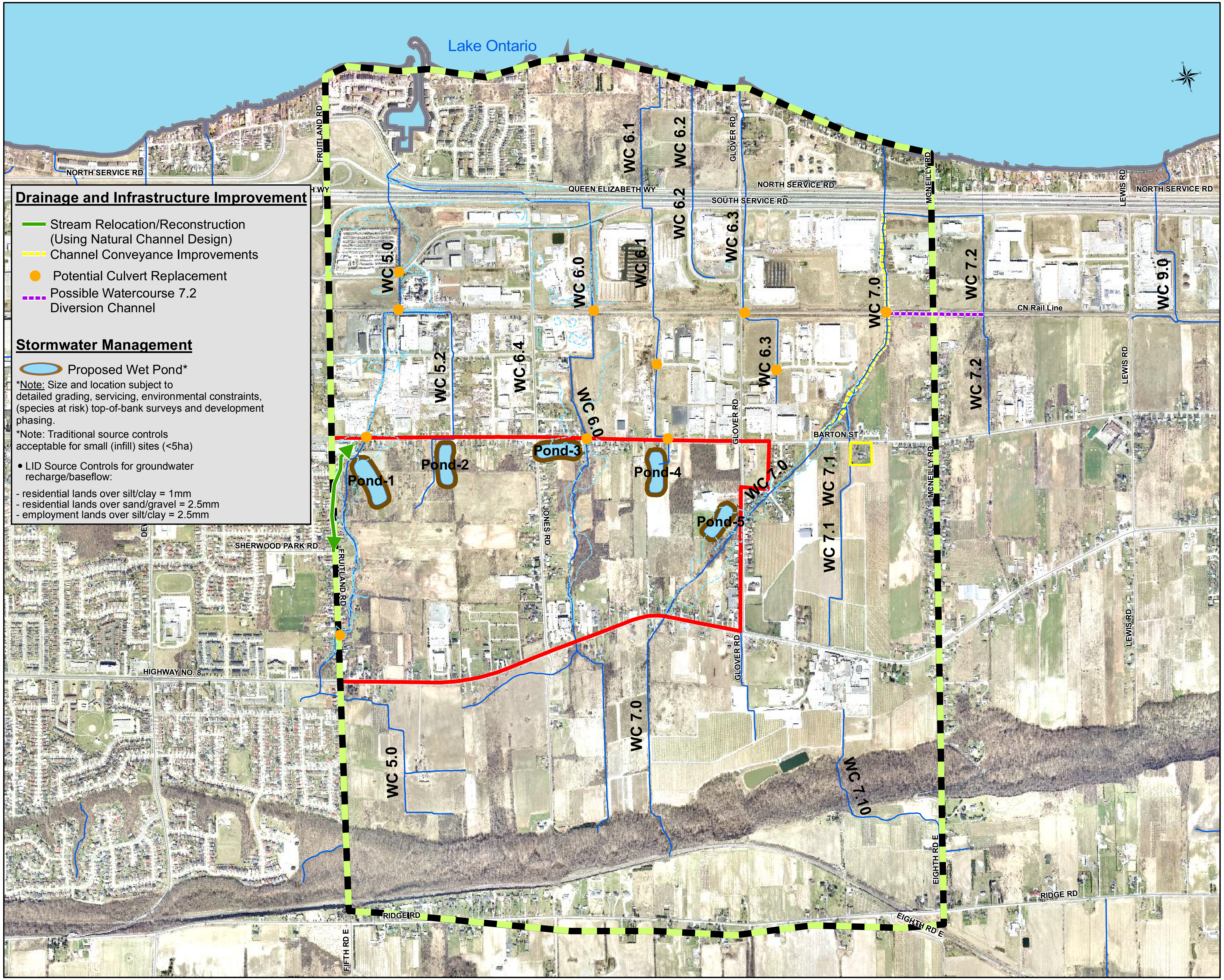
- Stormwater management controls;
- Drainage and infrastructure improvement works;
- Establishment of the recommended NHS, including Core Areas and Linkages;
- Environmental restoration and enhancement; and
- NHS management.

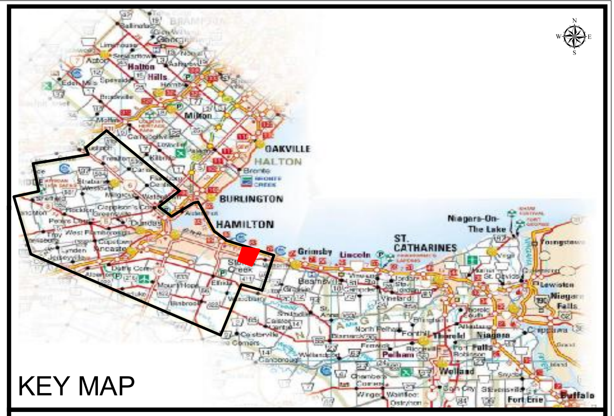
The individual components of each category are discussed below:

2.1 Stormwater Management Controls

Stormwater management controls consist of the recommended works required to mitigate the impacts from proposed future development. This includes:

- End-of-pipe wet ponds for water quality control, as well as post-to-pre runoff control for flooding and erosion, where required;
- Low Impact Development (LID) source control techniques to promote infiltration and maintain groundwater recharge rates; and





KEY MAP

LEGEND:

- Study Area Boundary-SCUBE West Subwatershed Study
- Lands Under Consideration for Urban Development
- Urban – Not Subject to Policies of Greenbelt Plan
- Floodplain Area

NOTES:

0 100 200 400 600 800 1,000
Meters

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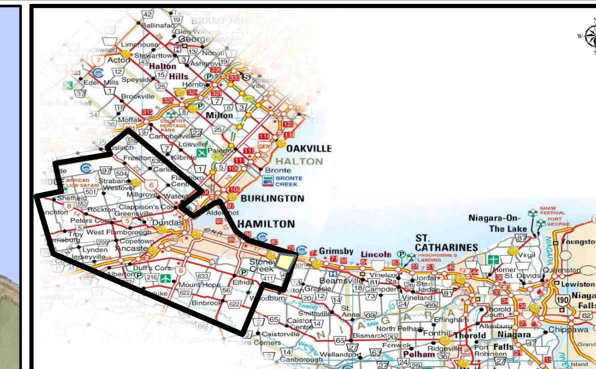
Recommended Subwatershed Strategy:
Stormwater Management Controls/Drainage
and Infrastructure Improvement Works

SCUBE WEST

FIGURE No. 2.1

DATE: May 2013



LEGEND:
- Study Area - SCUBE East Subwatershed Study
- Land Under Consideration for Urban Development
- Urban – Not Subject to Policies of Greenbelt Plan
- Floodplain Area
- Floodplain Area - To Be Defined

NOTES:

0 125 250 500 750 1,000
Meters

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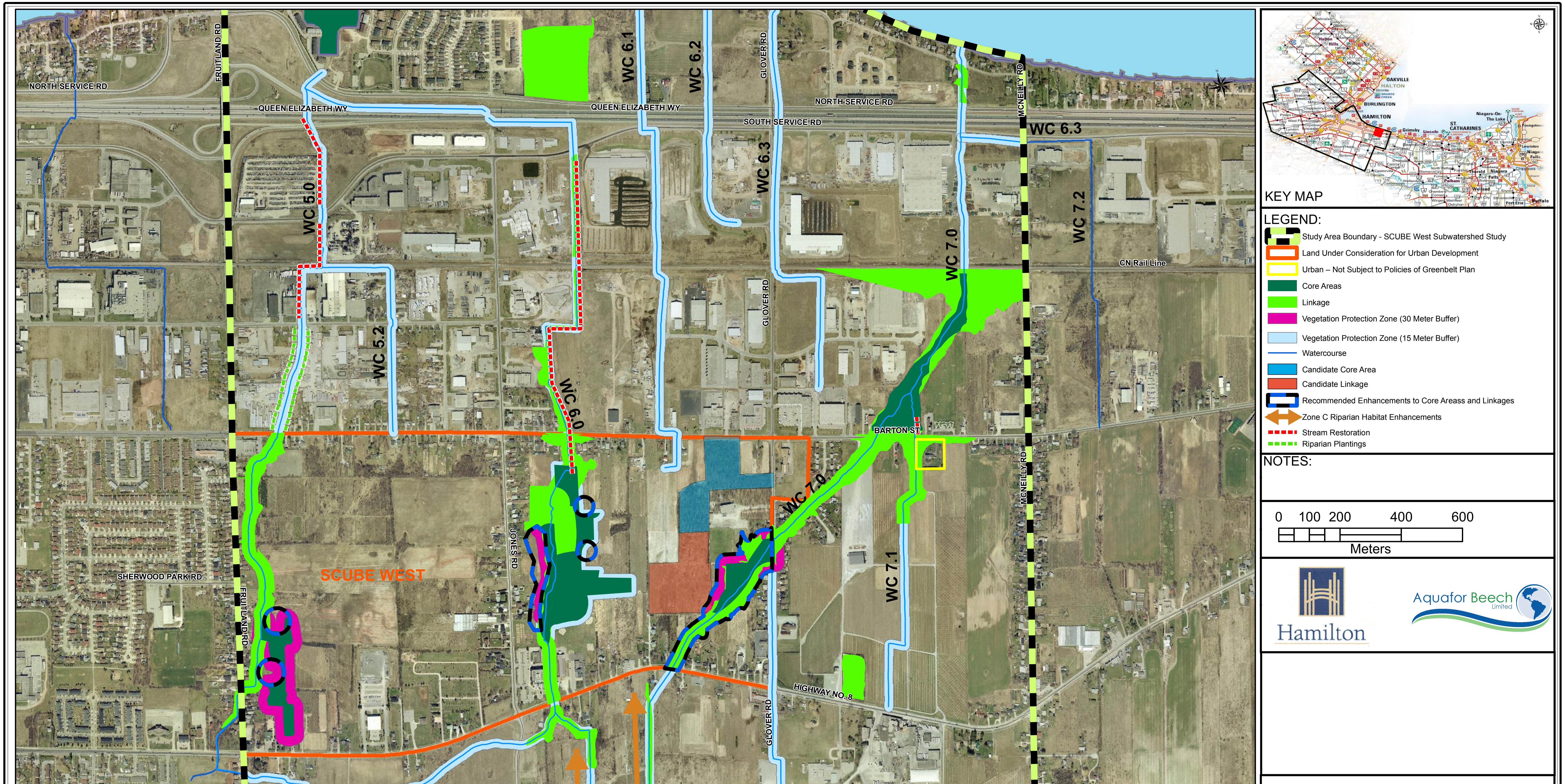
Recommended Subwatershed Strategy: Stormwater Management Controls/Drainage and Infrastructure Improvement Works

SCUBE EAST

FIGURE No. 2.2

DATE: February 23, 2012

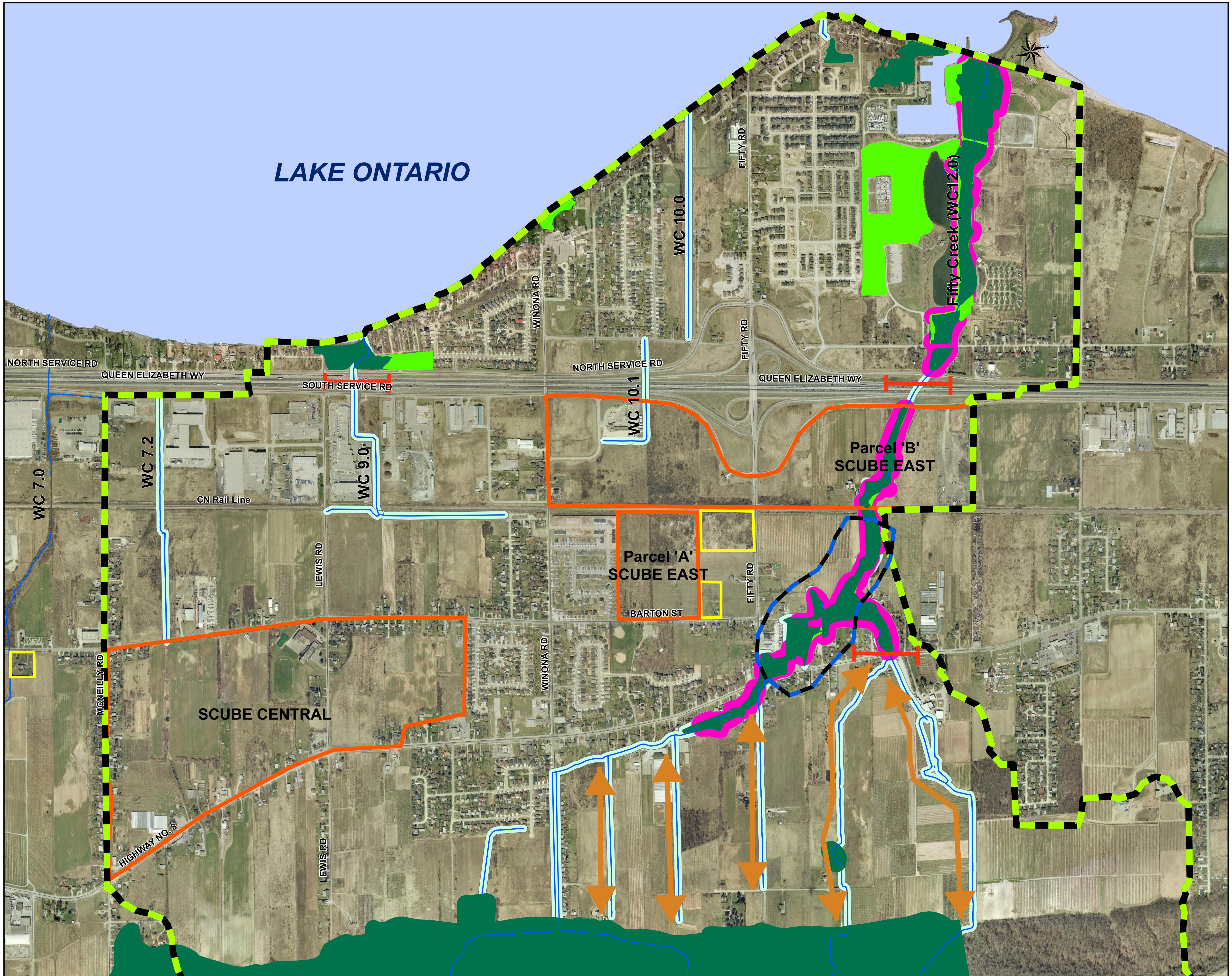


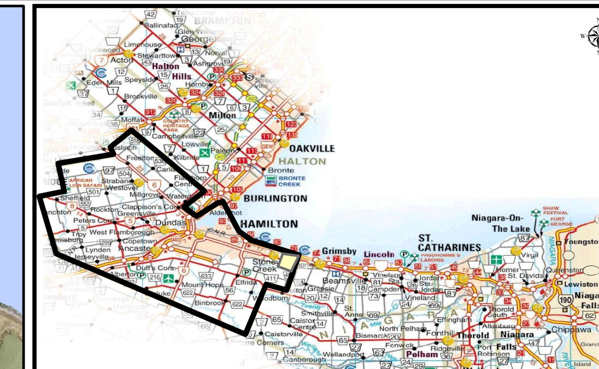
Recommended Subwatershed Strategy: Natural Heritage System and Environmental Restoration and Enhancement

SCUBE WEST

FIGURE No. 2.3

DATE: April 17, 2012





KEY MAP

LEGEND:

- Study Area - SCUBE East Subwatershed Study
- Land Under Consideration for Urban Development
- Urban – Not Subject to Policies of Greenbelt Plan
- Core Areas
- Linkage
- Vegetation Protection Zone (30 Meter Buffer)
- Vegetation Protection Zone (15 Meter Buffer)
- Watercourse
- Recommended Enhancements to Core Areass and Linkages
- Eliminate Fish Barriers
- Zone C Riparian Habitat Enhancements

NOTES:

0 125 250 500 750

Meters

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Recommended Subwatershed Strategy: Natural Heritage System and Environmental Restoration and Enhancement

SCUBE EAST

FIGURE No. 2.4

DATE: February 23, 2012

- Traditional lot-level source controls for sites which are too small to be serviced by a stormwater pond (i.e. less than 5 ha).

2.2 Drainage and Infrastructure Improvement Works

These works have been recommended to reduce existing flooding and erosion problems within the study area streams. These measures consist of a series of recommended modifications to existing stream channels and culverts to improve the conveyance capacity of existing drainage systems. In addition to the above, some of the recommended works are also anticipated to provide a range of secondary benefits. These benefits include the provision of warmwater habitat, the enhancement of vegetation protection zones adjacent to watercourses, the elimination of barriers to fish passage and/or improved outlet options for future stormwater management facilities. In summary, the drainage and infrastructure improvement works include:

- Culvert upgrades at several road/rail crossings of Watercourses 5.0, 6.0, and 7.0;
- Watercourse 5.0 relocation and re-construction from approximately Sherwood Park Road to Barton Street;
- Channel conveyance improvements along Watercourse 7.0 (Barton Street to QEW);
- Possible diversion of Watercourse 7.2 upstream of the CN rail line, westward to the Main Branch of Watercourse 7.0, west of McNeilly Road; and
- Re-construction and capacity improvements for the Western Tributary of Watercourse 9 along the CN rail line and south along Lewis Road.

2.3 Establishment of the Recommended Natural Heritage System (NHS)

The Subwatershed Strategy identifies a recommended NHS intended to maintain, protect and enhance the study area's significant natural heritage features and ecological functions. The recommended NHS consists of the following:

- Core Areas as defined by the City of Hamilton (2009) including Key Natural Heritage Features, Key Hydrologic Features and Local Natural Areas;
- Linkages as defined by the City of Hamilton (2009);
- Hazardous Lands as defined by the Hamilton Conservation Authority (2009); and
- Preliminary vegetation protection zones consistent with the minimum requirements of the City of Hamilton (City of Hamilton 2009).

The SCUBE Subwatershed Study determined the preliminary (i.e. conceptual) boundaries of the recommended NHS. The final boundaries of the recommended NHS are to be determined at a subsequent planning stage (Draft Plan of Subdivision or Site Plan) through the completion of additional studies.

2.4 Environmental Restoration and Enhancement

The Subwatershed Strategy includes a number of recommendations to address existing environmental issues or to protect/enhance the Core Areas and Linkages of the recommended NHS.

Within Zone A (lands north of the Fruitland-Winona Secondary Plan Study Area) the recommended measures include the following:

- Stream restoration works and riparian plantings along Watercourses 5.0 and 6.0 downstream of Barton Street; and
- Removal of barriers to fish movement at select culvert locations along Watercourse 9 and Fifty Creek.

Within Zone B (lands within the Fruitland-Winona Secondary Plan Study Area) the recommended measures include the following:

- Plantings in and adjacent to Wetland 1 to consolidate its northern and southern portions, increase the diversity of adjacent habitats and create a buffer to future land uses.
- Plantings adjacent to Woodland 2 to reduce its edge-interior ratio and improve opportunities for wildlife movement.
- Plantings along Watercourse 7.0 between Highway 8 and Glover Road to enhance the potential use of riparian habitat by wildlife and improve water quality.
- Reforestation of selected areas of Woodland 5 to reduce its edge-interior ratio.

Within Zone C (lands between those within the Fruitland-Winona Secondary Plan Study Area and the Niagara Escarpment) the recommended measures include enhancement of riparian habitat along Watercourses 5.0, 6.0, 7.0 and Fifty Creek, upstream of Highway 8, to improve linkages (i.e. opportunities for wildlife movement) between the Niagara Escarpment and downstream elements of the recommended NHS.

2.5 NHS Management

To ensure its long-term protection, the Subwatershed Strategy identifies a variety of management measures to mitigate the potential impacts of future land uses on the recommended NHS. These measures include the following:

- the development of an Edge Management Plan;
- the use of fencing to prevent encroachment within the NHS;
- consideration of the location and design of road crossings of the NHS;
- the use of public trails to control access to sensitive vegetation communities within the NHS; and
- public education through signage and/or other material (e.g. homeowner's brochures) to highlight natural heritage features and encourage stewardship.

3.0 IMPLEMENTATION

The previous chapter outlined the findings of Phase 1 and Phase 2 of the SCUBE East and SCUBE West Subwatershed Studies including the five general categories of works and measures which together comprise the overall SCUBE Subwatershed Strategy. The next step in the Subwatershed Study process is to develop a plan to guide future work so that the recommended Strategy is successfully implemented.

Successful implementation of the Subwatershed Strategy will require the combined efforts of the City of Hamilton, development proponents, local residents, the Hamilton Conservation Authority and other agencies (e.g. MNR). As such, this Phase 3 Report outlines the following basic elements of a successful implementation plan:

- Responsibility for Implementation
- Targets/Objectives
- Requirements for Future Studies
- Phasing Considerations
- Additional Design Guidance and Policy Considerations
- Approvals

A general overview of the above implementation elements is provided below.

3.1 Responsibility for Implementation

This Report identifies who is responsible for the implementation of the various Subwatershed Strategy components. In general the recommended works and measures have been classified into two basic groups, according to who is responsible for their implementation:

- City/Agency Responsibility – these works and measures are not directly related to future urban development. Rather, these works and measures are generally recommended to address existing issues or to protect/enhance existing aquatic and terrestrial resources; and.
- Development Proponents' Responsibility – these works and measures are either directly related to future urban development (e.g. stormwater management facilities) or are expected to provide a direct benefit to the developing lands (e.g. capacity improvements along Watercourse 9 West Tributary).

3.2 Targets/Objectives

This report clearly identifies the target(s)/objective(s) associated with each component of the Subwatershed Strategy.

3.3 Requirements for Future Studies

This Report outlines the requirements for future studies to be completed in support of the implementation of the various components of the recommended Subwatershed Strategy.

For example, the Subwatershed Strategy identifies the stormwater management requirements for the SCUBE study area at a conceptual level of detail, but implementation of these recommendations will require further, progressively more detailed studies at both the "catchment" and "site" level, as development planning proceeds. Up to two general levels of additional stormwater management study are anticipated beyond the Subwatershed Study level. Consistent with the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document, these types of studies have been classified according to their level of design:

- **Functional Design Level –** In general, these types of studies and actions would take place on a "stream reach" or "catchment" level, and are required before further detailed planning and design can take place.

  For example, this Functional Design level of study is more appropriate for stream works that could affect several development properties and the associated development limits adjacent to the modified streams. The future re-alignment and re-construction of Watercourse 5.0 upstream of Barton Street could affect the development limits of several development properties through revised floodlines, for example.

  Similarly, the planning and design of future stormwater management ponds should take into account adjacent developments within a catchment in an effort to minimize the overall number of facilities by providing larger, more efficient centralized ponds which are shared by more than one development site.

  At this level of study, the analyses and actions required would often be undertaken as part of a Functional Servicing Report for Stormwater Management (FSR). The City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document recommends the preparation of an FSR for proposed developments with a minimum drainage area of 5 ha. A detailed listing and general checklist of components expected by the city for FSR submissions is also provided in the document.

- **Detailed Design Level –** In general, these types of studies would be completed at the Draft Plan of Subdivision or Site Plan approval level and are more detailed in nature, often relying on the findings and preliminary designs completed at the previous level of study (i.e. the Functional Design stage), such as the preliminary designs of the FSR. For example, the final design of a stormwater pond, including grading, depths, and outlet configuration will require the storage and release rate targets and overall rating curve determined during the FSR.

A detailed listing and general checklist of the components expected in Detailed SWM Report submissions is provided in the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document.

Through recent discussions with staff it has been noted that the City of Hamilton intends to undertake a Master Servicing Study. The Terms of Reference for this study have not yet been prepared. This study will primarily address items relating to municipal servicing (i.e. sanitary and storm sewers, water mains) but will provide an opportunity to undertake some of the stormwater tasks that would normally be undertaken at the Functional Design Stage. Where appropriate, recommendations as to which tasks could be considered as part of the Master Servicing Study has been provided.

3.4 Phasing Considerations

Some components of the recommended Subwatershed Strategy will require other components to be in place before they can proceed. For example, the Subwatershed Strategy includes a series of stream works, some of which will have a direct impact on the planning and design of future urban development. Coordination of the other components of the recommended Subwatershed Strategy (e.g. drainage and infrastructure improvements) may present opportunities to minimize in-stream disturbance and achieve cost savings. Therefore, this report identifies phasing considerations associated with the implementation of recommended works, particularly those that may be inter-related.

3.5 Additional Design Guidance and Policy Considerations

Additional design guidance from various sources is provided in Section 6 for the following Subwatershed Strategy components:

- Stormwater management ponds;
- Traditional source controls;
- Low Impact Development (LID) controls; and
- Conveyance improvements and stream restoration works.

The City of Hamilton's 2004 "Storm Drainage Policy" and 2007 "Criteria and Guidelines for Stormwater Management Infrastructure Design" documents provide a general outline of stormwater management policy considerations. These documents were reviewed so that key stormwater policy issues that may affect the implementation of the Subwatershed Strategy components were noted.

With respect to the Subwatershed Strategy recommendation of LID source controls, which are a relatively new concept that are just now beginning to be implemented in many southern Ontario municipalities, further discussion is provided in Section 7 with respect to policy changes and refinements for the City of Hamilton to consider.

3.6 Approvals

This Report identifies the approvals and/or permits that may be required for each component of the recommended Subwatershed Strategy.

Prior to the construction or implementation of many of the Subwatershed Strategy components (e.g. stream works, stormwater management facilities), approvals and/or permits may be required from one or more of the following agencies:

- City of Hamilton;
- Hamilton Conservation Authority;
- Ministry of Transportation (MTO);
- Ministry of the Environment (MOE);
- Ministry of Natural Resources (MNR); and
- Department of Fisheries and Oceans (DFO).

4.0 CITY OF HAMILTON & AGENCY WORKS

The works and measures recommended by the Subwatershed Strategy have been classified into two basic groups, according to who is responsible for their implementation:

- City of Hamilton and/or Agency Responsibility; and
- Development Proponents' Responsibility

This Section describes the implementation of works and measures that are recommended to address existing environmental issues or to protect and enhance the Core Areas and Linkages of the recommended Natural Heritage System. Accordingly, these works and measures are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority. Section 5 addresses works and measures that are either directly related to future urban development or are expected to provide a direct benefit to the developing lands.

Table 4.1 summarizes the implementation elements for those works and measures for which the City of Hamilton and/or Hamilton Conservation Authority are responsible. Details are provided below for each.

4.1 Stormwater Management Controls

In general, the City of Hamilton is not responsible for the planning and design of the stormwater management ponds, source controls and LID controls recommended under the Subwatershed Strategy. These works are related to future urban development and therefore are the responsibility of development proponents. Discussion of these works is provided in Section 5.1. However, it is noted that the City of Hamilton should play a role in ensuring co-ordination of future studies between development lands so that the number of stormwater ponds is minimized. The City should also provide policy guidance through its role as the primary review and approval agency for these works.

4.2 Drainage and Infrastructure Improvement Works

4.2.1 Watercourse 7 Channel Conveyance Improvements

Within the Watercourse 7 catchment, significant works have been recommended to relieve existing flooding and erosion between Barton Street and the QEW. Re-design of this stream reach using natural channel design, together with a culvert replacement at the CN rail line have been recommended. Preliminary design for the first portion of these works between the CN rail line and the QEW has recently been initiated. The City of Hamilton-led planning process for these works is also considering the potential diversion of Watercourse 7.2 westward along the CN rail line into the re-designed main branch of Watercourse 7.0. The potential diversion of Watercourse 7.2 is discussed further in Section 5.2.2.

TABLE 4.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH THE CITY OF HAMILTON AND/OR OTHER AGENCIES ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
1. Stormwater Management Controls - Refer to Report Section 4.1					
None identified – see Development Proponent Responsibility – Table 5.1					
2. Drainage and Infrastructure Improvement Works - Refer to Report Section 4.2					
Watercourse 7 channel capacity improvements (Barton Street to QEW) including possible diversion of Watercourse 7.2 westward along CN rail line	- flood and erosion relief	- fluvial geomorphologic and hydrologic/hydraulic studies in support of preliminary design - hydraulic impact assessment - detailed natural channel design - floodplain mapping updates to reflect revised development limits along the re-constructed reach	- design of CN rail line-QEW reach has begun, including CN rail line culvert upgrade - Watercourse 7.2 diversion could impact SWM planning. Therefore the studies, design, and construction of the diversion are to be completed prior to, or in conjunction with future development draining to Watercourse 7.2 - construction timing to account for warmwater fish habitat	- incorporate 15 m Vegetation Protection Zone, to the extent possible - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - MNR - DFO
Culvert Improvements (various locations) – Watercourses 5.0, 6.0, 6.1, 6.3 and 7.0	- flood relief - eliminate barriers to fish passage	- hydraulic modelling - hydraulic impact assessment- floodplain mapping updates	- investigate opportunities to co-ordinate culvert upgrades with other stream relocation/ restoration/ capacity improvement works along the same stream reach - construction timing to account for warmwater fish habitat	- City of Hamilton 2007 Criteria and Guidelines for Stormwater Infrastructure Design - Hamilton Conservation Authority's 2011 *Planning and Regulation Policies and Guidelines* document - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - MNR - DFO
3. Establishment of Recommended Natural Heritage System (NHS) – Refer to Report Section 4.3					
Refine preliminary (i.e. conceptual) boundaries of recommended NHS through the completion of additional studies to: • refine floodplain mapping for Watercourses 5.0 and 6.0; • determine the meander belt of unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands; and • confirm the distribution of breeding birds, particularly those designated species at risk, to guide the refinement of the recommended NHS.	- flood hazard protection - erosion hazard protection - maintain and protect the significant natural heritage features and ecological functions of the lands within the study area of the SCUBE Subwatershed Study.	Refinement and finalization of hydraulic modelling and floodplain mapping for Watercourses 5.0 and 6.0 north of Barton Street to be completed as part of future Environmental Assessment Studies .Meander Belt Assessment Meander belt assessments will be completed for the unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands, including Watercourses 5.0, 6.0, 7.0 and Fifty Creek. Meander belts constitute Hazardous Lands as defined by the Hamilton Conservation Authority (2009) and will be incorporated within the recommended NHS. Species at Risk Since the commencement of Phase 1 and Phase 2 of the SCUBE Subwatershed Study three species of birds previously recorded from the study area have been designated Threatened under the Endangered Species Act (2007), including Bobolink (*Dolichonyx oryzivorus*), Eastern Meadowlark (*Sturnella magna*) and Barn Swallow (*Hirundo rustica*). Additional surveys completed in 2012 confirmed that these species were not breeding within the study area of the SCUBE Subwatershed Study. Accordingly, further refinement of the recommended NHS to ensure that the Fruitland-Winona Secondary Plan satisfies the habitat protection requirements of the Endangered Species Act (2007) is not needed.	The location and design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) will be determined in part by the boundaries of the recommended NHS. Therefore studies to define the limits of NHS components should be completed before, or at least in conjunction with the site specific studies required at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS and the extent of the associated vegetation protection zone.	The refinement of floodplain mapping and the meander belt assessments will be guided by the requirements of the Natural Hazards Technical Guides (MNR 2006), and HCA Floodplain Mapping Review document (Dec 2010) . Additional guidance for the meander belt assessment is available from the meander belt width delineation procedures established by the TTRCA (2004). The MNR Niagara Area Species at Risk Biologist should be consulted to confirm breeding bird survey protocols, particularly those for species at risk.	- City - HCA - MNR

TABLE 4.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH THE CITY OF HAMILTON AND/OR OTHER AGENCIES ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
4. Environmental Restoration and Enhancement Works - Refer to Report Section 4.4					
Core Areas and Linkages within the Fruitland-Winona Secondary Plan Study Area	• naturalize Hazardous Lands as defined by the Hamilton Conservation Authority (2009) • decrease the edge-interior ratio of Significant Woodlands and Wetlands • provide improved opportunities for wildlife movement • buffer Core Areas from future land uses • increase habitat diversity • improve water quality	Site-specific restoration/planting plans should be prepared by a qualified professional (e.g. botanist, ecologist or landscape architect) to guide recommended enhancement activities within Zone B. The development of restoration/planting plans should be informed by the findings of the SCUBE Subwatershed Study. However, restoration/planting plans should also reflect new information derived from future studies and changes in COSEWIC/COSSARO status designations. Site-specific restoration/planting plans should account for the habitat requirements of species at risk and/or species of conservation concern, if present. Restoration/planting plans should also include recommendations to monitor the establishment/survival of enhancement plantings.	The extent and configuration of enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area will be determined by the final boundaries of the recommended NHS. Therefore site-specific restoration/planting plans should be completed in conjunction with, or after, the site specific studies required at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS. The City of Hamilton may undertake enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area or seek to implement these works as Conditions of Approval through future applications under the Planning Act. Coordination of enhancement activities with other works (e.g. drainage and infrastructure improvements) and/or development activities may present opportunities to minimize potential disturbance to the NHS and achieve cost savings.	Planting plans to provide enhancement plantings should incorporate site-appropriate native species. As outlined by Section F3.4.4.1 of the Urban Official Plan, the City of Hamilton encourages the use of native species when planting within or adjacent to natural areas.	- City - HCA
Watercourse 5.0 riparian plantings (Barton Street to Arvin Avenue) and stream restoration (Arvin Avenue to QEW)	- improve aquatic habitat, bank stability and stream shading so that Watercourse 5.0 can ultimately function as direct fish habitat	- fluvial geomorphologic assessment - hydraulic impact assessment - detailed specifications for riparian areas, including a minimum 15 m wide Vegetation Protection Zone along each side of the improved channel, to the extent possible - construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc... - input to incorporate aquatic habitat recommendations - restoration plans - landscaping/planting plans	- investigate opportunity to co-ordinate works with recommended culvert upgrades at CN rail line and South Service Road - construction timing to account for warmwater fish habitat	Stream restoration works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011). Additional guidance for stream restoration works is provided by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document. Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - DFO
Watercourse 6.0 stream restoration (Barton Street to South Service Road)	- improve aquatic habitat, bank stability and stream shading so that Watercourse 6.0 can ultimately function as direct fish habitat	- fluvial geomorphologic assessment - hydraulic impact assessment- detailed specifications for riparian areas, including a minimum 15 m wide Vegetation Protection Zone along each side of the improved channel, to the extent possible - construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc... - input to incorporate aquatic habitat recommendations - restoration plans - landscaping/planting plans	- investigate opportunity to co-ordinate works with recommended culvert upgrades at Barton Street and CN rail line - construction timing to account for warmwater fish habitat	Stream restoration works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011). Additional guidance for stream restoration works is provided by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document. Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - MNR - DFO

TABLE 4.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH THE CITY OF HAMILTON AND/OR OTHER AGENCIES ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
Fish Barrier Removal: - Watercourse 9 crossing of QEW - Fifty Creek crossings of QEW and Highway 8	- fish passage	Preliminary design for recommended works would focus on hydraulic analyses to determine an appropriate opening size to convey the specified flood flow. The sizing would also take into account requirements for fish passage and physical constraints such as the existing road profile. A hydraulic impact assessment would be required. Following the preliminary planning and design works above, detailed design of the recommended works would be completed. For this step, the preliminary design drawings would be refined to include specific details including: • Detailed specifications for culvert structure such as structural details, headwalls, wingwalls, grading, and channel details for open bottom structures, etc. • Construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc. • Landscaping and restoration plans; and • Erosion and sediment control plans.	- the timing of the recommended barrier removals is not dependent on any other works or urban development. Rather, it is anticipated that the barrier removals could take place in conjunction with any future planned works on these roadways that might include modifications to the subject culvert structures, such as future highway expansions. - construction timing to account for warmwater fish habitat	- Design guidance for culvert and channel improvements is provided by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document. - Recommended works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011). - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- MTO - DFO - City - HCA
Zone C Riparian Habitat Enhancements	- to improve the ability of headwater reaches of Watercourses 5.0, 6.0, 7.0 and Fifty Creek to function as linkages between the Niagara Escarpment and Core Areas of the recommended NHS within Zone B, particularly the Fifty Creek Valley Environmentally Significant Area. - recommended enhancements will improve opportunities for wildlife movement and enhance downstream aquatic habitat through increased bank stability and stream shading.	Site-specific restoration/planting plans should be prepared by a qualified professional (e.g. botanist, ecologist or landscape architect) to guide recommended enhancement of riparian habitat. This may involve restoration/enhancement plantings and/or the control of invasive species. The development of restoration/planting plans should be informed by the findings of the SCUBE Subwatershed Study. However, restoration/planting plans should also reflect new information derived from future studies and changes in COSEWIC/COSSARO status designations. Site-specific restoration/planting plans should account for the habitat requirements of species at risk and/or species of conservation concern, if present. Restoration/planting plans should also include recommendations to monitor the establishment/survival of enhancement plantings.	The timing of the recommended riparian habitat enhancements is not dependent on any other works or urban development. However, any required vegetation removals (e.g. invasive species) must adhere to timing windows associated with the Migratory Birds Convention Act.	Planting plans to provide enhancement plantings should incorporate site-appropriate native species. As outlined by Section F3.4.4.1 of the Urban Official Plan, the City of Hamilton encourages the use of native species when planting within or adjacent to natural areas.	- landowners - HCA - City - NEC
5. Natural Heritage System Management – Refer to Report Section 4.5					

TABLE 4.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH THE CITY OF HAMILTON AND/OR OTHER AGENCIES ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
Establishment of Trails	Avoid or mitigate the potential impacts of the proposed trail network on the natural features and ecological functions of the NHS.	The City of Hamilton will complete a Streetscape Master Plan for Barton Street which will include the design and definition of the Barton Street Pedestrian Promenade. The City of Hamilton should also complete an Environmental Impact Statement (EIS) to: • assess any proposed connection between the BSPP and elements of the SCUBE NHS; • determine the exact location, design and construction material requirements for Trail A; and • review and confirm management measures to minimize the potential impacts of the future trail network use on the SCUBE NHS. **<u>Design Guidance and Policy Considerations</u>** Section 8 of the SCUBE Subwatershed Study Phase 1 and Phase 2 Reports includes a number of recommendations regarding the location and operation of the proposed trail network. The City of Hamilton's 2007 *Recreational Trails Master Plan* document provides recommendations regarding trail development and maintenance standards.	The location of Trail A and any connection(s) between the BSPP and the SCUBE NHS will be determined by future development plans and the final boundaries of the NHS. Trail planning should be completed in conjunction with, or after, the site specific studies that will be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to establish the configuration of proposed development and define the final boundaries of the recommended NHS. The City of Hamilton may undertake enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area or seek to implement these works as Conditions of Approval through future applications under the Planning Act. Coordination of trail construction with NHS enhancement activities and/or development activities may present opportunities to minimize potential disturbance to the NHS and achieve cost savings.	- Per Section F3.2.1.1 of the Urban Official Plan, Environmental Impact Statements are to be prepared in accordance with EIS guidelines adopted by City of Hamilton Council in July, 2004.	- City - HCA - MNR -ESAIEG
Stewardship (educational brochure)	The educational brochure is intended to: • Emphasize the importance of conserving retained natural areas in urbanizing landscapes. • Provide an overview of the significant natural heritage features and functions of the SCUBE NHS. • Provide specific recommendations to residents to promote environmental stewardship. • Outline the environmental responsibilities of the City of Hamilton, developers and local residents. • Promote opportunities for resident participation in the management and restoration of retained natural areas. • Provide contact information for sources of additional information and support for stewardship efforts, such as the Hamilton-Halton Watershed Stewardship Program and the Hamilton Landowner Stewardship Council.	The development of the educational brochure should be informed by the findings of the SCUBE Subwatershed Study as well as new information derived from the site specific studies that will be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS.	Additional site-specific studies are to be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to establish the configuration of proposed development and define the final boundaries of the recommended NHS. The recommended educational brochure should be developed after the completion of these studies.	The development of the recommended educational brochure is consistent with Sections C2.12 and F3.1.6.2(d) of the City of Hamilton Urban Official Plan.	- City

4.2.1.1 Targets/Objectives

The objective of the proposed channel capacity improvements can be described as the provision of a stable, naturalized stream (including a minimum 15 m wide Vegetation Protection Zone, to the extent possible) that provides warmwater habitat and has the capacity to convey flood flows without impacting the adjacent roads or development lands.

4.2.1.2 Future Studies

Preliminary channel design would typically be undertaken at a Functional Design stage. At this phase, the required studies include:

- Fluvial geomorphologic assessment to establish the existing and proposed natural channel form;
- Hydraulic modelling to provide an appropriately sized channel capable of conveying flood flows and maintaining or exceeding the overall flood storage volumes of the existing floodplain;
- Hydraulic modelling to size any proposed new bridge/culvert crossings;
- Hydraulic impact assessment to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential.
- Identification of design measures to avoid/mitigate the potential negative effects of the proposed channel improvements on existing natural heritage features and functions;
- Input to incorporate aquatic habitat recommendations.

The key outcome from the Functional Design stage would be a preliminary natural channel design, including plan/profile, and typical cross-section drawings for the proposed works. Floodplain mapping would also be updated at this time.

Following the preliminary planning and design works above, detailed natural channel design would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- Detailed specifications for channel features such as side slopes, riffle-pool locations and dimensions;
- Detailed specifications for riparian areas, including a minimum 15 m wide Vegetation Protection Zone along each side of the improved channel (to the extent possible);
- Details for any proposed new bridge/culvert crossings;
- Construction phasing plans that address fisheries and other environmental timing windows (e.g. those associated with the Migratory Birds Convention Act), temporary diversions, pumping, re-connection, etc.
- Landscaping and restoration plans;
- Erosion and sediment control plans.

Additional design guidance and recommendations for natural channel design are provided in Section 6.4.

4.2.1.3 Phasing

The planning, design and construction of these works is being undertaken in two phases:

- From the QEW upstream to the CN rail line. As noted, this phase has recently been initiated.
- From the CN rail line upstream to Barton Street.

In general, the design and construction timelines for these works north of Barton Street will not impact the stormwater management planning and development of the upstream SCUBE lands west of McNeilly Road. However, the ultimate decision about diverting Watercourse 7.2 along the CN rail line could affect the stormwater management planning for the development lands which currently drain to this tributary. Therefore, the future studies, design and construction that are required for this proposed diversion will need to be completed either before, or at the very least, in conjunction with the stormwater management planning and development for the Watercourse 7.2 drainage area. This is discussed further in Section 5.2.2.

4.2.1.4 Design Guidance and Policy Considerations

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports identify opportunities to enhance the Core Areas and Linkages of the recommended Natural Heritage System, including Watercourse 7.0. Conveyance improvements should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011), and the *Floodplain Mapping Review* document (December 2010). Additional guidance for natural channel design and restoration works, as specified by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document, is provided in Section 6.4.

4.2.1.5 Approvals

Hamilton Conservation Authority would be the primary approval agency for stream works, with input from the City of Hamilton. One or more additional permits may be required from MNR. Should the proposed works have the potential to impact species at risk (e.g. Butternut) a permit would be required under the Endangered Species Act (2007). Should the proposed works involve a fish rescue, a permit would be required under the Fish and Wildlife Conservation Act (1997). DFO authorization may also be required.

4.2.2 Culvert Improvements

The Phase 1 and Phase 2 Report of the SCUBE West Subwatershed Study recommends culvert improvements at a number of road/rail crossings of Watercourses 5.0, 6.0, 6.1, 6.3 and 7.0:

- Watercourse 5.0 crossings of Barton Street and the CN rail line
- Watercourse 6.0 crossings of Barton Street and the CN rail line

- Watercourse 6.1 crossings of Barton Street and Arvin Avenue
- Watercourse 6.3 crossings of Arvin Avenue and the CN rail line
- Watercourse 7.0 crossing of the CN rail line

The Fruitland-Winona Secondary Plan identifies two new road crossings of watercourses within the SCUBE West lands. Collector Road B is proposed to cross Watercourse 5.0 approximately 30 m north of Wetland 4. Collector Road C is proposed to cross Watercourse 7.0 midway through Wetland 3. The culverts currently located at these locations will need to be improved prior to the construction of the preferred road crossings.

4.2.2.1 Targets/Objectives

The primary objective of the recommended culvert improvements is to reduce the existing flood-susceptibility of these structures and the surrounding lands. However, Watercourses 5.0, 6.0, 6.1 and 7.0 are all warmwater watercourses that function as indirect fish habitat; recommended culvert improvements may eliminate barriers to the upstream movement of fish. Therefore, the design of the recommended culvert improvements should also consider fish passage.

The City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document recommends that new culverts and bridges be designed to convey the Regulatory flood and be designed in accordance with MTO policies and guidelines.

4.2.2.2 Future Studies

Preliminary design work for recommended culvert improvements would focus on hydraulic analyses to determine an appropriate opening size to convey the specified flood flow. The sizing should also take into account requirements for fish passage and physical constraints such as:

- Existing road profile;
- Existing buried municipal services; and
- Land availability and property ownership.

The Hamilton Conservation Authority's most up-to-date HEC-RAS hydraulic model for the subject watercourse should be used for the analysis. A hydraulic impact assessment to should be completed to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential.

Following the preliminary planning and design works above, detailed design of the culvert works would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- Detailed specifications for culvert structure such as structural details, headwalls, wingwalls, grading, and channel details for open bottom structures, etc.
- Construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc.
- Landscaping and restoration plans; and
- Erosion and sediment control plans.

Additional design guidance and recommendations for culvert and channel improvements are provided in Section 6.4.

4.2.2.3 Phasing

The timing of the recommended culvert improvements is not dependent on any other works or urban development. However, many of these works are located within stream reaches for which the Subwatershed Strategy has also recommended channel capacity improvements or enhancement measures. Therefore, in an effort to minimize in-stream disturbance and achieve possible cost savings, opportunities to co-ordinate City of Hamilton culvert improvements with other adjacent channel works should be investigated. It is noted that the recently-initiated design works for the channel capacity improvements along Watercourse 7.0 also include the recommended culvert improvement at the CN rail line crossing.

The actual construction of the culvert improvements along Watercourses 5.0, 6.0, 6.1 and 7.0 will need to take place within a specific window associated with their warmwater fish habitat. No such timing window applies to the Watercourse 6.3 crossing of the CN rail line as this watercourse does not function as fish habitat.

4.2.2.4 Design Guidance and Policy Considerations

Culvert improvements should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) and the *Floodplain Mapping Review* document (December 2010). Additional guidance for culvert and channel design works, as specified by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document, is provided in Section 6.4.

4.2.2.5 Approvals

Hamilton Conservation Authority is the primary approval agency for flood relief works associated with the culvert upgrades. One or more additional permits may be required from MNR. Should culvert improvements have the potential to impact species at risk (e.g. Butternut) a permit would be required under the Endangered Species Act (2007). Should the improvements involve a fish rescue, a permit would be required under the Fish and Wildlife Conservation Act (1997). DFO authorization of culvert improvements may also be required.

4.3 Establishment of the Recommended Natural Heritage System

The Subwatershed Strategy identifies a recommended NHS that consists of the following:

- Core Areas as defined by the City of Hamilton (2009) including Key Natural Heritage Features, Key Hydrologic Features and Local Natural Areas;
- Linkages as defined by the City of Hamilton (2009);
- Hazardous Lands as defined by the Hamilton Conservation Authority (2009); and

- Preliminary vegetation protection zones consistent with the minimum requirements of the City of Hamilton (City of Hamilton 2009)

4.3.1 Targets/Objectives

The recommended NHS is intended to maintain, protect and enhance the significant natural heritage features and ecological functions of the lands within the study area of the SCUBE Subwatershed Study.

4.3.2 Future Studies

The preliminary (i.e. conceptual) boundaries of the recommended NHS were determined during Phase 1 and Phase 2 of the SCUBE Subwatershed Study. However, further studies are required to refine the limits of these boundaries within the SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) lands. Three of the required studies are most appropriately completed at the subwatershed scale; accordingly, the City of Hamilton has been assigned responsibility for their completion. These studies include the following:

4.3.2.1 Refinement of Floodplain Mapping for Watercourses 5.0 and 6.0

The creek reaches located north of Barton Street are characterized by flat topography resulting in multiple spills between channels. Precise delineation of the spills as part of the Phase 1 & 2 Subwatershed Study was difficult to quantify due to the flat topography of the area, however, the locations of the spills are generally consistent with the results of the earlier 1990 FDRP mapping.

Drainage improvements within this area are expected to be investigated as part of future Environmental Assessment studies. Future refinement to the hydraulic modelling downstream of Barton Street and associated floodline mapping is anticipated to be undertaken as part of these studies.

Additional hydraulic modelling and floodplain mapping refinements are recommended for select locations south of Barton Street. These are discussed under development-related works in Section 5.3.

4.3.2.2 Meander Belt Assessment

Meander belt assessments will be completed for the unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands, including Watercourses 5.0, 6.0, 7.0 and Fifty Creek. Meander belts constitute Hazardous Lands as defined by the Hamilton Conservation Authority (2009) and will be incorporated within the recommended NHS.

4.3.2.3 Species at Risk

Since the commencement of Phase 1 and Phase 2 of the SCUBE Subwatershed Study three species of birds previously recorded from the study area have been designated Threatened under the Endangered Species Act (2007), including Bobolink (*Dolichonyx oryzivorus*), Eastern Meadowlark (*Sturnella magna*) and Barn Swallow (*Hirundo rustica*). Additional surveys completed in 2012 by Stantec Consulting Limited confirmed that these avifaunal species were not breeding in and immediately adjacent to the study area of the SCUBE Subwatershed Study. Accordingly, refinement of the recommended NHS to ensure that the Fruitland-Winona Secondary Plan satisfies the habitat protection requirements of the Endangered Species Act (2007) for Bobolink, Eastern Meadowlark, and Barn Swallow is not needed.

4.3.3 Phasing

The location and design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) will be determined in part by the boundaries of the recommended NHS. Therefore the above-noted studies to define the limits of NHS components, including Core Areas (i.e. the habitat of species at risk) and Hazardous Lands as defined by the Hamilton Conservation Authority (i.e. floodplain, meander belt) should be completed before, or at least in conjunction with the site specific studies required at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS and the extent of the associated vegetation protection zone. These site-specific studies are described in Section 5.3.2.

4.3.4 Design Guidance and Policy Considerations

The refinement of floodplain mapping for Watercourses 5.0 and 6.0 and the meander belt assessments for the unconfined portions of Watercourses 5.0, 6.0, 7.0 and Fifty Creek will be guided by the requirements of the Natural Hazards Technical Guides (MNR 2006) and the *Floodplain Mapping Review* document (December 2010). Additional guidance for the meander belt assessment is available from the meander belt width delineation procedures established by the Toronto and Region Conservation Authority (TRCA 2004).

4.3.5 Approvals

The Hamilton Conservation Authority will review and approve refined floodplain mapping for Watercourses 5.0 and 6.0 as well as the results of the meander belt assessments.

The recommended NHS is to be established by the City of Hamilton, in consultation with the Hamilton Conservation Authority and the MNR, through the planning process to prepare the Fruitland-Winona Secondary Plan. The Fruitland-Winona Secondary Plan will be adopted as City of Hamilton policy as an amendment to the Urban Official Plan.

Section C2.2.8 of the City of Hamilton Urban Official Plan states that all natural features, required vegetation protection zones and enhancement or restoration areas on a property are to be placed under appropriate zoning in the zoning by-law and/or protected through a conservation easement to the satisfaction of the City of Hamilton or the Hamilton Conservation Authority, or deeded to a public authority. Acquisition by a public body may also be considered as an option for protecting natural features and functions.

Per Section C2.12 of the Urban Official Plan, the City of Hamilton may also support the use of non-regulatory measures to establish the recommended NHS. Such measures could include conservation easements, land trusts, public land dedication or acquisition, property tax mechanisms, or similar tools.

4.4 Environmental Restoration and Enhancement

The environmental restoration and enhancement works recommended by the Subwatershed Strategy are not directly related to, or expected to benefit the future urban development lands. Rather, these works are generally recommended to address existing environmental issues, or to protect and enhance the Core Areas and Linkages of the recommended NHS. Accordingly, these works are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority. Development proponents are not responsible for any of the recommended restoration and enhancement works at this time. However, it should be recognized that the City of Hamilton may seek to implement these works as Conditions of Approval through future applications under the Planning Act.

4.4.1 Core Areas and Linkages within the Fruitland-Winona Secondary Plan Study Area

The Subwatershed Strategy recommends enhancements to the Core Areas and Linkages of the recommended NHS within Zone B (i.e. the Fruitland-Winona Secondary Plan Study Area) including the following:

- Wetlands associated with Watercourse 5.0
- Core Areas associated with Watercourse 6.0
- Wetlands associated with Watercourse 7.0
- Woodland 5

4.4.1.1 Targets/Objectives

The objectives of the recommended enhancements include the following:

- naturalize Hazardous Lands (e.g. floodplain) as defined by the Hamilton Conservation Authority (2009);
- decrease the edge-interior ratio of Significant Woodlands and Wetlands;
- provide improved opportunities for wildlife movement;

- buffer Core Areas from future land uses;
- increase habitat diversity; and
- improve water quality.

4.4.1.2 Future Studies

Site-specific restoration/planting plans should be prepared by a qualified professional (e.g. botanist, ecologist or landscape architect) to guide recommended enhancement activities within Zone B. The development of restoration/planting plans should be informed by the findings of the SCUBE Subwatershed Study. However, restoration/planting plans should also reflect new information derived from future studies and changes in COSEWIC/COSSARO status designations. Site-specific restoration/planting plans should account for the habitat requirements of species at risk and/or species of conservation concern, if present. Restoration/planting plans should also include recommendations to monitor the establishment/survival of enhancement plantings.

4.4.1.3 Phasing

The extent and configuration of enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area will be determined by the final boundaries of the recommended NHS. Therefore site-specific restoration/planting plans should be completed in conjunction with, or after, the site specific studies required at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS. These site-specific studies are described in Section 5.3.2.

The City of Hamilton may undertake enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area or seek to implement these works as Conditions of Approval through future applications under the Planning Act. Coordination of enhancement activities with other works (e.g. drainage and infrastructure improvements) and/or development activities may present opportunities to minimize potential disturbance to the NHS and achieve cost savings.

Ideally, plantings plans would be implemented during the spring or autumn rather than during the hot, dry summer months. Monitoring of the survivorship of plantings should commence one year after planting has been completed and should continue for one-three years depending on site-specific conditions, the availability of funding and the capacity of monitoring staff.

4.4.1.4 Design Guidance and Policy Considerations

Section C2.9.1 of the Urban Official Plan notes that the City of Hamilton will pursue partnerships to rehabilitate Core Areas and re-establish and strengthen Linkages. The City of Hamilton will also encourage naturalization, or the re-establishment of native indigenous vegetation throughout the NHS to maintain ecological functions.

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports identify opportunities to enhance the Core Areas and Linkages of the recommended NHS. Planting plans to provide enhancement plantings should incorporate site-appropriate native species. As outlined by Section F3.4.4.1 of the Urban Official Plan, the City of Hamilton encourages the use of native species when planting within or adjacent to natural areas. Appendix K of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) provides a lists species of trees, shrubs and vines native to the City of Hamilton.

4.4.1.5 Approvals

Enhancement activities to be undertaken by the City of Hamilton within areas subject to Ontario Regulation 161/06 will require approval from the Hamilton Conservation Authority.

4.4.2 Watercourse 5.0 and 6.0 Stream Restoration and Riparian Plantings downstream of Barton Street

Section 3.2.4.4 of the Phase 1 and Phase 2 Report of the SCUBE West Subwatershed Study recommends stream restoration works and riparian plantings along Watercourse 5.0 and Watercourse 6.0 downstream of Barton Street.

4.4.2.1 Targets/Objectives

The objective of the proposed restoration works and riparian plantings is to improve the existing aquatic habitat, bank stability and stream shading of the urbanized reaches of Watercourses 5.0 and 6.0. These measures are intended to contribute to the enhancement of these watercourses so that they can ultimately function as direct fish habitat.

4.4.2.2 Future Study

The planning and design of these proposed works would include:

- Fluvial geomorphic assessment to establish the proposed natural channel form;
- Hydraulic impact assessment to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential;
- Detailed specifications for riparian areas, including a minimum 15 m wide Vegetation Protection Zone along each side of the improved channel (to the extent possible);
- Construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc...
- Input to incorporate aquatic habitat recommendations;
- Restoration plans; and
- Landscaping/planting plans.

Future studies should include site walks with Hamilton Conservation Authority staff to identify areas for riparian plantings. These areas should include areas of significant bank erosion, exposed soil and any other areas of concern.

4.4.2.3 Phasing

The timing of the recommended restoration works and riparian plantings is not dependent on any other works or urban development. However, as noted earlier, the Subwatershed Strategy also recommends a number of culvert upgrades within these reaches of Watercourses 5.0 and 6.0. Therefore, in an effort to minimize in-stream disturbance and achieve possible cost savings, opportunities to co-ordinate the City of Hamilton's restoration works with the culvert improvement works should be investigated.

The actual construction of the in-stream restoration works will need to take place within a specific window associated with the warmwater fish habitat of these streams.

4.4.2.4 Design Guidance and Policy Considerations

Section C2.9.1 of the Urban Official Plan notes that the City of Hamilton will pursue partnerships to rehabilitate Core Areas and re-establish and strengthen Linkages. The City of Hamilton will also encourage naturalization, or the re-establishment of native indigenous vegetation throughout the NHS to maintain ecological functions.

Stream restoration works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) and the *Floodplain Mapping Review* document (December 2010). Additional guidance for stream restoration works, as specified by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document, is provided in Section 6.4.

4.4.2.5 Approvals

Enhancement activities to be undertaken by the City of Hamilton within areas subject to Ontario Regulation 161/06 will require approval from the Hamilton Conservation Authority. DFO authorization of in-stream works may also be required.

4.4.3 Fish Barrier Removal

The removal of barriers to fish movement is typically a management priority, and Section 8 of the Ministry of Transportation's Environmental Guide for Fish and Fish Habitat (2009) recommends methods of mitigating existing barriers to fish movement. With respect to culverts under existing highways, the guide suggests several on-site mitigation opportunities, including:

- Removal of a 'perched' culvert outfall, either through replacement or channel modifications;
- Creation of a low flow channel through a culvert or narrow structure opening to provide passage under low flow conditions;
- Replacement of an undersized culvert or narrow structure opening that creates a 'velocity' barrier during high flow conditions; and
- Replacement of over-steepened culverts or retrofit of culverts to permit fish passage.

The Subwatershed Strategy recommends improvements to existing structures that present barriers to fish passage at three watercourse crossings of roads (Figure 2.4):

- Watercourse 9 crossing of QEW
- Fifty Creek crossing of QEW
- Fifty Creek (East Tributary) crossing of Highway 8

4.4.3.1 Targets/Objectives

The objective of the recommended works is to eliminate existing barriers to fish movement, including grade control structures and perched culverts. The removal of these barriers would allow fish to move from the downstream sections of the watercourses upstream, thereby converting indirect fish habitat to direct fish habitat.

The City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document recommends that new culverts and bridges be designed to convey the Regulatory flood and be designed in accordance with MTO policies and guidelines.

4.4.3.2 Future Studies

Preliminary design work for recommended works would focus on hydraulic analyses to determine an appropriate opening size to convey the specified flood flow. The sizing would also take into account requirements for fish passage and physical constraints such as the existing road profile. The Hamilton Conservation Authority's most up-to-date HEC-RAS hydraulic model for the subject watercourse should be used for the analysis. A hydraulic impact assessment to should be completed to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential.

Following the preliminary planning and design works above, detailed design of the recommended works would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- Detailed specifications for culvert structure such as structural details, headwalls, wingwalls, grading, and channel details for open bottom structures, etc.
- Construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc.
- Landscaping and restoration plans; and
- Erosion and sediment control plans.

4.4.3.3 Phasing

The timing of the recommended barrier removals is not dependent on any other works or urban development. Rather, it is anticipated that the barrier removals could take place in conjunction with any future planned works on these roadways that might include modifications to the subject culvert structures, such as future highway expansions.

The actual construction of the recommended works would need to take place within a specific window associated with the warmwater fish habitat of Watercourse 9 and Fifty Creek.

4.4.3.4 Design Guidance and Policy Considerations

Design guidance for culvert and channel improvements, as specified by the City of Hamilton's 2007 Criteria and Guidelines for Stormwater Infrastructure Design document, is provided in Section 6.4. Recommended works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) and the *Floodplain Mapping Review* document (December 2010).

4.4.3.5 Approvals

Proposed works would require the approvals of the City of Hamilton and the Ministry of Transportation (QEW culverts), with the support of Hamilton Conservation Authority. One or more additional permits may be required from MNR. Should culvert improvements have the potential to impact species at risk (e.g. Butternut) a permit would be required under the Endangered Species Act (2007). Should the improvements involve a fish rescue, a permit would be required under the Fish and Wildlife Conservation Act (1997). DFO authorization of the recommended works may also be required.

4.4.4 Zone C Riparian Habitat Enhancements

The Subwatershed Strategy recommends the enhancement of riparian habitat along Watercourses 5.0, 6.0, 7.0 and Fifty Creek between the Niagara Escarpment and Highway 8. Recommended enhancements would be implemented by the City and Hamilton and/or the Hamilton Conservation Authority in co-operation with rural landowners. Opportunities to involve other community organizations in enhancement activities should be investigated. Potential partners include the Hamilton-Wentworth Stewardship Council, ReLeaf Hamilton, the Hamilton Naturalists Club and the Field and Stream Rescue Team.

4.4.4.1 Targets/Objectives

The objective of the recommended riparian habitat enhancements is to improve the ability of headwater reaches of Watercourses 5.0, 6.0, 7.0 and Fifty Creek to function as linkages between the Niagara Escarpment and Core Areas of the recommended NHS within Zone B, particularly the Fifty Creek Valley Environmentally Significant Area. Recommended enhancements will improve opportunities for wildlife movement and enhance downstream aquatic habitat through increased bank stability and stream shading.

Section F3.4.1 of the Rural Official Plan indicates that the City of Hamilton's target for riparian vegetation is to have 75% of the length of streams consist of natural vegetation more than 30 m wide.

4.4.4.2 Future Studies

Site-specific restoration/planting plans should be prepared by a qualified professional (e.g. botanist, ecologist or landscape architect) to guide recommended enhancement of riparian habitat. This may involve restoration/enhancement plantings and/or the control of invasive species. The development of restoration/planting plans should be informed by the findings of the SCUBE Subwatershed Study. However, restoration/planting plans should also reflect new information derived from future studies and changes in COSEWIC/COSSARO status designations. Site-specific restoration/planting plans should account for the habitat requirements of species at risk and/or species of conservation concern, if present. Restoration/planting plans should also include recommendations to monitor the establishment/survival of enhancement plantings.

4.4.4.3 Phasing

The timing of the recommended riparian habitat enhancements is not dependent on any other works or urban development. However, any required vegetation removals (e.g. invasive species) must adhere to timing windows associated with the Migratory Birds Convention Act.

Ideally, plantings plans would be implemented during the spring or autumn rather than during the hot, dry summer months. Monitoring of the survivorship of plantings should commence one year after planting has been completed and should continue for one-three years depending on site-specific conditions, the availability of funding and the capacity of monitoring staff.

4.4.4.4 Design Guidance and Policy Considerations

Section C2.9.1 of the Urban Official Plan notes that the City of Hamilton will pursue partnerships to rehabilitate Core Areas and re-establish and strengthen Linkages. The City of Hamilton will also encourage naturalization, or the re-establishment of native indigenous vegetation throughout the NHS to maintain ecological functions.

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports identify opportunities to enhance the riparian habitat of Watercourses 5.0, 6.0, 7.0 and Fifty Creek between the Niagara Escarpment and Highway 8. Where possible, restoration/planting plans should incorporate existing natural areas adjacent to these watercourses.

Planting plans to provide enhancement plantings should incorporate site-appropriate native species. As outlined by Section F3.4.1.1 of the Rural Official Plan, the City of Hamilton encourages the use of native species when planting within or adjacent to natural areas. Appendix K of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) provides a lists species of trees, shrubs and vines native to the City of Hamilton.

4.4.4.5 Approvals

Consultation with Hamilton Conservation Authority is recommended as proposed measures to enhance riparian habitat along Watercourses 5.0, 6.0, 7.0 and Fifty Creek between the Niagara Escarpment and Highway 8 may be subject to Ontario Regulation 161/06. Consultation with the Niagara Escarpment Commission (NEC) is recommended as proposed enhancement measures may also require NEC review and approval.

4.5 Natural Heritage System Management

The conversion of the existing mosaic of agricultural lands and cultural vegetation communities of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) to urban land uses has the potential to degrade the ecological features and functions of the recommended NHS. To ensure its long-term protection, the Subwatershed Strategy includes a variety of management measures intended to mitigate the potential impacts of future land uses on the NHS. The City of Hamilton is responsible for the implementation of several of these management measures including the establishment of trails and stewardship. These measures are described in further detail below.

4.5.1 Trails

The Fruitland-Winona Secondary Plan draft preferred land use option identifies a conceptual trail network that includes the following:

- The Barton Street Pedestrian Promenade (BSPP) - a City of Hamilton-owned multi-use pathway located along the south side of Barton Street that is to connect public spaces such as schools and City Parks. Where possible, the BSPP is to encourage connections with adjacent natural areas, streets and trails.

- A multi-purpose pedestrian trail link that is to extend east of Jones Road to connect proposed Collector Road B and proposed Collector Road C (hereafter, Trail A).

The Subwatershed Strategy includes a number of recommendations regarding the location and operation of the proposed trail network.

4.5.1.1 Targets/Objectives

The objective of the recommendations is to minimize the potential impacts of the proposed trail network on the natural features and ecological functions of the NHS.

4.5.1.2 Future Study

The City of Hamilton will complete a Streetscape Master Plan for Barton Street which will include the design and definition of the Barton Street Pedestrian Promenade. The City of Hamilton should also complete an Environmental Impact Statement (EIS) to:

- assess any proposed connection between the BSPP and elements of the SCUBE NHS;
- determine the exact location, design and construction material requirements for Trail A; and
- review and confirm management measures to minimize the potential impacts of the future trail network use on the SCUBE NHS.

4.5.1.3 Phasing

The location of Trail A and any connection(s) between the BSPP and the SCUBE NHS will be determined by future development plans and the final boundaries of the NHS. Therefore trail planning should be completed in conjunction with, or after, the site specific studies that will be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to establish the configuration of proposed development and define the final boundaries of the recommended NHS. These site-specific studies are described in Section 5.3.2.

The City of Hamilton may undertake enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area or seek to implement these works as Conditions of Approval through future applications under the Planning Act. Coordination of trail construction with NHS enhancement activities and/or development activities may present opportunities to minimize potential disturbance to the NHS and achieve cost savings.

4.5.1.4 Design Guidance and Policy Considerations

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports include a number of recommendations regarding the location and operation of the proposed trail network. The City of Hamilton's 2007 *Recreational Trails Master Plan* document provides recommendations regarding trail development and maintenance standards.

4.5.1.5 Approvals

Proposed trails should conform to the policies outlined in Section 2.1.3 and 3.1.3 of the Hamilton Conservation Authority's 2011 *Planning and Regulation Policies and Guidelines* document. Per Section F3.3.1.1 of the Urban Official Plan, the Environmentally Significant Area Impact Evaluation Group (ESAIEG) will review all Environmental Impact Statement reports and advise City of Hamilton staff on the impacts of proposed land use changes within or adjacent to natural areas.

4.5.2 Stewardship

The Subwatershed Strategy recommends that the City of Hamilton prepare an educational brochure to encourage local stewardship of the SCUBE NHS.

4.5.2.1 Targets/Objectives

The recommended educational brochure is intended to:

- Emphasize the importance of conserving retained natural areas in urbanizing landscapes.
- Provide an overview of the significant natural heritage features and functions of the SCUBE NHS.
- Provide specific recommendations to residents to promote environmental stewardship.
- Outline the environmental responsibilities of the City of Hamilton, developers and local residents.

- Promote opportunities for resident participation in the management and restoration of retained natural areas.
- Provide contact information for sources of additional information and support for stewardship efforts, such as the Hamilton-Halton Watershed Stewardship Program and the Hamilton Landowner Stewardship Council.

4.5.2.2 Future Study

The development of the educational brochure should be informed by the findings of the SCUBE Subwatershed Study as well as new information derived from the site specific studies that will be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to define the final boundaries of the recommended NHS. These studies are described in Section 5.3.2.

4.5.2.3 Phasing

As noted above, additional site-specific studies are to be completed at subsequent planning stages (i.e. Draft Plan of Subdivision or Site Plan) to establish the configuration of proposed development and define the final boundaries of the recommended NHS. The recommended educational brochure should be developed after the completion of these studies.

4.5.2.4 Design Guidance and Policy Considerations

The development of the recommended educational brochure is consistent with Sections C2.12 and F3.1.6.2(d) of the City of Hamilton Urban Official Plan.

4.5.2.5 Approvals

Per Section F3.1.6.3 of the City of Hamilton Urban Official Plan, the recommendation to prepare an educational brochure is to be implemented by the City of Hamilton, in consultation with the Hamilton Conservation Authority through the planning process to prepare the Fruitland-Winona Secondary Plan. The Fruitland-Winona Secondary Plan will be adopted as City of Hamilton policy as an amendment to the Urban Official Plan.

5.0 DEVELOPMENT RELATED WORK

As noted in the previous chapter, the works and measures recommended by the Subwatershed Strategy have been classified into two basic groups, according to who is responsible for their implementation:

- City of Hamilton and/or Agency Responsibility; and
- Development Proponents' Responsibility.

Section 4 addresses the works and measures that are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority.

This section describes the implementation of works and measures for which development proponents are responsible, i.e. those that are either directly related to future urban development or are expected to provide a direct benefit to the developing lands. Table 5.1 provides an overview of the implementation elements for these works and measures; additional details for each are provided below.

5.1 Stormwater Management Controls

5.1.1 End-of-Pipe Stormwater Management Ponds

End-of-pipe wet pond facilities are recommended for water quality, erosion and flood control for future development lands.

5.1.1.1 Targets/Objectives

5.1.1.1.1 Water Quality Control

In terms of water quality control, Level 2, or "normal" water quality control is required. The MOE Stormwater Management Planning Manual was used to define the following targets for water quality control:

- 65 m^3/ha of permanent pool storage, and 40 m^3/ha of active storage for ponds servicing residential land uses (50% impervious); and
- 105 m^3/ha of permanent pool storage, and 40 m^3/ha of active storage for ponds servicing residential land uses (80% impervious).

It should be noted that, for ponds within most catchments, the small amount of active storage specified above will already be provided within the erosion and/or flood control component of the pond. However, for SWM Ponds 9-1 and 9-5 draining to the lined Watercourse 9 channel, erosion and flood control is not required. Therefore, this additional 40m^3/ha of extended detention storage for water quality control only will be required above the permanent pool level for those facilities.

TABLE 5.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	Policy Considerations	Approvals
1. Stormwater Management Controls – Refer to Report Section 5.1					
Construction of centralized stormwater management facilities: (Note – traditional source controls to be used for sites too small for SWM ponds)	- Level 2 water quality control (all ponds) - minimize future instream erosion potential on un-lined, open watercourses; - prevent increases in flood frequency (not required for SWM ponds draining to lined Watercourse 9 channel)	Functional Design Stage - Functional Servicing Studies (FSR's) for planning and preliminary design of drainage systems and centralized SWM facilities • Hydrologic modelling to confirm/refine storage requirements based on updated drainage areas and development densities; • Preliminary design of SWM Ponds (grading, inlet/outlet, rating curves); • Geotechnical investigations at proposed pond locations; - Additional hydrologic/hydraulic studies for works on specific receiving streams (see individual ponds below) Detailed Design Stage - Detailed Stormwater Management Reports for individual subdivisions/sites • Detailed design of ponds (grading, operating levels, inlet/outlet design, forebay, maintenance access, emergency overflow, etc.) - Landscape plans for SWM ponds - Operations and Maintenance Manuals for SWM ponds		- refer to City of Hamilton 2007 Criteria and Guidelines for Stormwater Infrastructure Design - refer to MOE 2003 Stormwater Management Planning and Design Manual	- City - HCA
SCUBE West – Ponds1,2,3,4,5:	- Level 2 water quality control - erosion and post-to-pre flood control		- Location of SWM pond(s) draining to Watercourse 5 will need to account for the proposed relocation & reconstruction works and associated floodline revisions within the SCUBE West lands (Fruitland Road to Barton Street)		- City - HCA
SCUBE East – Pond 7-2-1:	- Level 2 water quality control - erosion and post-to-pre flood control	- possible refinements to the storage requirements for SWM facilities draining to the proposed Watercourse 7-2 diversion to be investigated through hydrologic and hydraulic modelling of proposed diversion and downstream channel capacity improvements on Watercourse 7	- if storage requirements are to be refined for SWM facilities draining to the proposed Watercourse 7-2 diversion channel, then the hydrologic/hydraulic modelling in support of the diversion feasibility should be completed prior to SWM facility design. Otherwise, SWM facilities will require post-to-pre runoff control by default, up to 100-year storm.		- City - HCA
SCUBE East – Ponds 9-2, 9-3, 9-4:	- Level 2 water quality control - erosion and post-to-pre flood control	- possible refinements to the storage requirements of these SWM Ponds draining to the West Tributary of Watercourse 9 to be investigated through hydrologic and hydraulic modelling of proposed downstream channel capacity improvements.	- Location and storage requirements of SWM ponds draining to the West Tributary of Watercourse 9 will need to account for the proposed channel improvements works associated floodlines along Lewis Road and CN rail line. - if storage requirements are to be refined for SWM facilities draining to the reconstructed West Tributary of Watercourse 9, then the hydrologic/hydraulic modelling in support of the capacity improvements should be completed prior to SWM facility design. Otherwise, SWM facilities will require post-to-pre runoff control by default, up to 100-year storm.		- City - HCA - MTO
SCUBE East – Ponds 9-1, 9-5	- Level 2 water quality control				- City - HCA - MTO
SCUBE East – Ponds 10-1, 10-2, 10-3:	- Level 2 water quality control - post-to-pre flood control	- possible refinements to the storage requirements of these SWM Ponds to be investigated through detailed hydraulic modelling of the downstream Watercourse 10 storm sewer systems.		- prevent increased frequency of surcharging and roadway flooding in downstream major/minor drainage system	- City - HCA - MTO
SCUBE East –Ponds 12-1, 12-2 (Fifty Creek)	- Level 2 water quality control - erosion and post-to-pre flood control			- prevent increased frequency of flooding of downstream private lands	- City - HCA

TABLE 5.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	Policy Considerations	Approvals
Traditional Source Control Measures for sites too small for SWM ponds: - apply same water quality, erosion and flood control requirements as SWM ponds within same Watercourse / catchment	- Level 2 water quality control - minimize future instream erosion potential on un-lined, open watercourses; - prevent increases in flood frequency (not required for SWM sites draining to lined Watercourse 9 channel	<u>Detailed Design Stage</u> - Detailed Stormwater Management Reports for individual subdivisions/sites • Detailed design of source controls (grading, operating levels, inlet/outlet design, pre-treatment, maintenance access, emergency overflow, etc.)		- City discourages use of: • Reduced lot grading; • Rear yard ponding; • Rooftop storage (considered on site-by-site basis) - City may allow use of: • Soakaway pits • Parking lot storage - oil-grit separators need pre-treatment and should not be applied as stand-alone measure - City may require easements where facilities located on private lands	- City - HCA
Low Impact Development (LID) – source controls: - 1mm to 3mm, depending on soils and proposed land use	- maintain existing groundwater recharge rates	<u>Functional Design Stage</u> - preliminary design of centralized/communal LIDS as part of FSR <u>Detailed Design Stage</u> - geotechnical investigations to define infiltration rates - detailed design of LID's as part of SWM Report		- City discourages use of: • Reduced lot grading; • Rear yard ponding; - City may allow use of: • Soakaway pits • Porous/pervious pavement - City may require easements where facilities located on private lands	- City - HCA
2. Drainage and Infrastructure Improvement Works – Refer to Report Section 5.2					
Watercourse 5 relocation/reconstruction within the SCUBE West lands (Sherwood Park Road to Barton Street)	- floodplain and SWM servicing improvements - stable, naturalized stream that provides warmwater fish habitat	<u>Functional Design Stage</u> - fluvial geomorphologic and hydrologic/hydraulic studies in support of preliminary design - floodplain mapping updates to reflect revised development limits along the re-constructed reach <u>Detailed Design Stage</u> - detailed natural channel design	- studies, design, and construction to be completed prior to, or in conjunction with urban development upstream of Barton Street - investigate opportunity to co-ordinate works with recommended culvert upgrade at Barton Street - timing of construction to account for warmwater fish habitat; construction timing may also be affected by requirements of the Migratory Birds Convention Act	- incorporate 15 m Vegetation Protection Zone along each side of relocated watercourse - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - MNR - DFO
Possible Watercourse 7.2 Diversion along CN rail line to Main Branch of Watercourse 7	- floodplain and SWM servicing improvements	<u>Feasibility Assessment</u> - hydrologic/hydraulic modelling to determine impacts of the proposed diversion on flood flows in downstream Main Branch of Watercourse 7, and to confirm if diversion is feasible based on the downstream channel & culvert capacities. If so: <u>Functional Design Stage</u> - fluvial geomorphologic and hydraulic modelling in support of preliminary design of diversion channel - floodplain mapping to be completed to reflect revised development limits along the diverted and remnant channel reaches. <u>Detailed Design Stage</u> - detailed channel and culvert designs	- if storage requirements are to be refined for SWM facilities draining to this feature, then the hydrologic/hydraulic modelling in support of the diversion should be completed prior to SWM facility design. Otherwise, SWM facilities will require post-to-pre runoff control by default, up to 100-year storm. - construction timing to account for warmwater fish habitat of Watercourse 7; construction timing may also be affected by requirements of the Migratory Birds Convention Act.	- incorporate 15 m Vegetation Protection Zone along each side of relocated watercourse - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City - MNR - DFO
Watercourse 9 – West Tributary channel capacity improvements along Lewis Road & CN rail line	- flood relief - future SWM facility servicing	<u>Functional Design Stage</u> - fluvial geomorphologic and hydrologic/hydraulic studies in support of preliminary design - floodplain mapping to be completed to reflect revised development limits along the re-constructed reach <u>Detailed Design Stage</u> - detailed channel design	- studies, design, and construction to be completed prior to, or in conjunction with urban development draining to the West Tributary upstream of CN rail line. - co-ordinate with Lewis Road improvements and design. - timing of construction to account for warmwater fish habitat	- incorporate 15 m Vegetation Protection Zone along each side of relocated watercourse - Any hydraulic alterations to consider HCA Floodplain Mapping Review document (Dec 2010)	- HCA - City
3. Establishment of Recommended Natural Heritage System (NHS) – Refer to Report Section 5.3					

TABLE 5.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	Policy Considerations	Approvals
Refine preliminary (i.e. conceptual) boundaries of recommended NHS through the completion of additional studies to: • confirm the flooding hazard limit along watercourses impacted by proposed drainage and infrastructure improve works or environmental restoration and enhancement works; • identify the erosion hazard limit along confined portions of Fifty Creek; • identify the final boundaries of Core Areas and Linkages; and • confirm the extent of Vegetation Protection Zones.	- flood hazard protection - slope stability /erosion hazard protection - maintain and protect the significant natural heritage features and ecological functions of the lands within the study area of the SCUBE Subwatershed Study.	Identification of Flooding Hazard Limits - hydraulic analysis and floodplain mapping revisions to reflect the following: • Watercourse 5.0 relocation/reconstruction; • Culvert improvements (Watercourses 5.0, 6.0, 6.1, 6.3 and 7.0); and • New bridge/culvert structures. - new hydraulic modelling and floodplain mapping following proposed channel works: • Possible Watercourse 7.2 diversion; and • Watercourse 9 West Tributary channel capacity improvements. - Refinements of Watercourse 5 and Watercourse 6 floodplain mapping along select locations as more accurate, up-to-date topographic mapping becomes available during the Block Planning stage. - Refinements of Fifty Creek floodplain mapping as more accurate, up-to-date topographic mapping becomes available to overcome existing mapping deficiencies. Identification of Erosion Hazard Limits - geotechnical assessment to define the erosion hazard limit along confined portions of Fifty Creek. This assessment will require field surveys to identify the top of slope (also known as the top of bank) and the toe of slope (also known as base of slope). Identification of Core Areas and Linkages - Environmental Impact Statement (EIS) to determine the final boundaries of NHS Core Areas and Linkages. Depending on site-specific conditions, this may include the following: • surveys for species at risk; • field delineation of permanent and intermittent streams as defined by the edges of their bankfull width; • field delineation of the limits of Woodlands 2 and 5; • field delineation of the limits of Wetlands 1, 2, 3, 4 and 7 as well as the Fifty Creek Locally Significant Wetland Complex; • surveys/assessment of Significant Wildlife Habitat; • assessment of linkages; and • assessment of hedgerows. - EIS should also confirm the extent of Core Area Vegetation Protection Zones.	- The location and design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) will be determined in part by the boundaries of the recommended NHS. Therefore studies to define the limits of NHS components, including Core Areas (e.g. the habitat of species at risk), Linkages, Hazardous Lands as defined by the Hamilton Conservation Authority (i.e. floodplain, meander belt) and VPZ will need to be completed as part of the Draft Plan of Subdivision or Site Plan planning process.	- Section 2.1 of Hamilton Conservation Authority's 2011 *Planning and Regulation Policies and Guidelines* document), and HCA Floodplain Mapping Review document (Dec 2010) - Section F3.2.1 of the City of Hamilton's Urban Official Plan. -Endangered Species Act (2007) - Fish and Wildlife Conservation Act (1997)	- City - HCA - MNR -ESAIEG
4. Environmental Restoration and Enhancement Works - Refer to Report Section 5.4					
None identified – see City/Agency Responsibility – Table 4.1					
5. Natural Heritage System Management – Refer to Report Section 5.5					

TABLE 5.1: SUBWATERSHED STUDY IMPLEMENTATION:

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	Policy Considerations	Approvals
To ensure its long-term protection, the Subwatershed Strategy recommends management measures to mitigate the potential impacts of future land uses on the NHS. The proponents of development are responsible for the review, refinement and implementation of measures that address edge management, fencing and future road crossings of watercourses within SCUBE West.	Avoid or mitigate the potential negative impacts of future land use on the NHS.	Environmental Impact Statement to review, refine and implement recommended NHS management measures that address edge management, fencing and future road crossings of watercourses within SCUBE West.	EIS results will provide input to the planning process that may affect the location and/or design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). Therefore the EIS will be completed as part of the Draft Plan of Subdivision or Site Plan planning process.	- Per Section F3.2.1.1 of the Urban Official Plan, Environmental Impact Statements are to be prepared in accordance with EIS guidelines adopted by City of Hamilton Council in July, 2004. - Per Section F3.2.1.5 of the Urban Official Plan, the requirements of an EIS may be scoped by the City of Hamilton in consultation with the Hamilton Conservation Authority.	- City - HCA - MNR -ESAIEG

5.1.1.1.2 Erosion and Flood Control

SCUBE West

During the Phase 1 and 2 SCUBE West Subwatershed Study, a VISUAL OTTYMO hydrologic model was setup and calibrated to observed rainfall-runoff gauge data. The model was then used to estimate flood flows which in turn were used to define flood hazard lands over Watercourses 5, 6, and 7 within the study area. The hydrologic model was also used to estimate storage requirements for erosion and flood control for future stormwater management ponds within the SCUBE West development lands south of Barton Street. Table 5.2 summarizes the relaease rates and storage volumes requirements for the conceptual stormwater ponds.

Figure 2.1 illustrates the conceptual stormwater pond locations from the Phase 1 and 2 report. The exact number of ponds, their locations and sizes are unknown at this point in time. These factors will ultimately depend on the location and depth of suitable pond outlets, fragmentation of land ownership, and ability to co-ordinate the timing of the various development sites through functional servicing studies (see below). Therefore, Table 5.2 also includes unit release rates and storage volume targets which can be applied on a catchment-by-catchment basis to estimate future facility requirements for ponds of varying service areas.

SCUBE East

During the Phase 1 and 2 SCUBE East Subwatershed Study, continuous hydrologic modelling was completed using the MIKE-11 model and 30 years of meteorological data to estimate the frequency of flood flows within study area streams. These in-stream flood flow rates were then used to define the extent of the regulatory floodplain over many of the study area streams. This modelling was also used to estimate a very preliminary target for the erosion and quantity control storage requirements within stormwater management facilities on the future development lands. The modelling results indicate that, for those areas requiring erosion and quantity control, on average, approximately 550 m^3/ha of storage is necessary to control post-development runoff rates to pre-development rates.

The Phase 1 and 2 report also illustrated conceptual stormwater pond locations throughout the proposed development lands (Figure 2.2). The exact number of ponds, their locations and sizes are unknown at this point in time. These factors will ultimately depend on the location and depth of suitable pond outlets, fragmentation of land ownership, and ability to co-ordinate the timing of the various development sites through functional servicing studies (see below). With this in mind, the present Phase 3 Report includes further hydrologic modelling work intended to refine the preliminary stormwater management targets so that future development proponents can determine their requirements depending on the specific size of their site, and the streams to which the lands drain to.

Similar to the approach taken in the SCUBE West study, a design storm modelling approach was used to estimate the erosion and flood control requirements for the future SCUBE East ponds. With a design storm approach, a rainfall input (i.e. duration, return period depth, and temporal distribution) is selected and design flows are estimate through hydrologic modelling. For the conceptual SCUBE East pond designs, the SWMHYMO hydrologic model was used.

TABLE 5.2:
Conceptual Stormwater Management Pond Characteristics
SCUBE Subwatershed - East and West

Pond # or Catchment	Estimated Drainage Area (ha)	Landuse	Assumed % Impervious	Water Quality Control (Level 2)				Extended Detention for Flood (Quantity) Ctonrol												Total Storage Volume * (m^3)	Conceptual Pond Footprint Area ** (ha)	Pond # or Catchment
								Extended Detention for Erosion Control														
								Erosion Control				2-Year Control				100-Year Control						
				Perament Pool Storage for Water Quality		Extended Detention for Water Quality		Release Rate		Storage Volume		Release Rate		Storage Volume		Release Rate		Storage Volume				
				(m^3/ha)	(m^3)	(m^3/ha)	(m^3)	(m^3/s)	(L/s/ha)	(m^3)	(m^3/ha)	(m^3/s)	(L/s/ha)	(m^3)	(m^3/ha)	(m^3/s)	(L/s/ha)	(m^3)	(m^3/ha)			
SCUBE East																						
12-1	11.8	employment	80%	105	1,239	40	472	0.013	1.1	2,401	203	0.087	7.4	3,430	291	0.333	28.3	7,730	655	8,969	1.2	12-1
12-2	14.5	employment	80%	105	1,523	40	580	0.016	1.1	2,947	203	0.107	7.4	4,210	290	0.410	28.3	9,490	654	11,013	1.4	12-2
9-1	14.7	residential	50%	65	956	40	588													1,544	0.6	9-1
9-2	54.0	residential	50%	65	3,510	40	2,160	0.035	0.6	7,952	147	0.231	4.3	11,360	210	0.942	17.4	30,550	566	34,060	2.8	9-2
9-3	23.1	residential	50%	65	1,502	40	924	0.015	0.6	3,409	148	0.099	4.3	4,870	211	0.403	17.4	13,090	567	14,592	1.6	9-3
9-4	16.2	employment	80%	105	1,701	40	648	0.023	1.4	3,171	196	0.151	9.3	4,530	280	0.582	35.9	9,980	616	11,681	1.4	9-4
9-5	24.8	employment	80%	105	2,604	40	992													3,596	0.9	9-5
10-1	16.4	employment	80%	105	1,722	40	656					0.208	12.7	3,580	218	0.798	48.7	8,040	490	9,762	1.2	10-1
10-2	9.6	employment	80%	105	1,008	40	384					0.128	13.3	2,050	214	0.490	51.1	4,600	479	5,608	0.9	10-2
10-3	9.3	employment	80%	105	977	40	372					0.127	13.7	1,940	209	0.489	52.6	4,360	469	5,337	0.9	10-3
7-2-1	10.3	employment	80%	105	1,082	40	412	0.027	2.7	1,659	161	0.182	17.7	2,370	230	0.707	68.6	4,890	475	5,972	1.0	7-2-1
7-2-2	4.8	employment	80%	Catchment areas may be less than minimum recommended for a SWM Pond, and other traditional source control methods may be necessary instead. Unit storage and release rates from SWM Pond catchment #7-2-1 would apply.																		7-2-2
7-2-3	4.3	employment	80%																			7-2-3
7-2-4	2.4	employment	80%																			7-2-4
SCUBE West																						
1	39.8	residential	50%	65	2,587	40	1,592	0.025	0.6	4,011	101	0.166	4.2	5,730	144	1.143	28.7	16,830	423	19,417	1.9	1
2	24.5	residential	52%	65	1,593	40	980	0.024	1.0	2,625	107	0.159	6.5	3,750	153	0.997	40.7	11,180	456	12,773	1.5	2
3	26.4	residential	48%	65	1,716	40	1,056	0.026	1.0	2,611	99	0.171	6.5	3,730	141	1.071	40.6	11,500	436	13,216	1.5	3
4	26.5	residential	52%	65	1,723	40	1,060	0.037	1.4	2,800	106	0.248	9.4	4,000	151	1.477	55.7	11,850	447	13,573	1.6	4
5	21.1	residential	50%	65	1,372	40	844	0.013	0.6	2,198	104	0.084	4.0	3,140	149	0.564	26.7	9,330	442	10,702	1.3	5

* Note - Total volume includes permanent pool storage plus the higher of extended detention storage for water quality or flood control.

** Note - Actual footprint areas will depend on physical constraints including grading / storm sewer inverts / outlet (creek) elevations, etc. For conceptual purposes, the pond footprint areas were estimated assuming a 3:1 length to width flowpath, max. water depth of 2.5m for flood control ponds, 1.5m for ponds with water quality control only, and included allowances for sideslopes, etc.

SWMHYMO is a Windows-based model which is compatible with the widely used OTTHYMO/INTERHYMO and VISUAL OTTHYMO hydrologic model formats.

A number of possible design storm distributions and durations are available for use. The City of Hamilton Criteria and Guidelines for Stormwater Management Infrastructure (2007) document includes several design storm alternatives derived from City rainfall gauges. The 24-hour SCS design storm distribution was used as it tended to result in the highest runoff rates.

Modelling was completed to estimate the pre-development runoff rates from each of the existing catchments for the 2-year and 100-year design storm frequencies. The unitary pre-development runoff rates were then used to define the allowable release rates from future proposed stormwater pond catchment areas for these storm frequencies. In addition, for those catchments requiring erosion control, the MOE Stormwater Management Practices Manual was used to estimate an erosion control release rate of 15% of the allowable 2-year release rate. These targets were then applied to the future land use scenario to define the necessary erosion and flood control storage volumes. A summary of model parameters and catchment mapping is provided in Appendix A.

Table 5.2 summarizes the release rates and storage volume requirements for erosion and flood control, ranging from the 2-year to the 100-year storm event, for the conceptual SCUBE stormwater ponds (Figure 2.1, Figure 2.2). Also summarized are the required water quality control storage volumes.

As noted above, the exact number of ponds and their locations are unknown at this point in time. Therefore, Table 5.2 also includes unit release rates and storage volume targets which can be applied on a catchment-by-catchment basis to estimate future stormwater facility requirements for ponds of varying service areas. For example, regarding the future development catchments draining to Watercourse 7.2, several are too small for traditional end-of-pipe ponds due to the drainage constraints represented by the existing roadway/railway networks. Therefore, for these smaller sites, traditional on-site controls are recommended to provide the water quality and quantity controls. The unit storage and release rates summarized in Table 5.2 can be applied to define the targets for these small sites.

5.1.1.2 Future Studies

As noted in Section 3, it is anticipated that two progressively more detailed levels of study will be required as development and stormwater management planning and design progresses:

5.1.1.2.1 Functional Design Stage

This stage of planning should include efforts to refine the conceptual pond locations identified in the Subwatershed Strategy. As noted earlier, location planning and design of future stormwater management ponds should take into account adjacent developments within a catchment, rather than on a site-by-site basis, in order to identify opportunities to minimize the overall number of facilities by providing larger, more efficient centralized ponds which are shared by more than one development site. The centralized ponds would provide benefits to both the development proponent and the City through savings in land and lower future maintenance requirements.

The preliminary planning and design of the overall drainage and stormwater pond networks should be completed as part of a Functional Servicing Study (FSR). The FSR would include:

- hydrologic modelling to confirm/refine storage requirements based on updated drainage areas and development densities;
- preliminary design of SWM Ponds, including preliminary grading, inlet/outlet locations and elevations, and stage-storage-discharge rating curves; and
- geotechnical investigations to confirm soils and groundwater conditions at proposed pond locations.

In addition to the above, the Functional Design stage for stormwater ponds draining to several specific receiving streams will need to account for proposed downstream capacity constraints and/or stream works. The proposed stream works, which should also be commenced at the Functional Design stage, are discussed further in Section 4.2 and Section 5.2. In some cases, such as the works on Watercourse 7.2 and the West Tributary of Watercourse 9, downstream capacity improvements have been recommended which may ultimately alleviate some downstream flood capacity constraints, and thereby possibly relaxing the storage requirements for the future stormwater ponds which drain to these channels. It is noted, however, that HCA does not support stream capacity improvements where the direct objective is to increase development area. A review of the issues to be considered for the proposed ponds illustrated in Figures 2.1 and 2.2 is provided below:

SCUBE West Ponds 1, 2, 3, 4 and 5

Within the SCUBE West lands, future stormwater management ponds require extended detention for erosion and quantity control due to the presence of existing downstream erosion and due to the flood-susceptibility of downstream lands on the receiving streams of Watercourse Systems 5, 6, and 7. Level 2 water quality control is also required.

For the most part, these future stormwater facilities can proceed on this basis without further study of the downstream watercourses. However, the ultimate location of stormwater pond(s) draining to Watercourse 5.0 will need to account for its proposed relocation and reconstruction within the SCUBE West lands from approximately Sherwood Park Road to Barton Street. These works, and the associated future studies and designs are discussed further in Section 5.2.1.

SCUBE East Watercourse 7-2 Ponds/Facilities

Because of the limited capacity of this system, the Phase 1 and Phase 2 Reports of the SCUBE East Subwatershed Study recommend post-to-pre flood (quantity) control via stormwater ponds or other traditional source control methods for future development lands draining to Watercourse 7.2. Level 2 water quality control and erosion control is also required. However, the sizing of these facilities and possible relaxation of the flood control requirements will need to consider potential capacity improvement associated with the construction of a possible diversion of the stream along the CN rail line. Future study requirements to investigate the feasibility of constructing the diversion and relaxing the post-to-pre flood controls are discussed further in Section 5.2.2.

If development of these lands is to take place before the diversion works, or if the diversion works are ultimately deemed to be infeasible, then future Watercourse 7.2 stormwater management facilities will continue to require post-to-pre runoff control by default up to the 100-year storm.

SCUBE East – Watercourse 9 Ponds

The Phase 1 and Phase 2 Report of the SCUBE East Subwatershed Study note that, without controls, future urban development upstream of the QEW would result in increased flood flows in Watercourse 9. Given the Ministry of Transportation requirement that future development not increase the flood-susceptibility of the QEW, the HEC-RAS hydraulic model developed for the lined portion of Watercourse 9 was used to determine if uncontrolled future flood flows would result in an increased frequency of flooding of the freeway. The results of modelling completed during Phase 1 and Phase 2 of the SCUBE Subwatershed Study indicate the following:

- the QEW and Service Road culverts have sufficient capacity to convey the future uncontrolled flows without flooding the roadways;
- approximately 3.5 m of freeboard is available for the future uncontrolled 100-year flood flow; and

- approximately 2.5 m of freeboard is available for the future Regional storm event.

The CN rail line culvert structure and lined channel were also found to have sufficient capacity to convey the future uncontrolled 100-year and Regional storm flows. Therefore, future stormwater Ponds 9-1 and 9-5 draining to the lined Watercourse 9 channel do not require post-to-pre flood control. Only water quality control is required for these stormwater facilities.

Although the above analysis indicates that the downstream lined channel and culverts could convey the future uncontrolled flows, post-to pre quantity controls are still recommended for ponds discharging to the unlined West Tributary of Watercourse 9 along Lewis Road (Ponds 9-2, 9-3 and 9-4) due to current capacity limitations of this tributary. The feasibility of relaxing or removing the post-to-pre flood control requirements for the West Tributary will depend on proposed channel capacity improvement works along this reach. Future study requirements related to these channel works are discussed further in Section 5.2.3.

Any proposed relaxation of the post-to-pre flood control requirements which may come from the West Tributary channel improvement works would require review and approval by City of Hamilton and MTO staff. It is noted that HCA does not support stream capacity improvements where the direct objective is to increase development area. Regardless of whether the flood control requirements can be relaxed, these stormwater management facilities draining to the unlined West Tributary will still need to provide Level 2 water quality control and extended detention for erosion control.

SCUBE East – Watercourse 10 Storm Sewer Tributary Ponds

These proposed future stormwater facilities will drain northward via existing QEW and Service Road culverts. From here, the outflows drain to Lake Ontario via the existing major/minor drainage systems of the subdivision located north of the QEW. Because of the potential capacity limitations of the existing downstream sewer systems, the Phase 1 and Phase 2 Report of the SCUBE East Subwatershed Study recommends post-to-pre flood (quantity) control for these ponds to prevent an increase in the frequency of downstream surcharging and road flooding. Level 2 water quality control is also required. Extended detention for erosion control is not required for these ponds draining into the Watercourse 10 storm sewer systems.

Following the Phase 1 and Phase 2 of the Subwatershed Study, a subsequent meeting was held with City of Hamilton staff and consultants for the development community to discuss the possibility of relaxing the post-to-pre control requirements for these ponds. Two previous reports related to these drainage systems were provided for review:

- Drainage Report – Marina Point on Baseline (AJ Clarke & Associates, August 2007)
- Visual Otthymo and PCSWMM Modelling – Marina Point on Baseline Development (MTE, February 2008)

The reports were completed in support of the recently-constructed Marina Point development, located north of the QEW, between North Service Road and Baseline Road. Using a series of hydrologic and hydraulic models, the studies investigated the impacts of this specific development on the existing downstream storm sewer system to the north and on the QEW culvert to the south.

External lands draining to this site (and then to the existing storm sewer system to the north) include portions of the future SCUBE development lands on the South side of the QEW. Review of the reports indicates that the analyses completed in the studies was based on the existing, pre-development land use scenario for the external SCUBE lands and it was assumed that future quantity controls will be put in place on these lands. Section 2 of the February 2008 report states:

> Future development of the external lands will require stormwater management controls to limit post-development flows to pre-development flow rates draining to the existing MTO culvert crossings. Consequently a specific post-development model was not created since future works will require the implementation of SWM measures to control post-development flows.

Therefore, based on the above, the Subwatershed Study recommendation that quantity control be required for the SCUBE lands draining to these Watercourse 10 storm sewer systems remains in place. However, it was agreed that future stormwater management studies in support of proposed development could potentially include further detailed hydrologic/hydraulic analyses to investigate the impacts of the future SCUBE developments on the QEW culverts and the major/minor systems north of the QEW. In doing so, these future studies could determine whether the quantity control requirements for the SCUBE ponds could be relaxed to any degree.

Further investigation into these systems would require detailed hydraulic grade line analysis of the downstream MTO culverts and Watercourse 10 storm sewer systems using the City's MIKE-URBAN hydraulic model. The analysis would need to determine the allowable pond release rates and corresponding pond storage volumes that would be necessary to achieve the following:

- Meet the conveyance and freeboard targets for the QEW targets as specified by MTO Directive B-100.
- Confirmation that the frequency of surcharging within the downstream storm sewer system does not increase.
- Confirmation that the frequency of surface flooding does not increase.

Regarding the last point above, the City of Hamilton discourages the use of significant collector or arterial roadways to convey major system flows. Any proposed relaxation of the post-to-pre flood control requirements which may come from the above analysis would require review and approval by City, Hamilton Conservation Authority and MTO staff. Regardless of whether the flood control requirements can be relaxed, these stormwater management facilities will still need to provide Level 2 water quality control.

<u>SCUBE East – Fifty Creek Ponds</u>

The Phase 1 and Phase 2 Report of the SCUBE East Subwatershed Study notes that, without controls, future urban development within the SCUBE East lands upstream of the QEW would result in moderate increases in flood flows in the downstream reaches of Fifty Creek. Given the

Ministry of Transportation requirement that future development not increase the flood-susceptibility of the QEW, the HEC-RAS hydraulic model developed for Fifty Creek was used to determine if uncontrolled future flood flows would result in an increased frequency of flooding of the freeway. The results of modeling completed during Phase 1 and Phase 2 Report of the SCUBE East Subwatershed Study indicate the following:

- the QEW and Service Road culverts have sufficient capacity to convey the future uncontrolled flows without flooding the roadways;
- approximately 3 m of freeboard is available for the future uncontrolled 100-year flood flow; and
- approximately 1 m of freeboard is available for the future Regional storm event.

Therefore it was concluded that, even without flood (quantity) control within the SCUBE East ponds, the QEW and Service Road culvert structures have sufficient capacity to convey the future flows. However, through the public consultation process, downstream landowner concerns were expressed regarding the potential for increased runoff rates due to proposed future upstream urban development. Without future controls to prevent these increases, an increase in the frequency of flooding of private lands within the Fifty Creek floodplain may occur, which would be unacceptable.

Therefore, based on the above, future stormwater management planning and design for facilities draining to Fifty Creek will indeed require post-to-pre quantity control. In addition, these ponds will also require Level 2 water quality control and extended detention for erosion control.

5.1.1.2.2 Detailed Design Stage

This stage of planning builds upon the preliminary work at the functional design level in order to finalize the drainage and stormwater designs. The following studies and analyses will be required:

- Preparation of Detailed Stormwater Management Reports for individual subdivisions or sites to demonstrate how the proposed systems conform to the targets identified in the overall Subwatershed Strategy and/or FSR findings. This includes:
    - Site grading;
    - Calculations and/or modelling for sizing and detailed design of the major/minor drainage systems;
    - Detailed design for end-of-pipe stormwater ponds, including grades, operating levels, inlet/outlet designs, forebay, maintenance access, emergency overflow, etc.
- An Operations and Maintenance Manual for stormwater facilities;
- Landscaping plans for stormwater ponds;
- An Erosion and Sediment Control Plan;

Detailed listings and general checklists of the components expected in SWM Reports and Operation and Maintenance Manual submissions is provided in the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document.

5.1.1.3 Phasing

As noted above, the planning and design for several stormwater ponds will need to account for proposed downstream channel capacity and/or stream re-location works within the receiving streams, including:

- Watercourse 5.0 relocation and reconstruction from approximately Sherwood Park Road to Barton Street;
- Possible diversion of Watercourse 7.2 along the CN rail line; and
- Channel capacity improvements in the West Tributary of Watercourse 9 along Lewis Road and the CN rail line.

The hydrologic/hydraulic modelling and floodplain mapping for the above works may impact the design, location and/or storage requirements for the stormwater ponds draining into affected watercourses. Therefore, ideally, the design of the stormwater ponds should not precede the planning and design of these downstream works.

For example, if storage requirements are to be refined for facilities draining to the reconstructed West Tributary of Watercourse 9 or the possible Watercourse 7.2 diversion, then the hydrologic/hydraulic modelling in support of these channel works should be completed prior to the stormwater facility design. Otherwise, the stormwater facilities will require post-to-pre runoff control by default, up to 100-year storm.

5.1.1.4 Design Guidance and Policy Considerations

Design of future stormwater management ponds should be guided by the criteria and recommendations in the MOE 2003 Stormwater Management Planning and Design Manual and the City of Hamilton’s 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document. Section 6.1 provides an overview of City of Hamilton design guidance and standards for stormwater management ponds.

5.1.1.5 Approvals

The City of Hamilton and Hamilton Conservation Authority are primarily responsible for the review and approval of the proposed stormwater management ponds.

MTO approval would also be required where the proposed design may impact culvert crossings of the QEW through increased flows.

5.1.2 Traditional Source Controls

5.1.2.1 Targets/Objectives

For sites which are too small to be serviced by a stormwater pond (i.e. less than 5 ha), the Subwatershed Strategy recommends that traditional lot-level source controls be used to provide the necessary water quality, erosion and flood control. In particular, the development lands draining to Watercourse 7.2 are likely to develop as a number of smaller sites that are too small for traditional end-of-pipe ponds due to the drainage constraints represented by the existing roadway/railway networks.

Where traditional source controls are to be used instead of an end-of-pipe wet pond facility, the same storage and release targets identified in Section 5.1.1.1 for SWM ponds within the same watercourse/catchment should be applied.

5.1.2.2 Future Studies

The following studies and analyses will be required at the Detailed Design stage for sites using traditional source controls:

- Preparation of Detailed Stormwater Management Reports for individual sites to demonstrate how the proposed systems conform to the targets identified in the overall Subwatershed Strategy. This includes:
  - Site grading;
  - Calculations and/or modelling for sizing and detailed design of the major/minor drainage systems;
  - Detailed sizing and design of stormwater devices and storage areas, including grades, operating levels, inlet/outlet designs, pre-treatment areas, maintenance access, emergency overflow, etc.
- An Operations and Maintenance Manual, where appropriate;
- Landscaping plans for naturalized stormwater treatment areas;
- An Erosion and Sediment Control Plan;

Detailed listings and general checklists of the components expected in SWM Reports and Operation and Maintenance Manual submissions is provided in the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document.

5.1.2.3 Design Guidance and Policy Considerations

The City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document notes that the City generally discourages the use of the following source control methods:

- Reduced lot grading;
- Rear yard ponding; and
- Rooftop storage (considered on site-by-site basis).

The document notes that the City of Hamilton may allow the use of:

- Soakaway pits; and
- Parking lot storage.

Generally, the City of Hamilton requires easements where stormwater controls are to be located on private lands.

Additional design guidance for traditional on-site controls is provided in Section 6.2.

5.1.2.4 Approvals

The City of Hamilton is the primary approval agency for traditional stormwater source controls with additional review and approval provided by the Hamilton Conservation Authority.

5.1.3 Low Impact Development (LID) Controls

5.1.3.1 Targets/Objectives

Low Impact Development (LID) techniques are recommended to maintain the groundwater recharge rates within the study area. -Phase 2 of the SCUBE Subwatershed Study identified the following targets through a basic water balance assessment:

5.1.3.1.1 SCUBE West (West of McNeilly Road)

- Capture and infiltrate the first 1 mm of runoff over the catchment area for residential land uses underlain by silt/clay soils.
- Capture and infiltrate the first 2.5 mm of runoff over the catchment area for employment/institutional land uses underlain by silt/clay soils, and for residential land uses underlain by sand/gravel soils.-;

5.1.3.1.2 SCUBE East (East of McNeilly Road)

- Capture and infiltrate the first 1.5 mm of runoff over the catchment area for residential land uses underlain by silt/clay soils.
- Capture and infiltrate the first 3 mm of runoff over the catchment area for employment/institutional land uses underlain by silt/clay soils, and for residential land uses underlain by sand/gravel soils.

It is important to note that, in addition to providing groundwater recharge benefits, many LID measures may also provide other water balance, water quality, and erosion control benefits.

5.1.3.2 Future Studies

Where centralized or communal LID controls are to be shared by one or more development sites, preliminary planning and design should be undertaken at a Functional Design level as part of an FSR to demonstrate the necessary storage and size requirements and associated drainage networks.

Most LID controls, however, will be implemented at the individual site or subdivision level and the majority of their design will take place at the Detailed Design level. The following studies and analyses will be required at the Detailed Design stage for the use of LID controls within proposed development sites/subdivisions:

- In-situ Guelph Permeameter tests or equivalent as detailed in Appendix C of the Low Impact Development Planning and Design Guide Version 1.0 (TRCA/CVC 2010) to define the infiltration rates to be used in the design of the LID measures.
- Preparation of Detailed Stormwater Management Reports for individual sites to demonstrate how the proposed LID controls conform to the groundwater recharge targets identified in the overall Subwatershed Strategy. This includes:
    - Site grading;
    - Calculations and/or modelling for sizing and detailed design of the drainage systems;
    - Detailed sizing, location and design of LID controls, including grades, operating levels, inlet/outlet designs, pre-treatment areas, underdrains, maintenance access, emergency overflow, etc.
- An Operations and Maintenance Manual, where appropriate;
- Landscaping plans for naturalized LID stormwater treatment areas;
- An Erosion and Sediment Control Plan;

5.1.3.3 Design Guidance and Policy Considerations

Although LID techniques are not yet as widely used as traditional source control measures, many of the policy considerations for LID measures are similar to those noted in Section 5.1.2 above.

Additional design guidance for LID controls, including appropriate techniques for various land uses, is provided in Section 6.3.

Further recommendations with respect to policy changes and refinements for the City of Hamilton to consider in regard to LID controls are discussed in Section 7.

5.1.3.4 Approvals

The City of Hamilton would be the primary approval agency for LID controls with additional review and approval provided by the Hamilton Conservation Authority.

5.2 Drainage and Infrastructure Improvement Works

5.2.1 Watercourse 5.0 Relocation/Reconstruction within SCUBE West Lands

The Phase 1 and 2 Report of the SCUBE West Subwatershed Study includes hydrologic/hydraulic modelling and floodplain mapping for Watercourse 5.0. The Report also characterizes the aquatic habitat of Watercourse 5.0.

In its current form, Watercourse 5.0 is conveyed beneath Fruitland Road approximately 200 m north of Highway 8. From this point, Watercourse 5.0 extends north to Barton Street through the SCUBE West lands more or less parallel with Fruitland Road. A long, narrow parcel of land lies between Fruitland Road and the existing channel of Watercourse 5.0. The location and shape of this parcel of land would make it more expensive to service and more difficult to integrate with adjacent urban development. Accordingly, a portion of Watercourse 5.0 within the SCUBE West lands is proposed to be relocated and reconstructed. The proposed works would see the channel of Watercourse 5.0 between Sherwood Park Road and Barton Street moved closer to Fruitland Road. This would provide floodplain and stormwater servicing benefits and increase the amount of developable land east of the realigned channel. No realignment of Watercourse 5.0 is proposed upstream of Sherwood Park Road as the recommended NHS (including Wetlands 1 and 4) limit opportunities for urban development east of the existing channel.

The costs of design and construction associated with the relocation of Watercourse 5.0 between Sherwood Park Road and Barton Street have been assigned to the development community who would benefit from these works.

5.2.1.1 Targets/Objectives

The objective of the proposed relocation works can be described as provision of a stable, naturalized stream (including a minimum 15 m wide vegetation protection zone along each side) that provides warmwater fish habitat and has the capacity to convey flood flows without impacting the adjacent roads or development lands.

5.2.1.2 Future Studies

Although the proposed relocation of Watercourse 5.0 may impact several individual development parcels, the planning and design for these works should be completed for the entire reach, as a whole, from approximately Sherwood Park Road to Barton Street. As such, the planning for these works should commence with a preliminary channel design at the Functional Design stage. At this stage, the required studies include:

- fluvial geomorphologic assessment to establish the existing and proposed natural channel form;
- hydraulic modelling to provide an appropriately sized channel capable of conveying flood flows and maintaining the overall flood storage volumes of the existing floodplain;
- hydraulic modelling to size any proposed new bridge/culvert crossings;
- hydraulic impact assessment to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential;
- identification of design measures to avoid/mitigate the potential negative effects of the proposed stream relocation on existing natural heritage features and functions. Potential changes to the existing hydrologic regime are of particular concern as such changes could negatively impact Wetlands 1 and 4, located immediately upstream of Sherwood Park Road and
- input to incorporate aquatic habitat recommendations.

The key outcome from the Functional Design stage would be a preliminary natural channel design, including plan/profile, and typical cross-section drawings for the proposed works. Floodplain mapping would also be updated at this time to define revised flood hazards.

Following the preliminary planning and design works above, detailed natural channel design would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- detailed specifications for channel features such as sideslopes, riffle-pool locations and dimensions;
- detailed specifications for riparian areas, including a minimum 15 m wide natural vegetation protection zone along each side of the realigned channel;
- details for any proposed new bridge/culvert crossings;
- construction phasing plans that address fisheries and other environmental timing windows (e.g. those associated with the Migratory Birds Convention Act), temporary diversions, pumping, re-connection, etc;
- Landscaping and restoration plans; and
- Erosion and sediment control plans.

Additional design guidance and recommendations for natural channel design are provided in Section 6.4.

5.2.1.3 Phasing

Given that the Watercourse 5.0 channel relocation works will directly impact the urban development limits and stormwater servicing for the SCUBE West lands, the studies, design and construction of these works should be completed prior to, or in conjunction with urban development. The actual construction of the works will need to take place within a specific window associated with the warmwater fish habitat of Watercourse 5.0. Certain elements of the channel relocation works (e.g. vegetation removal) may also be affected by timing windows associated with the Migratory Birds Convention Act.

It should be noted that further culvert capacity works have been recommended along Watercourse 5.0 to relieve existing flooding, including a culvert upgrade at Barton Street (see Section 4.2.2). Although this culvert improvement is not the responsibility of the SCUBE development community, it is located immediately adjacent to the Watercourse 5.0 channel relocation works. Therefore, in an effort to minimize disruption and achieve possible cost savings, opportunities to co-ordinate the City of Hamilton's construction works for this culvert upgrade with the adjacent channel relocation should be investigated.

5.2.1.4 Design Guidance and Policy Considerations

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports identify opportunities to enhance the Core Areas and Linkages of the recommended NHS, including Watercourse 5.0. Additional guidance for natural channel design and restoration works, as specified by the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document, is provided in Section 6.4.

The City of Hamilton and Hamilton Conservation Authority require a minimum 15 m vegetation protection zone along each side of warmwater watercourses. Accordingly, the channel design for Watercourse 5.0 should include allowances which respect these requirements. Hydraulic alterations should also consider the HCA Floodplain Mapping Review document (December 2010).

5.2.1.5 Approvals

Hamilton Conservation Authority would be the primary approval agency for stream works, with input from the City of Hamilton. Stream relocation/reconstruction works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's 2011 ***Planning and Regulation Policies and Guidelines*** document.

One or more permits may be required from MNR. Should the realignment of Watercourse 5.0 have the potential to impact species at risk (e.g. Butternut) a permit would be required under the Endangered Species Act (2007). Should the realignment involve a fish rescue, a permit would be required under the Fish and Wildlife Conservation Act (1997). DFO authorization of the realignment may also be required.

5.2.2 Possible Watercourse Diversion

The Phase 1 and Phase 2 Report of the SCUBE West Subwatershed Study includes hydrologic modelling to define flood flows at key locations within the Watercourse 7 subwatershed. Hydraulic modelling and floodplain mapping is limited to the Main Branch of Watercourse7.0, west of McNeilly Road. Watercourse 7.2 is a tributary of Watercourse 7.0 located east of McNeilly Road. It consists of a shallow and narrow stream which drains into the Main Branch of Watercourse 7.0 via the roadside ditch and culverts along South Service Road. Currently, Watercourse 7.2 drains several existing and future development parcels north of the SCUBE Central lands. Because of the limited capacity in the system, the Subwatershed Study recommends quantity control facilities for future development lands draining to Watercourse 7.2.

Discussions with City of Hamilton staff indicate that previous historical plans suggested a possible diversion of the headwaters of Watercourse 7.2 to the Main Branch of Watercourse 7.0 via a new channel along the CN rail line. Currently, other recommended capacity improvements are being studied along the Main Branch of Watercourse 7.0, between the CN rail line and QEW. These works are discussed further in Section 4.2.1.

A feasibility assessment is still required to determine whether the proposed diversion channel flows can be accommodated within the re-designed downstream Main Branch (Watercourse 7.0). If deemed feasible, the diversion works would be beneficial in terms of capacity improvements, floodplain improvements and also in terms of providing suitable stormwater facility outlets. Also, depending on the ultimate capacity of the future diversion channel and downstream Main Branch improvements, the amount of flood (quantity) control necessary within future stormwater ponds draining to this channel could possibly be relaxed.

Given these potential benefits to the future development lands, the costs of assessing the feasibility of the diversion, together with the future design and ultimate construction of the diversion works have been assigned to the development community. However, the current and future capacity improvement works on the Main Branch of Watercourse 7.0 downstream are being undertaken by the City of Hamilton and would not be the responsibility of the development proponents (Section 4.2.1).

5.2.2.1 Targets/Objectives

If the proposed diversion is to be considered worthwhile, it will need to provide significant benefits in terms of relaxed stormwater quantity control storage requirements. In fact, unless the proposed diversion works can allow the quantity control requirements to be eliminated entirely, the costs associated with the diversion works may not be justified. Therefore, it is assumed that an appropriate design target for the future diversion channel is the conveyance of uncontrolled future flood flows from the upstream lands. However, a feasibility assessment of the diversion needs to be undertaken to consider other downstream constraints including the capacity of the downstream Watercourse 7.0 channel. This feasibility assessment is discussed further below.

If the diversion is considered feasible and worthwhile, design objectives would include:

- Conveyance of uncontrolled future flows from the contributing Watercourse 7.2 lands without impacting the adjacent roads/railways or development lands; and
- Provision of a stable, naturalized stream that provides warmwater habitat and includes a minimum 15 m wide vegetation protection zone along each side.

5.2.2.2 Future Studies

As noted above, a feasibility assessment is required to determine if the proposed diversion of flows from Watercourse 7.2 can be accommodated within the downstream Watercourse 7.0 channel. The City of Hamilton has already initiated planning and preliminary design of other downstream works on the Main Branch of Watercourse 7.0. This includes preliminary hydraulic modelling for the first phase of the works on Watercourse 7.0 consisting of:

- Capacity improvements using natural channel design between the QEW and the CN rail line; and
- Upgrades to the existing CN rail line culvert.

A HEC-RAS hydraulic model has also been set up and applied to estimate flood elevations along the re-designed Watercourse 7.0 reach as part of the preliminary design work. This hydraulic model applies previously approved flows from an earlier Master Drainage Plan for this area (Philips 1990).

The HEC-RAS hydraulic model would be used as the basis for the feasibility assessment. The following general steps would be recommended:

- Determine which flood flow rates will be used for the capacity assessment. As noted, the current work applies previously approved historic flow estimates. The Subwatershed Study flow estimates may also be considered, however, they are marginally higher than the flows that are currently used in the design.
- Estimate the increased design flow rates in the Watercourse 7.0 channel following the proposed diversion both at the CN rail line culvert and within the downstream channel

between the CN rail line and the QEW. Uncontrolled future flows from the Watercourse 7.2 diversion should be assumed.

- Apply the HEC-RAS hydraulic model to assess whether the preliminary design for the channel improvements has sufficient capacity to contain the revised flows, ***and*** assess whether the proposed culvert upgrade at the CN rail line will have sufficient capacity to convey the revised flows.
- If the proposed Watercourse 7.0 design and CN rail line culvert upgrade have sufficient capacity, then the diversion may be considered feasible.

Regarding Point 2 above, discussions with City of Hamilton staff indicate that:

- no additional flows at the CN rail line culvert may be accommodated, beyond those already assumed in the previous preliminary modelling work, due to physical limitations at the crossing;
- if the flood flows are to be increased at this location, either through the use of higher Subwatershed Study flows, and/or the addition of diversion flows on the upstream side of the culvert, then alternative bridge construction methods would required; and
- the alternative bridge construction would require a very extensive work plan involving the temporary diversion of the railway line which is considered to be unaffordable at this time.

If the above feasibility assessment were completed and if some method were found to accommodate the diversion flows, the planning and design for the diversion works should be completed for the entire reach, as a whole, from its current location at the CN rail line crossing westward to the proposed new confluence with Watercourse 7.0. The planning for these works should commence with a preliminary channel design at the Functional Design stage. At this phase, the required studies would include:

- fluvial geomorphologic assessment to establish the proposed channel form to be used for the diversion. This should include consideration of the proposed works for the proposed receiving Watercourse 7.0 so that the designs are consistent;
- hydraulic modelling to provide an appropriately sized diversion channel capable of conveying the uncontrolled future flood flows;
- hydraulic modelling to size any proposed new bridge/culvert crossings, including the McNeilly Road crossing;
- hydro-geologic assessment to determine impacts to the diverted channel bed; and
- input to incorporate aquatic habitat recommendations.

The key outcome from the Functional Design stage would be a preliminary natural channel design, including plan/profile, and typical cross-section drawings for the proposed works. Floodplain mapping would also be completed at this time to define revised flood hazards on both the diversion reach and the remnant channel reach.

Following the preliminary planning and design works above, detailed channel design would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- detailed specifications for channel features such as sideslopes, riffle-pool locations and dimensions;
- detailed specifications for riparian areas, including a minimum 15 m wide vegetation protection zone along each side of the diversion channel;
- details for any proposed new bridge/culvert crossings, including the McNeilly Road crossing;
- construction phasing plans that address fisheries and other environmental timing windows (e.g. those associated with the Migratory Birds Convention Act), temporary diversions, pumping, re-connection, etc.
- landscaping and restoration plans; and
- erosion and sediment control plans.

Additional design guidance and recommendations for natural channel design are provided in Section 6.4.

5.2.2.3 Phasing

If deemed feasible, the potential Watercourse 7.2 diversion works will directly impact the urban development limits and stormwater servicing for several development parcels located just north of the SCUBE Central lands. The studies, design and construction of the diversion works should therefore be completed prior to, or in conjunction with this urban development. The actual construction of the works will need to take place within a specific window associated with the warmwater fish habitat of Watercourse 7.0. Certain elements of the Watercourse 7.2 diversion works (e.g. vegetation removal) may also be affected by timing windows associated with the Migratory Birds Convention Act.

If development is to take place before the diversion works, or if the diversion works are deemed to be infeasible then future stormwater facilities draining to Watercourse 7.2 will continue to require post-to-pre runoff control by default, up to the 100-year storm.

5.2.2.4 Design Guidance and Policy Considerations

The SCUBE Subwatershed Study Phase 1 and Phase 2 Reports identify opportunities to enhance the Core Areas and Linkages of the recommended NHS, including Watercourse 7.0. Additional guidance for natural channel design and restoration works, as specified by the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document, is provided in Section 6.4.

The City of Hamilton and Hamilton Conservation Authority require a minimum 15 m vegetation protection zone along each side of warmwater watercourses. Accordingly, the design of the diversion channel should include allowances which respect these requirements. Hydraulic alterations should also consider the HCA Floodplain Mapping Review document (December 2010).

5.2.2.5 Approvals

Hamilton Conservation Authority would be the primary approval agency for stream works, with input from the City of Hamilton. Stream works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's 2011 *Planning and Regulation Policies and Guidelines* document. Should the diversion of Watercourse 7.2 have the potential to impact species at risk (e.g. Butternut) a permit would be required from the MNR under the Endangered Species Act (2007). DFO authorization of the diversion may also be required.

5.2.3 Watercourse 9 West Tributary Channel Capacity Improvements

The Phase 1 and Phase 2 Report of the SCUBE East Subwatershed Study includes hydrologic modelling to define flood flows for Watercourse 9. Hydraulic modelling and floodplain mapping is limited to the lined portion of this watercourse. The unlined Western Tributary of Watercourse 9 exists as a drainage ditch along the south side of the CN rail line and adjacent to Lewis Road, draining a significant amount of the SCUBE Central lands. The 2007 Lewis Road EA Study recommends the construction of a new open channel along Lewis Road to convey flows downstream to the lined portion of Watercourse 9. Although it is unclear whether the proposed channel works would move forward on the basis of this EA study alone, conceptual stormwater planning in this area indicates that channel works would be beneficial in terms of capacity improvements and are likely required to provide suitable outlets for SWM Ponds 9-2, 9-3 and 9-4. Given these potential floodplain and servicing improvements, the costs of design and construction associated with these channel works have been assigned to the development community who would benefit.

5.2.3.1 Targets/Objectives

The design and ultimate capacity of this proposed future channel are unknown at this time. Therefore, the SCUBE Subwatershed Study Phase 1 and Phase 2 Report assumes that quantity control will be necessary within the future development lands draining to the unlined West Tributary of Watercourse 9. However, the study also notes that, depending on the ultimate capacity of the future West Tributary, the amount of flood (quantity) control necessary within future stormwater ponds draining to this channel may be relaxed.

The feasibility of relaxing or removing the flood control requirements was also investigated during Phase 1 and Phase 2 of the Subwatershed Study. Hydraulic modelling was completed using uncontrolled future flood flows from all of the Watercourse 9 development lands; this modelling found that the existing downstream QEW culvert, CN rail line culvert, and lined Main Channel reaches all have sufficient capacity to contain and convey flood flows up to and including the Regional Storm event. The results of this hydraulic assessment were discussed with City of Hamilton and MTO staff. MTO indicated that they would not be opposed to allowing future development to proceed without quantity control, provided that they review and approve the supporting reports and analyses including the Subwatershed Study findings and subsequent analyses in support of the channel design.

Therefore, based on the above, the objective of the proposed channel improvements to the West Tributary of Watercourse 9 can be described as provision of a stable channel with sufficient hydraulic capacity to convey flood flows without impacting the adjacent roads or development lands. The improved channel should include a minimum 15 m wide vegetation protection zone along each side. Further, the channel improvements should allow for suitable stormwater pond outlets from the future development lands.

5.2.3.2 Future Studies

Although the channel capacity improvements for the West Tributary of Watercourse 9 may impact several individual development parcels, the planning and design for these works should be completed for the entire reach, as a whole, from the CN rail line culvert, south along Lewis Road and up to Barton Street. As such, the planning for these works should commence with a preliminary channel design at the Functional Design stage. At this stage, the required studies include:

- hydraulic modelling and floodline mapping to establish the existing baseline flood characteristics and flood hazard extents along this reach;
- hydraulic modelling to provide an appropriately sized channel capable of conveying flood flows and maintaining the overall flood storage volumes of the existing floodplain;
- hydraulic impact assessment to evaluate potential upstream and downstream impacts of the proposed works on peak flows, water levels, floodlines and erosion potential
- Fluvial geomorphologic input to ensure a stable channel design; and
- hydraulic modelling to size any proposed new bridges/culverts associated with future road crossings.

The key outcome from the Functional Design stage would be a preliminary channel design, including plan/profile, and typical cross-section drawings for the proposed works. Floodplain mapping would also be updated at this time to define the revised flood hazards.

Following the preliminary planning and design works above, detailed channel design would be completed. For this step, the preliminary design drawings would be refined to include specific details including:

- detailed specifications for channel features such as sideslopes, baseflow dimensions, etc;
- details for any proposed new bridge/culvert crossings;
- construction phasing plans that address fisheries timing windows, temporary diversions, pumping, re-connection, etc;
- detailed specifications for riparian areas, including a minimum 15 m wide vegetation protection zone along each side of the improved channel;
- landscaping and restoration plans; and
- erosion and sediment control plans.

Additional design guidance and recommendations for channel designs are provided in Section 6.4.

5.2.3.3 Phasing

Given that the channel improvements to the West Tributary of Watercourse 9 will directly impact the urban development limits and stormwater servicing for the SCUBE Central lands and other development lands to the north, the studies, design and construction of these works should be completed prior to, or in conjunction with urban development, and should also be coordinated with future Lewis Road improvements. The actual construction of the works will need to take place within a specific window associated with warmwater fish habitat.

5.2.3.4 Design Guidance and Policy Considerations

Guidance for natural channel design and restoration works, as specified by the City of Hamilton's 2007 *Criteria and Guidelines for Stormwater Infrastructure Design* document, is provided in Section 6.4.

The City of Hamilton and Hamilton Conservation Authority require a minimum 15 m vegetation protection zone along each side of warmwater watercourses. Accordingly, the design of the improved channel should include allowances which respect these requirements. Hydraulic alterations should also consider the HCA Floodplain Mapping Review document (December 2010).

5.2.3.5 Approvals

Hamilton Conservation Authority would be the primary approval agency for stream works, with input from the City of Hamilton. Channel capacity works should conform to the policies outlined in Section 2.1.3 of the Hamilton Conservation Authority's 2011 *Planning and Regulation Policies and Guidelines* document. Should the channel capacity improvements have the potential to impact species at risk (e.g. Butternut) a permit would be required from the MNR under the Endangered Species Act (2007). DFO authorization of the improvements may also be required.

5.3 Establishment of the Recommended Natural Heritage System

The Subwatershed Strategy identifies a recommended Natural Heritage System (NHS) that consists of the following:

- Core Areas as defined by the City of Hamilton (2009) including Key Natural Heritage Features, Key Hydrologic Features and Local Natural Areas;
- Linkages as defined by the City of Hamilton (2009);
- Hazardous Lands as defined by the Hamilton Conservation Authority (2009); and
- Preliminary vegetation protection zones consistent with the minimum requirements of the City of Hamilton (City of Hamilton 2009)

The SCUBE Subwatershed Study determined the preliminary (i.e. conceptual) boundaries of the recommended NHS. The final boundaries of the recommended NHS are to be determined at a subsequent planning stage (Draft Plan of Subdivision or Site Plan) through the completion of additional studies. As described in Section 4.3.2, the City of Hamilton has been assigned responsibility for three studies most appropriately completed at the subwatershed scale. Other studies are most appropriately completed at the site scale; accordingly, the proponents of development have been assigned responsibility for their completion. These studies are described below.

5.3.1 Targets/Objectives

The NHS is intended to maintain, protect and enhance the significant natural heritage features and ecological functions of the lands within the study area of the SCUBE Subwatershed Study. The primary objective of determining the final boundaries of the recommended NHS is to establish the limit of development.

5.3.2 Future Studies

5.3.2.1 Identification of Flooding Hazard Limit

New hydraulic modelling and floodplain mapping will be required to finalize the flooding hazard limit adjacent to:

- Watercourse 7.2, following a possible diversion of the headwaters to Watercourse 7.0; and
- Watercourse 9 West Tributary, following future channel capacity improvements.

In addition, many of the floodplain limits defined through Phase 1 and Phase 2 of the SCUBE Subwatershed Study may be impacted by proposed drainage and infrastructure improvement works or environmental restoration and enhancement works. Accordingly, further hydraulic analyses and floodplain mapping revisions are anticipated as part of the following:

- Watercourse 5.0 relocation/reconstruction;
- Various culvert improvements (Watercourses 5.0, 6.0, 6.1, 6.3 and 7.0);
- Removal of fish barriers (Watercourse 9 and Fifty Creek); and
- New bridge/culvert structures.

With respect to Watercourse 5 and Watercourse 6, future refinement of the hydraulic model and floodline mapping completed as part of the Phase 1 and 2 Subwatershed Study is anticipated at the block planning stage over select reaches where the creek location is poorly defined on the existing topographic mapping. Discussions between the City of Hamilton and HCA planning staff identified the requirements as follows:

- A Block Servicing Strategy, for the area identified as Block 1 on Map B.7.4-4 – Block Servicing Strategy Area Delineation, shall determine the floodplains for the following two locations:
  - i) Along Watercourse 5.0, immediately downstream of Fruitland Road (between sections 2221 and 2150); and,
  - ii) Along Watercourse 5.0, halfway between Highway No. 8 and Barton Street (between sections 1693.967 and 1537.457).

- A Block Servicing Strategy, for the area identified as Block 2 on Map B.7.4-4 – Block Servicing Strategy Area Delineation, shall determine the floodplains for the following location:
  - i) Along Watercourse 6.0, downstream of Highway No. 8 (between sections 2232.182 and 1785.033).

With regard to the floodplain mapping for Fifty Creek, some inconsistencies were noted between the topographic mapping and aerial photography supplied for use in the SCUBE East Subwatershed Study. In some locations, the contour mapping used to plot the floodlines does not appear to reflect the location of the stream/valley. One such location is found just downstream of the CN rail line within the lands of SCUBE East (Parcel B). Therefore, as more detailed and accurate topographic mapping becomes available as development planning proceeds, it is recommended that the floodplain mapping be reviewed and refined as required.

5.3.2.2 Identification of Erosion Hazard Limit

A geotechnical assessment will be required to define the erosion hazard limit along confined portions of Fifty Creek. This assessment will require field surveys to identify the top of slope (also known as top of bank) and the toe of slope (also known as base of slope).

5.3.2.3 Environmental Impact Statement (EIS)

The planning area of the Fruitland-Winona Secondary Plan is not subject to the Greenbelt Plan. Accordingly, per Section F3.2.1.4 of the City of Hamilton's Urban Official Plan, when development is proposed in or adjacent to a Core Area, the City of Hamilton shall require the proponent to prepare an EIS to the satisfaction of the City and the relevant Conservation Authority.

Table 5.3 outlines the extent of adjacent lands, that is, the proximity of proposed development to Core Areas that triggers the requirement to complete an EIS. Per Section F.3.2.1.4 of the City of Hamilton's Urban Official Plan, these distances are guidelines only. The City of Hamilton may require the preparation of an EIS for applications for development outside of the adjacent lands if, in its judgment, the proposed development has greater potential to impact natural heritage features and functions (City of Hamilton 2009).

Table 5.3: Extent of adjacent lands, that is, the distance of proposed development from Natural Heritage features that triggers the requirement to complete an EIS (City of Hamilton 2009).

Natural Heritage Feature	Boundary Definition	Extent of Adjacent Lands
Fish Habitat	Streams, rivers, lakes, ponds and wetlands	30 m from bankfull channel
Provincially Significant Wetlands, Local Wetlands and Unevaluated	Defined by the Province, Conservation Authorities	120 m

Wetlands greater than 2 ha in size	and the City of Hamilton	
Significant Habitat of Threatened and Endangered Species	Defined by the Province and the City of Hamilton	50 m
Unevaluated Wetlands	Defined by Conservation Authorities and the City of Hamilton	50 m
Significant Woodlands	Defined by the City of Hamilton	50 m (measured from the dripline)
Stream and River Valleys	Conservation Authority regulatory lines, flood plain mapping	30 m (from stable top of bank)
Areas of Natural and Scientific Interest	As defined by the Province	50 m
Significant Valley Lands	As defined by the Province and the City of Hamilton	50 m
Significant Wildlife Habitat	As defined by the Province and the City of Hamilton	50 m
Environmentally Significant Areas	As defined by the City of Hamilton	50 m

Section F3.2.1.2 of the City of Hamilton Urban Official Plan states the following:

> When a development proposal has the potential to negatively impact a Core Area or its function, the proponent shall be required to prepare an EIS to the satisfaction of the City and the relevant Conservation Authority. An EIS inventories and describes the existing Core Areas and ecological functions of the site in the context of the surrounding landscape. An EIS also assesses the potential negative impacts that proposed development may have on Core Areas and Linkages and provide recommendations on whether the development proposal should proceed or be modified, natural area boundaries, mitigation measures, and design measures to accommodate or enhance existing natural features and functions.

Environmental Impact Statements prepared in response to proposed development adjacent to the Core Areas of the SCUBE NHS should address the following Subwatershed Study recommendations regarding the determination of the final boundaries of the recommended NHS as appropriate:

5.3.2.3.1 Species at Risk

The Subwatershed Strategy recommends that additional surveys be completed for seven species at risk as described below. Since the completion of the Subwatershed Study, breeding bird studies were completed within the Fruitland-Winona Secondary Plan Area, SCUBE Central, SCUBE East parcels A and B, and SCUBE West by Stantec Consulting Limited (August, 2012). The August 2012 report was reviewed and accepted by Hamilton Conservation Authority in November 2012. The report concluded that four avian species at risk (Barn Swallow, Bobolink, Eastern Meadowlark, and Chimney Swift) were not breeding within the study area(s) due to the presence of marginal or unsuitable habitat. Accordingly, habitat preservation for these four avian species at risk is not required. A copy of the report and subsequent correspondence from the Hamilton Conservation Authority is located in Appendix C.

American Columbo (*Frasera caroliniensis*)

Individual specimens of American Columbo are protected under the Endangered Species Act (2007). The Subwatershed Strategy recommends that additional surveys of areas proposed for development in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) be completed to determine whether this species is extant.

If American Columbo is found within areas proposed for development, the Subwatershed Strategy recommends the following:

- Individual or small groups of plants (i.e. less than 10 individuals) should be transplanted to areas of suitable habitat within the NHS. Any transplant of American Columbo should be completed under the supervision of a qualified botanist/ecologist and would require a permit issued under the Endangered Species Act (2007). Post-transplant monitoring is recommended.

- Groups of 10 or more plants should be incorporated in the NHS as a Core Area. The area to be incorporated in the NHS should be identified by a qualified botanist/ecologist and include an appropriate buffer.

Butternut (*Juglans cinerea*)

Individual specimens of Butternut are protected under the Endangered Species Act (2007). The Subwatershed Strategy recommends that additional surveys of areas proposed for development in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) be completed to determine whether this species is extant.

If viable Butternut trees are found within areas proposed for development, the trees will need to be assessed by a MNR designated Butternut Health Assessor. Trees assessed as "non-retainable" could be removed. Consultation with the MNR Guelph District Office would be required to develop a site specific management approach for retainable trees. The removal of trees assessed as "retainable" would require a permit issued under the Endangered Species Act (2007).

American Badger (*Taxidea taxus jacksoni*)

The habitat of American Badger is protected by regulation under the Endangered Species Act (2007). Section 24 of Ontario Regulation 242/06 defines American Badger habitat as follows:

1. An American badger den that is being used by an American badger or was used by an American badger at any time during the previous 12 months.
2. The area within five metres of the entrance of a den described in paragraph 1.
3. A woodchuck burrow or Franklin's ground squirrel burrow that,
   (i) is being used by a woodchuck or Franklin's ground squirrel or was used by a woodchuck or Franklin's ground squirrel at any time in the past, and
   (ii) is within 850 metres of a den described in paragraph 1.

A large isolated area of sand and gravel deposits extends from the southwestern portion of SCUBE Central to Zone C; within the study area of the SCUBE Subwatershed Study this area has the greatest potential to function as American Badger habitat. The Subwatershed Strategy recommends that potential dens and Woodchuck burrows within the area of sand and gravel deposits in SCUBE Central be surveyed for use by American Badger. If present, the Subwatershed Strategy recommends that the NHS be revised as required to incorporate as Core Areas its habitat as defined by Ontario Regulation 242/06.

Barn Owl (*Tyto alba*)

The habitat of Barn Owl is protected by regulation under the Endangered Species Act (2007). Section 24.1 of Ontario Regulation 242/06 defines Barn Owl habitat as follows:

1. A nesting or roosting site that is being used by a barn owl or was used by a barn owl at any time during the previous 12 months.
2. A barn, building or other structure, or a tree or other natural feature, on or in which a nesting or roosting site described in paragraph 1 is located.
3. If a nesting or roosting site described in paragraph 1 is located on a tree or other natural feature, the area within 25 metres of the base of the tree or other natural feature.
4. Those parts of the area within one kilometre of an area described in paragraph 1 or 2 that provide suitable foraging conditions for a barn owl.

The Subwatershed Strategy recommends that additional surveys of potentially suitable habitat in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) be completed to determine whether this species is extant. If present, the Subwatershed Study recommends that the NHS be revised as required to incorporate as Core Areas its habitat as defined by Ontario Regulation 242/06.

Jefferson Salamander (*Ambystoma jeffersonainum*)

The habitat of Jefferson Salamander is protected by regulation under the Endangered Species Act (2007). Section 28 of Ontario Regulation 242/06 defines Jefferson Salamander habitat as follows:

In the City of Hamilton, the counties of Brant, Dufferin, Elgin, Grey, Haldimand, Norfolk and Wellington and the regional municipalities of Halton, Niagara, Peel, Waterloo and York,

i. a wetland, pond or vernal or other temporary pool that is being used by a Jefferson salamander or Jefferson dominated polyploid or was used by a Jefferson salamander or Jefferson dominated polyploid at any time during the previous five years,

ii. an area that is within 300 metres of a wetland, pond or vernal or other temporary pool described in subparagraph i and that provides suitable foraging, dispersal, migration or hibernation conditions for Jefferson salamanders or Jefferson dominated polyploids,

iii. a wetland, pond or vernal or other temporary pool that,

  A. would provide suitable breeding conditions for Jefferson salamanders or Jefferson dominated polyploids,

  B. is within one kilometre of an area described in subparagraph i, and

  C. is connected to the area described in subparagraph i by an area described in subparagraph iv, and

iv. an area that provides suitable conditions for Jefferson salamanders or Jefferson dominated polyploids to disperse and is within one kilometre of an area described in subparagraph i.

Potentially suitable habitat in Zone B has not been surveyed for Jefferson Salamander. The Subwatershed Strategy recommends that Woodlands 2 and 6 be surveyed for use by Jefferson Salamander. If present, the Subwatershed Strategy recommends that the NHS be revised as required to incorporate as Core Areas its habitat as defined by Ontario Regulation 242/06.

Chimney Swift (*Chaetura pelagica*)

Chimney Swift habitat is protected under the provisions of the Endangered Species Act (2007) based on the Act’s general definition of habitat:

> An area on which a species depends, directly or indirectly, to carry on its life processes, including life processes such as reproduction, rearing, hibernation, migration or feeding and includes places that are used by members of the species such as dens, nests, hibernacula or other residences.

The Subwatershed Strategy recommends additional surveys of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) at a subsequent planning stage for Chimney Swift nesting and roosting sites.

MNR is currently developing a Recovery Strategy and a species-specific habitat regulation for Chimney Swift (MNR 2009). In the absence of specific MNR guidelines, the Subwatershed Strategy recommends the protection of any identified Chimney Swift nesting and roosting sites to satisfy the requirements of the Endangered Species Act (2007). The Subwatershed Strategy also recommends that the NHS be revised as required to incorporate as a Core Area any natural feature (e.g. hollow tree) that functions as a Chimney Swift nesting or roosting site. However, the Subwatershed Strategy recommends that the City of Hamilton not incorporate in the NHS any anthropogenic structure (e.g. abandoned building) that functions as a Chimney Swift nesting or roosting site. Consultation with the MNR Guelph District Office would be required to develop a site specific management approach for any such structure identified.

As mentioned above, breeding bird studies completed in 2012 by Stantec Consulting Limited determined that chimney swifts do not appear to nest or roost within the study area. Accordingly, no management recommendations are required to preserve chimney swifts.

Eastern Milk Snake (*Lampropeltis triangulum*)

The Subwatershed Strategy recommends additional surveys of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) at a subsequent planning stage to determine whether this species is extant. If present, the Subwatershed Strategy recommends that additional surveys be completed per MNR-specified protocols to identify potential Eastern Milk Snake hibernation sites. Hibernation sites likely constitute significant habitat as defined by the City of Hamilton (2009). Accordingly, the Subwatershed Strategy recommends that the NHS be revised as required to incorporate as a Core Area any Eastern Milk Snake hibernation site identified. The area to be incorporated in the NHS should be identified by a qualified biologist and include an appropriate buffer.

Newly Designated Species at Risk

Subwatershed Strategy recommendations are based on COSEWIC/COSSARO status designations and MNR policy regarding the Endangered Species Act (2007) in effect at the time of the SCUBE Subwatershed Study's preparation. COSEWIC/COSSARO designations are subject to regular review and revision; MNR policy regarding the Endangered Species Act (2007) is rapidly evolving. To satisfy the requirements of the Endangered Species Act (2007), the Provincial Policy Statement and the City of Hamilton Urban Official Plan, planning decisions for lands subject to the Fruitland-Winona Secondary Plan will need to reflect COSEWIC/COSSARO status designations in effect at the time of future applications for development. Accordingly, the City of Hamilton may require an EIS to incorporate surveys/habitat assessments for additional species not presently designated species at risk.

5.3.2.3.2 Permanent and Intermittent Streams

The two edges of the bankfull width of permanent and intermittent streams should be confirmed through additional fieldwork. These limits should be staked, reviewed and approved by municipal/agency staff, then surveyed.

5.3.2.3.3 Significant Woodlands

SCUBE Subwatershed Study mapping of the recommended NHS is based on the preliminary delineation of vegetation communities through aerial photograph interpretation. The Subwatershed Strategy recommends that the limits of Significant Woodlands incorporated in the NHS (Woodlands 2 and 5) be confirmed through additional fieldwork. These limits (i.e. dripline) of Woodlands 2 and 5 should be staked, reviewed and approved by municipal/agency staff, then surveyed.

The refined SCUBE NHS does not identify Woodland 6, the largest remaining woodland in SCUBE West, as a core area because it does not satisfy City of Hamilton criteria as a Significant Woodland. Rather, Woodland 6 has been identified as a candidate core area. As property access to the woodland was not granted during the course of this Study it is recommended that Woodland 6 be investigated during subsequent planning stages, such as the secondary plan stage, to determine the ecological function and planning status (i.e. significant woodland status) of the woodland

5.3.2.3.4 Wetlands

As noted above, SCUBE Subwatershed Study mapping of the recommended NHS is based on the preliminary delineation of vegetation communities through aerial photograph interpretation. The Subwatershed Strategy recommends that additional fieldwork be completed to confirm the limits of wetlands incorporated in the recommended NHS. These include Wetlands 1, 2, 3, 4 and 7 as well as the Fifty Creek Locally Significant Wetland Complex. Wetland limits should be staked, reviewed and approved by municipal/agency staff, then surveyed.

5.3.2.3.5 Significant Wildlife Habitat

The Subwatershed Strategy recommends that additional surveys be completed to identify Significant Wildlife Habitat; recommended surveys are described in further detail below.

5.3.2.3.6 Seasonal Concentration of Animals

The Subwatershed Strategy recommends that additional surveys of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) be completed at a subsequent planning stage to determine whether these areas function as landbird migratory stopover areas or migratory butterfly stopover areas as described by MNR (2000). The Subwatershed Strategy recommends that the SCUBE NHS be revised as required to incorporate as a Core Area any lands so identified.

5.3.2.3.7 Specialized Habitats for Wildlife

The SCUBE NHS incorporates as Core Areas most forested areas within Zone B. However, the SCUBE NHS does not incorporate Woodland 6, the largest remaining woodland in SCUBE West. The Subwatershed Strategy recommends that this woodland be investigated further to determine whether it functions as Significant Wildlife Habitat by providing (i) a high diversity of habitats, (ii) amphibian woodland breeding ponds and/or (iii) habitat for area sensitive species. If shown to provide one or more of these three specialized habitats for wildlife, the Subwatershed Study recommends that the SCUBE NHS be revised to incorporate Woodland 6 as a potential Core Area, pending future study.

5.3.2.3.8 Habitats of Species of Conservation Concern

Zone B provides potentially suitable habitat for 24 locally rare species not designated species at risk by COSEWIC and/or COSSARO. The SCUBE Subwatershed Study divides these species into the following three categories:

Category 1 – the SCUBE NHS incorporates most of the vegetation communities in Zone B that provide potentially suitable habitat for these species.

Category 2 – the SCUBE NHS incorporates few of the vegetation communities in Zone B that provide potentially suitable habitat for these species; however, the same vegetation communities occur in Zone C and immediately adjacent lands and have similar or greater potential to function as habitat for these species.

Category 3 - the SCUBE NHS incorporates some of the vegetation communities in Zone B that provide potentially suitable habitat for these species; however, the same vegetation communities occur in Zone C and immediately adjacent lands and have similar or greater potential to function as habitat for these species. These species may also use anthropogenic habitat, such as suburban yards, orchards, agricultural lands and/or industrial parks. Such habitat is located in throughout the study area of the SCUBE Subwatershed Study.

Table 5.4 classifies the 24 locally rare species based on the above three categories.

The SCUBE NHS incorporates most of the vegetation communities in Zone B that provide potentially suitable habitat for Category 1 species. However, the SCUBE NHS does not incorporate Woodland 6, the largest remaining woodland in SCUBE West as a Core Area. Rather, Woodland 6 is identified as a potential Core Area, pending full property access and study at a subsequent planning stage. Woodland 6 has the potential to function as habitat for a number of Category 1 species, such as Eastern Few-fruited Sedge, American Redstart and Red-bellied Woodpecker. The Subwatershed Strategy recommends that Woodland 6 be investigated further to determine whether it functions as habitat for locally rare species. If shown to provide habitat for one or more locally rare species, the Subwatershed Strategy recommends that the NHS be revised to incorporate Woodland 6 as a Core Area.

Table 5.4: Categories of 24 locally rare species. See text above for clarification.

Category 1	Category 2	Category 3
Blue Beech	Perfoliate Bellwort	Spearscale
Eastern Few-fruited Sedge	Prickly Rose	American Kestrel
Hardstem Bulrush	Clay-coloured Sparrow	Eastern Bluebird
American Redstart	Grasshopper Sparrow	Herring Gull
Belted Kingfisher	Mourning Warbler	Northern Mockingbird
Blue-gray Gnatcatcher	White-throated Sparrow	Orchard Oriole
Hairy Woodpecker		Purple Martin
Red-bellied Woodpecker		Turkey Vulture
Scarlet Tanager		
Red-spotted Newt		

The SCUBE NHS incorporates few of the vegetation communities in Zone B that provide potentially suitable habitat for Category 2 species (i.e. cultural meadow, cultural thicket and cultural woodland). However, Zone C and the immediately adjacent lands to the east between Highway 8 and the Niagara Escarpment consist of a similar mosaic of cultural vegetation communities and agricultural land as is found in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). Moreover, the cultural vegetation communities of Zone C and the immediately adjacent lands to the east have similar or greater potential to function long term as habitat for Category 2 species. Nevertheless, the Subwatershed Strategy recommends that potentially suitable habitat in areas proposed for development in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) be surveyed for Category 2 species (Table 5.5).

If one or both of the Category 2 plant species is present, the Subwatershed Strategy recommends that the plants be transplanted to areas of suitable habitat within the NHS. Any transplant should be completed under the supervision of a qualified botanist/ecologist. Caution should be exercised when selecting a transplant site for Prickly Rose as the species readily hybridizes with other rose species such as *R. blanda* (Voss 1985).

Table 5.5: Recommended surveys for Category 2 species.

Species	Recommended Surveys
Perfoliate Bellwort *Uvularia perfoliata*	Survey potentially suitable habitats in SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) that are not incorporated in the SCUBE NHS.
Prickly Rose *Rosa acicularis*	Survey Woodland 6 and meadows, thickets and hedgerows located in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel A) that are not incorporated in the SCUBE NHS.
Clay-coloured Sparrow *Spizella pallida*	Survey potentially suitable habitats located in SCUBE West and SCUBE Central that are not incorporated in the SCUBE NHS.
Grasshopper Sparrow *Ammodramus savannarum*	Survey large areas of cultural meadow in SCUBE West and SCUBE Central that are not incorporated in the SCUBE NHS.
Mourning Warbler *Oporornis philadelphia*	Survey potentially suitable habitats located in SCUBE West and SCUBE Central that are not incorporated in the SCUBE NHS.
White-throated Sparrow *Zonotrichia albicollis*	Survey potentially suitable habitats located in SCUBE West and SCUBE Central that are not incorporated in the SCUBE NHS.

If one or more of the Category 2 bird species is present, the Subwatershed Strategy recommends the following:

- Evaluate the significance of any potential habitat located in areas proposed for development per MNR guidelines as described by Section 8 of the Significant Wildlife Habitat Technical Guide (MNR 2000).
- Assess and recommend measures to avoid or mitigate the potential impacts of proposed developed on identified Significant Wildlife Habitat.
- Consider opportunities to refine the NHS to incorporate as Core Areas identified Significant Wildlife Habitat.

5.3.2.3.9 Assessment of Linkages

The City of Hamilton (2009) defines linkages as landscape areas that connect natural areas. Linkages may include the following:

- Woodland linkages (e.g. small woodlands);
- Other natural vegetation types (e.g. meadows, old field, thickets); and
- Streams and watercourses that connect Core Areas.

The City of Hamilton recognizes the importance of linkages in reducing the adverse impacts of habitat fragmentation of natural areas and has adopted policies intended to protect and enhance Linkages to sustain the City's NHS wherever possible. In particular, Section C.2.7.6 of the City of Hamilton's Urban Official Plan states that where new development or site alteration is proposed within a Linkage within the City's NHS, the proponent shall prepare a Linkage Assessment.

The City of Hamilton's Urban Official Plan outlines Linkage Assessment requirements. Specifically, Section C.2.7.7 states the following:

> Linkage Assessments shall include the following information:
>
> (a) identify and assess the Linkage including its vegetative, wildlife, and/or landscape features or functions;
>
> (b) assess the potential impacts on the viability and integrity of the Linkage as a result of the development proposal; and,
>
> (c) make recommendations on how to protect, enhance or mitigate impacts on the Linkage(s) and its functions through planning, design and construction practices.

Per Section F.3.2.1.11 of the City of Hamilton's Urban Official Plan, linkage assessments are to consider both the linkage within the site and connections with other sites and include the following:

(a) identify and assess the linkage including its vegetative, wildlife, and/or landscape features or functions, including:

- (i) the natural areas and habitats/functions linked;
- (ii) linkage type (e.g. railway or utility corridor, hedgerow, plantation or natural community);
- (iii) vegetation cover quality (health, condition, maturity, species and aesthetic value);
- (iv) width;
- (v) length; and,
- (vi) vegetation continuity (gaps > 100 m, gaps with barriers, or gaps < 30 m with no barriers);

(b) assess the potential impacts on the viability and integrity of the linkage as a result of the development proposal; and,

(c) make recommendations on how to protect, enhance or mitigate impacts on the linkage(s) and its functions through planning, design and construction practices.

5.3.2.3.10 Assessment of Hedgerows

The City of Hamilton (2009) defines a hedgerow as a narrow, linear band or row of trees or shrubs with a minimum width of 10 m and length of 200 m or more. Hedgerows may be natural or cultural features and may contribute to species dispersal. Per Policy C.2.7.8 of the City of Hamilton's Official Plan, Linkage Assessments should also consider hedgerows, particularly where:

(1) they link Core Areas;

(2) there is evidence that wildlife regularly use them as movement corridors or habitat;

(3) they are composed of mature, healthy trees and generally provide a wide, unbroken linkage between Core Areas;

(4) they contain trees which are rare, unique, culturally important, or old (more than 100 years); or,

(5) they represent an important cultural feature and contribute to the aesthetics of the landscape, particularly adjacent to the Niagara Escarpment.

5.3.2.3.11 Identification of Final NHS Boundaries

The SCUBE Subwatershed Study identifies preliminary (i.e. conceptual) boundaries of the recommended NHS. The EIS is the recommended mechanism to determine the final boundaries of the NHS and therefore the limits of potential development. The final boundaries of the NHS should reflect the following:

(1) results of studies to be completed by the City of Hamilton, including:

- refinement of floodplain Mapping for Watercourses 5.0 and 6.0 (see Section 4.3.2.1);
- meander belt assessments for the unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands, including Watercourses 5.0, 6.0, 7.0 and Fifty Creek (see Section 4.3.2.2); and
- Breeding birds surveys of the study area of the SCUBE Subwatershed Study and immediately adjacent lands, with a particularly focus on Bobolink, Eastern Meadowlark and Barn Swallow (see Section 4.3.2.3).

(2) Relocation/Reconstruction of Watercourse 5.0 between Sherwood Park Road and Barton Street (See Section 4.2.1);
(3) Identification of Flooding Hazard Limits and Erosion Hazard Limits as described above;
(4) Results of additional surveys for species at risk as described above;
(5) Field delineation of permanent and intermittent streams as defined by the edges of their bankfull width as described above;
(6) Field delineation of the limits of Woodlands 2 and 5 as described above;
(7) Field delineation of the limits of Wetlands 1, 2, 3, 4 and 7 as well as the Fifty Creek Locally Significant Wetland Complex, as described above;
(8) Results of surveys/assessment of Significant Wildlife Habitat, as described above;
(9) Results of linkage assessment(s) as described above; and
(10) Results of hedgerow assessment(s) as described above.

The final boundaries of the NHS (not including the associated Vegetation Protection Zone) should be based on the greatest extent of the various NHS components, including Core Areas (e.g. the habitat of species at risk), Linkages (based on Linkage assessment recommendations) and Hazardous Lands (i.e. floodplain, meander belt).

5.3.2.3.12 Identification of Vegetation Protection Zones (VPZ)

The NHS identified by the SCUBE Subwatershed Study incorporates preliminary VPZ consistent with the minimum requirements of the City of Hamilton's Urban Official Plan. The widths of the preliminary VPZ applied to the Core Areas subject to an EIS should be reviewed to confirm that they:

(1) have sufficient width to protect the Core Area and its ecological functions from impacts of the proposed land use or site alteration occurring during and after construction;

(2) are established to achieve and be maintained as natural self-sustaining native vegetation; and

(3) where possible, restore or enhance the Core Area and/or its ecological functions.

Per Section C.2.5.11 of the City of Hamilton's Urban Official Plan, VPZ widths are to be determined on a site-specific basis, by considering factors such as the sensitivity of the habitat, the potential impacts of the proposed land use, the intended function of the buffer, and the physiography of the site. The EIS should recommend VPZ widths greater than the City of Hamilton's minimum requirements as required (City of Hamilton 2009).

Vegetation Protection Zones as confirmed through the EIS are to be applied to the final boundaries of NHS Core Areas as determined above. The final boundaries of the VPZ should be based on the greatest extent of the VPZ applied to the various NHS Core Areas.

5.3.2.4 Secondary Plan Studies

The refined NHS identified by the SCUBE Subwatershed Study does not identify Woodland 6, the largest remaining woodland in SCUBE West, as a core area because it does not satisfy City of Hamilton criteria as a Significant Woodland. Rather, Woodland 6 is identified as a candidate core area. As property access to the woodland was not granted during the course of the Study it is recommended that Woodland 6 be investigated during the secondary plan stage so that the ecological function and planning status of the woodland can be determined. In addition, the area of natural vegetation which links the south of Woodland 6 to the natural heritage features associated with Watercourse 7, has accordingly been marked as a candidate linkage area. Should it be determined through future study that Woodland 6 is a core area, the natural area immediately south will qualify as a linkage. See Figure 2.3 for the location of the aforementioned candidate sites.

5.3.3 Phasing

The location and design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) will be determined in part by the boundaries of the recommended NHS. Therefore the above-noted studies to define the limits of NHS components, including Core Areas (e.g. the habitat of species at risk), Linkages, Hazardous Lands as defined by the Hamilton Conservation Authority (i.e. floodplain, meander belt) and VPZ will need to be completed as part of the Draft Plan of Subdivision or Site Plan planning process.

5.3.4 Design Guidance and Policy Considerations

The refinement of floodplain mapping and the geotechnical assessment of the confined portions of Fifty Creek will be guided by the requirements of the Natural Hazards Technical Guides (MNR 2006) and Section 2.1 of the Hamilton Conservation Authority's *Planning and Regulation Policies and Guidelines* document (October, 2011) and the *Floodplain Mapping Review* document (December 2010)..

Per Section F3.2.1.1 of the Urban Official Plan, Environmental Impact Statements are to be prepared in accordance with EIS guidelines adopted by City of Hamilton Council in July, 2004. These guidelines describe the contents of an EIS and specify the methodology to be used to complete certain EIS elements, such as biological inventories (City of Hamilton 2004). Per Section F3.2.1.5 of the Urban Official Plan, the requirements of an EIS may be scoped by the City of Hamilton in consultation with the Hamilton Conservation Authority.

The MNR Niagara Area Species at Risk Biologist should be consulted to confirm protocols to complete surveys for species at risk and to assess Significant Wildlife Habitat.

5.3.5 Approvals

The Hamilton Conservation will review and approve all studies to define the limits of Hazardous Lands, including the Flooding Hazard Limit and the Erosion Hazard Limit.

Permits may be required from MNR to complete species at risk surveys. Permits may be required under the Fish and Wildlife Conservation Act (1997) and the Endangered Species Act (2007).

Per Section F3.2.1.2 of the Urban Official Plan, the City of Hamilton, in consultation with the Hamilton Conservation Authority, will review and approve all Environmental Impact Statements. Per Section F3.3.1.1 of the Urban Official Plan, the Environmentally Significant Area Impact Evaluation Group (ESAIEG) will review all Environmental Impact Statement reports and advise City of Hamilton staff on the impacts of proposed land use changes within or adjacent to natural areas.

Per Section 3.2.1.6 of the Urban Official Plan, Environmental Impact Statements must be submitted as part of a complete development application to ensure that environmental impacts are considered early in the design process when there is the greatest opportunity to design in harmony with the natural environment.

The MNR will review and confirm the results of studies to identify the habitat of species at risk protected under the Endangered Species Act (2007).

Section C2.2.8 of the City of Hamilton Urban Official Plan states that all natural features, required vegetation protection zones and enhancement or restoration areas on a property are to be placed under appropriate zoning in the zoning by-law and/or protected through a conservation easement to the satisfaction of the City of Hamilton or the Hamilton Conservation Authority, or deeded to a public authority.

Per Section C2.12 of the Urban Official Plan, the City of Hamilton may also support the use of non-regulatory measures to establish the recommended NHS. Such measures could include conservation easements, land trusts, public land dedication or acquisition, property tax mechanisms, or similar tools.

5.4 Environmental Restoration and Enhancement

The environmental restoration and enhancement works recommended by the Subwatershed Strategy are not directly related to, or expected to benefit the future urban development lands. Rather, these works are generally recommended to address existing environmental issues, or to protect and enhance the Core Areas and Linkages of the recommended NHS. Accordingly, these works are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority and are described under Section 4.4. Therefore, development proponents are not responsible for any of the recommended environmental restoration and enhancement works at this time. However, it should be recognized that the City of Hamilton may seek to implement these works as conditions of approval through future applications under the Planning Act.

5.5 Natural Heritage System Management

As noted in Section 4.5, the conversion of the existing mosaic of agricultural lands and cultural vegetation communities of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) to urban land uses has the potential to degrade the ecological features and functions of the recommended NHS. To ensure its long-term protection, the Subwatershed Strategy recommends a number of potential management measures intended to mitigate the impacts of future land uses on the NHS. The proponents of development are responsible for the review, refinement and implementation of a number of these management measures. These measures are described in further detail below.

5.5.1 Targets/Objectives

The NHS is intended to maintain, protect and enhance the significant natural heritage features and ecological functions of the lands within the study area of the SCUBE Subwatershed Study. Management measures are intended to avoid or mitigate the potential negative impacts of future land uses on the NHS.

5.5.2 Future Study

Section 5.3.2.3 (above) describes the proximity of proposed development to Core Areas that triggers the requirement to complete an EIS. As noted by Section 5.3.2.3, Section F3.2.1.2 of the City of Hamilton Urban Official Plan states the following:

> When a development proposal has the potential to negatively impact a Core Area or its function, the proponent shall be required to prepare an EIS to the satisfaction of the City and the relevant Conservation Authority. An EIS inventories and describes the existing Core Areas and ecological functions of the site in the context of the surrounding landscape. An EIS also assesses the potential negative impacts that proposed development may have on Core Areas and Linkages and provide recommendations on whether the development proposal should proceed or be modified, natural area boundaries, mitigation measures, and design measures to accommodate or enhance existing natural features and functions.

Environmental Impact Statements prepared in response to proposed development adjacent to the Core Areas of the SCUBE NHS should address the following Subwatershed Strategy recommendations regarding potential management measures as appropriate based on site-specific conditions:

5.5.2.1 Edge Management

Although many portions of the recommended NHS are culturally influenced, their interface with lands proposed for development would benefit from edge management. Where proposed development borders the more sensitive vegetation communities of the NHS, particularly deciduous forest and deciduous swamp, the EIS should address the following:

- Removal of vegetation and hazard trees from adjacent areas proposed for development;
- Evaluation of trees beyond the NHS (i.e. within the area proposed for development) for retention;
- Tree protection measures (e.g. temporary fencing, signage) to be implemented during construction;
- Active restoration (including invasive species removal and enhancement plantings of native species);
- Management of construction timing, practices and materials; and
- Construction monitoring

5.5.2.2 Fencing

The EIS should consider the permanent fencing of rear lot lines to prevent encroachment and uncontrolled access into the NHS. If fencing is considered appropriate, the EIS should make recommendations regarding the type of fencing and the potential offsetting of the fence onto public lands to preclude fence alterations/gate installation. Opportunities for wildlife passage should also be considered.

5.5.2.3 Road Crossings

The Fruitland-Winona Secondary Plan draft preferred land use option identifies two new road crossings of watercourses within SCUBE West. Collector Road B is proposed to cross Watercourse 5.0 approximately 30 m north of Wetland 4. Collector Road C is proposed to cross Watercourse 7.0 midway through Wetland 3. To minimize the potential impacts of these road crossings on the features and functions of watercourses, the EIS should address the following:

- Road crossings should avoid significant and/or sensitive aquatic habitat.
- To the extent possible, road crossings should be located within watercourse reaches subject to previous disturbance and/or those where the disturbance or removal of riparian vegetation (especially woody vegetation) can be minimized.
- Crossing structures should be perpendicular to the watercourse and should not be placed where the stream meanders.
- Crossing structures, particularly culvert crossings, must be constructed such that low flow conditions are maintained within the crossing and the character of the stream bed and banks are maintained.
- If culverts are used, they should be either open-bottomed or embedded a minimum of 20% with material similar to adjacent segments lining the bed.
- Opportunities for wildlife passage through crossing structures should be considered.
- If a minor realignment of the stream channel is required to achieve the desired crossing configuration, the new channel should be established using natural channel design principles.

5.5.3 Phasing

EIS results will provide input to the planning process that may affect the location and/or design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). Therefore the EIS will be completed as part of the Draft Plan of Subdivision or Site Plan planning process.

5.5.4 Design Guidance and Policy Considerations

Per Section F3.2.1.1 of the Urban Official Plan, Environmental Impact Statements are to be prepared in accordance with EIS guidelines adopted by City of Hamilton Council in July, 2004. These guidelines describe the contents of an EIS and specify the methodology to be used to complete certain EIS elements, such as biological inventories (City of Hamilton 2004). Per Section F3.2.1.5 of the Urban Official Plan, the requirements of an EIS may be scoped by the City of Hamilton in consultation with the Hamilton Conservation Authority.

5.5.5 Approvals

Per Section F3.2.1.2 of the Urban Official Plan, the City of Hamilton, in consultation with the Hamilton Conservation Authority, will review and approve all Environmental Impact Statements. Per Section F3.3.1.1 of the Urban Official Plan, the Environmentally Significant Area Impact Evaluation Group (ESAIEG) will review all Environmental Impact Statement reports and advise City of Hamilton staff on the impacts of proposed land use changes within or adjacent to natural areas.

Per Section F3.2.1.6 of the Urban Official Plan, Environmental Impact Statements must be submitted as part of a complete development application to ensure that environmental impacts are considered early in the design process when there is the greatest opportunity to design in harmony with the natural environment.

6.0 DESIGN GUIDANCE

Provided in the following sections is additional design guidance and recommendations which should be considered as stormwater management planning proceeds. With respect to LID source controls, further policy considerations are discussed in Section 7.

6.1 Stormwater Management Ponds

The physical design of end-of-pipe stormwater ponds will need to incorporate standard City and provincial criteria and guidelines. The following is a preliminary list of design recommendations for end-of-pipe stormwater facilities taken from the City's Criteria and Guidelines for Stormwater Management Infrastructure (2007) document. The guidelines from this document are considered to compliment those of the MOE 2003 Stormwater Management Planning and Design Manual. Both documents should be referred to for further details as stormwater management and development planning progress.

- Minimum drainage area of 5ha;
- The length-to-width ratio of the flowpath should be at least 3:1;
- Sediment forebay is to be separated from the main pond cell with a forebay berm:
  - Min 3.0m topwidth;
  - 3:1 max. sideslopes
- The major system drainage should be directed to the main pond cell, bypassing the forebay;
- Water depths:
  - Permanent pool – 1.0 to 1.0m
  - Permanent pool at outlet – 2.5m max.
  - Extended detention (erosion control) storage – 1.5m max.
  - Quantity control storage – 2.5m max.
  - Overall max. depth – 5.0 max.
- Side slopes:
  - 7:1 for at least 3m at the edge of the permanent pool;
  - 5:1 max. above the planting shelf (7:1 preferred);
  - 4:1 max. below the planting shelf
- Perimeter berming should have a top width of at least 3.0m at an elevation at least 0.3m above the 100-year water level
- Inlet:
  - Pipe invert should be set to the permanent pool elevation;
  - Scour protection within forebay
- Outlet:
  - Reverse slope pipe and perforated riser pipe;
  - Gravity drain pipe;
  - Weir outfall/spillway for less frequent events;

- Erosion protection at outfall;
- Maintenance via access road

- Emergency overflow spillway is required to convey the Regional Storm or post-development flow from the design storm event. The spillway invert should be set 0.1m above the 100-year or maximum water level;
- A maintenance access road, at least 4m wide, is required for access to the inlet, outlet and forebay;
- A minimum 5m setback is required before facility grading;
- A sediment drying area should be provided:
  - Immediately adjacent to the access road and sediment forebay;
  - 2% minimum slope;
  - Sized assuming 1m sediment depth and 4:1 sideslopes
- Fencing is recommended adjacent to residential land uses;
- Geotechnical investigation is required to confirm soil and groundwater conditions;
- Landscaping should be designed by a member of OALA;
- Safety considerations and warning signs should be incorporated

6.2 Traditional Source Control Measures

For sites which are too small to be serviced by a stormwater pond (i.e. less than 5 ha), traditional lot-level source controls may be used to provide the necessary water quality, erosion and flood control. The development lands draining to Watercourse 7.2 in particular, are likely to develop as a number of smaller sites that are too small for traditional end-of-pipe ponds due to the drainage constraints represented by the existing roadway / railway networks.

The MOE Stormwater Management Planning Manual (2003) and the City of Hamilton's Criteria and Guidelines for Stormwater Management Infrastructure (2007) document review several source control methods for stormwater management. It should be noted that the use of such techniques is very dependent on the type of development, the site characteristics, and the acceptability of the techniques to the municipality. The City of Hamilton document provides the following recommendations with respect which techniques may be feasible and acceptable:

- Reduced lot grading below existing City standards is not currently endorsed.
- Roof leaders discharging to the surface is encouraged. This technique promotes infiltration and provides water quality benefits
- Rear yard ponding is discouraged.
- Soakaway pits are acceptable where infiltration is feasible. If the soakaway pits serve only rooftop drainage, then no additional pretreatment is required.
- Rooftop storage is discouraged, but may be considered on a site-by-site basis. This technique makes use of large flat rooftops on commercial, industrial, or institutional buildings to provide quantity control storage. If this method of storage is to be used, the development proponents would be required to agree to a restrictive covenant with the City.

- Parking lot storage is another technique used to control post-development flows to pre-development levels. The City may permit parking lot storage if the City maintains access to the controlling device and controlling manhole which is to be located on the development boundary or easement. Ponding depths are generally limited to 0.25m.
- Porous and pervious pavement may be used in specialized applications. These source control techniques are discussed under LID methods (Section 6.3).

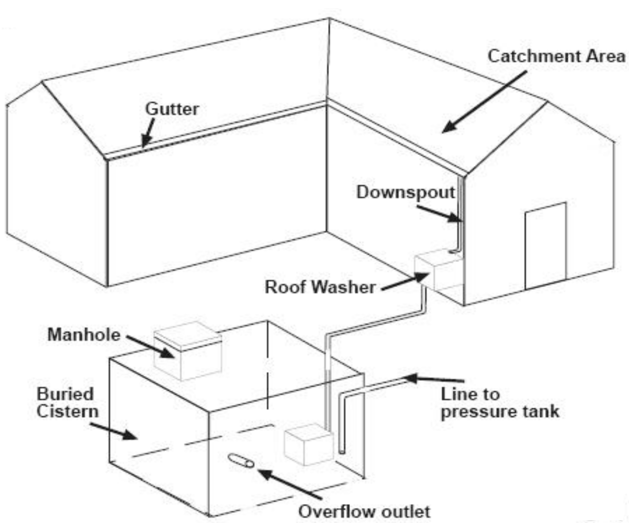
In addition to the above, on-site storm sewer systems, such as those used to drain a large commercial or industrial parking area, may be used to provide water quality and/or quantity control through infiltration and/or storage:

- Pervious pipes and pervious catchbasins may be used to exfiltrate stormwater where infiltration is feasible and approved by the City.
- Oversized (super) pipes may be used to provide subsurface storage to reduce post-development peak flows for small sites, re-development, or infill sites where no other practical solution exists.
- Oil-grit separator devices are appropriate for industrial and commercial land uses. These devices typically serve drainage area less than 2 ha and require pre-treatment using other methods and should not be used alone for water quality control. These devices are best applied for spill control, and, if used, they should be located within a City easement.

As noted in the last point above, the use of oil-grit separators requires pre-treatment. Therefore, where they are proposed for use in the SCUBE study area, it is recommended that they be located down-gradient from the other recommended LID techniques which could perform a dual function of pre-treatment for the oil-grit devices as well as groundwater recharge to meet the Subwatershed Study infiltration targets.

6.3 Low Impact Development

Design guidelines for Low Impact Development (LID) methods are outlined in the recently released Low Impact Development Stormwater Management Planning and Design Guide Version 1.0 (2010) by CVC and TRCA. Table 6.1 summarizes the various LID methods which may be applied to residential and employment land uses. Further discussion of the applicability of these methods to meet the groundwater recharge targets for the proposed SCUBE land uses is provided below:



6.3.1 Rainwater Harvesting

Rainwater harvesting is the process of intercepting rain that falls on a catchment surface, such as a rooftop, and conveyed to a storage tank for later use.

Table 6.1:

Applicability of Low Impact Development (LID) Methods for Groundwater Recharge in SCUBE

LID Method	Residential Land uses	Employment Land uses	Notes
Rainwater Harvesting	√	√	This LID provides groundwater recharge benefits if used for irrigation.
Green Roofs	-	√*	* This LID does not provide groundwater recharge benefits, but may be used for other environmental benefits.
Downspout Disconnection	√	√	Use in conjunction with topsoil amendments and increased topsoil depths to enhance groundwater recharge.
Soakaway Pits / Infiltration Chambers	√	√	Variety of design options are available for use in various land use settings.
Bioretention	√*	√	Most applicable for employment land uses. *May also take the form of small residential rain gardens, however, City does not support ponding/storage in rear lots.
Filter Strips	-	√	Most applicable for providing treatment (or pre-treatment) for runoff from employment land uses.
Permeable Pavement	√	√	Most applicable for providing treatment for large parking surfaces associated with employment land uses. May also be used for residential driveways.
Grassed Swales	√	√	Variety of design options are available for use in various land use settings.

Storage tanks can range in size from rain barrels for residential land uses to large cisterns for industrial or commercial land uses. The harvested rainwater can be used inside the building for non-potable water uses, or for outdoor uses such as irrigation.

When used to irrigate landscaped areas, rainwater harvesting is one alternative LID which could be used to promote infiltration within the SCUBE study area in an effort to maintain groundwater recharge. As noted, this LID is applicable for both future residential and employment land use areas.

6.3.2 Green roofs

Green roofs or rooftop gardens consist of a thin layer of vegetation and growing medium installed on top of flat or gently sloped roofs associated with industrial, commercial or institutional land uses.

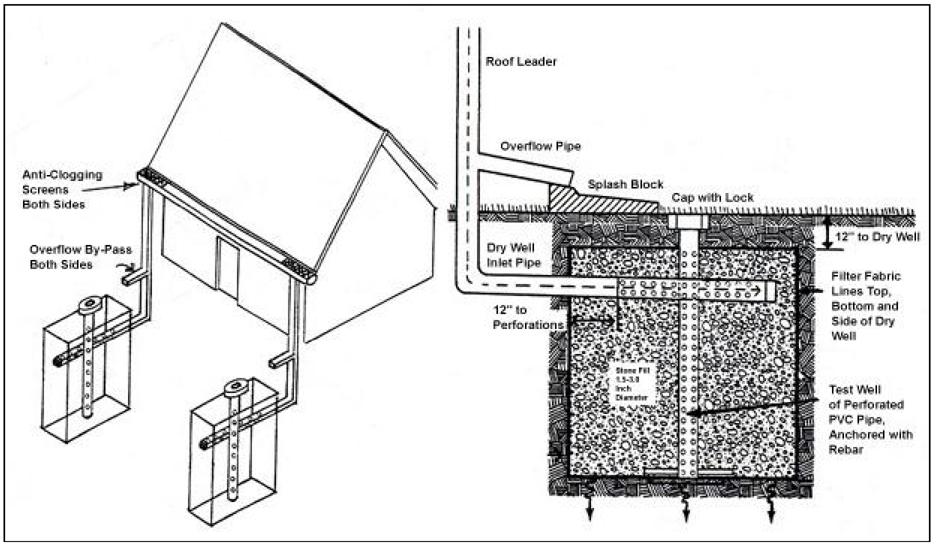
This LID acts like a lawn or meadow by storing rainwater in the growing medium and ponding areas. A large portion of this stored water is then evapotranspirated away by the plants. Although beneficial for other reasons, such as building insulation, water quality, water balance, and peak flow control, this LID does not promote groundwater recharge and therefore would not meet the groundwater recharge targets for the SCUBE study area.

6.3.3 Downspout Disconnection

Downspout disconnection is applicable to residential and employment land uses and promotes infiltration by directing roof runoff to pervious areas instead of directly entering the storm drain system or flowing across impervious surfaces. Infiltration using this LID can also be enhanced by amending the native topsoil with more pervious material and/or increased topsoil depths where necessary.

This LID technique is also considered a traditional source control method and is promoted by City of Hamilton for new residential developments in its 2007 Criteria and Guidelines document (see also Section 6.2).

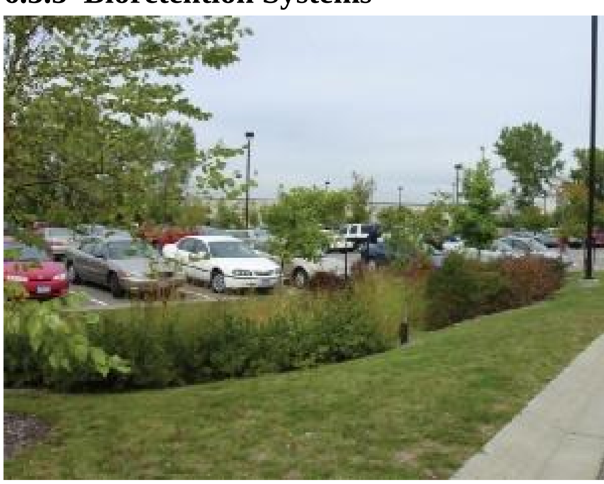
6.3.4 Soakaway Pits and Infiltration Chambers



Soakaway pits and infiltration chambers are stone-filled trenches or galleries that are constructed below grade within residential yards, under parking lots, parks or sports fields. Typically these LID's store and infiltrate runoff discharged from rooftop areas via a downspout or swale. Note that many open bottomed pre-manufactured systems would be classified as sub-set of soakaway pits and infiltration chambers and are considered LID.

This LID technique is also considered a traditional source control method that is acceptable to the City of Hamilton where space permits, and where soils are suitable (see also Section 6.2).

6.3.5 Bioretention Systems



Bioretention systems are landscaped areas which capture, temporarily store, and treat stormwater runoff by passing it through engineered soil filter media. The primary component of a bioretention cell is the filter bed with a mixture of sand, soil, and organic material as filtering medium. Pre-treatment, such as a settling forebay or grass filter strip, precedes the filter bed to remove particles that would otherwise clog the filter bed. For the SCUBE study area, this LID is most applicable to employment land uses where the systems can be worked into the landscaping to treat runoff from parking areas.

This LID can also be used in residential land uses in the form of rain gardens. However, this may be in contradiction of the City's Criteria and Guidelines for Stormwater Infrastructure Design document which notes that the city does not support ponding of stormwater within residential lots. Consideration may be given to using this LID method within residential development if the systems are located in the front yard along the boulevard.

Depending the on native soils, a bioretention system may include an underdrain which conveys the filtered stormwater to the storm drain system. In this case, the system acts as a filter only and may not provide any groundwater recharge through infiltration. Therefore, if bioretention units are to be used in SCUBE study area, the systems will have to be designed with a "raised" underdrain, allowing for sufficient storage within a granular media located beneath the underdrain in order to meet the recharge targets.

6.3.6 Filter (Buffer) Strips

Vegetated filter strips are gently sloping vegetated areas that treat runoff as sheet flow from adjacent impervious surfaces. This LID functions by slowing runoff velocities, filtering suspended sediment, and allowing some infiltration into the underlying soils.

Within the SCUBE study area, filter strips may be used within the future employment lands as a pre-treatment practice for parking lot runoff before it is conveyed into adjacent biofilter or grassed swale systems. The filter strips also provide a convenient area for snow storage and treatment.

6.3.7 Permeable Pavement

Permeable pavement systems are an alternative to traditional impervious pavements which allow stormwater to drain through into a stone reservoir where it is infiltrated into the native soil. They can be used for low traffic roads, parking lots, driveways and paths. There are several forms of this LID:

- permeable interlocking concrete pavers;
- plastic or concrete grid systems;
- pervious concrete; and
- porous asphalt

This LID is most applicable to employment land uses where the systems can be used to take advantage of the large impervious parking areas and where pervious landscaped areas are limited. These systems can also be used for residential driveways.

Depending the on the native soils, permeable pavement systems may include an underdrain which conveys the filtered stormwater to the storm drain system. In this case, the system acts as a filter only and may not provide any groundwater recharge through infiltration. Therefore, if permeable pavement systems are to be used in SCUBE study area, the systems will have to be designed with a “raised” underdrain, allowing for sufficient storage within the granular media located beneath the underdrain in order to meet the recharge targets.

6.3.8 Grassed Swales

Grassed swales are open vegetated channels designed to convey, treat and attenuate runoff. Design variations include simple grass channels, enhanced grass swales and dry (bio) swales.

The vegetation within the swales slows the runoff to allow sedimentation, filtration, and infiltration into the underlying soils. Although they are technically classified as a form of conveyance control, they can be used as a network of lot-level LID measures when designed to collect and convey runoff through the rear/side yards of a residential subdivision, or within a larger industrial/commercial development site.

6.4 Conveyance Improvements and Stream Restoration

Design for conveyance improvement and stream restoration works should consider the following recommendations from the City of Hamilton's Criteria and Guidelines for Stormwater Management Infrastructure (2007) document:

- New roadway culverts and bridges should be designed to convey the Regulatory flood.
- Culverts and bridges should be designed in accordance with MTO policies and guidelines.
- Future channel designs should be based on natural channel processes to achieve a stable system, with input from a qualified fluvial geomorphologist.
- Channel designs should be consistent with:
    - MNR Natural Hazards Technical Guides (2006);
    - MNR Adaptive Management of Stream Corridors in Ontario (2001).
- Channel designs should consider baseflow, bankfull flow, fish habitat, riparian and valley components.
- Channel designs should reflect aquatic habitat recommendations provided by a qualified aquatic biologist.
- Channel works should incorporate fish habitat protection/mitigation measures that reflect the significance and sensitivity of the watercourse and satisfy Hamilton Conservation Authority, DFO and MNR requirements, as applicable.
- Designs should reflect Official Plan and other agency requirement for the protection of associated natural features.
- Designs should include appropriate vegetation protection zones and maintenance access allowances to the satisfaction of the City of Hamilton and Hamilton Conservation Authority.

Other general criteria advocated by regulatory agencies include:

- Channel corridors should be as wide as, or wider than, the meander belt for the watercourse in new development areas (see Meander Belt Delineation Guidelines within the MNR Natural Hazards Technical Guides, 2006). Where existing land use constrains the channel corridor, the bottom width of the corridor should be as wide as possible.
- Culverts should be open bottom structures with a defined low flow and bankfull channel suitable for fish passage.
- Culvert span should be sufficiently wide span to minimize interference with fish passage (refer to DFO stream simulation road crossing design guidance).
- Bioengineering measures should be used for erosion control where feasible.

- Vegetation restoration designs should only include native species and seek to improve aquatic habitat (e.g., overhanging vegetation, shade) as appropriate for target species as determined by a qualified aquatic biologist.
- Ensure establishment of bankside vegetation before flow is diverted into constructed channel
- Establish a vegetation protection zone to provide a buffer to channel banks. Replicate the function of headwater streams (zero and first order) in the landscape through swales where such features are proposed to be removed from the drainage network.

Designed channel works should be constructed in the dry and, where possible, construction should allow for at least one season of vegetative growth before diverting the existing channel to the constructed channel. The purpose of this delay is to enable the vegetation to become somewhat established so that the rooting structure can begin to reinforce channel banks. That is, in the period immediately following construction, any newly constructed channel is particularly vulnerable to erosion. Establishment of vegetation on channel banks will enhance the structural stability of the banks. Further, such vegetation will also provide a direct and indirect benefit to aquatic habitat.

Typical background studies and analyses that are undertaken when completing channel restoration and/or relocation designs should follow those prescribed within the MNR Adaptive Management of Stream Corridors in Ontario (2001) document. Specifically, this includes the following:

- Historic assessment
- Existing conditions assessment including detailed field investigations to document existing form and process as a basis for proposed restoration works.
- Quantify the meander belt
- Determine channel response to previous disturbance
- Determine appropriate channel dimensions and parameters for the given flow regime and setting of the watercourse, taking into account historic upstream channel changes that may influence site specific processes (e.g., upstream reduction in channel length will have increased stream power).
- Hydraulic analyses, including development or update of existing and proposed conditions

7.0 POLICY CONSIDERATIONS FOR LID SOURCE CONTROLS

Because LID source controls are a relatively new concept that are just now beginning to be implemented in many southern Ontario municipalities, further discussion is provided below with respect to policy consideration for these types of controls.

7.1 Special Provisions in Zoning and Subdivision Agreements for SWM facilities

In most cases, the placement of LID stormwater source controls or other traditional source controls on individually or communally-owned private lands will be constructed, operated and maintained by the landowner. Consideration should be given to the following:

- Adoption of standardized LID facility design and construction standards/manual and references i.e. LID SWM Planning and Design Guide (TRCA/CVC, 2010)
- Testing to confirm as-built performance (monitoring programs)
- Adoption of standardized annual monitoring/inspection reports
- The definition (or redefinition) of 'standing water' in the City's Criteria and Guidelines for Stormwater Infrastructure Design to allow for up to 48 hrs of ponded water within LIS source controls.
- Performance bonds for approved on-site source controls to ensure proper installation in the field.

Municipalities need to have some assurances and long standing arrangements whereby they can ensure that these facilities continue to perform as designed into the future. Examples include:

- Agreements which make the removals of on-site source controls unlawful
- Placement on title of on-site LID source control.
- Maintenance agreements that assign long-term maintenance responsibility
- On-site source controls are placed/sited within easements and have adequate access for inspection and maintenance. Consideration should be given to easement requirements which permit the City to gain access to the private property to lawfully inspect, enforce maintenance requirements and undertake such maintenance or repair works should conditions of the maintenance agreement be violated (i.e. existing non-compliance regulations and/or variants of property standard by-laws).
- The management of multi-unit and single lot freehold developments utilizing source controls on communally owned private lands through the Condominium Act 1998 (Westminster Woods - Guelph, ON ; Dixon et al., 2005). These common stormwater management elements are governed and maintained by a member elected Board of Governors, and requires all owners of parcels of tied lands to automatically become members, provides for mandatory mediation and arbitration and is enforced by the Condominium Boards (then the Ontario Superior Court of Justice).

- Covenants placed on title of individually owned lots requires owners, individually and collectively, to maintain repair and replace infrastructure (Dixon et al., 2005) and enforced through Municipal Property Standards By-laws or other such strategies would allow the municipality to lawfully enter private property, inspect and maintain on-site SWM controls.

7.2 Updating of Municipal Standards/Codes

The ideal condition would be for the municipality to adopt a uniform and consistent set of standards and codes that support the need and implementation of LID SWM techniques. However, the vast area, terrain and identified environmental constraints unique to each area require a more realistic approach. The resolution of code and policy is best achieved through the application of "pilot projects" and/or 'demonstration sites" which functions twofold, by allowing City staff to relax current City standards without fear of precedent and enabling the standards to be tested using innovative approaches on the site-level rather than the City-wide scale where associated risks are greatly reduced. This approach can provide staff with first-hand knowledge and provide an avenue for inter-departmental collaboration of ideals and concerns. Often, resolution of code and policy conflicts that occurs during construction/implementation will occur through discussion and negotiation between municipal staff and their respective departments.

Typical Municipal Codes to be investigated include:

- Noxious Weed By-Laws,
- Property Standards By-laws
- Boulevard Planting By-laws

Similar to the City of Hamilton's Airport Employment Growth District (AEGD) where LID development site controls are proposed as the overall preferred SWM strategy, the OPA 135 (A)-Schedule 'B'1" to OPA 135 (A) has been drafted to include various provision relating to on-site SWM management and should be reviewed.

7.3 Training Requirements

City review staff responsible for approvals and inspections should be given specific LID SWM training which should include the basics of LID principles and techniques i.e. LID goals and objectives, function and performance, design basics, approval requirements and operation and maintenance considerations. This can be accomplished through tailored LID seminars or workshops or through existing second party programs such as the Canadian Standards Association (CSA) Sustainable Stormwater Practices training modules.

7.4 Operations and Maintenance Requirements for LID measures

Source and conveyance LID measures are considered “soft” engineered facilities that depend heavily on landscaping elements for their effectiveness. Additional direction with respect to operation, maintenance, and monitoring of these “soft” measures is provided in Appendix B.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The City of Hamilton is in the process of preparing the Fruitland-Winona Secondary Plan in support of future urban development within the Stoney Creek Urban Boundary Expansion (SCUBE) area. The SCUBE Subwatershed Study was undertaken in support of the Secondary Plan and is being completed in three phases.

Separate Phase 1 and Phase 2 Subwatershed Study reports were completed for the lands on the east and west sides of McNeilly Road. The SCUBE *West* Subwatershed Study addresses lands within the drainage boundaries of the watercourses which drain the SCUBE West lands, namely Watercourses 5.0, 6.0 and 7.0. The SCUBE *East* Subwatershed Study addresses lands within the drainage boundaries of the watercourses that drain the SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) lands, namely Watercourses 7.2, 9, 10, and Fifty Creek.

The Phase 1 and Phase 2 Reports (i.e. one report for SCUBE West and one for SCUBE East) conclude with a recommended Subwatershed Strategy that consists of a series of stormwater management controls, stream works, and management measures to maintain, protect and enhance the study area's significant natural heritage features and ecological functions, including the identification of a recommended Natural Heritage System (NHS). Figures 2.1 and 2.2 illustrate the Strategy's recommended stormwater management controls and drainage and infrastructure improvement works for the SCUBE West and SCUBE East study areas, respectively. Figures 2.3 and 2.4 illustrate the Strategy's recommended NHS and environmental restoration and enhancement measures for the SCUBE West and SCUBE East study areas, respectively. The recommended works and measures which comprise each Subwatershed Strategy can be classified into five general categories:

- Stormwater management controls;
- Drainage and infrastructure improvement works;
- Establishment of the recommended NHS, including Core Areas and Linkages;
- Environmental restoration and enhancement; and
- NHS management.

This Phase 3 Report addresses *both* the SCUBE East and SCUBE West study areas, and presents recommendations intended to guide the implementation of the above works and measures as planning and design proceeds. The following basic elements of a successful implementation plan are discussed:

- Responsibility for Implementation - identifies who is responsible for the implementation of the various Subwatershed Strategy components;
- Targets/Objectives - identifies the target(s)/objective(s) associated with each component of the Subwatershed Strategy;
- Requirements for Future Studies - outlines the requirements for future studies to be completed in support of the implementation of the various components of the recommended Subwatershed Strategy.

- Phasing Considerations - identifies phasing considerations associated with the implementation of recommended works, particularly those that are inter-related;
- Additional Design Guidance and Policy Considerations – provides additional design guidance for many key Subwatershed Strategy components. Stormwater policy issues that may affect the implementation of the Subwatershed Strategy components are also noted.
- Approvals - identifies the approvals and/or permits that may be required for each component of the recommended Subwatershed Strategy.

The implementation of works and measures recommended to address existing environmental issues or to protect and enhance the Core Areas and Linkages of the recommended Natural Heritage System are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority. These works and measures are summarized in Table 4.1 and include the following:

- Drainage and infrastructure improvement works, including:
  - Watercourse 7.0 channel conveyance improvements
  - Culvert improvement works;
- Establishment of the recommended Natural Heritage System, including studies to:
  - refine floodplain mapping for Watercourses 5.0 and 6.0;
  - determine the meander belt of unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands; and
  - confirm the distribution of breeding birds, particularly those designated species at risk, to guide the refinement of the recommended NHS.
- Environmental restoration and enhancement works associated with:
  - Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area;
  - Watercourses 5.0 and 6.0 downstream of Barton Street;
  - the removal of existing structures that present barriers to fish passage; and
  - Zone C riparian habitat enhancements.
- Natural Heritage System management measures, including those associated with trails and stewardship.

The implementation of works and measures that are either directly related to future urban development or are expected to provide a direct benefit to the developing lands are the responsibility of the development proponents. These works are summarized in Table 5.1 and include:

- Stormwater management controls, including:
  - Stormwater management ponds;
  - traditional source controls; and
  - Low Impact Development (LID) controls.
- Drainage and infrastructure improvement works, including:
  - Watercourse 5.0 relocation/reconstruction within the SCUBE West lands;
  - Possible Watercourse 7.2 diversion to the Main Watercourse 7.0 channel; and
  - Watercourse 9 West Tributary channel capacity improvements.
- Establishment of the recommended Natural Heritage System, including studies to:

  - confirm the flooding hazard limit along watercourses impacted by proposed drainage and infrastructure improve works or environmental restoration and enhancement works;
  - identify the erosion hazard limit along confined portions of Fifty Creek;
  - identify the final boundaries of Core Areas and Linkages; and
  - confirm the extent of Vegetation Protection Zones.
- Natural Heritage System management measures, including those associated with edge management, fencing and road crossings.

The individual components The recommended works and measures which comprise each Subwatershed Strategy can be classified into five general categories:

8.1 Stormwater Management

In terms of stormwater management recommendations, conceptual stormwater management pond locations were identified for the control of runoff from future development lands (Figures 2.1 and 2.2). Control requirements were identified according to downstream habitat, erosion, and flood conveyance constraints:

- All future stormwater management facilities will need to provide permanent pool and extended detention storage to meet Level 2 water quality control requirements.
- Extended detention for erosion control is required for all ponds with the exception of those draining directly to the lined reach of Watercourse 9 and into the storm sewer tributaries of Watercourse 10.
- Post-to-pre flood (quantity) control is recommended for all ponds with the exception of those ponds draining directly to the lined reach of Watercourse 9.

Further hydrologic modelling was completed to identify the release rate and storage requirements for each of the conceptual stormwater ponds. Table 5.2 summarizes these requirements together with unit release rate and storage targets for greater flexibility.

With respect to the requirements for post-to-pre runoff control, hydraulic modelling undertaken during Phase 1 and Phase 2 of the SCUBE Subwatershed Study concluded that the QEW and Service Road culverts at Watercourse 9 and Fifty Creek could actually convey the predicted future flood flows including uncontrolled runoff from the upstream development lands. However, post-to-pre quantity controls were still recommended for ponds discharging to the West Tributary of Watercourse 9 due to capacity limitations on this tributary, and post-to-pre quantity controls were still recommended for ponds on Fifty Creek due to the concerns of downstream landowners.

It was recommended that the possibility of relaxing the post-to-pre quantity control requirements of some stormwater ponds could be investigated at the Functional Design stage through the planning and design of other downstream works, including:

- The possible construction of a new diversion channel on Watercourse 7.2 could relax or eliminate quantity control requirements for stormwater facilities draining to the stream, depending on the ultimate capacity of the diversion and the Watercourse 7.0 channel improvements downstream;

- Future channel capacity improvements on the West Tributary of Watercourse 9, along Lewis Road and the CN rail line, could relax or eliminate the quantity control requirements for stormwater facilities draining to this stream reach;
- Detailed hydrologic/hydraulic analysis of the major-minor system capacities and hydraulic grade lines of the Watercourse 10 storm sewer tributaries and MTO culverts is recommended to study the feasibility of relaxing the post-to-pre storage requirements for the Watercourse 10 stormwater ponds.

For all instances where the requirements for post-to-pre quantity control are relaxed upstream of QEW culvert crossings, it was recommended that supporting reports and analyses be submitted to MTO for review and approval. City of Hamilton and Hamilton Conservation Authority review and approval would also be required. HCA does not support capacity improvements where the direct objective is to increase development area.

Further detailed planning and design of the future stormwater management facilities should follow the guidance and recommendations outlined in the MOE 2003 Stormwater Management Planning and Design Manual and the City of Hamilton 2007 Criteria and Guidelines for Stormwater Infrastructure Design document.

For sites that are too small to be serviced by an end-of-pipe stormwater management pond, it was recommended that traditional lot-level source controls be used to provide an equivalent level of water quality, erosion and flood controls using the techniques which are acceptable to the City as outlined in the 2007 Criteria and Guidelines for Stormwater Infrastructure Design document.

The Subwatershed Strategy also recommends LID source controls to promote infiltration in order to maintain groundwater recharge rates. Appropriate types of LID controls were reviewed for use with various land uses. For residential land uses, recommended LID methods would include:

- Rainwater harvesting for irrigation;
- Downspout disconnection;
- Soakaway pits;
- Front yard bioretention (rain gardens);
- Permeable driveways;
- Grassed swales

For higher density employment land uses, recommended LID methods would include:

- Rainwater harvesting for irrigation;
- Downspout disconnection;
- Soakaway pits / infiltration chambers;
- Bioretention;
- Filter strips;
- Permeable pavements for parking areas and driveways; and
- Grassed swales.

Because LID source controls are a relatively new concept that are now beginning to be implemented in many Southern Ontario municipalities, further policy discussions and recommendations were provided. Key recommendations would include consideration of:

- Adoption of LID standards;
- Locating the LID controls within City of Hamilton easements;
- Use of maintenance agreements;
- Testing and annual monitoring;
- Use of performance bonds during installation/construction; and
- Use of “pilot projects” or “demonstration sites” to evaluate new innovative approaches.

8.2 Drainage and Infrastructure Improvement Works

As shown by Figures 2.1 and 2.2, the Subwatershed Strategy identifies three drainage and infrastructure improvement projects that would be the responsibility of future development proponents:

- **Watercourse 5.0 Relocation/Reconstruction (Sherwood Park Road to Barton Street)** – These works were recommended in order to provide floodplain and stormwater servicing benefits along this stream reach which currently leaves a narrow parcel of the SCUBE West development lands landlocked. The re-located channel would be constructed using a natural channel design techniques and would consist of a stable, naturalized stream that provides warmwater fish habitat and has the capacity to convey flood flows.
- **Possible Watercourse 7.2 Diversion –** Previous master drainage planning had suggested a possible diversion of the headwaters of Watercourse 7.2 to the west along the CN rail line to the Main Channel of Watercourse 7.0. If feasible, the diversion works could be beneficial in terms of floodplain and servicing improvements. Further hydrologic and hydraulic analyses were recommended to assess the feasibility of the diversion, including the ability of the downstream Watercourse 7.0 channel and CN rail line culvert to accept the additional flows. If deemed feasible, it was recommended that the new channel design be consistent with the design of the downstream improvement works on Watercourse 7.0.
- **Watercourse 9 West Tributary Channel Improvement Works –** These works were recommended for the unlined channel along Lewis Road and the CN rail line in order to provide floodplain and stormwater servicing benefits.

In terms of phasing considerations, it was recommended that studies and planning for many of the above works be initiated at the Functional Design stage so that they can be coordinated with the planning and design of future stormwater ponds and servicing. This is particularly important if the works are required in order to possibly relax the post-to-pre quantity control requirements for several of the future ponds.

As shown by Figures 2.1 and 2.2, the Subwatershed Strategy also identifies two other types of drainage and infrastructure improvement projects for which the City of Hamilton would be responsible:

- **Watercourse 7.0 Channel Conveyance Improvements –** These works have been recommended to relieve existing flooding and erosion between Barton Street and the QEW. The improved channel should consist of a stable, naturalized stream that provides warmwater habitat and has the capacity to convey flood flows.

- **Culvert Improvement Works (road/rail crossings of Watercourses 5.0, 6.0, 6.1, 6.3 and 7) –** These improvements have been recommended to reduce the flood-susceptibility of the existing road/rail structures and the surrounding lands. The planning and design of these works would focus on maximizing the capacity of the improved structure while accounting for the existing physical constraints. Co-ordination with other planned channel works is recommended in an effort to save costs and to minimize disruption.

It is recommended that the future planning and design for the above channel and culvert improvement works include fluvial geomorphologic and aquatic habitat input at the early functional design stages. In addition to the actual design of the channel and culvert works, future studies should also include hydraulic modelling and floodplain mapping updates to reflect the channel and culvert works. The actual construction of the instream works will need to take place within appropriate construction windows associated with warmwater fish habitat and possibly the Migratory Birds Convention Act.

Typically, the primary approval agency for the above works will be the Hamilton Conservation Authority, with input from the City of Hamilton, and additional approvals/permits from MNR and DFO.

8.3 Establishment of the Recommended NHS

As shown by Figures 2.3 and 2.4, the Subwatershed Strategy identifies a recommended NHS that consists of the following:

- Core Areas as defined by the City of Hamilton (2009) including Key Natural Heritage Features, Key Hydrologic Features and Local Natural Areas;
- Linkages as defined by the City of Hamilton (2009);
- Hazardous Lands as defined by the Hamilton Conservation Authority (2009); and
- Preliminary vegetation protection zones consistent with the minimum requirements of the City of Hamilton (City of Hamilton 2009)

The recommended NHS is to be established by the City of Hamilton, in consultation with the Hamilton Conservation Authority and the MNR, through the planning process to prepare the Fruitland-Winona Secondary Plan. The Fruitland-Winona Secondary Plan will be adopted as City of Hamilton policy as an amendment to the Urban Official Plan.

The preliminary (i.e. conceptual) boundaries of the recommended NHS were determined during Phase 1 and Phase 2 of the SCUBE Subwatershed Study. However, further studies are required to refine the limits of these boundaries within the SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) lands. Two of the required studies are most appropriately completed at the subwatershed scale; accordingly, the City of Hamilton has been assigned responsibility for their completion. These studies include the following:

- refine floodplain mapping for Watercourses 5.0 and 6.0; and
- determine the meander belt of unconfined portions of watercourses within the SCUBE West and SCUBE East (Parcel B) lands.

Since the completion of the Phase 1 and 2 reports for the SCUBE East and SCUBE West study areas, as per the recommendations of the aforementioned studies Stantec Consulting Limited completed comprehensive breeding bird surveys for the entire Fruitland-Winona Secondary Plan Area. The report concluded that avian species at risk previously identified in the Area were not breeding, and that habitat preservation for avian species at risk was not needed. The report was submitted to the relevant review agencies. The Hamilton Conservation Authority has accepted the results and recommendations of the report, as detailed in the November 2012 letter (Appendix C). The MNR has not yet commented on the report. The report is located at the end of this document in Appendix C.

The final boundaries of the recommended NHS are to be determined through the completion of additional studies most appropriately completed at the site scale; accordingly, the proponents of development have been assigned responsibility for their completion. These include studies to:

- confirm the flooding hazard limit along watercourses impacted by proposed drainage and infrastructure improve works or environmental restoration and enhancement works;
- identify the erosion hazard limit along confined portions of Fifty Creek;
- identify the final boundaries of Core Areas and Linkages; and
- confirm the extent of Vegetation Protection Zones.

The location and design of future development within SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) will be determined in part by the final boundaries of the recommended NHS. Therefore the above-noted studies to define the final boundaries of the recommended NHS and the extent of the associated vegetation protection zone will need to be completed before or as part of the Draft Plan of Subdivision or Site Plan planning process.

8.4 Environmental Restoration and Enhancement Works

Figures 2.3 and 2.4 illustrate the environmental restoration and enhancement works recommended by the Subwatershed Strategy for the SCUBE West and SCUBE East study areas, respectively. These works are not directly related to, or expected to benefit the future urban development lands. Rather, these works are generally recommended to address existing environmental issues, or to protect and enhance the Core Areas and Linkages of the recommended NHS. Accordingly, these works are considered the responsibility of the City of Hamilton and/or the Hamilton Conservation Authority. Development proponents are not responsible for any of the recommended restoration and enhancement works at this time. However, it should be recognized that the City of Hamilton may seek to implement these works as Conditions of Approval through future applications under the Planning Act. These works include the following:

- **Enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area –** the objective of the recommended enhancements include:
    - naturalize Hazardous Lands (e.g. floodplain) as defined by the Hamilton Conservation Authority (2009):
    - decrease the edge-interior ratio of Significant Woodlands and Wetlands;
    - provide improved opportunities for wildlife movement;
    - buffer Core Areas from future land uses;
    - increase habitat diversity; and
    - improve water quality.

- **Watercourses 5.0 and 6.0 Stream Restoration and Riparian Plantings downstream of Barton Street –** these works are recommended to improve the existing aquatic habitat, bank stability and stream shading of the urbanized reaches of Watercourses 5.0 and 6.0 so that they can ultimately function as direct fish habitat. It is recommended that Hamilton Conservation Authority staff be included at the early restoration design stages to identify specific areas of concern.

- **Fish Barrier Removal –** these works are intended to eliminate existing barriers to fish movement, including grade control structures and perched culverts. The removal of these barriers would allow fish to move from the downstream sections of the watercourses upstream, thereby converting indirect fish habitat to direct fish habitat. Works to improve fish passage are recommended at Highway 8 (Fifty Creek East Tributary) and the QEW (Watercourse 9 and Fifty Creek).

- **Zone C Riparian Habitat Enhancements –** these works are intended to improve the ability of headwater reaches of Watercourses 5.0, 6.0, 7.0 and Fifty Creek to function as linkages between the Niagara Escarpment and Core Areas of the recommended NHS within Zone B, particularly the Fifty Creek Valley Environmentally Significant Area. Enhancements will improve opportunities for wildlife movement and enhance downstream aquatic habitat through increased bank stability and stream shading. Enhancements would be implemented by the City and Hamilton and/or the Hamilton Conservation Authority in co-operation with rural landowners. Opportunities to involve other community organizations in enhancement activities should be investigated. Potential partners include the Hamilton-Wentworth Stewardship Council, ReLeaf Hamilton, the Hamilton Naturalists Club and the Field and Stream Rescue Team.

The City of Hamilton may undertake enhancements to Core Areas and Linkages within the Fruitland-Winona Secondary Plan Area or seek to implement these works as Conditions of

Approval through future applications under the Planning Act. The timing of the other restoration and enhancement works is not dependent on any other works or development, but coordination of enhancement activities with other works (e.g. drainage and infrastructure improvements) and/or development may present opportunities to minimize potential disturbance to the NHS and achieve cost savings.

For most of the above restoration works, Hamilton Conservation Authority would be the primary approval agency, with input from the City of Hamilton, and additional approvals/permits from MNR, DFO and NEC where appropriate. MTO input and approval would also be required for proposed works to improve fish passage through watercourse crossings of the QEW.

8.5 Natural Heritage System Management Measures

To ensure its long-term protection, the Subwatershed Strategy recommends management measures to mitigate the potential impacts of future land uses on the NHS. The City of Hamilton is responsible for the implementation of several of these NHS management measures, including the establishment of trails and stewardship (i.e. the preparation of an educational brochure). The proponents of development are responsible for the review, refinement and implementation of a number of other NHS management measures that address edge management, fencing and future road crossings of watercourses within SCUBE West.

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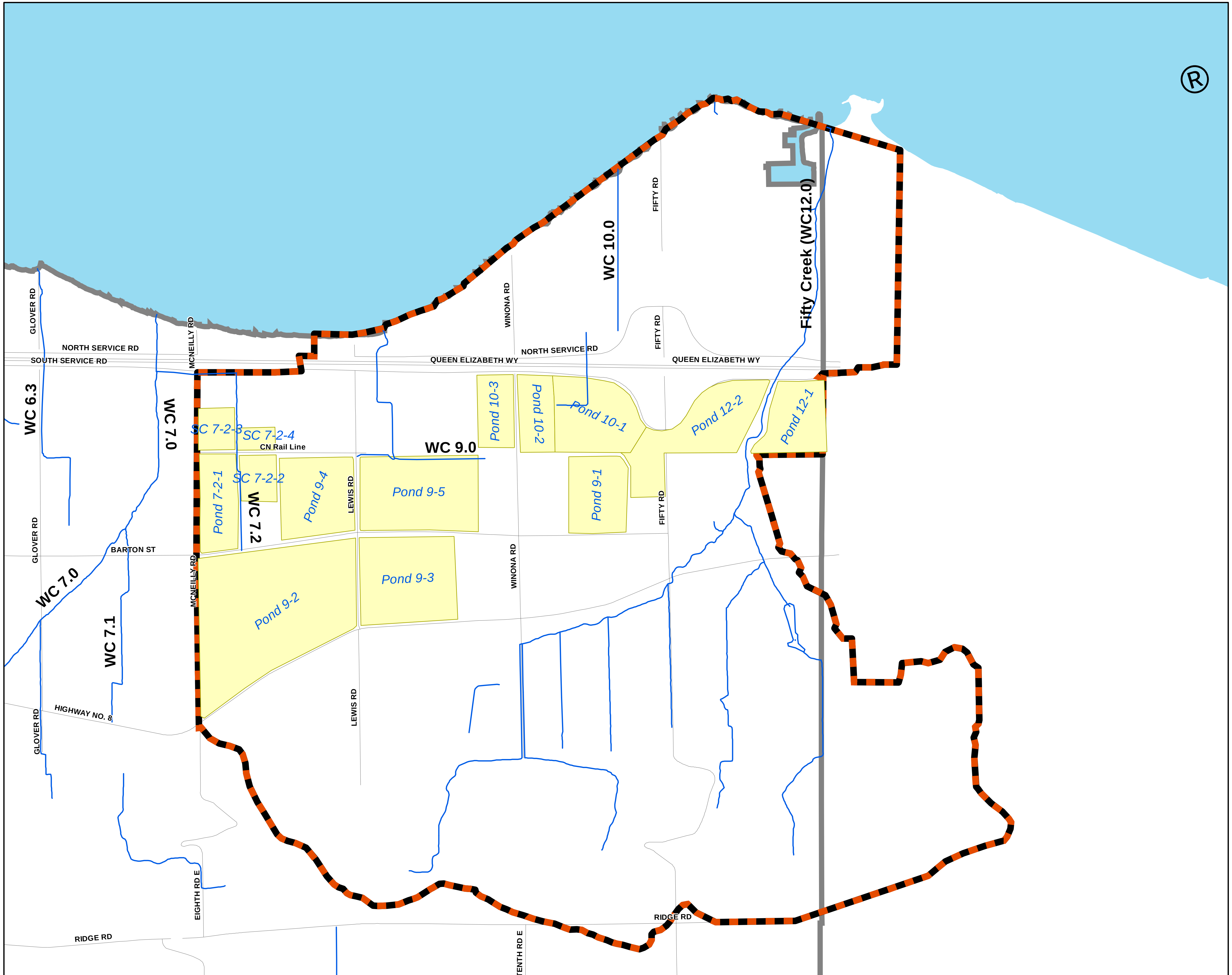
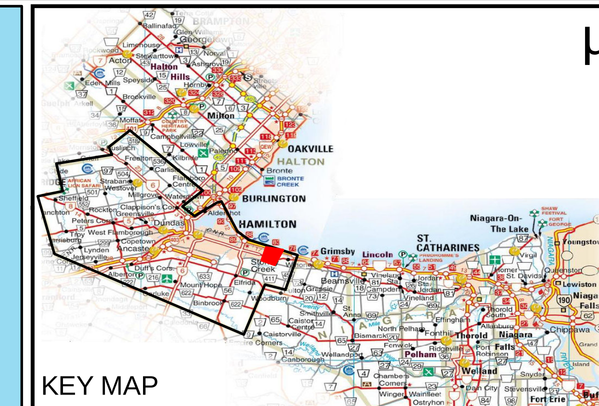
APPENDIX A

HYDROLOGIC MODELLING – STORMWATER POND SIZING





KEY MAP

LEGEND:

- CREEK
- STUDY AREA
- ROAD
- SWM POND CATCHMENT

NOTES:

0 150 300 600 900 1,200

Meters

Hamilton

Aquafor Beech Limited

STONEY CREEK URBAN EXPANSION (SCUBE) SUBWATERSHED STUDY

Phase 3: Implementation

SWMHYMO HYDROLOGIC MODEL

FUTURE LANDUSE CATCHMENTS

FIGURE No. A.1

DATE: MAY, 2013

Table A.1
Summary of SWMHYMO Hydrologic Model Parameters

Future Landuse Scenario (Figure A.1)

Catchment ID	Landuse	Unit Hydrograph	Area (ha)	CN	% Impervious
		SCUBE EAST			
125CA	Lawns	standhyd	11.8	80	80%
125CB	Lawns	standhyd	14.5	80	80%
1011	Lawns	standhyd	14.7	80	50%
92AA	Lawns	standhyd	54	75	50%
92AB	Lawns	standhyd	23.1	75	50%
96AB	Lawns	standhyd	16.2	80	80%
96AA	Lawns	standhyd	8.3	80	80%
97A	Lawns	standhyd	16.5	80	80%
101A	Lawns	standhyd	16.4	80	80%
102A	Lawns	standhyd	9.6	80	80%
103C	Lawns	standhyd	9.3	80	80%
720AA	Lawns	standhyd	10.3	80	80%
720AB	Lawns	standhyd	4.8	80	80%
721AA	Lawns	standhyd	4.3	80	80%
721AB	Lawns	standhyd	2.4	80	80%

Table A.2
Hydrologic Model Design Storm
SCS 24-hour distribution

Time (hrs)	Rainfall Intensity (mm/hr)	
	2-yr	100-yr
0	0.58	1.35
1	0.58	1.35
2	0.69	1.6
3	0.69	1.6
4	0.85	1.97
5	0.85	1.97
6	1.06	2.46
7	1.06	2.46
8	1.43	3.32
9	1.805	4.175
10	2.865	6.635
11	22.728	52.602
12	5.79	13.395
13	2.545	6.26
14	1.59	3.69
15	1.59	3.69
16	0.96	2.21
17	0.96	2.21
18	0.96	2.21
19	0.96	2.21
20	0.64	1.47
21	0.64	1.47
22	0.64	1.47
23	0.64	1.47
Total Rainfall (mm)	53.1	123.2

MODEL OUTPUT

```
===============================================================================

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9 =========
                                                     9   9  9   9 # 2686740
      StormWater Management HYdrologic Model          999    999  =========

 **************************************************************************
 ************************* SWMHYMO-99 Ver/4.02 *************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******                 OTTHYMO-83 and OTTHYMO-89.                  *******
 **************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          *******
 *******                 Ottawa,  Ontario: (613) 727-5199           *******
 *******                 Gatineau, Quebec: (819) 243-6858           *******
 *******                 E-Mail: swmhymo@jfsa.Com                   *******
 **************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: Aquafor Beech Ltd                           +++++++
 +++++++                                   SERIAL#:2686740          +++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 **************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *******
 *******          Maximum value for ID numbers  :     10            *******
 *******          Max. number of rainfall points:  15000            *******
 *******          Max. number of flow points    :  15000            *******
 **************************************************************************


 ********************   D E T A I L E D   O U T P U T   ********************
 **************************************************************************
 *       DATE: 2011-03-04     TIME: 15:42:51     RUN COUNTER: 000031      *
 **************************************************************************
 * Input   filename: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.da*
 * Output  filename: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.ou*
 * Summary filename: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.su*
 * User comments:                                                         *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 **************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#****************************************************************************
*#  Project Name: [SCUBE East]    Project Number: [64711]
*#  Date        : 12-06-2010
*#  Modeller    : [        ]
*#  Company     : Aquafor Beech Limited
*#  License #   :  3245976
*#****************************************************************************
*#  Future Landuse - SWM Pond - 100 Year
*#****************************************************************************
-------------------
| START            |  Project  dir.: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\
-------------------  Rainfall dir.: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=24SCS100.STM
--------------------------------------------------------------------------------
001:0002------------------------------------------------------------------------
-------------------
| READ STORM       |    Filename: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUB
| Ptotal= 123.25 mm|    Comments: 100yr/24hr
-------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              1.00   1.350 |   7.00   2.460 |  13.00  13.395 |  19.00   2.210
              2.00   1.350 |   8.00   2.460 |  14.00   6.260 |  20.00   2.210
              3.00   1.600 |   9.00   3.320 |  15.00   3.690 |  21.00   1.470
              4.00   1.600 |  10.00   4.175 |  16.00   3.690 |  22.00   1.470
              5.00   1.970 |  11.00   6.635 |  17.00   2.210 |  23.00   1.470
              6.00   1.970 |  12.00  52.602 |  18.00   2.210 |  24.00   1.470

--------------------------------------------------------------------------------
001:0003------------------------------------------------------------------------
*#****************************************************************************
*#
*#                          Watercourse 12
*#
*#****************************************************************************
*#****************************************************************************
*# Watercourse 12 - Catchment 125CA (Pond 12-1)
*#****************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   11.80
| 01:125CA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.44         2.36
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .20          .20
     Length            (m)=     535.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        60.97
               over (min)      15.00        30.00
     Storage Coeff.  (min)=      14.64 (ii)   31.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.21          .30         1.500 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17        12.000
     RUNOFF VOLUME    (mm)=     121.24        86.78       111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25       123.247
     RUNOFF COEFFICIENT   =        .98          .70          .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0004------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(125CA )   |
| OUT<02:(Pond-1)   |    =========  OUTFLOW STORAGE TABLE  =========
```

```
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |      .087  .3430E+00
                           .013  .2400E+00   |      .333  .7730E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (125CA )      11.80     1.500    12.000    111.598
     OUTFLOW<02: (Pond-1)      11.80      .333    13.333    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   22.184
                   TIME SHIFT OF PEAK FLOW         (min)=    80.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7730E+00

--------------------------------------------------------------------------------
001:0005------------------------------------------------------------------------
*#****************************************************************************
*# Watercourse 12 - Catchment 125CB (Pond 12-2)
*#****************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   14.50
| 01:125CB  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.60         2.90
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .20          .20
     Length            (m)=     535.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        60.97
               over (min)      15.00        30.00
     Storage Coeff.  (min)=      14.64 (ii)   31.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.49          .37         1.844 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17        12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78       111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25       123.247
     RUNOFF COEFFICIENT   =        .98          .70          .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0006------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(125CB )   |
| OUT<02:(Pond-1)   |    =========  OUTFLOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |      .107  .4210E+00
                           .016  .2950E+00   |      .410  .9490E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (125CB )      14.50     1.844    12.000    111.598
     OUTFLOW<02: (Pond-1)      14.50      .410    13.333    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   22.236
                   TIME SHIFT OF PEAK FLOW         (min)=    80.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9492E+00

--------------------------------------------------------------------------------
001:0007------------------------------------------------------------------------
*#****************************************************************************
*#
*#                          Watercourse 9
*#
*#****************************************************************************
*#****************************************************************************
*# Watercourse 9 - Catchment 1011 (Pond 9-1)
*#****************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   14.70
| 01:1011   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.35         7.35
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .10          .10
     Length            (m)=     580.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        54.27
               over (min)      20.00        40.00
     Storage Coeff.  (min)=      18.92 (ii)   41.06 (ii)
     Unit Hyd. Tpeak (min)=      20.00        40.00
     Unit Hyd. peak  (cms)=        .06          .03
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .71          .75         1.389 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.33        12.083
     RUNOFF VOLUME    (mm)=     121.24        84.73        97.514
     TOTAL RAINFALL   (mm)=     123.25       123.25       123.247
     RUNOFF COEFFICIENT   =        .98          .69          .791

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0008------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(1011  )   |
| OUT<02:(Pond-9)   |    =========  OUTFLOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |      .412  .6900E+00
                           .107  .2450E+00   |      .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (1011  )      14.70     1.389    12.083     97.514
     OUTFLOW<02: (Pond-9)      14.70      .412    13.750     97.514

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   29.623
                   TIME SHIFT OF PEAK FLOW         (min)=   100.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6895E+00
```

```
--------------------------------------------------------------------------------
001:0009------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 9 - Catchment 92AA (Pond 9-2)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   54.00
| 01:92AA   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      27.00         27.00
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .50           .50
     Length            (m)=     491.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         51.57
                over (min)       10.00         25.00
     Storage Coeff.  (min)=      10.57 (ii)    24.51 (ii)
     Unit Hyd. Tpeak (min)=      10.00         25.00
     Unit Hyd. peak  (cms)=        .11           .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       2.75          3.14          5.809 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25         77.26         92.655
     TOTAL RAINFALL   (mm)=     123.25        123.25        123.247
     RUNOFF COEFFICIENT   =        .98           .63           .752

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0010------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(92AA  )   |
| OUT<02:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .231  .1136E+01
                            .035  .7950E+00   |      .942  .3055E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >01: (92AA  )      54.00     5.809    12.000      92.655
     OUTFLOW<02: (Pond-9)      54.00      .942    14.000      92.653

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.215
                   TIME SHIFT OF PEAK FLOW         (min)=   120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3055E+01

--------------------------------------------------------------------------------
001:0011------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 9 - Catchment 92AB (Pond 9-3)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   23.10
| 01:92AB   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.55         11.55
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .50           .50
     Length            (m)=     350.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         51.57
                over (min)       10.00         25.00
     Storage Coeff.  (min)=       8.62 (ii)    22.57 (ii)
     Unit Hyd. Tpeak (min)=      10.00         25.00
     Unit Hyd. peak  (cms)=        .12           .05
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.18          1.37          2.523 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25         77.26         92.655
     TOTAL RAINFALL   (mm)=     123.25        123.25        123.247
     RUNOFF COEFFICIENT   =        .98           .63           .752

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0012------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(92AB  )   |
| OUT<02:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .099  .4870E+00
                            .015  .3410E+00   |      .403  .1309E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >01: (92AB  )      23.10     2.523    12.000      92.655
     OUTFLOW<02: (Pond-9)      23.10      .403    13.917      92.652

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.970
                   TIME SHIFT OF PEAK FLOW         (min)=   115.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1309E+01

--------------------------------------------------------------------------------
001:0013------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 9 - Catchment 96AB (Pond 9-4)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   16.20
| 01:96AB   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.96          3.24
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .90           .90
     Length            (m)=     581.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       9.80 (ii)    20.66 (ii)
```

```
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .11           .06
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.70           .48          2.184 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.000
     RUNOFF VOLUME    (mm)=     121.24         86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25        123.25        123.247
     RUNOFF COEFFICIENT   =        .98           .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0014------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(96AB  )   |
| OUT<02:(Pond 9)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .151  .4530E+00
                            .023  .3170E+00   |      .582  .9980E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >01: (96AB  )      16.20     2.184    12.000     111.597
     OUTFLOW<02: (Pond 9)      16.20      .582    13.083     111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   26.640
                   TIME SHIFT OF PEAK FLOW         (min)=    65.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9979E+00

--------------------------------------------------------------------------------
001:0015------------------------------------------------------------------------
*#******************************************************************************
*# Watercoures 9 - Catchment 96AA+97AA (Pond 9-5)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=    8.30
| 01:96AA   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.64          1.66
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .90           .90
     Length            (m)=     421.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       8.08 (ii)    18.93 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .13           .06
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .87           .25          1.125 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78        111.598
     TOTAL RAINFALL   (mm)=     123.25        123.25        123.247
     RUNOFF COEFFICIENT   =        .98           .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0016------------------------------------------------------------------------
---------------------
| CALIB STANDHYD     |   Area    (ha)=   16.50
| 02:97AA   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      13.20          3.30
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=       1.00          1.00
     Length            (m)=     451.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       8.16 (ii)    18.67 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .13           .06
                                                           *TOTALS*
     PEAK FLOW       (cms)=       1.73           .50          2.239 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78        111.598
     TOTAL RAINFALL   (mm)=     123.25        123.25        123.247
     RUNOFF COEFFICIENT   =        .98           .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0017------------------------------------------------------------------------
-------------------
| ADD HYD (Flow_P) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.    DWF
-------------------               (ha)     (cms)   (hrs)   (mm)   (cms)
                ID1 01:96AA       8.30     1.125   12.00 111.60    .000
               +ID2 02:97AA      16.50     2.239   12.00 111.60    .000
                ==================================================
                SUM 03:Flow_P    24.80     3.364   12.00 111.60    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
001:0018------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>03:(Flow_P)   |
| OUT<04:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .245  .6000E+00
      *** WARNING: STORAGE-Q values were extrapolated.
                   Increase curve or use overflow option.

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >03: (Flow_P)      24.80     3.364    12.000     111.598
```

```
    OUTFLOW<04: (Pond-9)      24.80      .623    13.250    111.597

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.525
                TIME SHIFT OF PEAK FLOW         (min)=    75.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.1526E+01

--------------------------------------------------------------------------------
001:0019------------------------------------------------------------------------
*#******************************************************************************
*#
*#                               Watercourse 10
*#
*#******************************************************************************
*#******************************************************************************
*# Watercourse 10 - Catchment 101A (Pond 10-1)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   16.40
| 01:101A   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      13.12          3.28
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .90           .90
     Length            (m)=     452.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       8.43 (ii)    19.28 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .12           .06
                                                              *TOTALS*
     PEAK FLOW       (cms)=       1.72           .50           2.221 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00          12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78         111.598
     TOTAL RAINFALL   (mm)=     123.25        123.25         123.247
     RUNOFF COEFFICIENT   =        .98           .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0020------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(101A  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .798  .8040E+00
                            .208  .3580E+00   |      .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (101A  )      16.40     2.221    12.000    111.598
     OUTFLOW<02: (Pond-1)      16.40      .797    12.500    111.597

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   35.895
                TIME SHIFT OF PEAK FLOW         (min)=    30.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.8039E+00

--------------------------------------------------------------------------------
001:0021------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 10 - Catchment 102A (Pond 10-2)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=    9.60
| 01:102A   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.68          1.92
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .90           .90
     Length            (m)=     423.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       8.10 (ii)    18.96 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .13           .06
                                                              *TOTALS*
     PEAK FLOW       (cms)=       1.01           .29           1.302 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00          12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78         111.598
     TOTAL RAINFALL   (mm)=     123.25        123.25         123.247
     RUNOFF COEFFICIENT   =        .98           .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0022------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(102A  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .490  .4600E+00
                            .128  .2050E+00   |      .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (102A  )       9.60     1.302    12.000    111.598
     OUTFLOW<02: (Pond-1)       9.60      .490    12.417    111.597

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   37.616
                TIME SHIFT OF PEAK FLOW         (min)=    25.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.4598E+00

--------------------------------------------------------------------------------
001:0023------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 10 - Catchment 103C (Pond 10-3)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=    9.30
| 01:103C   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.44          1.86
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .70           .70
     Length            (m)=     478.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)       10.00         20.00
     Storage Coeff.  (min)=       9.40 (ii)    21.11 (ii)
     Unit Hyd. Tpeak (min)=      10.00         20.00
     Unit Hyd. peak  (cms)=        .12           .05
                                                              *TOTALS*
     PEAK FLOW       (cms)=        .98           .28           1.253 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.08          12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78         111.597
     TOTAL RAINFALL   (mm)=     123.25        123.25         123.247
     RUNOFF COEFFICIENT   =        .98           .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0024------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(103C  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .489  .4360E+00
                            .127  .1950E+00   |      .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (103C  )       9.30     1.253    12.000    111.597
     OUTFLOW<02: (Pond-1)       9.30      .488    12.417    111.597

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.968
                TIME SHIFT OF PEAK FLOW         (min)=    25.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.4357E+00

--------------------------------------------------------------------------------
001:0025------------------------------------------------------------------------
*#******************************************************************************
*#
*#                               Watercourse 7
*#
*#******************************************************************************
*#******************************************************************************
*# Watercourse 7 - Catchment 720AA (Pond 7-2-1)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=   10.30
| 01:720AA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       8.24          2.06
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .80           .80
     Length            (m)=     340.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.02
                over (min)        5.00         20.00
     Storage Coeff.  (min)=       7.36 (ii)    18.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00         20.00
     Unit Hyd. peak  (cms)=        .17           .06
                                                              *TOTALS*
     PEAK FLOW       (cms)=       1.08           .31           1.398 (iii)
     TIME TO PEAK    (hrs)=      12.00         12.00          12.000
     RUNOFF VOLUME    (mm)=     121.25         86.78         111.597
     TOTAL RAINFALL   (mm)=     123.25        123.25         123.247
     RUNOFF COEFFICIENT   =        .98           .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0026------------------------------------------------------------------------
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(720AA )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .182  .2370E+00
                            .027  .1660E+00   |      .707  .4890E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (720AA )      10.30     1.398    12.000    111.597
     OUTFLOW<02: (Pond-7)      10.30      .706    12.250    111.597

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   50.496
                TIME SHIFT OF PEAK FLOW         (min)=    15.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.4894E+00

--------------------------------------------------------------------------------
001:0027------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 7 - Catchment 720AB (Pond 7-2-2)
*#******************************************************************************
---------------------
| CALIB STANDHYD     |   Area    (ha)=    4.80
| 01:720B   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.84           .96
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=        .80           .80
     Length            (m)=     170.00         40.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      52.60         62.48
                over (min)        5.00         15.00
     Storage Coeff.  (min)=       4.86 (ii)    16.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00         15.00
     Unit Hyd. peak  (cms)=        .22           .07
                                                              *TOTALS*
```

```
     PEAK FLOW       (cms)=        .50          .15           .659 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0028------------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(720B  )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .085  .1110E+00
                            .013  .7800E-01   |      .329  .2340E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (720B  )       4.80      .659    12.000    111.597
     OUTFLOW<02: (Pond-7)       4.80      .328    12.167    111.597

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   49.748
                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2336E+00

--------------------------------------------------------------------------------
001:0029------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 7 - Catchment 721AA (Pond 7-2-3)
*#******************************************************************************
----------------------
| CALIB STANDHYD     |   Area    (ha)=    4.30
| 01:721AA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.44          .86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .30          .30
     Length            (m)=     213.00        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        61.52
                over (min)        5.00        25.00
     Storage Coeff.  (min)=       7.46 (ii)   22.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .17          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .45          .12           .574 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0030------------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(721AA )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .073  .9900E-01
                            .011  .6900E-01   |      .281  .2040E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (721AA )       4.30      .574    12.000    111.597
     OUTFLOW<02: (Pond-7)       4.30      .281    12.250    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   48.864
                   TIME SHIFT OF PEAK FLOW         (min)=    15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2039E+00

--------------------------------------------------------------------------------
001:0031------------------------------------------------------------------------
*#******************************************************************************
*# Watercourse 7 - Catchment 721AB (Pond 7-2-4)
*#******************************************************************************
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.40
| 01:721AB  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92          .48
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .30          .30
     Length            (m)=     149.00        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       6.02 (ii)   21.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .19          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .25          .07           .324 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
001:0032------------------------------------------------------------------------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(721AB )   |
| OUT<02:(Pond-G)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .041  .5600E-01
                            .006  .3900E-01   |      .157  .1160E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (721AB )       2.40      .324    12.000    111.597
     OUTFLOW<02: (Pond-G)       2.40      .157    12.167    111.595

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   48.396
                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1160E+00

--------------------------------------------------------------------------------
001:0033------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0018 ROUTE RESERVOIR
      *** WARNING: STORAGE-Q values were extrapolated.
                   Increase curve or use overflow option.
 001:0027 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2011-03-04     at 15:42:55
================================================================================
```

```
========================================================================
====

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999
=========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver.
4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999 July
1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9
=========
                                                      9   9  9   9 #
2686740
      StormWater Management HYdrologic Model           999    999
=========

************************************************************************
**
 *************************** SWMHYMO-99 Ver/4.02
***************************
 *******  A single event and continuous hydrologic simulation model
*******
 *******     based on the principles of HYMO and its successors
*******
 *******                 OTTHYMO-83 and OTTHYMO-89.
*******

************************************************************************
**
 ******* Distributed by:  J.F. Sabourin and Associates Inc.
*******
 *******                  Ottawa,  Ontario: (613) 727-5199
*******
 *******                  Gatineau, Quebec: (819) 243-6858
*******
 *******                  E-Mail: swmhymo@jfsa.Com
*******

************************************************************************
**

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++
 +++++++ Licensed user: Aquafor Beech Ltd
+++++++
 +++++++                                       SERIAL#:2686740
+++++++

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++

************************************************************************
**
 *******           ++++++ PROGRAM ARRAY DIMENSIONS ++++++
*******
 *******           Maximum value for ID numbers  :     10
*******
 *******           Max. number of rainfall points:  15000
*******
 *******           Max. number of flow points    :  15000
*******

************************************************************************
**

 ********************   D E T A I L E D   O U T P U T
********************

************************************************************************
**
 *       DATE: 2011-03-04     TIME: 15:42:51     RUN COUNTER: 000031
*

************************************************************************
**
 * Input   filename:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.da*
 * Output  filename:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.ou*
 * Summary filename:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.su*
 * User comments:
*
 *
1:______________________________________________________________________*
 *
2:______________________________________________________________________*
 *
3:______________________________________________________________________*

************************************************************************
**

------------------------------------------------------------------------
------
001:0001----------------------------------------------------------------
------
*#**********************************************************************
*******
*#  Project Name: [SCUBE East]    Project Number: [64711]
*#  Date        : 12-06-2010
*#  Modeller    : [        ]
*#  Company     : Aquafor Beech Limited
*#  License #   :  3245976
*#**********************************************************************
*******
*#  Future Landuse - SWM Pond - 100 Year
*#**********************************************************************
*******
--------------------
| START            |  Project  dir.:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\
--------------------  Rainfall dir.:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
           #  1=24SCS100.STM
------------------------------------------------------------------------
------
001:0002----------------------------------------------------------------
------
--------------------
| READ STORM       |    Filename:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUB
| Ptotal= 123.25 mm|    Comments: 100yr/24hr
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME
RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs
mm/hr
              1.00   1.350 |   7.00   2.460 |  13.00  13.395 |  19.00
2.210
              2.00   1.350 |   8.00   2.460 |  14.00   6.260 |  20.00
2.210
              3.00   1.600 |   9.00   3.320 |  15.00   3.690 |  21.00
1.470
              4.00   1.600 |  10.00   4.175 |  16.00   3.690 |  22.00
1.470
              5.00   1.970 |  11.00   6.635 |  17.00   2.210 |  23.00
1.470
              6.00   1.970 |  12.00  52.602 |  18.00   2.210 |  24.00
1.470

------------------------------------------------------------------------
------
001:0003----------------------------------------------------------------
------
*#**********************************************************************
*******
*#
*#                                Watercourse 12
*#
*#**********************************************************************
*******
*#**********************************************************************
*******
*# Watercourse 12 - Catchment 125CA (Pond 12-1)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   11.80
| 01:125CA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       9.44         2.36
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .20          .20
     Length            (m)=     535.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        60.97
                over (min)      15.00        30.00
     Storage Coeff.  (min)=      14.64 (ii)   31.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.21          .30         1.500 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17        12.000
     RUNOFF VOLUME    (mm)=     121.24        86.78       111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25       123.247
     RUNOFF COEFFICIENT   =        .98          .70          .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
------
001:0004----------------------------------------------------------------
------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(125CA )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |   (cms)    (ha.m.)
                           .000  .0000E+00   |     .087  .3430E+00
                           .013  .2400E+00   |     .333  .7730E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
```

```
     INFLOW >01: (125CA )      11.80     1.500    12.000    111.598
     OUTFLOW<02: (Pond-1)      11.80      .333    13.333    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   22.184
                   TIME SHIFT OF PEAK FLOW         (min)=    80.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.7730E+00

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001:0005----------------------------------------------------------------
------
*#**********************************************************************
*******
*# Watercourse 12 - Catchment 125CB (Pond 12-2)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   14.50
| 01:125CB  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.60         2.90
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .20          .20
     Length            (m)=     535.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        60.97
                over (min)       15.00        30.00
     Storage Coeff.  (min)=      14.64 (ii)   31.81 (ii)
     Unit Hyd. Tpeak (min)=      15.00        30.00
     Unit Hyd. peak  (cms)=        .08          .04
                                                             *TOTALS*
     PEAK FLOW       (cms)=       1.49          .37           1.844 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.17          12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78         111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25         123.247
     RUNOFF COEFFICIENT   =        .98          .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
------
001:0006----------------------------------------------------------------
------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(125CB )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .107  .4210E+00
                            .016  .2950E+00   |     .410  .9490E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (125CB )      14.50     1.844    12.000    111.598
     OUTFLOW<02: (Pond-1)      14.50      .410    13.333    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   22.236
                   TIME SHIFT OF PEAK FLOW         (min)=    80.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9492E+00

------------------------------------------------------------------------
------
001:0007----------------------------------------------------------------
------
*#**********************************************************************
*******
*#
*#                              Watercourse 9
*#
*#**********************************************************************
*******
*#**********************************************************************
*******
*# Watercourse 9 - Catchment 1011 (Pond 9-1)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   14.70
| 01:1011   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       7.35         7.35
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .10          .10
     Length            (m)=     580.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        54.27
                over (min)       20.00        40.00
     Storage Coeff.  (min)=      18.92 (ii)   41.06 (ii)
     Unit Hyd. Tpeak (min)=      20.00        40.00
     Unit Hyd. peak  (cms)=        .06          .03
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .71          .75           1.389 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.33          12.083
     RUNOFF VOLUME    (mm)=     121.24        84.73          97.514
     TOTAL RAINFALL   (mm)=     123.25       123.25         123.247
     RUNOFF COEFFICIENT   =        .98          .69            .791

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
------
001:0008----------------------------------------------------------------
------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(1011  )   |
| OUT<02:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .412  .6900E+00
                            .107  .2450E+00   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (1011  )      14.70     1.389    12.083     97.514
     OUTFLOW<02: (Pond-9)      14.70      .412    13.750     97.514

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   29.623
                   TIME SHIFT OF PEAK FLOW         (min)=   100.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6895E+00

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001:0009----------------------------------------------------------------
------
*#**********************************************************************
*******
*# Watercourse 9 - Catchment 92AA (Pond 9-2)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   54.00
| 01:92AA   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      27.00        27.00
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .50          .50
     Length            (m)=     491.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        51.57
                over (min)       10.00        25.00
     Storage Coeff.  (min)=      10.57 (ii)   24.51 (ii)
     Unit Hyd. Tpeak (min)=      10.00        25.00
     Unit Hyd. peak  (cms)=        .11          .05
                                                             *TOTALS*
     PEAK FLOW       (cms)=       2.75         3.14           5.809 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08          12.000
     RUNOFF VOLUME    (mm)=     121.25        77.26          92.655
     TOTAL RAINFALL   (mm)=     123.25       123.25         123.247
     RUNOFF COEFFICIENT   =        .98          .63            .752

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------
------
001:0010----------------------------------------------------------------
------
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(92AA  )   |
| OUT<02:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .231  .1136E+01
                            .035  .7950E+00   |     .942  .3055E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (92AA  )      54.00     5.809    12.000     92.655
     OUTFLOW<02: (Pond-9)      54.00      .942    14.000     92.653

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.215
                   TIME SHIFT OF PEAK FLOW         (min)=   120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3055E+01

------------------------------------------------------------------------
------
001:0011----------------------------------------------------------------
------
*#**********************************************************************
*******
*# Watercourse 9 - Catchment 92AB (Pond 9-3)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   23.10
| 01:92AB   DT= 5.00 |   Total Imp(%)=   50.00   Dir. Conn.(%)=   35.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      11.55        11.55
     Dep. Storage     (mm)=       2.00         5.00
```

```
     Average Slope     (%)=        .50          .50
     Length            (m)=     350.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        51.57
                over (min)      10.00        25.00
     Storage Coeff.  (min)=       8.62 (ii)   22.57 (ii)
     Unit Hyd. Tpeak (min)=      10.00        25.00
     Unit Hyd. peak  (cms)=        .12          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.18         1.37          2.523 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25        77.26         92.655
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .63           .752

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  75.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------
------
001:0012-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(92AB  )   |
| OUT<02:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .099  .4870E+00
                            .015  .3410E+00   |      .403  .1309E+01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (92AB  )      23.10     2.523    12.000     92.655
     OUTFLOW<02: (Pond-9)      23.10      .403    13.917     92.652

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.970
                   TIME SHIFT OF PEAK FLOW         (min)=   115.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1309E+01

-------------------------------------------------------------------------
------
001:0013-----------------------------------------------------------------
------
*#***********************************************************************
*******
*# Watercourse 9 - Catchment 96AB (Pond 9-4)
*#***********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   16.20
| 01:96AB   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      12.96         3.24
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .90          .90
     Length            (m)=     581.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       9.80 (ii)   20.66 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .11          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.70          .48          2.184 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.24        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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------
001:0014-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(96AB  )   |
| OUT<02:(Pond 9)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .151  .4530E+00
                            .023  .3170E+00   |      .582  .9980E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (96AB  )      16.20     2.184    12.000    111.597
     OUTFLOW<02: (Pond 9)      16.20      .582    13.083    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   26.640
                   TIME SHIFT OF PEAK FLOW         (min)=    65.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.9979E+00

-------------------------------------------------------------------------
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001:0015-----------------------------------------------------------------
------
*#***********************************************************************
*******
*# Watercoures 9 - Catchment 96AA+97AA (Pond 9-5)
*#***********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    8.30
| 01:96AA   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.64         1.66
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .90          .90
     Length            (m)=     421.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       8.08 (ii)   18.93 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .87          .25          1.125 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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------
001:0016-----------------------------------------------------------------
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----------------------
| CALIB STANDHYD     |   Area    (ha)=   16.50
| 02:97AA   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      13.20         3.30
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         1.00
     Length            (m)=     451.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)      10.00        20.00
     Storage Coeff.  (min)=       8.16 (ii)   18.67 (ii)
     Unit Hyd. Tpeak (min)=      10.00        20.00
     Unit Hyd. peak  (cms)=        .13          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.73          .50          2.239 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.598
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0017-----------------------------------------------------------------
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--------------------
| ADD HYD (Flow_P) | ID: NHYD     AREA     QPEAK   TPEAK   R.V.    DWF
--------------------              (ha)    (cms)   (hrs)   (mm)   (cms)
                 ID1 01:96AA       8.30    1.125   12.00 111.60    .000
                +ID2 02:97AA      16.50    2.239   12.00 111.60    .000
                 ====================================================
                 SUM 03:Flow_P    24.80    3.364   12.00 111.60    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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001:0018-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>03:(Flow_P)   |
| OUT<04:(Pond-9)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .245  .6000E+00
      *** WARNING: STORAGE-Q values were extrapolated.
                   Increase curve or use overflow option.

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >03: (Flow_P)      24.80     3.364    12.000    111.598
     OUTFLOW<04: (Pond-9)      24.80      .623    13.250    111.597

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.525
```

```
               TIME SHIFT OF PEAK FLOW         (min)=    75.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.1526E+01

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001:0019----------------------------------------------------------------
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*#**********************************************************************
*******
*#
*#                                 Watercourse 10
*#
*#**********************************************************************
*******
*#**********************************************************************
*******
*# Watercourse 10 - Catchment 101A (Pond 10-1)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   16.40
| 01:101A   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       13.12         3.28
     Dep. Storage     (mm)=        2.00         5.00
     Average Slope     (%)=         .90          .90
     Length            (m)=      452.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=       52.60        62.02
                over (min)        10.00        20.00
     Storage Coeff.  (min)=        8.43 (ii)   19.28 (ii)
     Unit Hyd. Tpeak (min)=       10.00        20.00
     Unit Hyd. peak  (cms)=         .12          .06
                                                             *TOTALS*
     PEAK FLOW       (cms)=        1.72          .50           2.221 (iii)
     TIME TO PEAK    (hrs)=       12.00        12.00          12.000
     RUNOFF VOLUME    (mm)=      121.25        86.78         111.598
     TOTAL RAINFALL   (mm)=      123.25       123.25         123.247
     RUNOFF COEFFICIENT   =         .98          .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0020----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(101A  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00   |     .798  .8040E+00
                            .208  .3580E+00   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (101A  )      16.40     2.221    12.000    111.598
     OUTFLOW<02: (Pond-1)      16.40      .797    12.500    111.597

               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   35.895
               TIME SHIFT OF PEAK FLOW         (min)=    30.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.8039E+00

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001:0021----------------------------------------------------------------
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*#**********************************************************************
*******
*# Watercourse 10 - Catchment 102A (Pond 10-2)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    9.60
| 01:102A   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        7.68         1.92
     Dep. Storage     (mm)=        2.00         5.00
     Average Slope     (%)=         .90          .90
     Length            (m)=      423.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=       52.60        62.02
                over (min)        10.00        20.00
     Storage Coeff.  (min)=        8.10 (ii)   18.96 (ii)
     Unit Hyd. Tpeak (min)=       10.00        20.00
     Unit Hyd. peak  (cms)=         .13          .06
                                                             *TOTALS*
     PEAK FLOW       (cms)=        1.01          .29           1.302 (iii)
     TIME TO PEAK    (hrs)=       12.00        12.00          12.000
     RUNOFF VOLUME    (mm)=      121.25        86.78         111.598
     TOTAL RAINFALL   (mm)=      123.25       123.25         123.247
     RUNOFF COEFFICIENT   =         .98          .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0022----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(102A  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00   |     .490  .4600E+00
                            .128  .2050E+00   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (102A  )       9.60     1.302    12.000    111.598
     OUTFLOW<02: (Pond-1)       9.60      .490    12.417    111.597

               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   37.616
               TIME SHIFT OF PEAK FLOW         (min)=    25.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.4598E+00

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001:0023----------------------------------------------------------------
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*#**********************************************************************
*******
*# Watercourse 10 - Catchment 103C (Pond 10-3)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    9.30
| 01:103C   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        7.44         1.86
     Dep. Storage     (mm)=        2.00         5.00
     Average Slope     (%)=         .70          .70
     Length            (m)=      478.00        40.00
     Mannings n          =        .013         .250

     Max.eff.Inten.(mm/hr)=       52.60        62.02
                over (min)        10.00        20.00
     Storage Coeff.  (min)=        9.40 (ii)   21.11 (ii)
     Unit Hyd. Tpeak (min)=       10.00        20.00
     Unit Hyd. peak  (cms)=         .12          .05
                                                             *TOTALS*
     PEAK FLOW       (cms)=         .98          .28           1.253 (iii)
     TIME TO PEAK    (hrs)=       12.00        12.08          12.000
     RUNOFF VOLUME    (mm)=      121.25        86.78         111.597
     TOTAL RAINFALL   (mm)=      123.25       123.25         123.247
     RUNOFF COEFFICIENT   =         .98          .70            .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0024----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(103C  )   |
| OUT<02:(Pond-1)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00   |     .489  .4360E+00
                            .127  .1950E+00   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (103C  )       9.30     1.253    12.000    111.597
     OUTFLOW<02: (Pond-1)       9.30      .488    12.417    111.597

               PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.968
               TIME SHIFT OF PEAK FLOW         (min)=    25.00
               MAXIMUM  STORAGE   USED       (ha.m.)=.4357E+00

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001:0025----------------------------------------------------------------
------
*#**********************************************************************
*******
*#
*#                                 Watercourse 7
*#
*#**********************************************************************
*******
*#**********************************************************************
*******
*# Watercourse 7 - Catchment 720AA (Pond 7-2-1)
*#**********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=   10.30
| 01:720AA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
```

```
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       8.24         2.06
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .80          .80
     Length            (m)=     340.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)       5.00        20.00
     Storage Coeff.  (min)=       7.36 (ii)   18.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .17          .06
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.08          .31          1.398 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0026-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(720AA )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .182  .2370E+00
                            .027  .1660E+00   |      .707  .4890E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (720AA )      10.30     1.398    12.000    111.597
     OUTFLOW<02: (Pond-7)      10.30      .706    12.250    111.597

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   50.496
                   TIME SHIFT OF PEAK FLOW         (min)=    15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4894E+00

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001:0027-----------------------------------------------------------------
------
*#***********************************************************************
*******
*# Watercourse 7 - Catchment 720AB (Pond 7-2-2)
*#***********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    4.80
| 01:720B   DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.84          .96
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .80          .80
     Length            (m)=     170.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.48
                over (min)       5.00        15.00
     Storage Coeff.  (min)=       4.86 (ii)   16.07 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .22          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .50          .15           .659 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.00         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0028-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(720B  )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .085  .1110E+00
                            .013  .7800E-01   |      .329  .2340E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (720B  )       4.80      .659    12.000    111.597
     OUTFLOW<02: (Pond-7)       4.80      .328    12.167    111.597
```

```
                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   49.748
                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2336E+00

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001:0029-----------------------------------------------------------------
------
*#***********************************************************************
*******
*# Watercourse 7 - Catchment 721AA (Pond 7-2-3)
*#***********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    4.30
| 01:721AA  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.44          .86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .30          .30
     Length            (m)=     213.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        61.52
                over (min)       5.00        25.00
     Storage Coeff.  (min)=       7.46 (ii)   22.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .17          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .45          .12           .574 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0030-----------------------------------------------------------------
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---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(721AA )   |
| OUT<02:(Pond-7)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |      .073  .9900E-01
                            .011  .6900E-01   |      .281  .2040E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (721AA )       4.30      .574    12.000    111.597
     OUTFLOW<02: (Pond-7)       4.30      .281    12.250    111.596

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   48.864
                   TIME SHIFT OF PEAK FLOW         (min)=    15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2039E+00

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001:0031-----------------------------------------------------------------
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*#***********************************************************************
*******
*# Watercourse 7 - Catchment 721AB (Pond 7-2-4)
*#***********************************************************************
*******
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.40
| 01:721AB  DT= 5.00 |   Total Imp(%)=   80.00   Dir. Conn.(%)=   72.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92          .48
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=        .30          .30
     Length            (m)=     149.00        40.00
     Mannings n          =       .013         .250

     Max.eff.Inten.(mm/hr)=      52.60        62.02
                over (min)       5.00        20.00
     Storage Coeff.  (min)=       6.02 (ii)   21.12 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .19          .05
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .25          .07           .324 (iii)
     TIME TO PEAK    (hrs)=      12.00        12.08         12.000
     RUNOFF VOLUME    (mm)=     121.25        86.78        111.597
     TOTAL RAINFALL   (mm)=     123.25       123.25        123.247
     RUNOFF COEFFICIENT   =        .98          .70           .905

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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001:0032-----------------------------------------------------------------
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| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>01:(721AB )   |
| OUT<02:(Pond-G)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .041  .5600E-01
                            .006  .3900E-01   |     .157  .1160E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (721AB )       2.40      .324    12.000    111.597
     OUTFLOW<02: (Pond-G)       2.40      .157    12.167    111.595

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   48.396
                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1160E+00

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001:0033-----------------------------------------------------------------
------
      FINISH
-------------------------------------------------------------------------
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*************************************************************************
******
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0018 ROUTE RESERVOIR
      *** WARNING: STORAGE-Q values were extrapolated.
                   Increase curve or use overflow option.
 001:0027 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2011-03-04     at 15:42:55
=========================================================================
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APPENDIX B

OPERATION, MAINTENANCE AND MONITORING CONSIDERATIONS FOR LID SOURCE CONTROLS AND ASSOCIATED LANDSCAPING

Adequate maintenance is essential to ensure the long-term achievement of stormwater management performance targets.

The following section sets out management and maintenance recommendations that are specific to the landscape components of stormwater management facilities. These guidelines are of particular important due to the shift away from conventional end-of-pipe stormwater management strategy to decentralized, landscape-based Low Impact Development Techniques. The inclusion of large quantities of plant material as functional components of the stormwater management facilities requires that special care be given to operation and maintenance before and after the City of Hamilton assumes them.

Management options

In general there are three maintenance approaches for on-site source controls (LIDs). They include:

> Approach 1: Private Owner Maintenance – private property owners are responsible for performing ongoing on-site stormwater facility maintenance with municipal guidance and oversight.
>
> Approach 2: Municipal Maintenance – the municipality is responsible for performing ongoing on-site stormwater facility maintenance.
>
> Approach 2: Hybrid – a combination of Approach 1 and 2

Table B.1 summarizes the requirements/ steps associated with each approach and the advantages and disadvantages to each.

Table B.1 Summary of possible maintenance approaches for on-site Source Controls

Maintenance Approach	Typical Requirements /Steps	Advantages and Disadvantages
1. Private Owner Maintenance	1. Develop/ adopt program documents 2. Mandatory maintenance plan for site plan approval 3. Develop homeowner outreach program and materials 4. Develop Inspection Procedures 5. Establish tracking system 6. Compliance enforcement procedures	Reduced costs to the municipality Municipality required to undertake steps 3-6 Policy and By-law revision required. See previous sections
2. Municipal Maintenance	1. Collect a detailed inventory of all on-site controls 2. Establish maintenance policies 3. Mandatory easement requirement for site plan approval (new development) 4. Train inspectors and approvals staff 5. Develop tracking system 6. Perform and document maintenance activities	High costs, extensive staffing requirements and administrative burden Avoidance of enforcement issues, and increased control over maintenance frequency
3. Hybrid	Combination of Approaches 1 and 2	Provides maximum flexibility Ability to shift 'some' (typically more frequent) maintenance to the landowner.

(CWP, 2008)

In developing the recommendations to guide the maintenance of the landscape components of stormwater management facilities, it must be recognized that the landscape is a living system that evolves in response to the environment and natural successional processes. Consequently, the maintenance program must be implemented with an understanding of the long-term evolution of the landscape and with a view to the desired state of the landscape in the future.

The following are the objectives that served as the basis for developing the landscape maintenance program:

- promote the succession of naturally occurring species and associations;
- support the process of natural succession;
- manage for the control of non-native invasive or undesirable species;
- manage to ensure public safety with respect to preservation of sightlines, removal of hazards and control of noxious species; and

- ensure that the primary stormwater management function of the facility is achieved.

Maintenance Requirements and Recommendations

The landscape maintenance program is required to be initiated by the proponent upon completion of construction of the stormwater management facility until the expiration of the warranty period.

Landscape Maintenance Program

- The developer or his/her agent is required to maintain the stormwater management facility until the time of assumption by the City of Hamilton.

The following describes the recommended maintenance program required to be implemented until the facility is assumed by the municipality of Hamilton :

A. Routine Inspection

After every major storm event to ensure stability and function of the facility (approximately 4 times annually)

B. Litter Removal

Remove all litter from the site on a monthly basis during the period from March to December.

C. Vegetation Communities

Tree and Shrub Maintenance

i. Adjust stakes and guys to prevent girdling.
ii. Ensure rodent protection remains in contact with the ground.
iii. Prune out any dead or damaged limbs.
iv. Water trees as required to maintain health in consideration of meteorological, soil and site conditions as well as species requirements.
v. Top of mulch to ensure soil moisture is maintained

Seeded Area Maintenance

i. Monitor after initial seeding to ensure that adequate cover density has been achieved.
ii. Overseed as required to eliminate bare patches.
iii. Repair and reseed any rills or gullies that may form during the grow-in period.
iv. Remove weeds that may have become established during the germination and grow-in periods.
v. Monitor to ensure that established species correspond with specified seed mix species composition. Overseed as required to achieve specified composition and distribution.
vi. For areas designed to be maintained, mow to maintain a height of 60-75mm.
vii. Irrigate seeded areas as required to ensure germination and establishment.

Shrubs and Shrub Bed Maintenance

i. Prune out dead or damaged branches.
ii. Remove weeds from mulched beds.
iii. Water shrubs as required to ensure healthy growth in consideration of soil, meteorological and site conditions as well as species requirements.

D. <u>Other Landscape Components</u>

i. Rock works and natural stone flow control structures and spillways:
   a. Overseed as required ensuring that adequate vegetation cover is established in the voids between the stone.
   b. Adjust grades if required to achieve specified water levels.

ii. Fences, Signage and Furnishings
   a. Inspect and repair as required. Repair activities are to include the following as necessary:
      - removal of graffiti;
      - touch up painting;
      - replacement or tightening of loose hardware; and
      - ensuring all elements are securely anchored.

The Maintenance Program should include inspections of the stormwater management facility site on a routine basis to monitor the health of the plant community and the rate of establishment of seed as well as to determine the amount of weed establishment to implement maintenance actions.

Assumption of SWMF Landscaping

After verification and recommendation for assumption of stormwater management structural components and functional performance by the Public Works Department, the assumption of the stormwater management landscape components may proceed. To initiate the landscape assumption process, the project landscape architect will issue a completion notification certificate to the municipality. Upon receipt, a site inspection will be conducted by the Municipality to verify that the landscaping has been installed in conformity with the approved site and landscape plans. Any deficiencies found will be recorded in the municipality's inspection report and forwarded to the project landscape architect. Upon notification from same that the deficiencies have been rectified, the municipality will conduct a final inspection, notify the finance department that the project is complete and assume responsibility for the routine maintenance of the facility. Final landscaping inspections may only be scheduled between June 1 and September 30 to ensure that vegetation can be inspected when it is in leaf. The following conditions must be met prior to City assumption:

Trees

a. All trees must be in a healthy growing condition based upon the following:
   – well-developed, full crown;
   – no evidence of disease or stress including defoliation, loss of limbs, discolouration, spotting or perforation of leaves or bark damage; and
   – no evidence of frost cracking or structural damage to the trunk.
b. Limbs pruned as required for form or to remove any dead limbs.
c. All trees stakes and guys removed.
d. Mulch (where required) in place to the specified depth.
e. Rodent guards are installed on all trees as necessary.

Shrubs

a. Shrubs are in a healthy growing condition.
b. Mulch (where required) in place to the specified depth.
c. Shrubs are pruned as required to remove any dead branches.

Perennials & Aquatics

a. Exhibit satisfactory growth and root development.
b. Mulch (if required) in place to the specified depth.

Seeded Areas

a. All seeded areas must exhibit continuous cover.
b. Seeded areas must be comprised predominantly of the species specified.
c. Free from noxious weeds as specified in Municipality's By-laws.

Trails & Maintenance Access Routes

a. Trails and maintenance access routes must be free draining and free of ruts and rills.
b. Trails and maintenance access routes must be compacted in accordance with the specifications.

Downstream Receiving Watercourse Erosion Mitigation Contingency Plan

a. Components of the plan implemented as required to mitigate erosion and ensure the stability of the downstream watercourse within the zone of influence.

Structures & Amenities

a. Signs, structures and other components of the landscape of the stormwater management facility must be in good condition and anchored in accordance with the specifications.
b. All maintenance information or operation manuals must be submitted to the municipality of Caledon.

Landscape Monitoring Program

With respect to the landscape components of stormwater management facilities, the monitoring program is focused on gauging the sustainability, performance and evolution of the vegetation community to identify remedial maintenance activities that may be required. A description of the recommended monitoring program is provided in the following section.

Table B.2: Vegetation Community Monitoring Program

Vegetation Community	Description	Frequency
Trees and Shrubs	Visual inspection to identify dieback, stress or presence of disease.	Biannually: i. Spring - after leaf out ii. Fall - after leaf drop
Aquatic Vegetation	Visual inspection to confirm desired species composition.	Annually: i. Midsummer
Groundcover	Visual inspection to confirm adequate	Biannually: i. Spring - after leaf out ii. Fall - after leaf drop
Presence of Noxious Weeds/ Invasives	Visual inspection to identify undesirable species and requirements for control	Biannually: i. Midsummer and early fall

Table B.3: Landscape Elements Monitoring Program

Landscape Element	Description	Frequency
Riverstone Weirs and Spillways	Visual inspection to identify displacement or erosion.	Biannually: i. Spring ii. Fall
Fieldstone Revetments	Visual inspection to identify displacement or erosion.	Biannually: i. Spring ii. Fall
Trails and Maintenance Access	Visual inspection to identify erosion. Routes	Biannually: i. Spring ii. Fall

The above monitoring program should also include the compilation of a photographic inventory of the site. Photographs should be taken twice yearly corresponding with the spring and fall monitoring sessions. Each photograph should be annotated with a description of the subject matter. The photo inventory package should be bound with a key map and CD of the digital photographs. This documentation should form part of the monitoring report for the site that will be submitted to the Municipality as a condition of assumption of the facility.

Operation and Maintenance requirements for LID techniques

The purpose of this section is to outline the maintenance requirements for the various LID techniques.

Maintenance requirements for most LID technologies have little difference from most turf, landscaped, or natural areas and do not typically require new or specialized equipment (EPA, 2007). However, LID techniques are green 'infrastructure' and do therefore provide a necessary function in communities. The relative importance of this function requires that maintenance personnel and inspectors are well versed in the design, intended function and maintenance requirements of each system. Just as contractor education is critical to ensure proper post-construction function, the education and training of the individuals servicing LID facilities is vital to their long continued operation. Table B.4 provides a summary of the maintenance requirements for the various LID measures.

Table B.4: Maintenance Requirements for Various LID Measures

LID Technique	**Maintenance Requirements**	**Notes:**
Rain Water Harvesting	Semi- annual inspection • gutters, downspouts and screens • patch mosquito screens • clean first flush system • replace damaged components	Vary according to use • Irrigation use has low maintenance • Indoor use has higher maintenance Winter use may increase maintenance requirements due to freezing
Green Roofs	Regular Maintenance • Irrigation (establishment only) • Leak detection Ongoing Maintenance (2x/yr) • Weeding / Debris removal	Maintenance is greatest in first 2 yrs of operation
Downspout Disconnection	No greater than other lawns or landscaped area	Area should be protected from compaction
Soakaway Pits	Regular Maintenance • Clean debris and litter • Annual inspection of stone drainage area	ensure that the stone fill is level to the ground surface and that the filter fabric has not become clogged.
Bioretention	Post Installation (1st 6 months) • Inspection after each storm >10mm or min. of twice • Irrigate until established (weekly for 1st yr and bi-weekly for 2nd year; as needed based on rainfall) Annual • Inspect each spring and events >60mm • Replace mulch as required Regular • Integration into existing landscape maintenance program (additional training required)	Legally binding agreements required for facilities on private property Lost plants should be re-planted to maintain desired plant density Core aerating or deep tilling may be required to alleviate clogging due to fines accumulation Additional trash and debris removal may be require due to high visibility (Special Bioretention areas)
Soil Amendments	No greater than other lawns or landscaped area	Area should be protected from compaction
Filter Strips	• Irrigate – 1st 2 years • Mowing operations should avoid compaction whenever possible • Remove invasive plants • Mulch in spring to maintain organic matter content where subject to road salts	Grass height of 150mm
Permeable Pavement	Bi- annually • Surface sweeping and/or Vacuuming Annual • Spring inspections to ensure continued infiltration performance	Heavy vehicles can compact debris into voids Snow removal plows should be raised 25mm, avoid aggregate use
Grass Channels	Municipal maintenance programs standards are well established.	Mowing operations should avoid compaction whenever possible. Grass height of 150mm
Dry Swales	Concerns revolve around maintenance of vegetation Post Installation (1st 6 months) • Inspection after each storm >10mm or min of twice Annual inspection of drainage feature	

(Source: TRCA, 2010)

APPENDIX C

2012 Breeding Bird Survey Report by Stantec Consulting Limited

REPORT ON FOUR AVIAN SPECIES AT RISK AND OTHER BREEDING BIRD SPECIES

Within Fruitland-Winona Secondary Plan Area, Scube Central, Scube East 'A' and Scube East 'B' Parcels

DRAFT COPY

Prepared for:

City of Hamilton.

Planning and Economic Development Department

Community Planning and Design Section

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Hamilton ON L8P 4Y5

Prepared by:

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Guelph, Ontario N1G 4P5

Stantec File 160950433

August 2012

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1.0 Introduction

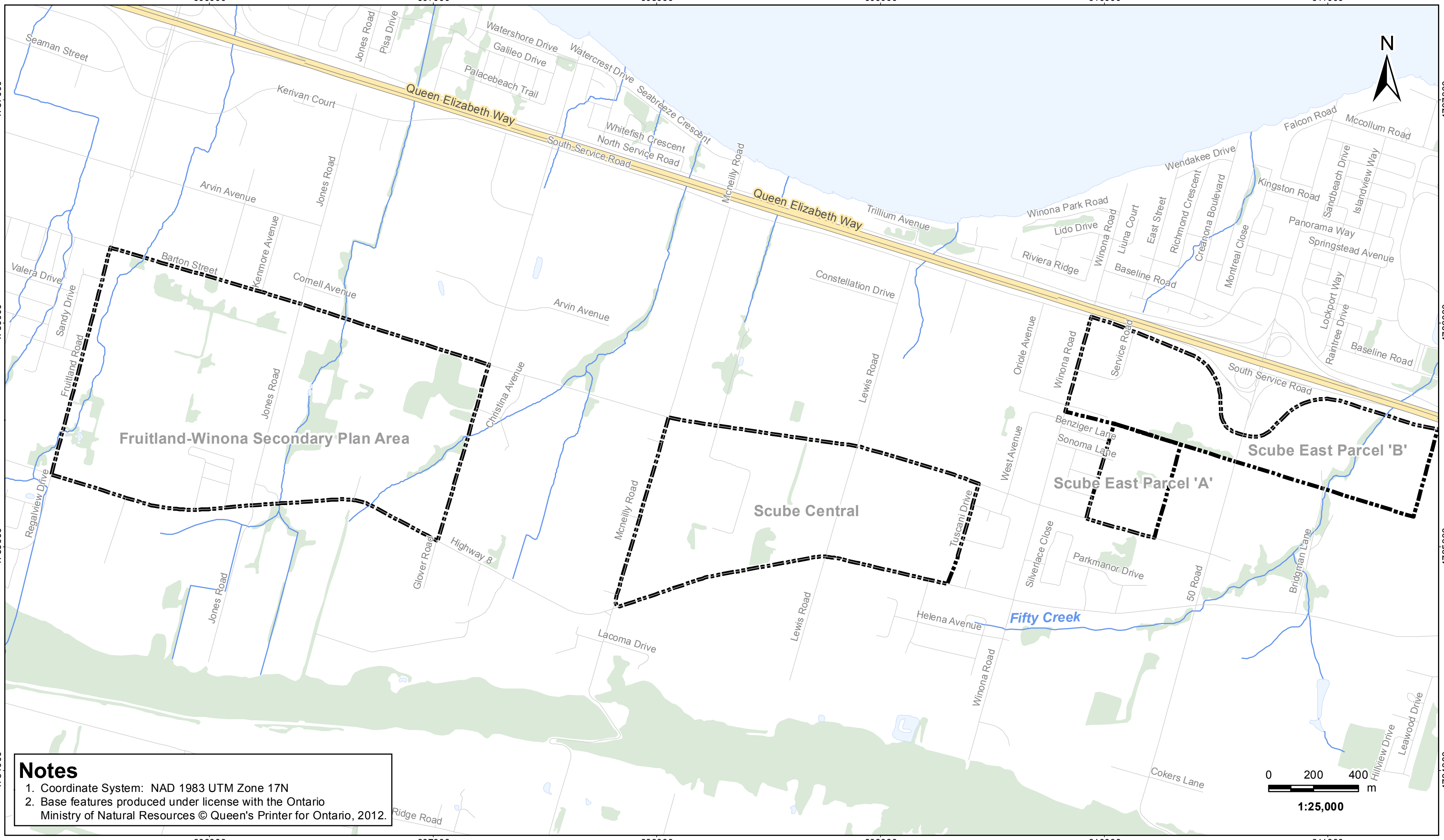
Stantec was retained by the City of Hamilton in 2012 to conduct avian Species at Risk (SAR) surveys and Breeding Bird Surveys within the Fruitland-Winona Secondary Plan Area (hereafter SPA) and the Scube Central, Scube East ‘A’ and Scube East ‘B’ parcels (hereafter Scube Parcels). The SPA and Scube Parcels are located in the east portion of the City of Hamilton and are generally bounded to the north by the Queen Elizabeth Way, to the west by Fruitland Road, to the south by Highway 8 and to the east by Fifty Road. A portion of the Scube East Parcel B extends easterly from Fifty Road approximately 1 kilometre so as to contain the channel of 50 Creek and additional lands east of the channel. The location of these parcels is shown in Figure 1.

SAR surveys were conducted for Bobolink (*Dolichonyx oryzivorus*), Eastern Meadowlark (*Sturnella magna*), Barn Swallow (*Hirundo rustica*) and Chimney Swift (*Chaetura pelagica*) as these species were considered to potentially occur and breed in the SPA and Scube Parcels (Karine Beriault, MNR Guelph District SAR Biologist). Each of these provincially threatened species typically nest and forage in human-altered habitats throughout much of eastern North America, including areas with a mix of rural and urban land use such as occur within the SPA and Scube Parcels. The Bobolink, Eastern Meadowlark and Barn Swallow typically nest and forage in agricultural habitats while Chimney Swift nests and forages over urban areas.

The purpose of these surveys was to determine whether particular avian SAR occur within the SPA and Scube Parcels and, to identify locations where avian SAR occur. Based on our findings, we were to make recommendations regarding areas, if any, which should be preserved for these avian SAR. General Breeding Bird Surveys were also conducted to identify breeding bird species within the SPA and Scube Parcels, whether SAR or non-SAR species. Findings of these surveys will be used to guide land use planning as part of the Fruitland-Winona Secondary Plan. Work performed was based on the Scope of Work provided by the City of Hamilton on April 3rd, 2012 and June 25th, 2012.

This report includes:

- Findings of avian SAR Surveys
- Maps of avian SAR Locations
- An evaluation of the habitat types in the study area in terms of their potential use by the following SAR: Bobolink, Eastern Meadowlark, Barn Swallow, and Chimney Swift;
- Recommendations regarding any potential areas for preservation of avian SAR habitat;
- Findings of Breeding Bird Surveys; and
- Field data sheets.



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Revised: 2012-08-30 By: searles

August 2012
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Stantec

Legend

- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

Client/Project

City of Hamilton
SAR Surveys

Figure No.

1

DRAFT

Title

Study Area

2.0 Current Land Use

The SPA and Scube Parcels have historically been rural areas where farming was the dominant land use. In the SPA, wheat is still farmed to the west of Jones Road and remnant fruit trees and vineyards are occasionally present throughout the remainder of the SPA. In the Scube Parcels, farming still occurs on the east side of Lewis Road.

An examination of aerial imagery reveals that buildings within the SPA and Scube Central Parcel are common and highly concentrated along roadways; fallow land and limited active agricultural land lies in the interiors of parcels. The majority of buildings present are residences, but business and municipal buildings also occur. In the Scube East 'A' and Scube East 'B' parcels, fallow land occupies almost all of the parcels and buildings are only rarely present along roadways.

In addition to widespread fallow land, the SPA and Scube Parcels include small woodlands, shrub thickets and wetlands. All forms of natural habitat within the SPA and Scube Parcels are small in area, fragmented and in pioneering or early stages of vegetation succession.

3.0 Methods

SAR Surveys for Chimney Swift, Barn Swallow, Eastern Meadowlark and Bobolink were carried out in the SPA and Scube Parcels using protocols recommended by the MNR and Bird Studies Canada when these had been developed; and, protocols of the Ontario Breeding Bird Atlas (OBBA) when specialized protocols do not exist.

Surveys for non-SAR birds were carried out in the SPA and Scube Parcels using protocols of the OBBA.

Survey methods for both SAR and non-SAR birds are described below.

3.1 CHIMNEY SWIFT

Chimney Swift is known to depend almost entirely on chimneys for nesting and roosting within southern Ontario. Therefore, assessment for this species focused on examining the suitability of chimneys for nesting and roosting using the Chimney Swift Monitoring Protocol (Bird Studies Canada, 2009) as well as making Chimney Swift observations.

The Chimney Swift Monitoring Protocol assesses the suitability of chimneys for Chimney Swift roosting/nesting based on their physical dimensions and the presence/absence of features which prevent Chimney Swifts from entering and leaving chimneys such as animal guards, spark protectors, terra cotta liners and metal liners. As buildings with potentially suitable chimneys were found within the Study Area only along the existing roadways, surveys consisted of stopping at 200 m intervals along all roadways where buildings occurred and determining the suitability of chimneys at these locations for Chimney Swift nesting and roosting. At each survey location, chimneys were observed for 15 minutes to allow opportunity to detect any Chimney Swifts using the chimney. Surveys for Chimney Swift were conducted throughout daylight hours as this species remains active throughout the day.

Using the 200 m intervals, and given the length of roadways present, 27 locations were surveyed within the SPA and 13 locations were surveyed within the Scube parcels. The lower number of locations within the Scube parcels is due to the lack of buildings in Scube East 'A' and Scube East 'B' parcels. Locations where chimneys were assessed for their suitability for Chimney Swift nesting are shown In Figure 2.

Chimney Swift surveys were conducted within the SPA on May 17th and 31st, 2012. Additional observations within the SPA were made June 25th, 2012 at two locations where Chimney Swift were encountered on May 31st. Surveys within the Scube Parcels occurred on June 26th, July 4th and July 12th, 2012.

In addition to the dedicated Chimney Swift survey, any Chimney Swifts encountered in all other surveys conducted including SAR Surveys for Barn Swallow, Bobolink and Eastern Meadowlark and surveys for non-SAR birds were also recorded.

3.2 BARN SWALLOW

No MNR-sanctioned survey method for Barn Swallows exists. Recognizing that it is standard practice in avian surveys to identify and record all species of birds heard or seen, it was decided to assess Barn Swallows simultaneously with other species during standard OBBA point counts. These point counts are of five minute duration and are conducted during early morning hours (5 AM to 10 AM) when bird activity is at a maximum.

Point count locations were chosen before fieldwork commenced through consideration of habitat as characterized by Aquafor Beech (2012). Locations were chosen to provide the best possible access to all habitats found within the study area. Selection of point count locations had to accommodate limited property access within the SPA and restriction to road ROWs within the Scube Parcels. The survey locations selected for Barn Swallows were considered to adequately cover available habitat since Barn Swallows are aerial foragers and are highly mobile and easily detectable. To increase the probability of detection, monitoring occurred 3 times spaced through the nesting season.

Seventeen point count locations were chosen within both the SPA and Scube Parcels (Figure 3). Point counts within the SPA included locations both on and off roadways. Point counts within the Scube Parcels were limited to road ROWs. Surveys at the point count locations took place on June 11th/12th, June 25th and July 10th 2012 within the SPA and on June 26th, July 4th and July 12th, 2012 within the Scube Parcels.

Barn Swallow nests were searched for under bridges spanning watercourses within the SPA and Scube Parcels because Barn Swallows often nest on the exposed beams of older bridges (Cadman et al. 2007). Aerial imagery and background documents identify that small watercourses cross under several roadways within the SPA and Scube Parcels including Barton, Highway 8, Fruitland Road and Glover Road in the SPA and the South Service Road in the Scube Parcels. Searches for Barn Swallow nests occurred at all locations where roads crossed watercourses.

Surveys for Barn Swallow nests took place at 7 watercourse locations within the SPA (Figure 3). These surveys took place on June 11th/12th, June 25th and July 10th 2012 within the SPA. Surveys for Barn Swallow nests took place at 2 watercourse locations within the Scube Parcels (Figure 3). Surveys within the Scube Parcels occurred on June 26th, July 4th and July 12th, 2012. Surveys for Barn Swallow nests took place throughout the day as any nests present would be visible at any time of the day.

Any incidental observations of Barn Swallows made during Chimney Swift, Bobolink and Eastern Meadowlark surveys were also recorded.

3.3 EASTERN MEADOWLARK

Surveys for Eastern Meadowlark used 10 minute point counts in areas of apparently suitable habitat as identified through prior studies (Aquafor Beech, 2012) and aerial imagery. The 10 minute period is suggested by the MNR and is probably sufficient given the species frequent and distinctive vocalizations and conspicuousness in the open habitats it frequents.

Areas of apparently suitable habitat for Eastern Meadowlark consist of forb meadow, fresh – moist mixed meadow habitats and other open habitats. Point count locations were selected within the SPA and Scube Parcels before fieldwork commenced, in areas where access had been granted and habitat appeared suitable. To improve probability of detection, monitoring occurred 3 times spaced through the nesting season.

Surveys within the SPA took place at 10 locations on June 11th/12th, June 25th and July 10th, 2012. An initial reconnaissance of the Scube Parcels for Eastern Meadowlark habitat found habitat to be limited such that only 1 location of apparently suitable habitat was selected for surveys. Surveys within the Scube Parcels occurred on June 26th, July 4th and July 12th, 2012. Because access to properties was not obtained for the Scube Parcels, this survey took place along the roadway adjacent to suitable habitat. Eastern Meadowlark survey locations are shown on Figure 4.

During general Breeding Bird Surveys and all other surveys, any additional Eastern Meadowlark sightings were recorded.

3.4 BOBOLINK

Bobolink was searched for simultaneously with Eastern Meadowlark at the same locations and dates. Therefore, surveys within the SPA took place at 10 locations on June 11th/12th, June 25th and July 10th, 2012 and within the Scube Parcels at 1 location on June 26th, July 4th and July 12th, 2012. Bobolink survey locations are shown on Figure 4.

During general Breeding Bird Surveys and all other surveys, any additional Bobolink sightings were recorded.

3.5 COMMON SPECIES

Surveys of non-SAR birds were conducted within the SPA and Scube Parcels using 5 minute point counts during which all species of birds heard or seen are identified and recorded. This 5 minute period is the standard recommended in the OBBA (Cadman et al. 2007). Surveys were conducted during early morning hours (5 AM to 10 AM) when bird activity is at a maximum.

Point count locations were chosen before fieldwork commenced through consideration of habitat as characterized by Aquafor Beech (2012). Locations were selected to to provide the best possible access to all habitats found within the study area. Selection of point count locations had to accommodate limited property access within the SPA and restriction to road ROWs within the Scube Parcels. This restriction on point count locations likely affected detection of some species within the Scube Parcels.

To improve probability of detection, monitoring occurred 3 times spaced through the nesting season. Seventeen point count locations were chosen within both the SPA and Scube Parcels (Figure 5). Point counts within the SPA included locations both on and off roadways. Point counts within the Scube Parcels were limited to road ROWs. Surveys at the point count locations took place on June 11th/12th, June 25th and July 10th 2012 within the SPA and on June 26th, July 4th and July 12th, 2012 within the Scube Parcels.

Any avian SAR observed during these surveys were recorded and are mapped and considered in this report.

4.0 Considerations for Species at Risk

This section presents relevant information on the biology of Chimney Swift, Barn Swallow, Eastern Meadowlark and Bobolink, evidence that declines have occurred in Ontario's populations and factors thought to be involved in their declines.

Evidence of declines is based primarily on the Ontario Breeding Bird Atlas (OBBA) and Breeding Bird Survey (BBS) as these two projects provide the most comprehensive information on Ontario's bird populations. The OBBA was conducted from 1981 to 1985 (Cadman et al.

1987) and again from 2001 to 2005 (Cadman et al. 2007), with over 121,000 hours and 152,000 hours of observations conducted in the first and second atlases respectively. The BBS has been conducted annually since 1966 across North America and Ontario and over 300 surveys have been conducted within Ontario (Sauer et al. 2011).

Factors thought to be involved in declines are those discussed in relevant COSEWIC and COSSARO reports.

4.1 CHIMNEY SWIFT

Chimney Swift can be thought of as having two components to its habitat: chimneys within which nesting, roosting and reproduction occur and air masses within which foraging takes place. Chimney Swift nest sites have been afforded general habitat protection through the ESA (MNR 2008).

Chimney Swift is an aerial forager of flying insects; a group or guild of bird species that includes swallows, martins, flycatchers, goatsuckers and others . Aerial foragers have experienced widespread population declines since about the 1980’s and these declines are suspected to be due, in part, to declining populations of flying insects (McCracken 2008). According to the BBS, the Canadian Chimney Swift population declined 7.8% annually between 1968 and 2005, resulting in a cumulative decline of 95% over that 37-year period (COSEWIC 2007). Similarly, data from the OBBA estimates that the probability of Chimney Swift detection declined by 46% in Ontario between 1981-1985 and 2001-2005. Data from the United States indicates that the species is declining there as well (COSEWIC 2007).

Chimney Swifts are believed to have declined only in part due to drops in flying insect populations. Major losses of nest and roost sites may be a more significant problem. Chimney Swifts are almost entirely dependent upon chimneys for nesting and roosting. Suitable chimneys are larger than 28.5 cm in diameter, offer protection against cold weather and include a rough inner surface of brick, cement, or tile permitting the attachment of nests. . Suitable chimneys also must be freely accessible to Chimney Swifts (Bird Studies Canada, 2009). In recent decades, older chimneys have been modified to improve safety by the addition of spark protectors, animal guards, metal liners and caps. These modifications inadvertently made chimneys inaccessible to Chimney Swifts (COSSARO, 2009; COSEWIC 2007). As well, since about 1960, homes have generally been built with chimneys too small for use by Chimney Swift.

As the dramatic reduction in suitable nesting and roosting sites appears to be a principal cause for declining populations of Chimney Swift, any effort to protect the species would need to focus on protecting remaining nest and roost sites.

4.2 BARN SWALLOW

Like the Chimney Swift, Barn Swallow habitat can be considered to consist of a nest site and foraging habitat. Nests are almost always built on human structures that provide a horizontal nesting surface such as barns, sheds, garages, bridges with exposed beams and road culverts.

Barns have historically been important breeding sites for Barn Swallow and unlike garages, shed and other structures where nest sites are more limited, barns typically support larger colonies of Barn Swallow (COSEWIC 2011a). Barn Swallows forage for flying insects over a variety of relatively open areas such as pastures, fallow land, and farmland of various descriptions, wetlands, road rights-of-way, large forest clearings, cottage areas, islands, sand dunes and lakeshores (COSEWIC 2011a).

Like Chimney Swift, Barn Swallows are aerial foragers and have experienced widespread population declines both within Ontario and across much of North America (COSSARO 2011a). The declines in Barn Swallow populations are likely due in part to reductions in flying insect populations (McCracken 2008). In Canada, long-term BBS data show a statistically significant decline of 3.6% per year between 1970 and 2009, which corresponds to an overall population decline of about 76% over the last 40 years (COSEWIC 2011a). In Ontario, the probability of detection for Barn Swallow declined by 35% between the first and second OBBA (Cadman et al. 2007).

Despite these declines, Barn Swallows remain quite widespread and common in southern Ontario (Cadman *et al.* 2007; COSEWIC 2011a). While it may seem contradictory that a species can be both “at risk” and relatively common and widespread, SAR classification within Ontario considers population trends and threats to a species as well as its current abundance and distribution. For Barn Swallow, classification as a provincially threatened species was made because the population decline is over the threshold level of 30% over the most recent 10-year period (COSSARO 2011a).

While declining populations of flying insects are likely partly responsible for declines in Barn Swallow populations, declines in the number of nest sites may also be involved as older-style wooden farm structures with easy access to nest sites are gradually replaced by modern buildings that lack easy access to suitable nesting sites (COSEWIC 2011a, COSSARO 2011a). Other factors responsible for declining populations are the replacement of grassland and pastures with row crops and urban land uses, use of pesticides, reduction in the fecundity of Barn Swallows and other factors (COSEWIC, 2011a).

4.3 EASTERN MEADOWLARK

The Eastern Meadowlark is most common in native grasslands, pastures and savannahs. It also uses other anthropogenic grassland habitats including hayfields, weedy meadows and grassy airfields. Eastern Meadowlarks occasionally nest in row crop fields such as corn and soybean, but these crops are considered low-quality habitat. Large tracts of grasslands are preferred over smaller fragments: the *Significant Wildlife Habitat Technical Guide* (MNR, 2000) states that 10 ha of suitable habitat are necessary for Eastern Meadowlark breeding. Vegetation structure is also important. Generally, optimal habitat contains moderately tall (25 to 50 cm) grass with abundant litter cover, a high proportion of grass, moderate to high forb density and low shrub and tree cover.

The Eastern Meadowlark is one of a number of grassland species which have shown widespread population declines (McCracken 2005). The Eastern Meadowlark has shown significant declines in Ontario and Canada. Long-term BBS data show a statistically significant population decline of 3.1% per year in Canada between 1970 and 2009, which corresponds to an overall decline of 71% over 40 years (Sauer et al. 2011). The OBBA shows a similar decline with Eastern Meadowlark detected 13% less frequently in Ontario and 16% less frequently in the Carolinian zone in the second Atlas compared to the first 20 years earlier.

Several factors appear to be involved in the species' declining populations. Habitat loss appears to be a primary factor as grasslands and pastures at the edges of urban areas or in marginal farming areas are abandoned and succeed to forest or shrub-dominated areas. Habitat is also lost when grasslands and pastures are converted to row crops or urban land uses. Other factors that may be involved in declining populations include: changes in farming practices, particularly earlier and more frequent haying that appears to significantly reduce nestling and adult survival; pesticide use; predation; Brown-headed Cowbird parasitism; climate change; and overgrazing by livestock (COSEWIC 2011b; COSSARO 2011b).

4.4 BOBOLINK

The Bobolink nests primarily in forage crops (e.g., hayfields and pastures), abandoned fields dominated by tall grasses and small-grain fields (COSEWIC 2010). In Ontario it was probably originally rare, but its range expanded with the arrival of Europeans and the conversion of forests to forage crops. The Bobolink is sensitive to habitat size; the MNR (2000) suggests that habitat should be at least 50 ha in size to support breeding.

Like Eastern Meadowlark, Bobolink is a grassland species. The Bobolink has significantly declined in Canada and Ontario. In Canada, long-term BBS data show a significant decline of 5.2% per year between 1968 and 2008, which corresponds to a population loss of 88% over the last 40 years (COSEWIC 2010). In Ontario, the OBBA showed a statistically significant decline in the probability of detection of 28% in Ontario and of 10% within the Carolinian zone between 1981-1985 and 2001-2005.

Changing farming practices and habitat loss appear to be the major factors involved in population declines. Haying is occurring earlier in the summer and frequently occurs before Bobolinks fledge. When fields with active nests are cut, mortality of young is 94% (COSEWIC 2010). The conversion of hayfields and pastures to row crops has also played a part in population declines as row crops are rarely used for nesting. Pastures have declined by 35% to 70% between 1981 and 2001 in different regions of Ontario (Cadman et al. 2007). Bobolink breeding habitat has also been lost as farmland near cities have been converted to urban land uses, and abandoned farmland has succeeded to forested or shrub-dominated habitat. Pesticide use on both breeding and wintering grounds, habitat fragmentation, overgrazing by livestock and climate change are also considered potential contributors to population declines (COSEWIC 2010; COSSARO 2010).

5.0 Results

The following reports findings of 2012 surveys for SAR based on all survey types and for non-SAR based on general Breeding Bird Surveys. All data sheets used to record observations are provided in Appendix C.

5.1 CHIMNEY SWIFT

Fruitland-Winona SPA

A significant effort was made to detect Chimney Swift and Chimney Swift accessible chimneys in the SPA. Surveys of chimneys took place at 27 locations on May 17th and 31st, 2012. Additional opportunity to detect Chimney Swifts occurred while conducting non-SAR bird surveys. Such surveys took place at 17 locations throughout the SPA on June 11th/12th, June 25th and July 10th, 2012. The total time spent searching for Chimney Swift within the SPA was approximately 30 hours.

Despite this considerable search effort, Chimney Swift was recorded at only 3 locations within the SPA. Birds observed appeared to be foraging only, flying well above chimneys present, making no effort to enter chimneys and flying over an extensive area. As Chimney Swifts are aerial foragers which fly for much of the day and wander widely from nest and roost sites, the limited observations suggest that the observed swifts nest and roost outside of the SPA but occasionally forage in the air mass above the SPA. Locations where Chimney Swift was encountered were in the vicinity of Highway 8 and are shown in Figure 6.

During surveys of chimneys, chimneys at 27 properties were assessed for suitability based on their dimensions and the presence or absence of safety features such as animal guards, spark protectors, metal liners, and terra cotta liners. At all chimneys examined, it was observed that chimneys were unsuitable for nesting or roosting due to various types of modifications to chimneys which prevent swifts from entering.

Based on the unsuitability of chimneys, the limited number of Chimney Swift sightings and the behaviour of those swifts observed, Chimney Swifts do not appear to nest or roost within the SPA.

Scube Parcels

A significant effort was also made to detect Chimney Swift and Chimney Swift accessible chimneys in the Scube parcels. Surveys of chimneys took place on June 26th, July 4th and 12th, 2012 using the Chimney Swift Monitoring Protocol at 13 locations. As with the SPA, additional opportunity to detect Chimney Swifts occurred while conducting non-SAR bird surveys which took place on June 26th, July 4th and July 12th, 2012 at 17 locations. Despite a search effort of approximately 10 hours during dedicated Chimney Swift surveys and an additional time of approximately 15 hours during general breeding bird surveys, Chimney Swift was not recorded within any of the Scube parcels during any component of fieldwork (Figure 6).

Chimneys were assessed for suitability for Chimney Swift nesting and roosting on June 26th, July 4th and 12th, 2012 using the Chimney Swift Monitoring Protocol at 13 locations. No chimneys were found which appeared suitable for use by Chimney Swift. Only Scube Central had a significant number of buildings with chimneys, but these chimneys all had modifications such as animal guards and metal liners which prevent Chimney Swift from entering the chimney. Chimneys were found to be almost entirely lacking in the Scube East ‘A’ and Scube East ‘B’ parcels due to buildings being only rarely present.

Based on the lack of Chimney Swift sightings and the unsuitability of chimneys, Chimney Swifts do not appear to nest or roost within the Scube Parcels.

5.2 BARN SWALLOW

Fruitland-Winona SPA

Barn Swallows are common and widespread within the SPA. They were observed at 17 locations and were encountered on surveys conducted May 17th and 31st, June 11th, 12th and 25th and July 10th, 2012. Birds were encountered on general Breeding Bird Surveys, Bobolink and Eastern Meadowlark surveys and Chimney Swift surveys. Surprisingly, no Barn Swallows or Barn Swallow nests were encountered at the seven watercourse crossing locations. Overall, the species was encountered with such frequency that it was one of the most widespread species in the SPA (Table 1). The locations of observed birds are shown in Figure 7. The abundance of Barn Swallow within the SPA may seem at odds with its status as a provincially threatened SAR but its provincial status is based on declining numbers (COSSARO 2011a) rather than rarity and our results are in accord with results of the second OBBA which showed it to be present in almost all parts of southern Ontario (Cadman et al. 2007).

Birds were observed to preferentially forage over cultural meadows, abandoned farmland, agricultural fields and mown lawns. These habitats are all herbaceous-dominated and consistent with descriptions of foraging habitat provided in COSEWIC (2011a). Field investigations and aerial photography show such herbaceous-dominated areas to dominate the majority of the SPA and the ubiquity of this type of habitat likely accounts for the abundance of the species within the SPA. When observed, Barn Swallows were found in small numbers (<10) rather than large concentrations.

During fieldwork it was observed that apparently suitable nest sites for Barn Swallow such as sheds and garages were common within the SPA. While these structures were not counted they may number several hundred. These apparently suitable structures are for the most part associated with private residences which are common along all roadways and not within the interior of land parcels. Field investigations also determined that barns which could support larger Barn Swallow colonies were not present within the SPA. Therefore it is expected that sheds, garages and other structures associated with private residences are the most frequently used and important structures for Barn Swallow nesting. Observations which would suggest nesting in these structures such as birds entering/leaving buildings were limited but did occur. Unlike barns which can support larger colonies (COSEWIC 2011a), individual sheds and garages within the SPA likely typically support only one or two pairs due to their relatively limited space.

Barn Swallow nests were specifically searched for at 7 locations where roadways within the SPA crossed watercourses (Figure 2). This specific effort was made because Barn Swallows frequently nest on the exposed horizontal beams that support many bridges. Barn Swallow nests were not observed at any of the 7 watercourse crossings and watercourses were found to be spanned by box culverts or corrugated steel pipes rather than bridges. The box culverts and corrugated steel pipes which span watercourses within the SPA do not provide Barn Swallow nesting opportunities due to the lack of horizontal structures upon which swallows could build nests, their relatively small height and width (1 to 2 metres) and the presence of vegetation at the ends of culverts which appears likely to obstruct Barn Swallows from entering.

Scube Parcels

Barn Swallows are common and widespread within the Scube parcels. They were observed at 14 locations within the Scube parcels distributed across all Scube Parcels. Barn Swallows were observed on surveys conducted June 26th, July 4th and July 12th, 2012 both during general Breeding Bird and dedicated Chimney Swift surveys. The locations of observed birds are shown in Figure 7 and the relevant data sheets are provided in Appendix B.

Birds observed were foraging over cultural meadows, abandoned farmland and mown lawns. Field investigations and aerial photography show such areas to dominate the majority of the Scube Parcels and the ubiquity of this type of habitat likely accounts for the abundance of the species within the Scube Parcels. When observed, Barn Swallows were found in small numbers (<10) rather than large concentrations.

Field investigations determined that apparently suitable nest sites such as sheds and garages were common within the Scube Central parcel and concentrated along existing roadways and not within the interior of land parcels. Scube East Parcel 'A' and Scube East Parcel 'B' had very limited number of garages, sheds and other potential nest sites within them. Field investigations also determined that barns which often support larger colonies in Ontario were not present within the Scube parcels.

Watercourse crossings which have the potential to allow Barn Swallow nesting under bridges were limited to a crossing of a creek along the South Service Road to the east of Fifty Road. No Barn Swallows or their nests were observed at this watercourse (Appendix B). Field investigations determined that this watercourse is spanned by a relatively large box culvert which does not provide nesting opportunities due to the lack of ledges upon which swallows could build nests, and the presence of vegetation at the ends of culverts which appeared to obstruct entrance to the culverts.

5.3 EASTERN MEADOWLARK

Fruitland-Winona SPA

A significant effort was made to detect Eastern Meadowlark in the SPA. Dedicated Eastern Meadowlark surveys took place at 10 locations with suitable habitat located throughout the SPA on June 11th/12th, June 25th and July 10th, 2012. General breeding bird surveys which can also detect Eastern Meadowlark took place at an additional 7 locations on June 11th/12th, June 25th and July 10th, 2012. The total time spent searching for Eastern Meadowlark within the SPA was approximately 15 hours.

Despite this significant search effort, Eastern Meadowlarks were not observed within the SPA during surveys dedicated to this species or during other fieldwork (Figure 8). The lack of observations occurred despite the conspicuous nature of the species and the observers' prior experience with the species. When present, the Eastern Meadowlark is easily detected as its breeding songs and calls are distinctive and its frequent flights above grasslands are conspicuous. The absence of sightings during our 2012 investigations provides good evidence that no Eastern Meadowlark breeding occurred this year within the SPA.

Habitat within the SPA appears unsuitable for Eastern Meadowlarks for two reasons. First, grassland habitats within the SPA are relatively small compared to the 10 ha value cited in the *Significant Wildlife Habitat Technical Guide* (MNR, 2000). Second, herbaceous vegetation appears to be denser, higher and composed of a high frequency of forbs relative to grasses compared to optimal habitat preferred by Eastern Meadowlarks (Zimmerman 1992; Bollinger 1995). Optimal habitat for Eastern Meadowlark is considered to consist of sparse, short, patchily-distributed, grass-dominated vegetation. Third, shrubs and tree saplings appear to be too frequent within abandoned farmland for Eastern Meadowlark. Shrub and tree cover values of 5% are considered optimal for Eastern Meadowlark habitat (COSEWIC 2011b) but shrub and tree cover within the SPA appeared to significantly exceed this value. As the shrub and tree saplings already present will likely increase in density and height, the suitability of the land for breeding by Eastern Meadowlark will only decrease in the future.

Scube Parcels

Search effort for Eastern Meadowlark within the Scube Parcels was considerable with searches occurring at 17 locations on June 26th, July 4th and July 12th, 2012. Despite a search effort of approximately 15 hours within the Scube parcels, Eastern Meadowlarks were detected at only three locations within the Scube parcels, all in the vicinity of Lewis Road (Figure 8). Birds were encountered at these sites only on the initial survey (June 26th) and appeared to be absent on subsequent surveys (July 4th and 12th) at the same locations. Due to its frequent vocalizations, Eastern Meadowlark is a fairly conspicuous species and the lack of sightings on July 4th and 12th suggests the species may have abandoned the sites between the first and subsequent surveys.

Habitat within the Scube parcels was compared to optimal Eastern Meadowlark habitat as described in COSEWIC (2011b**)** and the *Significant Wildlife Habitat Technical Guide* (MNR, 2000). To be suitable for occupancy, grassland habitat must be 10 ha or larger (MNR 2000). However, within the Scube parcels, hedgerows, shrubs and treed areas are frequent and appear to fragment grassland habitat into areas less than 10 ha in size. Second, optimal shrub and tree cover is considered to be 5% for Eastern Meadowlark (COSEWIC 2011b) but shrub and tree cover within herbaceous-dominated areas appears to exceed this value. Due to insufficient sizes and excessive woody cover, habitat for Eastern Meadowlark appears to be marginal within the Scube parcels.

5.4 BOBOLINK

Fruitland-Winona SPA

Despite three surveys conducted specifically to detect Bobolink at 10 point count locations and an additional three surveys conducted for breeding birds in general at 17 point count locations, Bobolinks were observed in only one part of the SPA. These sightings occurred between Fruitland and Jones Roads where a mixed meadow several hectares in size exists (Figure 8). During the June 11th, 2012 survey, 4 male and 1 female Bobolink were observed in a mixed meadow. Two males appeared agitated by the observer's presence and the female appeared paired with one of the males. These observations suggest that at this date, Bobolinks were attempting to breed within the area. During the second and third surveys conducted June 25th and July 10th, 2012, no Bobolinks were observed in the same area. Their absence at these later dates suggests the birds had abandoned the mixed meadow as it is unlikely that birds would have successfully bred and then dispersed from the area by these dates.

The area Bobolinks were observed within had earlier been identified as a fresh-moist mixed meadow (Aquafor Beech, 2012). Habitat within this area was compared to optimal Bobolink habitat as described in COSEWIC (2010) and the *Significant Wildlife Habitat Technical Manual* (MNR 2000). Optimal Bobolink habitat has a low frequency of shrub and tree cover within the dominant herbaceous vegetation (COSEWIC 2010). While conducting fieldwork, it was observed that the mixed meadow had inclusions of old hedgerows and stands of trees and shrubs and that the number of new saplings and shrubs was high, making the area unsuitable as Bobolink habitat. Further evidence of the unsuitability of the area for Bobolink is based on the area occupied. The *Significant Wildlife Habitat Technical Manual* states that 50 ha or more of habitat is required for occupancy by Bobolink. Within the SPA, the area occupied by Bobolink was estimated by creating a polygon from observation locations and determining the enclosed area. This area was determined by be 7 ha, far below the 50 ha value cited in the *Technical Manual*.

During the July 10th, 2012 survey, 2 male and one female/juvenile Bobolinks overflew the area. Based on their behaviour, these birds appeared to be post-breeding individuals moving through the area. Fall migration of this species begins in mid-to-late July, with adults and immature birds forming loose flocks close to the breeding grounds (COSEWIC, 2010).

Scube Parcels

Despite a search effort of approximately 15 hours which included three surveys for breeding birds in general at 17 locations and three surveys specifically for Bobolink at one location, no evidence that Bobolink breed within the Scube parcels was obtained. During surveys conducted June 26th and July 4th, Bobolink was not observed at any locations despite the conspicuous nature of this species with its frequent singing and flights over open grasslands. The absence of sightings provides good evidence that Bobolinks do not breed within the Scube Parcels.

On the July 12th survey, Bobolink was observed at one location (Figure 8). At this location, three Bobolinks were observed to overfly the area, moving in an easterly direction without stopping. Fall migration of this species begins in mid-to-late July, with adults and immature birds forming loose flocks close to the breeding grounds (COSEWIC, 2010). The three individuals observed overflying the Scube parcels were judged to be post-breeding birds engaged in this behavior.

As with the SPA, habitat within the Scube parcels was compared to optimal Bobolink habitat as described in COSEWIC (2010) and the *Significant Wildlife Habitat Technical Manual* (MNR 2000). Optimal Bobolink habitat has a low frequency of shrub and tree cover within the dominant herbaceous vegetation (COSEWIC 2010). While conducting fieldwork, it was observed that no land was being farmed and that fallow land was a mix of herbaceous meadows, thickets and early succession forest. As with the SPA, herbaceous dominated areas appeared to include a frequency of shrubs and saplings sufficiently high that these areas would be unsuitable for Bobolink. As well, no area of herbaceous-dominated vegetation was near in size to the 50 ha value cited in The *Significant Wildlife Habitat Technical Manual* (MNR 2000). It was also noted during fieldwork that some portions of the Scube parcels are being developed for residences.

Our observations that much of the Scube parcels are succeeding to tree and shrub-dominated communities or are being developed for residences, coupled with the lack of breeding evidence, strongly suggests that the Scube parcels lack breeding Bobolink and that the species will continue to be absent from the area.

5.5 COMMON NIGHTHAWK

Common Nighthawk (*Chordeiles minor*) has been designated as a species of Special Concern on the SARO list and when observed is often within urban areas (Cadman et al. 2007). Surveys for this species were not included within the work plan but one individual was observed during the Chimney Swift chimney assessment carried out May 31st. The individual observed was flying about 100 m above the ground in an erratic manner and appeared to be foraging in the way characteristic of its species. No behavior was observed which would suggest nesting. As a species of special concern, the Common Nighthawk and its habitat are not protected through the ESA (2007).

5.6 COMMON SPECIES

The following section reports findings of 2012 general Breeding Bird Surveys with respect to all species of breeding birds including SAR. SAR results are discussed in more detail in Sections 5.1 through 5.5.

Fruitland-Winona SPA

A total of 44 species were encountered within the SPA. These species are listed in Table 1 (Appendix B) from the most frequently encountered to least frequently encountered species. Of the 44 species encountered, 26 are considered to be common and widespread within Ontario (S5 rank), 14 are considered uncommon but not rare within Ontario (S4 rank) and 2 species are not native to Ontario.

Species observed are adaptive to a wide variety of habitat and capable of using small, fragmented areas of suitable habitat. Examples of such species include American Robin (*Turdus migratorius*), Song Sparrow (*Melospiza melodia*), Northern Cardinal (*Cardinalis cardinalis*), American Goldfinch (*Carduelis tristis*) and Brown-headed Cowbird (*Molothrus ater*). Each of these species was encountered at 10 or more locations within the SPA. Due to their abundance and widespread distributions within Ontario, these species are not considered of conservation concern. The provincially threatened Barn Swallow was also widespread (10 locations) and is discussed in Section 5.2.

The least frequent species were 11 species encountered at only 1 location. These species were Red-tailed Hawk, (*Buteo jamaicensis*), American Kestrel (*Falco sparverius*), American Woodcock (*Scolopax minor*), Black-billed Cuckoo (*Coccyzus erythropthalmus*), Downy Woodpecker (*Picoides pubescens*), Northern Flicker (*Colaptes auratus*), Alder Flycatcher (*Empidonax alnorum*), Warbling Vireo (*Vireo gilvus*), White-breasted Nuthatch (*Sitta carolinensis*), Brown Thrasher (*Toxostoma rufum*) and Swamp Sparrow (*Melospiza georgiana*). Although these species were only infrequently found within the SPA, they are still relatively common species within Ontario with wide distributions (S4 and S5 species) and are not of conservation concern.

Within the SPA, most species encountered have relatively stable populations. Thirty of 44 species encountered did not show any statistically significant change in numbers between the two OBBAs in the Carolinian zone (Table 1). Relatively stable species include most of the more widespread species such as Northern Cardinal, Song Sparrow, Gray Catbird and Brown-headed Cowbird and the Barn Swallow, which was reported as stable in the Carolinian zone, even though this species was reported as showing statistically significant declines in the province as a whole based on the OBBA work.

Statistically significant declines over the OBBA periods were reported in 11 of the 44 species encountered (Table 1). Declining species included four aerial insectivores, five grassland/shrub species, one wetland and one forest species.

Declines in aerial insectivores are possibly due to declines in aerial insects, pesticides use both on breeding grounds and wintering areas, loss of habitat and for Chimney Swift, loss of nesting and roosting sites (North American Bird Conservation Initiative Canada. 2012; Nebel *et al.* 2010). Declining aerial insectivores encountered within the SPA were Chimney Swift, Northern Rough-winged Swallow, Common Nighthawk and Eastern Kingbird.

Grassland and shrub dwelling species have shown widespread declines in much of North America (North American Bird Conservation Initiative Canada. 2012). The decline in grassland/shrub species appears to be due to: the loss of habitat as grasslands/shrub habitat is replaced by urban development near urban areas or reforested on marginal farmland; as pastures are replaced by row crops and hedgerows are removed; and through increases in pesticide and herbicide use (North American Bird Conservation Initiative Canada. 2012). Declining grassland/shrub species detected consisted of Field Sparrow, Bobolink, American Kestrel, Brown Thrasher and Eastern Kingbird, which is also considered a member of the aerial insectivores.

The wetland species encountered within the SPA which has shown declines within the Carolinian zone is the American Woodcock while the forest-dwelling species is the Northern Flicker.

Three species encountered within the SPA have had statistically significant population increases within the Carolinian zone; these species are House Finch, Cooper's Hawk and Black-capped Chickadee. The House Finch has shown a large population increase between 1981/85 and 2001/05. During this time period the species colonized southern Ontario after being introduced in New York state (Cadman et al. 2007). Cooper's Hawk has also increased greatly after adapting to urban landscapes (BirdLife International (2012). The Black-capped Chickadee population increase is much smaller but still statistically significant. Population increases are possibly due to an increase in the amount of forest habitat (North American Bird Conservation Initiative Canada. 2012).

Scube Parcels

A total of 45 species were encountered within the Scube parcels and these are listed in Table 2 (Appendix B) from the most frequently encountered to least frequently encountered species. Of species encountered, 24 are considered to be common and widespread within Ontario (S5 rank), 18 species are considered uncommon but not rare within Ontario (S4 rank) and 3 species are not native to Ontario.

As with the SPA, species were adaptive to a wide variety of habitat and capable of using small, fragmented areas of suitable habitat. The most widespread species were largely the same as within the SPA: American Robin, Northern Cardinal, Red-winged Blackbird (*Agelaius phoeniceus*), American Goldfinch, Song Sparrow and Brown-headed Cowbird were all encountered at 15 or more locations. These species are not considered of conservation concern.

The least frequently encountered species were 7 species encountered at 1 location: American Kestrel, Downy Woodpecker, Eastern Phoebe (*Sayornis phoebe*), Purple Martin (Progne subis), White-breasted Nuthatch (*Sitta carolinensis*), Indigo Bunting (*Passerina cyanea*) and Purple Finch (*Carpodacus purpureus*).

Barn Swallow, Eastern Meadowlark and Bobolink, all of which are provincially threatened, were all encountered within the Scube parcels. The Barn Swallow was observed at 14 locations (Figure 4) while the Eastern Meadowlark and Bobolink were observed at 3 and 1 locations respectively. These SAR are discussed in Sections 5.2 through 5.5.

The comparison of birds encountered in the Scube parcels and the list of increasing, decreasing and relatively stable species, based on the two OBBAs, yielded results similar to the SPA area. Of the 45 species encountered, 27 have shown relatively stable populations within the larger Carolinian zone between 1981/85 and 2001/05 (Table 2). Relatively stable species again include most of the species which are widespread in the Scube Parcels such as American Robin, Red-winged Blackbird, Mourning Dove, Song Sparrow and the Barn Swallow although this species has shown statistically significant declines in the province as a whole.

Statistically significant (<0.1) declines have occurred in 12 of the 45 species encountered within the Scube parcels (Table 1). Declining species included three aerial insectivores, six grassland/shrub species and three forest species. Declining aerial insectivores encountered within the Scube parcels were Northern Rough-winged Swallow, Eastern Kingbird and Purple Martin. Declines in aerial insectivores are possibly due to declines in aerial insects, pesticides use both on breeding grounds and wintering areas and loss of habitat (North American Bird Conservation Initiative Canada. 2012; Nebel *et al.* 2010).

Grassland/shrub species encountered within the Scube parcels which have declined significantly in the Carolinian zone are Eastern Meadowlark, Field Sparrow, Bobolink, Brown Thrasher, American Kestrel and Eastern Kingbird which is a shrub-dwelling species as well as an aerial insectivore.

Forest-dwelling species encountered within the Scube parcels which have declined significantly in the Carolinian zone are Northern Flicker, Indigo Bunting and Purple Finch.

One additional declining species was encountered whose habitat is difficult to categorize. This species, the Killdeer, typically forages and nests on lawns and bare soil.

6.0 Discussion

The following section evaluates habitat in the SPA and Scube Parcels in terms of their potential use by Bobolink, Eastern Meadowlark, Barn Swallow, Chimney Swift and common species. No areas are recommended for preservation for these species due to small or non-existent populations, poor quality habitat which appears to be further declining in value as breeding habitat, and for Barn Swallows, the lack of concentrated breeding or foraging areas.

6.1 CHIMNEY SWIFT

Fruitland-Winona SPA

No areas within the SPA are recommended for preservation as a means of preserving the provincially threatened Chimney Swift..

The primary reason for not protecting any portion of the SPA for Chimney Swift populations is that the species appears to be limited to occasional foraging within the air mass above the SPA. Nesting appears to occur somewhere outside of the SPA.

Secondly, it was observed that chimneys in the SPA were unsuitable for nesting or roosting by this species due to modifications to chimneys which increase safety but prevented Chimney Swift from entering.

Scube Parcels

No areas within the Scube Parcels are recommended for preservation as a means of preserving the provincially threatened Chimney Swift. The rationale for this conclusion is as follows.

Based on our 2012 surveys, the Chimney Swift does not appear to occur within the Scube Parcels (Figure 6).

Secondly, it was observed that chimneys in the Scube Parcels were unsuitable for nesting or roosting by this species due to the absence of chimneys in the Scube East 'A' and Scube East 'B' parcels, and the modifications to chimneys which had occurred in the Scube Central parcel.

6.2 BARN SWALLOW

Fruitland-Winona SPA

No areas within the SPA are recommended for preservation as a means of preserving the provincially threatened Barn Swallow. This conclusion is based on the lack of concentrated foraging and nesting areas for Barn Swallows. The absence of areas where Barn Swallows nest or forage in large numbers means that protecting specific areas would be ineffective in protecting a large proportion of birds currently present. In addition, because Barn Swallow populations appear to be falling in part due to declining numbers of flying insects, and because numbers of flying insects are expected to continue to fall (McCracken, 2008), retention of specific nest sites and/or foraging areas is not likely to prevent Barn Swallow numbers from falling within the SPA.

Scube Parcels

No areas within the Scube Parcels are recommended for preservation as a means of preserving the provincially threatened Barn Swallow. This conclusion is based on the lack of concentrated foraging and nesting areas for Barn Swallows. The absence of areas where Barn Swallows nest or forage in large numbers means that protecting specific areas would be ineffective in protecting a large proportion of birds currently present. In addition, because Barn Swallow populations appear to be falling in part due to declining numbers of flying insects, and because numbers of flying insects are expected to continue to fall (McCracken, 2008), retention of specific nest sites and/or foraging areas is not likely to prevent Barn Swallow numbers from falling within the Scube Parcels.

6.3 EASTERN MEADOWLARK

Fruitland-Winona SPA

No areas within the SPA are recommended for preservation as a means of preserving the provincially threatened Eastern Meadowlark.

The principal reason for not protecting land for Eastern Meadowlark within the SPA is that the species already appears to be absent. This conclusion is based on the findings of our 2012 surveys which did not detect Eastern Meadowlark within any part of the SPA (Figure 8).

A second reason for not protecting land for Eastern Meadowlark populations within the SPA is that habitat within the SPA appears to be unsuitable for Eastern Meadowlarks due to the insufficient size of grasslands present and excessive amounts of shrub and tree cover within grassland areas.

Succession of fallow land within the SPA from herbaceous-dominated to shrub and tree-dominated communities is widespread and has made the SPA unsuitable for Eastern Meadowlark breeding. This same process of succession is also occurring within marginal farmland across much of Ontario and North America and causing declining populations in these much larger areas (COSSARO 2011b).

Scube Parcels

No areas within the Scube Parcels are recommended for preservation as a means of preserving the provincially threatened Eastern Meadowlark.

The primary reason for not protecting land for Eastern Meadowlark populations within the Scube Parcels is that populations are small. This conclusion is based on our 2012 surveys which found only three individuals during approximately 15 hours of field investigations.

A second reason for not protecting land for Eastern Meadowlark populations within the Scube Parcels is that habitat within the Scube parcels appears to be unsuitable for Eastern Meadowlarks due to insufficient size and excessive woody cover.

The reforestation of fallow land within the Scube Parcels is reducing the suitability of habitat for Eastern Meadowlark. This same process is also occurring within marginal farmland across much of Ontario and North America and causing declining populations in these much larger areas (COSSARO 2011b).

6.4 BOBOLINK

Fruitland-Winona SPA

No areas within the SPA are recommended for preservation as a means of preserving the provincially threatened Bobolink.

The first reason for not protecting land for Bobolink populations within the SPA is that the Bobolink population is already small and likely declining.

The second reason for not protecting land for Bobolink populations within the SPA is that Bobolink habitat within the SPA is of marginal and decreasing value to Bobolinks due to insufficient area and the high frequency of shrub and sapling growth. Within several years, this growth in the amount of woody vegetation will likely result in the disappearance of Bobolink as a breeding species from the SPA.

The succession of abandoned farmland from herbaceous-dominated to shrub and tree-dominated communities which is occurring within the SPA is an example of the larger scale succession of abandoned farmland across Ontario and much of North America which is considered to be a major factor in the species' decline within Ontario and much of North America (COSSARO 2010).

Scube Parcels

No areas within the Scube Parcels are recommended for preservation as a means of preserving the provincially threatened Bobolink..

The first reason for not protecting land for Bobolink populations within the Scube Parcels is that a breeding population within these parcels already appears to be absent. This conclusion is based on the findings of our 2012 surveys

The second reason for not protecting land for Bobolink populations within the Scube Parcels is that habitat within the Scube parcels already appears to be unsuitable for Bobolinks due to the insufficient size of habitats and the high and increasing frequency of shrub and tree cover.

6.5 COMMON SPECIES

Fruitland-Winona SPA

Forty-four species of birds were encountered within the SPA and these included four Species at Risk (Chimney Swift, Barn Swallow, Common Nighthawk and Bobolink) (Table 1). Most species encountered likely breed within the SPA and are common, widespread species within Ontario (S5), are uncommon but not rare within Ontario (S4) or are non-native species to Ontario (SNA). The majority of species are widespread because they commonly nest and forage in small and fragmented areas of suitable habitat such as occurs within the studied areas.

No portions of the SPA are recommended for preservation to protect common bird species found within them. This is because most common species present have stable numbers, are widespread within Ontario and adaptive to human development to the extent that that they will continue to occur in developed areas, using planted trees and shrubs for nesting. Examples of such species include American Robin, Chipping Sparrow and American Goldfinch. Additional common species found within the SPA are declining in the larger Carolinian zone but preservation of habitat for these species within the SPA is not recommended due to the ineffectiveness of habitat protection in a small portion of these species' ranges to reverse declining populations at much larger scales. For example, Field Sparrow, Eastern Kingbird, Northern Rough-winged Swallow and American Woodcock are all declining in the Carolinian zone, but protecting the limited habitat for these species found within the SPA will not effectively reverse population declines throughout the Carolinian zone. Other species which currently occur such as Willow Flycatcher, Savannah Sparrow and Northern Flicker are expected to disappear from the SPA as a result of development, but their expected disappearance is not considered sufficient cause to preserve the area as they are widespread within Ontario and not considered to be of conservation concern. Area-sensitive species of forest, grassland and wetland are often of conservation concern in areas with extensive development such as occurs within the SPA and Scube Parcels because suitable large areas of forest, grassland and wetland are infrequent in such areas. Within the SPA, 3 of 44 species found (Bobolink, Cooper's Hawk and White-breasted Nuthatch) are considered to be area-sensitive species. Based on the fragmented nature of habitat within the SPA, it cannot be considered important habitat for area-sensitive species.

Scube Parcels

Forty-five species of birds were encountered within the Scube Parcels including three Species at Risk (Barn Swallow, Bobolink and Eastern Meadowlark) (Table 2). All species encountered likely breed within the Scube Parcels and are common, widespread species within Ontario (S5), are uncommon but not rare within Ontario (S4) or are non-native species to Ontario (SNA). The majority of species are widespread because they commonly nest and forage in small and fragmented areas of suitable habitat such as occurs within the studied areas.

No portions of the Scube Parcels are recommended for preservation to protect common bird species found within them. This is because most species present are common and widespread within Ontario and are adaptive to human development such that many will continue to occur in developed areas, using planted trees and shrubs for nesting. As with the SPA, additional common species found within the Scube Parcels are declining in the larger Carolinian zone but preservation of habitat for these species within the Scube parcels is not recommended due to the ineffectiveness of habitat protection in a small portion of these species' ranges to reverse declining populations at much larger scales. For example, Field Sparrow, Eastern Kingbird, Northern Rough-winged Swallow and American Woodcock are all declining in the Carolinian zone, but protecting habitat for these species within the Scube parcels will not effectively reverse population declines throughout the Carolinian zone. With development, some species are expected to disappear such as Willow Flycatcher, Gray Catbird and Savannah Sparrow however these species are not considered to be of conservation concern. Area-sensitive species of forest, grassland and wetland were limited to 3 of 45 species (Bobolink, Eastern Meadowlark and White-breasted Nuthatch) detected within the Scube Parcels. Based on the fragmented nature of habitat within the Scube Parcels, it cannot be considered important habitat for area-sensitive species.

7.0 References

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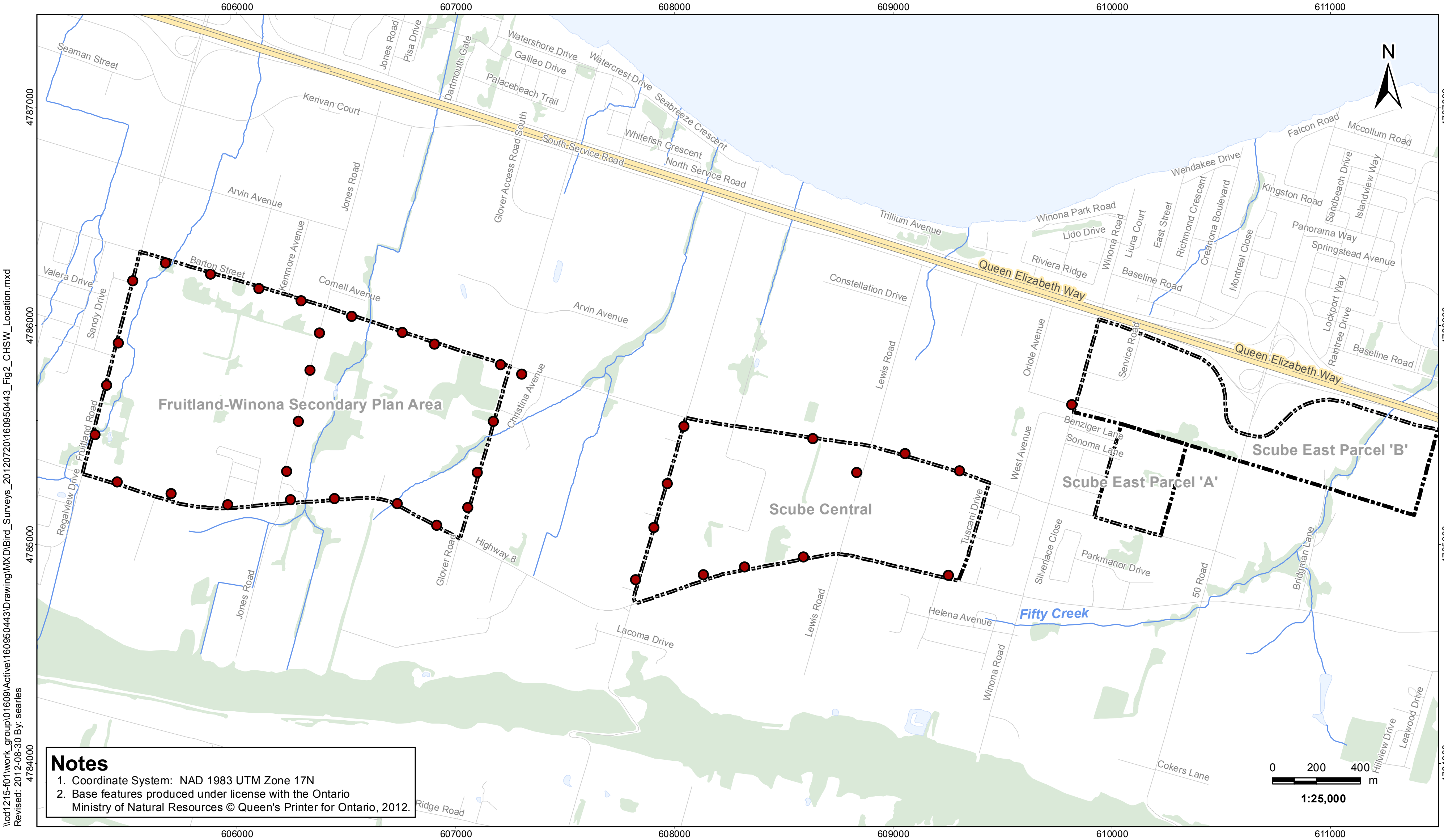
APPENDIX A:
Figures



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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August 2012
160950443

Stantec

Legend

- Chimney Swift Survey Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

Client/Project

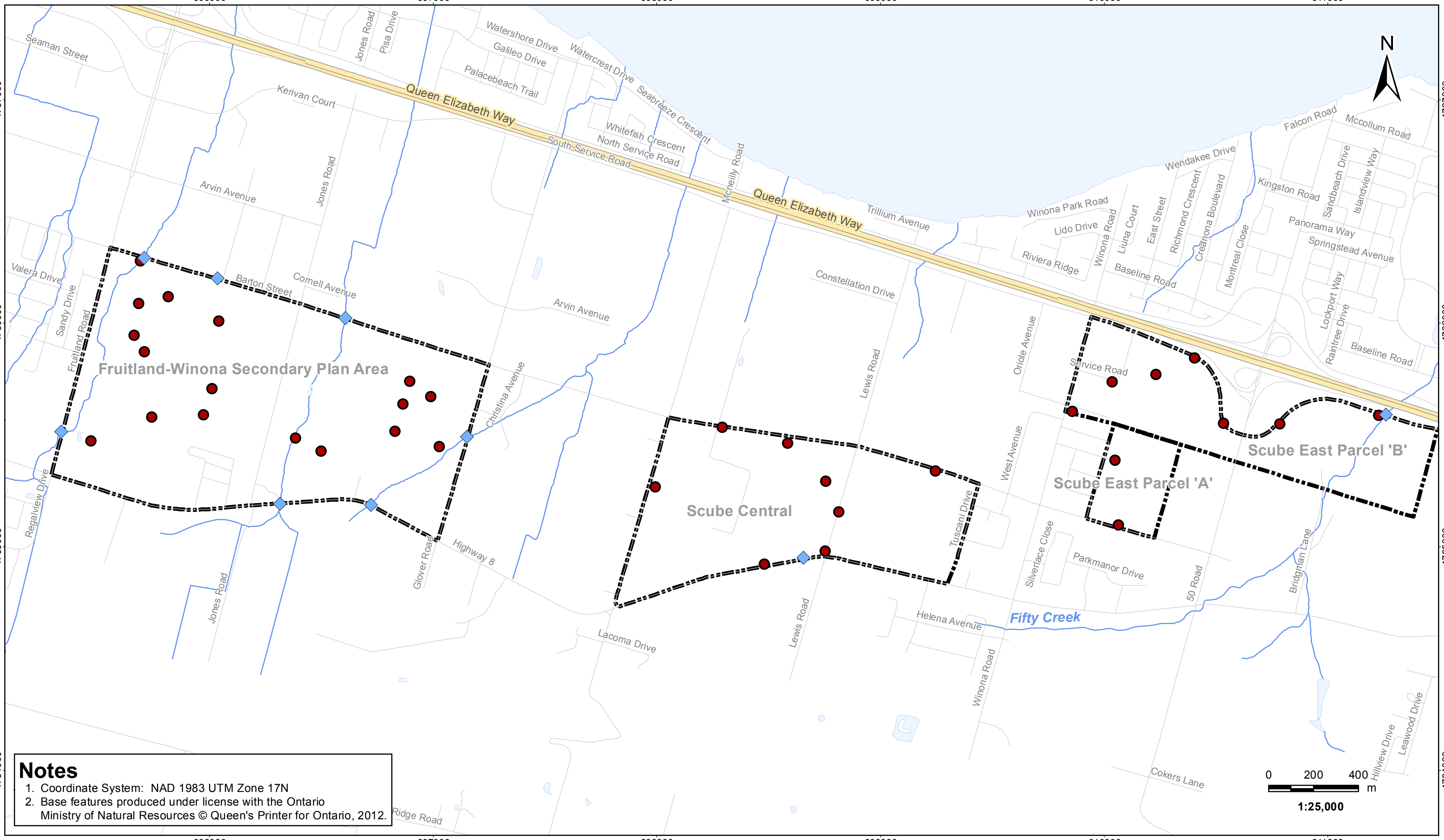
City of Hamilton
SAR Surveys

Figure No.
2

DRAFT

Title

Chimney Swift Survey Location



Notes
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\\cd1215-f01\work_group\01609\Active\160950443\Drawing\MXD\Bird_Surveys_20120720\160950443_Fig3_BARS_Location.mxd
Revised: 2012-08-30 By: searles

August 2012
160950443

Stantec

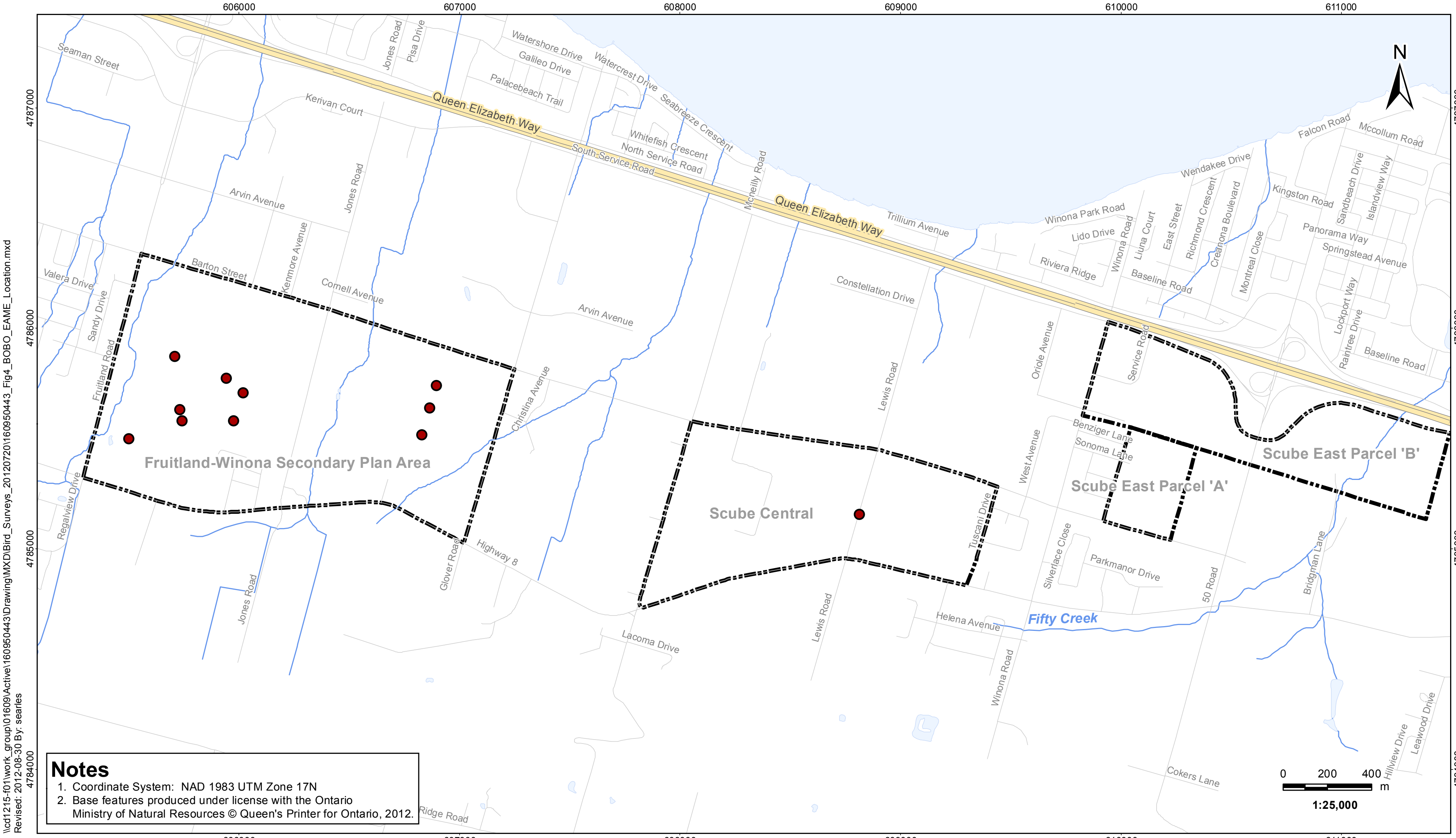
Legend
- Barn Swallow Survey Location
- Barn Swallow Nest Search Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody

Client/Project
City of Hamilton
SAR Surveys

Figure No.
3

DRAFT

Title
Barn Swallow Survey Location



Notes

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160950443

Stantec

Legend

- Bobolink/Eastern Meadowlark Survey Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody

Client/Project

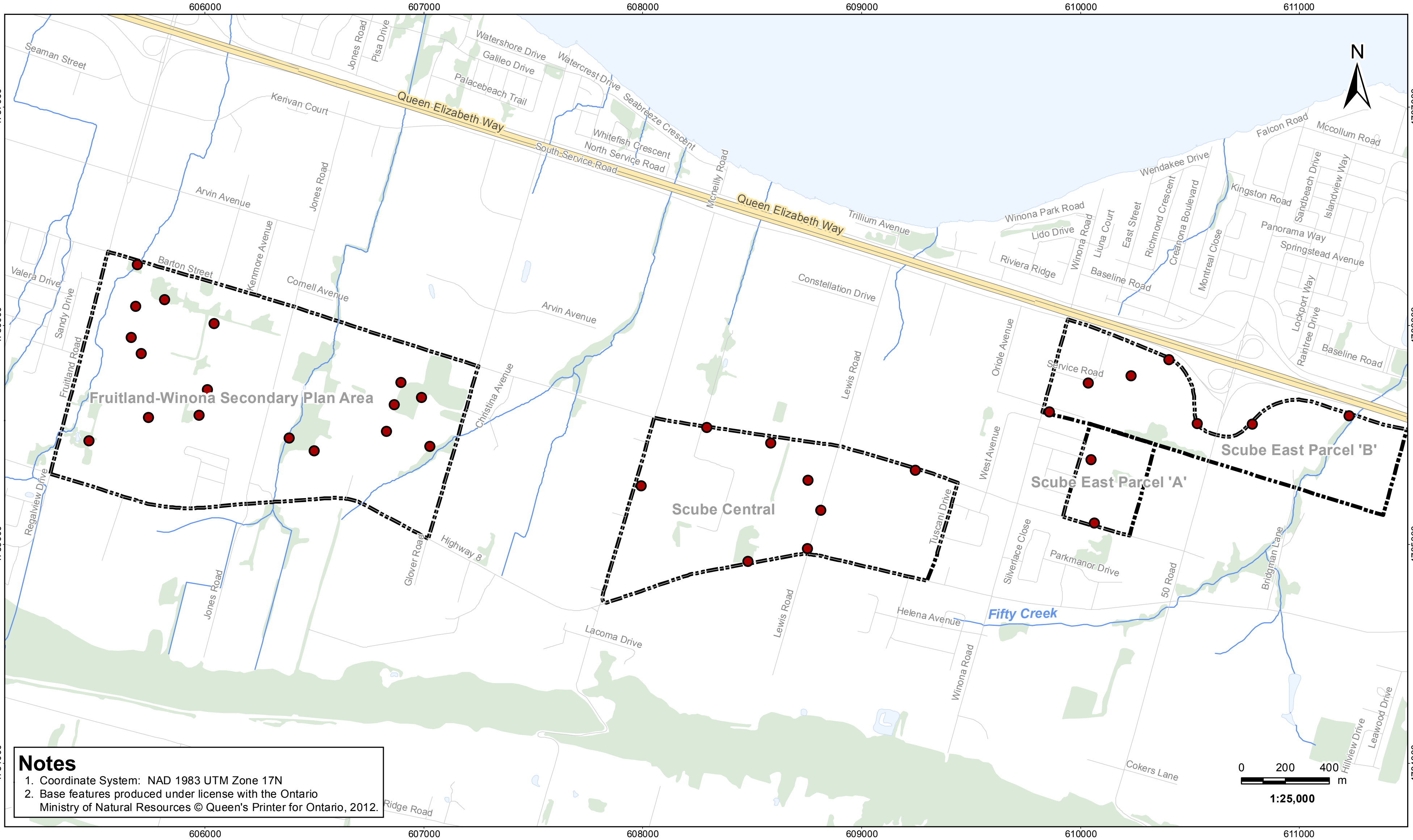
City of Hamilton
SAR Surveys

Figure No.
4

DRAFT

Title

Bobolink & Eastern Meadowlark Survey Location



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Revised: 2012-08-30 By: searles

August 2012
160950443

Stantec

Legend

- Breeding Bird Survey Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

Client/Project

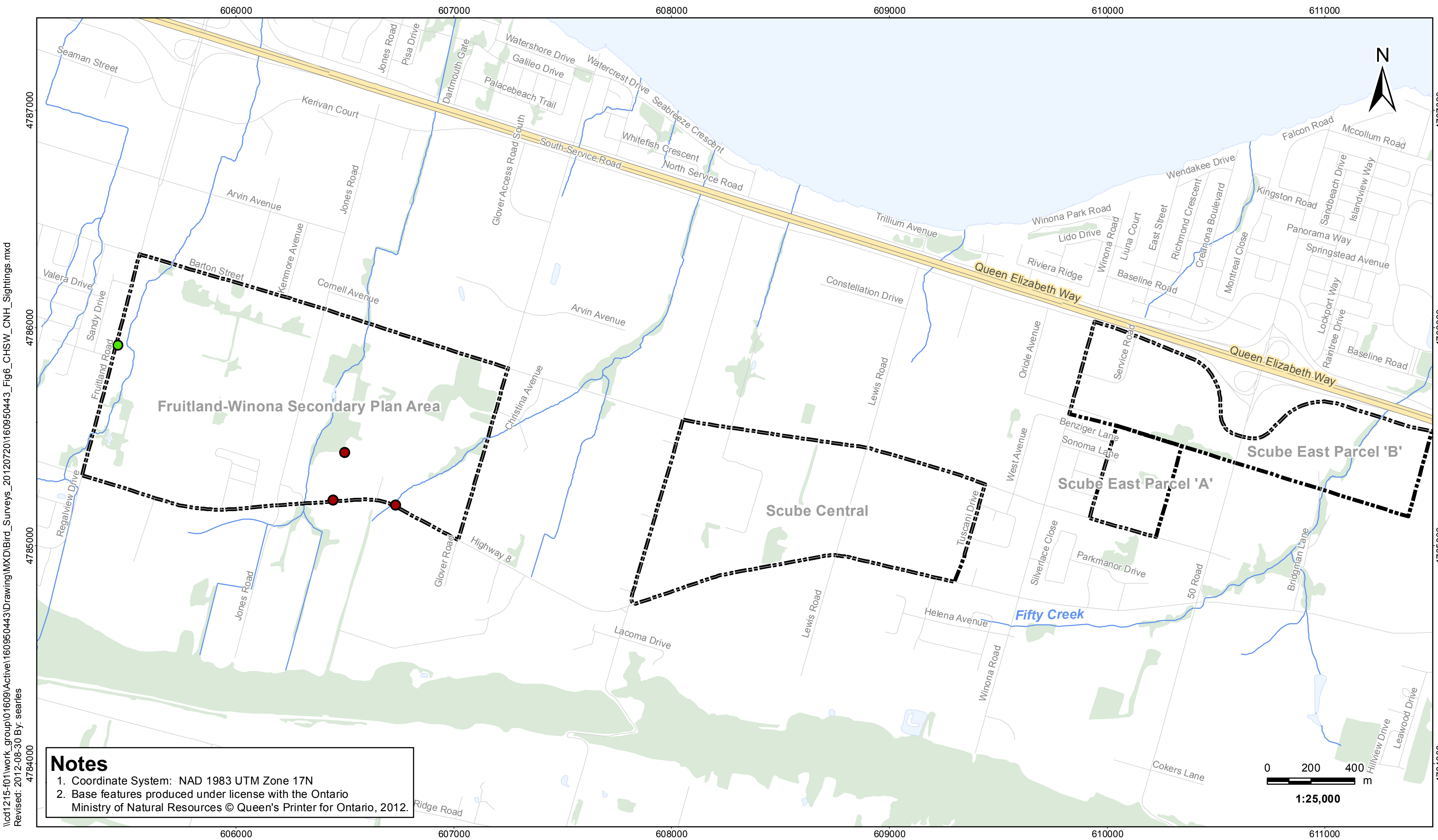
City of Hamilton
SAR Surveys

Figure No.
5

DRAFT

Title

Breeding Bird Survey Locations



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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160950443

Stantec

Legend

- Common Nighthawk Sighting Location
- Chimney Swift Sighting Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

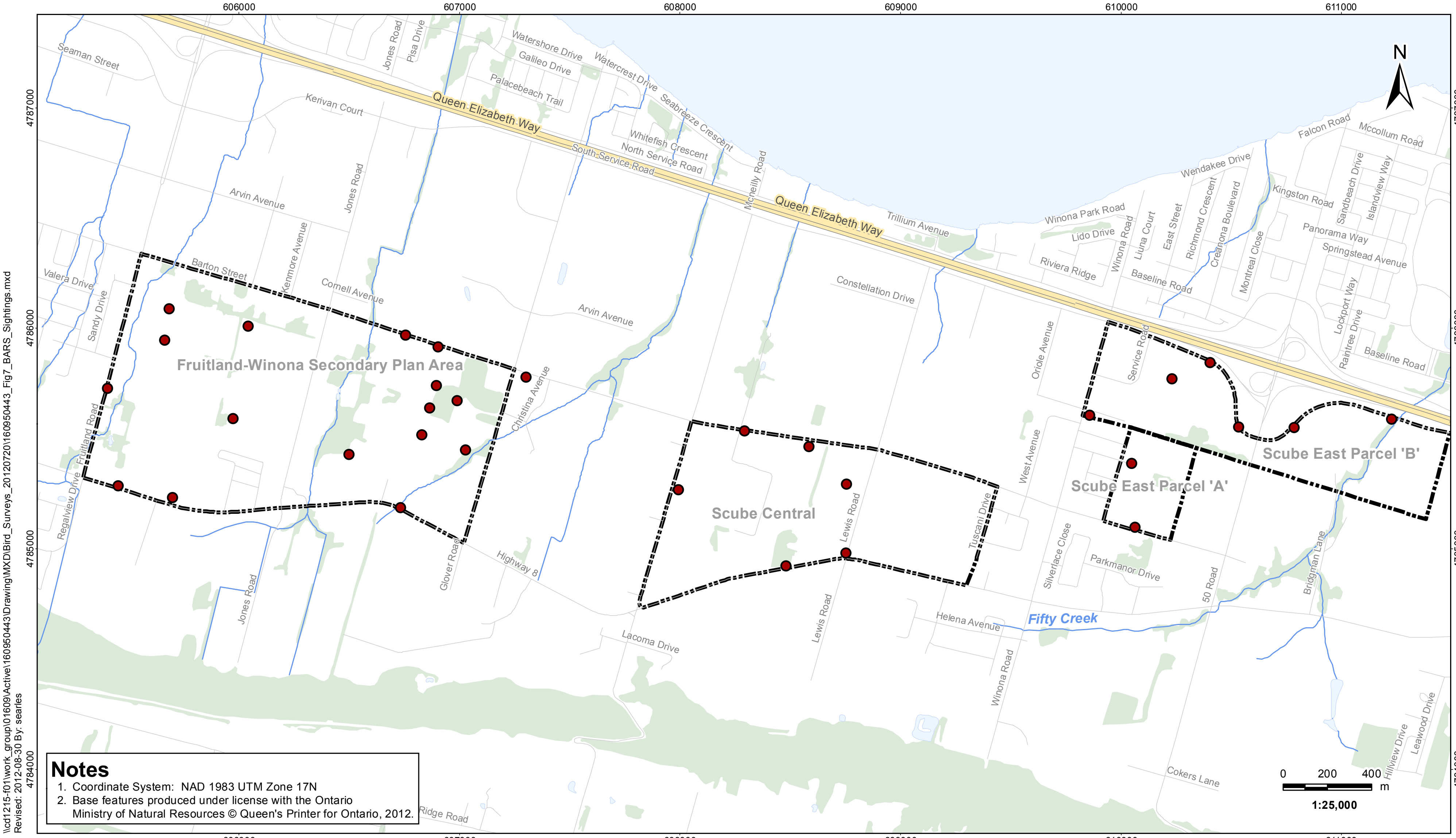
Client/Project

City of Hamilton
SAR Surveys

Figure No.
6

DRAFT

Title
Chimney Swift & Common Nighthawk Sighting Location



August 2012
160950443

Stantec

Legend

- Barn Swallow Sighting Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

Client/Project

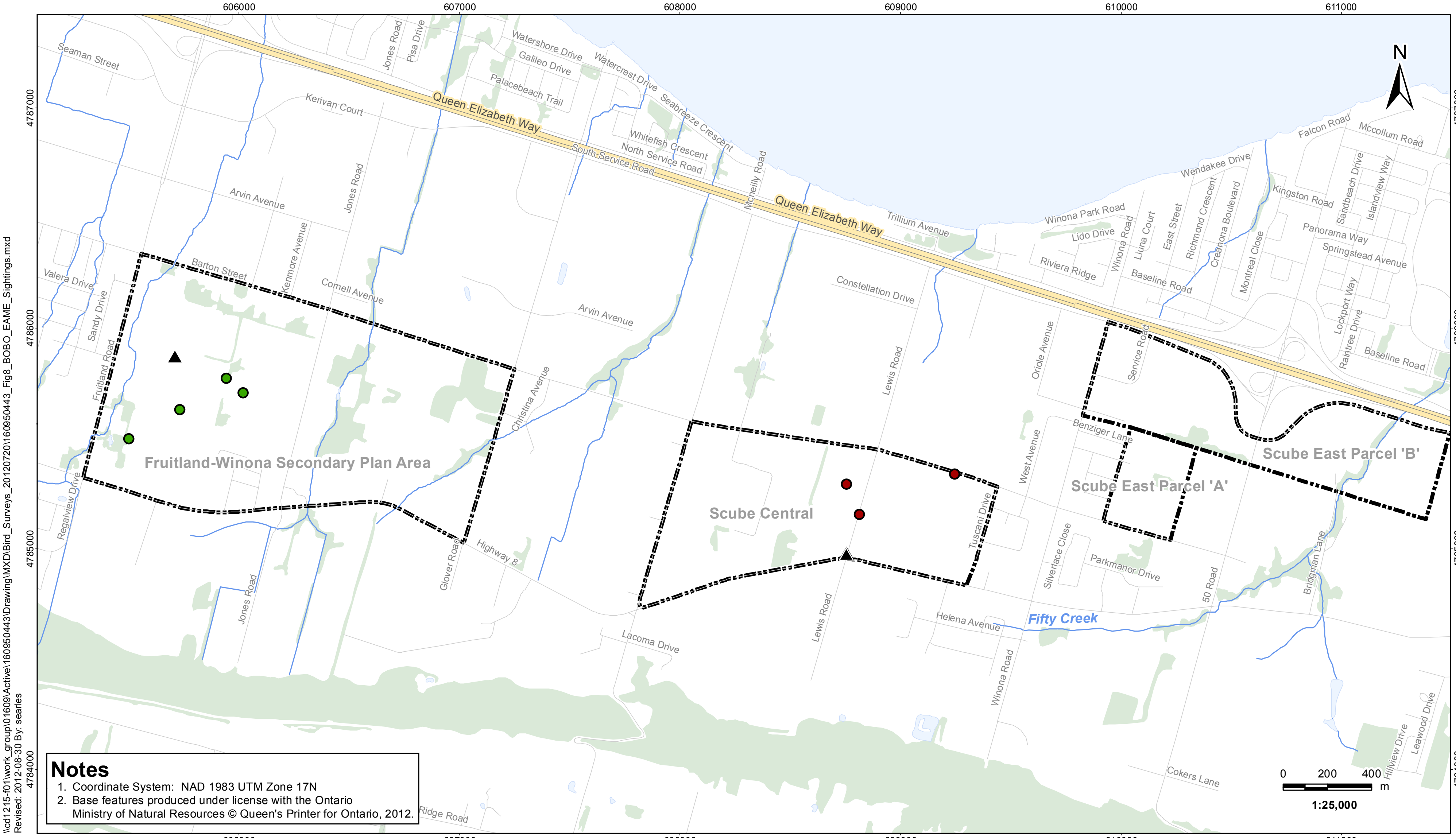
City of Hamilton
SAR Surveys

Figure No.
7

DRAFT

Title

Barn Swallow Sighting Location



Notes

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Stantec

Legend

- Bobolink Sighting Location
- Boblink Non-Breeding Sighting Location
- Eastern Meadowlark Sighting Location
- Study Area
- Road
- Highway
- Watercourse
- Waterbody
- Woodlot

Client/Project

City of Hamilton
SAR Surveys

Figure No.
8

DRAFT

Title

Bobolink & Eastern Meadowlark Sighting Location

APPENDIX B:

Tables

Table 1: Breeding Bird Species within the SPA.

Common Name	Scientific Name	Habitat Preference	Total # of Stations per Species	Ontario Status	COSSARO	COSEWIC	Population Changes Between Atlases[1]	Area Sensitivity (ha)	Local Status Hamilton
American Robin	*Turdus migratorius*	Isolated trees/Forest	*16*	S5B			NS		
Song Sparrow	*Melospiza melodia*	Shrubs	*15*	S5B			NS		
Northern Cardinal	*Cardinalis cardinalis*	Shrubs	*15*	S5			NS		
American Goldfinch	*Carduelis tristis*	Shrubs	*15*	S5B			NS		
Brown-headed Cowbird	*Molothrus ater*	Shrubs	*13*	S4B			NS		
Barn Swallow	*Hirundo rustica*	Grassland	*10*	S4B	THR	THR-NS	NS		
Gray Catbird	*Dumetella carolinensis*	Shrubs	*9*	S4B			NS		
Red-winged Blackbird	*Agelaius phoeniceus*	Grassland	*9*	S5			NS		
Mourning Dove	*Zenaida macroura*	Isolated trees/Forest	*8*	S5			NS		
European Starling	*Sturnus vulgaris*	Isolated trees/Forest	*8*	SNA			NS		
Field Sparrow	*Spizella pusilla*	Grassland/Shrubs	*7*	S4B			-17		
Common Grackle	*Quiscalus quiscula*	Isolated trees	*7*	S5B			NS		
Blue Jay	*Cyanocitta cristata*	Forest	*6*	S5			NS		
Cedar Waxwing	*Bombycilla cedrorum*	Shrubs	*6*	S5B			NS		
Willow Flycatcher	*Empidonax traillii*	Shrubs	*5*	S5B			NS		
Eastern Kingbird	*Tyrannus tyrannus*	Shrubs	*5*	S4B			-8		
American Crow	*Corvus brachyrhynchos*	Isolated trees/Forest	*5*	S5B			NS		
Tree Swallow	*Tachycineta bicolor*	Grassland	*5*	S4B			NS		
Black-capped Chickadee	*Poecile atricapillus*	Forest	*5*	S5			+11		
House Wren	*Troglodytes aedon*	Shrubs	*5*	S5B			NS		
Yellow Warbler	*Setophaga petechia*	Shrubs	*5*	S5B			NS		
Chipping Sparrow	*Spizella passerina*	Residential	*4*	S5B			NS		
Savannah Sparrow	*Passerculus sandwichensis*	Grassland	*4*	S4B			NS		

Table 1: Breeding Bird Species within the SPA.

Common Name	*Scientific Name*	*Habitat Preference*	*Total # of Stations per Species*	*Ontario Status*	COSSARO	COSEWIC	Population Changes Between Atlases[1]	Area Sensitivity (ha)	Local Status Hamilton
Killdeer	*Charadrius vociferus*	Grassland	*3*	S5B, S5N			-11		
Red-eyed Vireo	*Vireo olivaceus*	Forest	*3*	S5B			NS		
Common Yellowthroat	*Geothlypis trichas*	Wetland	*3*	S5B			NS		
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Grassland	*2*	S4B			-11		
Bobolink	*Dolichonyx oryzivorus*	Grassland	*2*	S4B	THR	THR-NS	-10	50	
Baltimore Oriole	*Icterus galbula*	Forest	*2*	S4B			NS		
House Finch	*Carpodacus mexicanus*	Residential	*2*	SNA			>+200		
Cooper's Hawk	*Accipiter cooperii*	Residential/Forest	*1*	S4	NAR	NAR	>+200	4-50+	Rare
Red-tailed Hawk	*Buteo jamaicensis*	Grassland	*1*	S5	NAR	NAR	NS		
American Kestrel	*Falco sparverius*	Grassland	*1*	S5B			-21		Uncommon
American Woodcock	*Scolopax minor*	Wetland	*1*	S4B			-29		
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Shrubs	*1*	S5B			NS		Uncommon
Common Nighthawk	*Chordeiles minor*	Residential	*1*	S4B	SC	THR	-59		Rare
Chimney Swift	*Chaetura pelagica*	Aerial forager	*1*	S4B, S4N	THR	THR	-32		Uncommon
Downy Woodpecker	*Picoides pubescens*	Forest	*1*	S5			NS		
Northern Flicker	*Colaptes auratus*	Forest	*1*	S4B			-7		
Alder Flycatcher	*Empidonax alnorum*	Shrubs	*1*	S5B			NS		Uncommon

Table 1: Breeding Bird Species within the SPA.

Common Name	***Scientific Name***	***Habitat Preference***	***Total # of Stations per Species***	***Ontario Status***	**COSSARO**	**COSEWIC**	**Population Changes Between Atlases[1]**	**Area Sensitivity (ha)**	**Local Status Hamilton**
Warbling Vireo	*Vireo gilvus*	Forest	*1*	S5B			NS		
White-breasted Nuthatch	*Sitta carolinensis*	Forest	*1*	S5			NS	10	
Brown Thrasher	*Toxostoma rufum*	Shrubs	*1*	S4B			-32		Uncommon
Swamp Sparrow	*Melospiza georgiana*	Wetland	*1*	S5B			NS		

[1] Proportional changes in species numbers between the 1st (1981-1985) and 2nd (2001-2005) OBBAs (Cadman et al. 2007).
COSSARO: Committee on the Status of Species at Risk in Ontario

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

S4: Apparently Secure—Uncommon but not rare

S5: Secure—Common, widespread, and abundant in the province

SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

END: Endangered

THR: Threatened

NS: Not Statistically Significant

Table 2: Breeding Bird Species within Scube Central, Scube East Parcel 'A' and Scube East Parcel 'B'.

Common Name	*Scientific Name*	*Habitat Preference*	*Total # of Stations per Species*	*Ontario Status*	COSSARO	COSEWIC	Population Changes Between Atlases	Area Sensitivity (ha)	Local Status Hamilton
American Robin	*Turdus migratorius*	Isolated trees/Forest	17	S5B			NS		
Northern Cardinal	*Cardinalis cardinalis*	Shrubs	17	S5			NS		
Red-winged Blackbird	*Agelaius phoeniceus*	Grassland	17	S5			NS		
American Goldfinch	*Carduelis tristis*	Shrubs	17	S5B			NS		
Song Sparrow	*Melospiza melodia*	Shrubs	15	S5B			NS		
Brown-headed Cowbird	*Molothrus ater*	Shrubs	15	S4B			NS		
Mourning Dove	*Zenaida macroura*	Isolated trees/Forest	14	S5			NS		
Barn Swallow	*Hirundo rustica*	Grassland	14	S4B	THR	THR-NS	NS		
European Starling	*Sturnus vulgaris*	Isolated trees/Forest	14	SNA			NS		
Common Grackle	*Quiscalus quiscula*	Isolated trees	12	S5B			NS		
Eastern Kingbird	*Tyrannus tyrannus*	Shrubs	11	S4B			-8		
Field Sparrow	*Spizella pusilla*	Grassland/Shrub s	10	S4B			-17		
Savannah Sparrow	*Passerculus sandwichensis*	Grassland	10	S4B			NS		
Gray Catbird	*Dumetella carolinensis*	Shrubs	9	S4B			NS		
Cedar Waxwing	*Bombycilla cedrorum*	Shrubs	9	S5B			NS		
House Sparrow	*Passer domesticus*	Residential	9	SNA			NS		
Blue Jay	*Cyanocitta cristata*	Forest	8	S5			NS		
Willow Flycatcher	*Empidonax traillii*	Shrubs	7	S5B			NS		
House Wren	*Troglodytes aedon*	Shrubs	7	S5B			NS		
Tree Swallow	*Tachycineta bicolor*	Grassland	6	S4B			+6		
Black-capped Chickadee	*Poecile atricapillus*	Forest	6	S5			+11		

Table 2: Breeding Bird Species within Scube Central, Scube East Parcel ‘A’ and Scube East Parcel ‘B’.

Common Name	*Scientific Name*	*Habitat Preference*	*Total # of Stations per Species*	*Ontario Status*	COSSARO	COSEWIC	Population Changes Between Atlases	Area Sensitivity (ha)	Local Status Hamilton
Yellow Warbler	*Setophaga petechia*	Shrubs	6	S5B			NS		
Chipping Sparrow	*Spizella passerina*	Residential	6	S5B			NS		
Killdeer	*Charadrius vociferus*	Grassland	5	S5B, S5N			-11		
Northern Flicker	*Colaptes auratus*	Forest	4	S4B			-7		
Bobolink	*Dolichonyx oryzivorus*	Grassland	4	S4B	THR	THR-NS	-10	50	
Red-tailed Hawk	*Buteo jamaicensis*	Grassland	3	S5	NAR	NAR	NS		
Warbling Vireo	*Vireo gilvus*	Forest	3	S5B			NS		
American Crow	*Corvus brachyrhynchos*	Isolated trees/Forest	3	S5B			NS		
Northern Mockingbird	*Mimus polyglottos*	Shrubs	3	S4			>+200		Uncommon
Brown Thrasher	*Toxostoma rufum*	Shrubs	3	S4B			-32		Uncommon
Common Yellowthroat	*Geothlypis trichas*	Wetland	3	S5B			NS		
Eastern Meadowlark	*Sturnella magna*	Grassland	3	S4B	THR	THR-NS	-16	10	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Grassland	2	S4B			-11		
Carolina Wren	*Thryothorus ludovicianus*	Shrubs	2	S4			>+200		Rare
Swamp Sparrow	*Melospiza georgiana*	Wetland	2	S5B			NS		
Baltimore Oriole	*Icterus galbula*	Forest	2	S4B			NS		
House Finch	*Carpodacus mexicanus*	Residential	2	SNA			>+200		
American Kestrel	*Falco sparverius*	Grassland	1	S5B			-21		Uncommon
Downy Woodpecker	*Picoides pubescens*	Forest	1	S5			NS		
Eastern Phoebe	*Sayornis phoebe*	Forest	1	S5B			+44		Uncommon

Table 2: Breeding Bird Species within Scube Central, Scube East Parcel ‘A’ and Scube East Parcel ‘B’.

Common Name	*Scientific Name*	*Habitat Preference*	*Total # of Stations per Species*	*Ontario Status*	COSSARO	COSEWIC	Population Changes Between Atlases	Area Sensitivity (ha)	Local Status Hamilton
Purple Martin	*Progne subis*	Aerial forager	1	S4B			-21		Uncommon
White-breasted Nuthatch	*Sitta carolinensis*	Forest	1	S5			NS	10	
Indigo Bunting	*Passerina cyanea*	Forest	1	S4B			-14		
Purple Finch	*Carpodacus purpureus*	Forest	1	S4B			-36		Uncommon

COSSARO: Committee on the Status of Species at Risk in Ontario

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

S4: Apparently Secure—Uncommon but not rare

S5: Secure—Common, widespread, and abundant in the province

SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

END: Endangered

THR: Threatened

NS: Not Statistically Significant

APPENDIX C:
Data Sheets

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443 | Project Name: Fruitland-Winona

Date: June 25, 2012 | Field Personnel: Nicole Kopysch

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:
	16-20°C	2-3	10%	Ø	rain

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive
4	6:19-6:24		2	N.A.	Foraging only		
10	8:11-8:16		2	N.A.	Foraging only		
9	8:30-8:35		1	N.A.	Foraging only		
14	9:37-9:42		8	N.A.	Foraging only		
15	9:45-9:50		8	N.A.	Foraging only		
13	9:30-9:35		8	N.A.	Foraging only		
17	10:04-10:09		2	N.A.	Foraging only		

Quality Control: This form is complete (__) & legible (__).

Signature: ______________________ Signature: ______________________
(Field Personnel) (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 60950443

Project Name: Hamilton.

Date: June 12, 2012

Field Personnel: N. Kopysh

Weather Conditions:	Temp: 20°C.	Wind: 3	Cloud: 100%	PPT:	PPT in last 24 hrs: rain overnight

Station #13.

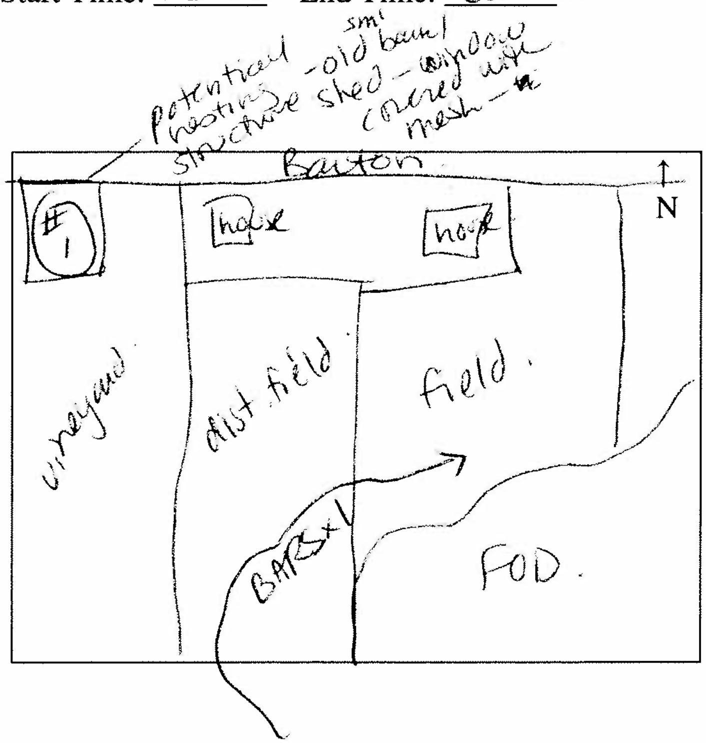
Location of BARS observation: ~~∅~~

Start Time: 06:30 End Time: 06:45.

Tally of BARS: ~~∅~~ 1

Sketch of Habitat (include foraging habitat and location of potential nesting structures) or provide details on air photo

- Map crop types in vicinity of BARS observation and surrounding area (i.e. within 200m)
- Include location of water bodies (e.g. river, pond)
- Mark location of BARS foraging
- Mark location of potential nesting structures



Description of Potential Nesting Structures:

Structure # (indicate location on map)	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Number of nests present			
			BARS		CLIS	
			Active	Inactive	Active	Inactive
#1	barn/shed.	open windows =	unknown - no		access	
		covered with	to observe			
		mesh				
		Y - front =	∅	BARS	seen	

open doorway. entering/exiting
1 seen in vicinity foraging

Quality Control: This form is complete (✓) & legible (✓).

Signature: [signature] (Field Personnel)

Signature: ________________ (Project Manager)

REV: June-09 FORM 034

Stantec
Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443 Project Name: Fruitland - Winona

Date: June 11, 2012 Field Personnel: M Oliveira

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:
	17°C	0	20%	Ø	Ø

Hwy 8

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive
1	10^{10}-10^{15}	606318, 4785210	0	Concrete box culvert	No.		None.
	10^{23}-10^{28}	606729, 4785199	0	Concrete box culvert	No		None
	10^{35}-10^{40}	607153, 4785490	0	Concrete box culvert	No		None
	10^{43}-10^{48}	606608, 4786033	0	Pipe culvert	No		None
	10^{55}-11^{03}	606002, 4786211	0	No culvert present	No		None
	11^{09}-11^{14}	608693, 4786279	0	Pipe/concrete culvert	No		None
	11^{18}-11^{23}	608331, 4785484	0	Two small concrete	No		None
				pipes running			
				parallel with			
				Fruitland Rd.			
				Not suitable			
				for nesting			

Quality Control: This form is complete (__) & legible (__).

Signature: ________________ (Field Personnel) Signature: ________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 16095043

Project Name: Fonthill - Winona

Date: June 11, 2012

Field Personnel: Michael Oliveira

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:
	17°C	0	20%	0	0

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive
10	913-918	606801 4785428	5	N/A.	Foraging only		

Quality Control: This form is complete (__) & legible (__).

Signature: ____________________ (Field Personnel)

Signature: ____________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443

Project Name: Fruitland - Winona

Date: July 10, 2012

Field Personnel: D. Graham

Weather Conditions:	Temp: 17-24°C	Wind: 1	Cloud: 10%	PPT: None	PPT in last 24 hrs: Light rain

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests	
						Active	Inactive
1	5^{30}-5^{35}	605665, 4785945	~~8~~ 1	N.A.	Foraging only		
2	5^{40}-5^{45}	605685, 4786087	1	N.A.	Foraging only		
4	6^{15}-6^{20}	606042, 4786009	1	N.A.	Foraging only		
10	8^{34}-8^{39}	606501, 4785428	6	N.A.	Foraging only		
13	9^{25}-9^{30}	606896, 4785741	1	N.A.	Foraging only		
14	9^{35}-9^{40}	606866, 4785638	1	N.A.	Foraging only		
15	9^{45}-9^{50}	606832, 4785515	1	N.A.	Foraging only		
16	10^{05}-10^{10}	606992, 4785671	1	N.A.	Foraging only		
17	10^{15}-10^{20}	607028, 4785448	1	N.A.	Foraging only		

Quality Control: This form is complete (__) & legible (__).

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443

Project Name: Fruitland - Winona

Date: July 12, 2012

Field Personnel: D. Graham

Weather Conditions:	Temp: 26 °C	Wind: 1	Cloud: 0 %	PPT: None	PPT in last 24 hrs: None

	Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests: Active	Nests: Inactive
Hwy 8	1	1233	606323 4785209	0	Box culvert	N. - no ledges for nesting - roof of culvert too, vegetation obstruct. entrance		
Hwy 8	2	1245	606912 4785072	0	Corrugated steel culvert	N - too small 1 m dia. no ledges, veg. obstructs		
Glover	3	1300	607163 4785495	0	Box culvert	N - no ledges, veg. obstructs		
Barton	4	1310	606607 4786030	0	Corrugated steel culvert	N - too small 1.5 m dia. no ledges, veg. obstructs		
Barton	5	1325	605990 4786219	0	unable to find any structure or watercourse			
Barton	6	1335	605681 4786313	0	Box culvert	N - no ledges, veg. obstructs		
Fruitland	7	1345	605353 4785531	0	Box culvert	N - "		"

Quality Control: This form is complete (__) & legible (__).

Signature: ____________________
(Field Personnel)

Signature: ____________________
(Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 60950443

Project Name: Hamilton - Fruitland

Date: June 25, 2012 05:30 - 10:40

Field Personnel: N. KOPYSH

Weather Conditions:	Temp: 20°C.	Wind: 2-3	Cloud: 10%	PPT: ∅	PPT in last 24 hrs:

Survey Station BARS#	Time	GPS Coordinates	# BARS observed out/in culvert	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive
6	05:30	0605692/	∅	sml, round culvert	N	∅.	
		4786278					
3	10:11	Glover Rd. ~~see map~~	~~start~~ ∅	sml. rnd. culvert	N.	∅.	
2	10:32	Hwy 8	∅		N	∅	
1	10:34	Hwy 8.	∅		N	∅	
4	10:37	Barton	∅	see rd 1	N	∅	
5.	10:40	Barton	∅.		N	∅.	

Quality Control: This form is complete (✓) & legible (✓).

Signature: NKoPysh (Field Personnel)

Signature: ________ (Project Manager)

BBS

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 60950443 **Project Name:** Hamilton

Date: June 12, 2012 **Field Personnel:** N. Kopysh

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	20°C	1-2	100%	∅	rain overnight

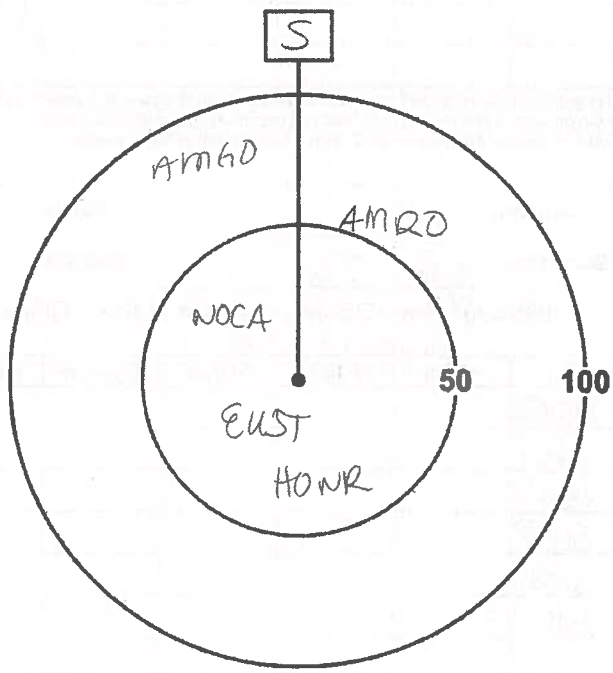
GPS #: T
BBS - 5min PC

Station: 12 **Feature:** riparian corridor **UTM:**

Start Time: 06:00 **End Time:** 06:05

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO		1			
EUST	1				
HOWR	1				
AMRO		1			
NOCA	1				



Height of blade sweep varies from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep; C-Above height of blade sweep; D-Well above height of blade sweep

Page 1 of 2 Quality Control: This form is complete ❑ & legible ❑.

Signature: NKop (Field Personnel) **Signature:** (Project Manager)

REV: 2011-05-04 / FORM 020

17T 0606896, 4785741

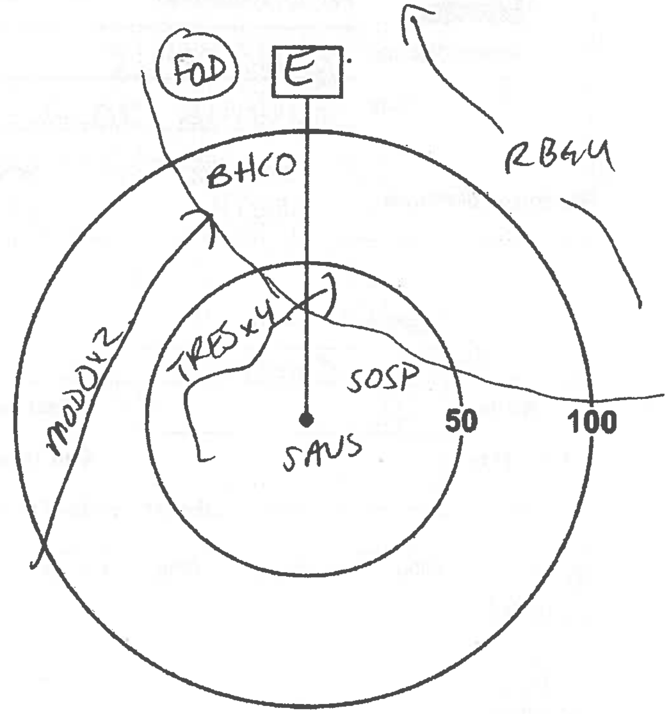
Station: 13 **Feature:** ______ **UTM:** ______

Start Time: 06:30 **End Time:** 06:35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
TRES				4	
MODO				2	
SOSP	1				
SAVS	1				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Station: 14. **Feature:** ______ **UTM:** 17T 0606866 4785638

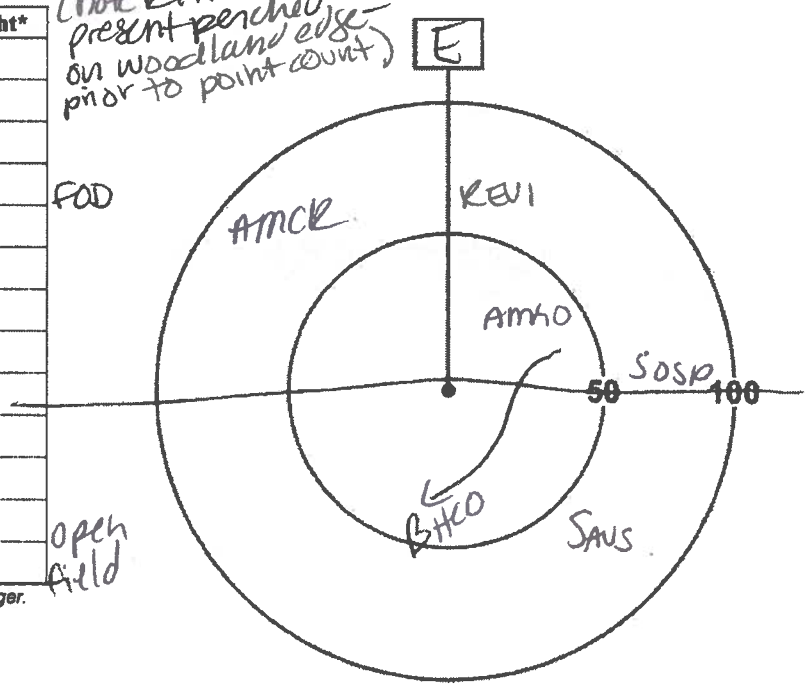
Start Time: 06:56 **End Time:** 07:01

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop
open field

(not RTHA present perched on woodland edge prior to point count) flew 080

Species	<50m	50-100m	>100m	Flyovers	Height*
AMCR		1			
REVI		1			
AMGO	1				
SOSP		1			
SAVS		1			
BHCO				1	

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel) **Signature:** ______________________ (Project Manager)

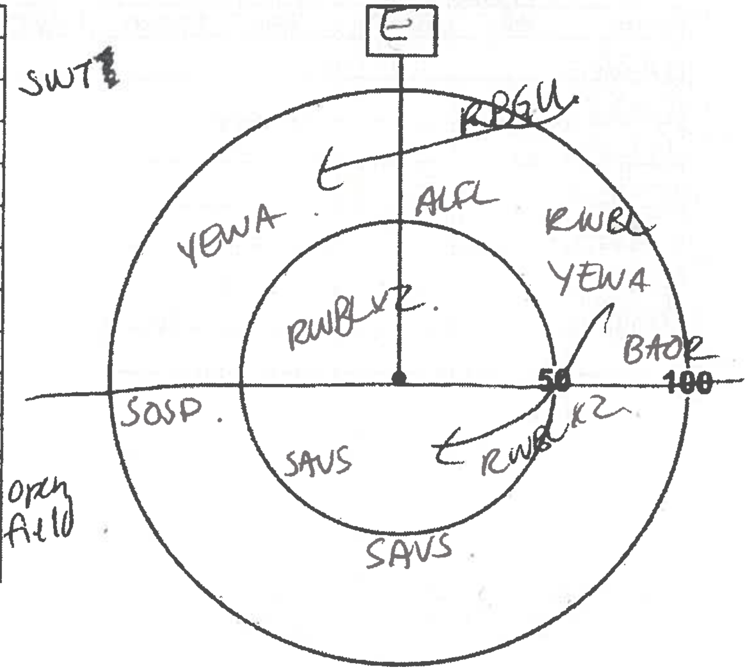
REV: 2011-05-04 / FORM 020

Station: 15 **Feature:** **UTM:** 17T 0606832 4785515

Start Time: 07:15 **End Time:** 07:20.

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YEWA		2			
RWBL	2	1		2	
ALFL		1			
BAOR		1			
RBGU				1	
SOSP		1			
SAUS	1	1			



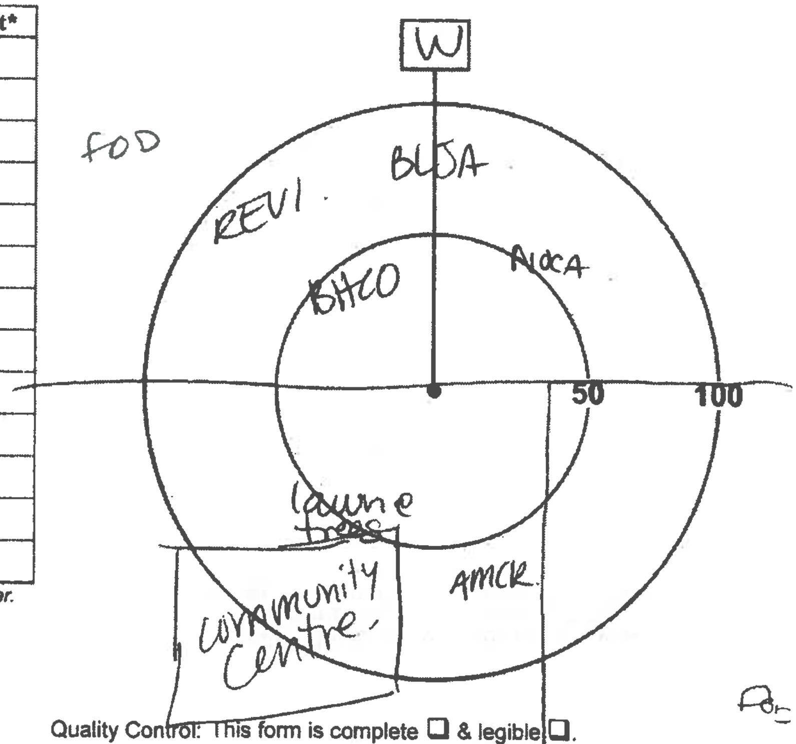
** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep; C-Above height of blade sweep; D-Well above height of blade sweep

Station: 16 – community centre **Feature:** **UTM:** 0606992 4785671

Start Time: 07 40 **End Time:** 07:45

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop
lawn.

Species	<50m	50-100m	>100m	Flyovers	Height*
REVI		1			
BLJA		1			
BHCO	1				
NOCA		1			
AMCR		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep; C-Above height of blade sweep; D-Well above height of blade sweep

Page 2 of 2

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Project Manager)

birdscare guns

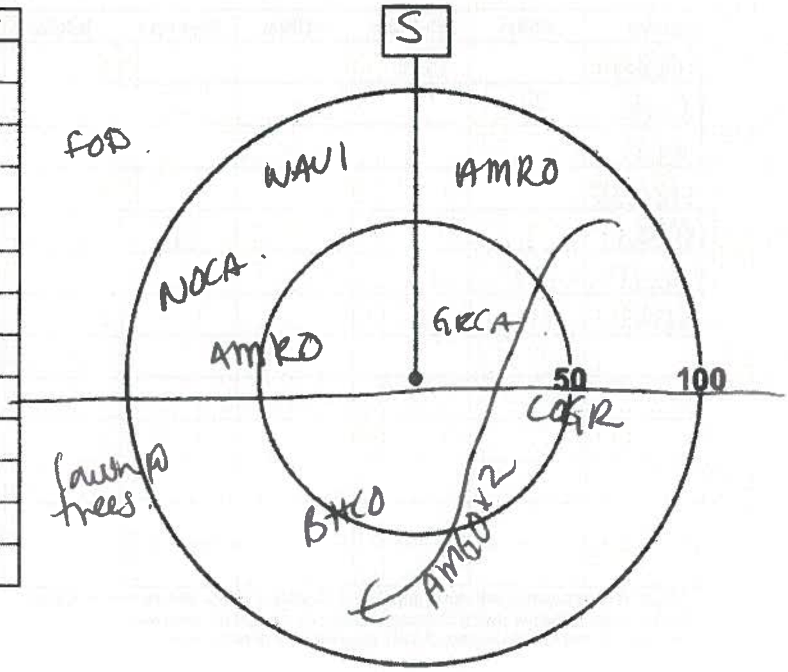
Station: 17 – Community Centre. Feature: ______ UTM: 17T 0607028 4785448.

Start Time: 07:50 End Time: 07:55.

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop lawn.

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA.		1			
AMRO	1	1			
GRCA	1				
BHCO		1			
COGR	1				
WAVI		1			
AMGO				2.	

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



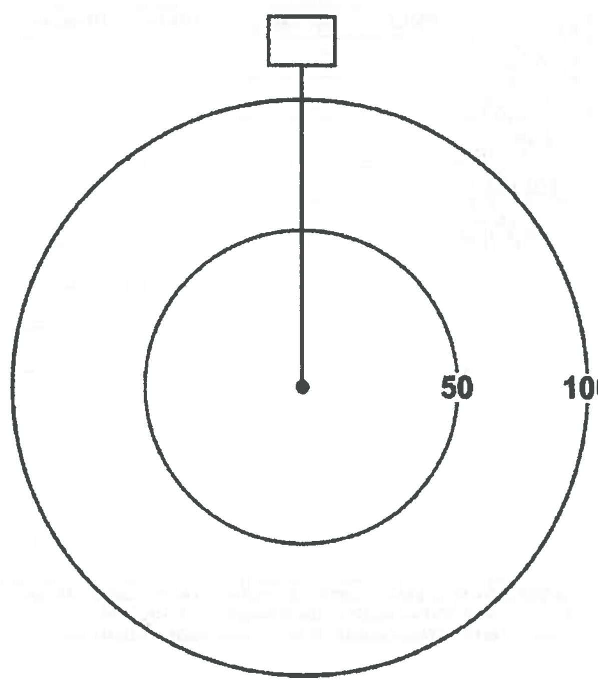
Station: ______ Feature: ______ UTM: ______

Start Time: ______ End Time: ______

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

Stantec

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Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 160950443

Project Name: Fruitland-Winona Secondary Plan Area.

Date: JUNE 11 2012

Field Personnel: ~~D Graham~~, MICHAEL OLIVEIRA

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	17°c	0	20 %	0	0

GPS #: T (PERSONAL GPS, MODEL: GARMIN 60CSX)

Station: 1

Feature: SPRUCE PLANTATION / EARLY SUCCESSION

UTM: 17 T 0605665 4785945

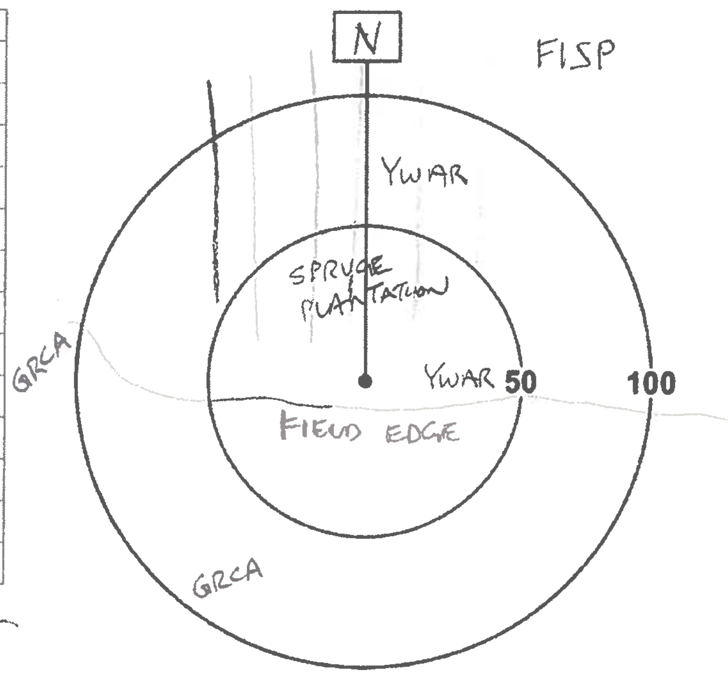
Start Time: 5:26

End Time: 5:31

Habitat: ☑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YWAR	1	1			
GRCA		1	1		
FISP			1		

~~* Height of blade sweep varies from project to project; check with project manager.~~
~~O-On ground; A-Below height of blade sweep; B-At height of blade sweep;~~
~~C-Above height of blade sweep; D-Well above height of blade sweep~~



Page ___ of ___

Signature: (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

dsg g:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

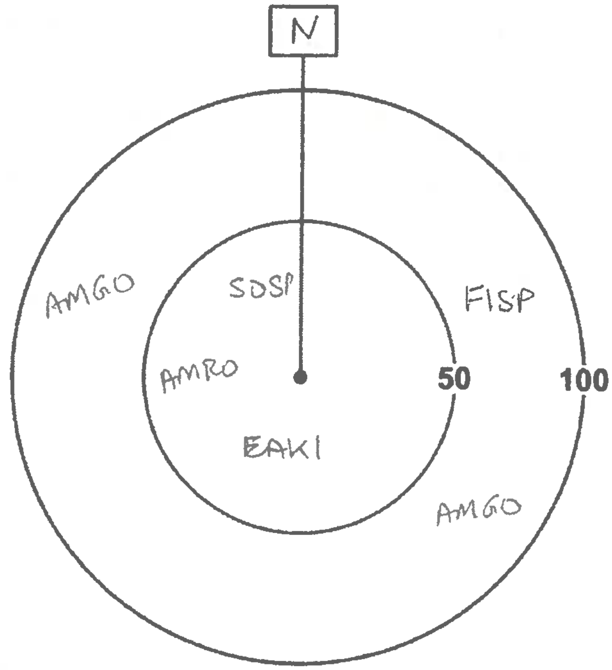
Station: 2 **Feature:** SPRUCE PLANTATION / EARLY SUCCESSIONAL **UTM:** 17 T 0605685 4786087

Start Time: 05:41 **End Time:** 05:46

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EAKI	1				
AMRO	1				
AMGO		2			
SOSP	1				
FISP		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



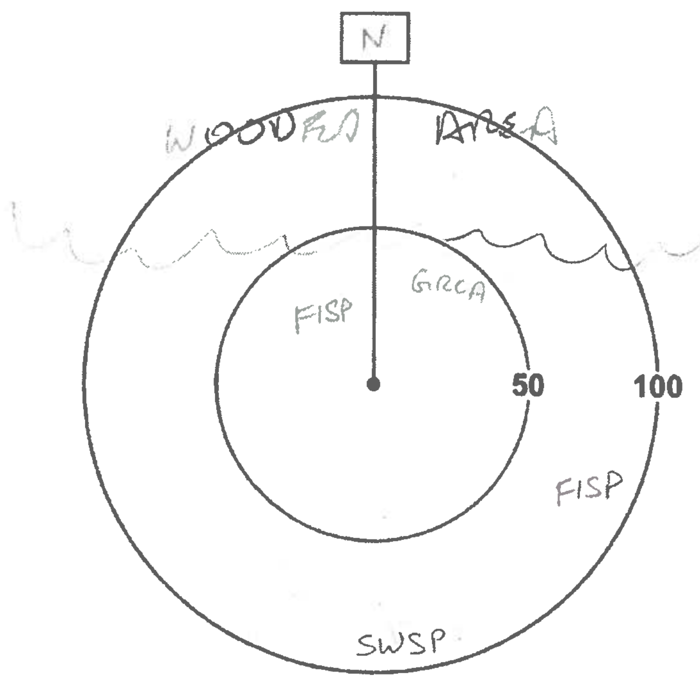
Station: 3 **Feature:** WOODED AREA / EARLY SUCCESSION **UTM:** 17 T 0605817 4786118

Start Time: 05:50 **End Time:** 05:55

Habitat: ☑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
FISP	1	1			
GRCA	1				
SWSP		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Page ___ of ___

Signature: ____________________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________________ (Project Manager)

REV: 2011-05-04 / FORM 020

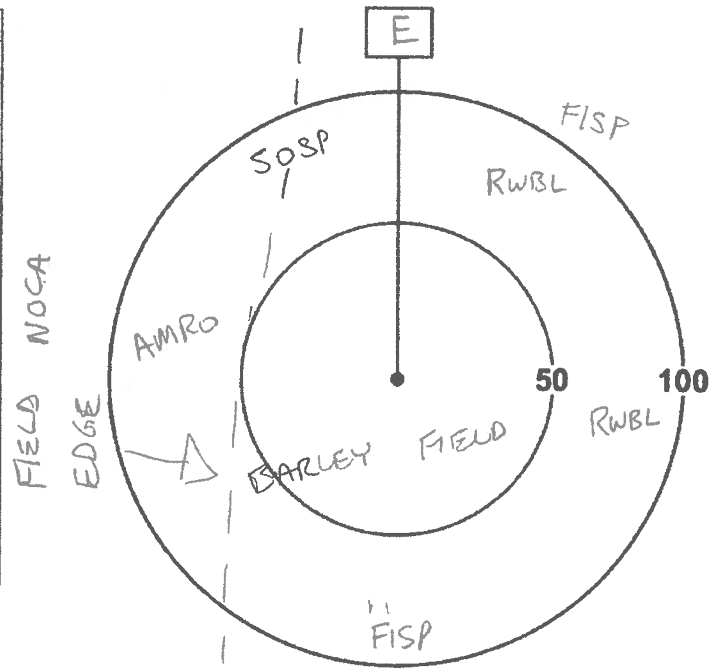
Station: 4 **Feature:** CROP FIELD **UTM:** 17 T 0606042 4786009

Start Time: 06:04 **End Time:** 06:09

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ☑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
SOSP		1			
AMRO		1			
FISP		1	1		
RWBL		2			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



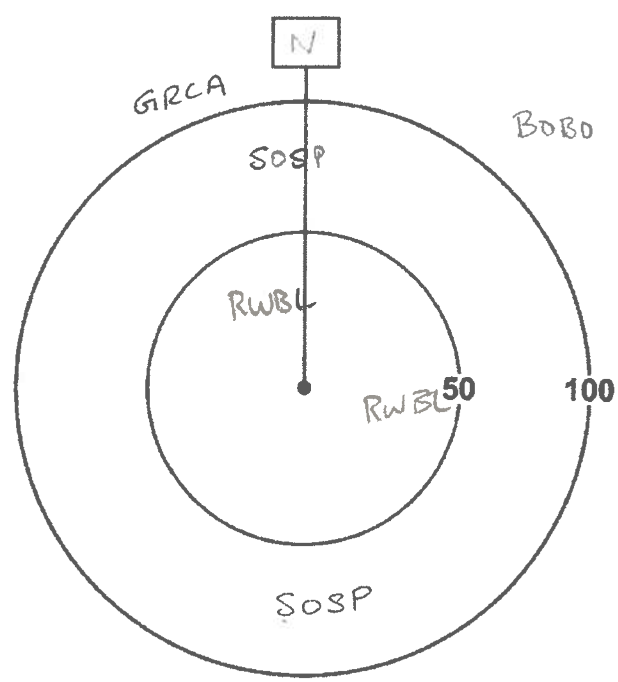
Station: 5 **Feature:** OPEN FIELD **UTM:** 17 T 0606012 4785706

Start Time: 06:17 **End Time:** 06:22

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ☑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
GRCA			1		
SOSP		2			
BOBO			1		
RWBL	2				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Signature: ______________________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Project Manager)

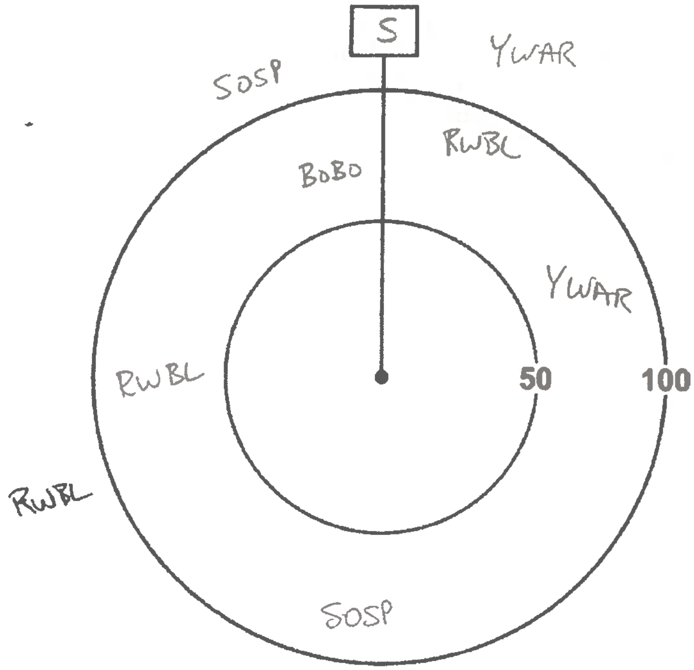
REV: 2011-05-04 / FORM 020

Station: 6 **Feature:** HAYFIELD **UTM:** 17T 0605709 4785872

Start Time: 06:54 **End Time:** 06:59

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☑Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YWAR		1	1		
SOSP		1	1		
RWBL		2	1		
BOBO		1			



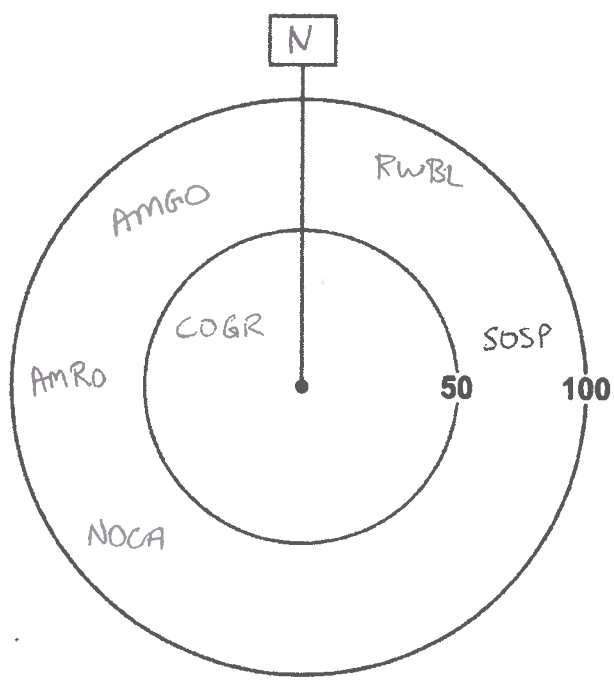
** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 7 **Feature:** WOODLOT **UTM:** 17T 0605472 4785472

Start Time: 07:22 **End Time:** 07:27

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO		1			
RWBL		1			
COGR	1				
SOSP		1			
NOCA		1			
AMRO		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ____________ (Field Personnel)

Signature: ____________ (Project Manager)

REV: 2011-05-04 / FORM 020

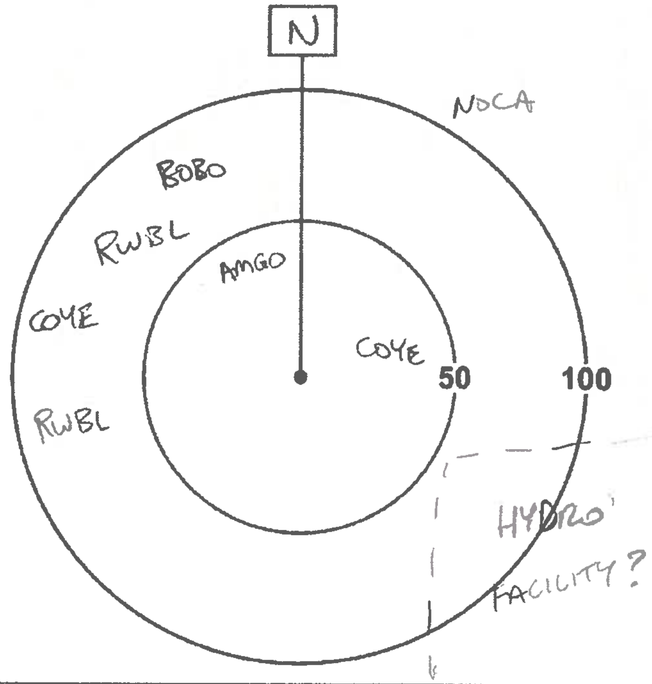
Station: 8 **Feature:** OPEN FIELD / WETLAND MIX **UTM:** 17T 0605743 4785580

Start Time: 08:08 **End Time:** 08:13

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			1		
BOBO		1			
RWBL					
COYE	1	1			
RWBL		2			
AMGO	1				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



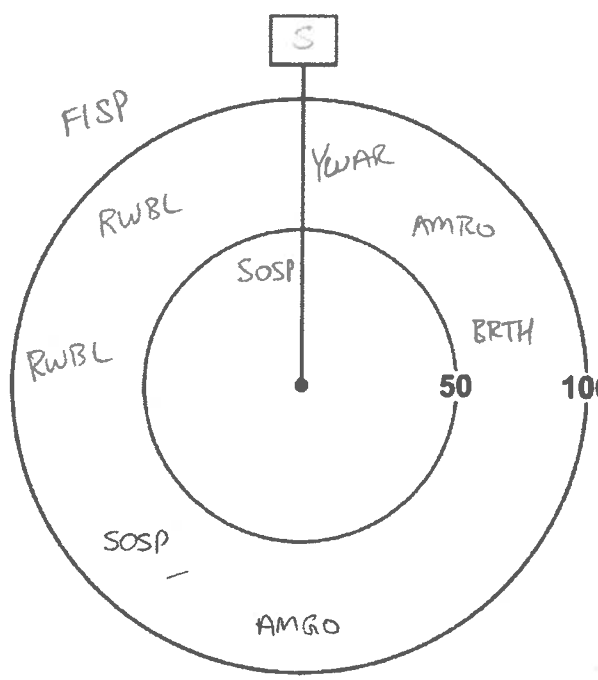
Station: 9 **Feature:** MOIST SCRUB / FIELD **UTM:** 17T 0605974 4785591

Start Time: 08:30 **End Time:** 08:35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
FISP			1		
RWBL		2			
SOSP	1	1			
YWAR		1			
AMRO		1			
BRTH		1			
AMGO		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

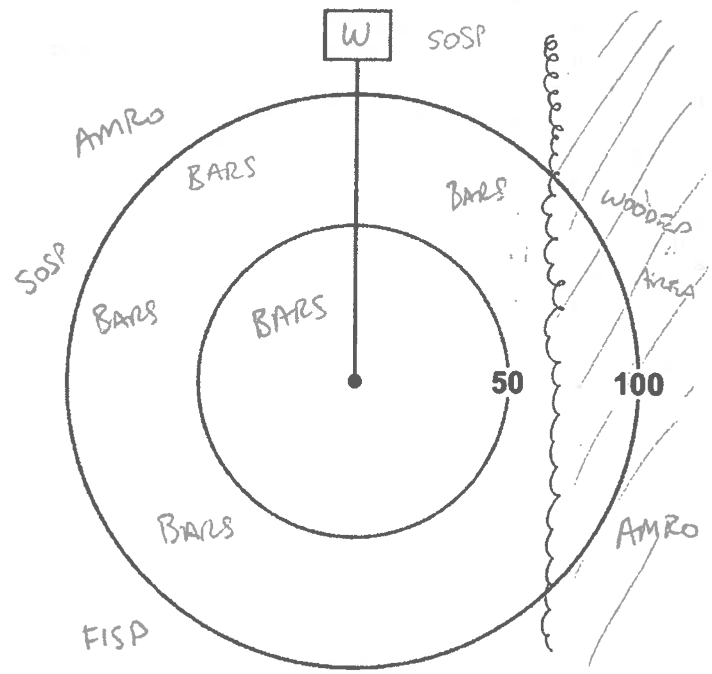
Station: 10 Feature: WOODED AREA ADJACENT TO SOCCER FIELDS & BB ◇ UTM: 17T 0606501 4785428

Start Time: 09:13 End Time: 09:18

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS	1	4			
AMRO			1		
SOSP			2		
FISP			1		

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



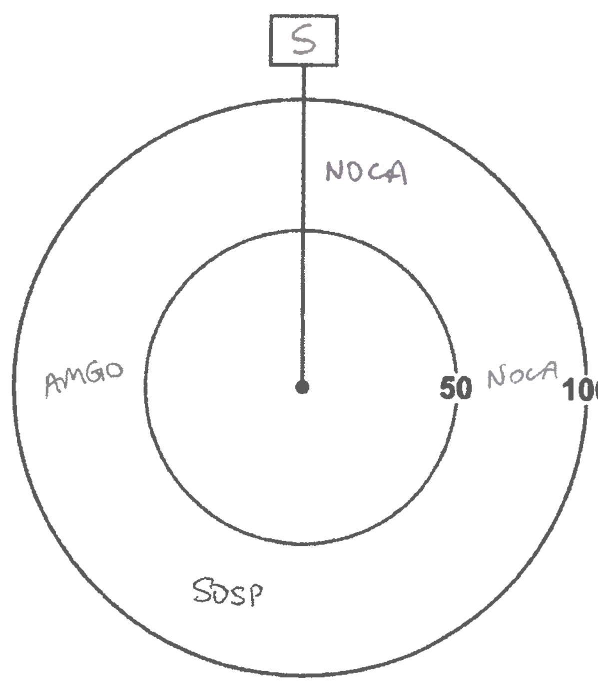
Station: 11 Feature: WOODLOT W/ SMALL CREEK UTM: 17T 0606387 4785485

Start Time: 09:26 End Time: 09:31

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA		2			
AMGO		1			
SOSP		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
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Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 160950443 Project Name: Fruitland-Winona

Date: July 10, 2012 Field Personnel: D. Graham

Weather Conditions:	TEMP (ºC):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	17-24°C	1	10%	None	Light rain

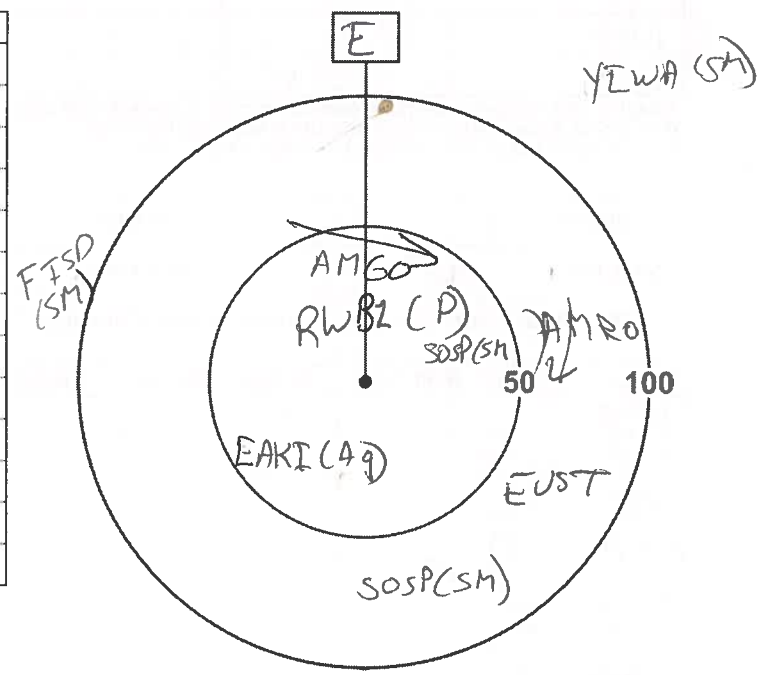
GPS #: T

Station: 1 Feature: UTM: 605665 4785945

Start Time: 5:30 End Time: 5:35

Habitat: ☒Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL	P				
EAKI	As				
AMGO	✓			✓	
SOSP	SM	SM			
EUST	✓				
AMRO		✓		✓	
YEWA			SM		
BASW	✓			✓	
FISP			SM		



** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Signature: ______________________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 2 Feature: UTM: 605685 4786087

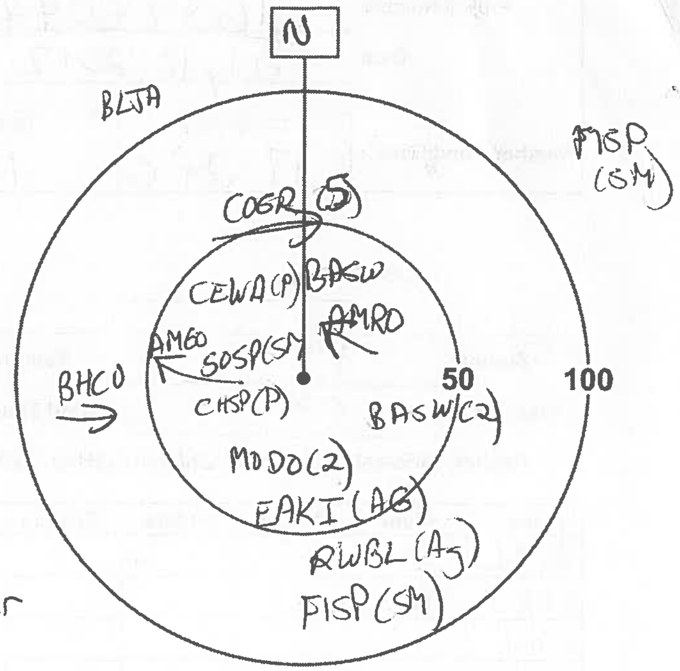
Start Time: 5:40 End Time: 5 45

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
COGR	✓			✓	
CEWA	P				
BASW	✓			✓	
AMRO	✓			✓	
AMGO	✓			✓	
SOSP	SM				
CHSP	P				
MODO	P				
EAKI	AG				
RWBL	~~Ag~~	Ag			
FISP		SM			
BHCO		✓		✓	
BLJA			✓		

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Deer



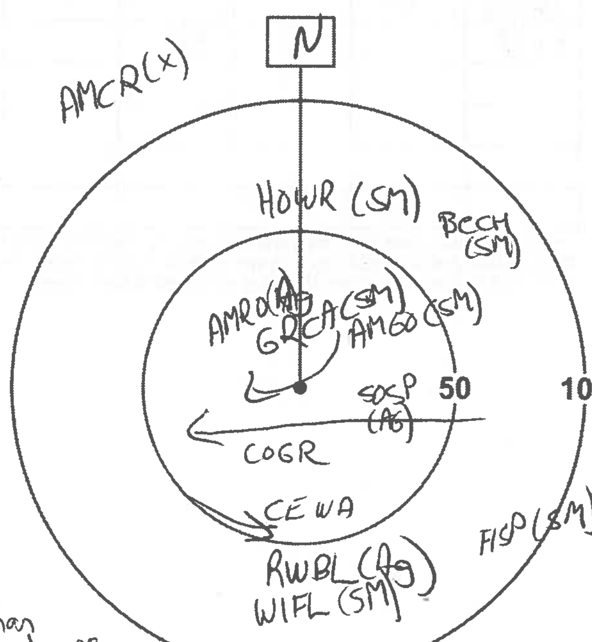
Station: 3 Feature: UTM: 605817 4786118

Start Time: 6 00 End Time: 6 05

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMCR			✓		
HOWR	✓SM				
AMRO	Ag				
GRCA	SM				
AMGO	SM				
SOSP	Ag				
COGR	✓			✓	
BCCH		SM			
CEWA	✓			✓	
RWBL		Ag			
WIFL		SM			
FISP		SM			

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Other than housewrens robins, birds are avoiding dec. forest to north

Page ___ of ___ Quality Control: This form is complete ☐ & legible ☐.

Signature: ________ (Field Personnel) Signature: ________ (Project Manager)

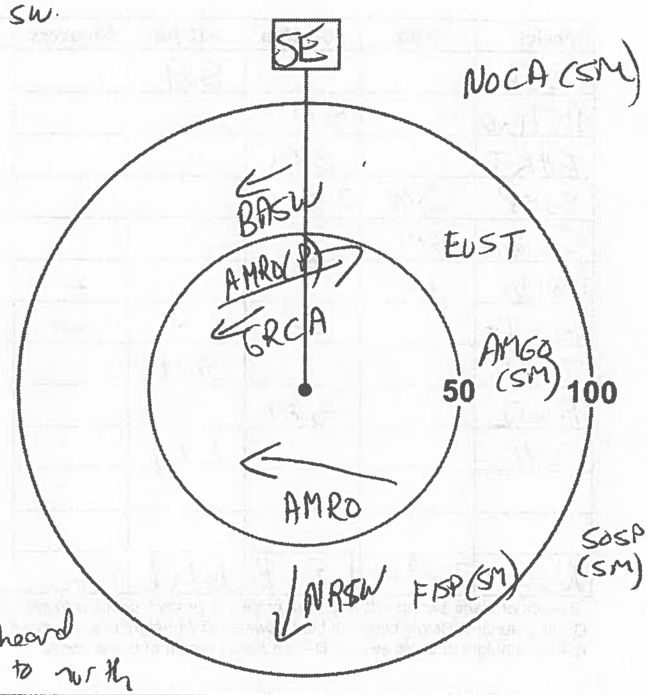
REV: 2011-05-04 / FORM 020

Station: 4 **Feature:** C **UTM:** 606042 4786009

Start Time: 6:15 **End Time:** 6:20

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ☑Crop grain to SW.

Species	<50m	50-100m	>100m	Flyovers	Height*
BASW		✓		✓	
NOCA			SM		
EUST		✓			
AMRO	✓	P		✓	
GRCA	✓			✓	
AMGO		SM			
NRSW		✓			
FISP		SM			
SOSP			SM		
No bobolinks or meadowlarks					



Treefrog heard in forest to north

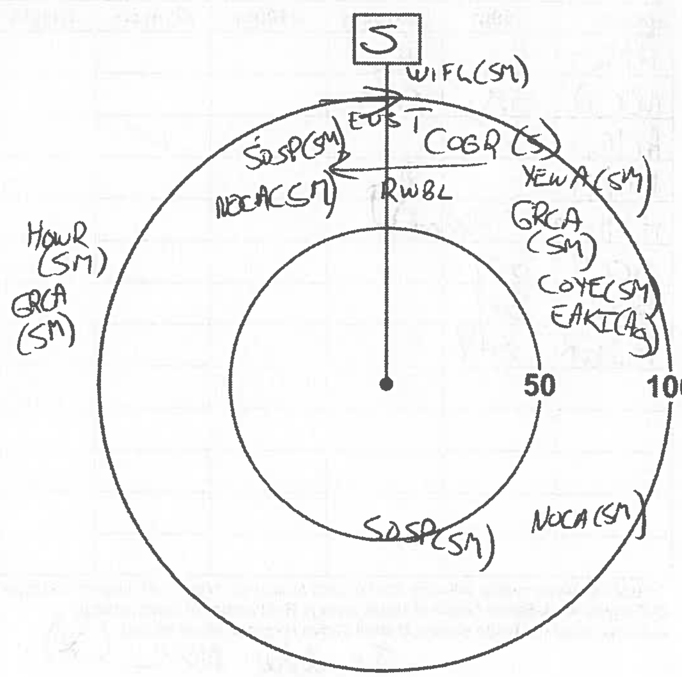
** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 5 **Feature:** **UTM:** 606012 4785872

Start Time: 6:30 **End Time:** 6:35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ☑Crop Cut meadow

Species	<50m	50-100m	>100m	Flyovers	Height*
WIFL			SM		
EUST		✓		✓	
COGR		✓		✓	
SOSP	SM	SM			
NOCA		2 SM			
RWBL		✓			
YEWA		SM			
GRCA		SM	SM		
COYE		SM			
EAKI		Ag			
HOWR			SM		



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________ (Field Personnel) **Signature:** ______________ (Project Manager)

REV: 2011-05-04 / FORM 020

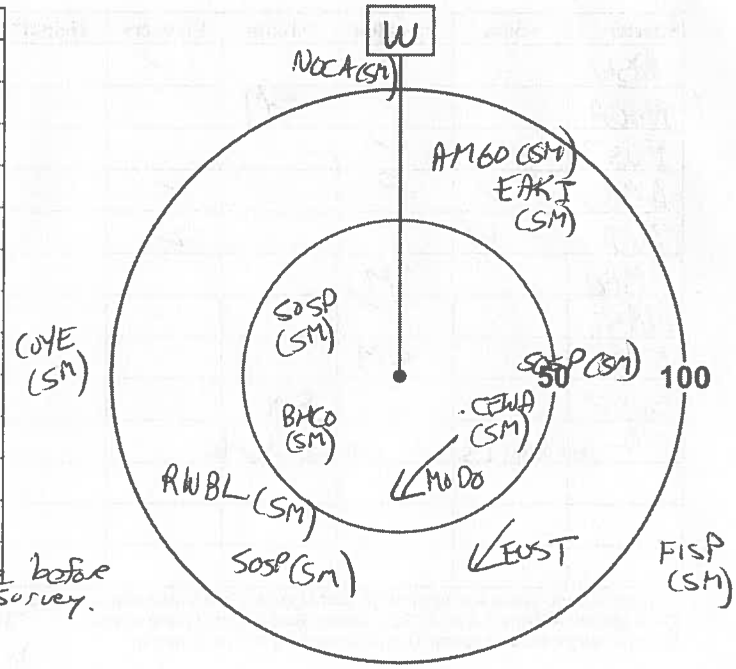
Station: 6 **Feature:** **UTM:** 605709 4785472

Start Time: 6:45 **End Time:** 6:50

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop CUM

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
AMGO		SM			
EAKI		SM			
SOSP	SM	2 SM			
CEWA	SM				
MODO	✓			✓	
EUST		✓		✓	
FISP			SM		
RWBL		SM			
COYE			SM		

Note: 2♂ & 1♀ Bobolink flew over me before survey.



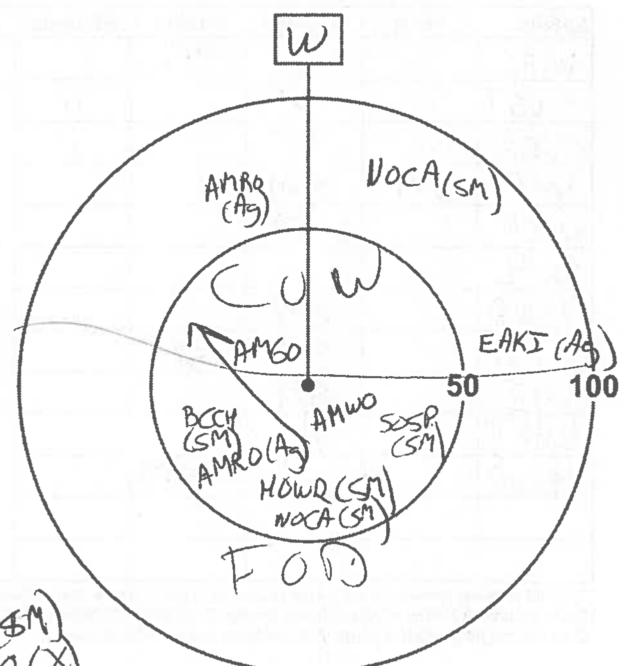
* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 7 **Feature:** **UTM:** 605472 4785472

Start Time: 7:15 **End Time:** 7:20

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMRO	Ag	Ag			
NOCA	SM	SM			
AMGO	✓			✓	
EAKI		Ag			
AMWO	✓ (flushed)				
BCCH	SM				
SOSP	SM				
HOWR	SM				



* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Incidental: NOFL (X), WAVI (SM), DOWO (X)

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: __________ (Field Personnel)

Signature: __________ (Project Manager)

REV: 2011-05-04 / FORM 020

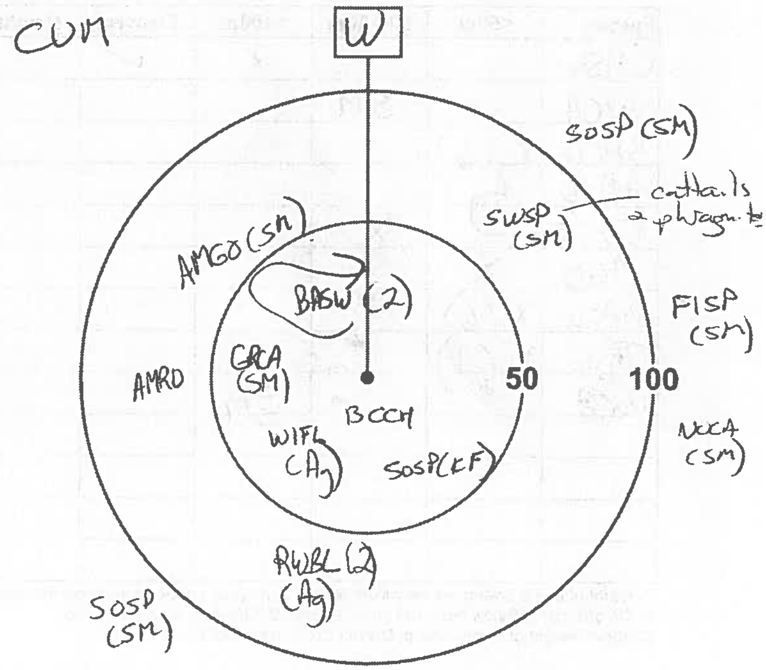
Station: 8 **Feature:** **UTM:** 605743

Start Time: 8⁰⁰ **End Time:** 8⁰⁵ 4785580

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
SosP	CF		SM(2)		
SWSP		SM			
FISP			SM		
NOCA			SM		
BCCH	X				
WIFL	Ag				
GRCA	SM				
AMGO		SM			
AMRO	V				
RWBL		Ag(2)			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



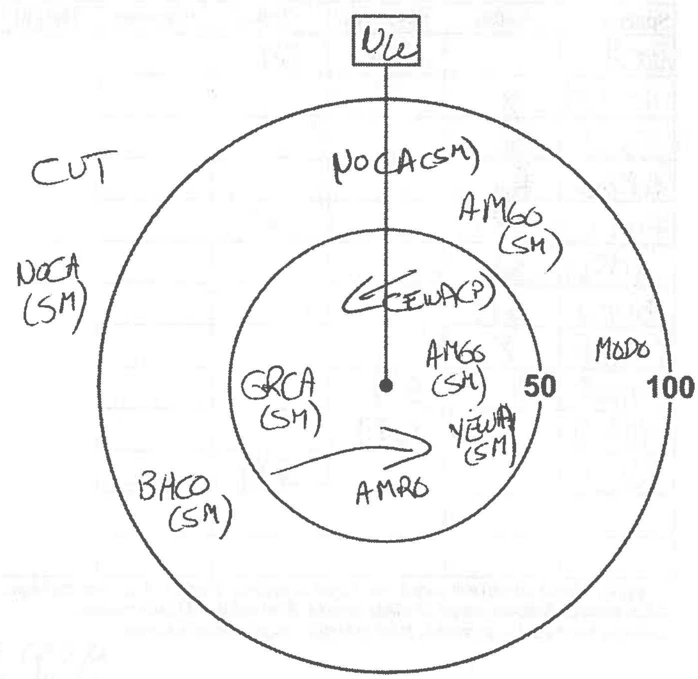
Station: 9 **Feature:** **UTM:** 605974

Start Time: 7⁴⁰ **End Time:** 7⁴⁵ 4785591

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NoCA		SM	SM		
AMGO	SM	SM			
CEWA	P				
MODO		X			
YEWA	SM				
AMRO	X				
GRCA	SM				
BHCO		SM			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________ (Field Personnel) **Signature:** ____________ (Project Manager)

REV: 2011-05-04 / FORM 020

*

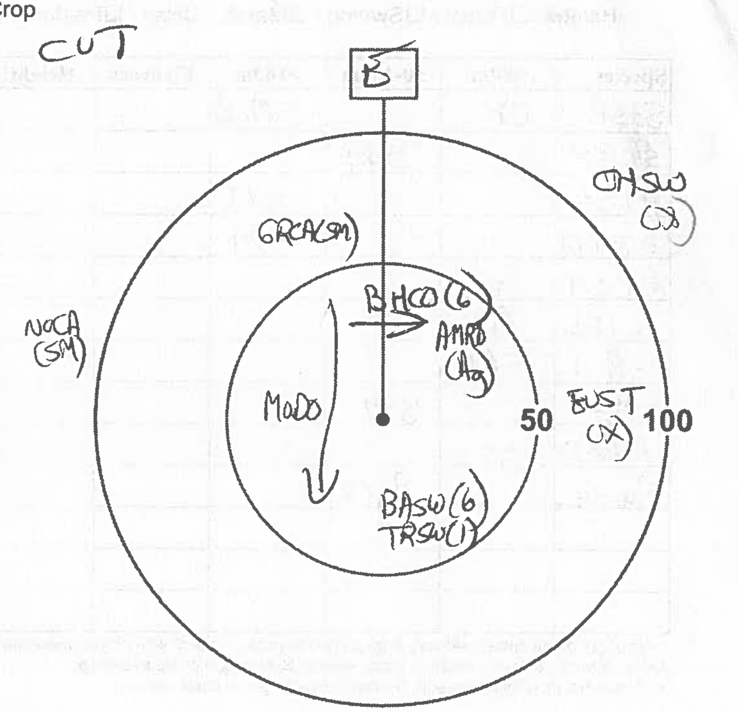
Station: 10 **Feature:** **UTM:** 606509 4785428

Start Time: 8^34 **End Time:** 8^39

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop CUT

Species	<50m	50-100m	>100m	Flyovers	Height*
CHSW			X	✓	
GRCA		SM			
BHCO	P (6)				
AMRO	Ag				
EUST		X			
MODO	X				
BASW	X (6)				
TRSW	X (1)				
NOCA			SM		

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



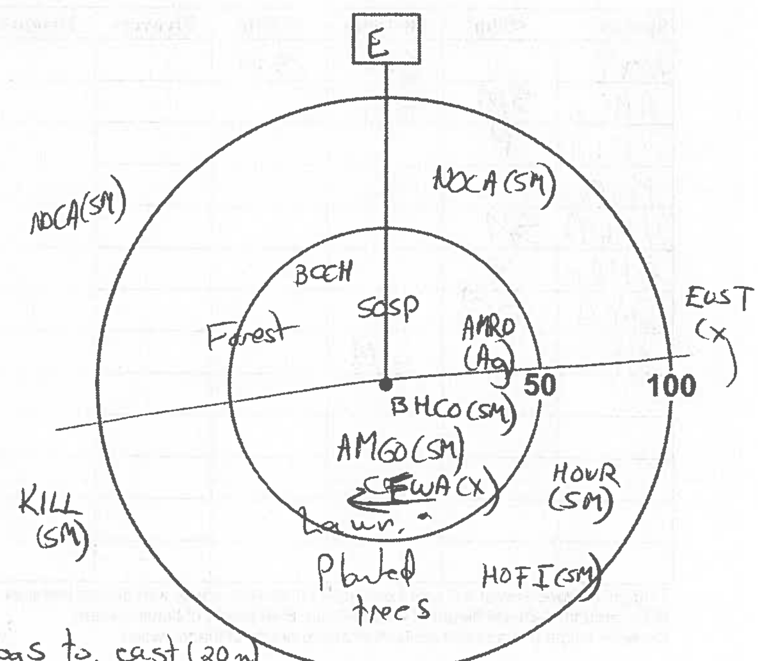
Station: 11 **Feature:** **UTM:** 606387 4785485

Start Time: 8^45 **End Time:**

Habitat: ☑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA		SM	SM		
BCCH	X				
SOSP	X				
AMRO	Ag				
EUST			X		
AMGO	SM				
BHCO	SM				
CEWA	X				
HOWR		SM			
HOFI		SM			
KILL			SM		

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



green frogs to east (20m) of survey station

Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ________ (Field Personnel) **Signature:** ________ (Project Manager)

REV: 2011-05-04 / FORM 020

Stantec
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1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: ____ Project Name: ____

Date: July 10, 2012 Field Personnel: ____

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):

GPS #: T

Station: 12 **Feature:** ____ **UTM:** 605692 4786278

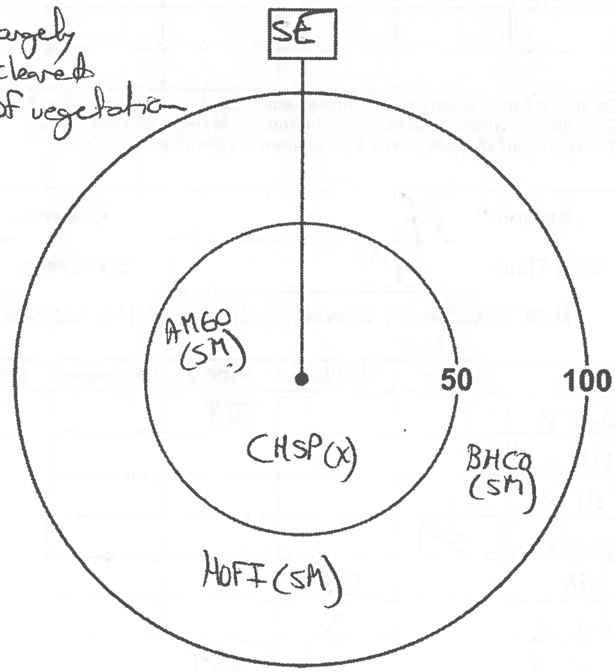
Start Time: 8⁵⁵ **End Time:** 9⁰⁰

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO	SM				
CHSP	X				
BHCO		SM			
HOFI		SM			

** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

largely cleared of vegetation



Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____ (Field Personnel)

Signature: ____ (Project Manager)

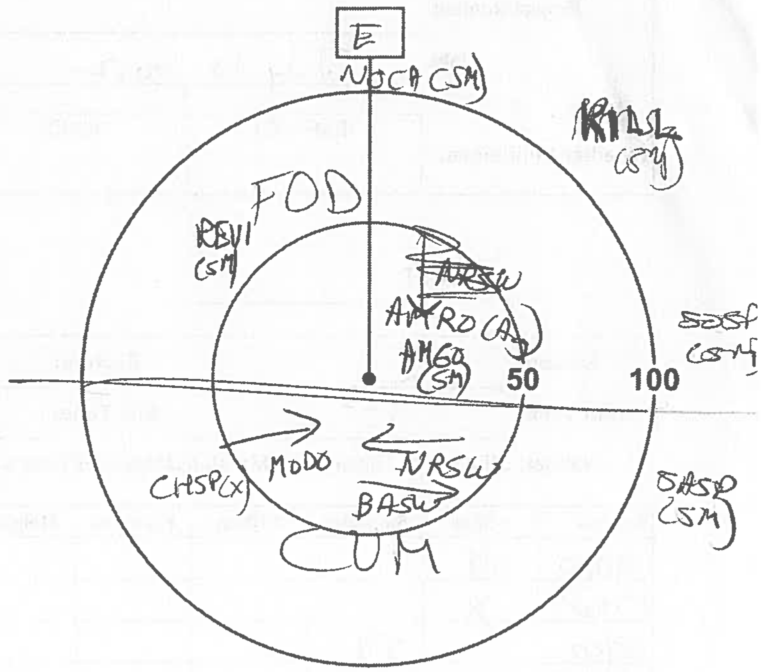
Station: 13 **Feature:** **UTM:** 606896 4785741

Start Time: 9[25] **End Time:** 9[30]

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop
CUM

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
KILL			SM		
REVI		SM			
AMRO	Ag				
AMGO	SM				
SOSP			SM		
CHSP		X			
NRSW	✓			✓	
BASW	✓			✓	
SASP			SM	✓	
MODO	✓				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



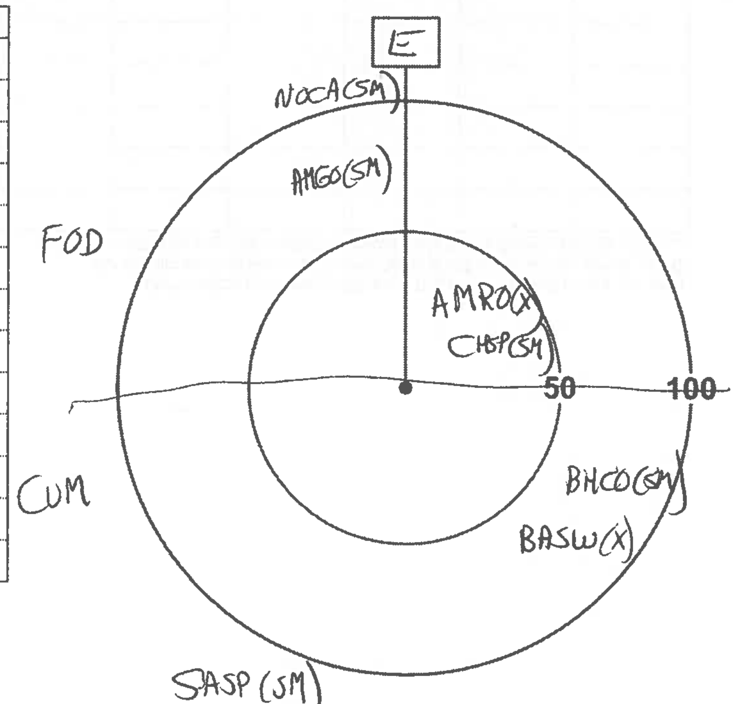
Station: 14 **Feature:** **UTM:** 606866 4785638

Start Time: 9[35] **End Time:** 9[40]

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop
CUM

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
AMGO		SM			
AMRO	X				
CHSP	SM				
BHCO		SM			
BASW		X			
SASP			SM		

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________________ (Field Personnel)

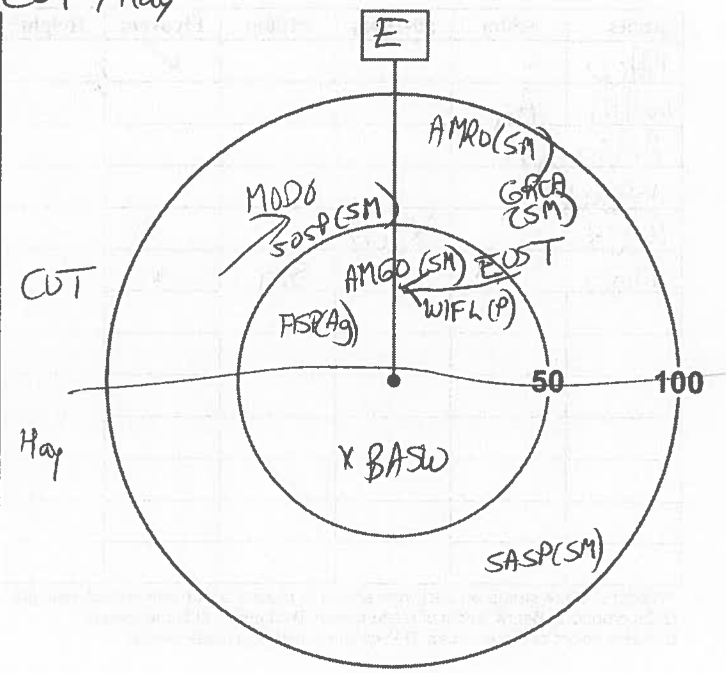
Signature: ______________________ (Project Manager)

Station: 15 Feature: UTM: 606832 4785515

Start Time: 9⁴⁵ End Time: 9⁵⁰

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop CUT / Hay

Species	<50m	50-100m	>100m	Flyovers	Height*
AMRO		SM			
GRCA		SM			
MODO		X			
SOSP		SM			
AMGO	SM				
EUST	X				
WIFL	P				
FISP	Ag				
SASP		SM			
BASW	X				



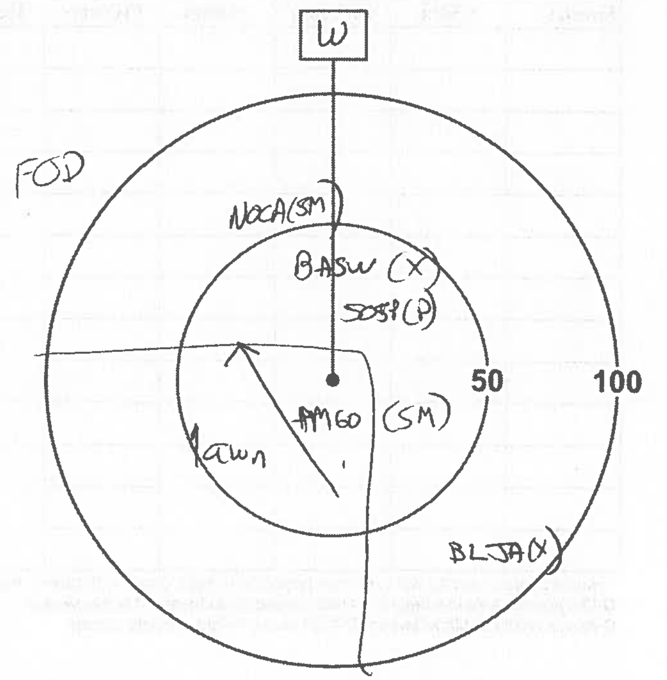
* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 16 Feature: UTM: 606992 4785671

Start Time: 10⁰⁵ End Time: 10¹⁵

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA		SM			
BASW	X			✓	
SOSP	P				
AMGO	SM			✓	
BLJA		X			



* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________ (Field Personnel) Signature: ______________ (Project Manager)

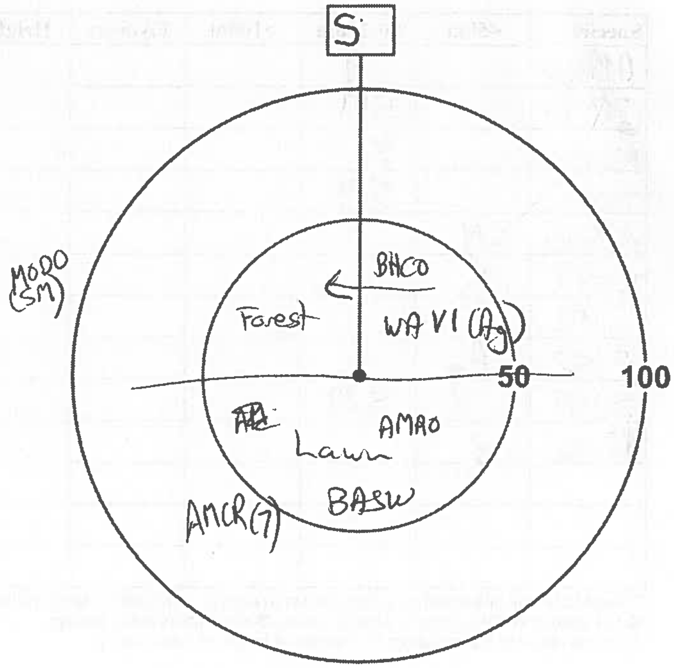
REV: 2011-05-04 / FORM 020

Station: 17 **Feature:** **UTM:** 607028

Start Time: 10^{15} **End Time:** 10^{20} 4785448

Habitat: ☑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BHCO	✓			✓	
WAVI	Ag				
AMRO	X				
BASW	X				
AMCR		X (7)			
MODO			SM		



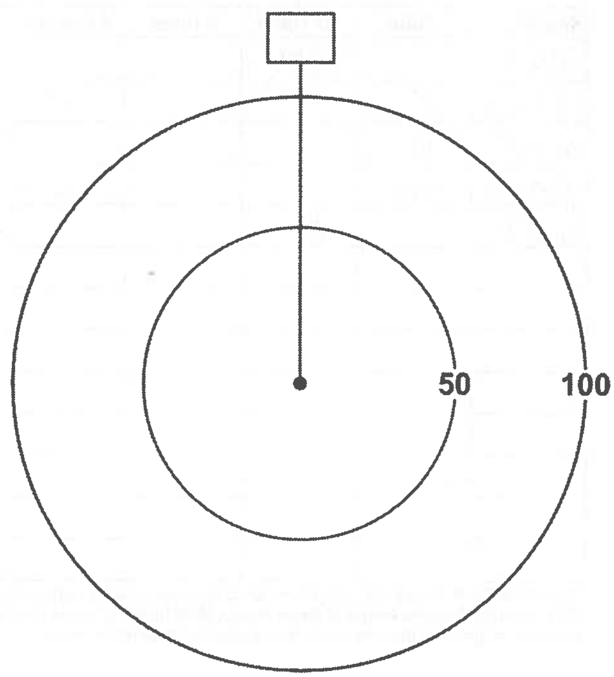
* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: **Feature:** **UTM:**

Start Time: **End Time:**

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*



* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________ (Field Personnel) **Signature:** ______________ (Project Manager)

Stantec
Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 60950443
Project Name: Hamilton-Fruitland
Date: June 25, 2012 05.30 –
Field Personnel: M. Korpyl

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	16° T 20°	2-3 (incr. to 4 by 9:45)	10%	Ø	rain

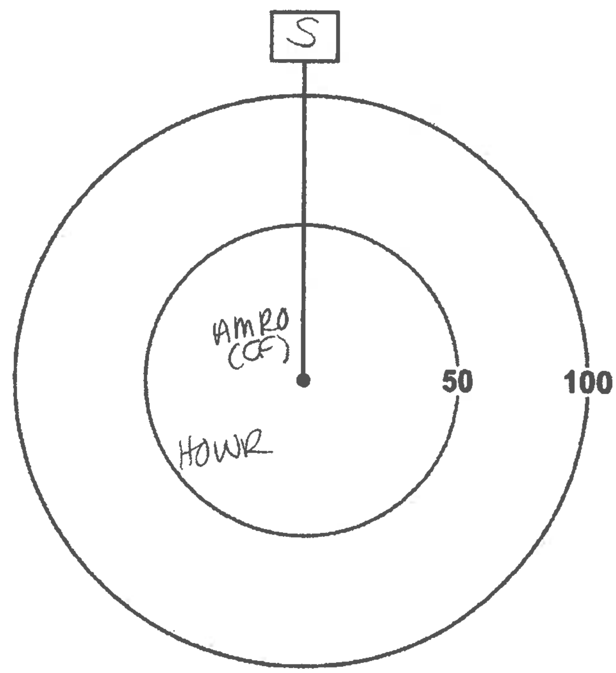
GPS #: T

Station: 12
Feature:
UTM: 17T 0605692 4786278
Start Time: 05 30
End Time: 05 35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMCR	1				
HOWR	1				

** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Page 1 of 5
Signature: [signature]
(Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.
Signature:
(Project Manager)

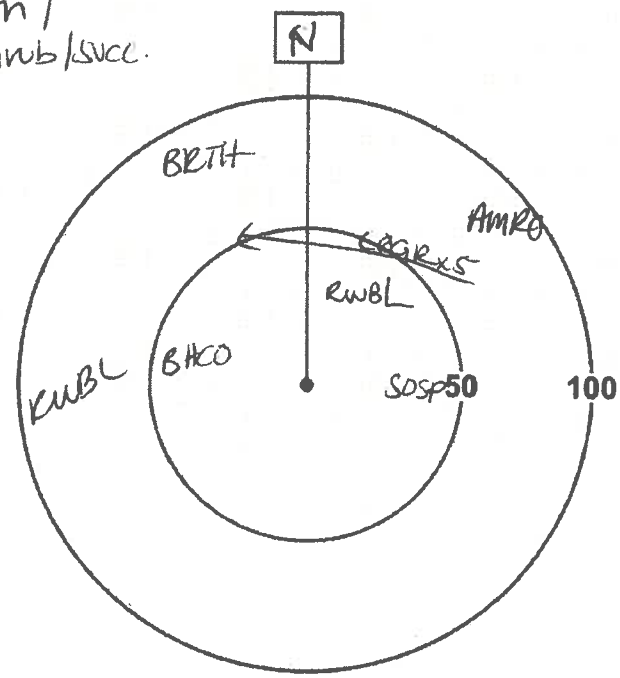
Station: 2 Feature: UTM: see Round 1

Start Time: 05:58 End Time: 06:03

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

cwm / shrub/succ.

Species	<50m	50-100m	>100m	Flyovers	Height*
BRTH		1			
BHCO	1				
RWBL	1	1			
COGR				5	
AMRO		1			
SOSP	1				



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

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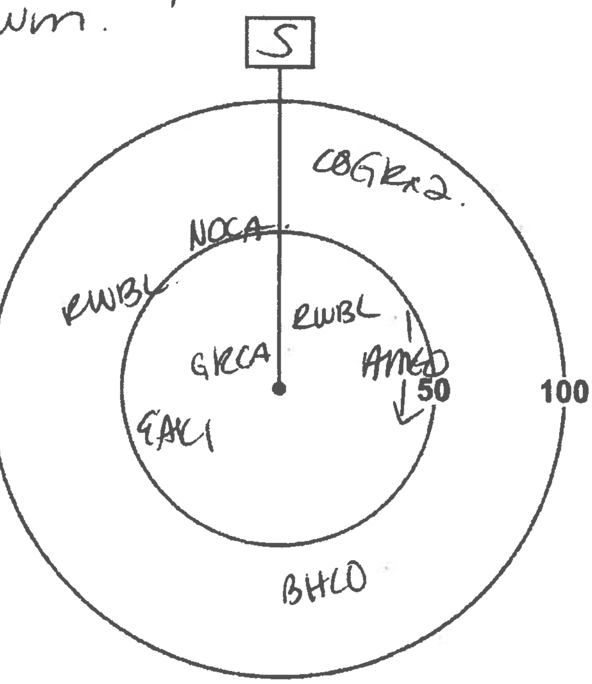
Station: 1 Feature: UTM: see round 1.

Start Time: 07:15 End Time: 07:20.

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

shrub/succ / cwm.

Species	<50m	50-100m	>100m	Flyovers	Height*
COGR		2			
NOCA		1			
RWBL	1	1			
GRCA	1				
GAKI	1				
AMGO				1	
BHCO		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page ___ of ___

Signature: (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 5 **Feature:** **UTM:** see round 1

Start Time: 06:35 **End Time:** 06:40

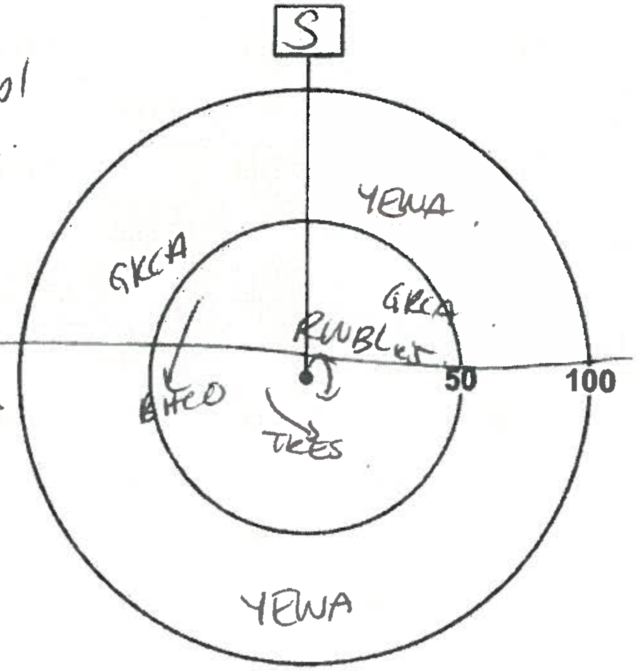
-no BARS

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
GRCA	1	1			
YEWA		2			
BHCO	1				
RWBL	5				
TRES				1	

shrub/ succ.

cum.



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 6 **Feature:** **UTM:** See Round 1

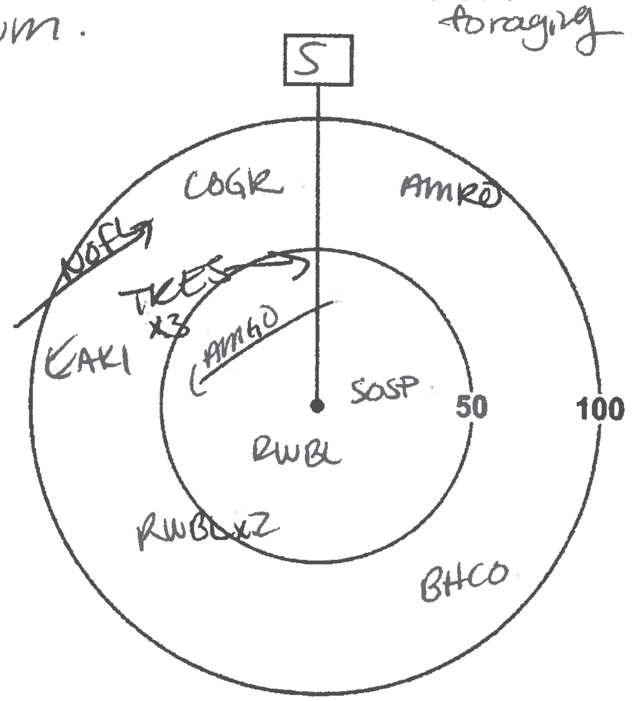
Start Time: 06:55 **End Time:** 07:00

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

+ 4 BARS foraging.

cum.

Species	<50m	50-100m	>100m	Flyovers	Height*
COGR		1			
AMRO		1			
TRES				3	
AMGO				1	
SOSP	1				
RWBL	1	2			
BHCO		1			
EAKI		1			
NOFL				1	



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Signature: _______________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑

Signature: _______________ (Project Manager)

Station: 3 **Feature:** **UTM:**

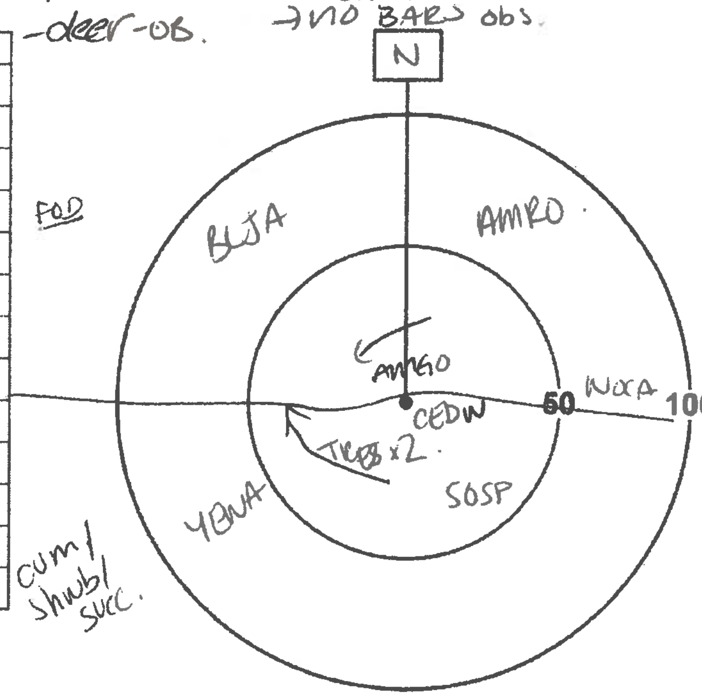
Start Time: 06:09 **End Time:** 06:14.

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop
CUM

-deer-OB.

→no BOBO/game habitat
→no BARS obs.

Species	<50m	50-100m	>100m	Flyovers	Height*
BLJA		1			
AMRO		1			
AMGO				1	
CEDW	1				
TRES				2	
YEWA		1			
SOSP	1				
NOCA		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 4 **Feature:** **UTM:**

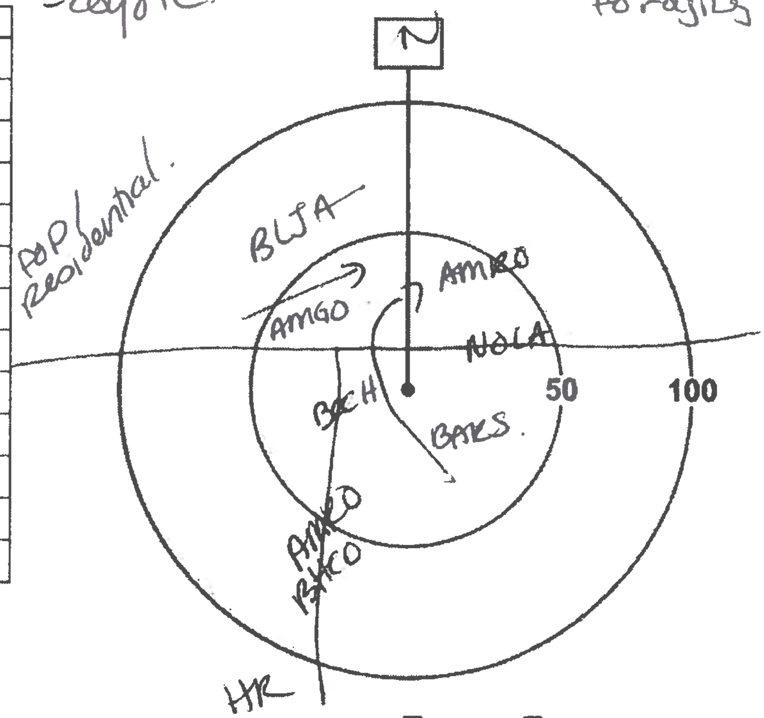
Start Time: 06:19 **End Time:** 06:24

Habitat: ☑Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☑Crop

-coyote.

*BARS x2 foraging

Species	<50m	50-100m	>100m	Flyovers	Height*
BLJA		1			
AMGO				1	
AMRO	2				
NOCA	1				
BCCH	1				
BARS				2	
BHCO		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page ___ of ___ Quality Control: This form is complete ☐ & legible ☐.

Signature: ____________________ **Signature:** ____________________
(Field Personnel) (Project Manager)

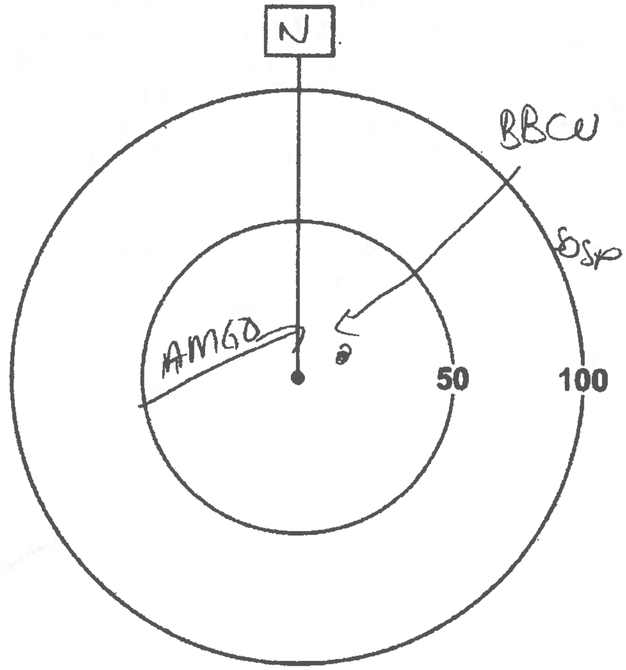
REV: 2011-05-04 / FORM 020

Station: 7 **Feature:** **UTM:**

Start Time: 07:35 **End Time:** 07:40

Habitat: ☒Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO				1	
BBCU	1				
SOSP			1		



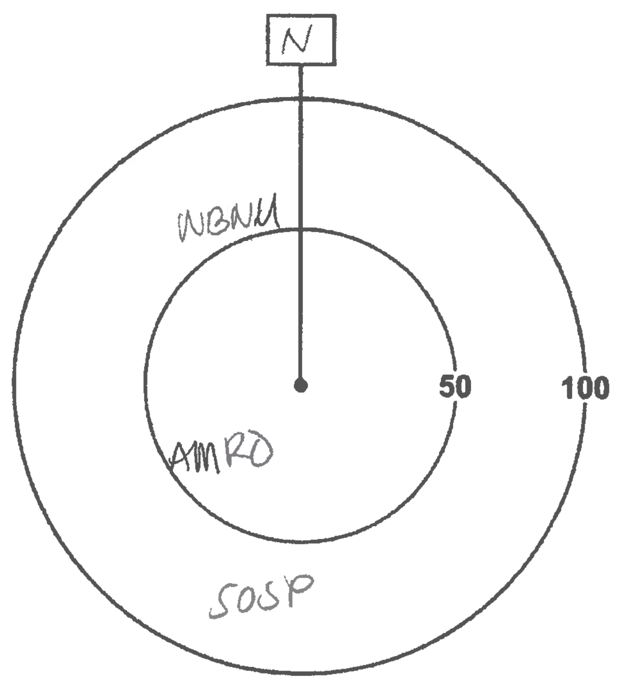
** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 11 **Feature:** **UTM:**

Start Time: 08:04 **End Time:** 08:09

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
WBNU		1			
AMRO	1				
SOSP		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Signature: (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 10 **Feature:** **UTM:**

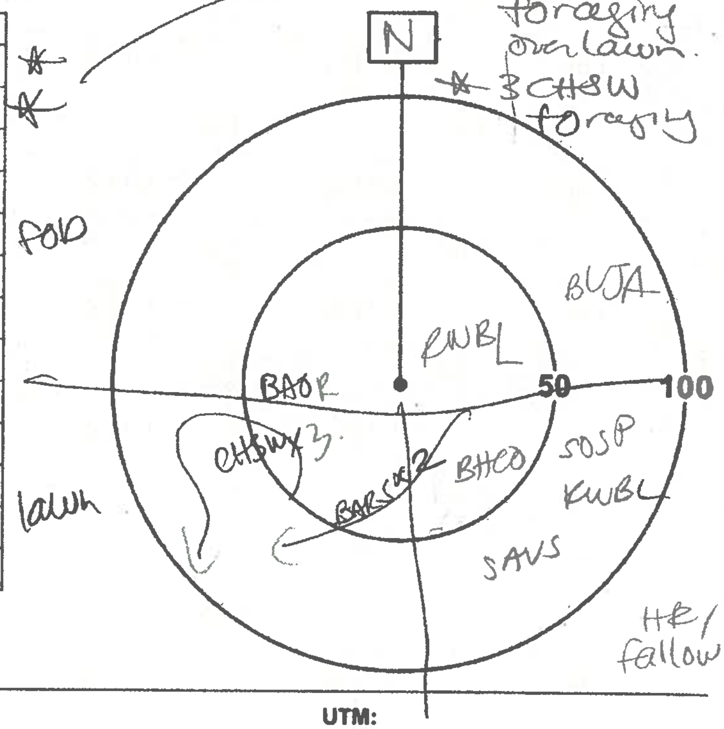
Start Time: 08:11 **End Time:** 08:16

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop
/lawn

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS				2	
CHSW				3	
BAOR	1				
RWBL	1	1			
BHCO	1				
SOSP		1			
SAVS		1			
BLJA		1			

*Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

* 2 BARS foraging over lawn.
* 3 CHSW foraging



Station: 9 **Feature:** **UTM:**

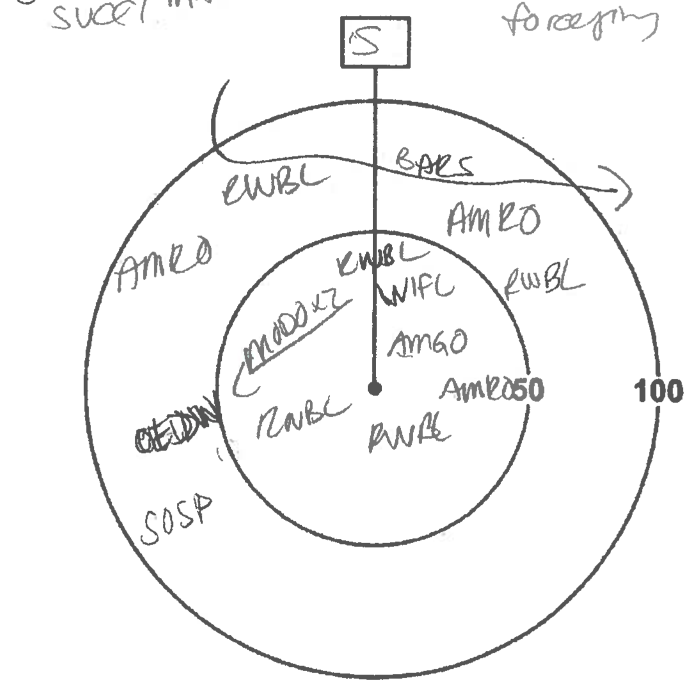
Start Time: 08:30 **End Time:** 08:35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop
shrub/succ/MAM

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS				1	
AMRO	1	2			
MODO				2	
AMGO	1				
RWBL	3	2			
WIFL	1				
SOSP		1			

*Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

√ 1 BARS foraging



Page ___ of ___

Signature: ______________________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Project Manager)

REV: 2011-05-04 / FORM 020

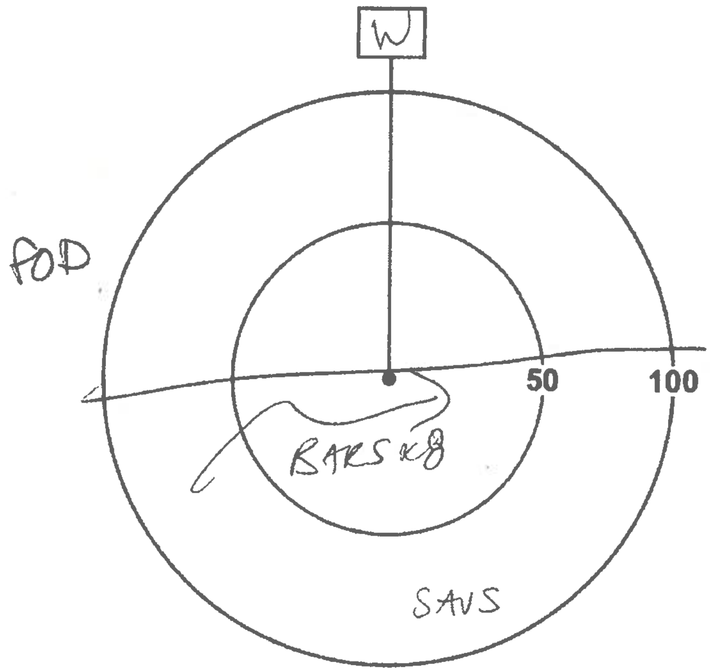
Station: 14 Feature: UTM:

Start Time: 09:37 End Time: 09:42

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS				8	
SAVS		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



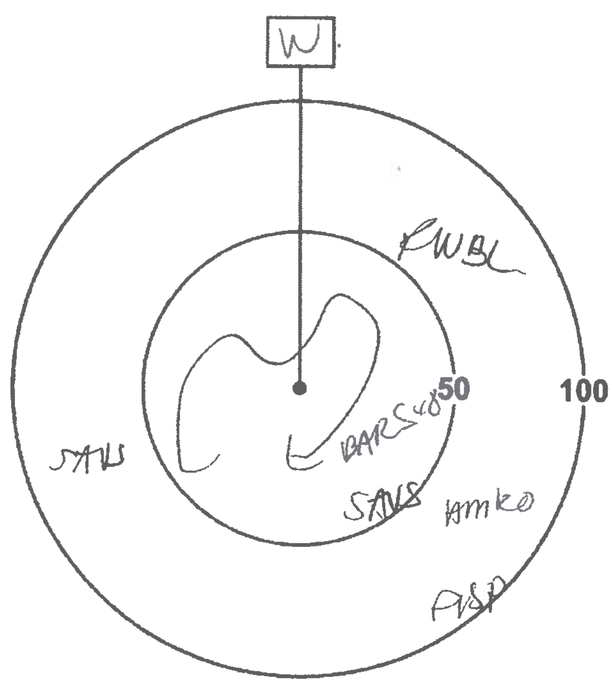
Station: 15 Feature: UTM:

Start Time: 09.45 End Time: 09:50

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS				8	
SAVS	1	1			
FISP		1			
AMKO		1			
RNBL		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Signature: [signature] (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 8 **Feature:** **UTM:** 0605757 4785545

Start Time: 09:05 **End Time:** 09:10

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL		1			
BHCO	1				
AMRO	1	1			
COYE	1				
MODO			8		
KILL	1				
GRCA		1			
COGR	2				

** Height of blade sweep will vary from project to project; check with project manager.*
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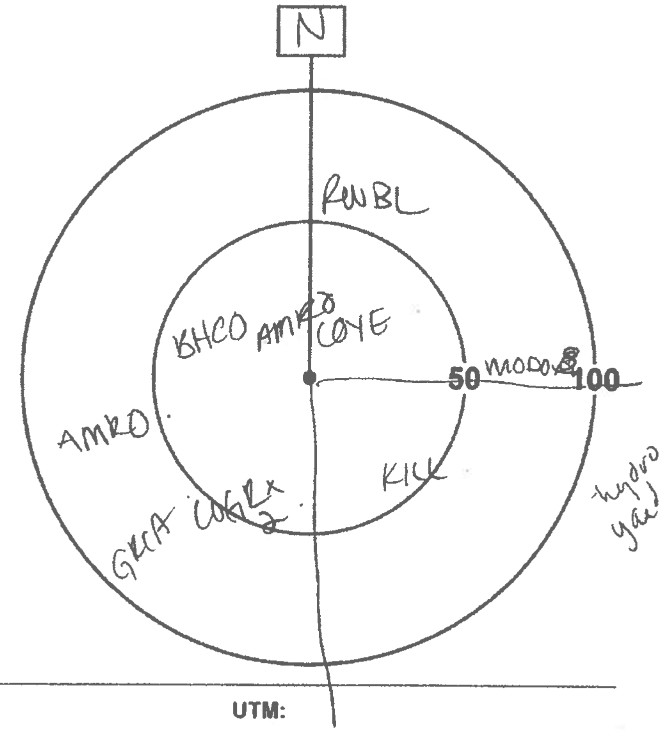
C-Above height of blade sweep; D-Well above height of blade sweep



Station: 13 **Feature:** **UTM:**

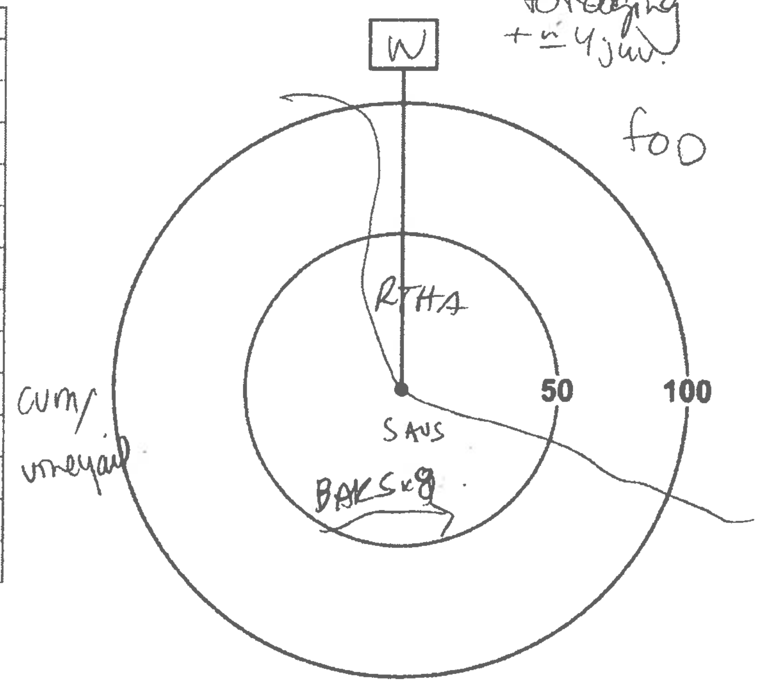
Start Time: 09:30 **End Time:** 09:35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop
corn

Species	<50m	50-100m	>100m	Flyovers	Height*
RTHA	1				
BARS				8	
SAVS	1				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

* 4 adult BARS foraging + ~4 juv.



Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel) **Signature:** ______________________ (Project Manager)

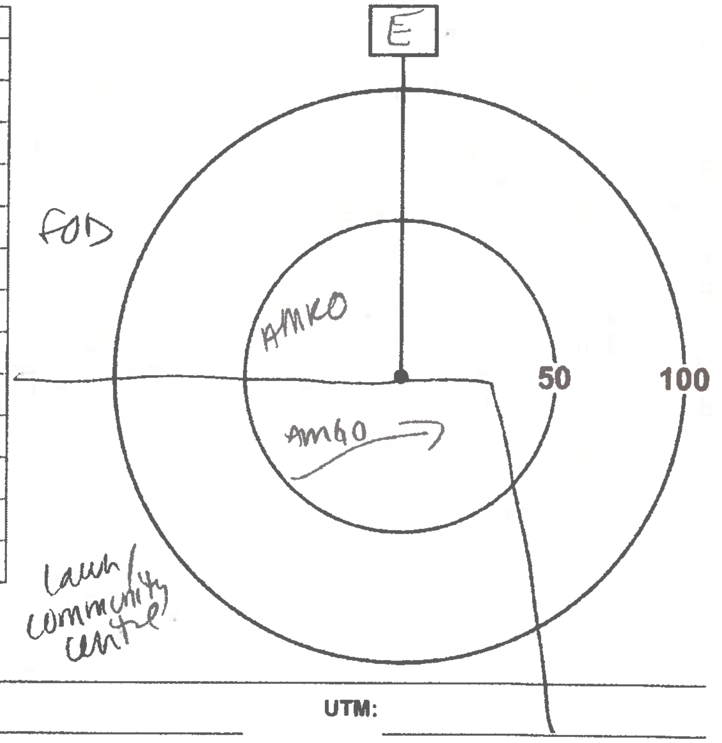
REV: 2011-05-04 / FORM 020

Station: 16 **Feature:** **UTM:**

Start Time: 09:56 **End Time:** 10:01

Habitat: ☒Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMKO	1				
AMGO				1	



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O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

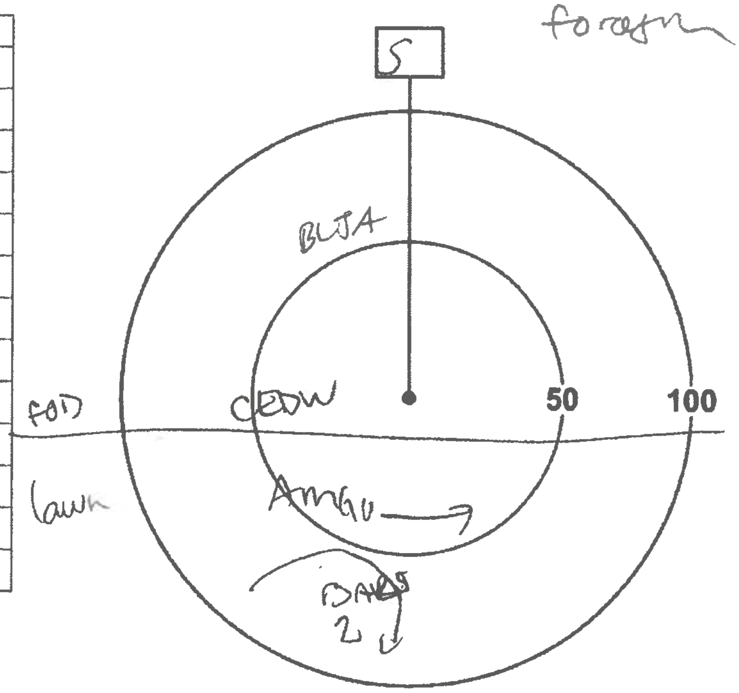
Station: 17 **Feature:** **UTM:**

Start Time: 10:04 **End Time:** 10:09

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

* 2 BARS foraging

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO				1	
CEDW	1				
BLJA		1			
BARS				2	



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page 5 of 5

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 160950443

Project Name: Fruitland-Winona Secondary Plan Area

Date: June 11 2012

Field Personnel: [redacted] M. Oliveira

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	17°c	0	20%	Ø	Ø

Please mark transect location on map and indicate areas of species observations on map.

Transect No.: 1

Habitat: NO SUITABLE HABITAT (SHRUB SUCCESSIONAL)

Start Time: /

End Time: /

Start Point UTM: /

End Point UTM: /

Species	Tally
Bobolink	0
Eastern Meadowlark	0

Transect No.: 2

Habitat: NO SUITABLE HABITAT

Start Time: /

End Time: /

Start Point UTM: /

End Point UTM: /

Species	Tally
Bobolink	0
Eastern Meadowlark	0

Pg. ___ of ___

Signature: [signature]
(Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: ____________
(Project Manager)

Transect No.:	3	**Habitat:**	CROP FIELD (NOT SUITABLE HABITAT)
Start Time:	06:	**End Time:**	
Start Point UTM:		**End Point UTM:**	

Species	Tally
Bobolink	
Eastern Meadowlark	

Transect No.:	4	**Habitat:**	HAY FIELD (UNCUT)
Start Time:	06:22	**End Time:**	06:32
Start Point UTM:	0606019 4785708	**End Point UTM:**	0606132 4785774

Species	Tally
Bobolink	11 (PAIR)
Eastern Meadowlark	0

Transect No.:	5	**Habitat:**	HAY FIELD (UNCUT)
Start Time:	06:39	**End Time:**	06:50
Start Point UTM:	0605944 4785773	**End Point UTM:**	06057355 4785841

Species	Tally
Bobolink	1 ♂
Eastern Meadowlark	0

Pg. ___ of ___

Signature: ______________________ (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________________ (Project Manager)

Transect No.: 6

Habitat: FIELD

Start Time: 07:31

End Time: 07:41

Start Point UTM: 0605501 4785499

End Point UTM: 0605585 4785606

Species	Tally
Bobolink	1 ♂
Eastern Meadowlark	0

Transect No.: 7

Habitat: FIELD / MIXED HAY/SCRUB
DRY/WET MEADOW FALLOW AREA

Start Time: 08:16

End Time: 08:26

Start Point UTM: 0605732 4785631

End Point UTM: 0605910 4785646

Species	Tally
Bobolink	1 ♂
Eastern Meadowlark	0

Transect No.: 8

Habitat: WET MEADOW ? /FIELD

Start Time: 08:35

End Time: 08:45

Start Point UTM: 0605977 4785580

End Point UTM: 0606046 4785562

Species	Tally
Bobolink	0
Eastern Meadowlark	0

Pg. ___ of ___

Signature: ______________________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 160950443
Project Name: Fruitland-Winona
Date: July 10, 2012
Field Personnel: D. Graham

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	17-24°C	1	10%	None	Light rain

Please mark transect location on map and indicate areas of species observations on map.

Station ~~Transect~~ No.: 4
Habitat: Wheat field
Start Time: 6[15]
End Time: 6[25]
Start Point UTM: 606042, 4786009
End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	Ø

Station ~~Transect~~ No.: 6
Habitat: Cultural meadow
Start Time: 6[45]
End Time: 6[50]
Start Point UTM: 605709, 4785872
End Point UTM:

Species	Tally
Bobolink	3: Two males, 1 female/juvenile
Eastern Meadowlark	Ø

Pg. ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 60950443 Project Name: Hamilton-Fruitland

Date: June 25, 2012. Field Personnel: N. Kopysh

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
		2.		∅	

10 min pc + transects.

Please mark transect location on map and indicate areas of species observations on map.

stn/ Transect No.: 5 Habitat: CUM - high degree of forbs

Start Time: 06:40. End Time: 06:50.

Start Point UTM: 060612/4785706 End Point UTM:

Species	Tally
Bobolink	∅
Eastern Meadowlark	∅
→ walked transects through field - no EAME or BOBO observed	

stn/ Transect No.: 6. Habitat: CUM - high degree of forbs

Start Time: 07:00 End Time: 07:10.

Start Point UTM: 600509/4785872 End Point UTM:

Species	Tally
Bobolink	∅
Eastern Meadowlark	∅,

Pg. 1 of 1

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Project Manager)

Transect No.: 7. Habitat: CUM

Start Time: 07:45 End Time: 07:55 -

Start Point UTM: 0605506 / 4785507. End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	Ø
COGR / RWBL / BHCO	flocks in field -

Transect No.: 9 Habitat: CUW / CUM.

Start Time: 08:30 - 08:40 End Time:

Start Point UTM: 0605974 / 4785591 End Point UTM:

Species	Tally
Bobolink	Ø not suitable habitat -
Eastern Meadowlark	Ø shrub/succ. habitat
	sml - CUM/CUW
	+ patches of MAM.

Transect No.: 8. Habitat: CUM.

Start Time: 09:10 End Time: 09:20

Start Point UTM: 0605743 / 4785580 End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	Ø

Pg. ___ of ___

Signature: ____________ (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: ____________ (Project Manager)

Chimney Assessment Form

Page 1

May 17, 2012 1

Observer Details

Name	Phone Number	Email Address	
Don Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
660 Barton	Hamilton	ON	
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- ☐ House
- ☐ Church
- ☑ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ______

Chimney Details

Site Name: 660 ~~Frontland~~ Barton

Chimney Code: H-660-0

GPS coordinates (DD.dddd):

Lat. 4786287 ° N

Long. 605674 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1 LO-141-2

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

No chimney

Chimney material (please check one):

- ☐ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ______

Surrounding habitat (please check one):

- ☐ Residential
- ☐ Industrial
- ☑ Commercial
- ☐ Natural
- ☐ Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☐ Square → Width (cm): ______
- ☐ Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443 Project Name: Scube

Date: July 12, 2012 Field Personnel: D. Graham

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:
	16-25°C	0-1	10%	None	None

Survey Station	Time AM	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive	
2	5^{45}	608483 4784921	2					Foraging
4	6^{15}	608758 4785292	3					Foraging
6	6^{45}		1					Foraging
8	7^{05}	610065 4785097	1					Foraging
11	7^{45}	610234 4785771	1					Foraging
14	8^{15}	609860 4785605	1					Foraging
15	9^{05}	610787 4785550	3					Foraging
16	8^{35}	608784 4785104	1					Foraging
17	8^{50}	611228 4785587	4					Foraging
Box culvert - on								
south Service Rd	12^{10}	6124[illegible] 4785577	0	Box culvert	N			
Box culvert - Hwy 8	12^{30}	608[illegible] 4784950	0	Box culvert	N			

Quality Control: This form is complete (__) & legible (__).

Signature: ______________________ Signature: \ ______________________
(Field Personnel) (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 160950443 Project Name: Scube

Date: July 4, 2012 Field Personnel: Michael Oliveira

Weather Conditions:	Temp: 20° C	Wind: 1-2	Cloud: 50%	PPT: Ø	PPT in last 24 hrs: Ø

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests	
						Active	Inactive
6	6:51-6:56	608587, 4785464	1	N.A.	Foraging only		
8	7:16-7:21	610089, 4785467	2	N.A.	Foraging only		

Quality Control: This form is complete (__) & legible (__).

Signature: ______________________ (Field Personnel) Signature: ______________________ (Project Manager)

Stantec

Stantec Consulting Ltd.
70-1 Southgate Drive
Guelph, Ontario, Canada
N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Barn Swallow Observation Form

Project Number: 60950443 Project Name: Scube

Date: June 26, 2012 Field Personnel: N. Kopysch

Weather Conditions:	Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:
	15 to 20°C	0-1	20%	Ø	Ø

Survey Station	Time	GPS Coordinates	# BARS observed	Type of structure (e.g. barn, culvert)	Accessible nesting sites (Y or N)	Nests Active	Nests Inactive
15	6:50-6:55	610049, 4785387	1	N.A.	Foraging only		
8	7:04-7:09	610651, 4785097	2	N.A.	Foraging only		
17	7:49-7:54	608784 4785404	1	N.A.	Foraging only		
5	8:35-8:40	608294' 4785534	1	N.A.	Foraging only		
6	8:45-8:50	608587' 4785464	3	N.A.	Foraging only		
18	9:00-9:05	610787' 4785550	1	N.A	Foraging only		

Quality Control: This form is complete (__) & legible (__).

Signature: ________________ (Field Personnel) Signature: ________________ (Project Manager)

Chimney Assessment Form

Page 2

Chimney height above roofline (m):	Number of Flues:	Colour of Chimney:

Total Chimney Height (m) = ______ × 3 m + ______ = ______ m

(Number of stories in building) (approx height of one story) (Height above roofline (m))

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:

None seen

Created by:

In partnership with:

Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
692 Barton	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- ☑ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ______

Chimney Details

Site Name: 692 Barton

Chimney Code: H-692-1

GPS coordinates (DD.dddd):

Lat. 4786235 ° N

Long. 605881 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

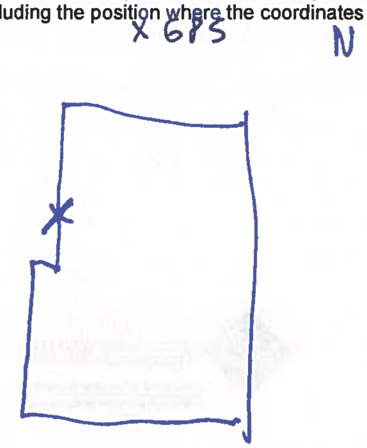
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☑ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☑ Spark Protector
- ☑ Metal Liner
- ☐ Other, please specify: ______

Surrounding habitat (please check one):

- ☑ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: limited to roadway

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☑ Square → Width (cm): 40
- ☐ Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

2

Chimney height above roofline (m):	2 m	Number of Flues:	1 ✓	Colour of Chimney:	Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 2m (Height above roofline (m)) = 5m m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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THE ONTARIO TRILLIUM FOUNDATION
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Environment Canada / Environnement Canada
Ontario Region / Région de l'Ontario

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Chimney Assessment Form

Page 1

3

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
720 Barton	Hamilton	ON	
Owner Name	Phone Number	Email Address	
	( )		

Type of building (please check one):

- ☐ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ________

Chimney Details

Site Name	Chimney Code
720 Barton	H - 720 - 1

GPS coordinates (DD.dddd):

Lat. 4786169 ° N

Long. 606102 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

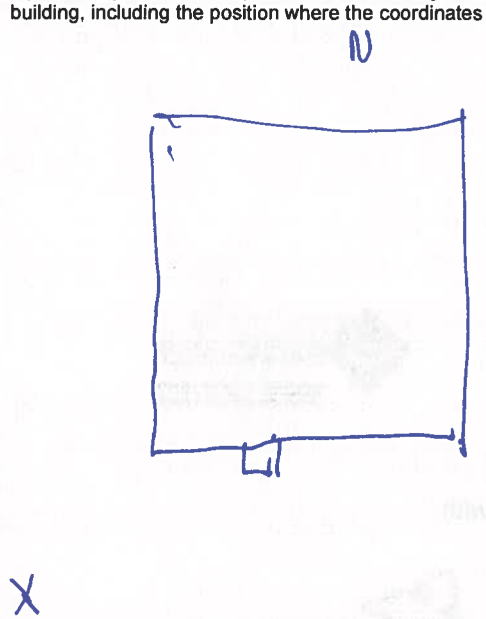
Eg. City Name	Site Name	No. of Chimneys	Code
Port Rowan	Public Library	1	PR-PL-1
London	141 Wortley	2	LO-141-1
			LO-141-2

Number of years active (if known):

Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☑ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☑ Metal Liner
- ☐ Other, please specify: ________

Surrounding habitat (please check one):

- ☑ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ________
- ☑ Square → Width (cm): 40
- ☐ Rectangular → Width (cm): ________ Length (cm): ________

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

3

Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

Page 1

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Observer Details

Name	Phone Number	Email Address
D. Graham	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
748 Barton	Hamilton	ON	

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 748 Barton

Chimney Code: H-748-1

GPS coordinates (DD.dddd):

Lat. 111 ° N

Long. 297 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

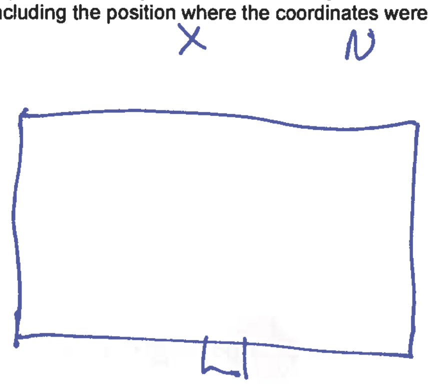
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [x] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 60 Length (cm): 21

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

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Chimney Assessment Form

Page 2

Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:

None seen.

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address
D. Graham	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
789 Barton	Hamilton	ON	

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- [ ] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 789 Barton

Chimney Code: H-789-1

GPS coordinates (DD.dddd):

Lat. 4786 043536 ° N

Long. 606 527 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

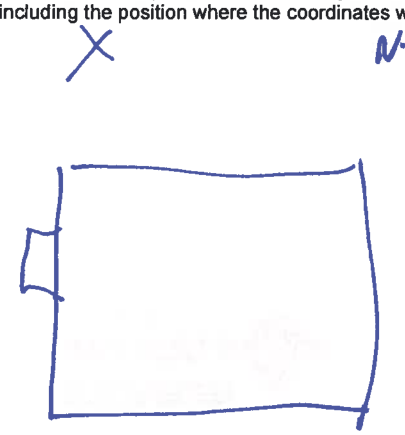
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1 LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [x] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [x] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ____________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 40
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

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Chimney height above roofline (m): 3	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = ~~2~~ 1 (Number of stories in building) × 3 m (approx height of one story) + 3 (Height above roofline (m)) = 6 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address
D Graham	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
822 Barton	Hamilton	ON	

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ______

Chimney Details

Site Name: 822 Barton

Chimney Code: H-822-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 478.5968 ° N

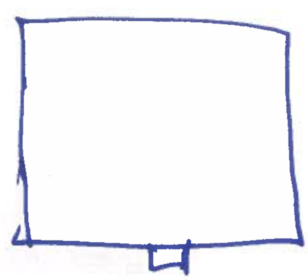
Long. 606758 ° W

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Concrete
- [ ] Stucco
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Animal Guard
- [ ] Metal Liner
- [ ] Terra Cotta Liner
- [ ] Spark Protector
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential
- [ ] Commercial
- [ ] Industrial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 40 x 40
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

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Chimney height above roofline (m): 0.5	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 0.5 (Height above roofline (m)) = 6.5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments: None seen.

However several Barn Swallows observed flying in & out of wooden garage, behaviour which suggests nesting.

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Chimney Assessment Form

Page 1

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Observer Details

Name		Phone Number	Email Address
D. Graham		( )	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
844 Barton	Hamilton	ON	
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____

Chimney Details

Site Name: 844 Barton

Chimney Code: H -844-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4785915 ° N

Long. 606904 ° W

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

Chimney material (please check one):

- [ ] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [x] Metal Liner
- [ ] Other, please specify: ____

Surrounding habitat (please check one):

- [ ] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [x] Other, please specify: Rural/residential

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ____
- [ ] Square → Width (cm): ____
- [x] Rectangular → Width (cm): 40 Length (cm): 80

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

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Chimney height above roofline (m): 1	Number of Flues: 2	Colour of Chimney: Black

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

At least 2 Barn Swallow seen here

2 potential nest sites @ 832 Barton exists (barn, garage)

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Chimney Assessment Form

Page 1

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Observer Details

Name D. Graham	Phone Number ( )	Email Address	
Street Address ~~Barton~~	City	Prov. ON	Postal Code

Building Details

Street Address Barton	City Hamilton	Prov. ON	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 884 Barton

Chimney Code: H-884-1

GPS coordinates (DD.dddd):

Lat. 4785821 ° N

Long. 607206 ° W

Number of years active (if known):

NOTE: Chimney codes are created using the following scheme:

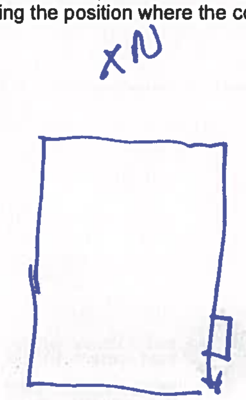
City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [x] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 40x40
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

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Chimney height above roofline (m): 3	Number of Flues: 1	Colour of Chimney: Brown
Total Chimney Height (m) = 10 (Number of stories in building) × 3 m (approx height of one story) + 3 (Height above roofline (m)) = 6 m		
If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown		
Additional Comments: None seen		

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Ontario

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Chimney Assessment Form

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Observer Details

Name		Phone Number	Email Address
D. Graham		( )	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
Barton	Hamilton	ON	
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- ☐ House
- ☑ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ____________

Chimney Details

Site Name

Chimney Code H -

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4785777 ° N

Long. 607304 ° W

Number of years active (if known):

Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ____________

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☑ Terra Cotta Liner
- ☑ Animal Guard
- ☑ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ____________

Surrounding habitat (please check one):

- ☑ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☐ Square → Width (cm): ______
- ☑ Rectangular → Width (cm): 90 Length (cm): 270

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 2	Number of Flues: 1	Colour of Chimney: Tan.

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 8 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

1 Barn Swallow nesting on east side of church under eaves. 2nd BASW pair present.

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
Don Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
26 Glover	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 26 Glover

Chimney Code: H-26-1

GPS coordinates (DD.dddd):

Lat. 4785563 ° N

Long. 607173 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

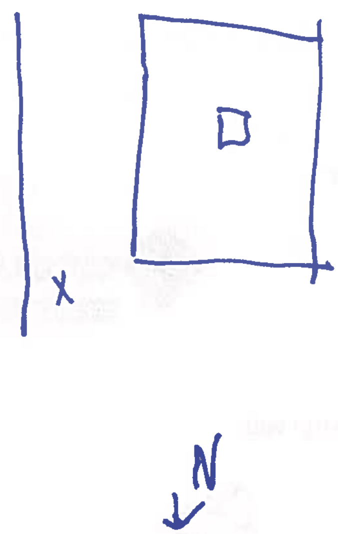
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [x] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 40
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m):	2	Number of Flues:	1	Colour of Chimney:	Brown

Total Chimney Height (m) = 1.5 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 6.5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
239 Glover	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- ☑ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: Apr

Chimney Details

Site Name: 239 Glover

Chimney Code: H-239-1

GPS coordinates (DD.dddd):

Lat. 4785327 ° N

Long. 607101 ° W

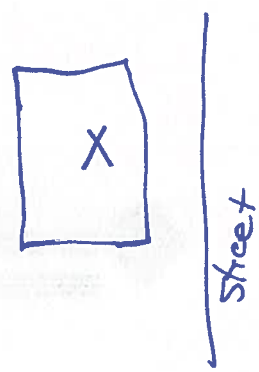
NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify:

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☑ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify:

Surrounding habitat (please check one):

- ☑ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify:

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm):
- ☐ Square → Width (cm):
- ☑ Rectangular → Width (cm): 40 Length (cm): 80

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form
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Chimney height above roofline (m): 1.5	Number of Flues: 2	Colour of Chimney: Tan

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 1.5 (Height above roofline (m)) = 4.5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:
None seen

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Chimney Assessment Form

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Observer Details

Name D. Graham	Phone Number ( )	Email Address

Street Address	City	Prov.	Postal Code

Building Details

Street Address Glover	City Hamilton	Prov. ON	Postal Code

Owner Name	Phone Number ( )	Email Address

Type of building (please check one):

- [ ] House
- [x] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify:

Kingdom Hall of Jehovah Witnesses

Chimney Details

Site Name: Glover

Chimney Code: H- -0

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4785169 ° N

Long. 607057 ° W

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

None seen

Chimney material (please check one):

- [ ] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify:

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify:

Surrounding habitat (please check one):

- [x] Residential + Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify:

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm):
- [ ] Square → Width (cm):
- [ ] Rectangular → Width (cm): Length (cm):

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

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Chimney height above roofline (m):	Number of Flues:	Colour of Chimney:

Total Chimney Height (m) = ______ (Number of stories in building) × 3 m (approx height of one story) + ______ (Height above roofline (m)) = ______ m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None. seen

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
873 Hwy 8	Hamilton	ON	
Owner Name	Phone Number	Email Address	
	( )		

Type of building (please check one):

- ☐ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ______

Chimney Details

Site Name: 873 Hwy 8

Chimney Code: H -

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1 LO-141-2

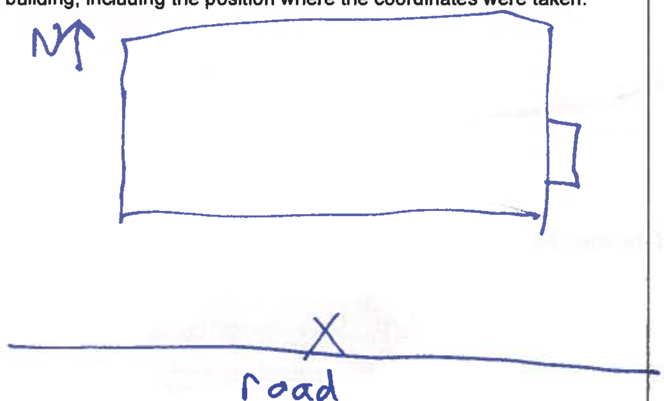
GPS coordinates (DD.dddd):

Lat. 4785087 ° N

Long. 606915 ° W

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☑ Cap
- ☑ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ______

Surrounding habitat (please check one):

- ☑ Residential / Rural
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☐ Square → Width (cm): ______
- ☑ Rectangular → Width (cm): 40 Length (cm): 120

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 2	Number of Flues: 2	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
843 Hwy 8	Ham. Ham	ON.	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 843 Hwy 8

Chimney Code: H-843-1

GPS coordinates (DD.dddd):

Lat. 4785187 ° N

Long. 606734 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

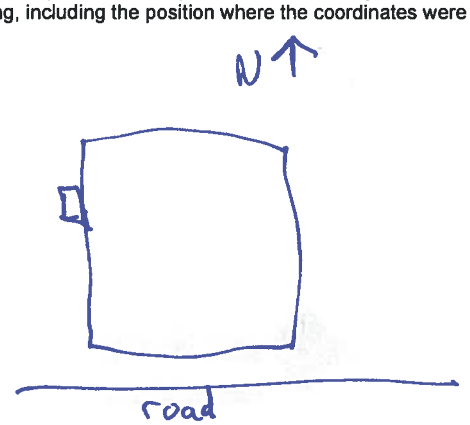
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [ ] Brick
- [ ] Stucco
- [x] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 40cm
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form
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Chimney height above roofline (m): 2	Number of Flues: 1	Colour of Chimney: Gray

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 8 m

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:
None seen.
BASW Seen in area. Potential nest sites in area.

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
809 Hwy 8	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 809 Hwy 8

Chimney Code: H-809

GPS coordinates (DD.dddd):

Lat. 43.12 ° N

Long. 79.41 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 20 Length (cm): 120

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 3	Number of Flues: 2	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 3 (Height above roofline (m)) = 6 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen.

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address
D. Graham	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
777 Hwy 8	Hamilton	ON	

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- ☐ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☑ Other, please specify: Stoney Creek Municipal Building

Chimney Details

Site Name: 777 Hwy 8

Chimney Code: H-777-0

GPS coordinates (DD.dddd):

Lat. 43.12.731 ° N

Long. 79.41.500 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

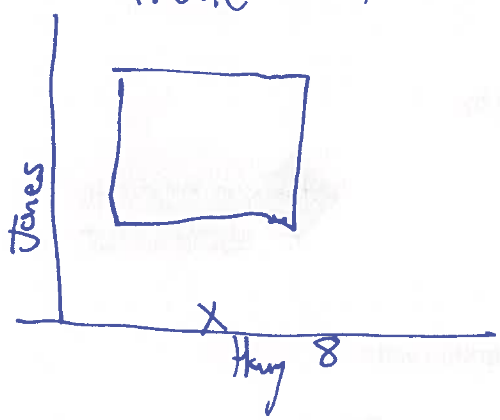
Number of years active (if known):

Chimney material (please check one):

- ☐ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ____

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

None seen



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ____

Surrounding habitat (please check one):

- ☐ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ____

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ____
- ☐ Square → Width (cm): ____
- ☐ Rectangular → Width (cm): ____ Length (cm): ____

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

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Chimney Assessment Form

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Chimney height above roofline (m):	Number of Flues:	Colour of Chimney:
Total Chimney Height (m) = ______ (Number of stories in building) × 3 m (approx height of one story) + ______ (Height above roofline (m)) = ______ m		
If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**		
Additional Comments:		

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Chimney Assessment Form

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Observer Details

Name D. Graham	Phone Number ( )	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address 743 Hwy 8	City Hamilton	Prov. ON	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ______

Chimney Details

Site Name: 743 Hwy 8

Chimney Code: H-

GPS coordinates (DD.dddd):

Lat. 4785182 ° N

Long. 605959 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

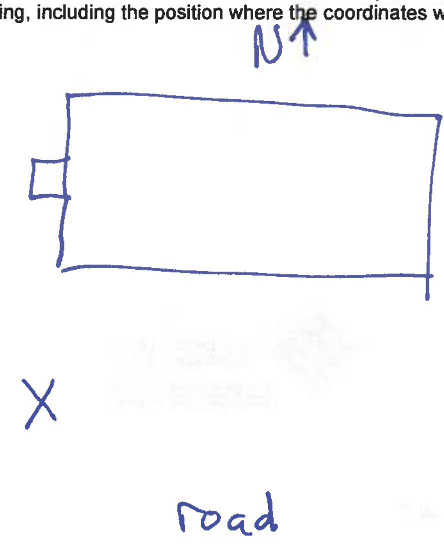
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Concrete
- [ ] Other, please specify: ______
- [ ] Stucco
- [ ] Stone

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [ ] Animal Guard
- [ ] Metal Liner
- [x] Terra Cotta Liner
- [ ] Spark Protector
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Commercial
- [ ] Other, please specify: ______
- [ ] Industrial
- [ ] Natural

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 50 X 50
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
703 Hwy 8	Hamilton	ON.	
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- ☐ House
- ☐ Church
- ☑ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ______

Chimney Details

Site Name: 703 Hwy 8

Chimney Code: H - 703

GPS coordinates (DD.dddd):

Lat. 4785231 ° N

Long. 605701 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

No chimney

Chimney material (please check one):

- ☐ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ______

Surrounding habitat (please check one):

- ☐ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☐ Square → Width (cm): ______
- ☐ Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Page 2

Chimney height above roofline (m):	Number of Flues:	Colour of Chimney:
Total Chimney Height (m) = _____ Number of stories in building × 3 m (approx height of one story) + _____ Height above roofline (m) = _____ m		
If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown		
Additional Comments: No birds seen		

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
669 Hwy 8	Ham. Hon	ON	
Owner Name	Phone Number	Email Address	
	( )		

Type of building (please check one):

- ☑ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ____________

Chimney Details

Site Name: 669 Hwy 8

Chimney Code: H-669-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4785285 ° N

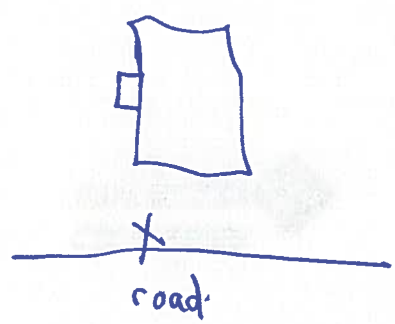
Long. 605454 ° W

Number of years active (if known):

Chimney material (please check one):

- ☐ Brick
- ☐ Stucco
- ☐ Concrete
- ☑ Stone
- ☐ Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☑ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ____________

Surrounding habitat (please check one):

- ☑ Residential (road)
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ____________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ______
- ☑ Square → Width (cm): 40 cm
- ☐ Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

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Chimney height above roofline (m): 2	Number of Flues: 1	Colour of Chimney: Gray

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen.

Barn Swallow foraging. Apparently suitable nesting sites nearby.

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
196 Fruitland Rd	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- ☑ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ____

Chimney Details

Site Name: 196 Fruitland

Chimney Code: H-

GPS coordinates (DD.dddd):

Lat. 4785502 ° N

Long. 605353 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

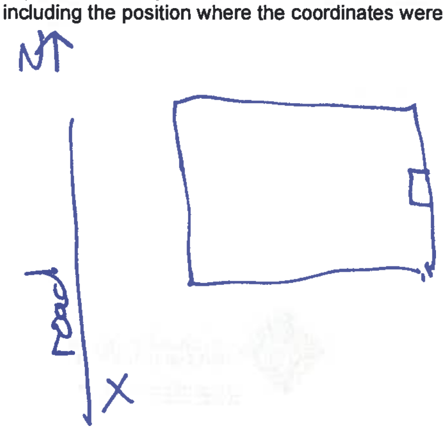
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- ☑ Brick
- ☐ Stucco
- ☐ Concrete
- ☐ Stone
- ☐ Other, please specify: ____

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☑ Cap
- ☐ Terra Cotta Liner
- ☐ Animal Guard
- ☐ Spark Protector
- ☑ Metal Liner
- ☐ Other, please specify: ____

Surrounding habitat (please check one):

- ☑ Residential
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ____

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ____
- ☐ Square → Width (cm): ____
- ☑ Rectangular → Width (cm): 15 Length (cm): 30

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 0.5	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:

None seen

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Chimney Assessment Form

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
222 Fruitland Rd	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 222 Fruitland

Chimney Code: H-222-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

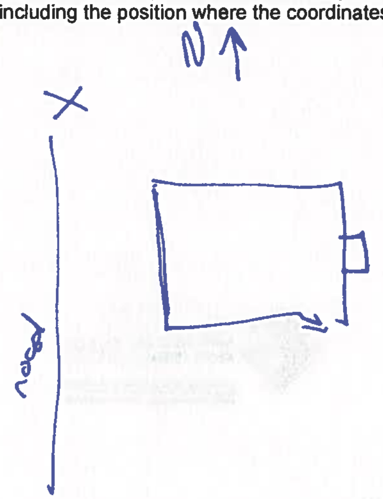
GPS coordinates (DD.dddd):

Lat. 4785727 ° N

Long. 605406 ° W

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Chimney material (please check one):

- [ ] Brick
- [ ] Stucco
- [x] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 20 Length (cm): 60

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Gray

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen.

Barn Swallow foraging overhead

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Chimney Assessment Form

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Page 1

Observer Details

Name D. Graham		Phone Number ( )	Email Address
Street Address	City	Prov.	Postal Code

Building Details

Street Address 250 Fruitland Rd		City Hamilton	Prov. ON	Postal Code
Owner Name	Phone Number ( )	Email Address		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name 250 Fruitland

Chimney Code H-250-1

GPS coordinates (DD.dddd):

Lat. 4785 921 ° N

Long. 605459 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

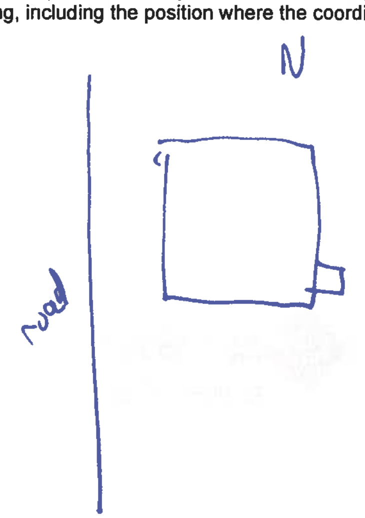
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [x] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential /Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 25 Length (cm): 50

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 3	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 3 (Height above roofline (m)) = 6 m

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:

None seen

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Chimney Assessment Form

Page 1

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Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
288 Fruitland Rd	Hamilton	ON	
Owner Name	Phone Number	Email Address	
	( )		

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ______

Chimney Details

Site Name: 288 Fruitland

Chimney Code: H-288-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4786204 ° N

Long. 605526 ° W

Number of years active (if known):

Chimney material (please check one):

- [ ] Brick
- [x] Concrete
- [ ] Other, please specify: ______
- [ ] Stucco
- [ ] Stone

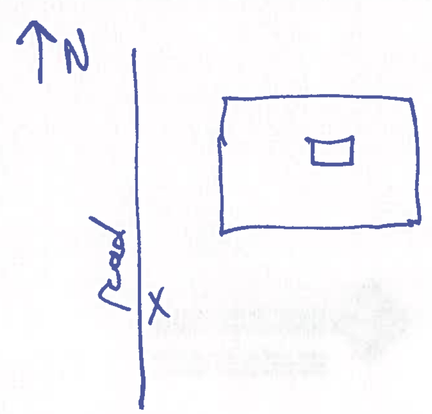
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Animal Guard
- [ ] Metal Liner
- [ ] Terra Cotta Liner
- [ ] Spark Protector
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential /rural
- [ ] Commercial
- [ ] Other, please specify: ______
- [ ] Industrial
- [ ] Natural

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 50
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Gray

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

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Chimney Assessment Form

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Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
287 Jones Rd.	Hamilton	ON	
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 287 Jones

Chimney Code: H-287

GPS coordinates (DD.dddd):

Lat. 4785965 ° N

Long. 606379 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

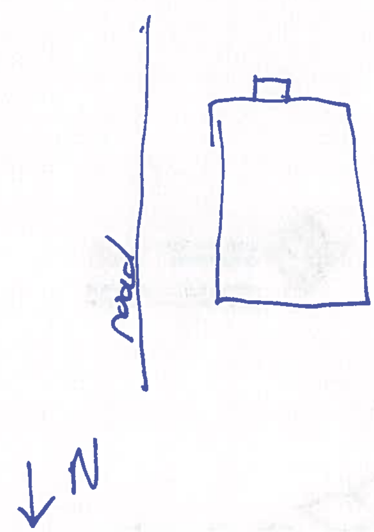
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [ ] Brick
- [ ] Stucco
- [x] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): 50
- [ ] Rectangular → Width (cm): ______ Length (cm): ______

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Gray
Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 4 m		
If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**		
Additional Comments: None seen		

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Chimney Assessment Form

Page 1

Observer Details

Name		Phone Number	Email Address	
D. Graham		( )		
Street Address	City		Prov.	Postal Code

Building Details

Street Address	City		Prov.	Postal Code
259 Jones Rd	Hamilton		ON	
Owner Name	Phone Number		Email Address	
	( )			

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 259 Jones

Chimney Code: H-259

GPS coordinates (DD.dddd):

Lat. 4785796 ° N

Long. 606335 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

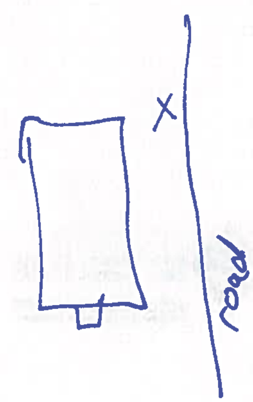
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [x] Residential | Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ____________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 50 Length (cm): 80

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

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Chimney height above roofline (m): 2.5		Number of Flues: 1		Colour of Chimney: Brown		
Total Chimney Height (m)	= 1 Number of stories in building	×	3 m (approx height of one story)	+	2.5 Height above roofline (m)	= 5.5 m
If swifts are present, are they:	☐ Nesting		☐ Roosting		☐ Unknown	
Additional Comments: None seen						

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Chimney Assessment Form

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Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
238 Jones Rd	Hamilton	ON	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 238 Jones

Chimney Code: H-238-1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

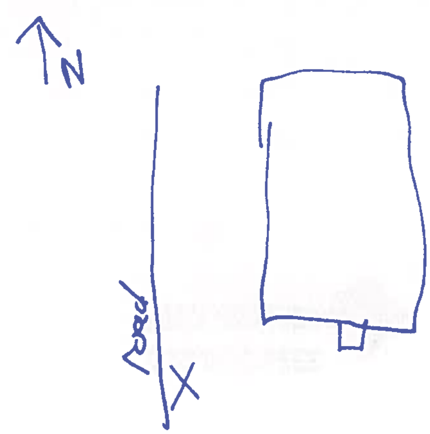
GPS coordinates (DD.dddd):

Lat. 4785562 ° N

Long. 606281 ° W

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Chimney material (please check one):

- [x] Brick
- [ ] Concrete
- [ ] Stucco
- [ ] Stone
- [ ] Other, please specify: ____________

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [ ] Animal Guard
- [ ] Metal Liner
- [ ] Terra Cotta Liner
- [ ] Spark Protector
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [x] Residential | rural
- [ ] Commercial
- [ ] Industrial
- [ ] Natural
- [ ] Other, please specify: ____________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 40 Length (cm): 80

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form 26

Page 2

Chimney height above roofline (m): 0.5	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 0.5 (Height above roofline (m)) = 6.5 m

If swifts are present, are they: ☐ Nesting ☐ Roofing ☐ Unknown

Additional Comments:

None seen

Created by:

Bird Studies Canada / Études d'Oiseaux Canada — understand appreciate conserve / comprendre apprécier conserver

Canadian co-partner of / un partenaire canadien de BirdLife International

In partnership with:

Ontario

The Ontario Trillium Foundation / La Fondation Trillium de l'Ontario

Environment Canada Ontario Region / Environnement Canada Région de l'Ontario

McIlwraith Field Naturalists

Chimney Assessment Form 27

Page 1

Observer Details

Name	Phone Number	Email Address	
D. Graham	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
197 Jones Rd	Ham. Iton	ON.	
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 197 Jones

Chimney Code: H- 197 -1

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4785332 ° N

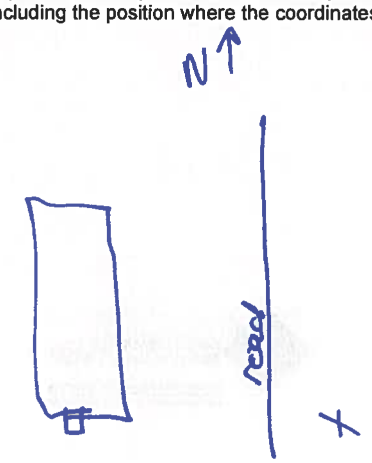
Long. 606228 ° W

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 50 Length (cm): 120

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

27

Page 2

Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Tan

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 4 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None seen

Created by:

BIRD STUDIES CANADA
ÉTUDES D'OISEAUX CANADA
understand appreciate conserve
comprendre apprécier conserver

Canadian co-partner of
un partenaire canadien de
BirdLife INTERNATIONAL

In partnership with:

Ontario

THE ONTARIO TRILLIUM FOUNDATION
LA FONDATION TRILLIUM DE L'ONTARIO

Environment Canada Environnement Canada
Ontario Region Région de l'Ontario

McIlwraith Field Naturalists

Hamilton
60950443
CHSW

June 25 2012

- wind ≈ 4m
- 20°C
- 10% cloud
- ∅ precip.

① stn 14 – 843 Hwy 8
10:15 – 10:30 – ∅ CHSW observed.

② stn 15 – 809 – Hwy 8
10:35 – 10:50
→ ∅ CHSW obs. BUT
→ note ~~#~~ 3CHSW obs.
on BBS#10 adjacent to
this stn (earlier)

Daytime Chimney Observation Form

Page 1

Province: Ontario

City: Hamilton

Site Name: Fruitland Winona

Chimney Code:

GPS Coord. (UTMs or Lat/Long):

Observer Name: D. Graham

Observer Address: Stantec Markham
300-675 Cochrane Dr. West Tower

Telephone: 905-415-6417

E-mail: don.graham@stantec.com

Date (dd/mm/yy)	Observation start time (hh:mm)	Observation end time (hh:mm)	Visit #	Estimated # of birds using chimney
31/05/12	14:45	21:15	1	

Precipitation	Cloud	Wind	Temperature (°C)
None Trace Rain	1 2 3 4 5	0 1 ~~2~~ 3 4 5 6	18° C.

Additional Comments:
No chimneys suitable for chimney swift roosting or nesting were observed at the following 27 sites during a reconnaissance survey conducted May 2012. This additional survey conducted to provide evidence that Chimney Swift is absent as a nesting or roosting species in the Fruitland-Winona Secondary Plan Area.

Wind (Beaufort Scale)
- 0 Calm, smoke rises vertically
- 1 Light air movement, smoke drifts
- 2 Slight breeze, wind felt on face
- 3 Gentle breeze, small twigs move
- 4 Moderate breeze, small branches move
- 5 Fresh breeze, small trees sway
- 6 Strong breeze, large branches in motion

Cloud Cover
- 1 0-25%
- 2 25-50%
- 3 50-75%
- 4 75-100%
- 5 Fog

Easting & Northing recorded on 2nd sheet

Station #	Entrances Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Exits Time (hh:mm)	# Birds	Time (hh:mm)	# Birds
1	14:45	0			14:45	0		
2	15:00	0			15:00	0		
3	15:15	0			15:15	0		
4	15:30	0			15:30	0		
5	15:45	0			15:45	0		
6	16:00	0			16:00	0		
7	16:20	0			16:20	0		
8	16:40	0			16:40	0		
9	17:00	0			17:00	0		
10	17:20	0			17:20	0		
11	17:40	0			17:40	0		
12	18:00	0			18:00	0		
13	18:20	0			18:20	0		
14	18:40	0			18:40	0		
15	19:00	0			19:00	0		

2 birds flew over but made no effort to the into chimney Site. adjacent properties have chimneys unsuited for CHSW using criteria in the CHSW Mandatory Protocol.

Incidental.
Barn Swallow seen @ #7, #6, #14, #18, #19
Cooper's Hawk: #19
C. Nighthawk (THR) #22

Daytime Chimney Observation Form

Page 2

	Entrances				Exits			
	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds
16	19:20	0			19:20	0		
17	19:40	0			19:40	0		
18	20:00	0			20:00	0		
19	20:15	0			20:15	0		
20	20:30	0			20:30	0		
21	20:40	0			20:40	0		
22	20:50	0			20:50	0		
23	21:00	0			21:00	0		
24								
25								
26								
27								

Property	Site Number	Easting	Northing
660 Barton ✓	1	605674	4786287
692 Barton ✓	2	605881	4786235
720 Barton ✓	3	606102	4786169
748 Barton ✓✓	4	606297	4786111
789 Barton ✓✓	5	606527	4786043
822 Barton ✓✓	6	606758	4785968
844 Barton ✓✓	7	606904	4785915
884 Barton ✓	8	607206	4785821
Barton (Stoney Creek Christian Fellowship) ✓	9	607304	4785777
26 Glover ✓	10	607173	4785563
239 Glover ✓	11	607101	4785327
Glover ✓ (Kingdom Hall of Jehovah's Witness	12	607057	4785169
873 Hwy 8 ✓	13	606915	4785087
843 Hwy 8 ✓✓	14	606734	4785187
809 Hwy 8 ✓✓	15	43.12	79.41
777 Hwy 8 ✓✓	16	43.12	79.41
743 Hwy 8 ✓✓	17	605959	4785182
703 Hwy 8 ✓	18	605701	4785231
669 Hwy 8 ✓✓	19	605454	4785285
196 Fruitland ✓✓	20	605353	4785502
222 Fruitland ✓	21	605406	4785727
250 Fruitland ✓	22	605459	4785921
288 Fruitland ✓	23	605526	4786204
287 Jones ✓✓	24	606379	4785965
259 Jones ✓✓	25	606335	4785796
238 Jones ✓	26	606281	4785562
197 Jones	27	606228	4785332

CHSW
606448, 4785209
606241, 4785242

May 31st Daytime Chimney Swift Survey

Comments

Site 2: AMKE, a declining grassland species observed overflying site.

Site 14: 2 CHSW aerial foraging over site. Birds made no effort to fly into chimney of this or adjacent properties. Chimneys of subject property & adjacent properties appeared unsuitable for species based on criteria contained in the CHSW Monitoring Protocol.

Site 15: As at site 14, only differing in 4 CHSW aerial foraging

Daytime Chimney Observation Form

Page 1

Province: Ontario
City: Hamilton
Site Name: Fruitland-Winona
Chimney Code:
GPS Coord. (UTMs or Lat/Long):

Observer Name: ~~D. Graham~~ N. KOPYSH.
Observer Address: Stantec Markham 300-675 Cochrane Dr West Tower
Telephone: 905-415-6417
E-mail: ~~don.graham~~ nicole.kopysh @stantec.com

Date (dd/mm/yy)	Observation start time (hh:mm)	Observation end time (hh:mm)	Visit #	Estimated # of birds using chimney
12/06/12	08:15	09:15	1	

Precipitation	Cloud	Wind	Temperature (°C)
None Trace Rain	1 2 3 4 5	0 1 2 3 4 5 6	20°C

Additional Comments:

Wind (Beaufort Scale)
- **0** Calm, smoke rises vertically
- **1** Light air movement, smoke drifts
- **2** Slight breeze, wind felt on face
- **3** Gentle breeze, small twigs move
- **4** Moderate breeze, small branches move
- **5** Fresh breeze, small trees sway
- **6** Strong breeze, large branches in motion

Cloud Cover
- **1** 0-25%
- **2** 25-50%
- **3** 50-75%
- **4** 75-100%
- **5** Fog

Station #

Station #	Entrances Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Exits Time (hh:mm)	# Birds	Time (hh:mm)	# Birds
24	08:15	Ø			08:15	Ø		
25	08:30	Ø			08:30	Ø		
26	08:45	Ø			08:45	Ø		
27	09:00	Ø			09:00	Ø		

Daytime Chimney Observation Form

Page 2

Entrances				Exits			
Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 160950443
Project Name: Scobe parcels
Date: July 12, 2012
Field Personnel: D. Graham.

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	16- 25	0-1	10%	None	None

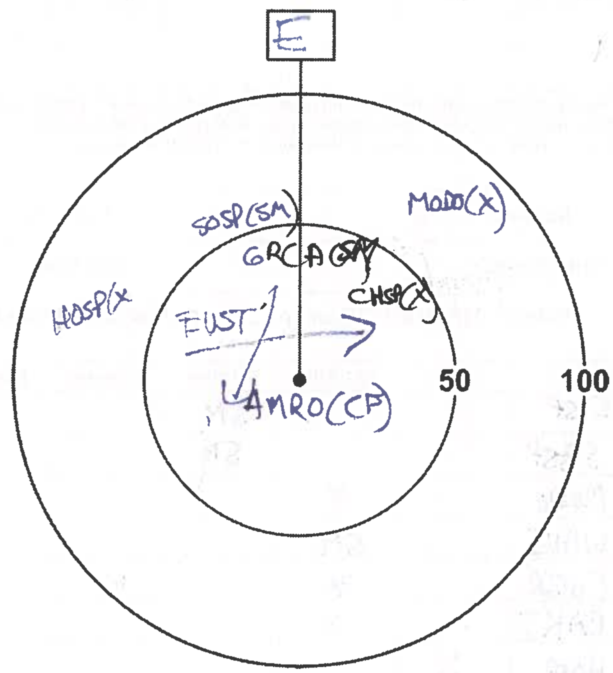
GPS #: T

Station: 1
Feature:
UTM: 607994 4785266
Start Time: 5^30
End Time: 5^35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop residential

Species	<50m	50-100m	>100m	Flyovers	Height*
MODO		X			
SOSP		SM			
GRCA	SM				
CHSP	X				
EUST	X			✓	
AMRO	CF				
HOSP		X			

** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Signature: (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

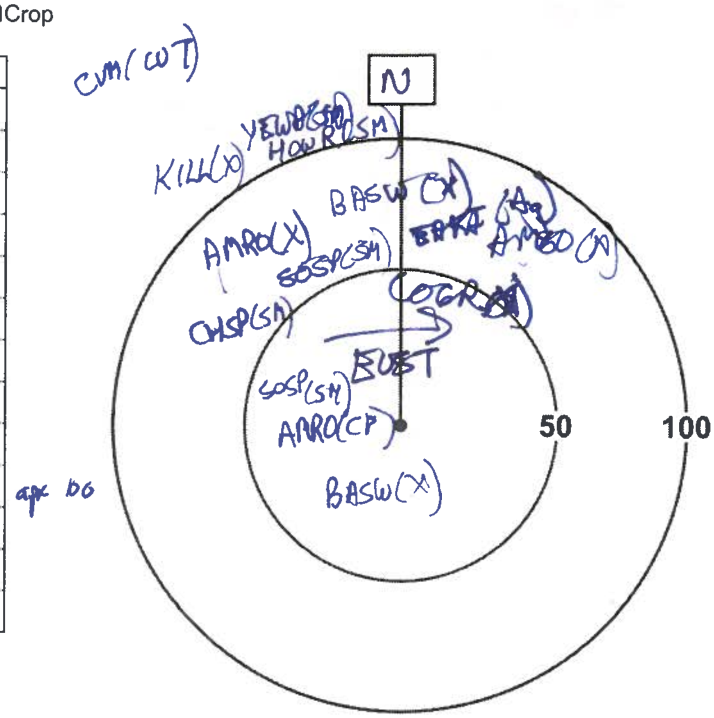
Station: 2 Feature: UTM: 608483 4784921

Start Time: 5 45 End Time: 5 50

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YEWA			SM		
HOWR			SM		
KILL			X		
AMRO	CF	X			
CHSP		SM			
BASW	X	X		✓	
SOSP	SM	SM			
EAKI		Ag			
AMGO		X		✓	
COGR	X			✓	
EUST	X			✓	

Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



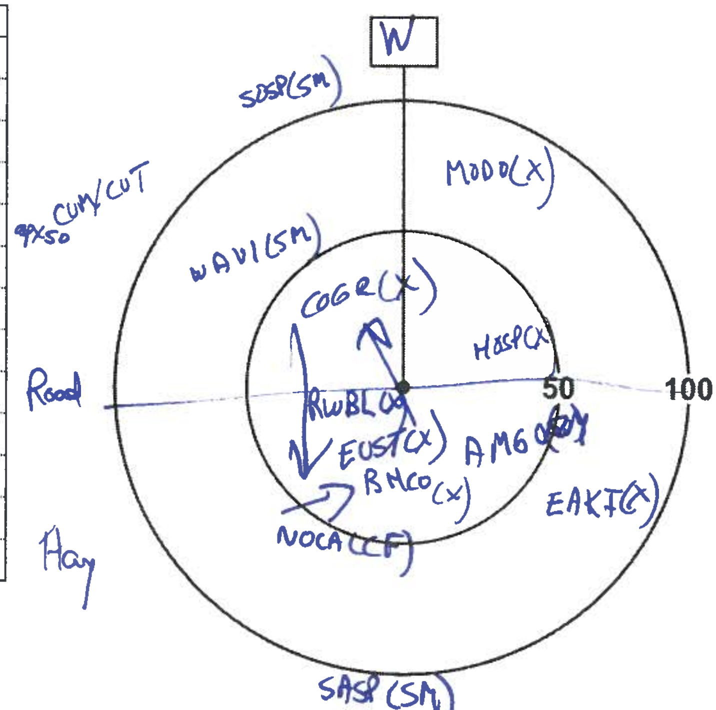
Station: 3 Feature: UTM: 608816 4785156

Start Time: 6 00 End Time: 6 10

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
SOSP			SM		
SASP			SM		
MODO		X			
WAVI		SM			
COGR		X		✓	
EAKI		X			
HOSP	X				
AMGO	SM				
RWBL	X			✓	
EUST	X				
BHCO	X				
NOCA		CF			

Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Field Personnel)

Signature: (Project Manager)

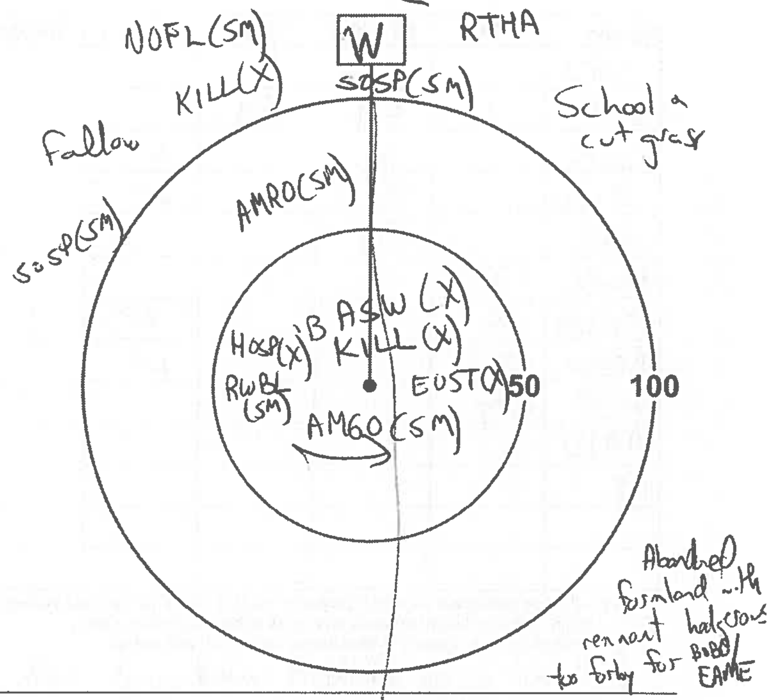
Station: 4 **Feature:** **UTM:** 608758 4785292

Start Time: 6:15 **End Time:** 6:20

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RTHA			FY	✓	
NOFL			SM		
KILL	X		X		
SOSP			SM		
AMRO		SM			
BASW	3 X			✓	
HOSP	X				
RWBL	SM				
AMGO	SM				
EUST	X				

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



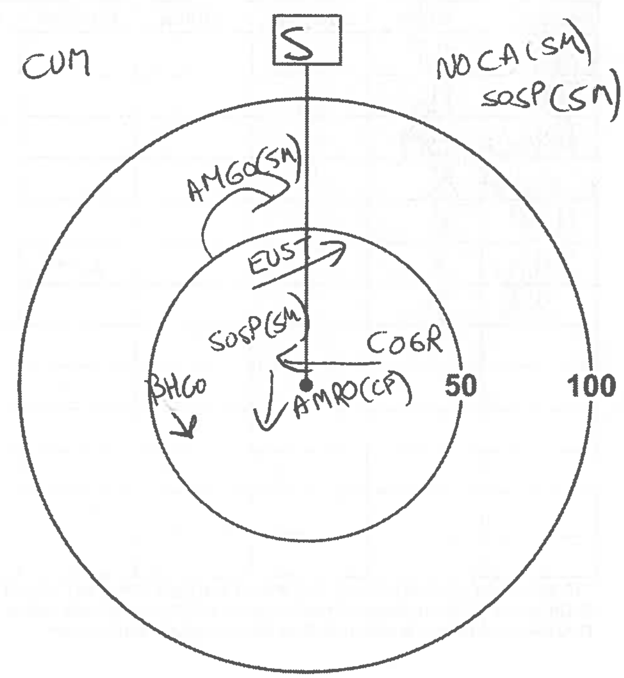
Station: 5 **Feature:** **UTM:** 608294 4785534

Start Time: 6:35 **End Time:** 6:40

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
SOSP	SM		SM		
AMGO		SM			
EUST	X			✓	
COGR	X			✓	
AMRO	CF				
BHCO	X			✓	

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________ (Field Personnel) **Signature:** ______________ (Project Manager)

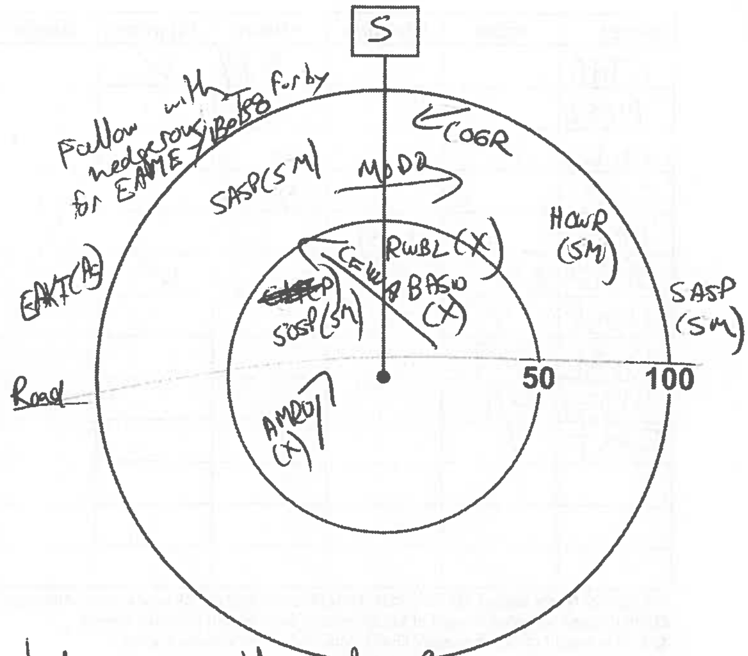
REV: 2011-05-04 / FORM 020

Station: 6 Feature: UTM: 608587 4785464

Start Time: 6^{45} End Time: 6^{50}

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EAKI			Ag		
SASP		SM	SM		
COGR		X		✓	
MODO		X		✓	
HOWR		SM			
RWBL	X				
CEWA	X			✓	
BASW	X			✓	
SOSP	SM				
AMRO	X				
~~EK~~					



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

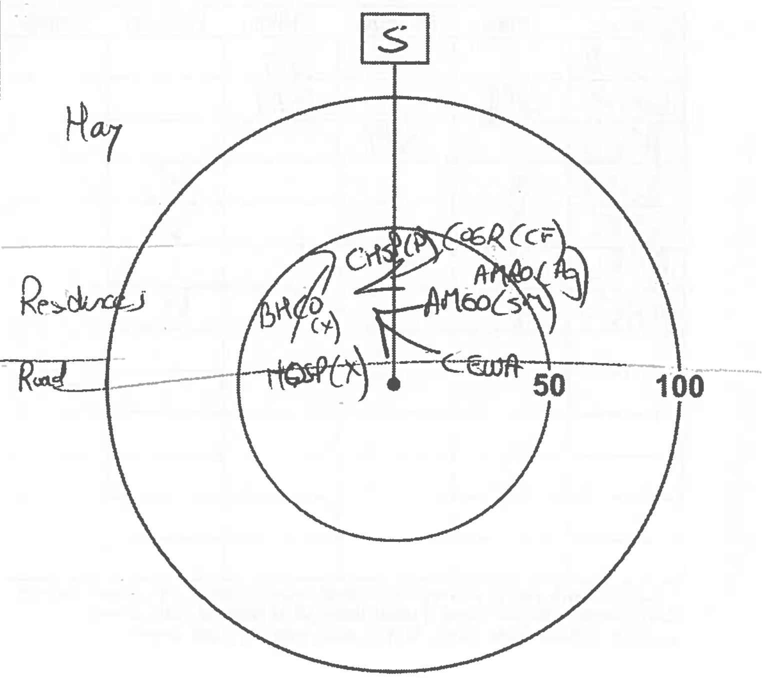
Butternut or hybrid butternut noted just north of study area @ old residence

Station: 7 Feature: UTM: 609246 4785339

Start Time: 6^{55} End Time: 7^{00}

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
COGR	CF				
AMRO	Ag				
AMGO	SM				
CEWA	X				
HOSP	X				
BHCO	X			✓	
CHSP	P				



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________________ (Field Personnel)

Signature: ____________________ (Project Manager)

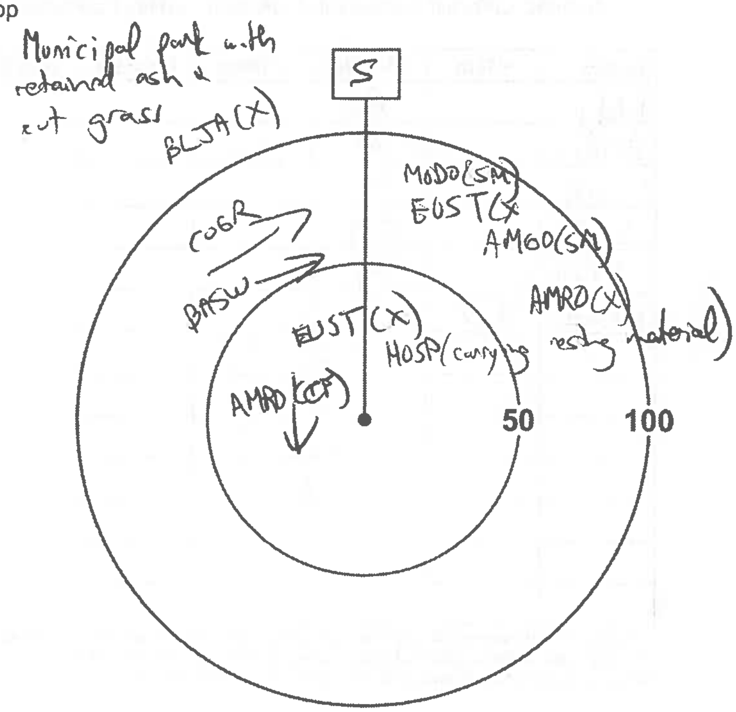
REV: 2011-05-04 / FORM 020

Station: 8 | Feature: | UTM: 610065 4785097

Start Time: 7[05] | End Time: 7[10]

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BLJA			X		
COGR		X		✓	
MODO		SM			
EUST	X	X			
AMGO		SM			
AMRO	CF	X			
HOSP	carrying	nesting	material		
BASW		X			



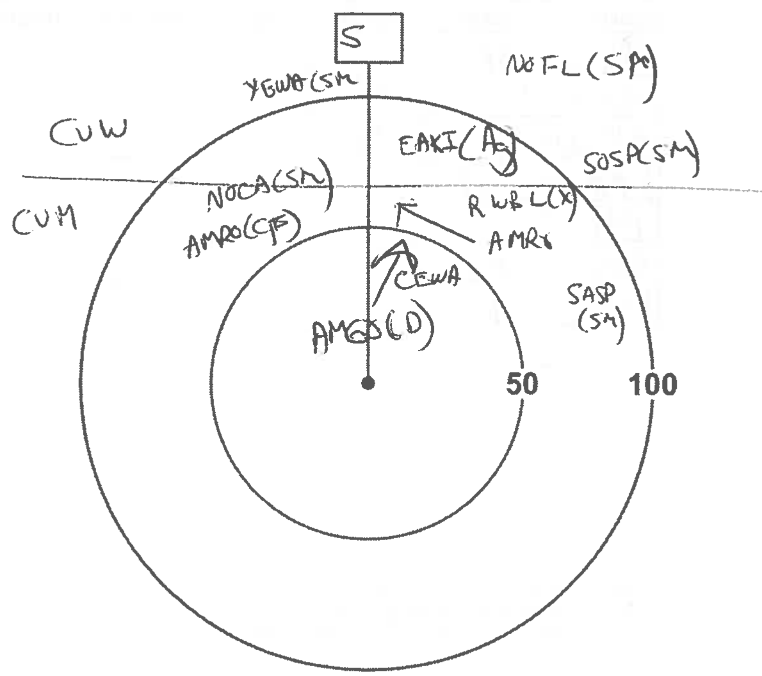
* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 9 | Feature: | UTM: 610535 478553

Start Time: 7[20] | End Time: 7[25]

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YEWA			SM		
NOFL			SM		
EAKI		Ag			
SOSP			SM		
NOCA		SM			
AMRO		CF		✓	
CEWA	X				
AMGO	D				
SASP		SM			
RWBL		X			



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________________ (Field Personnel)

Signature: ____________________ (Project Manager)

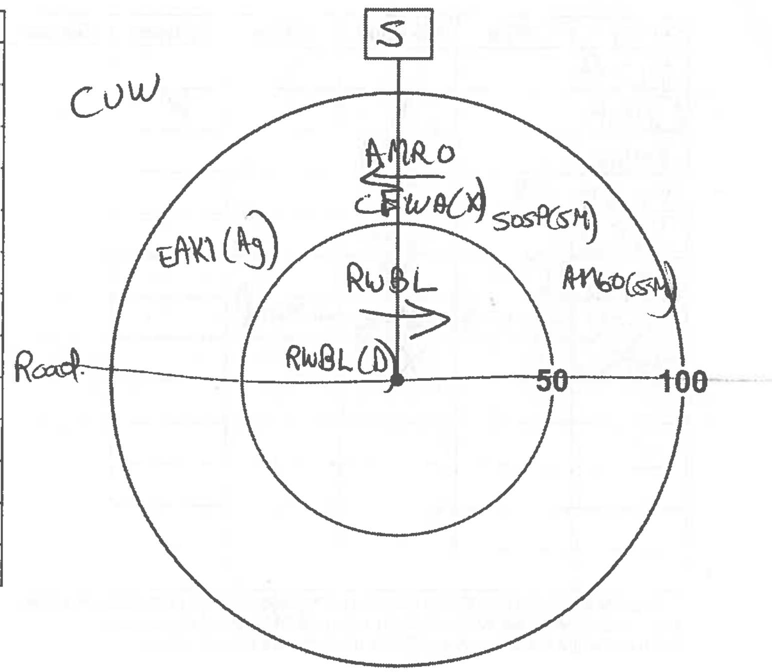
Station: 10 | Feature: | UTM: 610406 4785845

Start Time: 7 30 | End Time: 7 35

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EAKI		Ag			
AMRO		X			
CEWA		X			
SOSP		SM			
AMGO		SM			
RWBL	D				

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



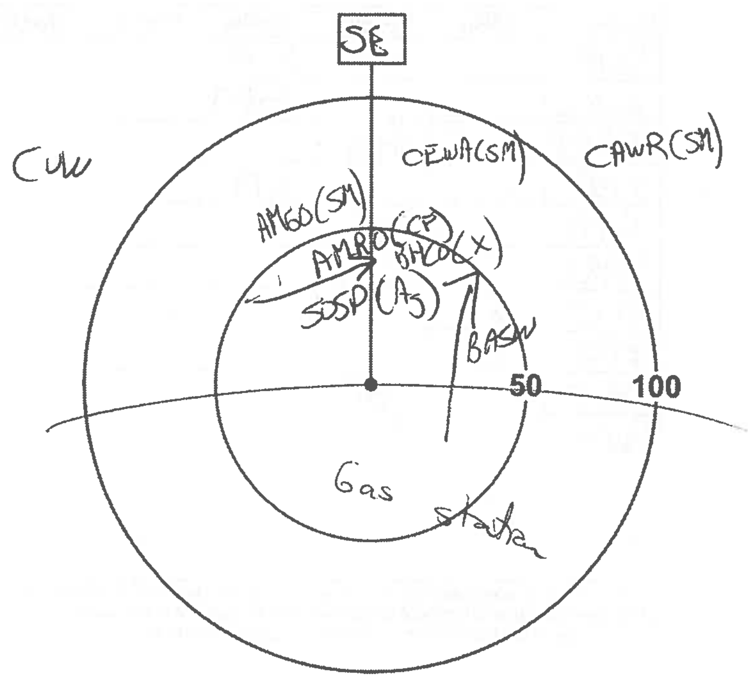
Station: 11 | Feature: | UTM: 610234 4785771

Start Time: 7 45 | End Time: 7 50

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
CAWR	SM				
CEWA		SM			
AMGO		SM			
AMRO	CF				
BHCO	X				
SOSP	Ag				
BASW	X			✓	

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Signature: ____________ (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________ (Project Manager)

Stantec
Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 160950443 | Project Name: Scube Parcels
Date: July 12, 2012 | Field Personnel:

Weather Conditions:

TEMP (ºC):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
16-25	0-1	10%	None	None

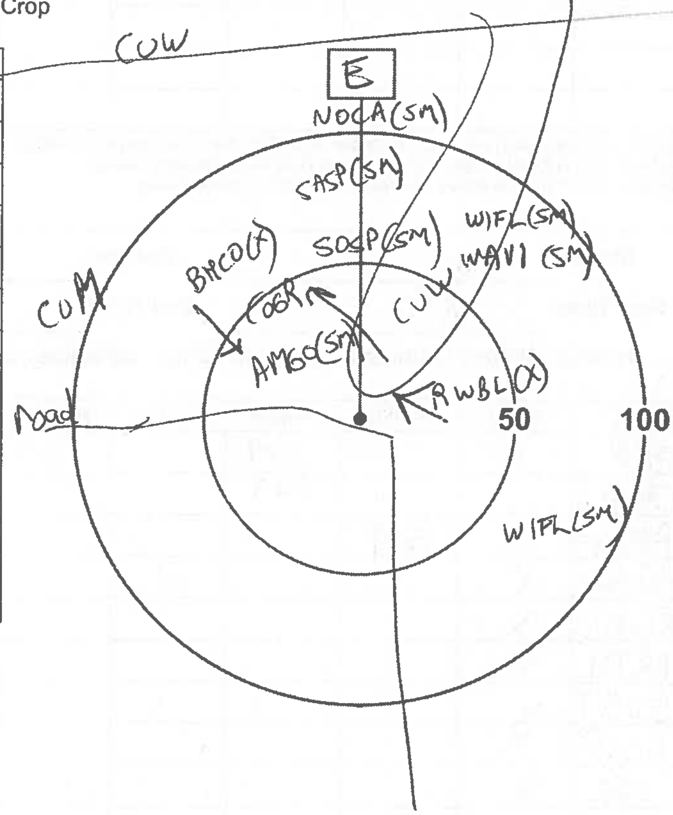
GPS #: T

Station: 12 | Feature: | UTM: 610037 4785737
Start Time: 7[50] | End Time: 7[55]

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
SASP		SM			
SOSP		SM			
BHCO	X			✓	
COGR	X			✓	
AMGO	SM				
WIFL		SM			
WAVI		SM			
RWBL	X			✓	

* *Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___ | Quality Control: This form is complete ❑ & legible ❑.

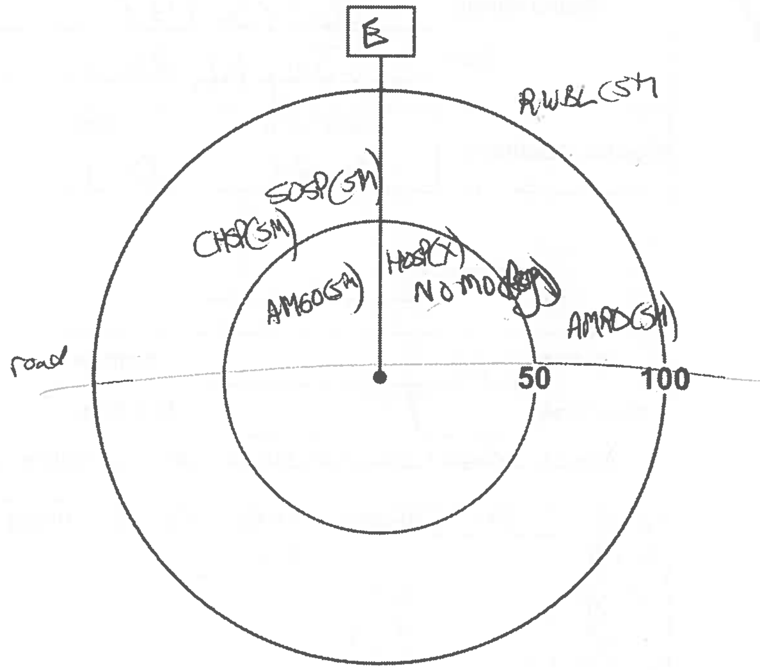
Signature: ______________________ (Field Personnel) | Signature: ______________________ (Project Manager)

Station: 13 Feature: UTM: 610049 4785387

Start Time: 8:00 End Time:

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL			SM		
SOSP		SM			
CHSP		SM.			
AMGO	SM				
HOSP	X				
NOMO	Ag				
AMRO		SM			



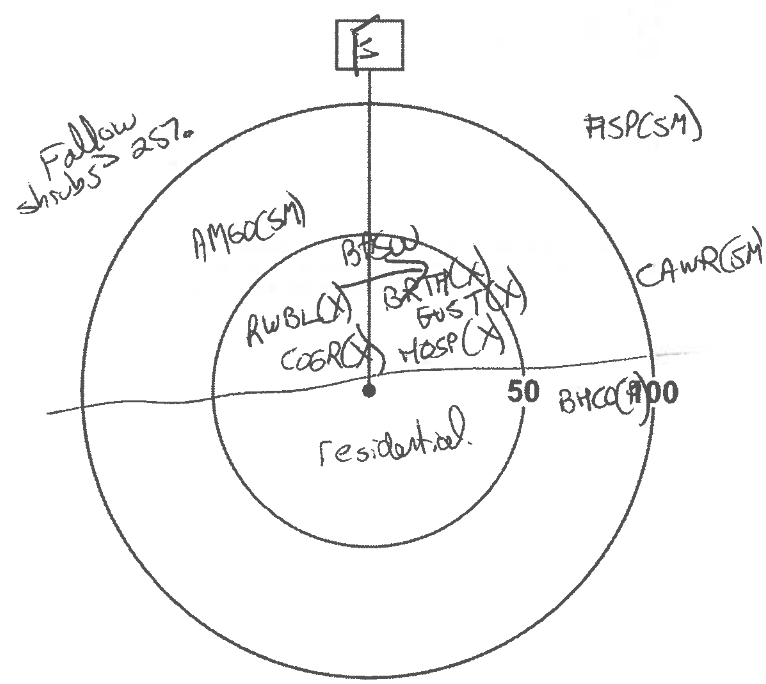
* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 14 Feature: UTM: 609860 4785605

Start Time: 8:15 End Time: 8:20

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
FISP			SM		
CAWR			SM		
AMGO		SM			
BASW	X			✓	
RWBL	X				
BRTH	X				
EUST	X				
HOSP	X				
COGR	X				
BHCO		P			



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: __________ (Field Personnel)

Signature: __________ (Project Manager)

Station: 16   Feature: UTM: 608784

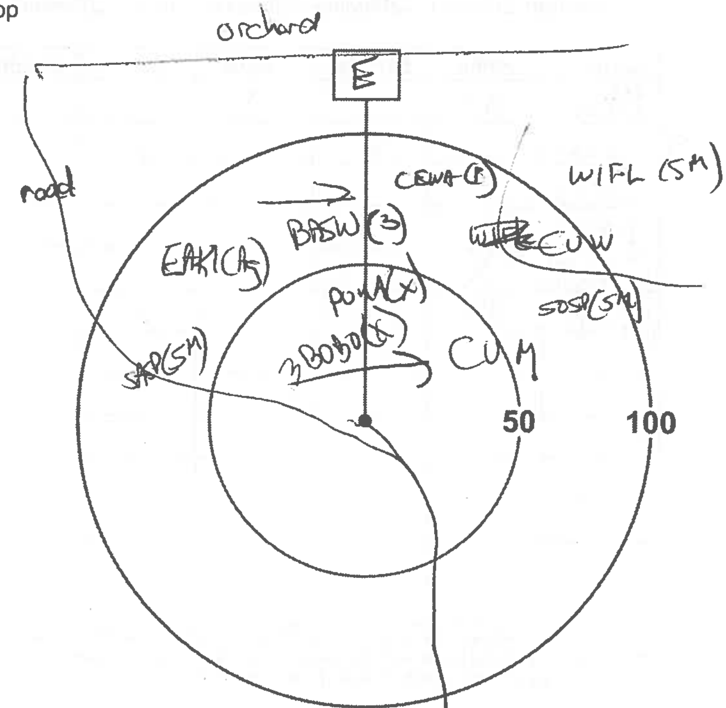
Start Time: 8:35   End Time: 8:40   4785104

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
WIFL			SM		
CEWA		P			
BASW		X		✓	
PUMA	X			✓	
EAKI		Ag			
SASP		SM			
BOBO	3X			✓	
SOSP		SM			

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Incidental: BAOR



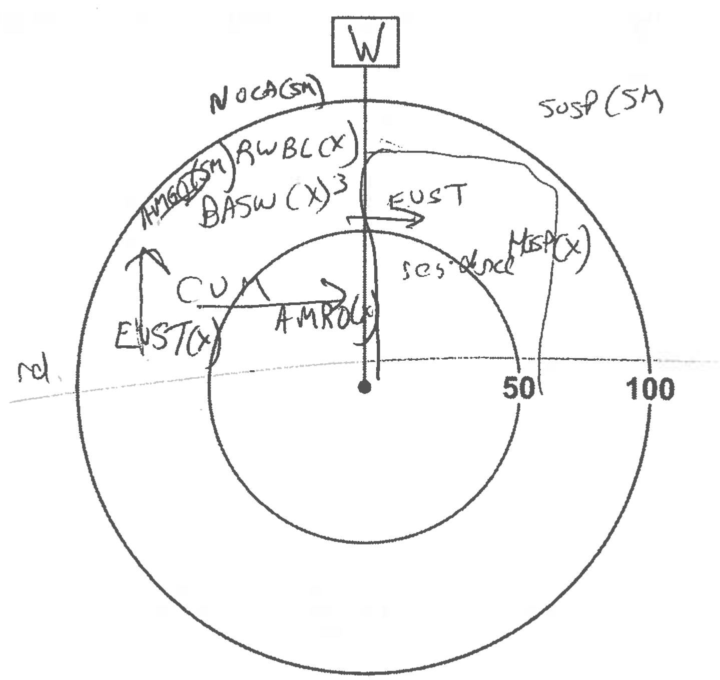
Station: 15   Feature: UTM: 610787

Start Time: 9:05   End Time: 9:10   4785550

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA			SM		
RWBL		X			
BASW		X(3)			
AMGO		SM			
EUST		X			
AMRO	X				
HOSP		X			
SOSP			SM		

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___   Quality Control: This form is complete ❑ & legible ❑.

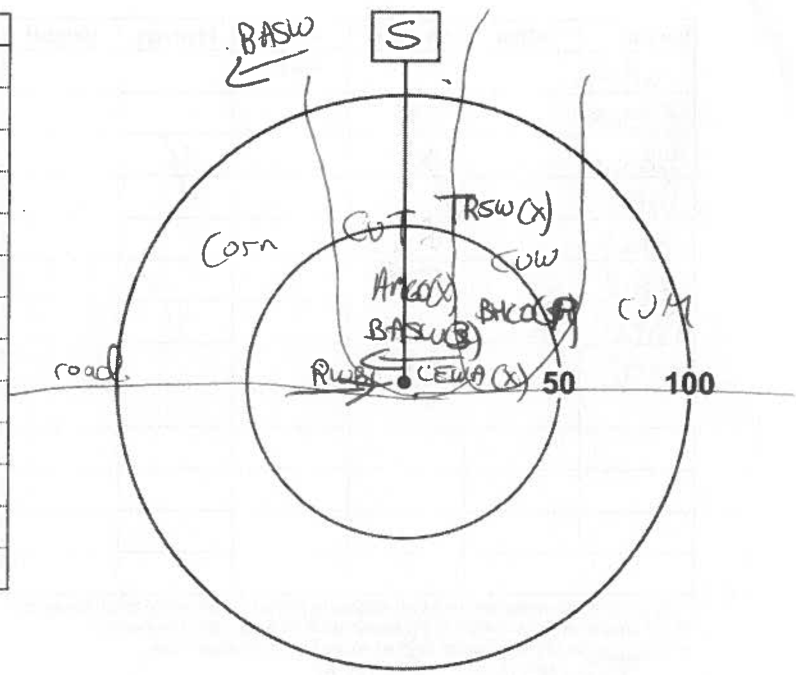
Signature: ____________________ (Field Personnel)   Signature: ____________________ (Project Manager)

Station: 17 | Feature: | UTM: 611228 4785587

Start Time: 8 50 | End Time: 8 55

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BASW	3X		X	✓✓✓✓	
TRSW		X		✓	
BHCO	P				
AMGO	X				
CEWA	X				
RWBL	X			✓	



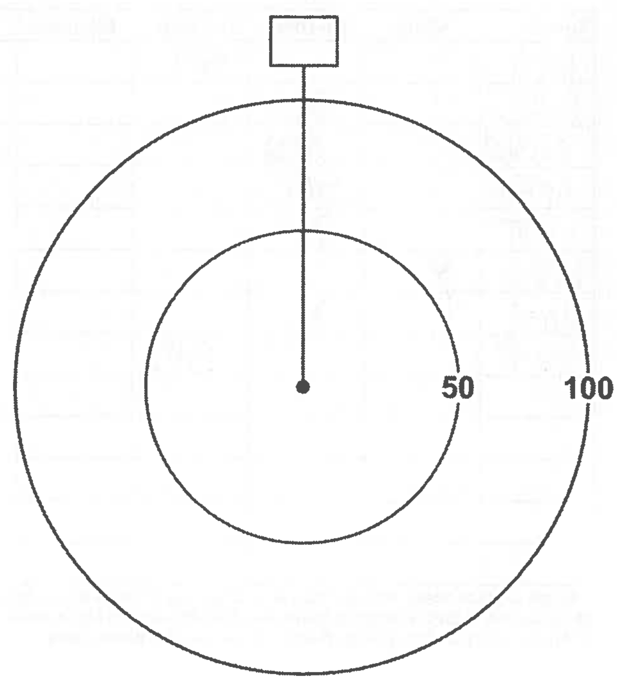
* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: | Feature: | UTM:

Start Time: | End Time:

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*



* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

REV: 2011-05-04 / FORM 020

Stantec
Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 160950443
Project Name: HAMILTON – SCUBE
Date: JULY 4, 2012
Field Personnel: MICHAEL OLIVEIRA

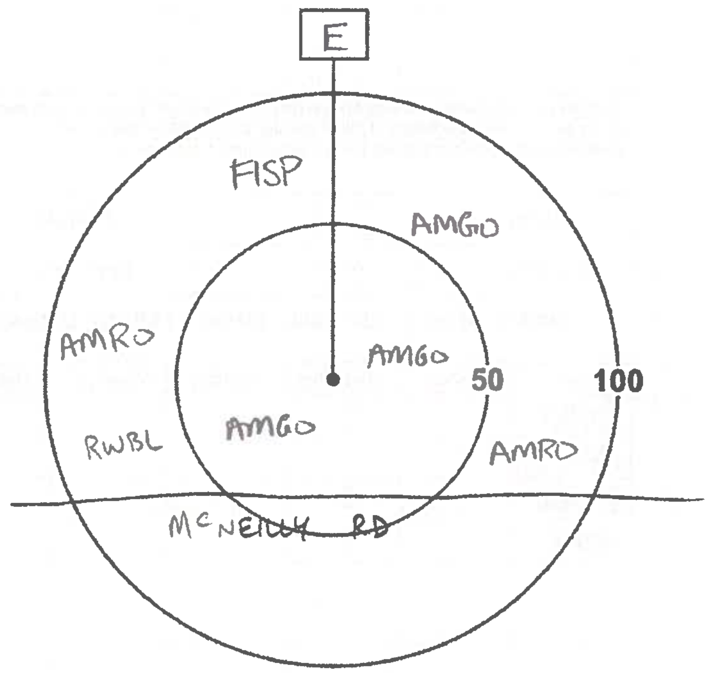
Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	19°C	1	20%	Ø	Ø

GPS #: T N/A

Station: 1
Feature:
UTM: 0607994 4785266
Start Time: 05:43
End Time: 05:48

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO	2	1			
AMRO		2			
FISP		1			
RWBL		1			



** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page 1 of 9

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

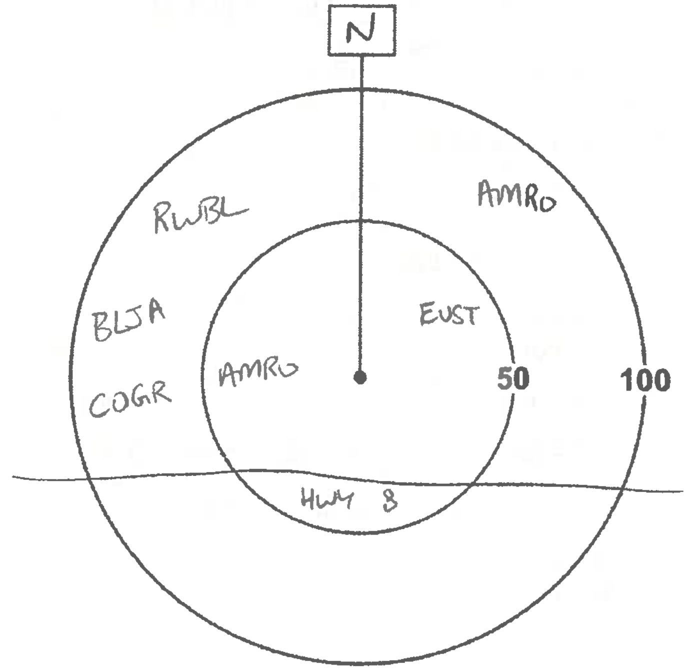
Signature: (Project Manager)

Station: 2 **Feature:** **UTM:** 0608483 4784921

Start Time: 05:57 **End Time:** 06:02

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMRO	1	1			
RWBL		1			
BLJA		1			
COGR		1			
EUST	1				



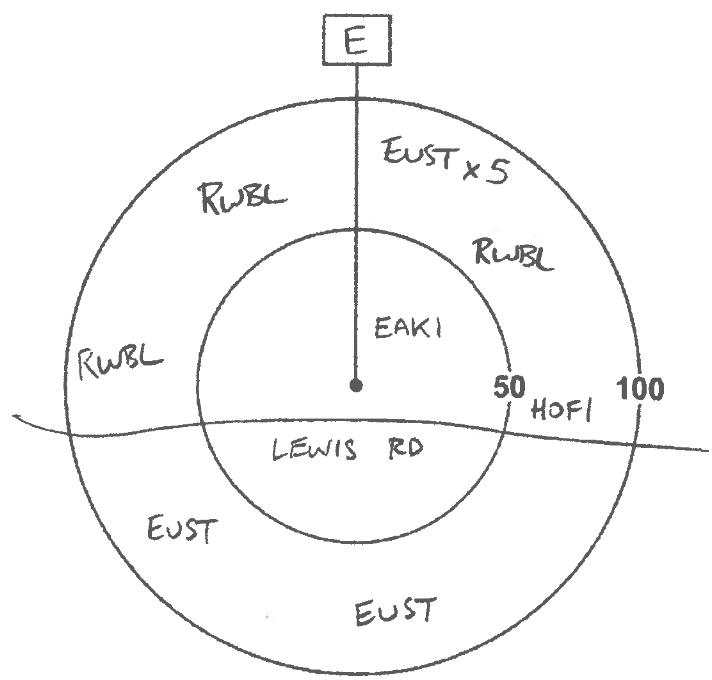
** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 3 **Feature:** **UTM:** 0608813 4785148

Start Time: 6:09 **End Time:** 6:14

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST		7			
EAKI	1				
RWBL		3			
HOFI		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page 2 of 9

Signature: (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

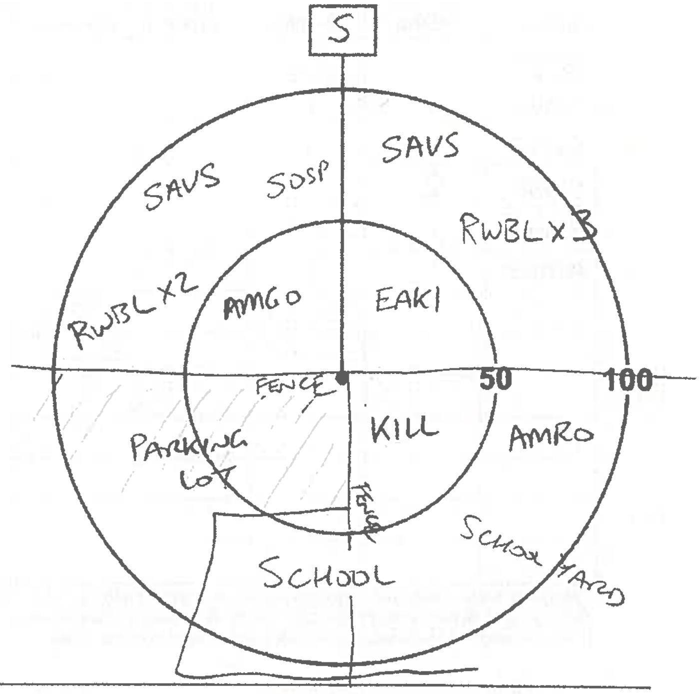
Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 4 | Feature: | UTM: 0608764
Start Time: 06:29 | End Time: 06:34 | 4785285

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO	1				
SAVS		2			
KILL	1				
RWBL		5			
SOSP		1			
AMRO		1			
EAKI	1				

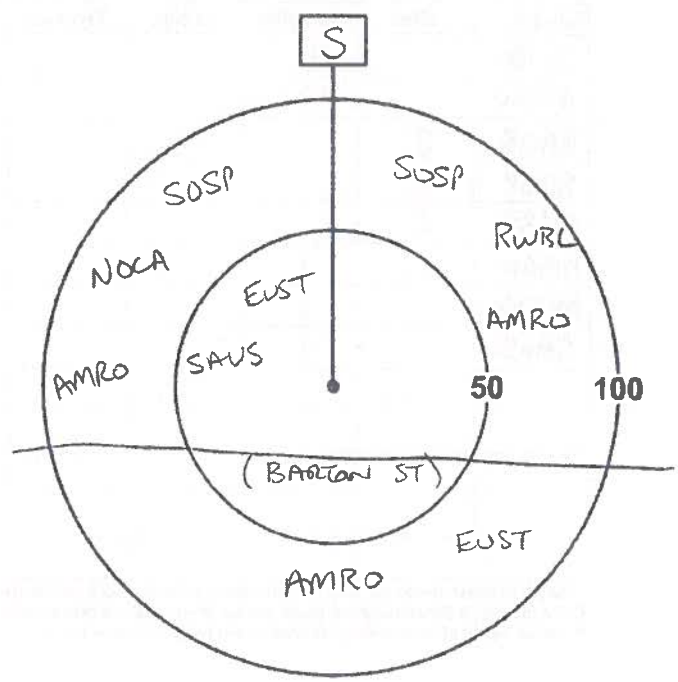


** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Station: 5 | Feature: | UTM: 0608293
Start Time: 06:40 | End Time: 06:45 | 4785532

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST	1	1			
AMRO		3			
SOSP		2			
NOCA		1			
SAVS	1				
RWBL		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page 3 of 9

Quality Control: This form is complete ❑ & legible ❑.

Signature: [signature] (Field Personnel)

Signature: ______ (Project Manager)

Station: 6 **Feature:** **UTM:** 0608587 4785464

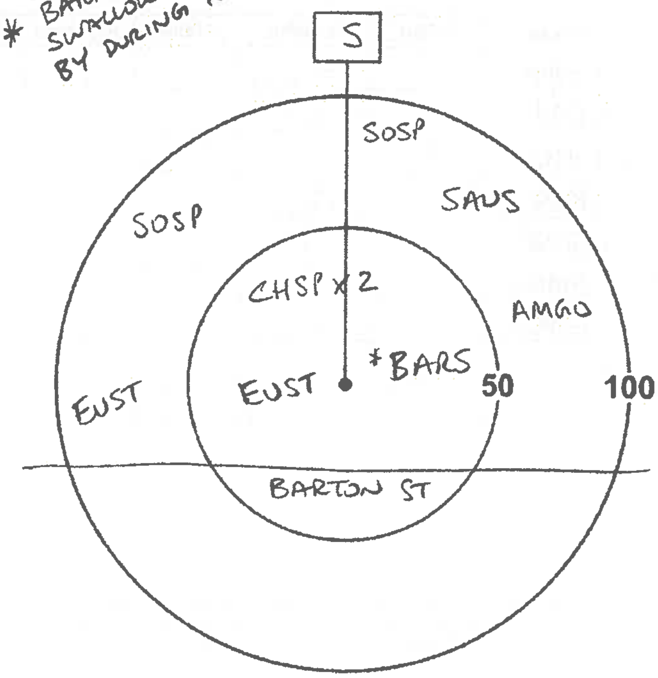
Start Time: 06:51 **End Time:** 06:56

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

* ① BARN SWALLOW FLEW BY DURING P.C.

Species	<50m	50-100m	>100m	Flyovers	Height*
SOSP		2			
SAVS		1			
EUST	1	1			
CHSP	2				
BARS	1				
AMGO		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



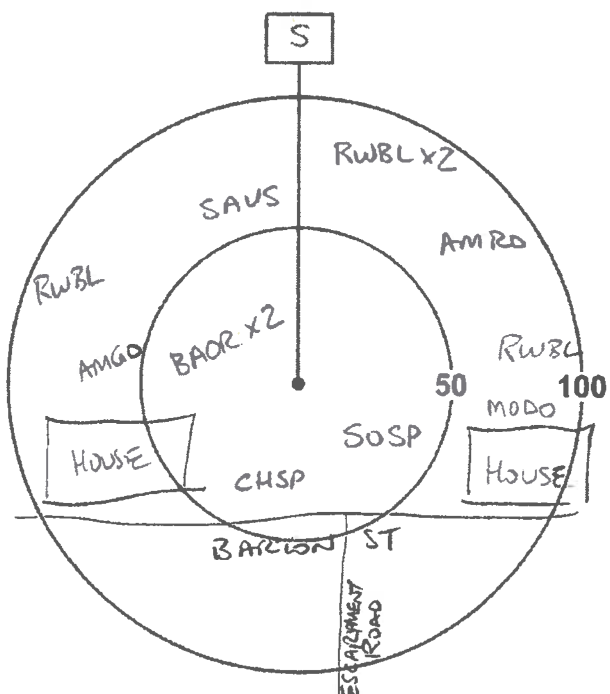
Station: 7 **Feature:** **UTM:** 0609227 4785257

Start Time: 07:03 **End Time:** 07:08

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL		4			
AMRO		1			
BAOR	2				
SOSP	1				
CHSP	1				
AMGO		1			
MODO		1			
SAVS		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page 4 of 9

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

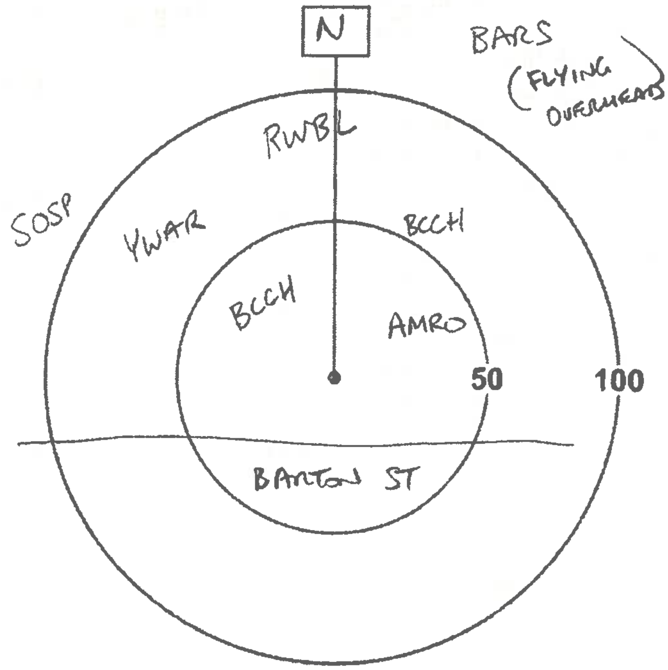
Station: 8 **Feature:** **UTM:** 0610089
4785167

Start Time: 07:16 **End Time:** 07:21

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
BCCH	1	1			
AMRO	1				
RWBL		1			
YWAR		1			
SOSP			1		
BARS			2		

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



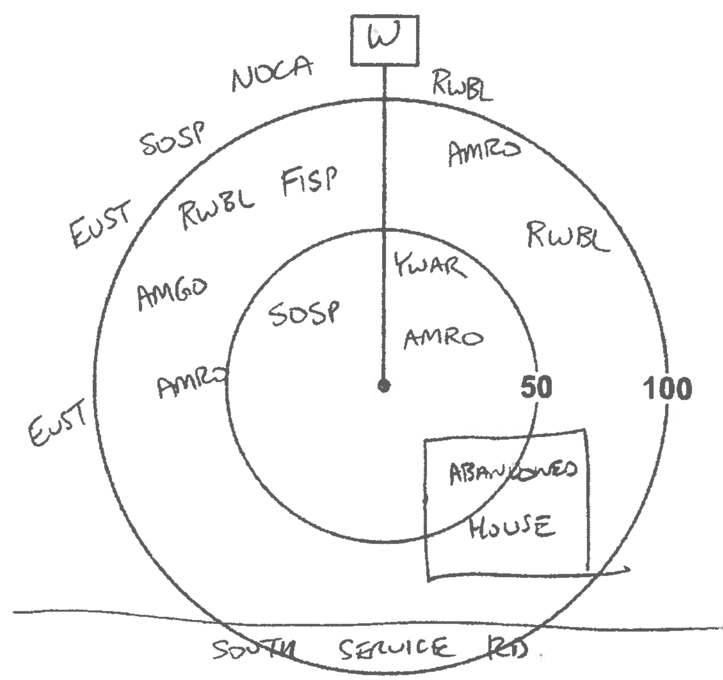
Station: 11 **Feature:** **UTM:** 0610501
4785518

Start Time: 07:36 **End Time:** 07:41

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST			2		
AMRO	1	2			
SOSP	1		1		
YWAR	1				
RWBL		2	1		
NOCA			1		
FISP		1			
AMGO		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page 5 of 9

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Field Personnel)

Signature: (Project Manager)

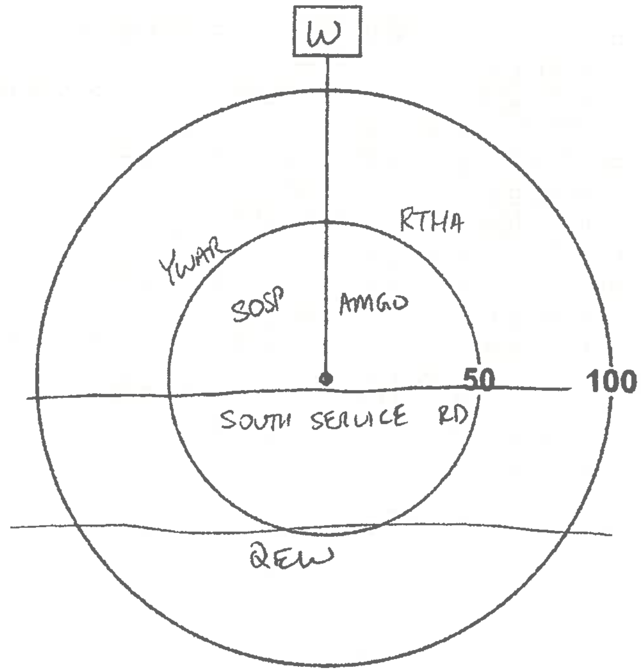
REV: 2011-05-04 / FORM 020

Station: 12 **Feature:** **UTM:** 0610405 4785844

Start Time: 07:46 **End Time:** 07:51

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO	1				
SOSP	1				
RTHA		1			
YWAR		1			



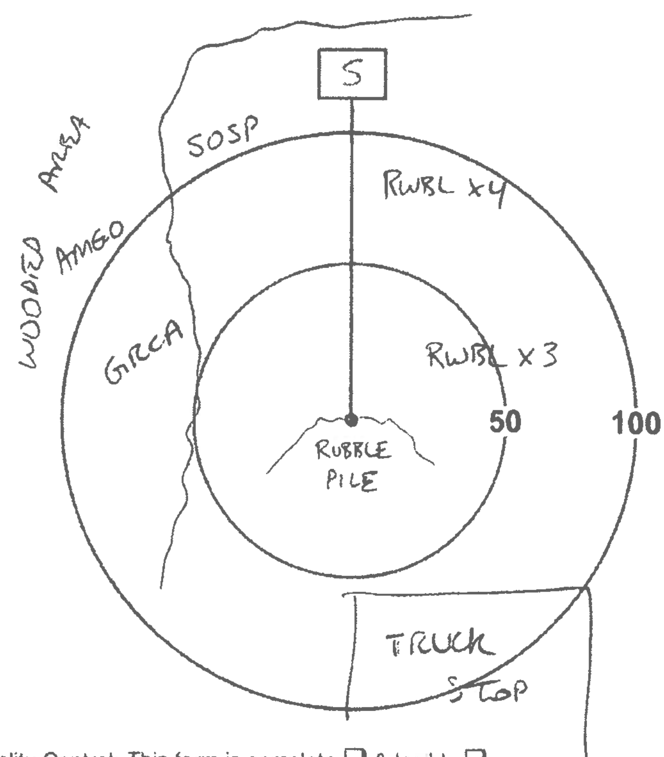
* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 13 **Feature:** **UTM:** 0610234 4785765

Start Time: 08:00 **End Time:** 08:05

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL	3	4			
AMGO			1		
GRCA		1			
SOSP			1		



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page 6 of 9

Signature: (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

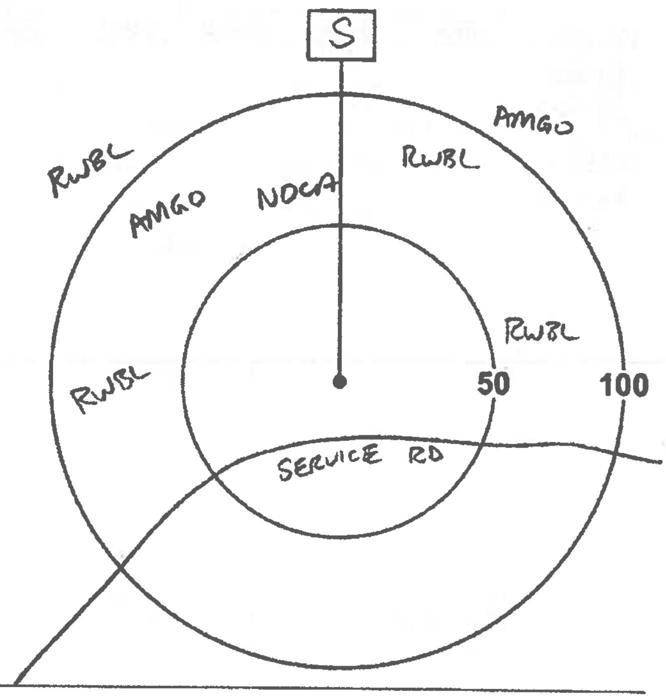
Station: 14 | Feature: | UTM: 0610034 4785729

Start Time: 08:09 | End Time: 08:14

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL		3	1		
NOCA		1			
AMGO		1	1		

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Station: 15 | Feature: | UTM: 0610047 4785387

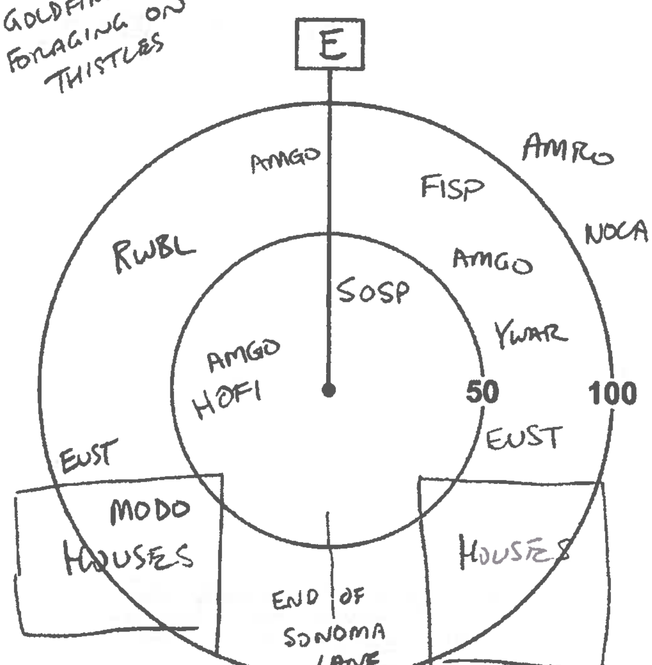
Start Time: 08:21 | End Time: 08:26

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMGO	1	2			
HOFI	1				
SOSP	1				
YWAR		1			
EUST		2			
AMRO			1		
NOCA			1		
FISP		1			
MODO		1			
RWBL		1			

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

GOLDFINCHES FORAGING ON THISTLES



Page 7 of 9

Quality Control: This form is complete ❑ & legible ❑.

Signature: [signature] (Field Personnel)

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

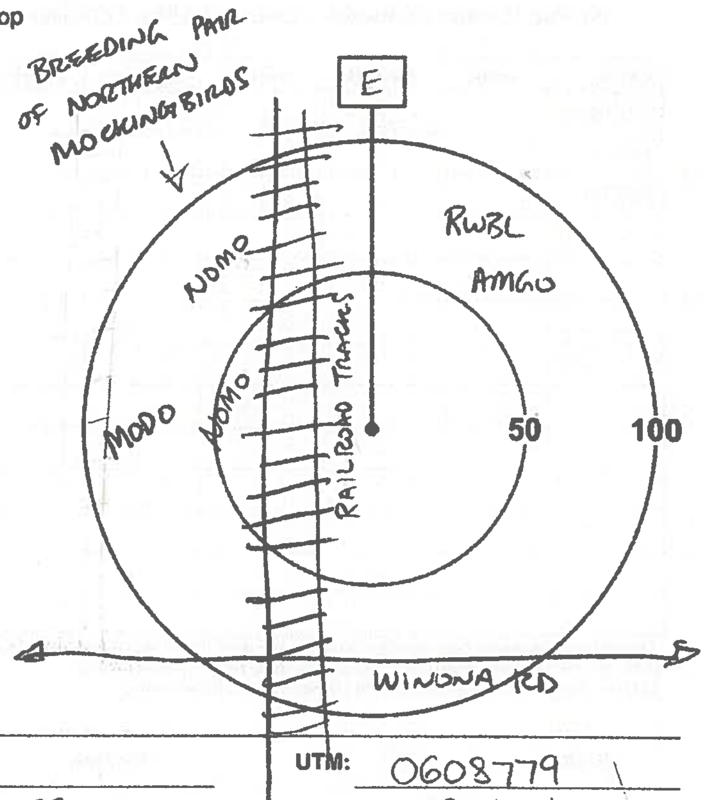
Station: 16 **Feature:** **UTM:** 0609848 4785592

Start Time: 08:36 **End Time:** 08:41

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL		1			
AMGO		1			
NOMO	1	1			
MODO		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



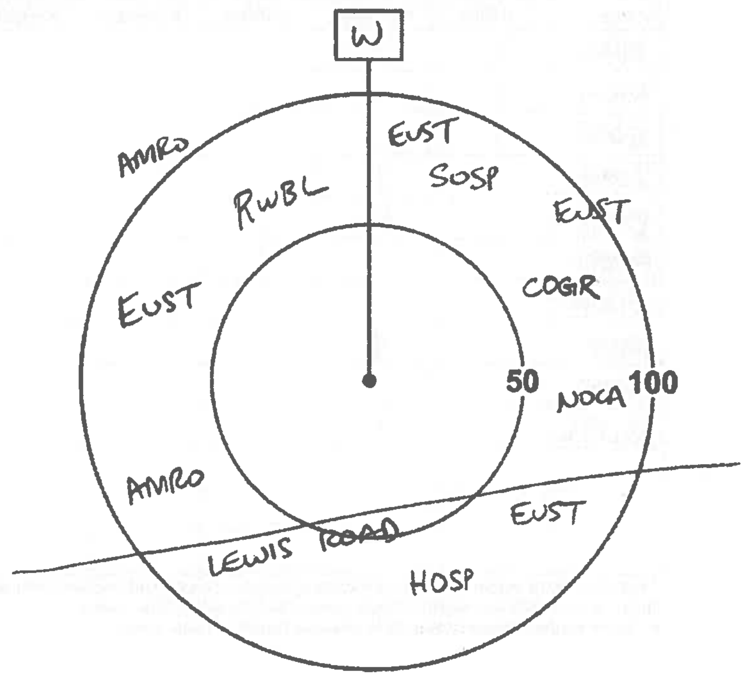
Station: 17 **Feature:** **UTM:** 0608779 4785104

Start Time: 08:53 **End Time:** 08:58

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST		4			
RWBL		1			
SOSP		1			
COGR		1			
NOCA		1			
AMRO		1	1		
HOSP		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page 8 of 9

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Field Personnel) **Signature:** (Project Manager)

REV: 2011-05-04 / FORM 020

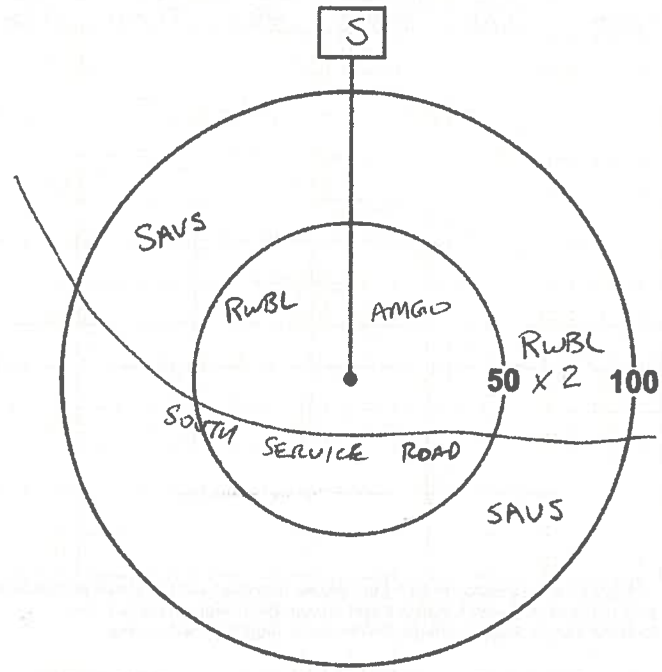
Station: 18 **Feature:** **UTM:** 0610793 4785545

Start Time: 09:08 **End Time:** 09:13

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
SAVS		2			
RWBL	1	2			
AMGO	1				

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



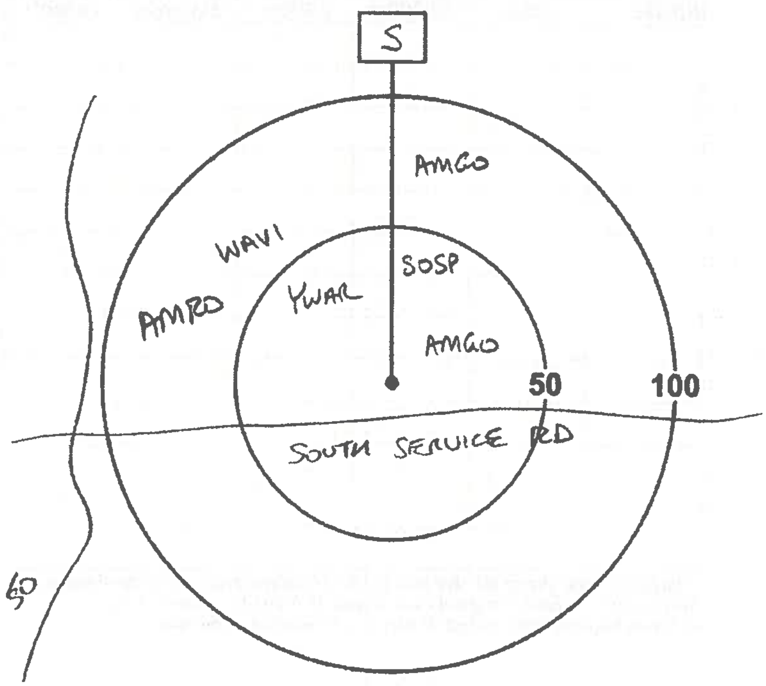
Station: 19 **Feature:** **UTM:** 0611221 4785578

Start Time: 09:35 **End Time:** 09:40

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
YWAR	1				
WAVI		1			
AMRO		1			
SOSP	1				
AMGO	1	1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

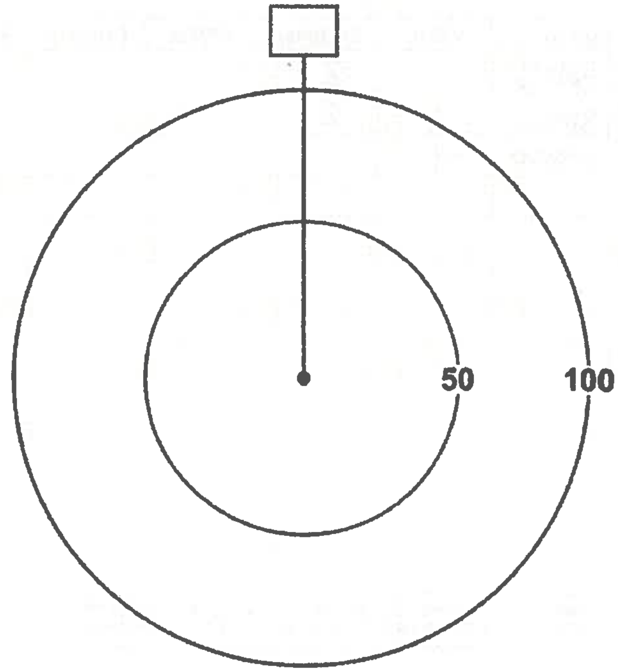
Station: ____________ **Feature:** ____________ **UTM:** ____________

Start Time: ____________ **End Time:** ____________

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



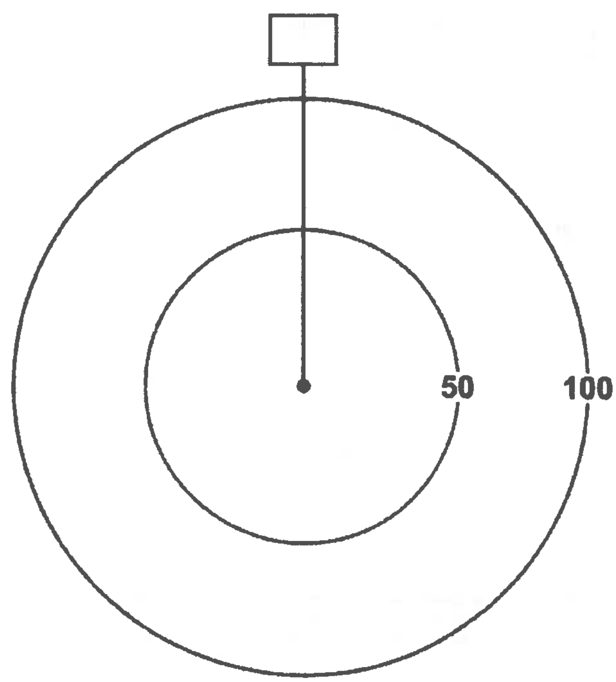
Station: ____________ **Feature:** ____________ **UTM:** ____________

Start Time: ____________ **End Time:** ____________

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

REV: 2011-05-04 / FORM 020

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Birding Point Counts Survey Observation Form

Project Number: 60950443 Project Name: Hamilton - SCUBE

Date: June 26, 2012 Field Personnel: N. Kopysh.

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	15°C to 20°C	0-1	20°	Ø	Ø

GPS #: T

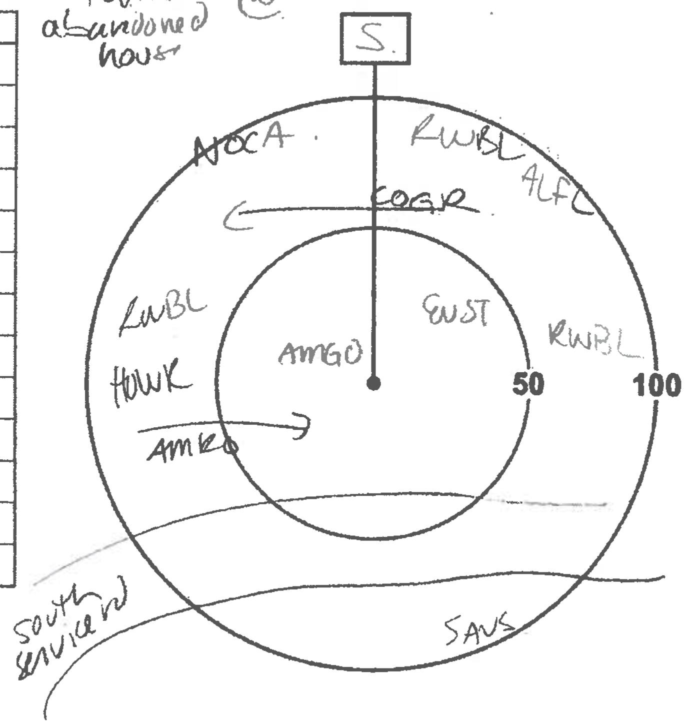
Station: 11 Feature: UTM: 0610535 4785535

Start Time: 05:50 End Time: 05:55

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop fallow @ on south service rd @ abandoned house

Species	<50m	50-100m	>100m	Flyovers	Height*
NOCA		1			
RWBL		3			
AMGO	1				
EUST	1				
AMRO				1	
SAVS		1			
HOWR		1			

** Height of blade sweep varies from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



note: hwy + south service rd. noise

Page 1 of 5

Signature: NKopysh
(Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature:
(Project Manager)

REV: 2011-05-04 / FORM 020

Station: 12 Feature: UTM: 0610406/4785845

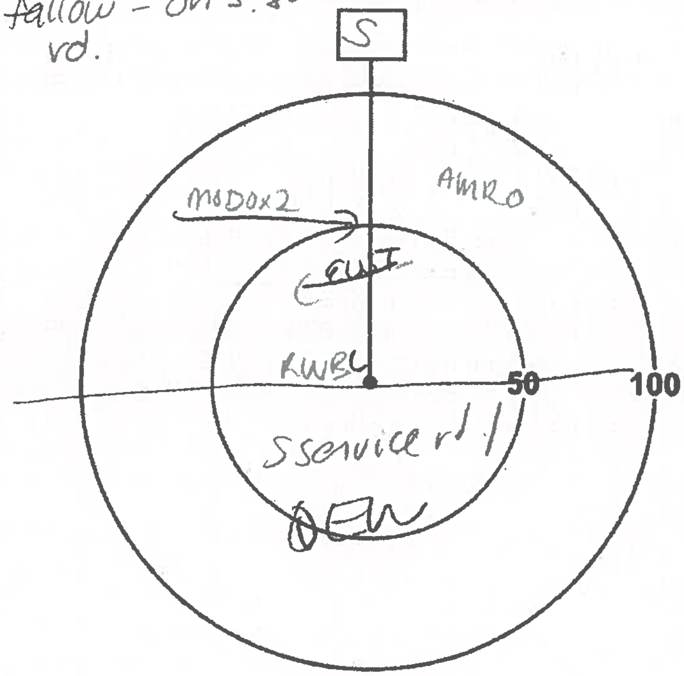
Start Time: 06:05 End Time: 06:10

note hwy noise

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

fallow - on S. service rd.

Species	<50m	50-100m	>100m	Flyovers	Height*
MODO				2	
AMRO		1			
CWST				1	
RWBL	1				



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

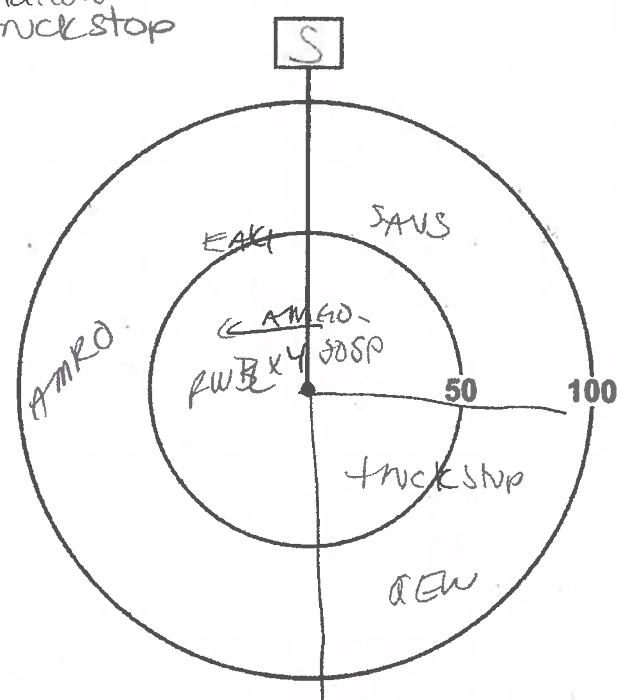
Station: 13 Feature: UTM: 0610234 4785771

Start Time: 06:14 End Time: 06:19

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

- fallow @truckstop

Species	<50m	50-100m	>100m	Flyovers	Height*
EAKI		1			
SAVS		1			
AMGO				1	
SOSP	1				
RWBL	4				
AMRO		1			



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: __________ (Field Personnel)

Signature: __________ (Project Manager)

REV: 2011-05-04 / FORM 020

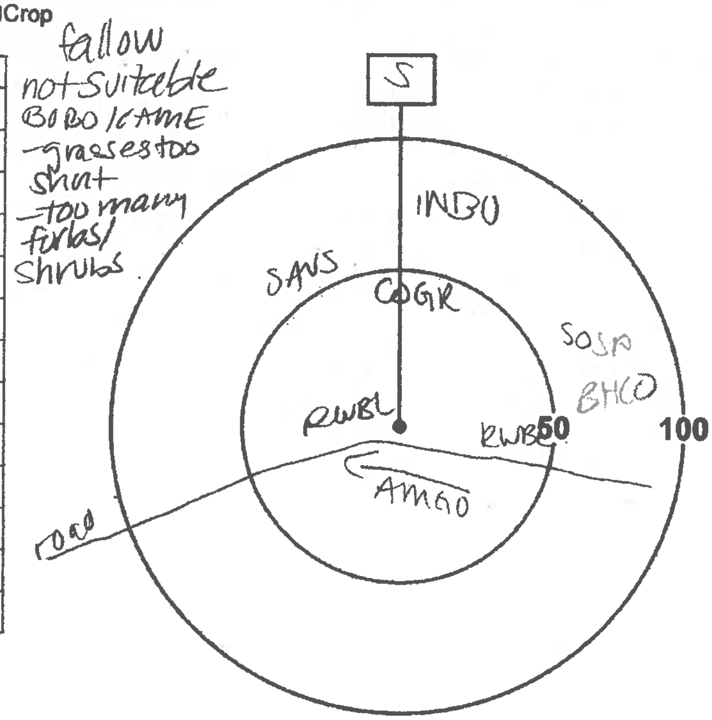
Station: 14. **Feature:** ____ **UTM:** 610037 / 4785737

Start Time: 06:25 **End Time:** 06:30

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
INBU		1			
SAVS		1			
COGR	1				
RWBL	2				
AMGO				1	
BHCO		1			

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



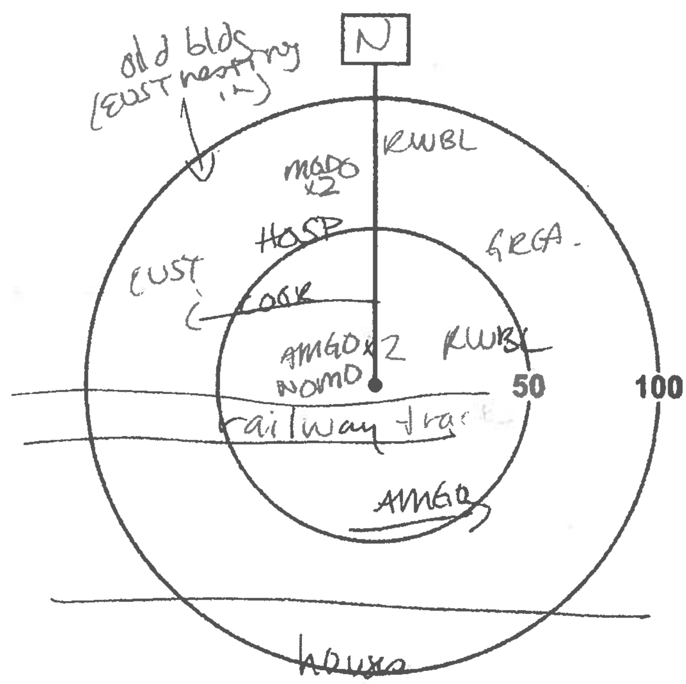
Station: 16 **Feature:** ____ **UTM:** 0609860 4785605

Start Time: 06:38 **End Time:** 06:42

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
MODO		2			
RWBL	1	1			
HOSP		1			
EUST		1			
COGR				1	
AMGO	2			1	
NOMO	1				
GRCA		1			

* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Page 2 of 5

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑

Signature: ____ (Project Manager)

REV: 2011-05-04 / FORM 020

Station: 15 **Feature:** **UTM:** 610049/ 4785387

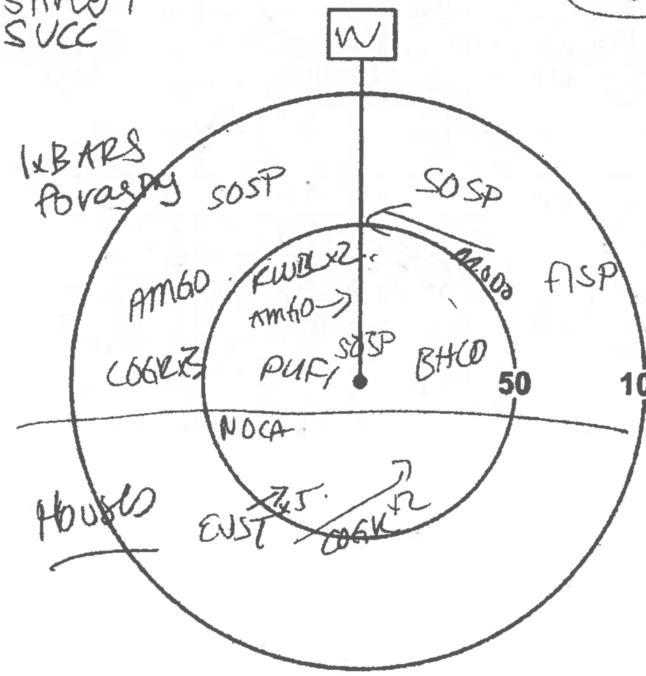
Start Time: 06:50 **End Time:** 06:55

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

shrub / SUCC

1 BARS obs

Species	<50m	50-100m	>100m	Flyovers	Height*
BARS			1		
SOSP	1	2			
AMGO	1	1			
COGR		3		2	
BHCO	1				
PUFI	1				
RWBL	2				
NOCA	1				
EUST	5				



* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 8 **Feature:** **UTM:** 610065/ 4785097

Start Time: 07:04 **End Time:** 07:09

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

shrub/ cuw succ + old orchard?

2 BARS obs

Species	<50m	50-100m	>100m	Flyovers	Height*
FISP		1			
RWBL		1			
TRES	1				
AMGO	1				
AMRO	1				
EUST	2				
BARS				2	
BLJA		1			
HOSP	2				

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

REV: 2011-05-04 / FORM 020

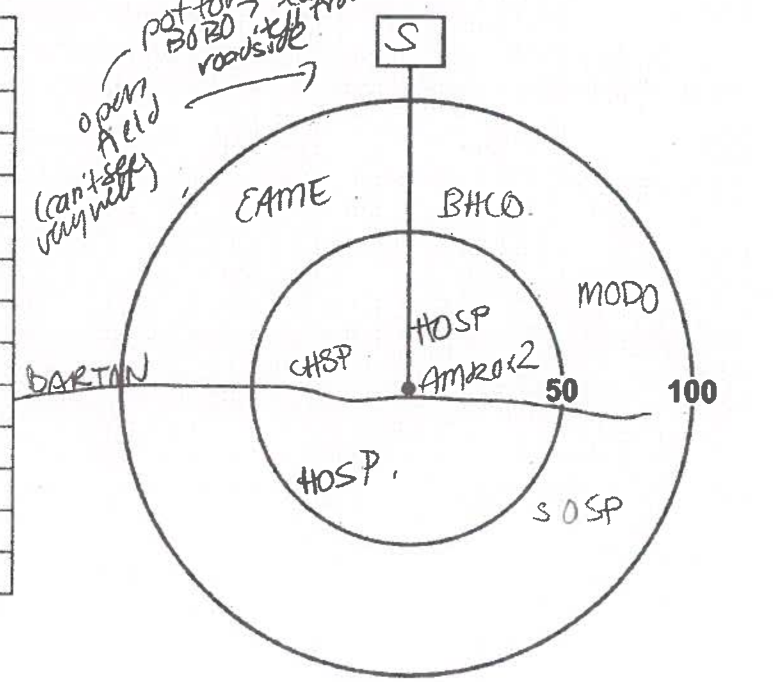
Station: 7 Feature: UTM: 609246 / 4785339 EAME

Start Time: 07:16 End Time: 07:21

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EAME		1			
BHCO		1			
MODO		1			
HOSP	2				
CHSP	1				
AMRO	2				
SOSP		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



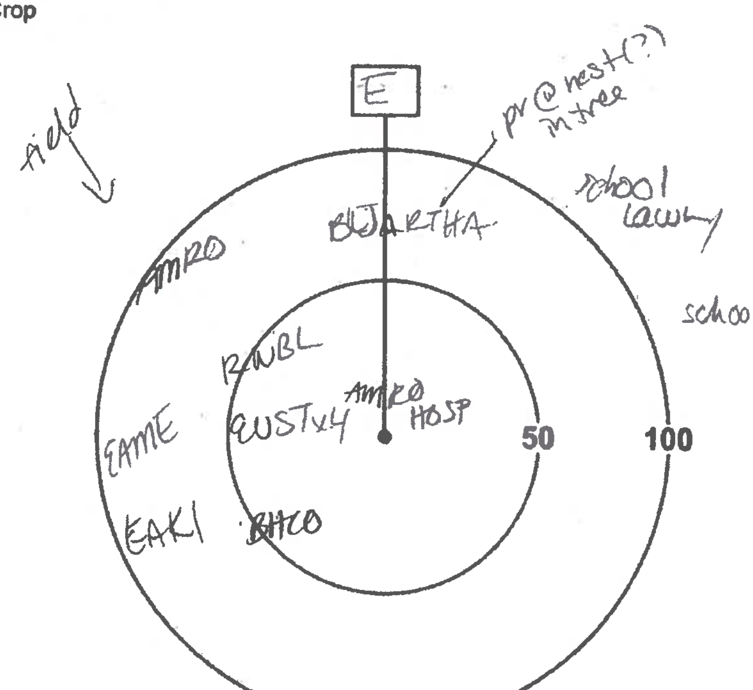
Station: 4 Feature: UTM: 0608758 / 4785292

Start Time: 07:27 End Time: 07:32

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMRO	1	1			
BLJA		1			
RTHA		1			
RWBL	1				
EUST	4				
HOSP	1				
BHCO	1				
EAKI		1			
EAME		1			

** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep



Page 3 of 5

Signature: MKon
(Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature:
(Project Manager)

REV: 2011-05-04 / FORM 020

Station: 3 | Feature: | UTM: 0608816 / 4785156.

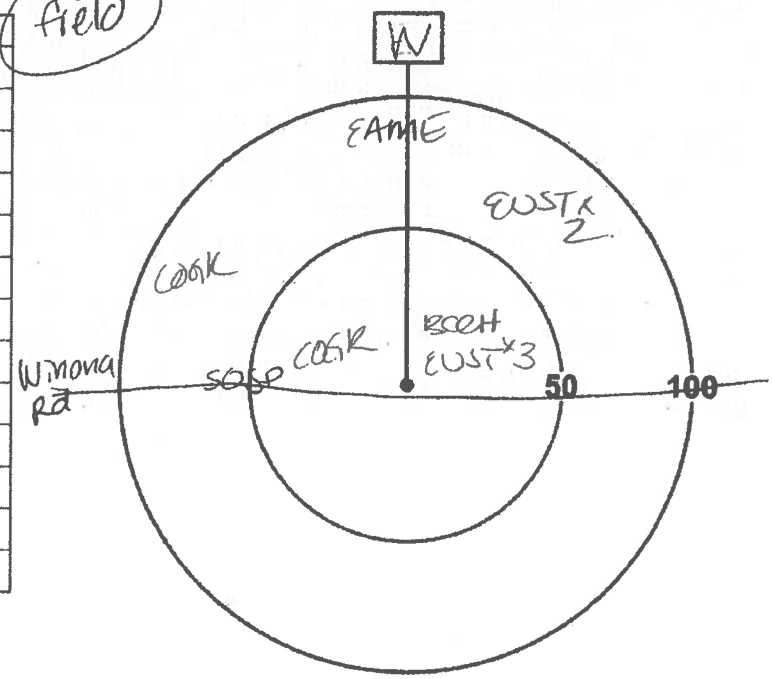
Start Time: 07:42 | End Time: 07:47

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop open field

*EAME

Species	<50m	50-100m	>100m	Flyovers	Height*
EAME		1			
EUST	3	2			
BCCH	1				
COGR	1	1			
SOSP		1			

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



Station: 17 | Feature: | UTM: 0608784 4785104

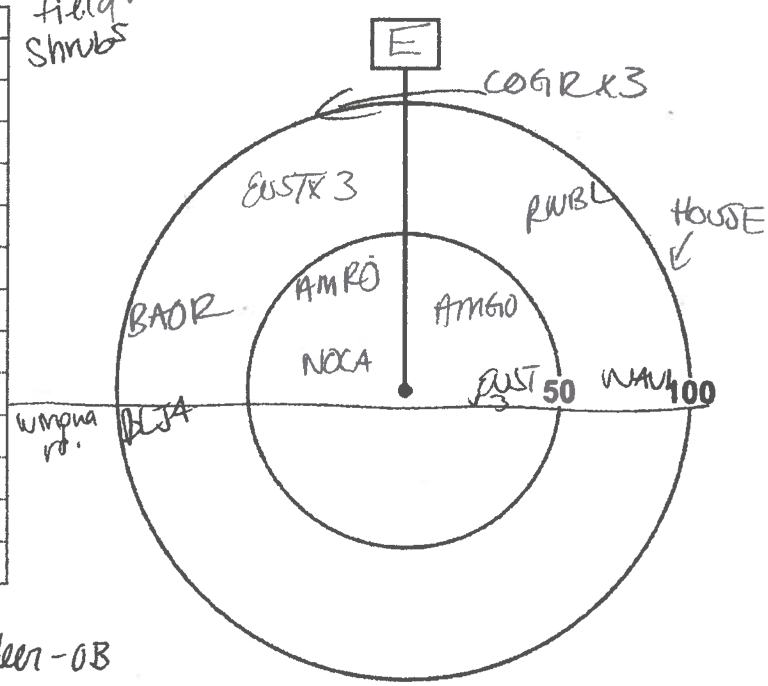
Start Time: 07:49 | End Time: 07:54

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

field w shrubs

Species	<50m	50-100m	>100m	Flyovers	Height*
BAOR		1			
BLJA		1			
AMRO	1				
NOCA	1				
AMGO	1				
EUST	3	3			
RWBL	1				
WAVI		1			
COGR				3	

* *Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep



-deer-OB

Page ___ of ___ Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________ (Field Personnel) Signature: ______________ (Project Manager)

Station: 5 Feature: . UTM: 0608294 4785534

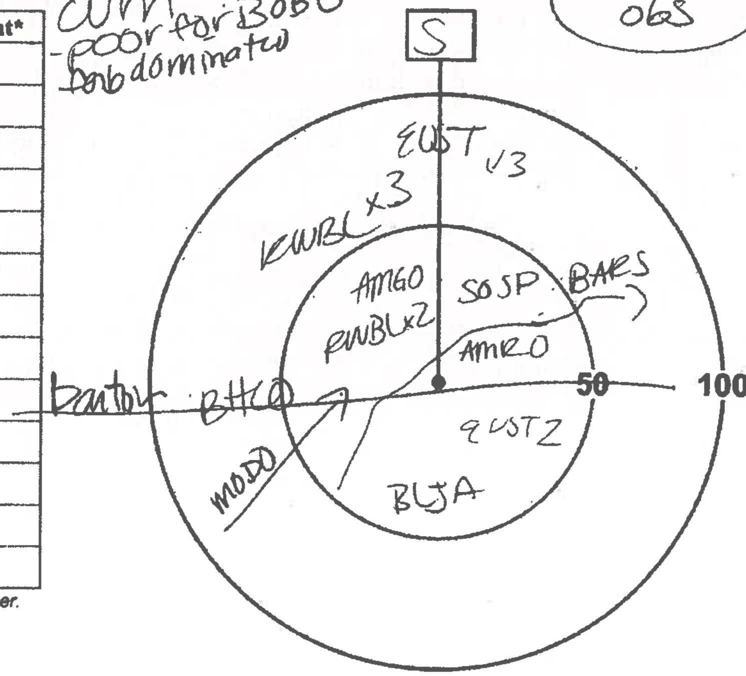
Start Time: 08:35 End Time: 08:40

Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST	2	3			
BARS				1	
RWBL	2	3			
AMGO	1				
SOSP	1				
AMRO	1				
MODO				1	
BHCO		1			
BLJA	1				

CWM - poor for BOBO ~~forb~~ forb dominated

*1 BARS obs



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 6 Feature: UTM:

Start Time: 08 45 End Time: 08:50

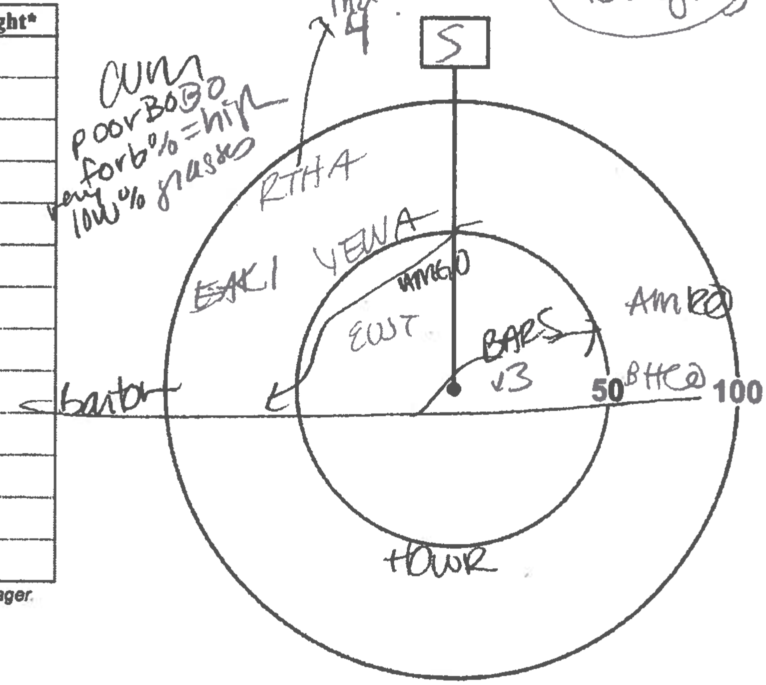
Habitat: ☐Forest / ☐Swamp / ☐Marsh / ☐Hay / ☐Pasture / ☐Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RTHA		1			
YEWA		1			
EAKI		1			
AMGO				1	
EUST	1				
BARS				3	
AMRO		1			
BHCO		1			

likely same man from str

*3 BARS foraging

CWM poor BOBO forb% = high rev forb 10% grasses



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

· cabbage white + sulphur butterflies

Page 4 of 5

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Project Manager)

REV: 2011-05-04 / FORM 020

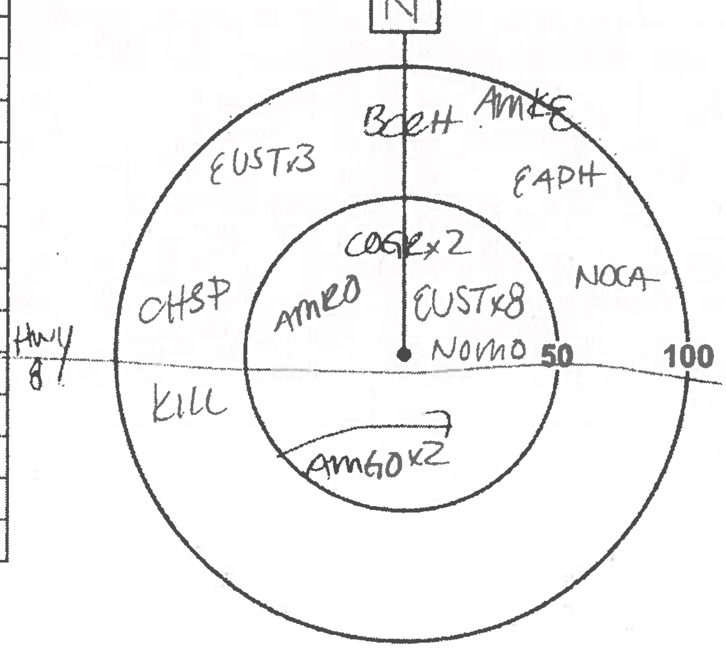
Station: 2 **Feature:** ______ **UTM:** 608484 4784922

Start Time: 08.10 **End Time:** 08:15

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
EUST	8	3			
BCCH		1			
AMKE		1			
EAPH		1			
NOCA		1			
NOMO	1				
COGR	2				
AMRO	1				
KILL		1			
AMGO				2	

cwm.



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

---

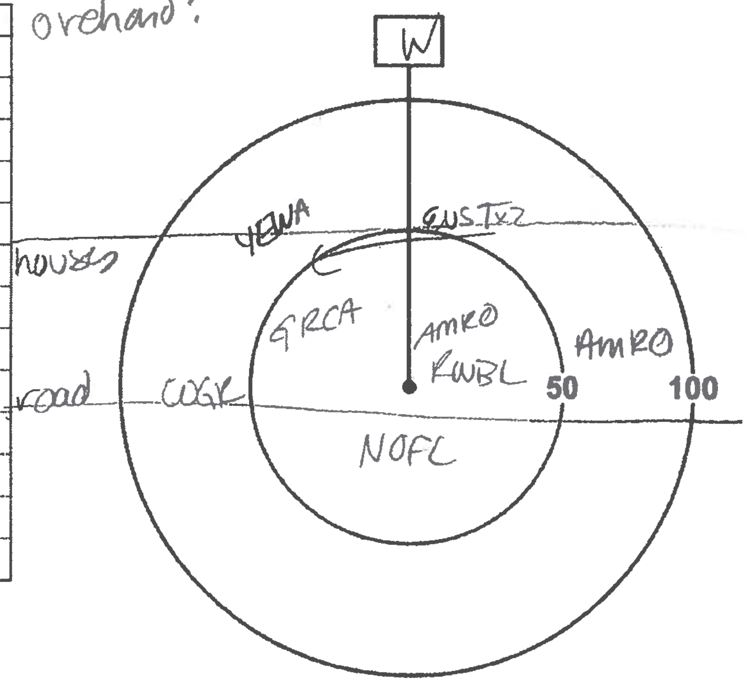
Station: 1 **Feature:** ______ **UTM:** 0607994 4785266

Start Time: 08:20 **End Time:** 08:25

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
NOFL	1				
GRCA	1				
AMRO	1	1			
RWBL	1				
COGR		1			
YEWA		1			
EUST				2	

orchard?



** Height of blade sweep will vary from project to project; check with project manager.*
O-On ground; **A**-Below height of blade sweep; **B**-At height of blade sweep;
C-Above height of blade sweep; **D**-Well above height of blade sweep

Page ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ______________________ (Field Personnel)

Signature: ______________________ (Project Manager)

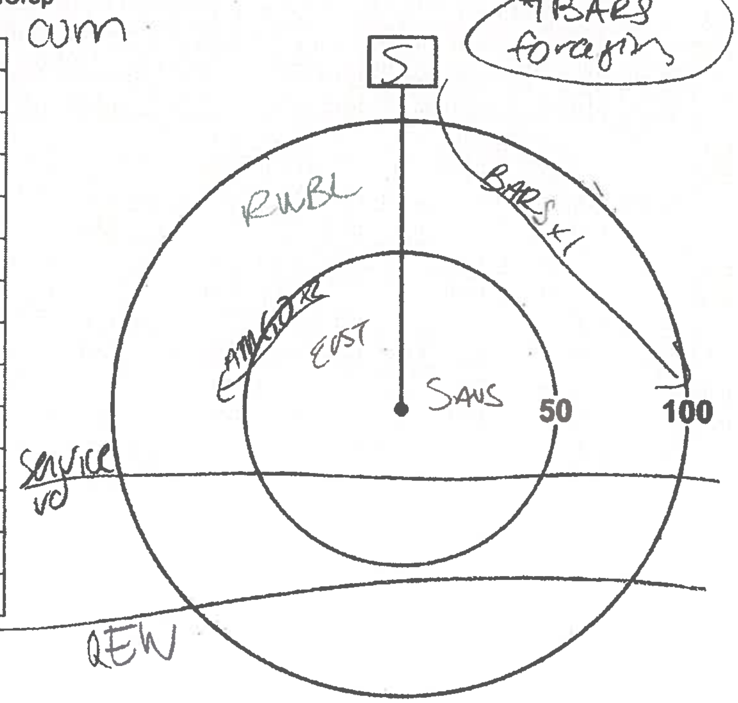
REV: 2011-05-04 / FORM 020

Station: 18 Feature: UTM: 0610787 4785550

Start Time: 09:00 End Time: 09:05

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
RWBL		1			
BARS				1	
EUST	1				
AMGO				2	
SAUS	1				



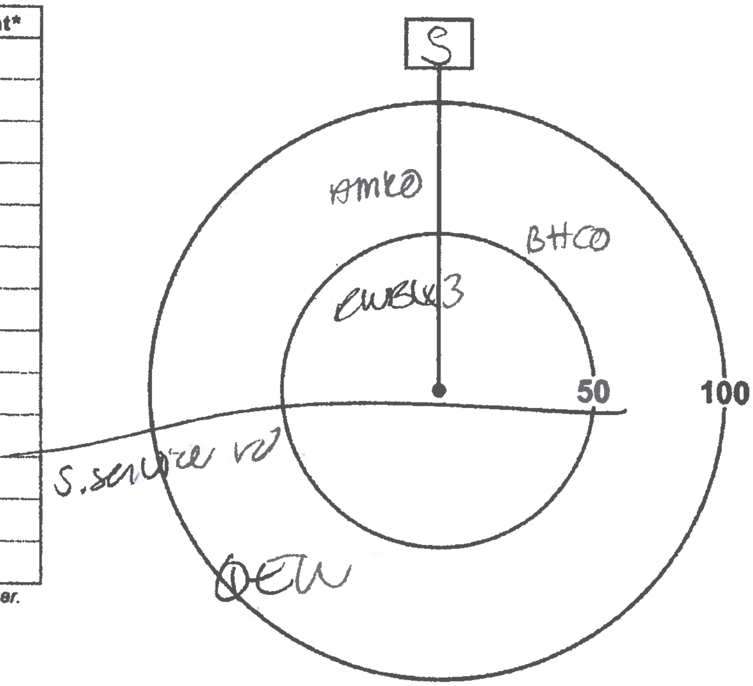
* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Station: 19 Feature: UTM: 0611228 / 4785587

Start Time: 09 10 End Time: 09 15

Habitat: ❑Forest / ❑Swamp / ❑Marsh / ❑Hay / ❑Pasture / ❑Crop

Species	<50m	50-100m	>100m	Flyovers	Height*
AMRO		1			
BHCO		1			
RWBL	3				



* Height of blade sweep will vary from project to project; check with project manager.
O-On ground; A-Below height of blade sweep; B-At height of blade sweep;
C-Above height of blade sweep; D-Well above height of blade sweep

Signature: [signature] (Field Personnel)

Quality Control: This form is complete ❑ & legible ❑.

Signature: (Project Manager)

Stantec
Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 160950443
Project Name: Scube parcels
Date: July 12, 2012
Field Personnel: D. Grahan

Weather Conditions:

TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
16-25	0-1	10%	None	None

Please mark transect location on map and indicate areas of species observations on map.

~~Transect~~ stn No.: 3
Habitat:
Start Time: 5:45
End Time: 5:55
Start Point UTM: 608483, 4784921
End Point UTM: same

Species	Tally
Bobolink	Ø
Eastern Meadowlark	Ø

~~Transect~~ Station No.: 16
Habitat:
Start Time: 8:35
End Time: 8:40
Start Point UTM: 608784 4785104
End Point UTM:

Species	Tally
Bobolink	3 (Flyovers)
Eastern Meadowlark	Ø

Pg. ___ of ___

Quality Control: This form is complete ☐ & legible ☐.

Signature: ____________________ (Field Personnel)

Signature: ____________________ (Project Manager)

REV: 2011-06-03 / FORM 014c

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 160950443
Project Name: HAMILTON – SCUBE
Date: JULY 4 2012
Field Personnel: MICHAEL OLIVEIRA

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	20°C	1-2	50%	Ø	Ø

Please mark transect location on map and indicate areas of species observations on map.

Transect No.: PT. #3
Habitat: OPEN FIELD
Start Time: 06:15
End Time: 06:25
Start Point UTM:
End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	Ø

Transect No.:
Habitat:
Start Time:
End Time:
Start Point UTM:
End Point UTM:

Species	Tally
Bobolink	
Eastern Meadowlark	

Pg. 1 of 1

Quality Control: This form is complete ☐ & legible ☐.

Signature: (Field Personnel)

Signature: (Project Manager)

Stantec

Stantec Consulting Ltd.
1 – 70 Southgate Drive
Guelph, ON
Canada N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Bobolink and Eastern Meadowlark Breeding Survey Form

Project Number: 60950443 Project Name: Hamilton-Winona/SWBE

Date: June 26 2012 Field Personnel: N. Kopysh

Weather Conditions:	TEMP (°C):	WIND:	CLOUD:	PPT:	PPT (in last 24 hrs):
	18°C.	0-1	20%	Ø	Ø

Please mark transect location on map and indicate areas of species observations on map.

Pt. Location ~~Transect~~ No.: 3 Habitat: open field

Start Time: 07:55 End Time: 08:05

Start Point UTM: End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	1
*access by roadside only	

Pt. location ~~Transect~~ No.: 7 Habitat: open field (can't see well)

Start Time: 7[16] End Time: 7[21]

Start Point UTM: 609246l, 4785339 End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	1

- all other habitat in study area = marginal = CUM (forb dominated) or shrub/succ.
- field at stn 7 not well visible from road - potential?

Pg. ___ of ___

Signature: ______________ (Field Personnel)

Quality Control: This form is complete ☐ & legible ☐.

Signature: ______________ (Project Manager)

Pt. location
~~Transect No.~~: 4

Habitat: Field

Start Time: 7[27]

End Time: 7[32]

Start Point UTM: 608758, 4785292

End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	1

Pt. location
~~Transect No.~~: 3

Habitat: Open field

Start Time: 7[42]

End Time: 7[47]

Start Point UTM: 608816, 4785156

End Point UTM:

Species	Tally
Bobolink	Ø
Eastern Meadowlark	1

Transect No.:

Habitat:

Start Time:

End Time:

Start Point UTM:

End Point UTM:

Species	Tally
Bobolink	
Eastern Meadowlark	

Pg. ___ of ___

Quality Control: This form is complete ❑ & legible ❑.

Signature: ____________________ (Field Personnel)

Signature: ____________________ (Project Manager)

Chimney Assessment Form

Scube.

Page 1

July 12, 2012 10:45 AM

Observer Details

Name D. Graham	Phone Number ( )	Email Address

Street Address	City	Prov.	Postal Code

Building Details

Street Address 24 Victoria	City Winona	Prov. On.	Postal Code

Owner Name	Phone Number ( )	Email Address

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 1

Chimney Code: SC - W1

GPS coordinates (DD.dddd):

Lat. 4785637 ° N

Long. 609801 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

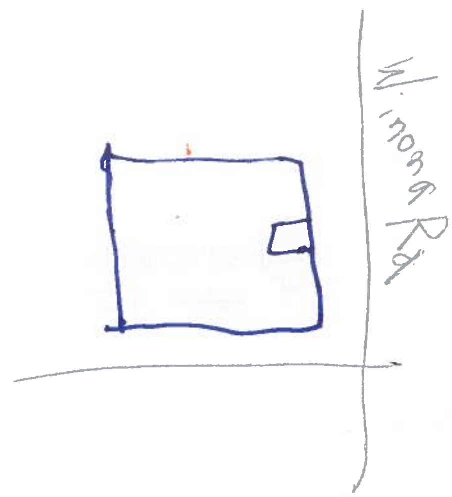
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [x] Metal Liner
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [ ] Residential
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [x] Other, please specify: Rural

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): ______
- [ ] Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

Chimney height above roofline (m): 2m	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

Created by:

Bird Studies Canada / Études d'Oiseaux Canada — understand appreciate conserve / comprendre apprécier conserver

Canadian co-partner of / un partenaire canadien de BirdLife International

In partnership with:

Ontario

The Ontario Trillium Foundation / La Fondation Trillium de l'Ontario

Environment Canada / Environnement Canada — Ontario Region / Région de l'Ontario

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number ( )	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address 1220 Barton	City	Prov.	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 2

Chimney Code: SC-B-2

GPS coordinates (DD.dddd):

Lat. 4785309 ° N

Long. 609379 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential/Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): ______
- [ ] Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Beige

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 4 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

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Chimney Assessment Form
Page 1

Observer Details

Name	Phone Number	Email Address	
	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
1182 Barton			
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 3

Chimney Code: SC-B-3

GPS coordinates (DD.dddd):
Lat. 4785399 ° N
Long. 609098 ° W

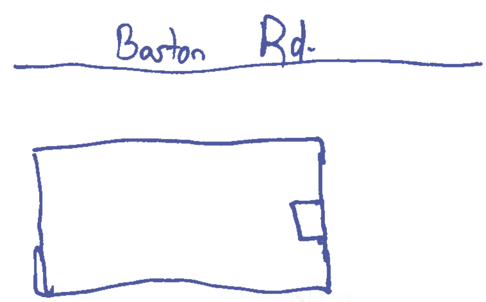
NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / Rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): ______
- [ ] Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 1	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 7 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

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LA FONDATION TRILLIUM DE L'ONTARIO

Environment Canada Ontario Region
Environnement Canada Région de l'Ontario

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number ( )	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address 292 Lewis	City	Prov.	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ______

Chimney Details

Site Name: 4

Chimney Code: SC-L-4

GPS coordinates (DD.dddd):

Lat. 4785299 ° N

Long. 608803 ° W

Number of years active (if known):

NOTE: Chimney codes are created using the following scheme:

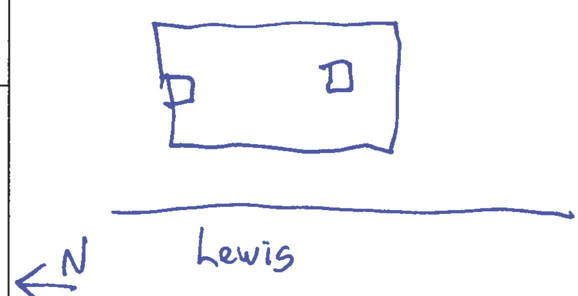
City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ______

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ______

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): ______
- [ ] Rectangular → Width (cm): 50 Length (cm): 50

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

Chimney height above roofline (m): 3	Number of Flues: 2	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 3 (Height above roofline (m)) = 6m m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None.

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number ( )	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address 1143 Hwy 8	City	Prov.	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

☐ House ☐ Church ☐ Store
☐ Lowrise Apartment ☐ School ☐ Factory
☐ Highrise Apartment ☐ Hospital ☑ Other, please specify: Hotel

Chimney Details

Site Name: 5

Chimney Code: SC-8-5

GPS coordinates (DD.dddd):
Lat. 4784962 ° N
Long. 608720 ° W

Number of years active (if known):

NOTE: Chimney codes are created using the following scheme:

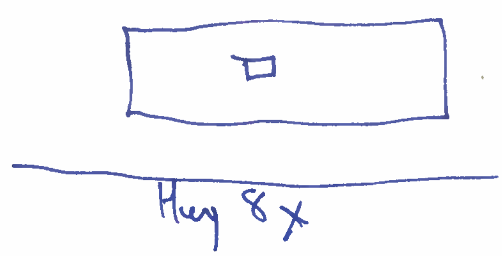
City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Chimney material (please check one):

☑ Brick ☐ Stucco
☐ Concrete ☐ Stone
☐ Other, please specify:

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

☑ Cap ☑ Terra Cotta Liner
☐ Animal Guard ☐ Spark Protector
☐ Metal Liner ☐ Other, please specify:

Surrounding habitat (please check one):

☑ Residential |roral ☐ Industrial
☐ Commercial ☐ Natural
☐ Other, please specify:

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

☐ Round → Diameter (cm):
☑ Square → Width (cm):
☐ Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

Chimney height above roofline (m): 2	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 2 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 8 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

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Environment Canada / Environnement Canada
Ontario Region / Région de l'Ontario

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address	
	( )		
Street Address	**City**	**Prov.**	**Postal Code**

Building Details

Street Address	City	Prov.	Postal Code
1101 Hwy 8			
Owner Name	**Phone Number**	**Email Address**	
	( )		

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 6

Chimney Code: SC-8-6

GPS coordinates (DD.dddd):

Lat. 4784905 ° N

Long. 608404 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

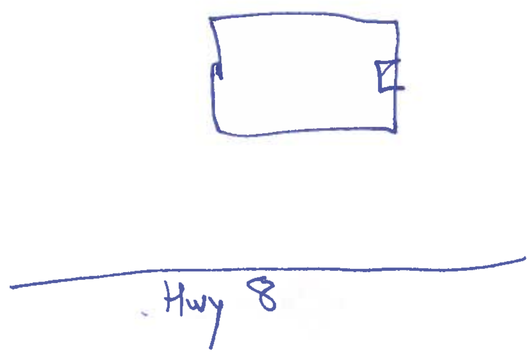
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [x] Cap
- [x] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [x] Residential (rural)
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ____________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 40 Length (cm): 60

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Page 2

Chimney height above roofline (m): 0.5	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m)	=	2 Number of stories in building	×	3 m (approx height of one story)	+	0.5 Height above roofline (m)	=	6.5	m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

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Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address
	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
~~[illegible]~~ 1859 Hwy 8			

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- [x] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 8 7

Chimney Code: SC-8-7

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

GPS coordinates (DD.dddd):

Lat. 4784859 ° N

Long. 608145 ° W

Number of years active (if known):

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

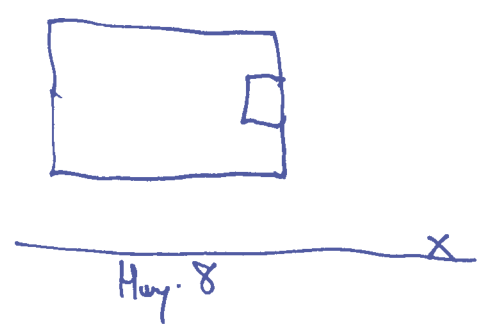
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [ ] Terra Cotta Liner
- [ ] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: No modifications

Surrounding habitat (please check one):

- [x] Residential rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 50 Length (cm): 100

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 3	Number of Flues: 2	Colour of Chimney: Brown

Total Chimney Height (m) = 3 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 11 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None observed. 1st chimney in Scube parcels that looks suitable for chimney swift.

Created by:

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Environment Canada, Ontario Region / Environnement Canada, Région de l'Ontario

McIlwraith Field Naturalists

Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address
	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
220 Mc Neilly			

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- [x] House
- [ ] Lowrise Apartment
- [ ] Highrise Apartment
- [ ] Church
- [ ] School
- [ ] Hospital
- [ ] Store
- [ ] Factory
- [ ] Other, please specify: ______

Chimney Details

Site Name: 8

Chimney Code: SC-M-8

GPS coordinates (DD.dddd):

Lat. 4784984 ° N

Long. 607878 ° W

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

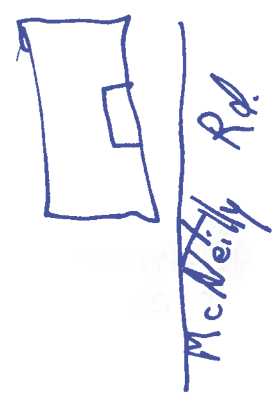
Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Number of years active (if known):

Chimney material (please check one):

- [ ] Brick
- [ ] Concrete
- [ ] Other, please specify: ______
- [x] Stucco
- [ ] Stone

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [ ] Animal Guard
- [ ] Metal Liner
- [x] Terra Cotta Liner
- [ ] Spark Protector
- [ ] Other, please specify: ______

Surrounding habitat (please check one):

- [x] Residential / rural
- [ ] Commercial
- [ ] Other, please specify: ______
- [ ] Industrial
- [ ] Natural

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [ ] Square → Width (cm): ______
- [x] Rectangular → Width (cm): 150 Length (cm): 30

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 1	Number of Flues: 4	Colour of Chimney: Beige

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 1 (Height above roofline (m)) = 4 m

If swifts are present, are they: ☐ Nesting ☐ Roosting ☐ Unknown

Additional Comments:

None

Created by:

Bird Studies Canada / Études d'Oiseaux Canada — understand appreciate conserve / comprendre apprécier conserver

Canadian co-partner of / un partenaire canadien de BirdLife International

In partnership with:

Ontario

The Ontario Trillium Foundation / La Fondation Trillium de l'Ontario

Environment Canada Ontario Region / Environnement Canada Région de l'Ontario

McIlwraith Field Naturalists

Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number	Email Address
	( )	

Street Address	City	Prov.	Postal Code

Building Details

Street Address	City	Prov.	Postal Code
252 Mc Neilly			

Owner Name	Phone Number	Email Address
	( )	

Type of building (please check one):

- ☑ House
- ☐ Church
- ☐ Store
- ☐ Lowrise Apartment
- ☐ School
- ☐ Factory
- ☐ Highrise Apartment
- ☐ Hospital
- ☐ Other, please specify: ________

Chimney Details

Site Name: 9

Chimney Code: SC - M - 9

GPS coordinates (DD.dddd):

Lat. 4785167 ° N

Long. 607939 ° W

Number of years active (if known):

NOTE: Chimney codes are created using the following scheme:

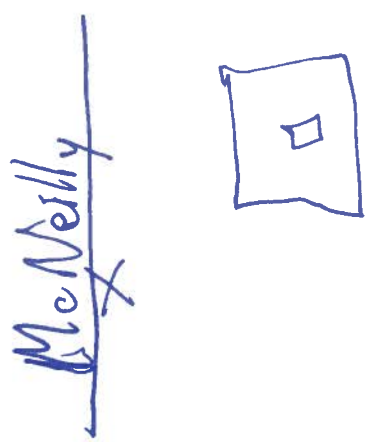
City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Chimney material (please check one):

- ☐ Brick
- ☐ Stucco
- ☑ Concrete
- ☐ Stone
- ☐ Other, please specify: ________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- ☐ Cap
- ☑ Terra Cotta Liner
- ☑ Animal Guard
- ☐ Spark Protector
- ☐ Metal Liner
- ☐ Other, please specify: ________

Surrounding habitat (please check one):

- ☑ Residential (rural)
- ☐ Industrial
- ☐ Commercial
- ☐ Natural
- ☐ Other, please specify: ________

Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- ☐ Round → Diameter (cm): ________
- ☑ Square → Width (cm): ________
- ☐ Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements: **20cm x 9cm x 6cm (L x W x H)**

Chimney Assessment Form

Chimney height above roofline (m): 2	Number of Flues: 1	Colour of Chimney: Grey

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 2 (Height above roofline (m)) = 5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

Created by:

Canadian co-partner of
un partenaire canadien de

In partnership with:

Chimney Assessment Form

Page 1

Observer Details

Name	Phone Number ( )	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address 276 Mc Neilly	City	Prov.	Postal Code
Owner Name	Phone Number ( )	Email Address	

Type of building (please check one):

- [ ] House
- [ ] Church
- [ ] Store
- [ ] Lowrise Apartment
- [ ] School
- [ ] Factory
- [ ] Highrise Apartment
- [ ] Hospital
- [ ] Other, please specify: ____________

Chimney Details

Site Name: 10

Chimney Code: SC-M-10

GPS coordinates (DD.dddd):
Lat. 4785345 ° N
Long. 607989 ° W

Number of years active (if known):

NOTE: Chimney codes are created using the following scheme:

City Initials - Site Initials - Chimney Number

Eg.	City Name	Site Name	No. of Chimneys	Code
	Port Rowan	Public Library	1	PR-PL-1
	London	141 Wortley	2	LO-141-1
				LO-141-2

Chimney material (please check one):

- [x] Brick
- [ ] Stucco
- [ ] Concrete
- [ ] Stone
- [ ] Other, please specify: ____________

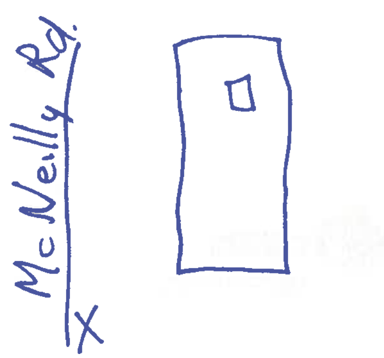
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:

- [ ] Cap
- [x] Terra Cotta Liner
- [x] Animal Guard
- [ ] Spark Protector
- [ ] Metal Liner
- [ ] Other, please specify: ____________

Surrounding habitat (please check one):

- [x] Residential /rural
- [ ] Industrial
- [ ] Commercial
- [ ] Natural
- [ ] Other, please specify: ____________

If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.



Please select the **SHAPE** of your chimney and provide the appropriate estimated measurements:

- [ ] Round → Diameter (cm): ______
- [x] Square → Width (cm): ______
- [ ] Rectangular → Width (cm): 40 Length (cm): 40

NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements:
20cm x 9cm x 6cm (L x W x H)

Chimney Assessment Form

Chimney height above roofline (m): 0.5	Number of Flues: 1	Colour of Chimney: Brown

Total Chimney Height (m) = 1 (Number of stories in building) × 3 m (approx height of one story) + 0.5 (Height above roofline (m)) = 3.5 m

If swifts are present, are they: ☐ **Nesting** ☐ **Roosting** ☐ **Unknown**

Additional Comments:

None

Created by:

BIRD STUDIES CANADA
ÉTUDES D'OISEAUX CANADA
understand appreciate conserve
comprendre apprécier conserver

Canadian co-partner of
un partenaire canadien de
BirdLife INTERNATIONAL

In partnership with:

Ontario

THE ONTARIO TRILLIUM FOUNDATION
LA FONDATION TRILLIUM DE L'ONTARIO

Environment Canada
Ontario Region
Environnement Canada
Région de l'Ontario

McIlwraith Field Naturalists

CHSW 160950443 JULY 4, 2012 HAMILTON-SCUBE

TIME:	STATION:	UTM:	# OF SUITABLE CHIMNEYS	# CHSW OBSERVED:	
10:35	1	0609819 4785639	Ø	Ø	
10:52	2	0609305 4785335	Ø	Ø	
11:08	3	0609056 4785414	Ø	Ø	
11:26	4	0608835 4785328	Ø	Ø	
11:43	5	0608591 4784942	Ø	Ø	BARS (3)
11:58	6	0608322 4784897	Ø	Ø	
12:15	7	0608135 4784860	Ø	Ø	
12:30	8	0607825 4784837	Ø	Ø	
12:45	9	0607909 4785077	Ø	Ø	
13:00	10	0607970 4785277	Ø	Ø	
13:15	11	0608046 4785539	Ø	Ø	
13:30	12	0608636 4785483	Ø	Ø	
13:47	13	0609256 4784859	Ø	Ø	

CHSW 60950443 Hamilton-SCUBE
June 26 2012

Time	station	UTM	location	#suitable chimneys	#CHSW obs.
09:30	1 wimona kde Wimona Equip	0609819 4785639		none -all=narrow, alum or capped	Ø
09:45	2 1216 Barton	0609305/ 4785335		none - new housing to N&E - no chimne to W - older houses - sml/capped	Ø
10:00	3 1178 Barton	0609056/ 4785414		none	Ø
10:15	4 school	0608835 4785328		houses across st none	Ø
(no other # stns on Lewis - no other pot. structures - all visible from #4 stn).				#265 → lrg wide chimney - not visible if access	Ø
10:30	5 1123 Hwy 8	608591/ 4784942		#1123 has long narrow brick chimney @3 stacks (not apparent if access	Ø
10:45	6 memphis fire BBQ	608322/ 4784897		none - capped/ sml	Ø
11:00	7 Thai cuisine 1065 Hwy 8	0608135/ 4784860		? older house - 1059 Hwy 8. narrow long (brick - no caps top not visible	Ø
11:15	8 201 mcneilly Rd.	0607825/ 4784837		none Ø	Ø
11:30	9 235 mcneily Rd	0607909 4785077		Ø	Ø
11:45	10 263 mcneily Rd	0607970 4785277		none	Ø
12:00	11 297 mcneily (mcneily/Barton)	0608046/ 4785539		none	Ø

CHSW June 26 2012 Scube

Time	Station	UTM	# suitable chimneys	# CHSW observed
12^{15}	12 (1095 Boston)	608636 4785483	None	Ø
12^{30}	13 (1226 Hwy 8)	609256 4784859	None	Ø

APPENDIX D: Correspondence