Appendix "D" to Report PED13099/PW13040 (Page 1 of 347)

Submitted to:

The City of Hamilton

SCUBE SUBWATERSHED STUDY:

PHASE 3: IMPLEMENTATION

Aquafor Beech Limited

May 15, 2013

Dave Maunder, M.Sc., P.Eng Principal, Aquafor Beech Limited <u>maunder.d@aquaforbeech.com</u>

> 6-202-2600 Skymark Avenue Mississauga, Ontario L4W 5B2 Telephone: (905) 629-0099

Reference Number: 65126

Table of Contents

1.0	INTRODUCTION	iii
1.1	Study Area	4
1.2	Proposed Land Uses	4
1.3	Objectives	6
1.4	Report Outline	6
2.0	BACKGROUND – PHASE 1 AND PHASE 2 REPORTS	8
2.1	Stormwater Management Controls	8
2.2	Drainage and Infrastructure Improvement Works	. 13
2.3	Establishment of the Recommended Natural Heritage System (NHS)	. 13
2.4	Environmental Restoration and Enhancement	. 14
2.5	NHS Management	. 14
3.0	IMPLEMENTATION	. 15
3.1	Responsibility for Implementation	. 15
3.2	Targets/Objectives	. 15
3.3	Requirements for Future Studies	. 16
3.4	Phasing Considerations	. 17
3.5	Additional Design Guidance and Policy Considerations	. 17
3.6	Approvals	. 18
4.0	CITY OF HAMILTON & AGENCY WORKS	. 19
4.1	Stormwater Management Controls	. 19
4.2	Drainage and Infrastructure Improvement Works	. 19
4	2.1 Watercourse 7 Channel Conveyance Improvements	. 19
4.3	Establishment of the Recommended Natural Heritage System	. 27
4	.3.1 Targets/Objectives	. 28
4	.3.2 Future Studies	. 28
4	.3.3 Phasing	. 29
4	.3.4 Design Guidance and Policy Considerations	. 29
4	.3.5 Approvals	. 29
4.4	Environmental Restoration and Enhancement	. 30

	4.4.1	Core Areas and Linkages within the Fruitland-Winona Secondary Plan Study Area	30
	4.4.2	······································	
		on Street	32
	4.4.3	Fish Barrier Removal	33
	4.4.4	Zone C Riparian Habitat Enhancements	35
4	.5]	Natural Heritage System Management	38
	4.5.1	Trails	38
	4.5.2	Stewardship	39
5.0	DE	EVELOPMENT RELATED WORK	41
5	.1 \$	Stormwater Management Controls	41
	5.1.1	End-of-Pipe Stormwater Management Ponds	41
	5.1.2	Traditional Source Controls	54
5	.2]	Drainage and Infrastructure Improvement Works	57
	5.2.1	Watercourse 5.0 Relocation/Reconstruction within SCUBE West Lands	57
	5.2.2	Possible Watercourse Diversion	60
	5.2.3	Watercourse 9 West Tributary Channel Capacity Improvements	64
5	.3]	Establishment of the Recommended Natural Heritage System	66
	5.3.1	Targets/Objectives	67
	5.3.2	Future Studies	67
	5.3.3	Phasing	84
	5.3.4	Design Guidance and Policy Considerations	85
	5.3.5	Approvals	85
5	.4]	Environmental Restoration and Enhancement	86
5	.5]	Natural Heritage System Management	86
	5.5.1	Targets/Objectives	86
	5.5.2	Future Study	87
	5.5.3	Phasing	88
	5.5.4	Design Guidance and Policy Considerations	88
		Approvals	
6.0		ESIGN GUIDANCE	
6	.1	Stormwater Management Ponds	90

6.2	Traditional Source Control Measures
6.3	Low Impact Development
6	3.1 Rainwater Harvesting
6	3.2 Green roofs
6	3.3 Downspout Disconnection
6	3.4 Soakaway Pits and Infiltration Chambers
6	3.5 Bioretention Systems
6	3.6 Filter (Buffer) Strips
6	3.7 Permeable Pavement
6	3.8 Grassed Swales
6.4	Conveyance Improvements and Stream Restoration
7.0	POLICY CONSIDERATIONS FOR LID SOURCE CONTROLS 100
7.1	Special Provisions in Zoning and Subdivision Agreements for SWM facilities 100
7.2	Updating of Municipal Standards/Codes
7.3	Training Requirements
7.4	Operations and Maintenance Requirements for LID measures
8.0	CONCLUSIONS AND RECOMMENDATIONS 103
8.1	Stormwater Management 105
8.2	Drainage and Infrastructure Improvement Works
8.3	Establishment of the Recommended NHS 108
8.4	Environmental Restoration and Enhancement Works 109
8.5	Natural Heritage System Management Measures 112
9.0	REFERENCES

APPENDIX A: HYDROLOGIC MODELLING – STORMWATER POND SIZING

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

APPENDIX C: 2012 BREEDING BIRD SURVEY REPORT BY STANTEC CONSULTING LIMITED

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;

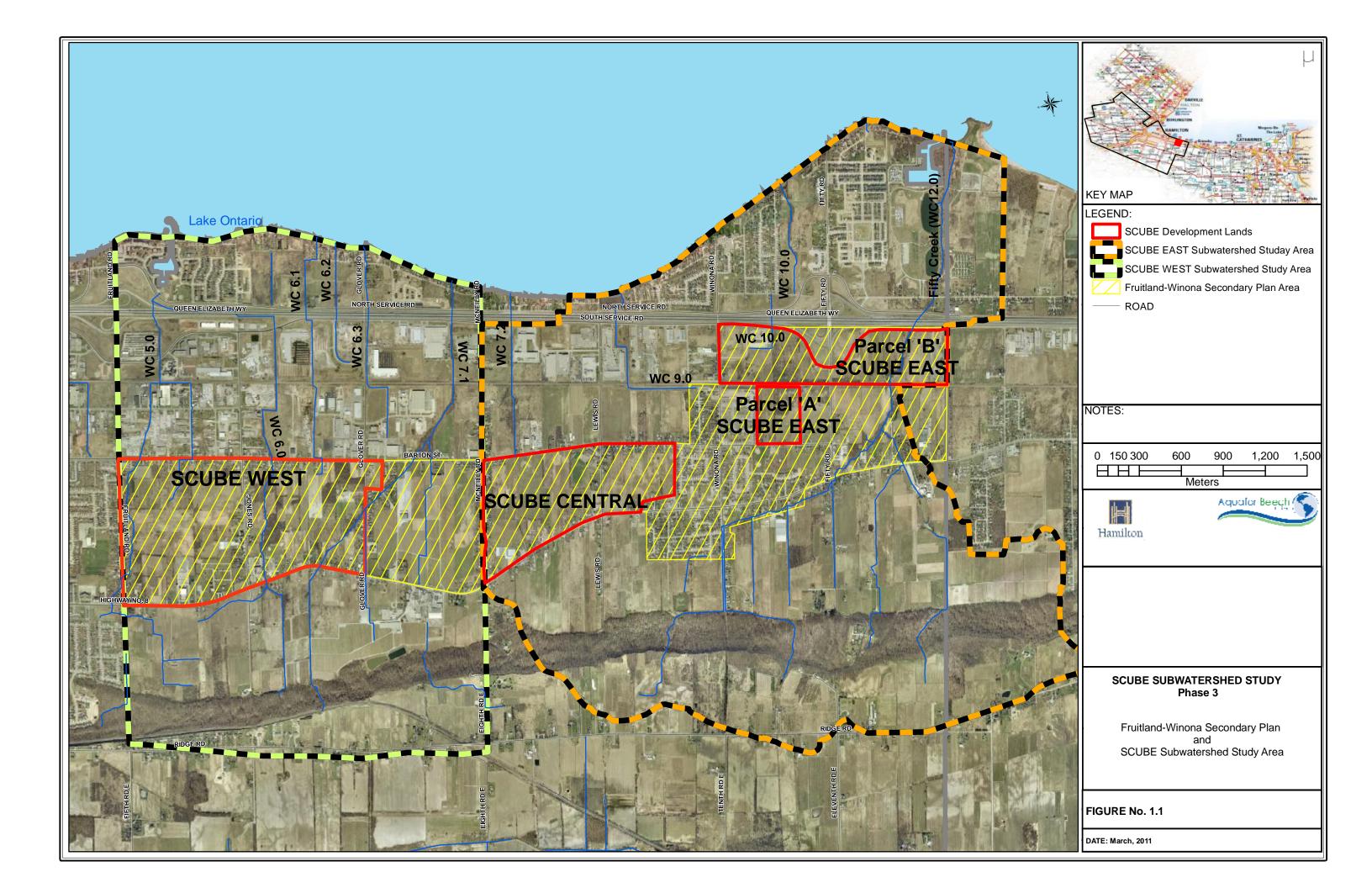
Phase 3: Develop an implementation plan to guide future work by the City of Hamilton and development proponents.

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



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

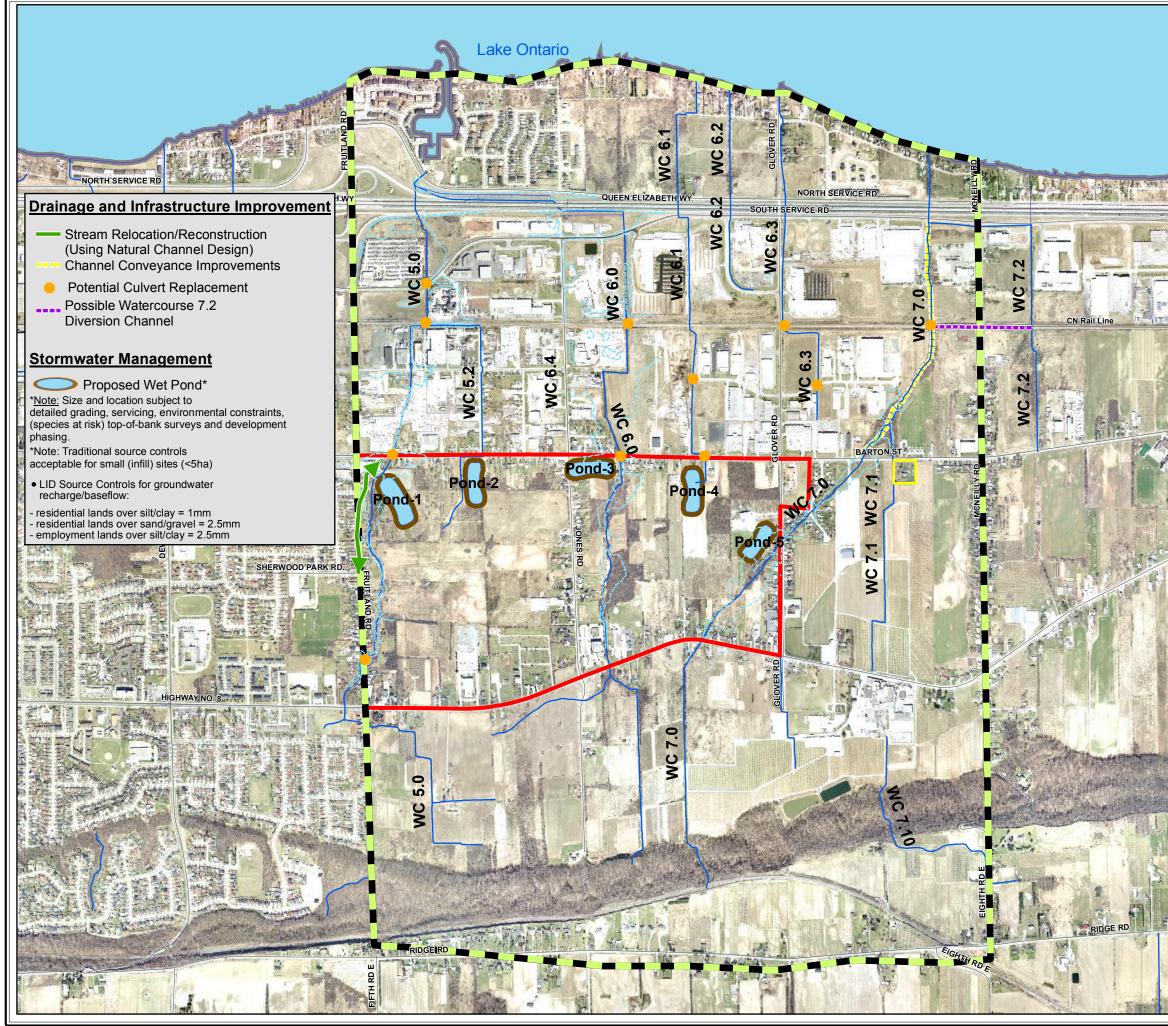
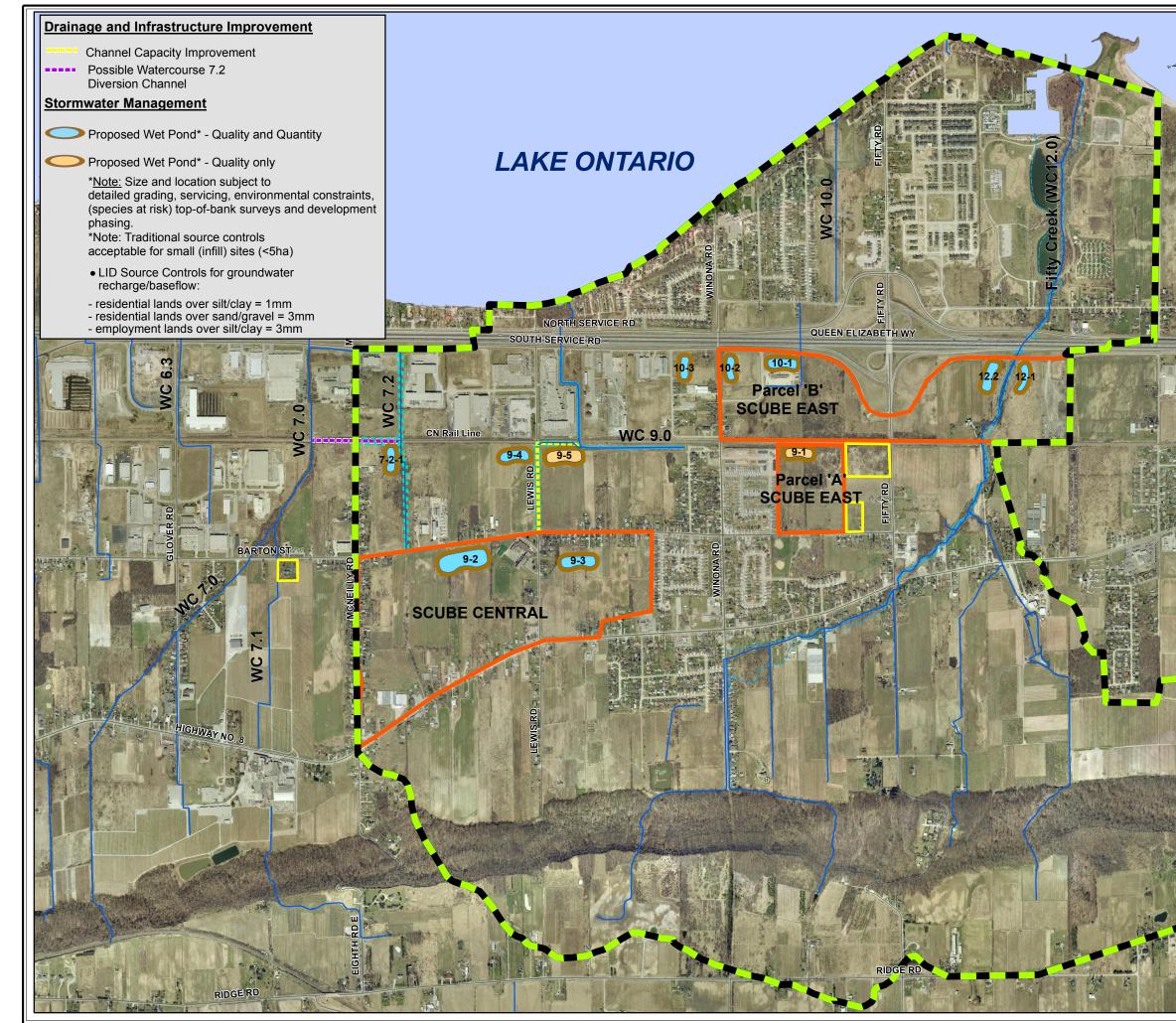
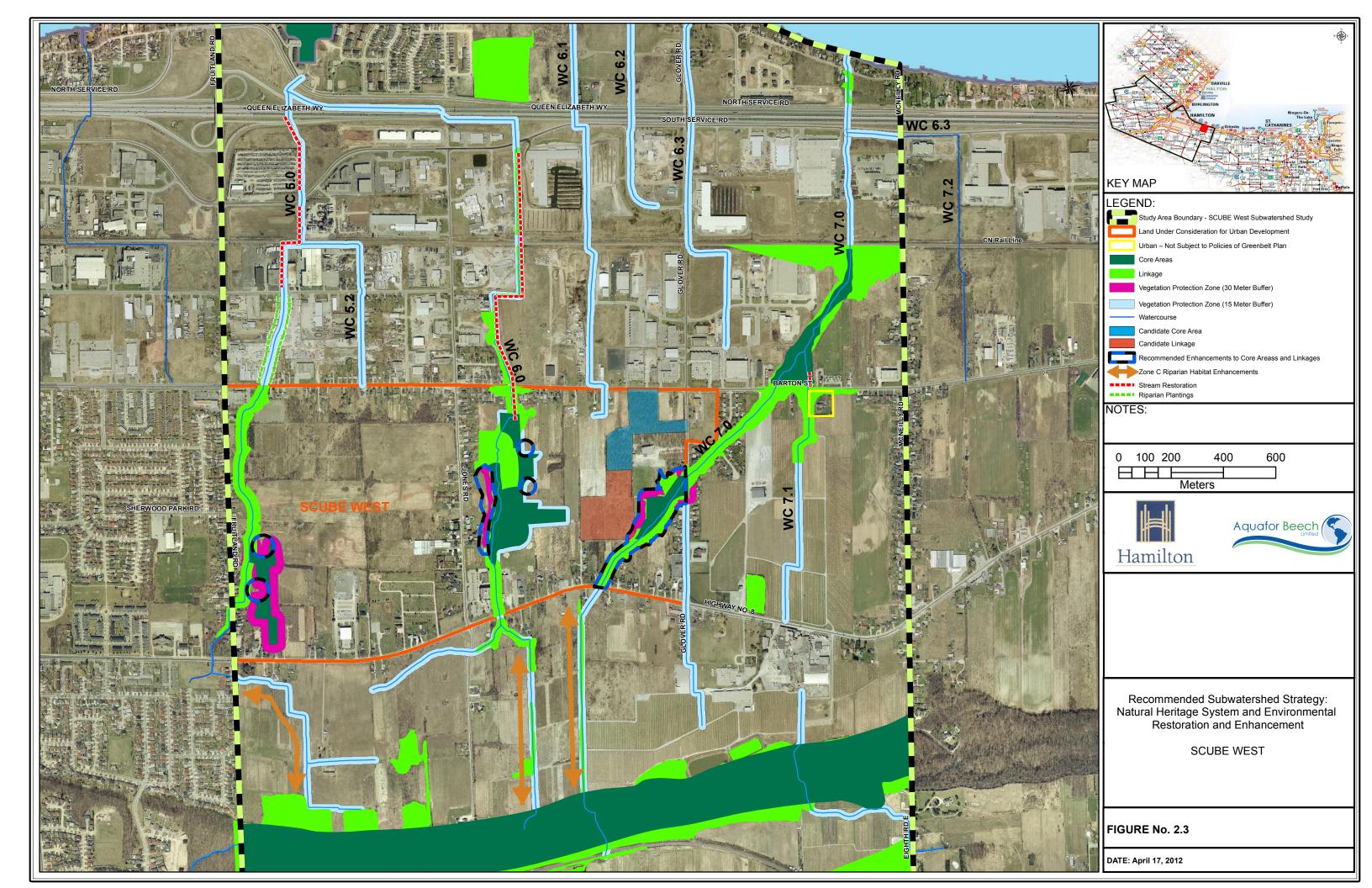
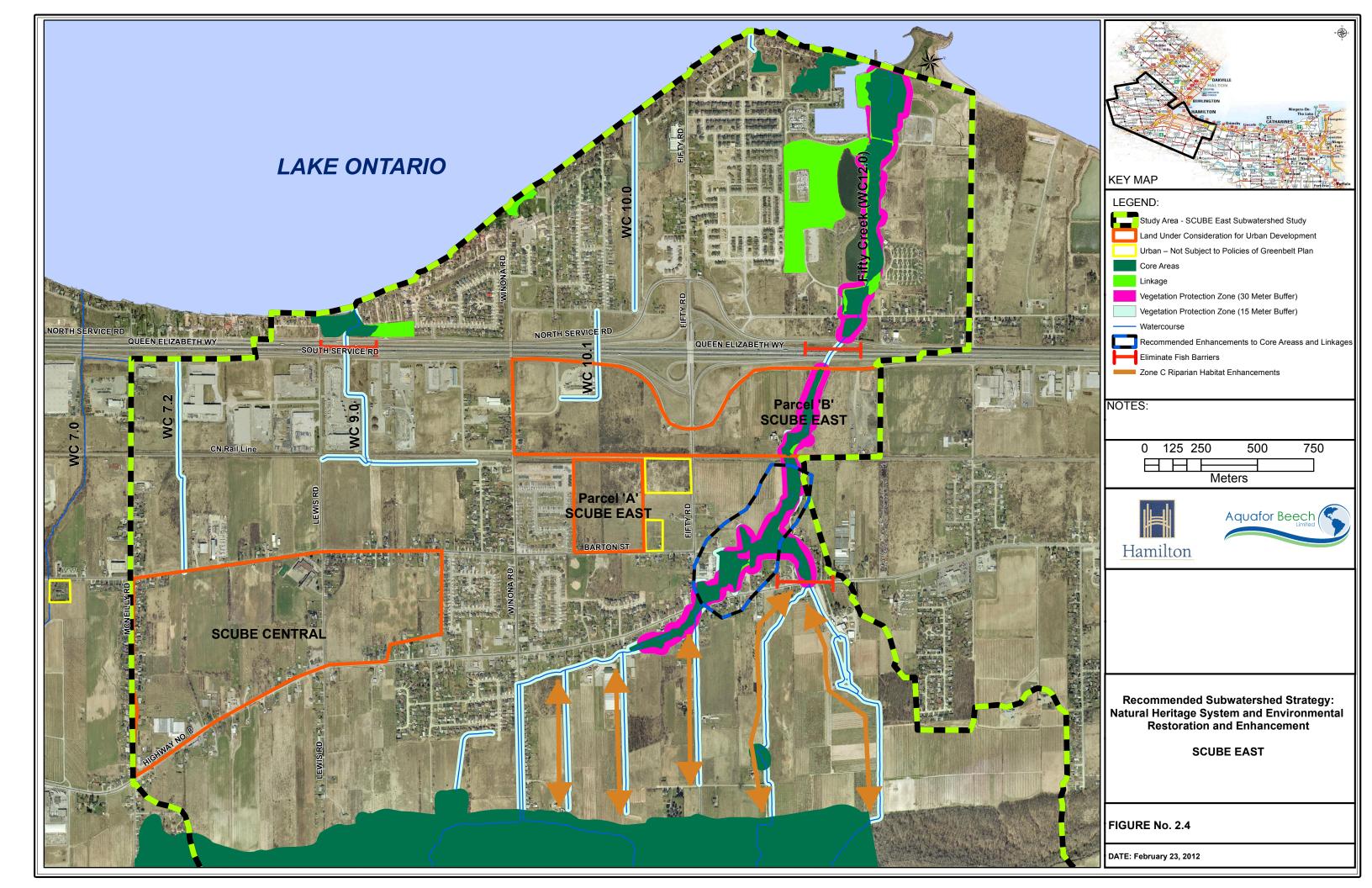


	Image: start of the start
I TEWIS RD	Meters Aquafor Beech Infred Hamilton
	Recommended Subwatershed Strategy:
	Stormwater Management Controls/Drainage and Infrastructure Improvement Works SCUBE WEST
	FIGURE No. 2.1
	DATE: May 2013



	HAMILTON HAMILT
	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
	Hamilton Aquafor Beech
	Recommended Subwatershed Strategy: Stormwater Management Controls/Drainage and Infrastructure Improvement Works SCUBE EAST
	FIGURE No. 2.2
- And -	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.

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
1. Stormwater Management Cor	ntrols - Refer to Report Section 4.1				
None identified - see Development Proponent	Responsibility – Table 5.1				
2. Drainage and Infrastructure I	Improvement Works - Refer to Rep	ort 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 reconstructed 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) – Re	fer 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 (<i>Dolichonyx oryzivorus</i>), Eastern Meadowlark (<i>Sturnella magna</i>) and Barn Swallow (<i>Hirundo rustica</i>). 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

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
•	nd Enhancement Works - Refer to	Report Section 4.4			<u> </u>
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 <i>Planning and Regulation</i> <i>Policies and Guidelines</i> 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 <i>Planning and Regulation</i> <i>Policies and Guidelines</i> 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

Subwatershed Strategy	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
Components					
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 <i>Planning and Regulation</i> <i>Policies and Guidelines</i> 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

Subwatershed Strategy	Objectives / Benefits	Future Study Requirements	Priority/Phasing Considerations	Policy Considerations	Approvals
Subwatershed Strategy Components 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. Design Guidance and Policy Considerations 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 <i>Recreational Trails Master Plan</i> 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. 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 floodsusceptibility 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 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 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 m³/ha of permanent pool storage, and 40 m³/ha of active storage for ponds servicing residential land uses (50% impervious); and
- 105 m³/ha of permanent pool storage, and 40 m³/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 40m³/ha of extended detention storage for water quality control only will be required above the permanent pool level for those facilities.

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy Components	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	I
1. Stormwater Management Contro	ols – 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 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 		- C D - P
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)	
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. 	
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. 	
SCUBE East – Ponds 9-1, 9-5	- Level 2 water quality control			
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. 		- a n
SCUBE East –Ponds 12-1, 12-2 (Fifty Creek)	 Level 2 water quality control erosion and post-to-pre flood control 	· · · · · · · · · · · · · · · · · · ·		- d

	Policy Considerations	Approvals
	 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
e 5		- City - HCA
ons arton		
uld ise, ol by		- City - HCA
l ents CN		- City - HCA - MTO
y of ling		
, ol by		
		- City - HCA
	 prevent increased frequency of surcharging and roadway flooding in downstream major/minor drainage system prevent increased frequency of flooding of downstream private lands 	- MTO - City - HCA - MTO - City - HCA

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

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 Imj	provement Works – Refer to R	eport 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 	Functional Design Stage - fluvial geomorphologic and hydrologic/hydraulic studies in support of preliminary design - floodplain mapping updates to reflect revised development limits along the reconstructed reach	 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 	 - 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
		<u>Detailed Design Stage</u> - detailed natural channel design	- timing of construction to account for warmwater fish habitat; construction timing may also be affected by requirements of the Migratory Birds Convention Act		
Possible Watercourse 7.2 Diversion along CN rail line to Main Branch of Watercourse 7	- floodplain and SWM servicing improvements	Detailed Design Stage - detailed natural channel design Feasibility Assessment - 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: Functional Design Stage - 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. Detailed Design Stage - detailed channel and culvert designs	 timing of construction to account for warmwater fish habitat; construction timing may also be affected by requirements of the Migratory Birds Convention Act 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

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations
Components			Thomy / Thasing Consider auons
Components 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;	- 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.

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

	Policy Considerations	Approvals
1)) y = e, , , , , , , , , , , , , , , , , ,	 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

WORKS AND MEASURES FOR WHICH DEVELOPMENT PROPONENTS ARE RESPONSIBLE

Subwatershed Strategy	Objectives / Benefits	Future Study Requirements	Priority / Phasing Considerations	Policy Considerations	Approvals
Components					
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.	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.	be prepared in accordance with EIS guidelines	

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 m³/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 CharacteristicsSCUBE Subwatershed - East and West

													Exte	ended Det	ention for I	Flood (Qua	antity) Ct	onrol				
										Extended	Detention	for Erosio	on Control				-					1
				W	ater Quality (Control (Level	2)		Erosion	Control			2-Year	• Control			100-Yea	r Control				1
	Estimated			Perament Po																Total Storage	Conceptual Pond	1
Pond # or	Drainage Area		Assumed %		Quality	Water		Releas	se Rate	Storage	e Volume	Relea	se Rate	Storage	e Volume	Releas	se Rate	Storage	e Volume	Volume *	Footprint Area **	Pond # or
Catchment	(ha)	Landuse	Impervious	(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)	0	(m ³ /ha)	(m ³ /s)	(L/s/ha)	1 1	(m ³ /ha)	(m ³)	(ha)	Catchment
	SCU	BE 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
																						l
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
		1 9												,						,		
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%											•							•	7-2-2
7-2-3	4.3	employment	80%	-	Catchment a	reas may be less	than minimum re	commended	for a SWM Po	nd, and othe	r traditional s	ource contro	l methods ma	ay be necessa	ary instead. U	Init storage a	nd release ra	tes from SW	M Pond catch	hment #7-2-1 would ap	ply.	7-2-3
7-2-4	2.4	employment	80%																			7-2-4
	SCUI	BE 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, predevelopment 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.

SCUBE East – Fifty Creek Ponds

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 floodsusceptibility 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			

	11	
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.

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		

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

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 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;
 - o 3:1 max. sideslopes
- The major system drainage should be directed to the main pond cell, bypassing the forebay;
- Water depths:
 - \circ Permanent pool 1.0 to 1.0m
 - \circ Permanent pool at outlet 2.5m max.
 - Extended detention (erosion control) storage 1.5m max.
 - Quantity control storage 2.5m max.
 - \circ Overall max. depth 5.0 max.
- Side slopes:
 - \circ 7:1 for at least 3m at the edge of the permanent pool;
 - o 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 postdevelopment 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;
 - o 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 predevelopment 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).

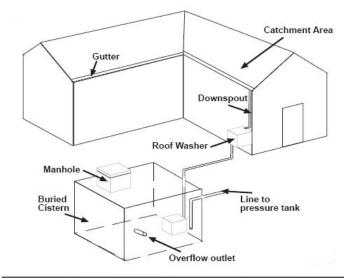
In addition to the above, on-site storm sewer systems, such as those used to drain a large commercial or industrial parking area, may be used to provide water quality and/or quantity control through infiltration and/or storage:

- 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 postdevelopment 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	\checkmark		This LID provides groundwater recharge
			benefits if used for irrigation.
Green Roofs	-	$\sqrt{*}$	* This LID does not provide groundwater
			recharge benefits, but may be used for other
			environmental benefits.
Downspout Disconnection	\checkmark	\checkmark	Use in conjunction with topsoil amendments
			and increased topsoil depths to enhance
			groundwater recharge.
Soakaway Pits / Infiltration	2/	2	Variety of design options are available for
Chambers	v	N	use in various land use settings.
Bioretention	$\sqrt{*}$	\checkmark	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	-	\checkmark	Most applicable for providing treatment (or
			pre-treatment) for runoff from employment
			land uses.
Permeable Pavement	\checkmark	\checkmark	Most applicable for providing treatment for
			large parking surfaces associated with
			employment land uses. May also be used for
			residential driveways.
Grassed Swales	\checkmark	\checkmark	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

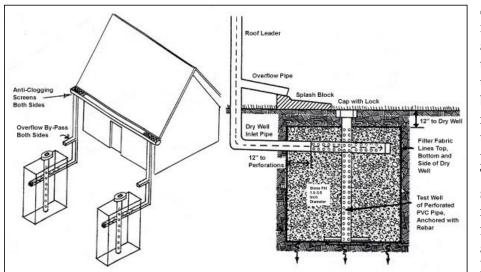


groundwater recharge and therefore would not meet the groundwater recharge targets for the SCUBE study area.



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 stone-filled are 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 discharged runoff 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 Guidelines for Stormwater and 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 vard 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;
- o identify the erosion hazard limit along confined portions of Fifty Creek;
- o identify the final boundaries of Core Areas and Linkages; and
- o 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 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):
 - o decrease the edge-interior ratio of Significant Woodlands and Wetlands;
 - o provide improved opportunities for wildlife movement;
 - o buffer Core Areas from future land uses;
 - o 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.

9.0 **REFERENCES**

AJ Clarke & Associates Ltd. August 2007. Drainage Report – Marina Point on Baseline, City of Hamilton (Stoney Creek).

Center for Watershed Protection. July 2008. Managing Stormwater in your Community - A guide for building an effective post-construction program, EPA No. 833-R-08-001.

City of Hamilton. May 2004. Storm Drainage Policy.

City of Hamilton. 2004. Environmental Impact Statement (EIS) Guidelines. 11 pp.

City of Hamilton. September 2007. Criteria and Guidelines for Stormwater Infrastructure Design.

City of Hamilton. 2009. Urban Hamilton Official Plan. Volume 1: Parent Plan.

City of Hamilton. 2010. Fruitland-Winona draft Secondary Plan Policy. 22 pp.

Coleman, J.S., S.A. Temple and S.R. Craven. 1997. Cats and Conservation: A Conservation Dilemma. University of Wisconsin, Madison Extension Service. 6 pp.

Credit Valley Conservation and Toronto and Region Conservation. March 2009. Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines.

Credit Valley Conservation and Toronto and Region Conservation. 2010. Low Impact Development Stormwater Management Planning and Design Guide, Version 1.

Dillon Consulting Limited. June 2010. Natural Heritage Assessment of Lands Bounded by Fruitland Road, Glover Road, Barton Street and Highway 8. Prepared for the City of Hamilton.

Dillon Consulting Limited. November 2007. Watercourse 5 & 6 Class Environmental Assessment Study Draft Report. Prepared for the City of Hamilton.

Dixon, J., Roon, M. Facilitating maintenance of Stormwater Devices on Communally Owned Land (New Zealand Water and Waste Association, 4th S. Pacific Conference, New Zealand (May 4-6, 2005).

Government of Canada – Department of Justice. 1983. Fisheries Act (R.S., 1985, c. F-14).

Ministry of Natural Resources. 2000. Significant Wildlife Habitat Technical Guide.

MTE Consultants Inc. February 11, 2008. Visual Otthymo and PCSWMM Modelling – Marina Point on Baseline Development, Hamilton, Ontario.

Ontario Ministry of Natural Resources (MNR). March 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement Ontario Ministry of the Environment (MOE). March 2003. Stormwater Management Planning and Design Manual.

Philips Engineering Limited. 2003. Watercourse No. 7 Creek System Improvements Class EA. Prepared for the City of Hamilton.

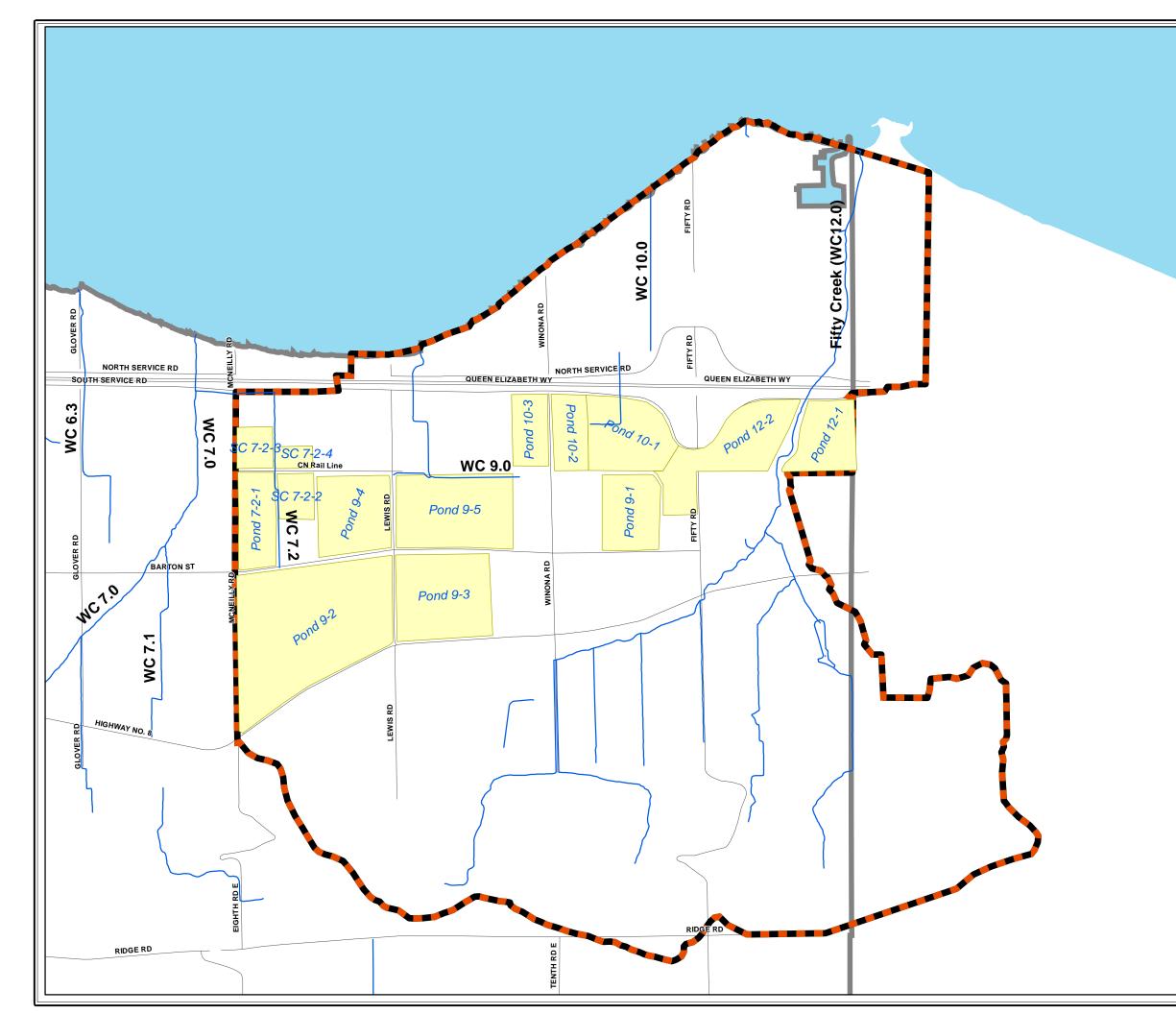
Philips Planning and Engineering Limited. March 1990. Master Drainage Plan – Industrial Corridor – Area No.'s 5, 6 and 7. Prepared for the City of Stoney Creek.

Saunders, D.A., R.J. Hobbs and C.R. Margules. 1991. Biological Consequences of Ecosystem Fragmentation: A Review. Conservation Biology. 5(1):18-32.

SNC-Lavalin. December 1991. Aquatic Habitat and Fisheries Impact Assessment Watercourses 5, 6, 7 and 9. Final Report to the City of Stoney Creek Department of Engineering.Voss, Edward G. 1985. Michigan flora. Part II. Dicots (Saururaceae-Cornaceae). Bulletin 59. Bloomfield Hills, MI: Cranbrook Institute of Science; Ann Arbor, MI: University of Michigan Herbarium. 724 p.

APPENDIX A

HYDROLOGIC MODELLING - STORMWATER POND SIZING



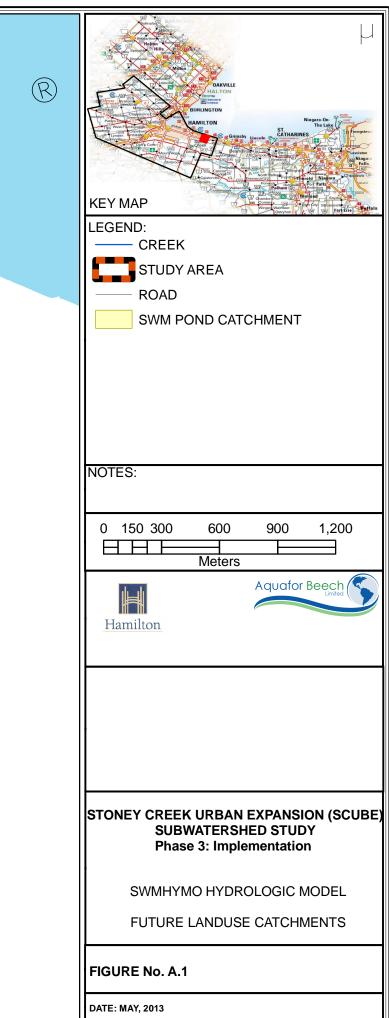


Table A.1 Summary of SWMHYMO Hydrologic Model Parameters

Future Landuse Scenario (Figure A.1)

Catchment ID	Landuse	<u>Unit Hydrograph</u>	<u>Area (ha)</u>	<u>CN</u>	<u>% Impervious</u>
		SCUBE EAS	ST		
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)
Time (Tits)		2-yr	100-yr
C)	0.58	1.35
1		0.58	1.35
2	<u>)</u>	0.69	1.6
3	}	0.69	1.6
4	ļ	0.85	1.97
5	5	0.85	1.97
6)	1.06	2.46
7		1.06	2.46
8	}	1.43	3.32
ç)	1.805	4.175
10)	2.865	6.635
11		22.728	52.602
12	<u>)</u>	5.79	13.395
13	}	2.545	6.26
14	ļ	1.59	3.69
15	5	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	<u>)</u>	0.64	1.47
23	}	0.64	1.47
Total Rainfall (mm)		53.1	123.2

MODEL OUTPUT

SSSSS W W M M S W W MM MM SSSSS W W M MM S W W M M SSSSS W W M M SSSSS W W M M						
S W W M MM MM		V V M M	000	000	000	
00000 ** ** ** **	нн	YY MM MM	0 0	9 9	9 9	4.00
SSSSS WWW MMM S WW M M	і ннннн і н н	Y MMM Y MM	0 0 ##	9 9 9999	9 9 Ver. 9999 July	. 4.02 7 1999
SSSSS WW M M	н н	У М М	000	9	9 ====	
StormWater Man	lagement H	NYdrologic Mod	el	999	999 ====	
*******************	******	*****	*******	*******	********	*****
****** >		and the second second second				
******* based o	n the pri OTTH	nciples of HY. NYMO-83 and OT	MO and its THYMO-89.	success	ors **	*****
******** Distributed	*******	******	********		**********	*****
******	Ott	awa, Ontario	: (613) 72	7-5199		*****
******		ineau, Quebec Mail: <u>swmhymo@</u>		3-6858	**	*****
******	*******	****	*******	*******	*********	*****
	+++++++++++++++++++++++++++++++++++++++	+++++++++++++++++++++++++++++++++++++++	*****	*****	*****	
++++++ Licensed us	er: Aquai	or Beech Ltd	SERIAL	#:268674	++ 0 ++	+++++
*****	++++++++	*****	++++++++++	++++++++	+++++++++++++++++++++++++++++++++++++++	+++++
*******		GRAM ARRAY DI			***************************************	*****
****** + ****** M ******	laximum va	lue for ID nu	mbers	10	**	*****
******* M ******* M	ax. numbe lax. numbe	lue for ID nu r of rainfall r of flow poi	points: nts :	15000 15000	**	*****
*****	*******	****	*******	*******	********	*****
				m		
*******************	*******	*********	********	*******	* * * * * * * * * * *	****
DATE: 2011-	03-04	TIME: 15:42:	51 RUN	COUNTER	: 000031	*
Input filename:	C:\DOCUM	E~1\XPMUser\M	YDOCU~1\SC	UBE\1SCU	BE~2\SCUBE	21.da*
Output filename: Summary filename:	C:\DOCUM	1E~1\XPMUser\M 1E~1\XPMUser\M	YDOCU~1\SC YDOCU~1\SC	UBE\1SCU	BE~2\SCUBEI	21.ou* 21.su*
User comments:		,		,	(00DD1	*
1:2:						*
3:	*******	*****	*******	*******	********	*
1:0001						
Project Name: [S					*********	******
Date : 12	-06-2010					
] uafor Bee	ch Limited				
Company : Aq License # : 3			*********	*******	* * * * * * * * * * * *	********
Future Landuse -	SWM Pond	l - 100 Year				
*****	*******	*****	********	*******	********	*******
START	Project	dir.: C:\DO	CUME~1\XPM	User\MYD	CU~1\SCUBE	S\1SCUBE~2
TZERO = 00 br			CUME~1\XPM	User\MYD	CU~1\SCUBE	E\1SCUBE~2
TZERO = .00 hr METOUT= 2 (out	put = MET	RIC)				
NRUN = 001 NSTORM= 1						
	S100.STM					
# 1=24SC						
# 1=24SC	Filer	name: C:\DOCUM	E~1\XPMUse	r\MYDOCU-	~1\SCUBE\18	SCUB
# 1=24SC	Filen Comme	name: C:\DOCUM ents: 100yr/24	E~1\XPMUse	r\MYDOCU-	~1\SCUBE\15	CUB
# 1=24SC 1:0002 READ STORM Ptotal= 123.25 mm TIME	Comme RAIN	nts: 100yr/24	hr N TIME	RAIN	TIME	RAIN
# 1=24SC 1:0002 READ STORM Ptotal= 123.25 mm 	Comme RAIN	nts: 100yr/24	hr N TIME	RAIN	TIME	RAIN
# 1=24SC 1:0002	Comme RAIN mm/hr 1.350 1.350	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46	hr N TIME r hrs 0 13.00 0 14.00	RAIN mm/hr 13.395 6.260	TIME hrs	RAIN mm/hr 2.210 2.210
# 1=24SC 1:0002	Comme RAIN mm/hr 1.350 1.350 1.600	mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32	hr N TIME r hrs 0 13.00 0 14.00 0 15.00	RAIN mm/hr 13.395 6.260 3.690	TIME hrs 19.00 20.00 21.00	RAIN mm/hr 2.210 2.210 1.470
<pre># 1=24SC 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970	Ents: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00	RAIN mm/hr 13.395 6.260 3.690 3.690 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470
# 1=24SC 1:0002	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970	mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00	RAIN mm/hr 13.395 6.260 3.690 3.690 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470
# 1=24SC 1:0002	Comme RAIN 1.350 1.350 1.600 1.600 1.970 1.970	Ents: 100yr/24 TIME RAI hrs mm/h 0.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00	RAIN mm/hr 13.395 6.260 3.690 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24SC 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 1.970	ents: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60	hr TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 1.970	Ents: 100yr/24 TIME RAI hrs mm/h 0.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 1.970	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.22 10.00 4.17 11.00 6.63 12.00 52.60 Watercour	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 1.970	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.970 1.970 	nts: 100yr/24 TIME RAL hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00 se 12 	RAIN mm/hr 13.395 6.260 3.690 3.690 2.210 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 1.970 1.977 1.977 Catchment Catchment	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour	hr N TIME r hrs 0 13.00 0 44.00 0 14.00 0 15.00 5 16.00 5 16.00 5 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 1.970 1.977 1.977 Catchment Catchment	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour	hr N TIME r hrs 0 13.00 0 44.00 0 14.00 0 15.00 5 16.00 5 16.00 5 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour : 125CA (Pond 4. (ha) = 1 11 Imp(%) = 8	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour : 125CA (Pond (ha)= 1 11 Imp(\$) = 8 IMPERVIOUS 9.44	hr N TIME r hrs 0 13.00 0 44.00 0 14.00 0 15.00 5 16.00 5 16.00 5 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour : 125CA (Pond (ha)= 1 11 Imp(\$) = 8 IMPERVIOUS 9.44	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour 125CA (Pond 111 imp(\$) = 8 IMPERVIOUS 9.44 2.00 .20 535.00	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr: 1.350 1.350 1.600 1.600 1.970 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIMES 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00 2 18.00 2 18.00 12-1) 1.80 0.00 Dir PERVIOUS 2.36 5.00 .20	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr: 1.350 1.350 1.600 1.600 1.970 .970 .970 Catchment 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME 0 13.00 0 14.00 0 15.00 5 16.00 5 17.00 2 18.00 2 18.00 .2 12-1) 1.80 DERVIOUS 2.36 5.00 .20 40.00 .250 60.97	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.350 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour (ha)= 1 11 Imp(%)= 8 IMPERVIOUS 9.44 2.00 .20 535.00 .013 52.60 15.00	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.600 1.600 1.970 .970 .9	<pre>mts: 100yr/24 TIME RAIL hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 	TIME hrs 19.00 20.00 21.00 22.00 23.00 24.00	RAIN mm/hr 2.210 1.470 1.470 1.470
<pre># 1=24sc 1:002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 .970 .970 1.970 .970	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour * (ha) = 1 11 Imp(%) = 8 IMPERVIOUS 9.44 2.00 5.2.00 5.2.00 15.00 14.64 (ii 15.00 .08	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 2.210 	<pre>TIME hrs 19.00 22.00 22.00 23.00 24.00 </pre>	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 Watercour Watercour * (ha) = 1 11 Imp(%) = 8 IMPERVIOUS 9.44 2.00 5.2.00 5.2.00 15.00 14.64 (ii 15.00 .08	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 .210 . Conn.(1 (i) (ii)	<pre> TIME hrs 19.00 20.00 22.00 22.00 23.00 23.00 24.00 24.00</pre>	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 	hr N TIME r hrs 0 13.00 0 14.00 0 14.00 0 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 	<pre> TIME hrs 19.00 22.00 22.00 23.00 24.00 24.00 </pre>	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME T hrss 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 se 12 1.80 0.00 Dir PERVIOUS 2.36 5.00 .20 40.00 .250 60.97 30.00) 31.81 30.00 .217 86.78 123.25	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 20.00 21.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 23.00 1.500 (iii) 1.500 (iii) 11.598 23.247	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.350 1.350 1.970 .970 1.970 .970 Catchment Catchment (ha) = (mn) = (mn) = (mn) = (cms) (cms) (nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 	hr N TIME T hrss 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 2 18.00 2 18.00 2 18.00 12-1) 1.80 PERVIOUS 2.36 5.00 .20 40.00 Dir PERVIOUS 60.97 30.00 12.17 86.78 123.25 .70	RAIN mm/hr 13.395 6.260 3.690 2.210 	<pre> TIME hrs 19.00 22.00 22.00 23.00 24.00 24.00 </pre>	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME 0 13.00 0 14.00 0 14.00 0 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 20.00 21.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 23.00 1.500 (iii) 1.500 (iii) 11.598 23.247	RAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sC b1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.600 1.600 1.970 .970	<pre>mts: 100yr/24 TIME RAIL hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME 0 13.00 0 14.00 0 14.00 0 15.00 5 17.00 2 18.00 2 18.00 2 18.00 2 18.00 2 18.00 12-1) 1.80 0.000 Dir 12-1) 1.80 0.000 Dir 2.36 5.00 40.00 2.250 60.97 30.00 12.17 86.78 12.17 86.78 12.27 92.00 12.17 86.78 12.27 92.00 12.17 92.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 13.18 13.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.02 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 12.17 13.00 13.18 13.12 13.18	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 20.00 21.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 23.00 1.500 (iii) 1.500 (iii) 11.598 23.247	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470
<pre># 1=24sC 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.350 1.350 1.970 1.970 1.970 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 20.00 21.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 23.00 1.500 (iii) 1.500 (iii) 11.598 23.247	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.350 1.350 1.970 1.970 1.970 	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME r hrs 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 20.00 21.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 23.00 1.500 (iii) 1.500 (iii) 11.598 23.247	RAIN mm/hr 2,210 2,210 1,470 1,470 1,470 1,470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hr 1.350 1.350 1.350 1.350 1.970 .970	<pre>mts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60</pre>	hr N TIME T hrss 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 2 18.00 2 18.00 2 18.00 2 18.00 12.17 PERVIOUS 2.36 5.00 .20 40.00 .20 60.97 30.00 .04 .30 12.17 86.78 123.25 .70 DUS LOSSES e (Above, CSSES R OR EQUAL FLOW IF AN	RAIN mm/hr 13.395 6.260 3.690 2.210 	<pre>TIME hrs 19.00 20.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 22.00 12.00 12.000 11.598 23.247 .905</pre>	PAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hri 1.350 1.350 1.350 1.350 1.350 1.970 .970	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 	hr N TIME T hrss 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 2 18.00 2 18.00 2 18.00 2 18.00 12-11 1.80 0.00 Dir PERVIOUS 2.36 5.00 .20 40.00 .25 60.97 30.00 12.17 86.78 123.25 .70 UUS LOSESS e (AbOxe) R OR EQUAL FLOW IF AN	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 22.00 22.00 23.00 24.00 ***********************************	PAIN mm/hr 2.210 2.210 1.470 1.470 1.470 1.470
<pre># 1=24sc 1:0002</pre>	Comme RAIN mm/hri 1.350 1.350 1.350 1.350 1.350 1.970 .970	nts: 100yr/24 TIME RAI hrs mm/h 7.00 2.46 8.00 2.46 9.00 3.32 10.00 4.17 11.00 6.63 12.00 52.60 	hr N TIME T hrss 0 13.00 0 14.00 0 15.00 5 17.00 2 18.00 2 18.00 2 18.00 2 18.00 2 18.00 12-11 1.80 0.00 Dir PERVIOUS 2.36 5.00 .20 40.00 .25 60.97 30.00 12.17 86.78 123.25 .70 UUS LOSESS e (AbOxe) R OR EQUAL FLOW IF AN	RAIN mm/hr 13.395 6.260 3.690 2.210 	TIME hrs 19.00 22.00 22.00 23.00 24.00 ***********************************	RAIN mm/hr 2,210 2,210 1.470 1.470 1.470 1.470

		(cr .(LOW STO ns) (ha 000 .0000 013 .2400	RAGE .m.) E+00 E+00	OUTFLOW (cms) .087 .333	STORAGE (ha.m.) .3430E+00 .7730E+00
-	COUTING RESULTS				TPEAK (hrs) 12.000 13.333	
	PE TI	AK FLOW ME SHIFT	REDUCT	ION [Qou LOW	t/Qin](%)= (min)= (ha.m.)=	22.184 80.00
*#**** *# Wat	005 *******************************	*********	125CB (Pc	********* nd 12-2)	******	
CALI	B STANDHYD 25CB DT= 5.00	- Area Total	(ha)=	14.50		
	Surface Area Dep. Storage werage Slope wength Mannings n		IMPERVIOU 11.60 2.00 .20 535.00 .013	S PER	VIOUS (i) 2.90 5.00 .20 0.00 .250	
N S T T	Max.eff.Inten.(m over Storage Coeff. Unit Hyd. Tpeak Unit Hyd. peak	m/hr)= (min) (min)= (min)= (cms)=	52.60 15.00 14.64 15.00 .08	6 3 (ii) 3	0.97 0.00 1.81 (ii) 0.00 .04	****
F T F F	PEAK FLOW CIME TO PEAK RUNOFF VOLUME COTAL RAINFALL RUNOFF COEFFICIE					*TOTALS* 1.844 (iii) 12.000 111.598 123.247 .905
(<pre>(i) CN PROCEDU CN* = 80. (ii) TIME STEP THAN THE S iii) PEAK FLOW</pre>	0 Ia = (DT) SHOU TORAGE CO	= Dep. Sto JLD BE SMA DEFFICIENT	rage (Al LLER OR 1	bove) EQUAL	
	06					
OUT<	YE RESERVOIR 01:(125CB) :02:(Pond-1)	====		T.FOW STO	OUTFLOW (cms)	STORAGE (ha.m.)
F -	COUTING RESULTS	.(016 .2950	E+00	.107 .410 TPEAK (hrs) 12.000 13.333	.9490E+00
	DUTFLOW<02: (Pon PE TI	AK FLOW ME SHIFT	REDUCT	ION [Qou LOW	13.333 t/Qin](%)= (min)= (ha.m.)=	22.236 80.00
001:00						
*#**** *# *#	*****	*******	********		*******	************
			Waterc	ourse 9		
*# *#**** *#**** *# Wat	:**************** :ercourse 9 - Ca	tchment 1	*********	******** ********* 9-1)	**********	
*# *#**** *# Wat *#**** CALI 01:1	ercourse 9 - Ca	++++++++++ +++++++++++++++++++++++++++	(ha)= Imp(%)=	********* 9-1) ******** 14.70 50.00	************ ************ Dir. Con	*******
*# *#**** *# Wat *# Wat CALJ 01:1 S S CALJ 01:1 S S CALJ 01:1 S S S S S S S S S S S S S S S	E STANDHYD .011 DT= 5.00 .012 Drage Area bep. Storage werage Slope .ength Mannings n	<pre>************************************</pre>	(ha)= (ha)= (mperviou 7.35 2.00 .10 580.00 .013	******** 9-1) ******** 14.70 50.00 S PER	Dir. Com VIOUS (i) 7.35 5.00 .10 0.00 .250	*******
*# *#**** *# Wat *#**** CALJ O1.J O1.J I O1.J I I I I I I I I I I I I I I I I I I I	errourse 9 - Ca B STANDHYD .011 DT= 5.00 .011 DT= 5.00 .01	**************************************	(ha) = [lmp(%) = IMPERVIOU 580.00 .013 52.60 20.00 18.92 20.00 .06		Dir. Com VIOUS (i) 7.35 5.00 .10 0.00 .250 4.27 0.00 1.06 (ii) 0.00 .03	ı.(≹)= 35.00
*# *#**** *# Wat *#**** CALJ O1.J O1.J I O1.J I I I I I I I I I I I I I I I I I I I	E STANDHYD .011 DT= 5.00 .012 Drage Area bep. Storage werage Slope .ength Mannings n	**************************************	(ha) = [lmp(%) = IMPERVIOU 580.00 .013 52.60 20.00 18.92 20.00 .06		Dir. Com VIOUS (i) 7.35 5.00 .10 0.00 .250 4.27 0.00 1.06 (ii) 0.00 .03	*******
*# *#*********************************	<pre>sercourse 9 - Ca B STANDHYD .011 DT = 5.00 Surface Area >ep. Storage verage Slope .ength fannings n fax.ef.Inten.(m over storage Coeff. nit Hyd. peak Dit Hyd. peak Dit Hyd. peak PEAK FLOW NIME TO PEAK UNNOFF VOLUME YOTAL RAINFALL UNNOFF COEFFICIE (i) CN PROCEDU CN* = 80. (ii) THE STEP THAN THE ST III) PEAK FLOW</pre>	<pre></pre>	(ha) = (ha) = IMPERVIOU 7.35 2.00 .00 50.00 .013 52.60 20.00 18.92 20.00 .00 12.04 .01 12.00 121.24 123.25 .98 FED FOR PEE DEPFRICIENT INCLUDE E SMA	9-1) 14.70 50.00 S PER 44 (ii) 4 (ii) 4 (ii) 4 12 RVIOUS LI rage (Al LLER OR 1 ASEFLOW 3	Dir. Com VIOUS (i) 7.35 5.00 .10 0.00 1.06 (ii) 0.00 .03 .75 2.33 3.25 .69 DSSES: DOVE) EQUAL IF ANY.	*TOTALS* 1.389 (iii) 12.083 97.514 123.247 .791
*# *#**** *# Wat CALL 01:3 F F F F F F F F C C C C C C C C C C C	ERCOURSE 9 - Ca ER STANDHYD Oll DT= 5.00 Surface Area bep. Storage werage Slope ength fannings n Max.eff.Inten.(m Storage Coeff. thit Hyd. Peak Mit Hyd. Peak DEAK FLOW TIME TO PEAK UNOFF VOLUME VOTAL RAINFALL UNOFF COEFFICIE (i) CN PROCEDD (ii) TIME STEP THAN THE S iii) PEAK FLOW 1000	<pre>table content of the second seco</pre>	(ha) = (ha) = Imp(%) = IMPERVIOU 7.35 2.00 .00 .00 .00 .00 .00 .00 .0	9-1) 14.70 50.00 S PER 4 (ii) 4 (ii) 4 (ii) 4 12 RVIOUS LA 12 RVIOUS LA LLER OR 1 - ASEFLOW 5 	Dir. Com VIOUS (i) 7.35 5.00 .10 0.00 1.06 (ii) 0.00 1.06 (ii) 0.03 .75 2.33 3.25 .69 DSSES: boye) EQUAL IF ANY.	*TOTALS* 1.389 (iii 12.083 97.514 123.247 .791
*# *#**** *#**** CAL1 CAL1 	E STANDHYD CONTRACTOR OF A CONTRACT CONTRACT OF A CONTRACT	<pre>************************************</pre>	(ha) = (ha) = Imp(%) = IMPERVIOU 7.35 2.00 .00 .013 52.60 20.00 .00 18.92 20.00 .00 18.92 20.00 .00 .00 .00 .01 12.04 123.25 .98 TED FOR PH = Dep. Stc. JLD BE SMA DEFFICIENT INCLUDE F 	9-1) 14.70 50.00 S PER 44 (ii) 4 (ii) 4 (ii) 4 12 RVIOUS LA rage (A LLER OR 1 - ASEFLOW : - 	Dir. Com VIOUS (i) 7.35 5.00 0.00 2.250 4.27 0.00 1.06 (ii) 0.00 03 75 2.33 3.25 69 DSSES: DOVE) EQUAL IF ANY. Step = 5 RAGE TABLE OUTFLOW	*TOTALS* 1.389 (iii) 12.083 97.514 123.247 .791 .0 min.
*# *#**** *#**** - CAL1 -	<pre>ercourse 9 - Ca B STANDHYD Oll DT= 5.00 Surface Area bep. Storage werage Slope ength dannings n dax.eff.Inten.(m</pre>	<pre>table content of the second seco</pre>	(ha) = (ha) = IMPERVIOU 7.35 2.00 .10 50.00 .013 52.60 20.00 2	14.70 50.00 S PER 44 (ii) 4 (ii) 4 (ii) 4 (ii) 4 (ii) 4 12 RVIOUS LI rage (Al LLER OR 1 ASEFLOW ing time LFOW STOI RAGE 1) E+00 E+00	Dir. Com VIOUS (i) 7.35 5.00 0.00 1.06 (ii) 0.00 .03 .75 2.33 4.73 3.25 .69 DSSES: DOVE) EQUAL IF ANY. 	*TOTALS* 1.389 (iii) 12.083 97.514 123.247 .791 .0 min. ====================================

====== OUTLFOW STORAGE TABLE =======

CALIB STANDHYD 01:92AA DT= 5.0				********
				n.(%)= 35.00
Surface Area Dep. Storage Average Slope Length Mannings n	(ha)=	27.00	PERVIOUS (i) 27.00 5.00	
Dep. Storage Average Slope	(mm) = (%) =	.50	.50	
Length Mannings n	(m) = =	491.00 .013	40.00	
Max.eff.Inten.	(mm/hr)=	52.60	51.57	
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak	r (min) (min)=	10.00 10.57 (ii	25.00) 24.51 (ii)	
Unit Hyd. Tpea Unit Hyd. peak	k (min)=	10.00	25.00	
DEAK FLOW	(cmc)-	2 75	2 14	*TOTALS* 5.809 (iii)
TIME TO PEAK	(hrs)=	12.00	12.08	12.000
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC	(mm)= (mm)= IENT =	121.25 123.25 .98	3.14 12.08 77.26 123.25 .63	92.655 123.247 .752
CN* = 7 (ii) TIME STE	5.0 Ia = P (DT) SHOU STORAGE CC	DEFFICIENT.	e (Above) R OR EQUAL	
01:0010				
ROUTE RESERVOIR	Reque	sted routing	time step = 5	.0 min.
ROUTE RESERVOIR IN>01:(92AA) OUT<02:(Pond-9)			W STORAGE TABLE	
		OW CTODAC		CTODACE
	.0	000 .0000E+0) (cms) 0 .231 0 .942	.1136E+01 .3055E+01
DODUTING DEGITE	.u		- I .742	D 17
TNPT OF A 23 - 12		(ha) (cms) (hrs)	(mm)
OUTFLOW<02: (P	2AA) ond-9)	54.00 5	PEAK TPEAK cms) (hrs) .809 12.000 .942 14.000	92.653
			[Qout/Qin](%)= (min)=	
	TIME SHIFT MAXIMUM ST	OF PEAK FLOW ORAGE USED	(min)= (ha.m.)=	120.00 .3055E+01
		IMPERVIOUS	DEBUTOUS (;)	n.(%)= 35.00
Surface Area Dep. Storage		IMPERVIOUS 11.55 2.00	DEBUTOUS (;)	1. (%)- 33.00
Surface Area Dep. Storage Average Slope Length		IMPERVIOUS 11.55 2.00 .50 350.00	DEBUTOUS (;)	n (*)
Surface Area Dep. Storage Average Slope Length Mannings n May eff Inten	(ha) = (mm) = (%) = (m) = =	11.55 2.00 .50 350.00 .013	PERVIOUS (i) 11.55 5.00 .50 40.00 .250	n.(s)- 55.00
Surface Area Dep. Storage Average Slope Length Mannings n Max.eff.Inten. ove	(ha) = (mm) = (%) = (m) = =	11.55 2.00 .50 350.00 .013	PERVIOUS (i) 11.55 5.00 .50 40.00 .250	
Surface Area Dep. Storage Average Slope Length Mannings n Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea	(ha) = (mm) = (%) = (m) = =	11.55 2.00 .50 350.00 .013	PERVIOUS (i) 11.55 5.00 .50 40.00 .250	
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak	(ha) = (mm) = (%) = (m) = = (mm/hr) = rr (min) (min) = k (min) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00) 22.57 (ii) 25.00 .05	*TOTALS*
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW	(ha) = (mm) = (%) = (m) = = (mm/hr) = rr (min) = (min) = k (min) = (cms) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .05 1.37	
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW	(ha) = (mm) = (%) = (m) = = (mm/hr) = rr (min) = (min) = k (min) = (cms) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .05 1.37	*TOTALS* 2.523 (iii) 12.000 92.655
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW	(ha) = (mm) = (%) = (m) = = (mm/hr) = rr (min) = (min) = k (min) = (cms) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .05 1.37	*TOTALS* 2.523 (iii) 12.000
<pre>Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE</pre>	(ha) = (mm) = (%) = (mm) = (mm)hr) = (mm)n = (min) = (min) = (min) = (cms) = (hrs) = (mm) = SIENT = SIENT = DURE SELECT 5.0 Ia = P. (DJ) SHOC	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .98 YED FOR PERVI > Dep. Storag LD BE SMALLE EFFFICIENT.	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 DUS LOSSES: e (Above) R OR EQUAL	*TOTALS* 2.523 (iii) 12.000 92.655 123.247
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 7 (ii) TIME STE THAN THE	(ha) = (mm) = (%) = (mm/hr) = (mm/hr) = (mn) = (cms) = (cms) = (hrs) = (mm) = (mm) = (mm) = DURE SELECT 5.0 Ia = PDURT SELECT STORAGE CCC W DOES NOT	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .98 YED FOR PERVI > Dep. Storag LD BE SMALLE EFFFICIENT.	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 DUS LOSSES: e (Above) R OR EQUAL	*TOTALS* 2.523 (iii) 12.000 92.655 123.247
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE THAN THE (iii) PEAK FLO 01:0012	(ha) = (mm) = (%) = (mm/hr) = (mm/hr) = (mm/hr) = (mm) = ((mm)	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (11 10.00 .12 1.18 12.00 121.25 123.25 .98 YED FOR PERVII PDEP SLOTAG ILD BE SMALLE	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 DUS LOSSES: e (Above) R OR EQUAL	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE THAN THE (iii) PEAK FLO 01:0012 ROUTE RESERVOIR IN>01:(92AB) 0UT-02:(Pond-9)	(ha) = (mm) = (%) = (mm/hr) = (mm/hr) = (mm) = (mn) = (cms) = (cms) = (cms) = (cms) = (cms) = (cms) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .98 YED FOR PERVIL DEP. Storag ILD BE SMALLE DEFFICIENT. INCLUDE BASE STATE AND	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00) 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min.
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE THAN THE (iii) PEAK FLO 01:0012	(ha) = (mm) = (mm) = (mm) = (mm)hr) = r (min) = (min) = k (min) = (cms) = (hrs) = (mm) = lIENT = DURE SELECT 5.0 Ia = P. (DJ) SHOU STORAGE CC W DOES NOT	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (11 10.00 121 12.00 121.25 123.25 .98 YED FOR PERVII PORPERVII INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00) 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 DUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min.
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO D1:0012	(ha) = (mm) = (mm) = (mm) + r (min) = (mmin) = (mnin) = (min) = (min) = (min) = (min) = (mm) = (mm) = common =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 12. 1.18 12.00 121.25 123.25 .98 YED FOR PERVIT INCLUDE BASE DEFFRICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 22.57 (ii) 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .48708+00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO D1:0012	(ha) = (mm) = (mm) = (mm) + r (min) = (mmin) = (mnin) = (min) = (min) = (min) = (min) = (mm) = (mm) = common =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 12. 1.18 12.00 121.25 123.25 .98 YED FOR PERVIT INCLUDE BASE DEFFRICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 22.57 (ii) 22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .48708+00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO D1:0012	(ha) = (mm) = (mm) = (mm) + r (min) = (mn) + r (min) = (mn) = (mn) = (mn) = (mn) = (mn) = (mn) = (mn) = (mn) = (mn) = DURE SELECT 5.0 Ia = P. (DT) SHOC STORAGE CC W DOES NOT 	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 121 1.18 12.00 121.25 123.25 .98 YED FOR PERVIT INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .752 .0 min. ======= STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COSFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO Ol:0012	(ha) = (mm) = (%) = (mm) + (%) = (mn) + (min) = (min) = (min) = (hrs) = (hrs) = (hrs) = (hrs) = (hrs) = (hrs) = (mm) = (mm) = STORAGE CC W DOES NOT 	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 121 1.18 12.00 121.25 123.25 .98 YED FOR PERVIT INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 COUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .752 .0 min. ======= STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COSFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO Ol:0012	(ha) = (mm) = (%) = (mm) + (%) = (mn) + (min) = (min) = (min) = (hrs) = (hrs) = (hrs) = (hrs) = (hrs) = (hrs) = (mm) = (mm) = STORAGE CC W DOES NOT 	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 12.12 1.18 12.00 121.25 123.25 .98 YED FOR PERVIT INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 COUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 7 (ii) TIME STE THAN THE (iii) PEAK FLO OUI:0012	(ha) = (mm) = (%) = (mm/hr) = (mm/hr) = (mm/hr) = (mm) = (cms) = (hrs) = (hrs) = (hrs) = (hrs) = (mm) = (mm	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .23.25 .98 YED FOR PERVI ID BE SNALLE DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 22.57 (ii) 22.57 (ii) 22.57 (ii) 22.57 (ii) 23.25 (.37 12.08 77.26 123.25 (.63 COUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO 01:0012	(ha) = (mm) = (mm) = (mm) = (mm) = (mm) n (min) = (mm) = (11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 121.25 123.25	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE (i) CN PROCE (ii) TIME STE THAN THE (iii) PEAK FLO 01:0012	(ha) = (mm) = (mm) = (mm) = = (mm/hr) = (mm) = (mm) = (cms) = (hrs) = (hrs) = (hrs) = (hrs) = (mm) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 .23.25 .98 TED FOR PERVI TED FOR PERVI ILD BE SMALLE DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (ii) 25.00 .05 1.37 12.08 77.26 123.25 .63 COUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpeau Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE (i) CN PROCE (ii) TIME STE THAN THE (iii) PEAK FLO 01:0012	(ha) = (mm) = (mm) = (mm) = = (mm/hr) = (mm) = (mm) = (cms) = (hrs) = (hrs) = (hrs) = (hrs) = (mm) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 .23.25 .98 TED FOR PERVI TED FOR PERVI ILD BE SMALLE DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 1.37 12.08 77.26 123.25 (Above) R OR EQUAL FLOW IF ANY. Time step = 5 W STORAGE TABLE E OUTFLOW (cms) 0 .099 0 .403 PEAK TPEAK Comb (hrs) .523 12.000 .403 13.917 [Qout/Qin](%)= (min)= (ha.m.)= 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE THAN THE (iii) PEAK FLO OUT-02:(POND-9) OUT-02:(POND-9) OUT-02:(POND-9) ROUTING RESULT 	(ha) = (mm) = (%) = (%) = (mm)hr) = (mn)hr) = (mn)hr) = (mn) = (cms) = (hrs) = (hrs) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (cms) = (mm) = (mm) = (cms) = (mm) = (cms) = (mm) = (cms) = (mm) = (cms)	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .23.25 .98 YED FOR PERVIL DEP: Storag DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00) 22.57 (i) 25.00 .05 1.37 12.08 77.26 123.25 .63 OUS LOSSES: e (Above) R OR EQUAL FLOW IF ANY. 	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01
Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC (i) CN PROCE CN* = 7 (ii) TIME STE (iii) PEAK FLO OI:0012	(ha) = (mm) = (%) = (%) = (mm/hr) = (%) = (mm/hr) = (mm) = (mm) = (cms) = (hrs) = (hrs) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (mm) = (%) =	11.55 2.00 .50 350.00 .013 52.60 10.00 8.62 (ii 10.00 .12 1.18 12.00 121.25 123.25 .23.25 .98 YED FOR PERVIL DEP: Storag DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE DEFFICIENT. INCLUDE BASE 	PERVIOUS (i) 11.55 5.00 .50 40.00 .250 51.57 25.00 .22.57 (i) 22.57	*TOTALS* 2.523 (iii) 12.000 92.655 123.247 .752 .0 min. ======== STORAGE (ha.m.) .4870E+00 .1309E+01 R.V. (mm) 92.655 92.652 15.970 115.00 .1309E+01

Unit Hyd. Tpeak (min Unit Hyd. peak (cms)= 10.00	20.00	
			TOTALS
PEAK FLOW (cms TIME TO PEAK (hrs RUNOFF VOLUME (mm TOTAL RAINFALL (mm RUNOFF COEFFICIENT)= 1.70)= 12.00	.48 12.00 86.78	2.184 (iii) 12.000 111.597
TOTAL RAINFALL (mm RUNOFF COEFFICIENT)= 123.25 = .98	123.25	123.247 .905
(i) CN PROCEDURE S	ELECTED FOR PERV	LOUS LOSSES:	
(ii) TIME STEP (DT)	Ia = Dep. Storag SHOULD BE SMALLI GE COEFFICIENT.		
(iii) PEAK FLOW DOES		EFLOW IF ANY.	
001:0014			
001:0014	Requested routing	g time step = !	5.0 min.
OUT<02:(Pond 9)	OUTLFO	OW STORAGE TABL	E ======= STORAGE
	(cms) (ha.m .000 .0000E+0 .023 .3170E+0	.) (cms) 00 .151	(ha.m.) .4530E+00
ROUTING RESULTS INFLOW >01: (96AB) OUTFLOW<02: (Pond 9)	(ha) (ha)	(cms) (hrs) 2.184 12.000	R.V. (mm) 111.597
PEAK TIME SI	FLOW REDUCTION HIFT OF PEAK FLOW M STORAGE USEN	N [Qout/Qin](%): N (min):	= 26.640 = 65.00
MAXIMU			
001:0015	*****	****	
*# Watercoures 9 - Catchme *#******	******	*****	
CALIB STANDHYD 1 01:96AA DT= 5.00	Area (ha)= Fotal Imp(%)= 8	8.30 30.00 Dir. Com	nn.(%)= 72.00
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha Dep. Storage (mm)= 6.64)= 2.00	1.66	
Surface Area (ha Dep. Storage (mm Average Slope (% Length (m Mannings n)= .90)= 421.00 = .013	.90 40.00 .250	
Max.eff.Inten.(mm/hr over (min Storage Coeff. (min Unit Hyd. Tpeak (min Unit Hyd. peak (cms) 10.00)= 8.08 (i:	20.00 i) 18.93 (ii)	
			TOTALS
PEAK FLOW (cms TIME TO PEAK (hrs)= .87)= 12.00	.25	1.125 (iii) 12.000
PEAK FLOW (cms TIME TO PEAK (hrs RUNOFF VOLUME (mm TOTAL RAINFALL (mm RUNOFF COEFFICIENT)= 121.25)= 123.25	86.78 123.25	111.598 123.247
RUNOFF COEFFICIENT (i) CN PROCEDURE SI			.905
CN* = 80.0	Ia = Dep. Storag	ge (Above)	
	Ia = Dep. Storag SHOULD BE SMALLI GE COEFFICIENT.	ge (Above) ER OR EQUAL	
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES	Ia = Dep. Storag SHOULD BE SMALLI GE COEFFICIENT. NOT INCLUDE BASI	ge (Above) ER OR EQUAL EFLOW IF ANY.	
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA	Ia = Dep. Storag SHOULD BE SMALLI 3E COEFFICIENT. NOT INCLUDE BASI	ge (Above) ER OR EQUAL EFLOW IF ANY.	
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storad SHOULD BE SMALLI SE COEFFICIENT. NOT INCLUDE BASI	ge (Above) SR OR EQUAL EFLOW IF ANY. 	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storad SHOULD BE SMALLI SE COEFFICIENT. NOT INCLUDE BASI	ge (Above) SR OR EQUAL EFLOW IF ANY. 	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storad SHOULD BE SMALLI SE COEFFICIENT. NOT INCLUDE BASI	ge (Above) SR OR EQUAL EFLOW IF ANY. 	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI Area (ha) = : Total Imp(%) = { IMPERVIOUS) = 13.20) = 1.00) = 1.00) = 451.00 = .013	<pre>ge (Above) eR OR EQUAL EFLOW IF ANY</pre>	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI Area (ha) = : Total Imp(%) = { IMPERVIOUS) = 13.20) = 1.00) = 1.00) = 451.00 = .013	<pre>ge (Above) eR OR EQUAL EFLOW IF ANY</pre>	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES OUI:0016	<pre>Ia = Dep. Storag. ShOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI</pre>	<pre>je (Above) er OR EQUAL EFLOW IF ANY</pre>	nn.(%)= 72.00
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORAN (iii) PEAK FLOW DOES 	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI Area (ha) = : Total Imp(%) = { IMPERVIOUS) = 13.20) = 13.20) = 1.00) = 1.00) = 0.013) = 52.60) 10.00) = 8.16 (i:) = 1.00) = 1.33) = 1.73	<pre>ge (Above) gr OR EQUAL 2FLOW IF ANY. 2FLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 .06 .50</pre>	*TOTALS* 2.239 (iii)
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORAN (iii) PEAK FLOW DOES 	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI Area (ha) = : Total Imp(%) = { IMPERVIOUS) = 13.20) = 13.20) = 1.00) = 1.00) = 0.013) = 52.60) 10.00) = 8.16 (i:) = 1.00) = 1.33) = 1.73	<pre>ge (Above) gr OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 .06 .50 12.00 85.78</pre>	*TOTALS* 2.239 (iii) 12.000 111.598
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 001:0016 CALIE STANDHYD 22 (24)IE STANDHYD 22 (24)IE STANDHYD 24 (25)7AA DT= 5.00 25 Surface Area (ha Dep. Storage (mm Average Slope (% Length (m Mannings n Max.eff.Inten.(mm/hr over (min Storage Coeff. (min Unit Hyd. Tpeak (min Unit Hyd. peak (cms	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT NOT INCLUDE BASI Area (ha) = : Total Imp(%) = 1 IMPERVIOUS) = 13.20) = 13.20) = 1.00) = 1.00) = 0.013) = 52.60) 10.00) = 0.13) = 52.60) 10.00) = 1.3) = 1.3) = 1.73) = 12.00) = 121.25	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. EFLOW IF ANY. 16.50 30.00 Dir. Cou PERVIOUS (i) 3.30 5.00 1.00 40.00 40.00 62.02 20.00 62.02 20.00 i) 18.67 (ii) 20.00 .06 .50 12.00</pre>	*TOTALS* 2.239 (iii) 12.000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES 001:0016 CALIE STANDHYD (2:97AA DT= 5.00 Surface Area (ha Dep. Storage (mm Average Slope (k Length (m Mannings n Max.eff.Inten.(mm/hr over (min Storage Coeff. (min Unit Hyd. Tpeak (mn Unit Hyd. peak (cms TIME TO PEAK (hrm TIME TO PEAK (mm TIME TO PEAK (mm TIME TO PEAK (mm TIME TO PEAK (mm TIME TO PEAK (mm TOTAL RAINPALL (mm RUNOFF COEFFICIENT (i) CN PROCEDURE SI	Ia = Dep. Storag SHOULD BE SMALLI SE COEFFICIENT. NOT INCLUDE BASI 	<pre>ge (Above) ger OR EQUAL SEFLOW IF ANY. SEFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 .06 .50 12.00 86.78 123.25 .70 COUS LOSSES:</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES 001:0016 (CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD CALTE STANDHYD Surface Area (ha Dep. Storage (mm Average Slope (% Length (m Mannings n Max.eff.Inten.(mm/hr over (min Storage Coeff. (min Unit Hyd. 7peak (min Unit Hyd. 7peak (cms TIME TO PEAK (hrs RUNOFF VOLUME (mm RUNOFF VOLUME (mm RUNOFF VOLUME (mm RUNOFF VOLUME (mm RUNOFF COEFFICIENT (i) CN PROCEDURE SI CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA	Ia = Dep. Stora; SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI Area (ha) = : Fotal Imp(%) = 3 IMPERVIOUS = 13.20 = 1.00 = 1.00 = .013 = .013 = .013)= 52.60) 10.00 = 8.16 (i: = 1.00) = 0.13 = 1.73 = 1.73 = 1.73 = 1.2.00) = 12.00) = 12.00) = .13 = .13 = .173 = 1.2.00) = 1.2.5 = .98 ELECTED FOR PERV: Ia = Dep. Stora; SHOULD BE SMALL	<pre>ge (Above) gR OR EQUAL EFLOW IF ANY. 2FLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 40.00 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i.50 12.00 86.78 123.25 .70 IOUS LOSSES: ge (Above) ER OR EQUAL</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES OO1:0016	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI 	<pre>ge (Above) gR OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Con PERVIOUS (i) 3.30 5.00 1.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i.06 .50 12.00 86.78 123.25 i.07 EQUAL EFLOW IF ANY. </pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORAN (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = { IMPERVIOUS = 13.20)= 2.00)= 451.00 = 2.00)= 451.00 = .013)= 52.60) 10.00)= 8.16 (i:)= 10.00)= 1.33)= 1.73)= 1.73)= 1.20)= 121.25 = .98 ELECTED FOR PERV: Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Coi PERVIOUS (i) 3.30</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORAN (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = { IMPERVIOUS = 13.20)= 2.00)= 451.00 = 2.00)= 451.00 = .013)= 52.60) 10.00)= 8.16 (i:)= 10.00)= 1.33)= 1.73)= 1.73)= 1.20)= 121.25 = .98 ELECTED FOR PERV: Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Coi PERVIOUS (i) 3.30</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASI 	<pre>ge (Above) gR OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 40.00 40.00 220.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i) 20.00 i) 20.00 i) 18.67 i23.25 i,70 IOUS LOSSES: ge (Above) ge (Above) GR OR EQUAL EFLOW IF ANY. QPEAK TPEAK (cms) (hrs) 1.125 12.00 </pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES OU1:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = { IMPERVIOUS = 13.20)= 2.00)= 451.00 = 2.00)= 451.00 = .013)= 52.60) 10.00)= 8.16 (i:)= 10.00)= 1.33)= 1.73)= 1.73)= 1.20)= 121.25 = .98 ELECTED FOR PERV: Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI	<pre>ge (Above) ger OR EQUAL SEFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 1.00 1.00 1.00 1.00 2.00 62.02 20.00 i) 18.67 (ii) 20.00 i.06 .50 1.20 0 0.06 .50 1.20 0 1.20 1.00 1.20 2.00 1.20 2.00 2.0</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES OU1:0016	Ia = Dep. Stora; SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = 1 IMPERVIOUS 1 3.20)= 1.3.20)= 2.00)= 1.00)= 451.00)= 0.13)= 52.60) 10.00)= 8.16 (i:)= 10.00)= 1.13)= 1.73)= 1.73)= 1.73)= 1.20)= 1.21.25)= 123.25 = .98 ELECTED FOR PERV. Ia = Dep. Stora; SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI SAN 6.30 7AA 16.50	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Coi PERVIOUS (i) 3.30 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 20.00 i) 18.67 (ii) 20.00 86.78 123.25 .70 IOUS LOSSES: ge (Above) ser OR EQUAL EFLOW IF ANY. OPEAK TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 3.364 12.00</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES 001:0016 CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD CALIE STANDHYD Surface Area (ha Dep. Storage (um Average Slope (% Length (m Mannings n Max.eff.Inten.(mm/hr over (min Storage Coeff. (min Unit Hyd. Tpeak (cms TIME TO PEAK (hrs TIME TO PEAK (hrs TIME TO PEAK (hrs TIME TO PEAK (hrs CN* = 80.0 (i) TIME STEP (DT) THAN THE STORM (ii) PEAK FLOW DOES 001:0017 SUM 03:F. NOTE: PEAK FLOWS DO N 001:0018	Ia = Dep. Storag. SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = 3 IMPERVIOUS IMPERVIOUS 1 a 200 1 a 100 1 a 451.00 1 a 451.00 1 a 52.60 1 0.00 1 a 451.00 1 a 52.60 1 0.00 1 a 1.00 1 a 1.00	<pre>ge (Above) ER OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 .50 12.00 86.78 123.25 .70 EOUS LOSSES: ge (Above) ER OR EQUAL EFLOW IF ANY. PERDAME TPEAK (cms) (hrs) 1.25 2.209 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.239 12.00 2.03 2.200 2.0</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES OU1:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASH Total Imp(%) = 3 IMPERVIOUS) = 13.20) = 2.00) = 13.20) = 2.00) = 1.00) = 451.00 = 0.01) = 0.01] = 0	<pre>ge (Above) ER OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 250 62.02 20.00 i) 18.67 (ii) 20.00 i0 12.00 86.78 123.25 .70 EOUS LOSSES: ge (Above) ER OR EQUAL EFLOW IF ANY. QPEAK TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 COWS IF ANY. </pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORM (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storag SHOULD BE SMALLI SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = 3 IMPERVIOUS = 1.3.20)= 2.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 0.00)= 4.00)= 0.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.13)= 1.73)= 1.73)= 1.20)= 1.21.25]= 1.23.25]= 1.23.25]= 1.23.25]= 1.23.25]= 1.23.25]= 0.5577CIENT. NOT INCLUDE BASI OT INCLUDE BASI INCLUDE BASI INCLUDE BASE INCLUDE BASE	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Coi PERVIOUS (i) 3.30 1.00 1.00 1.00 2.00 62.02 20.00 1.11 8.67 (ii) 20.00 1.00 1.00 2.00 86.78 122.25 .70 10US LOSSES: ge (Above) ger OR EQUAL EFLOW IF ANY. </pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORAM (iii) PEAK FLOW DOES 001:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASI Total Imp(%) = 1 IMPERVIOUS = 1.3.20)= 2.00)= 1.3.20)= 2.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 4.00)= 1.00)= 4.10 0)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.00)= 1.13 0]= 1.73)= 1.73)= 1.20)= 1.23.25 = .98 ELECTED FOR PERV. IA = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASEPI 	<pre>ge (Above) ger OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Coi PERVIOUS (i) 3.30</pre>	*TOTALS* 2.239 (iii) 12.000 111.598 123.247 .905
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES OO1:0016	Ia = Dep. Storag SHOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASH Trotal Imp(%) = 3 IMPERVIOUS) = 13.20) = 2.00) = 13.20) = 2.00) = 1.320) = 2.00) = 1.00) = 1.00) = 451.00 1 = .013) = 52.60) 10.00) = 0.13) = 1.73) = 1.73 SHOULD ESMALL SE COEFFICIENT. NOT INCLUDE BASH MOULD BE SMALL SE COEFFICIENT. NOT INCLUDE BASE TOW_P 24.80 DT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE COEFFICIENT. NOT INCLUDE BASE (ha) (ha) (cms) (ha.m .000 .000E+ C	<pre>ge (Above) ER OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i0 i 18.67 (ii) 20.00 i0 i0 86.78 123.25 .70 EOUS LOSSES: ge (Above) ER OR EQUAL EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) EFLOW IF ANY. COMPART TPEAK (ms) (hrs) EFLOW IF ANY. EFLOW</pre>	*TOTALS* 2.239 (iii) 12.000 11.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000 111.60 .000
CN* = 80.0 (ii) TIME STEP (DT) THAN THE STORA (iii) PEAK FLOW DOES OO1:0016	Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASJ Total Imp(%) = 1 IMPERVIOUS 1 13.20)= 13.20)= 2.00)= 1.32)= 2.00)= 2.00)= 451.00 = .013)= 2.00)= 451.00 = .013)= 1.00)= 451.00 0 = .013)= 1.00)= 451.00)= 10.00)= 451.00 0 = .013)= 1.00)= 121.25 0 = 1.73 0 = 1.23.25 = .98 ELECTED FOR PERV. Ia = Dep. Storag SHOULD BE SMALLJ SE COEFFICIENT. NOT INCLUDE BASEPI COEFFICIENT. NOT INCLUDE BASEPI COEFFICIENT. CREQUEST OUTLPC COUTLPC STORAG (cms) (ha.m .000 .00005+1 E-Q values were coutlpc cse curve or use coutlpc SECOUTLPC STORAG	<pre>ge (Above) ER OR EQUAL EFLOW IF ANY. 16.50 30.00 Dir. Cor PERVIOUS (i) 3.30 5.00 1.00 40.00 .250 62.02 20.00 i) 18.67 (ii) 20.00 i) 18.67 (ii) 20.00 i.06 .50 12.00 86.78 123.25 .70 EOUS LOSSES: ge (Above) ER OR EQUAL EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 EFLOW IF ANY. COMPART TPEAK (cms) (hrs) 1.125 12.00 2.239 12.00 COMS IF ANY. G time step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E Compared the step = 1 DW STORAGE TABLI E OUTFLOW E OUTF</pre>	*TOTALS* 2.239 (iii) 12.000 11.598 123.247 .905 R.V. DWF (mm) (cms) 111.60 .000 111.60 .000 111.60 .000

PEAK FLOW REDUCTION [Qout/Qin](%)= 18.525	
TIME SHIFT OF PEAK FLOW (min)= 75.00 MAXIMUM STORAGE USED (ha.m.)=.1526E+01	IMPERVIJOUS Surface Area (ha)= 7.44 Dep. Storage (mm)= 2.00 Average Slope (%)= .70 Length (m)= 478.00
001:0019	Length (m)= 478.00 Mannings n = .013
900-10019 ##***********************************	Max.eff.Inten.(mm/hr) = 52.60
# Watercourse 10 # Watercourse 10 #	wax.ell.filten.(um/nl) - 52.00 over (um) 10.00 Storage Coeff. (um) = 9.40 (li) Unit Hyd. Tpeak (um) = 10.00 Unit Hyd. peak (cms) = .12
# # # Watercourse 10 - Catchment 101A (Pond 10-1)	PEAK FLOW (cms)= .98 TIME TO PEAK (hrs)= 12.00
	RUNOFF VOLUME (mm) = 121.25 TOTAL RAINFALL (mm) = 123.25 RUNOFF COEFFICIENT = .98
TIMPERUTORIS PERUTORIS (1)	(i) CN PROCEDURE SELECTED FOR PERVI
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	CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
Max.eff.Inten.(mm/hr)= 52.60 62.02	001:0024
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)= .2 .06 PEAK FLOW (cms)= 1.72 .50 2.221 (iii) TIME TO PEAK (hrs)= 12.00 12.000 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	ROUTE RESERVOIR Requested routing IN>01:(103C)
Unit Hyd. peak (cms)= .12 .06 *TOTALS*	0UT<02:(Pond-1) ======= OUTLFO
PEAK FLOW (cms)= 1.72 .50 2.221 (iii) TIME TO PEAK (hrs)= 12.00 12.00 12.000	(cms) (ha.m. .000 .0000E+0
RUNOFF VOLUME (mm)= 121.25 86.78 111.598 TOTAL RAINFALL (mm)= 123.25 123.25 123.247	.127 .1950E+0
RUNOFF COEFFICIENT = .98 .70 .905	ROUTING RESULTS AREA Q
 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 80.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL 	INFLOW >01: (103C) 9.30 1 OUTFLOW<02: (Pond-1) 9.30
THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	PEAK FLOW REDUCTION TIME SHIFT OF PEAK FLOW MAXIMUM STORAGE USED
01:0020	
ROUTE RESERVOIR Requested routing time step = 5.0 min.	001:0025
IN>01:(101A) IN>01:(101A) OUT<02:(Pond-1)	*# *# Watercour:
OUTFLOW STORAGE OUTFLOW STORAGE	~# Walercour: *# *#********************************
(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.	
ROUTING RESULTS AREA QPEAK TPEAK R.V.	CALIB STANDHYD Area (ha)= 1 01:720AA DT= 5.00 Total Imp(%)= 8
	TYDERUTOUS
PEAK FLOW REDUCTION [Qout/Qin](%)= 35.895 TIME SHIFT OF PEAK FLOW (min)= 30.00 MAXIMUM STORAGE USED (ha.m.)=.80398+00	IMPERVIOUS Surface Area (ha) = 8.24 Dep. Storage (mm) = 2.00 Average Slope (%) = .80
TIME SHIFT OF PEAK FLOW (min)= 30.00	Surface Area (ba)= 8.24
TIME SHIFT OF PEAK FLOM (min)= 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii) Unit Hyd. peak (cms)= .17
TIME SHIFT OF PEAK FLOW MAXIMUM STORAGE USED (min)= 30.00 (ha.m.)=.8039E+00 01:0021	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00
TIME SHIFT OF PEAK FLOW (min)= 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha) = 8.24 Dep. Storage (mm) = 2.00 Average Slope (%) = .80 Length (m) = 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr) = 52.60 over (min) = 5.00 Storage Coeff. (min) = 7.36 (ii Unit Hyd. Tpeak (min) = 5.00 Unit Hyd. peak (cms) = .17 PEAK FLOW (cms) = 1.08 TIME TO PEAK (hrs) = 12.00 RUNOFF VOLUME (mm) = 121.25 TOTAL RAINFALL (mm) = 123.25 RUNOFF COEFFICIENT = .98
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 122.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mn)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN*= 80.0 Ia = Dep.Storag
TIME SHIFT OF PERK FLOW MAXIMUM STORAGE USED (nin) = 30.00 (ha.m.) = .8039E+00 01:0021	Surface Area (ha) = 8.24 Dep. Storage (mm) = 2.00 Average Slope (%) = .80 Length (m) = .340.00 Mannings = .013 Max.eff.Inten.(mm/hr) = 52.60 over (min) = 5.00 Storage Coeff. (min) = 7.36 (ii Unit Hyd. Tpeak (min) = .108 TIME TO PEAK (hrs) = .1.7 PEAK FLOW (cms) = 1.08 TIME TO PEAK (hrs) = 12.00 RUNOFF VOLUME (mm) = 121.25 TOTAL RAIMFALL (mm) = 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT.
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha) = 8.24 Dep. Storage (mm) = 2.00 Average Slope (%) = .80 Length (m) = 340.00 Mannings = .013 Max.eff.Inten.(mm/hr) = 52.60 over (min) = 5.00 Storage Coeff. (min) = 7.36 (ii Unit Hyd. Tpeak (min) = 5.00 Unit Hyd. Tpeak (min) = 1.7 PEAK FLOW (cms) = 1.08 TIME TO PEAK (hrs) = 12.00 RUNOFF VOLUME (mm) = 121.25 TOTAL RAINFALL (mm) = 123.25 RUNOFF COEFFICIENT = .98 (i) CM PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 01:0021	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVII (CN* = 80.0 Ia = Dep. Storag (ii) TIME STOR (DI = DOES NOT INCLUDE BASEL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEL
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. Tpeak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storaga (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)= 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO FEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storage (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PEAK PLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= .108 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mn)= 123.25 RUNOFF VOLUME (mn)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)= 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUMOFF VOLUME (mn)= 123.25 RUMOFF COLUME (mn)= 123.25 RUMOFF COLUME (mn)= 123.25 RUMOFF COLUME (mn)= 123.25 RUMOFF COLUME SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)= 8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= .340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Teak (min)= 7.36 (ii Unit Hyd. Teak (min)= .108 TIME TO PEAK (mn)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 123.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COLFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (cms)= 12.05 TOTAL RAINFALL (mm)= 123.25 RUNOFF VOLUME (hrs)= 12.12 OTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
THE SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 (ha.m.) = 72.00 (ha.m.) = 72.00	Surface Area (ha)= 8.24 Dep. Storage (mm = 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 1.08 TIME TO PEAK (hrs)= 1.20 RUNOFF VOLUME (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.) = 8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE TOTAL RAINFALL (mn)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI (CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PERK FLOW MAXIMUM STORAGE USED (min) = 30.00 (ha.m.) = 8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (mm)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mm)= 121.25 TOTAL RAINFALL (mm)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI (CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PERK FLOW MAXIMUM STORAGE USED (min) = 30.00 (ha.m.) = 8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (mn)= 2.00 Average Slope (%)= .80 Length (m)= .340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Teak (min)= .5.00 Unit Hyd. Teak (min)= .5.00 Unit Hyd. Teak (min)= .1.7 PEAK FLOW (cms)= .1.7 PEAK FLOW (cms)= .1.08 TIME TO PEAK (hrs)= .12.00 RUNOFF VOLUME (mn)= .123.25 TOTAL RAINFALL (mn)= .123.25 RUNOFF COLFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
THE SHIFT OF PERK FLOW MAXIMUM STORAGE USED (min) = 30.00 (ha.m.) = 8039E+00 01:0021	Surface Area (ha)= 8.24 Dep. Storage (mn)= 2.00 Average Slope (%)= .80 Length (m)= .340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Teak (min)= .5.00 Unit Hyd. Teak (min)= .5.00 Unit Hyd. Peak (cms)= .1.7 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mn)= 123.25 TOTAL RAINFALL (mn)= 123.25 RUNOFF COLFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIPT OF PERK FLOW MAXIMUM STORAGE USED (min) = 30.00 (ha.m.) = 8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (mn)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= .1.08 TIME TO PEAK (hrs)= .12.00 RUNOFF VOLUME (mn)= 123.25 RUNOFF VOLUME (mn)= 123.25 RUNOFF COFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIFT OF PEAK FLOW (min)= 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mn)= 123.25 RUNOFF VOLUME (mn)= 123.25 RUNOFF COFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIFT OF PEAK FLOW MAXIMUM STORAGE USED (min)= 30.00 (ha.m.)=.8039E+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (mn)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) = 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 7.36 (ii Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (rm)= 121.25 TOTAL RAINFALL (mn)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026
TIME SHIFT OF PERK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO PEAK (hrs)= 12.00 RUNOFF VOLUME (mn)= 121.25 TOTAL RAINFALL (mn)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep.Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE
TIME SHIFT OF PEAK FLOW (min) = 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039+00 001:0021	Surface Area (ha)= 8.24 Dep. Storage (m)= 2.00 Average Slope (%)= .80 Length (m)= 340.00 Mannings n = .013 Max.eff.Inten.(mm/hr)= 52.60 over (min) 5.00 Storage Coeff. (min)= 7.36 (ii Unit Hyd. Tpeak (min)= 5.00 Unit Hyd. peak (cms)= .17 PEAK FLOW (cms)= 1.08 TIME TO FEAK (hrs)= 12.00 RUNOFF VOLUME (rm)= 121.25 TOTAL RAINFALL (m)= 123.25 RUNOFF COEFFICIENT = .98 (i) CN PROCEDURE SELECTED FOR PERVI CN* = 80.0 Ia = Dep. Storag (ii) TIME STEP (DT) SHOULD BE SMALLE THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASE 001:0026

	Surface Area	(ha)=	MPERVIOUS 7.44	PERVIOUS (i) 1.86 5.00	
	Surface Area Dep. Storage Average Slope Length Mannings n	(mm) = (%) = (m) =	2.00 .70 478.00	5.00 .70 40.00	
	Mannings n	(mm (bx) =	.013	.250	
	OVe Storage Coeff	(min) = (min) =	10.00	20.00	
	Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak	(min)= k (min)= : (cms)=	10.00	20.00	
					TOTALS 1.253 (iii)
	PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALL RUNOFF COEFFIC	(hrs)= (mm)=	12.00	12.08 86.78	12.000 111.597
	RUNOFF COEFFIC	IENT =	.98	.70	123.247 .905
	(ii) TIME STE	0.0 Ia = P (DT) SHOUL STORAGE COE	Dep. Storage D BE SMALLER FFICIENT.	e (Above) R OR EQUAL	
		 Reques	ted routing	time step = 5	.0 min.
UU UU	JTE RESERVOIR N>01:(103C) F<02:(Pond-1)	======		N STORAGE TABLE	
		001FLC (cms .00	 (ha.m.) 0.0000E+00 1050E+00 	E OUTFLOW) (cms) D .489 D .000	(ha.m.) .4360E+00
	ROUTING RESULT	.12	ADE3 01		.0000E+00
		0.20	(ha) (c	PEAK TPEAK Cms) (hrs) .253 12.000 .488 12.417	(mm)
	INFLOW >01: (1 OUTFLOW<02: (F	ond-1)	9.30	.488 12.417	111.597
		PEAK FLOW	REDUCTION	[Qout/Qin](%)= (min)=	38.968
		MAXIMUM STC	RAGE USED	(ha.m.)=	.4357E+00

**	*****	*****			*****
	**************************************				*****
**	*****	*******	********	*****	*****
CA1 01	LIB STANDHYD 720AA DT= 5.0	Area 0 Total	(ha) = 10 Imp(%) = 80	0.30 0.00 Dir. Com	n.(%)= 72.00
	Surface Area	(ha)=	MPERVIOUS 8 24	PERVIOUS (i)	
	Dep. Storage	(mm) =	2.00	5.00	
	Surface Area Dep. Storage Average Slope Length Mannings n	(m)=	340.00	40.00	
	ove Storage Coeff.	r (min) (min)=	5.00 7.36 (ii	02.02 20.00) 18.61 (ii) 20.00 06	
	Max.eff.Inten. ove Storage Coeff. Unit Hyd. Tpea Unit Hyd. peak	k (min)= (cms)=	5.00 .17	20.00	
					TOTALS 1.398 (iii)
	TIME TO PEAK RUNOFF VOLUME	(hrs)= (mm)=	12.00 121.25	12.00 86.78	12.000 111.597
	TOTAL RAINFALL RUNOFF COEFFIC	(mm) = IENT =	123.25 .98	.31 12.00 86.78 123.25 .70	123.247 .905
	(i) CN PROCE CN* = 8 (ii) TIME STE	DURE SELECTE 0.0 Ia = P (DT) SHOUL STORAGE COE	D FOR PERVIO Dep. Storage D BE SMALLER FFICIENT.	DUS LOSSES: = (Above) R OR EQUAL	
1					
	JUZU JTE RESERVOIR			time step = 5	
II	N>01:(720AA)			CTODACE TADLE	
	F<02:(Pond-7)	OUTFLC	W STORAGE	E OUTFLOW (cms)	STORAGE (ha.m.)
		.00	0 .0000E+00) .182	.2370E+00 .4890E+00
	ROUTING RESULT		AREA QI	PEAK TPEAK	
			AREA QI (ha) (c 10.30 1 10.30	cms) (hrs) .398 12.000 706 12.250	(mm) 111.597
	INFLOW >01: (7 OUTFLOW<02: (F		10.30	.706 12.250	111.597
		PEAK FLOW TIME SHIFT C MAXIMUM STC	REDUCTION OF PEAK FLOW RAGE USED	[Qout/Qin](%)= (min)= (ha.m.)=	50.496 15.00 .4894E+00
**	027 ********************************	********			****
W2	atercourse 7 - ***********************************	********	***********	;	*****
01	LIB STANDHYD	Area 0 Total	(ha)= Imp(%)= 80	4.80).00 Dir. Com	n.(%)= 72.00
		I	2 0 /	PERVIOUS (i) .96	
	Surface Area Dep. Storage Average Slope	(mm) = (%) =	2.00	5.00 .80	
	Length Mannings n	('s) = (m) = =	170.00 .013	40.00	
	Max.eff.Inten.		E2 60	62 49	
	ove Storage Coeff.	r (min) (min)=	52.80 5.00 4.86 (ii)	15.00	
	Unit Hyd. Tpea Unit Hyd. peak	k (min)=	5.00	15.00	
	nju. peak	(*TOTALS*

*** WARNING:	storage Coe	erricient is	.15 12.00 86.78 123.25 .70 s smaller than 1	12.000 111.597 123.247 .905 DT!	
			larger area.		
			/IOUS LOSSES: age (Above)		
(ii) TIME STE	EP (DT) SHOU	ULD BE SMALI DEFFICIENT.	LER OR EQUAL		
(iii) PEAK FLC					
01:0028					
ROUTE RESERVOIR IN>01:(720B)	Reque	ested routir	ng time step =	5.0 min.	
IN>01:(720B) OUT<02:(Pond-7)		OUTLE	FOW STORAGE TAB	LE ========	
	(cr	ns) (ha.m	AGE OUTFLO n.) (cms +00 .08) (ha.m.)	
	.(000 .0000E4 013 .7800E-	-01 .08	5 .1110E+00 9 .2340E+00	
ROUTING RESULT	rs	AREA	QPEAK TPEA	K R.V.	
INFLOW >01: (7	720B)	(ha) 4.80	QPEAK TPEA (cms) (hrs .659 12.00 .328 12.16) (mm) 0 111.597	
INFLOW >01: (7 OUTFLOW<02: (F	Pond-7)	4.80	.328 12.16	7 111.597	
			ON [Qout/Qin](% OW (min		
	TIME SHIFT MAXIMUM ST	OF PEAK FLC FORAGE USE	DW (min ED (ha.m.) = 10.00) = .2336E+00	
01:0029 #******************* # Watercourse 7 - #******************	Catchment '	************* 721AA (Pond	7-2-3)		
CALIB STANDHYD 01:721AA DT= 5.0)0 İ Total	(ha)= 1 Imp(%)=	80.00 Dir. C	onn.(%)= 72.00	
Surface Ares	(ha)-	IMPERVIOUS	PERVIOUS (i .86 5.00 .30 40.00 .250)	
Dep. Storage	(mm) =	2.00	5.00		
Average Slope Length	(*)= (m)=	.30	40.00		
Mannings n	=	.013	.250		
Max.eff.Inten.	.(mm/hr)= er (min)	52.60	61.52 25.00		
Storage Coeff.	(min)=	7.46 (i	ii) 22.61 (ii)	
Unit Hyd. Tpea Unit Hyd. peak	ak (min)= ((cms)=	5.00	61.52 25.00 ii) 22.61 (ii 25.00 .05		
				.574 (iii))
PEAK FLOW TIME TO PEAK RUNOFF VOLUME TOTAL RAINFALI RUNOFF COEFFIC	(hrs)=	12.00	.12 12.08 86.78	12.000 111.597	
TOTAL RAINFALL	(mm)=	123.25	123.25	123.247	
CN* = 8 (ii) TIME STE THAN THE	EDURE SELEC 30.0 Ia = EP (DT) SHOU E STORAGE CO	TED FOR PERV = Dep. Stora ULD BE SMALI DEFFICIENT.		.905	
CN* = 8 (ii) TIME STE THAN THE (iii) PEAK FLC	EDURE SELEC" 30.0 Ia : EP (DT) SHOU E STORAGE CO DW DOES NOT	TED FOR PERV = Dep. Stora ULD BE SMALI DEFFICIENT. INCLUDE BAS	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.		
CN* = 8 (ii) TIME STF THAN THE (iii) PEAK FLC	EDURE SELEC 30.0 Ia : EP (DT) SHOU E STORAGE CO DW DOES NOT	TED FOR PERV = Dep. Storz ULD BE SMALI DEFFICIENT. INCLUDE BAS	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.		
CN* = 2 (ii) THAS ST THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC" 30.0 Ia : EP (DT) SHOU E STORAGE CC DW DOES NOT Reque Reque	TED FOR PERI TED FOR PERI ULD BE SMALL DEFFICIENT. INCLUDE BAS 	JIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min.	
CN* = 8 (ii) TIME STF THAN THE (iii) PEAK FLC	EDURE SELEC" 30.0 Ia : EP (DT) SHOU E STORAGE CC DW DOES NOT Reque Reque	TED FOR PERI TED FOR PERI ULD BE SMALL DEFFICIENT. INCLUDE BAS 	JIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min.	
CN* = 2 (ii) THAS ST THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC" SO.0 Ia : SP (DT) SHOI STORAGE CC DW DOES NOT Reque Reque COUTFI (cr (cr (cr	TED FOR PERU = Dep. Store JUD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLI LOW STORE ms) (ha.m 00 0.0000E	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. 	5.0 min. LE ======= W STORAGE) (ha.m.) 3.9900E-01	
CN* = 2 (ii) THAS ST THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC" SO.0 Ia : SP (DT) SHOI STORAGE CC DW DOES NOT Reque Reque COUTFI (cr (cr (cr	TED FOR PERI TED FOR PERI ULD BE SMALL DEFFICIENT. INCLUDE BAS 	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. 	5.0 min.	
CN* = 2 (ii) THAS ST THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : SP (DT) SHOU S STORAGE CC W DOES NOT Reque Reque CC (cr (cr (cr (cr (cr (cr (cr (cr	TED FOR PERN = Dep. Store DLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLL Ested routin ==== OUTLL LOW STORJ ms) (ha.m 000 .0000E- D1. 6900E- AREA	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. dg time step = row STORAGE TAB age OUTFLO a.) (cmms to0 .28	5.0 min. LE ======= W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC DI:0030 ROUTE RESERVOIR IN>01:(721AA) OUT<02:(Pond-7) ROUTING RESULT	EDURE SELEC: 30.0 Ia : 2P (DT) SHOU STORAGE CC DW DOES NOT Reque Reque Reque CTS CTS	TED FOR PERN = Dep. Store DLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLL Ested routin ==== OUTLL LOW STORJ ms) (ha.m 000 .0000E- D1. 6900E- AREA	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. dg time step = row STORAGE TAB age OUTFLO a.) (cmms to0 .28	5.0 min. LE ======= W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00	
CN* = 6 (ii) THAN THE (iii) PEAK FLC (iii) PEAK FLC COUTE RESERVOIR IN>01:(721AA) OUT<02:(Pend-7) COUTE(02:(Pend-7) INFLOW >01:(7 OUTFLOW<02:(F	EDURE SELEC: 30.0 Ia = SP (DT) SHOU SP (DT) SHOU STORAGE CC W DOES NOT Reque Reque CT CT CT CT CT CT CT CT CT CT	TED FOR PERN = Dep. Store JLD BE SNALL DEFFICIENT. INCLUDE BAS 	JOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min. LE	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC 	EDURE SELEC: 30.0 Ia = 2P (DT) SHOU STORAGE CC DW DOES NOT 	TED FOR PERN = Dep. Store JLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLI LOW STORY ms) (ha.m 000 .0000E- D11 .6900E- D11 .6900E- AREA (ha) 4.30 W REDUCTI(JOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. agg time step = YOW STORAGE TAB AGE OUTFLO n, (cms) +00 2.28 QPEAK TPEA (cms) (frs .574 .22.25 N (Oout/Oin)[%	5.0 min. LE	
CN* = 6 (i) THE STE (ii) THEN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia = SP (DT) SHOU SHOULD SHOT COMPANY SHOULD SHOUL	TED FOR PERN = Dep. Store JLD BE SNALL DEFFICIENT. INCLUDE BAS 	JIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. agt ime step = 700 STORAGE TAB AGE OUTFLO n.) (cms) 001 .28 QPEAK TPEA (cms) (hrs .574 12.00 .281 12.25 DN [Qout/Qin](% W	5.0 min. LE	
CN* = 6 (i) THE STE (ii) THEN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia = 30.0 Ja	TED FOR PER(TED FOR PER(TED FOR PER(DEFTICIENT. INCLUDE BAS TINCLUDE BAS TEDEFTICIENT. INCLUDE BAS TOTAL SESTED TOTAL TOTA	VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min. LE ====== W STORAGE) (ha.m.) 3.99008-01 1.20408+00 K R.V.) (mm) 0 111.597 0 111.597 0 111.596)= 48.664)= 15.00 =.2039E+00	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia = SP (DT) SHOU W DOES NOT Reque Reque Reque Carchaeter Carchaeter Carchaeter Catchment Carchaeter Catchment Carchaeter Ca	TED FOR PER(= Dep. Store DLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLH ==== OUTLH LOW STORN ms) (ha. (ha) 4.30 4.30 W REDUCTIO OF PERK FLA TORAGE USB 	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. ing time step = row STORAGE TAB GGE OUTFLO n.) (cms) ing time step = row STORAGE TAB GGE OUTFLO n.) (cms) ing time step = row STORAGE TAB GGE OUTFLO n.) (cms) (cms) (hrs .574 12.00 .281 12.25 DN [Qout/Qin](% W (min SD (ha.m. .7-2-4) 2.40 80.00 Dir. C	5.0 min. LE = W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : SP (DT) SHOU SP (DT) SHOU SP (DT) SHOU NOTE: Reque 	TED FOR PER\ TED FOR PER\ TED FOR PER\ DEFFICIENT. INCLUDE BAS DEFFICIENT. INCLUDE BAS DEFFICIENT. INCLUDE STORY BS (DAIN DOI 1000 000.0000 000.0000 AREA (ha) 4.30 W REDUCTIO OF PERK FLG TORAGE USB TORAGE USB TORAGE USB TORAGE USB TORAGE USB TABLE (Pond (ha)= 1 Imp(%)= IMPERVIOUS	JOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min. LE = W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC 	EDURE SELEC: 30.0 Ia = SP (DT) SHOU SP (DT) SHOU Carbon Content of the second Carbon Conten	TED FOR PERN = Dep. Store JLD BE SNALL DEFFICIENT. INCLUDE BAS ===== OUTLH COW STORN ms) (ha. (ba) 4.30 4.30 W REDUCTIC OF PERN FLA TORAGE USH ===== (ha) = 1 Imp(%) = IMPERVIOUS 1.92 2.00	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min. LE = W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (ii) THE STE (iii) PEAK FLC (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia = SP (DT) SHOU SP (DT) SHOU SP (DT) SHOU NOTE: PERSING Catchment ' Catchment ' Catchment ' (%) = (mm) = (%) = (m) = (%) = (m) =	TED FOR PERN = Dep. Store JLD BE SNALL DEFFICIENT. INCLUDE BAS 	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	5.0 min. LE = W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : SP (DT) SHOU SP (DT) SHOU SP (DT) SHOU NOT SP (C) SHOU Reque 	TED FOR PERN = Dep. Store DLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLH ===== OUTLH LOW STORN ms) (ha.r (ha) 4.30 4.30 W REDUCTIC OF PERK FLA TORAGE USN 	JIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. Ing time step = row STORAGE TAB GGE OUTFLO n.) (cms) 00 0.07 01 28 QPEAK TPEBA (cms) (Lrs .574 12.00 .281 12.25 DN [Qout/Qin](% W (min ED (ha.m.	5.0 min. LE ====== W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : 30.0 Ia : 30.0 Ja	TED FOR PERN = Dep. Store DLD BE SMALL DEFFICIENT. INCLUDE BAS ===== OUTLH ===== OUTLH LOW STORN ms) (ha.r (ha) 4.30 4.30 W REDUCTIC OF PERK FLA TORAGE USN 	JIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. Ing time step = row STORAGE TAB GGE OUTFLO n.) (cms) 00 0.07 01 28 QPEAK TPEBA (cms) (Lrs .574 12.00 .281 12.25 DN [Qout/Qin](% W (min ED (ha.m.	5.0 min. LE ====== W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030 ROUTE RESERVOIR IN>01:(721AA) OUT<02:(Pond-7) OUT<02:(Pond-7) INFLOW >01:(7 OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFLOW<02:(P OUTFL	EDURE SELEC: 30.0 Ia : 30.0 Ia : 40.0 Ia	<pre>TED FOR PER\ = Dep. Store Dep. Store DEFFICIENT. INCLUDE BAS ==== OUTLH EDW STORA ms) (ha.r NG) (0000E- 0011 .6900E- AREA (ha) 4.30 4.30 W REDUCTIC ORAGE USI 00 .0000E+ 1 Imp(%)= IMPERVIOUS 1.92 2.00 .01 .013 52.60 5.00</pre>	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. agg time step = YOW STORAGE TAB AGE OUTFLO n, (cms) +00 12.25 NN [QOUT/Qin] (% YOW (min gD) 22.40 80.00 Dir. C PERVIOUS (i .48 5.00 .30 40.00 .250 62.02 20.00 ii) 21.12 (ii)	5.0 min. LE ====== W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V. (mm) 0 111.597 0 111.597 0 111.596)= 48.864)= 15.00)= 2039E+00 	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC 	Catchment - (ha) = (mm/hr) = (TED FOR PERN TED FOR PERN TED FOR PERN TINCLUDE SMALL DEFFICIENT. INCLUDE BAS TOTAL ESTED FOR ESTED FOR TOTAL STORY TOTAL STORY S	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. and the step = 700 STORAGE TAB AGE OUTFLO n.) (cms) age OUTFLO) (cms)) (cms)) (cms) .	5.0 min. LE ======= W STORAGE) (ha.m.) 3.9900E-01 1.2040E+00 K R.V.) (mm) 0 111.597 0 111.597 0 111.597 0 111.597)= 48.864)= 48.864)= 48.864 0 111.597 0 111.597 0 111.597)= 72.00)	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC 	Catchment - (ha) = (mm/hr) = (TED FOR PERN TED FOR PERN TED FOR PERN TINCLUDE SMALL DEFFICIENT. INCLUDE BAS TOTAL ESTED FOR ESTED FOR TOTAL STORY TOTAL STORY S	<pre>JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. Junct Constraints age time step = FOW STORAGE TAB AGE OUTFLO 0. .) [(cms) (cms) -00 .28 00 (cms) (hrs) .574 12.00 .281 12.25 DN [Qout/Qin](% DW (min ED (ha.m. 7-2-4) 2.40 80.00 Dir. C PERVIOUS (i .48 5.00 .250 62.02 20.00 i) 21.12 (ii 20.00 .05 .07</pre>	<pre>5.0 min. LE ======== W STORAGE) (ha.m.) 3 .9900E-01 1 .2040E+00 K R.V.) (mm) 0 111.597 0 /pre>	
CN* = 6 (i) THE STE THAN THE (iii) PEAK FLC 	Catchment - (ha) = (mm/hr) = (TED FOR PERN TED FOR PERN TED FOR PERN TINCLUDE SMALL DEFFICIENT. INCLUDE BAS TOTAL ESTED FOR ESTED FOR TOTAL STORY TOTAL STORY S	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	<pre>5.0 min. LE</pre>	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	Catchment (mm) =	TED FOR PER(= Dep. Store = Dep. Store DEPErCIENT. INCLUDE BAS DEFFICIENT. INCLUDE BAS 	<pre>VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. yg time step = vow STORAGE TAB AGE OUTFLO n.) (cms) 00 0.07 -01 .28 QPEAK TPEA (cms) (Lrs .574 12.00 .281 12.25 N [Qout/Qin] (% OW (min ED (ha.m.) </pre>	<pre>5.0 min. LE ====================================</pre>	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	Catchment / Catchment / Catch	TED FOR PER(= Dep. Store = Dep. Store DID BE SMALL DEFFICIENT. INCLUDE BAS ==== OUTLI LOW STORE may (ha. model) AREA (ha) 4.30 W REDUCTI(OF PEAK FLG TORAGE USI 	<pre>//OUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. </pre>	5.0 min. LE ====================================	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : 50.0 Ia	<pre>TED FOR PERN TED FOR PERN TED FOR PERN TED FOR PERN TENT TENT TENT TENT TENT TENT TENT T</pre>	<pre>VIOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY. yg time step = vow STORAGE TAB AGE OUTFLO n.) (cms) 00 0.07 -01 .28 QPEAK TPEA (cms) (Lrs .574 12.00 .281 12.25 N [Qout/Qin] (% OW (min ED (ha.m.) </pre>	<pre>5.0 min. LE ====================================</pre>	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : 50.0 Ia	<pre>TED FOR PERV = Dep. Store Dep. Store DEFFICIENT. INCLUDE BAS DEFFICIENT. INCLUDE BAS ==== OUTLH ==== OUTLH COW STORA ms) (ha.; 4.30 4.30 W REDUCTIC OF PEAK FLG TORAGE USI OF PEAK FLG TORAGE USI 1 Imp(%)= 1 Imp(%)= 1 Imp(%)= 1 Imp(%)= 1 Imp(%)= 1 2.00 149.00 .013 52.60 5.00 (5.00 (5.00 (5.00) 121.25 12.325 123.25 .98 FED FOR PERV = Dep. Store UDD EE SMALL</pre>	JUOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	<pre>5.0 min. LE ====================================</pre>	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	Catchment - Catchment - (ha) = (mm/hr) = (mm/hr) = (mm/hr) = (mm/hr) = (mm/hr) = (mm)	TED FOR PERN TED FOR PERN TED FOR PERN TINCLUDE SMALL DEFFICIENT. INCLUDE BAS TOTAL STORY Sated routin Sated routin Sa	JOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	<pre>5.0 min. LE ====================================</pre>	
CN* = 6 (ii) THE STE THAN THE (iii) PEAK FLC D1:0030	EDURE SELEC: 30.0 Ia : EDURE SELEC: 30.0 Ia : EP (DT) SHOU STORAGE CC W DOES NOT 	TED FOR PER(= Dep. Store JLD BE SMALL DEFFICIENT. INCLUDE BAS DEFFICIENT. INCLUDE BAS DEFFICIENT. INCLUDE BAS DITLI ESTED OUTLINE TOTAGE INCLUDE BAS 1.92 2.00 .013 52.60 5.00 .199 .25 122.00 .192 .25 .25 .25 .25 .25 .25 .25 .2	JOUS LOSSES: age (Above) LER OR EQUAL SEFLOW IF ANY.	<pre>5.0 min. LE =</pre>)

OUT<02:(Pond-G	OUTF (c	LOW ST(ms) (ha 000 .000	ORAGE a.m.) 0E+00	OUTFLOW (cms) .041	STORAGE (ha.m.) .5600E-01	
		006 .390	0E-01	.157	.1160E+00	
ROUTING RESU	JLTS	AREA	OPEAK	TPEAK	R.V.	
		(ha)	(cms)	(hrs)	(mm)	
INFLOW >01:	(721AB)					
	(Pond-G)					
	PEAK FLO	W REDUC	TTON [Oout	(Oinl(%)=	48 396	
	TIME SHIFT					
	MAXIMUM S	TORAGE I	USED	(ha.m.)=.		
 001:0033 FINISH	MAXIMUM S	TORAGE	USED	(ha.m.)=.		
*****	MAXIMUM S	TORAGE 1	USED	(ha.m.)=.		*******
FINISH WARNINGS / 1 	MAXIMUM S MAXIMUM S RRORS / NOTE RESERVOIR 3: STORAGE-Q	TORAGE 1	USED 	(ha.m.)=.		*******
FINISH WARNINGS / 1 001:0018 ROUTE 1 *** WARNING 001:0027 CALIB 5	MAXIMUM S MAXIMUM S ERRORS / NOTE RESERVOIR 3: STORAGE-Q Increase C STANDHYD	TORAGE 1	USED	(ha.m.)=.	1160E+00	
FINISH WARNINGS / 1 001:0018 ROUTE 1 *** WARNING 001:0027 CALIB 5	MAXIMUM S MAXIMUM S ERRORS / NOTE EESERVOIR G: STORAGE-Q Increase c STANDHYD G: Storage Co Use a smal	TORAGE T 	USED 	(ha.m.)=.	1160E+00	

	*# Date : 12-06-2010 *# Modeller : []
SSSSS W W M M H H Y Y M M OOO 999 999	*# Company : Aquafor Beech Limited *# License # : 3245976 *#******
S WWW MMMM H H YY MMMM O O 9 9 9 9 SSSSS WWW MMM HHHHH Y MMM O O ## 9 9 9 9 Ver.	******* *# Future Landuse - SWM Pond - 100 Year
4.02 S W W M M H H Y M M O O 9999 9999 July	*#*************************************
1999 SSSSS WW M M H H Y M M OOO 9 9 =======	 START Project dir.: C:\DoCUME-1\XPMUsex\MYDOCU-1\SCUBE\lSCUBE-2\
9 9 9 9 # 2686740	C:\DOCUME-1\XPMUser\MYDOCU-1\SCUBE\1SCUBE-2\
StormWater Management HYdrologic Model 999 999	TZERO = .00 hrs on 0 METOUT= 2 (output = METRIC) NRUN = 001
**	NSTORM= 1 # 1=24SCS100.STM

******* A single event and continuous hydrologic simulation model ****	
******* based on the principles of HYMO and its successors	READ STORM Filename: C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUB
******* OTTHYMO-83 and OTTHYMO-89.	Ptotal= 123.25 mm Comments: 100yr/24hr
*****	TIME RAIN TIME RAIN TIME RAIN TIME RAIN
** ******* Distributed by: J.F. Sabourin and Associates Inc.	hrs mm/hr hrs mm/hr hrs mm/hr hrs mm/hr
******** Ottawa, Ontario: (613) 727-5199	1.00 1.350 7.00 2.460 13.00 13.395 19.00 2.210
******* Gatineau, Ouebec: (819) 243-6858	2.00 1.350 8.00 2.460 14.00 6.260 20.00
****** ******* E-Mail: swmhymo@jfsa.Com	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
++	
++++++ Licensed user: Aquafor Beech Ltd ++++++	001:0003
++++++ SERIAL#:2686740	 *#*******************************
*****	******
++	*# Watercourse 12 *#
*****	*#*************************************
** ****** ++++++ PROGRAM ARRAY DIMENSIONS ++++++	*#*************************************
******* ****** Maximum value for ID numbers : 10	*# Watercourse 12 - Catchment 125CA (Pond 12-1) *#***********************************
******* ******* Max. number of rainfall points: 15000 ******	*****
******* Max. number of flow points : 15000 *******	CALIE 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
** DATE: 2011-03-04 TIME: 15:42:51 RUN COUNTER: 000031 *	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)
** * Input filename:	TIME TO PEAK (hrs)= 12.00 12.17 12.000 RUNOFF VOLUME (mm)= 121.24 86.78 111.598
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.da* * Output filename:	TOTAL RAINFALL (mm)= 123.25 123.25 123.247 RUNOFF COEFFICIENT = .98 .70 .905
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.ou* * Summary filename:	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
C:\DOCUME~1\XPMUser\MYDOCU~1\SCUBE\1SCUBE~2\SCUBEP1.su* * User comments: * *	<pre>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.</pre>
*	
2:*	001:0004
3:*	
***************************************	ROUTE RESERVOIR Requested routing time step = 5.0 min. IN>01:(125CA)
	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.)
001:0001	.000 .0000E+00 .087 .3430E+00 .013 .2400E+00 .333 .7730E+00
*#************************************	ROUTING RESULTS AREA QPEAK TPEAK R.V.
*# Project Name: [SCUBE East] Project Number: [64711]	(ha) (cms) (hrs) (mm)

<pre>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</pre>	 (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.
 ##*******************************	
******* *# Watercourse 12 - Catchment 125CB (Pond 12-2) *#*******	ROUTE RESERVOIR Requested routing time step = 5.0 min. IN>01:(1011) Image: Start Star
CALIB STANDHYD Area (ha)= 14.50 01:125CB DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00	(cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .412 .6900E+00 .107 .2450E+00 .000 .0000E+00
IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 11.60 2.90	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm)
Dep. Storage (mm) = 2.00 5.00	INFLOW >01: (1011) 14.70 1.389 12.083 97.514
Average Slope (%)= .20 .20 Length (m)= 535.00 40.00	OUTFLOW<02: (Pond-9) 14.70 .412 13.750 97.514
Mannings n = .013 .250	PEAK FLOW REDUCTION [Qout/Qin](%)= 29.623
Max.eff.Inten.(mm/hr)= 52.60 60.97	TIME SHIFT OF PEAK FLOW (min)= 100.00 MAXIMUM STORAGE USED (ha.m.)=.6895E+00
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*	001:0009
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	****** *# Watercourse 9 - Catchment 92AA (Pond 9-2) *#*******
 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 80.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL 	CALIB STANDHYD Area (ha)= 54.00 01:92AA DT= 5.00 Total Imp(%)= 50.00 Dir. Conn.(%)= 35.00
THAN THE STORAGE COEFFICIENT.	IMPERVIOUS PERVIOUS (i)
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	Surface Area (ha)= 27.00 27.00 Dep. Storage (mm)= 2.00 5.00
	Average Slope (%)= .50 .50
 001:0006	Length (m)= 491.00 40.00 Mannings n = .013 .250
	-
ROUTE RESERVOIR Requested routing time step = 5.0 min.	Max.eff.Inten.(mm/hr)= 52.60 51.57 over (min) 10.00 25.00
IN>01:(125CB)	Storage Coeff. (min)= 10.57 (ii) 24.51 (ii)
OUT<02:(Pond-1)	Unit Hyd. Tpeak (min)= 10.00 25.00 Unit Hyd. peak (cms)= .11 .05
(cms) (ha.m.) (cms) (ha.m.)	*TOTALS*
.000 .0000E+00 .107 .4210E+00 .016 .2950E+00 .410 .9490E+00	PEAK FLOW (cms)= 2.75 3.14 5.809 (iii) TIME TO PEAK (hrs)= 12.00 12.08 12.000
.010 .22506+00 .410 .94506+00	RUNOFF VOLUME (mm) = 121.25 77.26 92.655
ROUTING RESULTS AREA QPEAK TPEAK R.V.	TOTAL RAINFALL (mm) = 123.25 123.25 123.247
(ha) (cms) (hrs) (mm) INFLOW >01: (125CB) 14.50 1.844 12.000 111.598	RUNOFF COEFFICIENT = .98 .63 .752
OUTFLOW<02: (Pond-1) 14.50 .410 13.333 111.596	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: $CN^* = 75.0$ Ia = Dep. Storage (Above)
PEAK FLOW REDUCTION [Qout/Qin](%)= 22.236 TIME SHIFT OF PEAK FLOW (min)= 80.00 MAXIMUM STORAGE USED (ha.m.)=.9492E+00	 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
001:0007	 001:0010
 *#*******************************	
·· *******	ROUTE RESERVOIR Requested routing time step = 5.0 min.
*# Watercourse 9	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
" ****	
*#****** *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm)
*#***** *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#*******	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
CALIB STANDHYD Area (ha)= 14.70 01:1011 DT= 5.00 Total Imp(%)= 50.00 Dir. Conn.(%)= 35.00 	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) ##***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* *# Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) ************************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) ********</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. INFLOW >01: (92AA 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) ******** ***************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. INFLOW >01: (92AA) 54.00 5.809 12.000 92.655 OUTFLOW<02:
<pre>******* ** Watercourse 9 - Catchment 1011 (Pond 9-1) *#***********************************</pre>	ROUTING RESULTS AREA QPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (92AA) 54.00 5809 12.000 92.655 OUTFLOW<02:

Average Slope (%)= .50 .50 Length (m)= 350.00 40.00	
Mannings n = .013 .250	001:0015
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 TIME TO PEAK (hrs)= 12.00 12.08 RUNOFF VOLUME (mm)= 121.25 77.26 92.655	CALIB STANDHYD Area (ha)= 8.30 01:96AA DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00
TOTAL RAINFALL (mm)= 123.25 123.25 123.247 RUNOFF COEFFICIENT = .98 .63 .752	IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 6.64 1.66 Dep. Storage (mm)= 2.00 5.00
 (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. 	Average Slope (%)= .90 .90 Length (m)= 421.00 40.00 Mannings n = .013 .250
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.	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
01:0012	Unit Hyd. peak (cms)= .13 .06 *TOTALS*
ROUTE RESERVOIR Requested routing time step = 5.0 min. IN>01:(92AB) Impose OUT<02:(Pond-9)	PEAK FLOW (cms)= .87 .25 1.125 (iii) TIME TO PEAK (hrs)= 12.00 12.000 12.000 RUNOFF VOLUME (mm)= 121.25 86.78 111.598 TOTAL RAINFALL (mm)= 123.25 123.25 123.247 RUNOFF COEFFICIENT
(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)	 (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.
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	001:0016
	CALIB STANDHYD Area (ha)= 16.50 02:97AA DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00
 01:0013	IMPERVIOUS PERVIOUS (i)
 #********************************	Surface Area (ha)= 13.20 3.30 Dep. Storage (mm)= 2.00 5.00
"****	Average Slope (%)= 1.00 1.00
"# Watercourse 9 - Catchment 96AB (Pond 9-4) "#************************************	Length (m)= 451.00 40.00 Mannings n = .013 .250
******	Max.eff.Inten.(mm/hr)= 52.60 62.02
CALIB STANDHYD Area (ha)= 16.20 01:96AB DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 IMPERVIOUS PERVIOUS (i)	over (min) 10.00 20.00 Storage Coeff. (min)= 8.16 (ii) 18.67 (ii) Unit Hyd. Tpeak (min)= 10.00 20.00 20.00 Unit Hyd. peak (cms)= .13 .06
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	*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
Max.eff.Inten.(mm/hr)= 52.60 62.02 over (min) 10.00 20.00 Storage Coeff. (min)= 9.80 (ii) 20.66 (ii)	RUNOFF COEFFICIENT = .98 .70 .905 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 80.0 Ia = Dep. Storage (Above)
Unit Hyd. Tpeak (min)= 10.00 20.00 Unit Hyd. peak (cms)= .11 .06 *TOTALS*	 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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	 001:0017
RUNOFF COEFFICIENT = .98 .70 .905 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: CN* = 80.0 Ia = Dep. Storage (Above)	 ADD HYD (Flow_P) ID: NHYD AREA QPEAK TPEAK R.V. DWF (ha) (cms) (hrs) (mm) (cms)
 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 	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.
ROUTE RESERVOIR Requested routing time step = 5.0 min.	 001:0018
IN>01:(96AB) OUT<02:(Pond 9) ======= OUTLFOW STORAGE TABLE ======= OUTFLOW STORAGE OUTFLOW STORAGE	Requested routing time step = 5.0 min.
(cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .151 .4530E+00 .023 .3170E+00 .582 .9980E+00	IN>03:(Flow_P) OUT<04:(Pond-9) ======= OUTLFOW STORAGE TABLE ======= OUTFLOW STORAGE OUTFLOW STORAGE (===) (b===) (b===) (b===)
ROUTING RESULTS AREA QPEAK TPEAK R.V.	(cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .245 .6000E+00
(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	*** WARNING: STORAGE-Q values were extrapolated. Increase curve or use overflow option.
PEAK FLOW REDUCTION [Qout/Qin](%)= 26.640 TIME SHIFT OF PEAK FLOW (min)= 65.00 MAXIMUM STORAGE USED (ha.m.)=.9979E+00	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:
	PEAK FLOW REDUCTION [Qout/Qin](%)= 18.525

	THAN	THE	STORAC	GE CO	DEFFICIEN	VT.		
(iii)	PEAK	FLOW	DOES	NOT	INCLUDE	BASEFLOW	IF	ANY.

001:0019-----001:0022---ROUTE RESERVOIR Requested routing time step = 5.0 min. *# IN>01:(102A *# Watercourse 10 OUT<02:(Pond-1) ======= OUTLFOW STORAGE TABLE ======= OUTFLOW STORAGE OUTFLOW STORAGE (ha.m.) (cms) (cms) (ha.m.) ' ***** .0000E+00 .4600E+00 .000 .490 .2050E+00 .000 .0000E+00 .128 *# Watercourse 10 - Catchment 101A (Pond 10-1) ROUTING RESULTS AREA OPEAK TPEAK (ha) 9.60 (cms) (hrs) (mm) ****** 1.302 INFLOW >01: (102A 12.000 111.598 OUTFLOW<02: (Pond-1) 9.60 .490 12.417 111.597 CALIB STANDHYD (ha)= 16.40 Т Area 01:101A DT= 5.00 PEAK FLOW REDUCTION [Qout/Qin](%)= TIME SHIFT OF PEAK FLOW (min)= Total Imp(%)= 80.00 37.616 Dir. Conn.(%)= 72.00 25.00 IMPERVIOUS PERVIOUS (i) MAXIMUM STORAGE (ha.m.)=.4598E+00 USED Surface Area (ha) =13 12 3 28 Dep. Storage 2.00 5.00 (mm) = Average Slope (%)= .90 .90 40.00 001:0023-----Length (m)= 452.00 .250 Mannings n .013 *#***** Max.eff.Inten.(mm/hr)= 52.60 62.02 ****** over (min) Storage Coeff. (min)= 10.00 20.00 *# Watercourse 10 - Catchment 103C (Pond 10-3) *#****************** 8.43 (ii) 19.28 (ii) Unit Hyd. Tpeak (min)= ****** 10.00 20.00 .12 .06 Unit Hyd. peak (cms)= CALIB STANDHYD *TOTALS* CALIB STANDHYD | 01:103C DT= 5.00 | Area (ha)= 9.30 PEAK FLOW (cms)= 1.72 .50 2.221 (iii) Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 TIME TO PEAK 12.00 12.00 12.000 (hrs)= RUNOFF VOLUME (mm) = TOTAL RAINFALL (mm) = 86.78 123.25 121.25 111.598 IMPERVIOUS PERVIOUS (i) 123.25 123.247 Surface Area (ha)= 7.44 1.86 RUNOFF COEFFICIENT = .98 .70 .905 Dep. Storage (mm) = 2.00 5.00 Average Slope (%)= .70 .70 478.00 40.00 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: Length (m)= .250 $CN^* = 80.0$ Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL Mannings n = .013 52.60 THAN THE STORAGE COEFFICIENT. Max.eff.Inten.(mm/hr)= 62.02 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. 10.00 20.00 over (min) 21.11 (ii) Storage Coeff. (min)= 9.40 (ii) Unit Hyd. Tpeak (min)= _____ 10.00 20.00 Unit Hyd. peak (cms)= .12 .05 001:0020-----*TOTALS* PEAK FLOW .98 .28 1.253 (iii) (cms)= TIME TO PEAK RUNOFF VOLUME (hrs)= 12.00 12.08 86.78 12.000 111.597 ROUTE RESERVOIR Requested routing time step = 5.0 min. (mm) = 121.25 TN>01:(101A TOTAL RAINFALL (mm) = 123.25 123.247 123.25 ======= OUTLFOW STORAGE TABLE RUNOFF COEFFICIENT OUT<02:(Pond-1) _____ = .98 .70 .905 OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: (i) IN TROUBLET DEPENDENT OF TROUBLET .000 .798 .0000E+00 .8040E+00 .208 .3580E+00 .000 .0000E+00 ROUTING RESULTS AREA (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY. OPEAK TPEAK R.V. (ha) (cms) (hrs) (mm) INFLOW >01: (101A 16.40 2.221 12.000 111.598 .797 OUTFLOW<02: (Pond-1) 16.40 12.500 111.597 001:0024-----PEAK FLOW REDUCTION TIME SHIFT OF PEAK FLOW REDUCTION [Qout/Qin](%)= 35 895 _____ (min)= 30.00 MAXIMUM STORAGE USED (ha.m.)=.8039E+00 ROUTE RESERVOIR Requested routing time step = 5.0 min. IN>01:(103C) OUT<02: (Pond-1) OUTLFOW STORAGE TABLE OUTFLOW STORAGE OUTFLOW STORAGE 001:0021-(cms) (ha.m.) (ha.m.) (cms) .000 .489 .0000E+00 4360E+00 *#***** .127 .1950E+00 .000 .0000E+00 ****** *# Watercourse 10 - Catchment 102A (Pond 10-2) ROUTING RESULTS AREA OPEAK TPEAK R.V. (ha) (hrs) (cms) (mm) ****** INFLOW >01: (103C 9.30 1.253 12,000 111.597 OUTFLOW<02: (Pond-1) 9.30 .488 12.417 111.597 CALIB STANDHYD (ha)= 9.60 Area 01:102A DT= 5.00 | REDUCTION [Oout/Oin](%)= Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 PEAK FLOW 38.968 TIME SHIFT OF PEAK FLOW (min)= 25.00 IMPERVIOUS PERVIOUS (i) (ha.m.) = .4357E+00MAXIMUM STORAGE USED Surface Area (ha)= 7.68 1.92 Dep. Storage (mm) = 2.00 5.00 Average Slope (%)= .90 .90 Length (m)= 423.00 40.00 001:0025-----.250 Mannings n .013 *#*********** Max.eff.Inten.(mm/hr)= 52.60 62.02 ****** over (min) 10.00 20.00 *# Storage Coeff. (min)= 8.10 (ii) 18.96 (ii) *# Watercourse 7 Unit Hyd. Tpeak (min)= 10.00 *# 20.00 Unit Hyd. peak (cms)= .13 .06 *TOTALS* *#***** .29 PEAK FLOW (cms)= 1.01 1.302 (iii) ****** 12.00 121.25 TIME TO PEAK (hrs)= 12.00 12.000 RUNOFF VOLUME (mm) = 86.78 111.598 *# Watercourse 7 - Catchment 720AA (Pond 7-2-1) 123.25 123.247 TOTAL RAINFALL (mm) = 123.25 π ***** RUNOFF COEFFICIENT .905 98 70 (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES: (ha)= CALIB STANDHYD Area 10.30 Total Imp(%)= CN* = 80.0 Ia = Dep. Storage (Above) 01:720AA DT= 5.00 80.00 Dir. Conn.(%)= 72.00 (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL

IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 8.24 2.06 Dep. Storage (mm)= 2.00 5.00 Average Slope (%)= .80 .80	PEAK FLOW REDUCTION [Qout/Qin](%)= 49.748 TIME SHIFT OF PEAK FLOW (min)= 10.00 MAXIMUM STORAGE USED (ha.m.)=.2336E+00
Length (m)= 340.00 40.00 Mannings n = .013 .250	
Max.eff.Inten.(mm/hr)= 52.60 62.02	001:0029
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*	*# Watercourse 7 - Catchment 721AA (Pond 7-2-3) *#***********************************
PEAK FLOW (cms)= 1.08 .31 1.398 (iii) TIME TO PEAK (hrs)= 12.00 12.00 12.00 RUNOFF VOLUME (mm)= 121.25 86.78 111.597 TOTAL RAINFALL (mm)= 123.25 123.25 123.247	CALIB STANDHYD Area (ha)= 4.30 01:721AA DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.0
RUNOFF COEFFICIENT = .98 .70 .905	IMPERVIOUS PERVIOUS (i) Surface Area (ha)= 3.44 .86
 (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. 	Dep. Storage (mm) = 2.00 5.00 Average Slope (%) = .30 .30 Length (m) = 213.00 40.00 Mannings n = .013 .250
(III) PERCEDON DOES NOT INCLUDE BREETION IF ANT.	Max.eff.Inten.(mm/hr)= 52.60 61.52 over (min) 5.00 25.00
 D1:0026	Storage Coeff. (min)= 7.46 (ii) 22.61 (ii) Unit Hyd. Tpeak (min)= 5.00 25.00 Unit Hyd. peak (cms)= .17 .05
ROUTE RESERVOIR Requested routing time step = 5.0 min.	*TOTALS* PEAK FLOW (cms)= .45 .12 .574 (ii
IN>01:(720AA) OUT<02:(Pond-7) ======= OUTLFOW STORAGE TABLE ======= OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.)	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
.000 .0000E+00 .182 .2370E+00 .027 .1660E+00 .707 .4890E+00	(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
ROUTING RESULTS AREA QPEAK TPEAK R.V.	CN* = 80.0 Ia = Dep. Storage (Above) (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
(ha) (cms) (hrs) (mm) INFLOW >01: (720AA) 10.30 1.398 12.000 111.597	THAN THE STORAGE COEFFICIENT. (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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	001:0030
MAXIMUM STORAGE USED (ha.m.)=.4894E+00	
	ROUTE RESERVOIR Requested routing time step = 5.0 min.
01:0027	
	OUT<02:(Pond-7) ======= OUTLFOW STORAGE TABLE ====================================
 ****** *****	
***************************************	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.)
¥************************************	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073 .9900E-01
¥************************************	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.
<pre>****** ****** ****** ****************</pre>	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
<pre>#****** # Watercourse 7 - Catchment 720AB (Pond 7-2-2) **********************************</pre>	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:
<pre>******* * Watercourse 7 - Catchment 720AB (Pond 7-2-2) **********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+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 12.000 111.596 OUTFLOW QEAK FLOW REDUCTION [Qout/Qin](%)= 48.864 TIME SHIFT OF PEAK FLOW (min)= 15.00
<pre>#****** # Watercourse 7 - Catchment 720AB (Pond 7-2-2) **********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073 .990E-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 QDUTFLOW REDUCTION [Qout/Qin](%)= 48.864 TIME SHIFT OF PEAK FLOW (min)= 15.00 MAXIMUM STORAGE USED (ha.m.)=.2039E+00
<pre>#****** # Watercourse 7 - Catchment 720AB (Pond 7-2-2) **********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073 .990E+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
<pre># Watercourse 7 - Catchment 720AB (Pond 7-2-2) #****** CALIE STANDHYD Area (ha) = 4.80 01:720B DT = 5.00 Total Imp(%) = 80.00 Dir. Conn.(%) = 72.00</pre>	
<pre>****** ***** ****** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ****** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ****** ***** ***** ***** ***** ***** ****</pre>	
<pre>****** ***** ***** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ****** ***** **** **** **** **** **</pre>	
<pre>#****** # Watercourse 7 - Catchment 720AB (Pond 7-2-2) #****** CALIE 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. 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 RUNOFE VOLUME (mm)= 121.25 </pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0002F00 .073 .990E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>****** ***** ***** ***** CALIB STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ****** ***** **** **** **** **** **</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .9900E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>******* ***** ***** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ****** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ***********************************</pre>	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.
<pre>******* ****** ****** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ***********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .9900E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>************************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .9900E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>************************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .9900E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>******* * Watercourse 7 - Catchment 720AB (Pond 7-2-2) **********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .9900E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>************************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073 .9900E+00 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>************************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073 .9900E+00 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>****** ***** ***** ***** CALIE STANDHYD Area (ha)= 4.80 01:720B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ***** **** **** **** **** **** ****</pre>	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.
<pre>************************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .00008+00 .073 .990E-01 .011 .6900E-01 .281 .2040E+00 ROUTING RESULTS AREA QPEAK TPEAK R.V.
<pre>****** ******************************</pre>	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. INFLOW >01: (721AA) 4.30 .574 12.00 111.597 OUTFLOW<02:
<pre>****** ***** ***** CALLB STANDHYD Area (ha)= 4.80 01:720B DT=5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ***********************************</pre>	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.
<pre>****** ***** ***** ***** CALLE STANDHYD Area (ha)= 4.80 Oli?20B DT= 5.00 Total Imp(%)= 80.00 Dir. Conn.(%)= 72.00 ***********************************</pre>	OUTFLOW STORAGE OUTFLOW STORAGE (cms) (ha.m.) (cms) (ha.m.) .000 .0000E+00 .073<.9900E-01

ROUTE RESERVOIR Requ IN>01:(721AB)	ested routing time	step = 5.0 min	1.
	==== OUTLFOW STOR	AGE TABLE ===	
		OUTFLOW ST	
(c			
	ms) (ha.m.) 000 .0000E+00	.041 .560	DE-01
	006 .3900E-01	.157 .116)E+00
ROUTING RESULTS	AREA QPEAK	TPEAK	R.V.
	(ha) (cms) 2.40 .324	(hrs)	(mm)
OUTFLOW<02: (Pond-G)	2.40 .157	12.167 113	L.595
PEAK FLO	W REDUCTION [Oout	:/Oin](%)= 48	. 396
TIME SHIFT	OF PEAK FLOW	(min) = 10	0.00
MAXIMUM S	TORAGE USED	(ha m) = 11601	Z+00
 01:0033 FINISH			
FINISH			
FINISH ****** WARNINGS / ERRORS / NOTE	 *******************************		
FINISH	 *******************************		
FINISH ****** WARNINGS / ERRORS / NOTE 001:0018 ROUTE RESERVOIR *** WARNING: STORAGE-Q	**************************************)lated.	
FINISH ****** WARNINGS / ERRORS / NOTE 001:0018 ROUTE RESERVOIR *** WARNING: STORAGE-Q	s)lated.	
FINISH WARNINGS / ERRORS / NOTE 001:0018 ROUTE RESERVOIR **** WARNING: STORAGE-Q Increase c	s - values were extrapc urve or use overflc	plated.	
FINISH FINISH WARNINGS / ERRORS / NOTE 001:0018 ROUTE RESERVOIR *** WARNING: STORAGE-Q Increase c 001:0027 CALIE STANDHYD *** WARNING: Storage Co	s - values were extrapc urve or use overflc	plated. w option. r than DT!	

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.

Maintenance	Typical Requirements /Steps	Advantages and
Approach		Disadvantages
1. Private	1. Develop/ adopt program	Reduced costs to the
Owner	documents	municipality
Maintenance	2. Mandatory maintenance plan for	
	site plan approval	Municipality required to
	3. Develop homeowner outreach	undertake steps 3-6
	program and materials	
	4. Develop Inspection Procedures	Policy and By-law revision
	5. Establish tracking system	required. See previous
	6. Compliance enforcement	sections
	procedures	
2. Municipal	1. Collect a detailed inventory of	High costs, extensive staffing
Maintenance	all on-site controls	requirements and
	2. Establish maintenance policies	administrative burden
	3. Mandatory easement	
	requirement for site plan	Avoidance of enforcement
	approval (new development)	issues, and increased control
	4. Train inspectors and approvals staff	over maintenance frequency
	5. Develop tracking system	
	6. Perform and document	
	maintenance activities	
3. Hybrid		Provides maximum flexibility
	Combination of Approaches 1	
	and 2	Ability to shift 'some'
		(typically more frequent)
		maintenance to the landowner.
		(CWP, 2008)

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

(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. <u>Vegetation Communities</u>

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. Other Landscape Components

- 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.

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.2: Veg	etation Comm	nunity Monito	ring 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

Table B.3:	Landscape	Elements	Monitoring	Program

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.

LID Technique	Maintenance Requirements	Notes:
*	Semi- annual inspection	Vary according to use
	• gutters, downspouts and screens	• Irrigation use has low maintenance
Rain Water	• patch mosquito screens	• Indoor use has higher maintenance
Harvesting	• clean first flush system	Winter use may increase maintenance
	replace damaged components	requirements due to freezing
	Regular Maintenance	
	Irrigation (establishment only)	Maintenance is greatest in first 2 yrs of
Green Roofs	Leak detection	operation
	Ongoing Maintenance (2x/yr)	-F
	Weeding / Debris removal	
Downspout	No greater than other lawns or landscaped area	Area should be protected from compaction
Disconnection	No greater than other fawns of fandscaped area	Area should be protected noin compaction
	Regular Maintenance	ensure that the stone fill is level to the ground
Soakaway Pits	• Clean debris and litter	surface and that the filter fabric has not
	• Annual inspection of stone drainage area	become clogged.
	Post Installation (1 st 6 months)	Legally binding agreements required for
	 Inspection after each storm >10mm or min. of 	facilities on private property
	twice	
	• Irrigate until established (weekly for 1 st yr and	Lost plants should be re-planted to maintain
	bi-weekly for 2 nd year; as needed based on	desired plant density
	rainfall)	1 5
Bioretention	Annual	Core aerating or deep tilling may be required
	• Inspect each spring and events >60mm	to alleviate clogging due to fines accumulation
	 Replace mulch as required 	
	Regular	Additional trash and debris removal may be
	Integration into existing landscape	require due to high visibility (Special
	maintenance program (additional training	Bioretention areas)
	required)	
Soil	No greater than other lawns or landscaped area	Area should be protected from compaction
Amendments		
	• Irrigate – 1 st 2 years	
	Mowing operations should avoid compaction	Grass height of 150mm
Eilten Ctuine	whenever possible	
Filter Strips	Remove invasive plants	
	• Mulch in spring to maintain organic matter	
	content where subject to road salts	
	Bi- annually	Heavy vehicles can compact debris into voids
Dommooh1-	Surface sweeping and/or Vacuuming	-
Permeable	Annual	Snow removal plows should be raised 25mm,
Pavement	• Spring inspections to ensure continued	avoid aggregate use
	infiltration performance	
	Municipal maintenance programs standards are well	Mowing operations should avoid compaction
Grass Channels	established.	whenever possible.
		Grass height of 150mm
	Concerns revolve around maintenance of vegetation	
Dry Swales	Post Installation (1 st 6 months)	
~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	• Inspection after each storm >10mm or min of	
	twice	
	Annual inspection of drainage feature	

Table B.4: Maintenance Requirements for Various LID Measures

(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 71 Main Street West, 6th Floor, Hamilton ON L8P 4Y5

Prepared by: **Stantec Consulting Ltd.** Suite 1 – 70 Southgate Drive Guelph, Ontario N1G 4P5

Stantec File 160950433 August 2012

Stantec

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

Table of Contents

1.0	Introduction1
2.0	Current Land Use
3.0	Methods
3.1	Chimney Swift
3.2	Barn Swallow4
3.3	Eastern Meadowlark
3.4	Bobolink6
3.5	Common Species
4.0	Considerations for Species at Risk
4.1	Chimney Swift7
4.2	Barn Swallow7
4.3	Eastern Meadowlark
4.4	Bobolink9
5.0	Results10
5.1	Chimney Swift
5.2	Barn Swallow11
5.3	Eastern Meadowlark
5.4	Bobolink14
5.5	Common Nighthawk
5.6	Common Species
6.0	Discussion19
6.1	Chimney Swift
6.2	Barn Swallow19
6.3	Eastern Meadowlark
6.4	Bobolink
6.5	Common Species
7.0	References

Stantec

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

LIST OF APPENDICES

APPENDIX A: Figures APPENDIX B: Tables APPENDIX C: Field <u>Data Sheets</u> <u>APPENDIX D: Correspondence</u>

LIST OF FIGURES

Appendix A

Figure 1 Stu	idy Area
--------------	----------

- Figure 2 Chimney Swift Survey Locations
- Figure 3 Barn Swallow Survey Locations
- Figure 4 Bobolink and Eastern Meadowlark Survey Locations
- Figure 5 Breeding Bird Survey Locations
- Figure 6 Chimney Swift and Common Nighthawk Sighting Locations
- Figure 7 Barn Swallow Sighting Locations
- Figure 8 Bobolink and Eastern Meadowlark Sighting Locations

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

1.0 Introduction

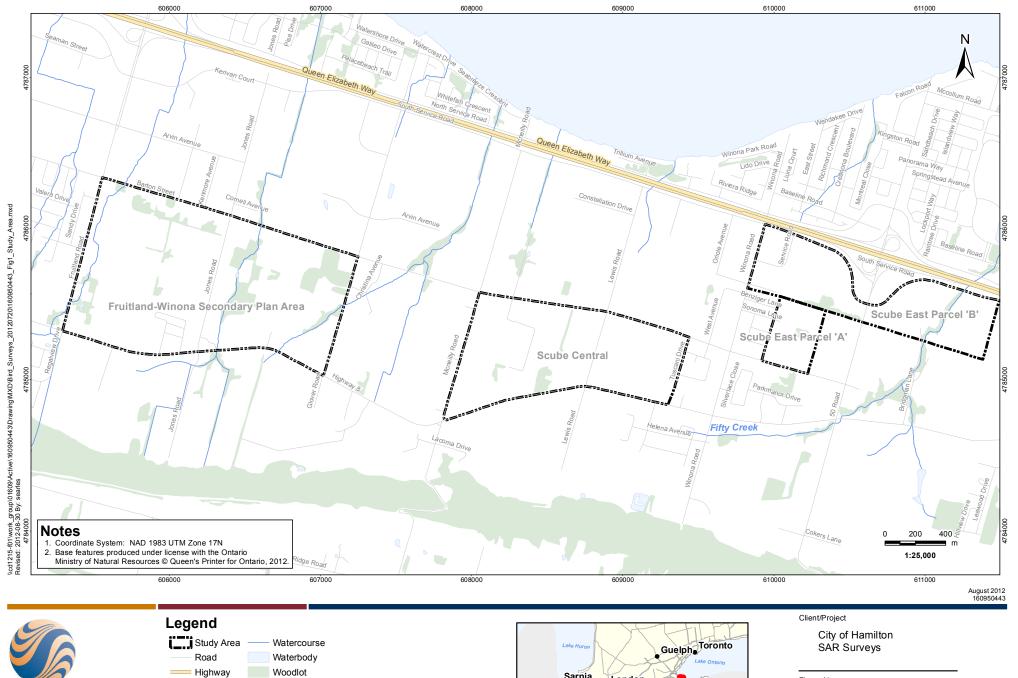
Stantec was retained by the City of Hamilton in 2012 to conduct avian Species at Risk (SAR) surveys and Breeding Bird Surveys within the Fruitland-Winona Secondary Plan Area (hereafter SPA) and the Scube Central, Scube East 'A' and Scube East 'B' parcels (hereafter Scube Parcels). The SPA and Scube Parcels 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.



Lake Huron Sarnia London Study Area Lake Erio



Study Area

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

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

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

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.

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

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.

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

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.

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

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.

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

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.

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

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).

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

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

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

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

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

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.

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

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,

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

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).

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

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).

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

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.

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

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.

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

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.

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

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

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

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 treedominated 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.

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

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 treedominated 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

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

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 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 Whitebreasted 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

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

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

AquaforBeech. 2012.

BirdLife International (2012) Species factsheet: *Accipiter cooperii*. Downloaded from <u>http://www.birdlife.org</u> on 13/08/2012.

Bird Studies Canada. 2009. Chimney Swift (Chaetura pelagica) Monitoring Protocol.

- Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier (eds). 2007. Atlas of the Breeding Birds of Ontario 2001- 2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto. 706 pp.
- Cadman, M.D., P.F.J. Eagles and F.M. Helleiner, 1987. Atlas of the Breeding Birds of Ontario. University of Waterloo Press.
- COSEWIC, 2007. COSEWIC assessment and status report on the Chimney Swift *Chaetura pelagica* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa vi + 49 pp.

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

- COSEWIC, 2010. COSEWIC assessment and status report on the Bobolink Dolichonyx oryzivorus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa vi + 42 pp.
- COSEWIC, 2011a. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa ix + 37 pp.
- COSEWIC, 2011b. COSEWIC assessment and status report on the Eastern Meadowlark Sturnella magna in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa vi + 40 pp.
- COSSARO. 2009. COSSARO classifications from March 24-25 and May 27-29, 2009 assessments reported to the Minister on June 11, 2009.
- COSSARO. 2010. COSSARO Candidate Species at Risk Evaluation Form for Bobolink (Dolichonyx oryzivorus). Committee on the Status of Species at Risk in Ontario.
- COSSARO. 2011a. COSSARO Candidate Species at Risk Evaluation Form for Barn Swallow (Hirundo rustica). Committee on the Status of Species at Risk in Ontario (COSSARO). June, 2011. Final
- COSSARO. 2011b. COSSARO Candidate Species at Risk Evaluation Form for Eastern Meadowlark (Sturnella magna). Committee on the Status of Species at Risk in Ontario (COSSARO). June, 2011. Final
- McCracken, J. 2005. Where the Bobolinks Roam: The Plight of North America's Grassland Birds. Tropical Conservancy 6: 20-29.

McCracken, J. 2008. Are Aerial Insectivores Being 'Bugged Out'? Bird Watch Canada. 42:4-7.

- Nebel, S., A. Mills, J. D. McCracken, and P. D. Taylor. 2010. Declines of aerial insectivores in North America follow a geographic gradient. Avian Conservation and Ecology - Écologie et conservation des oiseaux 5(2): 1. [online] URL: http://www.ace-eco.org/vol5/iss2/art1/
- North American Bird Conservation Initiative Canada. 2012. The State of Canada's Birds, 2012. Environment Canada, Ottawa, Canada. 36 pages.
- Ontario Ministry of Natural Resources (MNR). 2000. Significant Wildlife Habitat Technical Manual.
- Ontario Ministry of Natural Resources (MNR). 2007. Endangered Species Act. Available online at:

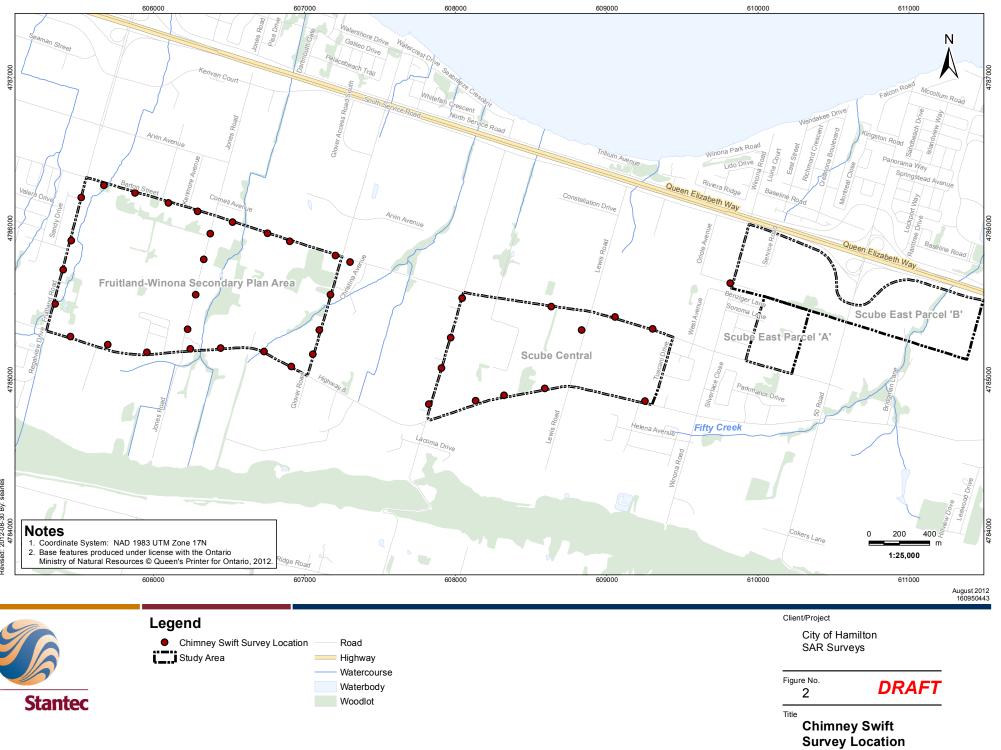
http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm#BK0.

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

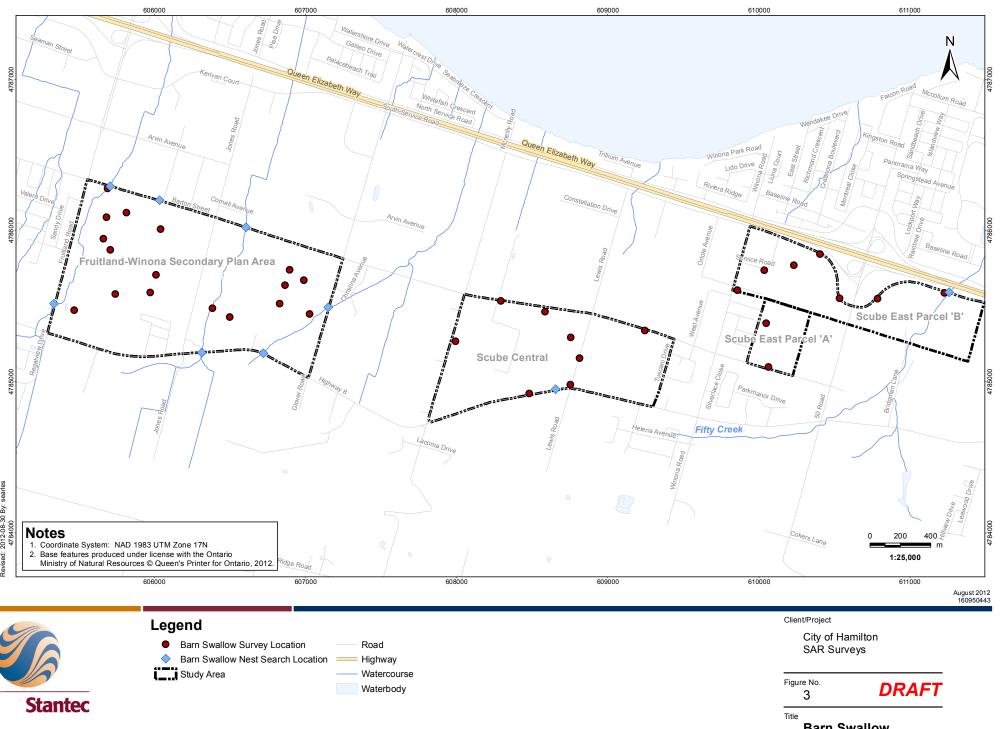
- Ontario Ministry of Natural Resources (MNR). 2008. Habitat protection for endangered, threatened and extirpated species under the Endangered Species Act, 2007.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 <u>USGS Patuxent Wildlife Research Center</u>, Laurel, MD

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

APPENDIX A: Figures

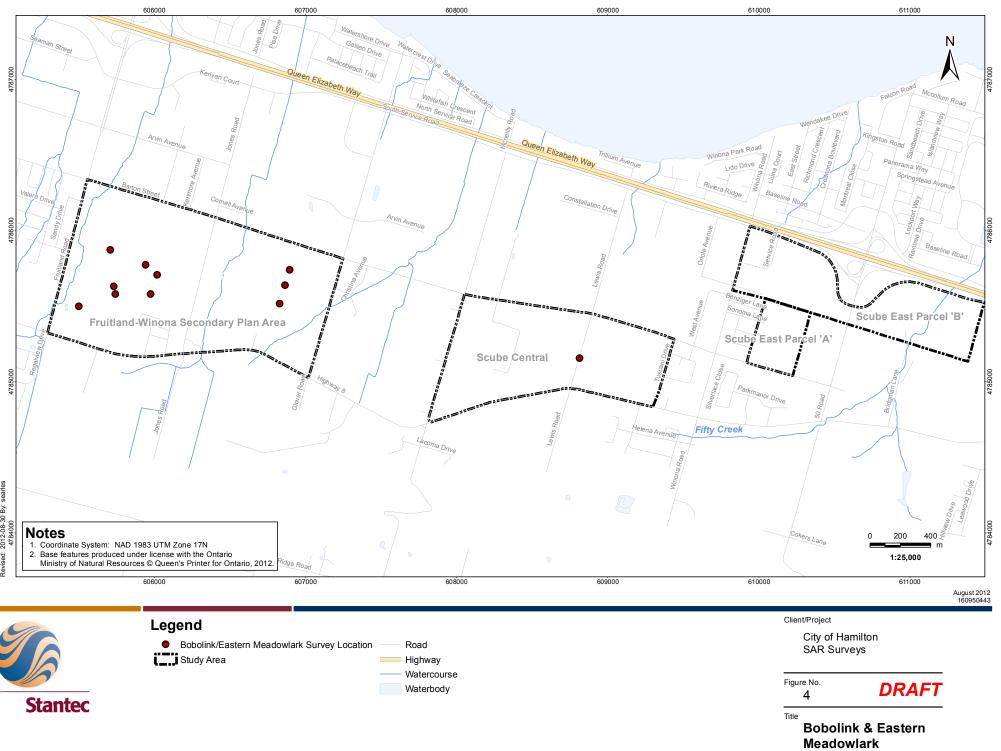


Ncd1216-D11 work, group/01609/Active/160950443/Drawing/MXD/Brd_Surveys_20120720/160950443_Fig2_CHSW_Location.mxd Revised: 2012-06-30 By: searles

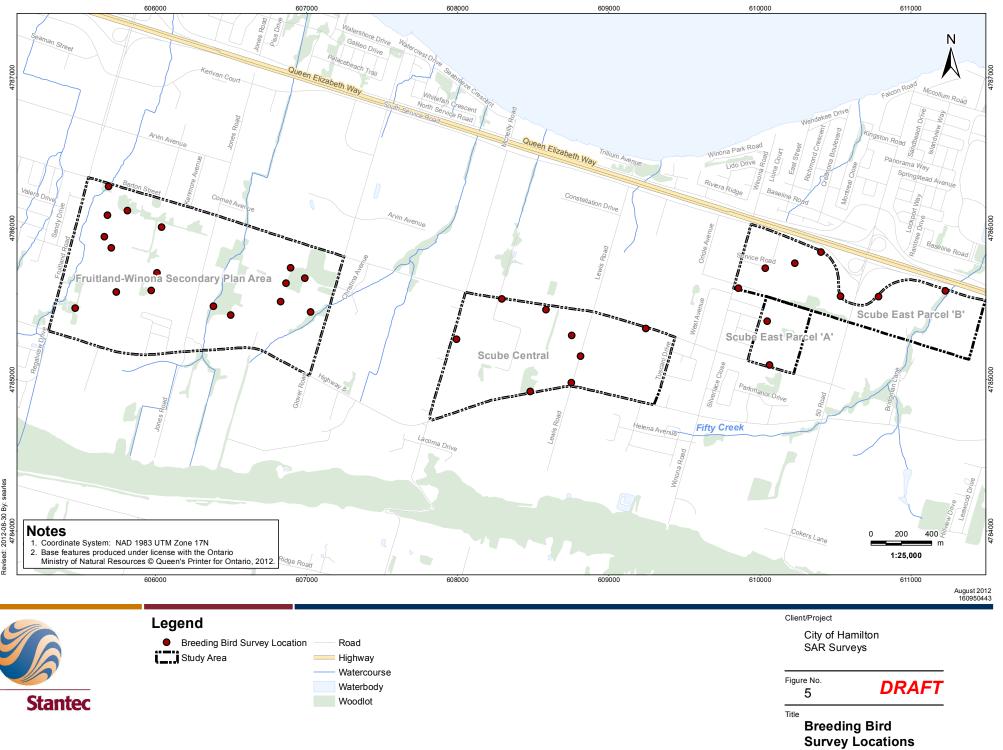


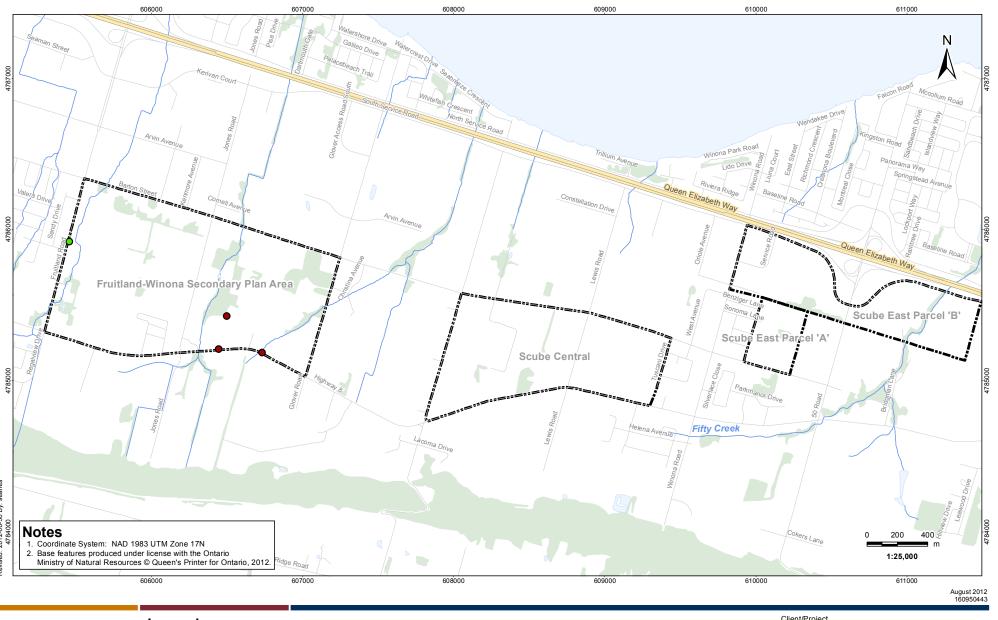
Ncd1215-011work_group/01609/Active/160950443/Drawing/MXD/Bird_Surveys_201207201160950443_Fig3_BARS_Location.mxd Revised: 2012-08-30 By: searles

> Barn Swallow Survey Location

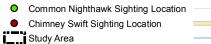


Survey Location









Road

Woodlot

Highway

Watercourse

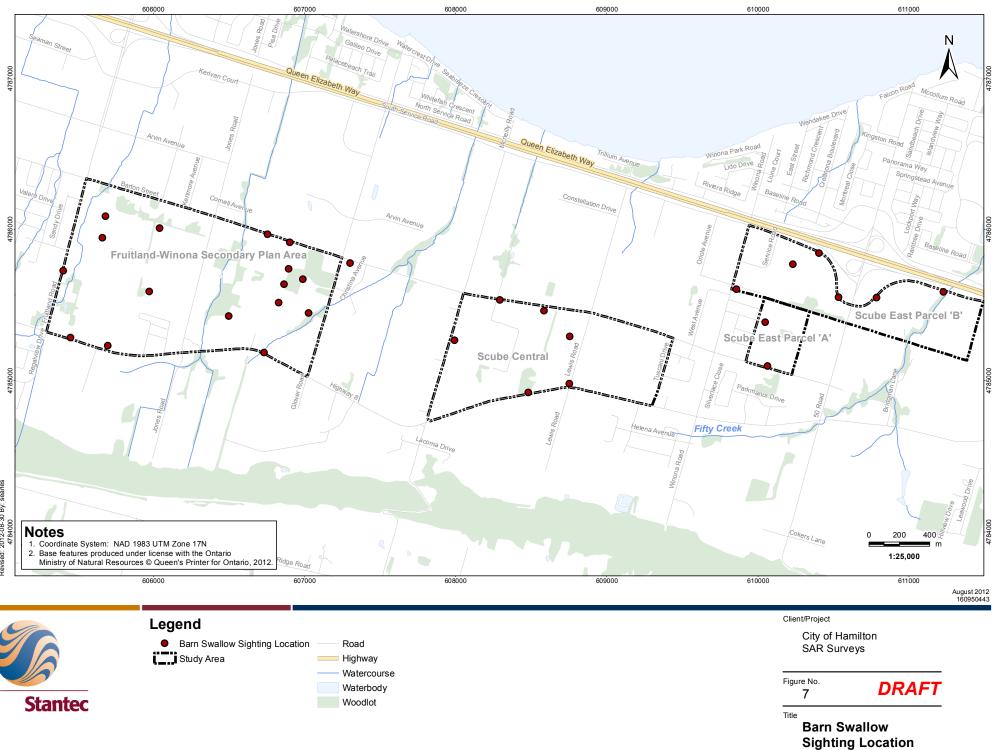
Waterbody

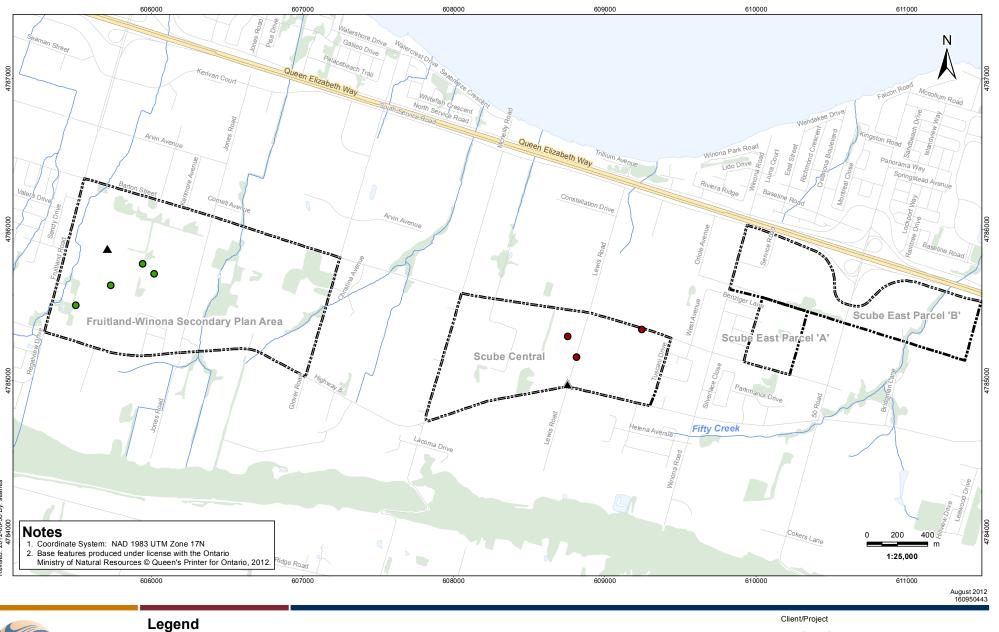
Client/Project

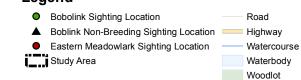
City of Hamilton SAR Surveys



Title Chimney Swift & Common Nighthawk Sighting Location







City of Hamilton SAR Surveys



Bobolink & Eastern Meadowlark Sighting Location

Stantec

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

APPENDIX B: Tables

One Team. Infinite Solutions. Project No. 160950443

Stantec 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

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		

Stantec 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

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	lcterus 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

Stantec 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

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

Stantec 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

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		

Stantec 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

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		1
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'.

Stantec 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

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

Stantec

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

APPENDIX C: Data Sheets

Stanter	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_16 Date: Jone 2		Project Name: Frentland - Winara Field Personnel: Nicole Kopysch.					
Weather Condition	s: Temp: Wind: $16 - 20^{\circ}$ C 2-3	Cloud: PPT: PPT in last 24 hrs:					

Survey	Time	GPS	# BARS	Type of	Accessible		
Station		Coordinates	observed	structure (e.g.	nesting sites	Ne	
10				barn, culvert)	(Y or N)	Active	Inactive
4	619-624		22	N.A.	Foragna	ONLO	
10	811-814		2	NAC	torocine.	anti	
9.	830-835		1	N.A.	Foragina	only	
14	937-94		8	N.A.	toracina	only	
15	945_950		8.	N-A.	Foração	only	
13	930 -935		8	N.A.	Foran		
17	10.4-1007		2	N.A.	Foracine	all	
			/))		
							· · · · ·
		<u> </u>				. =	
1							
	,						
	-						

Quality Control: This form is complete (___) & legible (__). Signature:

Signature: _

Stanter	Stantec Consulting Ltd. 70-1 Southgate Drive Guelph, Ontario, Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493			Swallow vation For		
Project Number 6095 Date: JUNC 12			Name: <u>Há</u> rsonnel: <u>N</u>	. Kopp	jh	
´	Temp: Wind: 3	Cloud:		PT:	PPT in las	12
Station of BARS observ Tally of BARS:	raging habitat and location s) or provide details on air sy of BARS observation within 200m) bodies (e.g. river, pond) foraging	Start Time: C	16:30 En tratial contract of son trace s Store Ba Index Aust field Aust field	iton Inort		N

Description of Potent	ial Nesting Structures	8:				
Structure # (indicate	Type of structure	Accessible		Number of r	nests present	
location on map)	(e.g. barn, culvert)	nesting sites (Y)	BA	RS	CL	.IS
		or N)	Active	Inactive	Active	Inactive
41	barn/shed.	open windows =	unkn	own - no	alless	
-		corred with	to	observe		
		mesh.	d			
	1	th front=	\mathcal{V}	BARS	seen	
	(D- open doorway.	ent	ing lex en in u oraging	iting	
		uer -	1 see	en mu	icenty	
		/	f	oragin	f. O	
Ouality Control:	This form is complete ()& I	legible ().				
Signature: 🖊	1 pc	Signature	:			
·	(Field Personnel)	-		(Project Manager)		
			RE	EV: June-09	FORM 03	34

Stantec	Stantec Consul 70-1 Southgate Guelph, Ontaric N1G 4P5 Tel: (519) 836- Fax: (519) 836-	Drive o, Canada 6050	Barn Swallow Observation Form					
Project Number 160950443			_ Project Name	Project Name: Fru, Hand - Winona				
Date: June	11,2012		Field Personnel: M. Oliveira					
Weather Condition	s: Temp: 17°C	Wind:	Cloud:	PPT:	PPT in last 24 hrs:			

	Survey	Time	GPS	# BARS	Type of	Accessible		
	Station		Coordinates	observed	structure (e.g.	nesting sites		ests
					barn, culvert)	(Y or N)	Active	Inactive
lwy 8	1	10"-10'5	606318,4785211		Concrete box	No.		None.
ſ		1023-1028			Concrete box cube	No No		Nore
		1035-1040	607/53 47854		Excrete box cul	ont No		None
		1043-1048	666608, 47860	30	Pipe culvert	No		None
		1055-1103	606002,47862	11 0	No colort	present No		None
		1107-114	608693, 47867		P.pe/concreter	shert No		None
		1/58-1123	68331 47854	84 🔿 👘	Two concrete	No		None
					pipes woning			
					porallel with			
					Fruitland Rd.			
					Not suitable			
					for nesting			
-								
					1			
	THE MARKET PARTY							

Quality Control: This form is complete (__) & legible (__). Signature:

Signature:

Stantec	Stantec Consult 70-1 Southgate Guelph, Ontario N1G 4P5 Tel: (519) 836-6 Fax: (519) 836-6	Drive , Canada 050	Barn Swallow Observation Form				
Project Number 16	3	Project Name: Frontland - Whona					
Date: June	-11, 2012		Field Personnel: Michael Olive; ra				
Weather Condition	s: Temp:	Wind:	Cloud:	PPT:	PPT in last 24 hrs:		

Survey	Time	GPS	# BARS	Type of	Accessible		
Station		Coordinates	observed	structure (e.g.	nesting sites	Ne	ests
				barn, culvert)	(Y or N)	Active	Inactive
D	913-918	606801 4785428	5	N.A.	Foraging	only	
					33	/	
							<u></u>
	-						
						-	
				5			

Quality Control: This form is complete (__) & legible (__). Signature:

Signature:

Stanter	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 6	0950443	Project Name: Frutland-	Winona				
Date: Ju	1410, 2012	Field Personnel: D-Gra	han				
Weather Conditions	s: Temp: Wind: 17-2半く 1	Cloud: PPT: 170 Nore	PPT in last 24 hrs:				

Survey	Time	GPS	# BARS	Type of	Accessible		
Station		Coordinates	observed	structure (e.g.	nesting sites		ests
		CITE		barn, culvert)	(Y or N)	Active	Inactive
	530,535	605 643 4785945	61	N.A.	Foragina	entr	
2	540-545	605685,4786087		N.A.	Faraning	on le	01
4	65-620	606042, 4786009	, í	N.A.	Faraging		
10	834-839	606501, 4785\$2	8 6	N.A.	Farable	ant.	
13	925-930	606896,4785741		N.A.	Forague	DI	
14	935-940	606866, 4785338	1	N.A.	Forder c	216	
15	945 950	66832, 478551	s/	N.A.	Foracha	Inty	
16	1005-100	66692 418557	/ /	N.A.	Foragae	anh	
17	1015-1020	607028,47851	48 /	N.A.	Farance	ask.	
		1.			05	17	
					·		
		1					
							1.
	n.						
				· · · · ·			
	,						,

Quality Control: This form is complete (__) & legible (__). Signature:

Signature:

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	0950443	Project Name: Fruitland - Winong
Date: Juy	12,2012	Field Personnel: D. Grahan
Weather Conditions	E Temp: C Wind:	Cloud: PPT: PPT in last 24 hrs: None None

]	Survey	Time	GPS	# BARS	Type of	Accessible			
	Station		Coordinates	observed	structure (e.g.	nesting sites	Ne	ests	
					barn, culvert)	(Y or N)	Active	Inactive	
Hur8		1235	606325	0	Box colvert	N 78. F	tor nes	53 veget	ation obstruct
Hwy8	<u>a</u>	12 45	606983072	0	Corrugated steelert	N-too small	no ledg	s, vor or	structs
Jores	3	1300	607 6785 495	0	Box culvert.	N- no ledges	s ver a	obstructs	
Porton	4	1310	6066 97 86030	0	Consigned steel	N - too small	yno Irde	es, veg.	churkeds
porto	r <u>5</u>	1325	605990 4786219	Ô	unable to find .	my structure	is under	CONTSC	
Booto	n 6	13 35	6056986313	D	Bacculiert	N. no leda	es, von	obstr	uets
Frudla	27	13*	605357 478553	0	Box cubert	N - 120		10	
1.								2	
1									
[
Ĩ									
ľ				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					
-									
ŀ									
ſ									Ĥ
1									
ľ									
8									
F									
-									
ŀ									
L			1]				

Quality Control: This form is complete (__) & legible (__). Signature: ________________(Field Personnel)

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: Juhe 2	5,2012 05:30	- 1040 Field Personnel: N.KOPYSH
Weather Conditi	ons: Temp: Wind:	-3 Cloud: PPT: PPT in last 24 hrs:

Survey	Time	GPS	#BARS	Type of	Accessible		
Station		Coordinates	observed ad	structure (e.g.	nesting sites		sts
BARSH	Arr. 77-	1.001	LIN CUIVUI	barn, culvert)	(Y or N)	Active	Inactive
6	05:30	0605692/	p	sml, roundculue	N	Q.	
		4786278	1			- 1	
		CIDE DA.					
3	10:11	Glacied.	Shat Q	sml, md. autum	EN.	X	
a	10:32	HW48 HW48	0		N	EX.	
	10:34	141118	d		N	8	
	10.01	HUGYO	<u>P</u>				
(1	(0127	Br. Al	8	see rol			
7	(0:37	Barton-		Sec IV 1			
5.	10:40	Banou	0.		N	Ø,	
				· · · · · · · · · · · · · · · · · · ·			

Quality Control: This form is complete (_) & legible(_). Signature: ______(Field Personnel)

Signature:

						E	BS	
Star	ntec	Stantec Co 1 – 70 Sout Guelph, ON Canada N Tel: (519) 8 Fax: (519) 8	thgate Drive 1 1G 4P5 336-6050			_	Point Cour servation I	-
	ct Number	609	5040	?		Project Name: 4	tamilton	
		- QUI				Field Personnel:	N. KOP	154
		June	10,0	2012		-	N. DOP	7511
Neather Co	nditions:	TEMP	°(°C):) ° (1	ND: - 2	CLOUD: 100%	PPT:	PPT (in last 24 hrs): Vain ducin ig
Station	3BS -	-5mir	np(in mundal	UTM:	
Station Start Time	: 12 : 06:.0	00		Featur - End Tim	re: <u>r ipar</u> ne: <u>00</u> Pasture / 00	ian covridor 05	UTM:	
Station Start Time Habitat	: 12 : 06:.0	00		Featur - End Tim	ne: 00	.05		
Station Start Time Habitat	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim - / OHay / OI	ne: 00 Pasture / 0Ci	.05	UTM:	
Station Start Time Habitat	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim - / OHay / OI	ne: 00 Pasture / 0Ci	- <u>05</u>	S	
Station Start Time Habitat Species AMGDI EUSP HOWR	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim - / OHay / OI	ne: 00 Pasture / 0Ci	- <u>05</u>		
Station Start Time Habitat pecies AMGD EUSP HOWR AMAD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim - / OHay / OI	ne: 00 Pasture / 0Ci	- <u>05</u>	5 n60	nRO
Station Start Time Habitat pecies AMGD EUSP HOWR AMRD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim - / OHay / OI	ne: 00 Pasture / 0Ci	op P	5 n60 4/	nRO
Station Start Time Habitat pecies AMGD EUSP HOWR AMRD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim / OHay / OI	ne: 00 Pasture / 0Ci	op P	5 n60	nizo
Station Start Time Habitat Species AMGDI EUSP HOWR	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim / OHay / OI	ne: 00 Pasture / 0Ci	op P	5 n60 4/	ngo 50 100
Station Start Time Habitat Species AMGD EUSP HOWR AMAD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim / OHay / OI	ne: 00 Pasture / 0Ci	op P	S n6D A	
Station Start Time Habitat Species AMGD EUSP HOWR AMRD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim / OHay / OI	ne: 00 Pasture / 0Ci	op P	S nGD AI NOCA EUST	50 100
Station Start Time Habitat Species AMGD EUSP HOWR AMRD	: 12 : <u>06'.C</u> : DForest) () () □Swamp	/ OMarsh	Featur End Tim / OHay / OI	ne: 00 Pasture / 0Ci	op P	S n6D A	50 100

Page _____ of _____

Signature:

(Field Personnel)

Quality Control: This form is complete $\hfill \Box$ & legible $\hfill \Box$.

Signature:

(Project Manager) REV: 2011-05-04 / FORM 020

als w:/vesource/internal info and teams/field forms/birds/breading bird/form_020_bird-point-counts-survey_2-sided, docx

Station	: 13	No.	1.56M	Featu		(78574) UTM:
Start Time	: 06	30	PO RAY	End Tim	ie: 0(0'	35
Habitat		t / OSwamp	/ 🗆 Marsh			
pecies	<50m	50-100m	>100m	Flyovers	Height*	(FOD) E!
TKES		sczilal, s		4		
MODO				2		BHCO RB44
SDSP					NR -	Brice
SANS	1	لارتس _	Ľ			
						n restrict soco
						ROD RESKUL SOSP ROD SAUS 50 100
			_			SO SOSP
						50 100
						The saus of the
			·····			$+$ \setminus $/$ $/$ $/$
		vary from project				
Start Time	00	50		End Tim	O	+:01 UTM: 177 0606866 478363
Habitat	: QForest	1 □Swamp	/ QMarsh /	/ 🗆 Hay / 🖵 F	Pasture / 🔾	Crop Crop Present penched se on woodland event) E prior to point count, E
ecies	<50m	50-100m	>100m	Flyovers	Height*	present per chevise
Amcri						NA WOOdlant Count) E
CRII		1				prior to point
amto	1					
SOSP						
						FOD AMOR REVI
SANS						1411100
BHCO						
						Amho Amho
						50 SOSP 100
					<i>4</i>	50 100
						and
						open bille Saus
eight of blad	e sweep will	vary from projec	ct to project; c	heck with prole	ct manager.	the lo
On ground; A	-Below heigh	nt of blade sweet	ep; B-At heigh	t of blade swee	ρ;	
						
						Quality Control: This form is complete 🗖 & legible 📮
ge of _ Signate			Field Perso			Quality Control: This form is complete 3 & legible 3 .

(Field Personnel)

(Project Manager) REV: 2011-05-04 / FORM 020

1

Sec. 1. 1

UTM: 177 0606832 4785515 5 Station: Feature: **Start Time:** 07:20. End Time: Habitat: OForest / OSwamp / OMarsh / OHay / OPasture / OCrop <50m Species 50-100m >100m Flyovers Height* 2 JENA SWT 2 R86U RWBL 2 ALPI í YEWA BADY ALEL RIVER PRLI SACD. EN4 RWB ANS BAD 100 SOSP RWB SAVS open ALLO SAVS * 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 Community UTM: 0606992-4785671 Station: Feature: 10 contre. Start Time: 40 End Time: 07:45 Habitat: @Forest/ OSwamp / OMarsh / OHay / OPasture / OCrop Jown **<50m** 50-100m Species >100m Flyovers Height* 2AI BIJA FOD BHA BUDA REVI. NOCA AMAK ALOCA. щO 50 100 sune whaminity AMCK * 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 RE Page _ of _ 2 Quality Control: This form is complete . & legible . Signature: Signature: (Field Personnel) (Project Manager)

1512

REV: 2011-05-04 / FORM 020

										TT
Statio	n: [-	7 - 00	mmur	Featu	re:			UT		607
Start Tim	e: 03	1:50		End Tin		:55 .			M: 00	RSY
		t/ Swamp	/ DMarsh		07		Ailes II.		72	J 1-
	<50m	<u>bh.</u> 50-100m	>100m	Electron	Height*					1
Species NOCA.	<90m	50-100m	~100m	Flyovers	neight"				9	1
AMRO	1							-	-	
GREA	1			-		FOP.	/			
RUN	1	1	1	1		401	/	NAUI		Ami
(DGR.	1						/	_	-	
HALL		1				/	JOCA .	/		1
anti	andrane	1962		a.		1	Jue	/	6	RECA
min		1					Am	KD	19	in T
										-+
							1	\		1
			1.59	1		(autiple)				las
										I.V.
						frees)	- 1. 1. 1. K	GKC	0	100
-						frees (GHE	0	not
		vary from proje				frees (BAR	An	and the
O-On ground;	A-Below heig	Vary from proje tht of blade swe eep; D-Well abo	ep; B-At heigh	nt of blade swee		frees (6me	A	to
D-On ground; C-Above heigh	A-Below heig t of blade sw	ht of blade swe	ep; B-At heigh	nt of blade swee blade sweep	ep;	frees (to
0-On ground; C-Above heigh Station	A-Below heig t of blade sw	ht of blade swe	ep; B-At heigh	nt of blade sweep blade sweep Featur	ne:	frees (6th	0 / A*	to
O-On ground; C-Above heigh Station Start Time	A-Below heig It of blade sw	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur End Tim	ne:	trees !			0 FM:	to
O-On ground; C-Above heigh Station Start Time	A-Below heig It of blade sw	ht of blade swe	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur End Tim	ne:	trees !			0 (h) (m)	to
O-On ground; C-Above heigh Station Start Time	A-Below heig It of blade sw	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur End Tim	ne:	trees !		6th	0 A ¹ IM:	T
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J UT		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		JUL DE		The last
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J J		The last
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		JUT UT		The line
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J UT		The line
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		5 the state of the		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J J		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		5 the state of the		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		5th		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !		J J UT		
D-On ground; C-Above heigh Station Start Time Habita	A-Below heig t of blade sw 1: 	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	nt of blade sweep blade sweep Featur - End Tim - / OHay / Of	ne: Pasture / 🗆 (trees !				

Signature:

(Field Personnel)

Page ____ of _

Signature:

Quality Control: This form is complete 📮 & legible 📮.

Stantec	Stantec Co 1 – 70 Sout Guelph, ON Canada N Tel: (519) 8 Fax: (519) 8	thgate Drive 1 1 G 4P5 136-6050				ng Point Count Observation F	
Project Number	: 160	950	443		Project Na	me: Fruitland-U	the Sand
Date		EII	2012		Field Person	nel: Plan theo	MICHAEL
		-				"the Giroulaa	- OLUEIN
leather Conditions:	1	°(°С): 7°С		IND: O	CLOUD: 20 %	PPT:	PPT (in last 24 hrs):
GPS #	: T (PEC	esonal.				N GOCSX)	
Start Time:	: 26		- End Tin			SUCCESSION	4185745
Habitat: EFores		/ 🗆 Marsh	_				
pecies <50m	50-100m	>100m	Flyovers	Height*		N	¥1.50
IWAR 1					1		FISP
ISP		1		68	in	SPRUCE FURTH TATION	
				61		FIEUD EDGE	AR 50 100

Page of Signature:	na al		rm is complete 🗖 & legible 🗐.
Signature.	(Field Personnel)	Signature:	(Project Manager) REV: 2011-05-04 / F

dsg g:/resource/internal info and teams/field forms/birds/breeding bird/form_020_bird-point-counts-survey_2-sided.docx

Station:		A/		– Featu				£ (* 0.0		
Start Time:		0541		End Tin	ne:	05:	4.6	/EARYUTM: SUCCESS	lonk	
Habitat:		t / 🛛 Swamp) / 🗆 Marsh	/ 🛛 Hay / 🔾 I	Pasture / 🖸					
Species	<50m	50-100m	>100m	Flyovers	Height*]		Г	N	
EAKI								L		
Amro	1									
Amgo		2								
SOSP	1									
FISP									+ -	$\langle \rangle$
							1.65	o sosi	,	
							AMGC			FISP
						-		1.0080		1
								AMRO	•	50 1
								EA	KI	/
						1			* ~ 1	
						1				AMGO /
						1				
-On ground; A-E	Below heigh f blade swe	nt of blade swe	ct to project; c ep; B-At heigh ove height of t	nt of blade swee	e: (000	5:55		Arun UTM: Succession		0605817
On ground; A-E -Above height of Station: 	Below heigh f blade swe 3	nt of blade swe ep; D-Well abo	ep; B-At heigh	nt of blade sweep blade sweep Featur	e: 0:	5:55				0605817 1786(18
On ground; A-E -Above height of Station: Start Time: Habitat: (pecies	Below heigh f blade swe 3	nt of blade swe ep; D-Well abo	ep; B-At heigh	nt of blade sweep Plade sweep Featur End Tim	e: 0:	5:55				0605817
Station: Station: Start Time: Habitat: (Pecies	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55				0605817
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		Srcersslo		2605817 1786118
Station: Station: Start Time: Habitat: (Pecies	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55				2605817 1786118
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		Srcersslo		2605817 1786118
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		Srcersslo	2	mag
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN		mag
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		Srcersslo	2	mag
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN	2	ATT A
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN	2	ATTER A
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN	2	50 1
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN	2	ATT A
Station: Station: Start Time: Habitat: FISP GRCA	Below heigh f blade swe 3 05 DForest	nt of blade swe ep; D-Well abo : 50 / QSwamp	ep; B-At heigh ove height of b	Featur End Tim	e: <u>()</u> e: <u>)</u> e: <u>)</u> asture / D	5:55		SICURSIO DOVEN	2	50 1
Hon ground; A-E -Above height of Station: Start Time: Habitat: I pecies FISP GRCA SWSP Height of blade s	Below heigh f blade swe 3 05 27 Forest 50m 1	ary from project	<pre>ep; B-At heigh vve height of b /</pre>	rt of blade sweep	e: 0: e: 0: Pasture / 0 Height*	5:55		SICURSIO DOVEN	2	50 1
Station: Station: Start Time: Habitat: I Pecies FISP GRCA SWSP	3elow height f blade swe 3 05 2Forest 50m 1 1	ary from project	<pre>p; B-At heigh we height of b / CIMarsh / >100m</pre>	Featur Featur End Tim / DHay / DP Flyovers	e: 0: e: 0: Pasture / 0 Height*	5:55		SICLEBUSIO SOUTION FISP	2	50 1 FISP

(Field Personnel)

Signature:

06:04 est / ISwamp 50-100m 1 1 2 2	/ 🗆 Marsh >100m	End Tin / □Hay / □1 Flyovers	ne: 0(5. AMRO	UTM: V7 T OGOU 4786
est / 🗅 Swamp			Pasture / 🛛	STOR AMRO	POSP RWBI
	>100m	Flyovers	Height*	5. AMRO	POSP RWBI
				5. AMRO	POSP RWBI
				5. AMRO	RWBI
2				5. AMRO	RWBI
2				5. AMRO	
				R	51
				R	51
				R	• 51
				R	• 5(
					• 5i
				5 . 1	1
					CIELD /
				F 3 A	ARLEY FIELD
					\sim
	/ QMarsh /	-			
			3		
	1		B		\mathbb{N}^{J}
2				GR	CA
	1				
					SOSP
					RWBY
	20 196				- 50
					RWBL50
					/
				\backslash	
					_
ight of blade swee	p: 8-At heigh	t of blade swee	ct manager. p;		SOSP
weep: D-Well abov	ve height of bi	ade sweep			
	S0-100m	ØG : [7] est / □Swamp / □Marsh 50-100m 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2<	06:17 End Time est / □Swamp / □Marsh / ☑Hay / □F 50-100m >100m 2 1 1 1 2 1 1 1 2 1 1 1	OG: 17 End Time: C est / □Swamp / □Marsh / ☑Hay / □Pasture / □ □ □ 50-100m >100m Flyovers Height* 1 1 □ 2 1 □ 1 □ □ 1 □ □ 2 1 □ 1 □ □	Ofen Prizedy 06:17 End Time: 06:22 est / DSwamp / DMarsh / DHay / DPasture / DCrop 6.6 50-100m >100m Flyovers 1 1 6.7 2 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 6.7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

3

(Field Personnel)

Signature:

	on:	2		Featu	re: HAr	(FIELD) UTM: 17T 060 5709 478 5872
Start Tin	ne: ()(6:54		End Tin		DG: S9
Habit		st / OSwamp	/ 🗆 Marsh	/ 100 Hay / 0		
Species	<50m	50-100m	>100m	Flyovers	Height*	S YWAR
YWAR	· · ·					SOSP
SOSP			1	<u> </u>		
RWBL		2		<u> </u>		BOBO RWBL
BOBO						Poor
					ļ	Yun
						RWBL 50
						RWBL 50
						RWEL
						Km.
						\backslash
Height of bla	de sweep will	vary from proje	ct to project; o	check with proje	ct manager.	SOSP
		eep; D-Well abo			- (P-)	000
Statio				E A		11TH. 17T 0605472
		./		- Featur	000	010T UTM: 4785472
Start Tim	<u>. 07</u>	:22		End Tim	e: 07:	:27
Habita	t: @Forest	t / 🛛 Swamp	/ DMarsh	/ 🖸 Hay / 🖬 F	Pasture / C	rop
pecies	<50m	50-100m	>100m	Flyovers	Height*	
AMGO						N
RW8L						
					1	
OGR	1					
and a second of the second	1		*****			RWBL
SOSP			****			AMGO RWBL
iosp Ioca			*****			AMGO RWBL
Josp Noca						Arman
iogr josp Noca Imro						AMGO COGR 50
josp Noca						AMGO COGR SO
josp Noca						AMGO COGR 50
Josp Joca						AMGO COGR SO
iosp Ioca						AmRo COGR SO
josp Noca						AmRo COGR SO
josp Joca Imro						AMGO COGR SO
SoSP JOCA IMRO IMRO	A-Below heigh	vary from project	p; B-At heigh	t of blade swee		AmRo COGR SO
IOCA	A-Below heigh		p; B-At heigh	t of blade swee		AmRo COGR SO
In the second se	A-Below heigt t of blade swe	nt of blade swee	p; B-At heigh	t of blade swee		AmRo COGR SO
IOCA	A-Below heigt t of blade swe	nt of blade swee	p; B-At heigh	t of blade swee	p;	AmRo COGR SO

(Field Personnel)

(Project Manager)

Station	1:	8			re: CASOFTEL				4785580
Start Time	»: 08	3:08		End Tin		1			
Habita			/ DMarsh	/ 🛛 Hay / 🔾	Pasture / Cro	р			
Species	<50m	50-100m	>100m	Flyovers	Height*			N	
NOCA			1						
8080							/		No(
RUBL.		-							
COYE	- 1						BOBO		
RUBL		2					NBL		
AMO	1					/ K ^U	A	mao	
						COME			
							(COYE
						_		•	50
						RUBL	\backslash		/
						\			1-
						\backslash			
									1
-On ground; A	A-Below heig t of blade sw	vary from proje ht of blade swe eep; D-Well abo	ep; B-At heigh	nt of blade swee	ep;	CAUR / ETE, 0		JTM: 17T	1 060 ser74
D-On ground; A C-Above height Station Start Time	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo	ep; B-At heig) ove height of t	nt of blade sweep blade sweep Featur End Tim	ne: <u>Molst S</u> ne: <u>08</u> :		-	JTM: 17-7	060 5974 4785591
D-On ground; A C-Above height Station Start Time Habitat	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	35	-	JTM: 17-7	6
D-On ground; A C-Above height Station Start Time Habitat	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo	ep; B-At heig) ove height of t	nt of blade sweep blade sweep Featur End Tim	ne: <u>Molst S</u> ne: <u>08</u> :	35	U	JTM: 17T	6
Station Station Start Time Habitat	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	35			6
Station Station Start Time Habitat Species FISP RWBL	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	35		S	605974 4785591
Station Station Start Time Habitat Species ASP KUBL SOSP	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	~		605974 4785591
Station Station Start Time Habitat Species PISP RUBL SOSP YURAR	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	~	S	1060 59774 47785591
Station Station Start Time Habitat Species ASP KUBL SOSP YUAR AMRO	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	JBL	S	605974 4785591
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	JBL	S	1060 59774 47785591
Station Station Start Time Habitat Species ASP KUBL SOSP YUAR AMRO	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	JBL	S	1060 59774 47785591
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Moist S</u> re: <u>0&:</u> Pasture / DCrop	FISP	JBL	S	AR AMIRO BR
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Mils7</u> Ie: <u>08</u> : Pasture / DCrop	FISP	JBL	S	60 59774 47285591 4R AMTRO
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Mils7</u> Ie: <u>08</u> : Pasture / DCrop	FISP	JBL	S	AR AMIRO BR
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Mils7</u> Ie: <u>08</u> : Pasture / DCrop	FISP	JBL	S	AR AMIRO BR
Station Station Start Time Habitat Species PISP RWBL SOSP YWAR AMRO BRTH	A-Below heig t of blade sw : : : : : : : : : : : : : : : : : : :	ht of blade swe eep; D-Well abo 2 50-100m	ep; B-At heigh ove height of t	Featur - End Tim - / DHay / DF	re: <u>Mils7</u> Ie: <u>08</u> : Pasture / DCrop	FISP RWBL	JBL	S	AR AMIRO BR

Page ____ of ____

ą

Signature:

Quality Control: This form is complete 🔲 & legible 🛄.

Signature:

BARS I Y AMRCO 1 SDSP 2 PISP 1 PISP PISP		n: [/	0		Featu	re:00004	D ATTREA ADJACENT TO UTM: 11 4785428
Spectra 350-100m >100m Flyovers Height AMRCo 1 1 1 1 1 505P 2 1	Start Time	e: 00	1:13		End Tin	ne: (D9:18 Society Fields
SMRS I Y I AMRo I I SSP Z FISP I Image: SSP Z SSP Z FISP I Image: SSP Z SSP Z SSP Z Image: SSP Z SSP Z SSP Z Image: SSP SSP Station: Image: SSP Image: QP Image: QP Habitat: CForest / DSwamp / CIMarsh / CIHay / CIPasture / DCrop Station: Image: QP Image: QP Image:	Habita	t: OFFores	t / 🗆 Swamp	/ CMarsh	/ 🗆 Hay / 🗔 i	Pasture / 🗆	Crop BE 4
BARS 1 4 1 AM20 1 1 1 SDSP 2 1 1 BER 1 1 1 Hold of Ladde sweep 1 1 1 Station: I Feature: 1000 Latt Smart_cristic 1 Habitat: GForest / QSwamp / QMarsh / QHay / QPasture / QCrop Image: Smart_cristic 1 1 SpSP 1 Image: Smart_cristic 1 1 1 SpSP 1 Image: Smart_cristic 1 1 1 1 SpSP 1 Image: Smart_cristic 1 1 1 1 1 1 1 </th <th>Species</th> <th><50m</th> <th>50-100m</th> <th>>100m</th> <th>Flyovers</th> <th>Height*</th> <th>W SOSP 6</th>	Species	<50 m	50-100m	>100m	Flyovers	Height*	W SOSP 6
Station: Image:	BARS	1	4	_			
PICP I	AMRO	=		l = 1		II	in Ro
Height of blade sweep, will way from project to project; check with project manager. So ⁵ BARS BARS So ⁶ Height of blade sweep, will way from project to project; check with project manager. FIS P UTM: 17T O6oc/38,1 Station:	SOSP			2			Privil Zanas
Height of blade sweep will vary from project to project, check with project manager. SACS BMCS SMCS Height of blade sweep, B-Xheight of blade sweep. Above height of blade sweep. SMAU Barrier Station: Image: Station: </td <td>FIS P</td> <td></td> <td></td> <td>1</td> <td></td> <td>-</td> <td>Dires EX W</td>	FIS P			1		-	Dires EX W
Image: Construct of the severe in the sev							508
Hight of Made sweep, will very from project to project; check with project manager. Alight of Made sweep, Will very from project to project; check with project manager. Station:							
Idight of blade sweep, will vary from project to project, check with project manager. Above height of blade sweep; B-Mt height of blade sweep; Above height of blade sweep; Statton:							
ieight of blade sweep, will vary from project to project; check with project manager.							
On ground: A Below height of blade sweep: FISP Above height of blade sweep: FISP Station:							BARS
VOCA Z YmGo I SbSP I Noca America Sold Sold Image: Sold Sold Image: Sold Sold Image: Sold Sold Image: Sold							от w small chark UTM: 17T 0606387 4785485
VOCA Z AmGo 1 SosP 1 Image: SosP 1	Start Time			/ □Marsh /	End Tim	a: ()	от w small charke UTM: 17T 0606387 9:31
StoSP I StoSP I Image: StoSP Image: StoSP	Start Time Habitat	: : : : : : : : : : : : : : : : : : :	/ 🛛 Swamp /	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CLARK UTM: 177 0606387 9:31 Crop
Image: system of blade sweep; B-At height of blade sweep;	Start Time Habitat	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CLARK UTM: 177 0606387 9:31 Crop
leight of blade sweep will vary from project to project; check with project manager. Don ground; A-Below height of blade sweep; B-At height of blade sweep;	Start Time Habitat	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CLARK UTM: 177 0606387 9:31 Crop
Image: Source of the system Image: Source of the system Source of the system Image: Source of the system Source of the system Source of the system	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CARRU UTM: 177 06063&7 9:31 Crop
Image: Source of the system Image: Source of the system Source of the system Image: Source of the system Source of the system Source of the system	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CARRU UTM: 177 06063&7 9:31 Crop
Image: Source of the system Image: Source of the system Source of the system Image: Source of the system Source of the system Source of the system	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CARRU UTM: 177 06063&7 9:31 Crop
leight of blade sweep will very from project to project; check with project manager. On ground; A-Below height of blade sweep; B-At height of blade sweep;	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CARRU UTM: 177 06063&7 9:31 Crop
Teight of blade sweep will vary from project to project; check with project manager. On ground; A-Below height of blade sweep; B-At height of blade sweep;	Start Time Habitat pecies NOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (57 W SMALL CARRU UTM: 177 06063&7 9:31 Crop
an greater in seven hoght of states and by, a state and by and by	Start Time Habitat pecies NOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от <i>W</i> SMALL CALER</u> UTM: 17T 06063&7 <u>9:31</u> Crop
an greater in seven hoght of states and by, a state and by and by	Start Time Habitat pecies NOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от ш Sman cnark</u> UTM: 17T 06063&7 9:31 Crop
an ground in Second height of black shock, shock and shock,	Start Time Habitat Decies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от <i>W</i> SMALL CALER</u> UTM: 17T 06063&7 <u>9:31</u> Crop
an ground in Section has a shoop, a rit height of black shoop,	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от <i>W</i> SMALL CALER</u> UTM: 17T 06063&7 <u>9:31</u> Crop
an greater in second angel of states and by, a state angel of states barbash	Start Time Habitat pecies VOCA AMGO	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от <i>W</i> SMALL CALER</u> UTM: 17T 06063&7 <u>9:31</u> Crop
an ground in East in sight of bladd sweep,	Start Time	: : : : : : : : : : : : : : : : : : :	/	-	End Time OHay / OP	e: () asture / 🗆 (<u>от <i>W</i> SMALL CALER</u> UTM: 17T 06063&7 <u>9:31</u> Crop
Above height of blade sweep; D-Well above height of blade sweep	Start Time Habitat: pecies NOCA AMGO SOS P	<pre>Sweep will y</pre>	/ USwamp / 50-100m 2 1 1 1 	>100m	End Time	B: () asture / □() Height* Height the second sec	<u>от <i>W</i> SMALL CALER</u> UTM: 17T 0606387 9:31 Crop
	Start Time Habitat: pecies VOCA AMGO SUS P	Sweep will u	/ USwamp / 50-100m 2 1 1 1 	>100m	End Time	B: () asture / □() Height* Height the second sec	<u>от <i>W</i> SMALL CALER</u> UTM: 17T 0606387 9:31 Crop

(Field Personnel)

Signature:

Sta	ntec		1G 4P5 336-6050			Bir		oint Co ervatio		Survey m	
	ect Number	. 1	1000	COIL	17	Project	t Name:	= 11	1 1.	1.	
i Toje			007	6044	-5			ruth	~ ~ ~	linond	
	Date		Ny ID,	2012		Field Per	sonnei:	D. 6	orah	an	
Weather Co	onditions:	1	P(°C): 24°C	WI I	ND:	CLOUD:		PPT: None		PPT (in last	A
	GPS #	: T									
Station	1:	1		Featu				UTM:	605	665	
Start Time	•:	5-30	- 1, k	- End Tim	ne: 5	.35	- <u> </u>		478	665 5945	i al
Habita	t: DiFores	t / 🗆 Swamp	/ DMarsh	- / 🗆 Hay / 🗆 P	Pasture / C	ор					
Species	<50m	50-100m	>100m	Flyovers	Height*			T	٦		
RWBL	P									VI	WA
SAKI	Ac			ļ			/	ß		10	
ANGU	V										
SOSP	SM	SN									
PUST	V					0		> +			
AMRO	11.014	V	A		1	FIN		AMG	00	1	
EWA			SM		na di silandi sila silandi di sila su suna di silandi a succe	ISTY		RW BZ	(P)	17AMP	0
BASIN	\checkmark		1.4	\checkmark					SOSPE	50 4	100
FISP			SM.		••••••••••]	1
							EA	<i(49)< td=""><td></td><td>/</td><td>1</td></i(49)<>		/	1
								T V		EUST	/
					Coloring and Coloring and					. /	
			to project: che		managar			Sa	osP(st	1)	
Height of blag	le sween van										
On ground;	A-Below heig	ht of blade swee	ep; B- At heigh	t of diade swee lade sween	εþ,						
On ground;	A-Below heig		ep; B -At heigh ove height of b	t of blade swee lade sweep	ιµ,						
O-On ground; /	A-Below heig	ht of blade swee	ep; B- At heigh ove height of b	t of blade sweep lade sweep	ε μ .						
Height of blac -On ground; J C-Above heigh	A-Below heig	ht of blade swee	ep; B -At heigh ove height of b	t of blade swee lade sweep	μ.						
On ground;	A-Below heig	ht of blade swee	ep; B -At heigh ove height of b	t of blade sweep lade sweep	μ.						

Page ____ of ____

Quality Control: This form is complete \Box & legible \Box .

Signature:

(Field Personnel)

Signature:

(Project Manager) REV: 2011-05-04 / FORM 020

als w:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

Species COGR CEWA BASW AMRO AMRO AMRO SOSP CHSP MUDO EAK T RVBL F/SP BHCO BLTA Height of blade s On ground; A-BR CON grou	Sweep will v Below height	50-100m	>100m	nt of blade sweep Iade sweep Featur End Tim	Pasture / Height* Height Height		BLITA BHCO	COST CEWAC MED SOSPC CHSP(P) MD S	P) BASW PMRO DO(2) AKI (AG RWBL FISP(S	50 550 550 550 550 550 550 550 550 550	(5
pecies COGR EWA BASW AMRO AMGO SOSP CHSP MUDO EAKT RUBL F/SP BHCO BLTA Height of blades -On ground; A-Be -On ground; A-Be -Above height of Station: Statt Time: Habitat: U pecies	Sweep will v Below height	/ Swamp	>100m	Flyovers	Height*	Deer	61	COST CEWAC MGO SOSPC MD S E	N R R B R M N M N N N N N N N N N N N N N	50 550 550 550 550 550 550 550 550 550	(5
COGR EWA BASW AMRO AMRO AMGO SOSP EHSP MUDD EAK T RUDD EAK T RUDD EAK T RUDD EAK T RUDD EAK T RUDD EAK T Station: Station: Station: Station: Station: MCR MCR NOR N RUDD EAK T RUDD EAK T RUDD T RUDD T RUDD T RUDD T RUDD T RUDD T RUDD T RUDD T RUDD T RUDD	P V SM P AG Ag sweep will v Below heigh f blade swee 3	A G S AL Vary from project to f blade sweet ep; D-Well abo	ct to project; c ep; B-At heigh pove height of b	Check with projection of blade sweep	re:	Deer	61	COST CEWAC CHSPCP Mos E	R (5) (P) BAGW SM (P) BAGW SM (P) BAGW BL RWBL FISP (S	(A_3)	100
EEWA BASW AMRO AMGO SOSP EMSP MUDO EAKT RUBL F/SP BHCO BLTA Height of blades On ground; ABR Above height of Station: Statt Time: Habitat: D peccies	P V SM P AG Ag sweep will u Below heigh f blade swee 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	Check with projection of blade sweep	re:	Deer	61	COST CEWAC CHSPCP Mos E	R (5) (P) BAGW SM (P) BAGW SM (P) BAGW BL RWBL FISP (S	(A_3)	(18
AMRO AMGO AMGO SOSP EHSP MUDO EAK T RUBE AVBE SACO BLCO BLCO BLCO BLCO BLCO BLCO BLCO BL	SM P P AG AG Sweep will N Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	61	CEWAC SOSPC CHSPCP Mos	P) BASW PMRO DO(2) AKI (AG RWBL FISP(S	(A_3)	(18
AMRO AMGO SOSP CHSP MUDO EAKT RUBL SAKT RUBL SAKT Height of blade s On ground; A-BR Above height of Station: Station: Station: Station: Above height of Above height of Station: Station: MR	SM P P AG AG Sweep will N Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	61	CEWAC SOSPC CHSPCP Mos	P) BASW PMRO DO(2) AKI (AG RWBL FISP(S	(A_3)	(18
AMRO AMGO SOSP CHSP MUDO EAKT RUBL SAKT RUBL SAKT Height of blade s On ground; A-BR Above height of Station: Station: Station: Station: Above height of Above height of Station: Station: MR	SM P P AG AG Sweep will v Below heigh f blade swee 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CEWAC SOSPC CHSPCP Mos	P) BASW PMRO DO(2) AKI (AG RWBL FISP(S	(A_3)	100
AMGO SOSP CHSP MUDD CAK T CAK T CAK T CO CAK T CO CAK T CO CAK T CO CO CO CO CO CO CO CO CO CO	SM P P AG AG Sweep will v Below heigh f blade swee 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CEWAC SOSPC CHSPCP Mos	P) BASW PMRO DO(2) AKI (AG RWBL FISP(S	(A_3)	100
HSP MUDD AKT WBL 7SP BHCO BLTA Height of blades On ground; A-Bu Above height of Station: Statt Time: Habitat: D Habitat: D Habitat: D	P P AG Ag sweep will v Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CHSP(P) CHSP(P) Mos	AKI (AC RWGL FISP(S	(A_3)	100
EHSP MUDD AKT AVBL A	P P AG Ag sweep will v Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CHSP(P) CHSP(P) Mos	AKI (AC RWGL FISP(S	(A_3)	100
MUDD EAK T RUBL F/SP BHCO BLTA Height of blade s On ground; A-BR Above height of Station: Station: Station: Habitat: D Decies	P AG Ag sweep will h Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CHSP(P) CHSP(P) Mos	AKI (AC RWGL FISP(S	(A_3)	100
EAK T RUBL TSP BHCO BLTA Height of blades On ground; A-Bu Above height of Station: Start Time: Habitat: Habitat: Decies	AG AG sweep will v Below heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer	BHCO	CHSP(P) Mos E	AKILAE RWBL FISP(S	(A_3)	100
BLTA Height of blade s On ground; A-Bi Above height of Station: Start Time: Habitat: D Decies	Sweep will v Selow heigh f blade swe 3	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(Deer			AKILAC AKILAC RWBL FISP(S	3) .(A5) .(A)	
BLTA Height of blade s On ground; A-Bi Above height of Station: Start Time: Habitat: D Decies	Below heigh f blade swe 3 (DefForest	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(AKILAC AKILAC RWBL FISP(S	3) .(A5) .(A)	
BLTA Height of blade s -On ground; A-Bi -Above height of Station: 	Below heigh f blade swe 3 (DefForest	very from projection to of blade sweet ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(AKI (AC RWGL FISP(S	(Ag) (M)	
BUTA Height of blades -On ground; A-Bi -Above height of Station: 	Below heigh f blade swe 3 (DefForest	t of blade swee ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(RWBL FISP(S	(Ag) (M)	/
Height of blade s -On ground; A-B -Above height of Station: 	Below heigh f blade swe 3 (DefForest	t of blade swee ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(UTM			
-On ground; A-B: -Above height of Station: 	Below heigh f blade swe 3 (DefForest	t of blade swee ep; D-Well abo	ep; B-At heigh ove height of b	nt of blade sweep Iade sweep Featur End Tim	re:(UTM			
pecies < IMAR IONR 1	1811	/ 🗆 Swamp	/ Marsh /	- / []]Hay / []]	Dacture / D						
AMAR 1	<50m				asture / 🖵	Сгор					
IMR 1	~3VIII	50-100m	>100m	Flyovers	Height*]		Г			
TONR 1	/		~				AMCRUX	3 L	N		
1 MAG	vsm		a (1. 3)		d l		PWCK		+	_	
1MR0 1	Aa						· /				
RCA	SM					·	/		OWR (Sr	$/ \langle \ell \rangle$	
AMGO S	Sm						/	η	DION LO	Bech (SM)	\sum
	Ag				*********	/		/	1	(SM)	
ZOGR	D					/	/	mod	ALSA (ST)	(sm)	
ACH .		SM					/	HING	Der Ane	νų '	/
ENA				. /	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			2	A are	P 50	100
WBL	~	Δ					/	Ē	(A6	7-1-	Ĩ
WDL		Hg SM					\backslash	- CO	GR		
JICO		······································						1.0	EWA	/ .	p(sm)
FISP		SM						No.		FIST	PLP U
Height of blade sv	weep will v	ary from proied	ct to proiect: c	heck with proie	ct manager.		\mathbf{i}	F	IMPLOT	3) /	
-On ground; A-Be Above height of I	elow height	t of blade swee	ep; B-At heigh	t of blade swee	^{p;} D	ther than		ω	ILL OU		
. Sere noight of i	21440 3800		. s noight of Di	A.	inserverue Li	ther than birds birds acc	forest to	0			
ge of	-				6	Quality Contro	horm	i is complete	e 🗖 & legible	e 🔲 .	
Signature						Signature					
		((Field Perso	onnel)		- Gunnet		(Pr	roject Manage	er)	

4 Station: Feature: UTM: 606042 4786009 15 20 Start Time: 0 End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop g Ca.M. tà SW Species <50m 50-100m >100m Flyovers Height* NOCA CSN ASW V 1 51 NOCA V BUST 10 AMRU ~ RAK V V EUST V AMGO SM GR. AMGQ SM (SM) 50 100 SUSP SM No 65 ς ne AMRO SOSP (SM) FISP (S * 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 Tredby heard 10 with 606012 4785872 Station: UTM: Feature: 635 30 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DErop Cultural meatow Species <50m 50-100m >100m Flyovers Height* SM WIFL WIFL(ST) EUST V Sosp(34) COGR COGR . NOCACSN SOSP SM SM RISM RWBL GREA NOCA SM 2 HOWR (SM) RWBI COVESSI QRCA. SM FWF EAKICA (SM M Q SM SI 50 100 Hr. SM HOWR NOCA (S * 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 .

- 10 M

(Project Manager) REV: 2011-05-04 / FORM 020

(Field Personnel)

Signature:

UTM: 605709 4785 472 Station: Feature: (0 45 6 650 Start Time: **End Time:** Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop CUM Species <50m 50-100m >100m **Flyovers** Height* SM Nochest NOCA SM AMGO SM EAK AM60 CSI SM EAK SUSP 2SM (SM EWA SM MODD L 2 SOSP EUST L ----(SM) (JE FISP SM Pan (SM 100 RWBI SM SU OVE RWBL 1/MOD FISP Sospan 8ª Note: В 2 bofor duer (SM) me Height of blade sweep will vary from project to project; check with project manager. Sorvey 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 UTM: 605472 Station: Feature: 115 20 4785472 **Start Time:** End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m >100m Species Flyovers Height* U μ MRD 40 H. SP SK Ū AMGO L VocA(sm Anre (Ag (Aus SM SM EAKI (A) SM AM60 100 50 AMWO SM DIA HOWD 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; WAVI (STM C-Above height of blade sweep; D-Well above height of blade sweep **X**)) · NOFL DOWO Page ____ of ___ Quality Control: This form is complete . & legible . Signature: Signature: (Field Personnel) (Project Manager)

REV: 2011-05-04 / FORM 020

UTM: 605743 4785.580 Station: Feature: 805 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m Species 50-100m >100m Flyovers Height* CUM Sasp CF 5M(2 SWSP SM SOSP(SI FISP SM SM NOCA Ango (sn SWSP BCCH V (SM A WIFL BASI 2 FIST GRA SP (st SM AMGO GRA (SM) AMRO 50 100 AMRO \checkmark BCCH NKC WIF RWBI (2 CSI CA SOSP(KI RWBL (2) (Ao * Height of blade sweep will vary from project to project; check with project manager. SOSP O-On ground; A-Below height of blade sweep; B-At height of blade sweep; (SM) C-Above height of blade sweep; D-Well above height of blade sweep 605974 a UTM: Station: Feature: 40 45 785591 4 **Start Time:** End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m >100m Species Flyovers Height* Vie SM NOCA SM SM SM NO(ACSN) CUT D AM60 (SH) SM DO 51 10 EWARP (51 SM MODO AM66 GRCA (SH) 50 100 (SM) AMRO BHOO (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

Signature:

(Field Personnel)

Signature:

UTM: 606501 Station: Feature: D 834 839 4785428 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Flyovers Height* HSG X V SM OHSU 6 CD Aa GRCACAN X HO MOOT NOCH Amri (SM Aa EUST 100 MODO 50 SM Nock BASW(6 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 UTM: Station: Feature: 606 387 4785485 85 Start Time: End Time: Habitat: @Forest / OSwamp / OMarsh / OHay / OPasture / OCrop <50m >100m Species 50-100m Flyovers Height* E Noch SM SM BCCH χ SOSP X ADCA (SM AMRO NDCA(SM) Ha \times FUST -AMGO SM BOCH EUST SM SOSP BHCO AMRO Trest (X F CEWA Х (Ao SM 50 100 HOWR BHCOCSM HOF SM AMGOLSM SM KΙ HOUR KILL (SM) (SM) HOFICS * 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 trees reep trays to, cast (20m State Survey Page ____ of ____ Quality Control: This form is complete . & legible . Signature: Signature: (Field Personnel) (Project Manager)

¥

REV: 2011-05-04 / FORM 020

Sta	intec	Stantec C 1 – 70 Sou Guelph, OI Canada N Tel: (519) 8 Fax: (519)	1G 4P5 836-6050	e.		0	Point Count	orm
	ect Number					Project Name:		
1.0	Date		-1 1			Field Personnel:	and the second second second	
	Date	. 0	uly 10	2012		riela Personnei:		
Weather C	onditions:	TEMI	P (°C):	W	IND:	CLOUD:	PPT:	PPT (in last 24 hrs)
	GPS #							
Statio	n: [2		– Featu			UTM: 60	5692 86278
Start Tim	e:	855	<u>á</u> /	End Tin	ne: <u>?</u>) U	47	86278
Habita	it: DFores	t / DSwamp	/ DMarsh	/ 🗆 Hay / 🛄	Pasture / 🛛 C	rop		
pecies	<50m	50-100m	>100m	Flyovers	Height*	Done P.	SE	
AMGO	SM					cleared		
EHSP	X					Vargely cleared of vegetation		
BHCO		5M				0		
HOFI		SM						
	267							
	2312							
					m 441		neq	
							(sm)	50 100
							1 12 1	50 100
		and the					CHSP(X)	BHCO
								(sh) /
						\backslash — —	\sim	- /
						\	HOFI(SM)	/
							CHSP(X)	50 Внса (sh)

Page of		Quality Control:	This form is complete \Box & legible \Box .
Signature:		Signature:	
	(Field Personnel)		(Project Manager)

(Project Manager) REV: 2011-05-04 / FORM 020

als w:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

3 606 896 4 785 741 UTM: Station: L Feature: 30 925 9 Start Time: End Time: Habitat: OForest / OSwamp / Marsh / Hay / Pasture / Crop cun Species <50m 50-100m >100m Flyovers Height* E NOCH SM NOCACSM SM KI 11 SM REVI Ag AMRO SM AMGO REV SM (51 Sosp CH SP Х SESt V Con NRSU -50 100 / -BA 51 5A.SP MODO TVR< MODIO CHSPO DASY 1 BASU CSM * 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 UTM: 606866 4785638 ų Station: Feature: 935 940 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop CUM <50m 50-100m >100m Flyovers Height* Species E 51 NOCA NOCACSM SM AMGO AM X AMGO(SM SM THSP SM BHCO FOD ßA AMROR SM SASP CHEPE 100-CUM BHCOCO 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 SASP (SM) Quality Control: This form is complete 🔲 & legible 🛄. Page ____ of ____ Signature: Signature:

(Field Personnel)

606832 4785515 Station: 1/5 Feature: UTM: 950 45 9 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Flyovers Height* E AMAD Sr SM ROA AMROLO X Mon MODO 5M Zospesn SM AMGO And X CUT EUS P WIFL WIFI FISRAG A FISP 50 100 SASP SM BASU Hay V X BASW 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 UTM: Station: Feature: 606992 6 Dos 1010 Start Time: End Time: 4785671 Habitat: Prorest / Swamp / Marsh / Hay / Pasture / Crop **Species** <50m 50-100m >100m Flyovers Height* W SM NOCA BASLO Х P SOSP FOD SM AMGO 1. NOCA(SM X ATT BASW SOSI(P 50 100 (SM) AM60 awn BLJAC * 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)

UTM: 607628 Station: Feature: 1015 1020 4785448 **Start Time:** End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Flyovers Height* \mathbf{v} V 7 Mogo) BHCO Sm MODO Fores WAVI 100 5.A AR AMAO BASW 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 UTM: Station: Feature: Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Flyovers Height* 50 100 * 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 Q & legible Q.

Signature:

(Field Personnel)

Stantec	Stantec Con 1 – 70 South Guelph, ON Canada N10 Tel: (519) 83 Fax: (519) 83	igate Drive G 4P5 86-6050			-	Point Coun pservation F	-
Project Number	609.5	044	3		Project Name:	Hamilton	7-Fruitland
Date	June	25,20	012 05	.30	Field Personnel:	N. Kopy	
Weather Conditions:	темр 1677		2	ND: -3	CLOUD:	PPT:	PPT (in last 24 hrs):
GPS #	к Т		(Ther 9:45	toy by			
Station:	L		Featu	'9:		UTM: 177	- 1,110
Start Time: 05	30		End Tim	ie: 05	35	0605	
Habitat: OFores		Marsh /	GHay / GF			4786	,278
Species <50m	50-100m	>100m	Flyovers	Height*		2	
AMCR 1						L-	
* Height of blade sweep vari 0-On ground; A-Below heig C-Above height of blade sweep	ht of blade sweep	: B-At height	of blade swee	manager. p;	H	AMED	50 100

1

Page of Signature:	MRa	Quality Control: Signature:	This form is complete 🖵 & legible 🛄.
	(Field Personnel)		(Project Manager)

als w/tresource\internal info and teams\field forms\birds\breedIng bird\form_020_bird-point-counts-survey_2-sided.docx

Static	in: 2		* - I	Featu	re:	UTM: see Round 1
Start Tim	10: 05:	58		End Tin	ne: 06	63
			o/ 🗆 Marsh	 / OHay / OI		
Species	<50m	50-100m	>100m	Flyovers	Height*	shub/suce.
BETH		1	- 100111	Tiyoters	Treight	Shub/suce.
BHCO	1				-	
EWBL	1					BRITH
COGR		1 2	=	5		
AMRO						Ampa
YJSP	1					HIMRO HIMRO
<u></u>	-11	641	1.5		2	RWBL
						KUBL (BHCO SOSP50 10
				-		VINB SOSP50 10
				101	-	
	5.00					
		11				
Height of bla	de sweep will A-Below beig	vary from proje	ct to project; o	check with proje	ct manager.	
Above heigi	nt of blade sw	sep; D-Well abo	ove height of b	ade sweep	°₩1	
Statio			· · · · · · · · · · · · · · · · · · ·	F		
				- Featur		UTM: Seevound !
Start Tim		: 15		End Tim		7:20.
Habita	t: DForest	/ USwamp	/ CMarsh	/ OHay / OF	Pasture / 🗆	Crop charble sure 1
pecies	<50m	50-100m	>100m	Flyovers	Height*	shub/succ./
COGE		2				
VCCA		1				
MBL)					
KCA	1					COGERZ.
AKI	1					
mtiò						
s HCO						EWBL GIECA EWBL GIECA AMED FACI
						GRCA AMGO
						• <u>50</u> 10
					a naga nagana na ng	(EACI)
Height of blac	le sweep will A-Below beich	vary from project	ct to project; ci	heck with project t of blade swee	ct manager.	BHLO
Above heigh	t of blade swe	ep; D-Weil abo	ve height of bl	ade sweep	μ,	
age of		AN A				Quality Control: This form is complete 🛛 & legible 📮
			_			
Signat	ure:	////	\sim			Signature:

Static	m: <u>5</u>			Featu	re:	UTM: see round !
Start Tim	ne: Ol	:35	20	End Tin	ne: Öla	:40 -NO BARS
Habit		t / OSwamp		 / 🗆 Hay / 🖸 I		
	-	-				
Species	<50m	50-100m	>100m	Flyovers	Height*	IS I
LLA				<u></u>		
PUA	ļ	2		1		chine
steo						shrufol succ.
WBL	5	1				YBUA
IRES				1		
						GKCA GROD
						1 pungala
			195			RUBLET
						cum. Atteo 1 50 10
						The I go The
ET.						
Height of bla	de sweep will	vary from proje	ct to project; c	heck with proje	ct manager.	YEWA
On ground; Above heig!	A-Below heig it of blade sw	ht of blade swe eep; D-Well abo	ep; B-At heigh ove height of b	nt of blade swee blade sweep	ep;	TEWN
			·····			
Statio	n:()			Featur	е:	UTM: Su Round]
Start Tim	e: D(0	:55		End Tim	e: 73-	L'300
Habita		/ 🛛 Swamp	/ 🛛 Marsh /	- / OHav / OF		
				-		A I DIM
pecies	<50m	50-100m	>100m	Flyovers	Height*	cum. (5) toraging
SGR		1				
med						
res				3		COGR AMRO
m60				1		COGR AMRO
OSP	<u> </u>					10 Pust
WBL	1	2				A THERE
SHOO		1				XX mb
AKI						KAKI TOMMEN
UDFL						SosP 50 10
						ewer / /
					- 18 - 17 Ballion (- 18 - 19 - 19 - 19 - 19 - 19 - 19 - 19	RUNGOVZ
						BHCO
leight of blac	le sweep will v	vary from projec	t to proiect: cl	heck with proise	t manager.	BHU
On ground; /	A-Below heigh	t of blade swee ep; D-Well abor	p: 8-At height	t of blade sweet	p;	\sim
mena meißin		-P1 - 1100 0001	Bucor Di	-20 anoch		
		-				
2	5	1				
ge <u>}</u> of Signat		1	1h	_	ÿ	Quality Control: This form is complete

(Field Personnel)

Ör der							
Static	n: 3			Featu	re:	UTM:	
Start Tim	ne: 06:	09		End Tin	ne: OCe	14. The BAROJGAN	
Habit	at: WFores		o / 🗆 Marsh	_ / 🖸 Hay / 🖸 I			nl
	1	(NM				-deer-ub) NO BARS	sp ? "
Species BUJA	<50m	50-100m	>100m	Flyovers	Height*	N	
MRO		<u> </u>		1			
Ambo				<u> </u>		TAD A	
TUTS				2		FOD HJA K	MIRO .
TRES		1		6			$\langle \rangle$
YONA		╂					$\langle \rangle$
SOSP		1				(Anneio	
NUA		<u> </u>				CEDW	50 WORA 100
						TROS X2.	
						Sost Sos	P/ /
		 	ļ			cumt 40 shuble.	
* Height of bla	de sweep will	vary from proje	ct to orniect: c	heck with proje	ct manager	Shugue.	
O-On ground;	A-Below heig	ht of blade swe eep; D-Well ab	ep; B-At heigh	it of blade swee	ap;		
•							
Statio	n: 4	ļ		Featu	10:	UTM:	
Statio Start Tim		6:19		Featur - End Tim			
Start Tim	e:	6 : [9]	/ 🗆 Marsh /	- End Tim	e: 06	:/24	
Start Tim Habita	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q		*BARS KZ foralls
Start Tim Habita Species	e:		/ □Marsh / >100m	- End Tim	e: 06	:/24	* BARS KZ Foragiz:
Start Tim Habita Species BLTA	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q	rop -ceypte.	*BARS X Z fo rayiz
Start Tim Habita Species BLJA MED	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q Height*	rop -coyote.	*BARS KZ forajiz
Start Tim Habita Species BLJA MED AM RD	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q Height*	rop -coyote.	* BARS X Z For rayin
Start Tim Habita Species BLJA MED MMRD VOCA	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q Height*	rop -coyote.	*BARS KZ forayils
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	rop -coyote.	
Start Tim Habita Species BLJA MED MMRD VOCA	e: O	/ DSwamp		End Tim	e: <u>)(</u> Pasture / Q Height*	Poplantal BLIA	* BARS X Z Porayiz
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Pop Jointal BLTA Am	RO
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA MGD MMRD VOCA	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim	e: O	/ DSwamp		End Tim / DHay / DF Flyovers	e: <u>)(</u> Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA AMED AMED AMED ACA BLAC BLAC BLAC	e: e: ct: ©Forest <50m _	I Constraints of the second se	>100m	End Tim	e: OC Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA MED AM RD DCA BLAC BLAC BLAC BLAC BLAC BLAC	e: e: const <50m _	I Constraints of the second se	>100m	End Tim	e: OC Pasture / Q Height*	Poplantal BLTA Am	RO OLA
Start Tim Habita Species BLJA MED MARD VOCA BCCH BARS SHCO Height of bla D-On ground;	e: e: const <50m _	I Control Swamp	>100m	End Tim	e: OC Pasture / Q Height*	Poplantal BLIA Am Regionnal BLIA Am Regionnal BLIA Am Armao Am Armao Am Armao Am Armao Am	RO OLA
Start Tim Habita Species BLJA- YMED WARD WCA- BARS BARS BARS BARS BARS	e: nt: GJF orest <50m 2 1 1 1 de sweep will A-Below heigh to f blade sweet	I Control Swamp	>100m	End Tim	e: OC Pasture / Q Height*	Poplantal BLIA Readental BLIA Readental BLIA Readental BLIA Armao Arma Armao Armao Arma Armao Arma	50 100 S.
Start Tim Habita Species BLJA MED AM RD VOCA BCCH BARS BHCO Height of bla D-On ground;	e:	I Control Swamp	>100m	End Tim	e: OC Pasture / Q Height*	Poplantal BLIA Am Regionnal BLIA Am Regionnal BLIA Am Amgo Am Amgo Am Amgo Am	50 100 S.

(Field Personnei)

Station: 7				Featu	re:	UTM:
Start Time: 07.35			End Time: 07:40			-: 47
Habita		st / DSwamp	/ 🗆 Marsh	 / 🖸 Hay / 🗔		
Species	<50m	50-100m	>100m	Flyovers	Height*	
AM60	00111		10011	/	treight	N.
Rech						
SACP			1			BBCU
		er pr	<u> </u>			
				1		
						lest lest
						AM60 50 100
						50 100
* Height of blac	le sweep wiil	vary from proje	ct to project: d	check with proje	ct manager	
O-On ground: /	A-Below heig	ht of blade swe eep; D-Well abo	ep: B -At heial	nt of blade swee	ap;	
Station:				Featu	re:	UTM:
Start Time		8:04		- End Tim		?:09
Habita		/ USwamp	/ 🗆 Marsh	- / 🛛 Hay / 🗅 I	The second s	
Species	<50m	50-100m	>100m	Flyovers	Height*	N
NONU	L					
ASD		1				
SUST 1						
					1944 - Marcania a constantina de la constanta de la constanta de la constantina de la constantina de la consta	WENM
						NO BRONT
			<u> </u>			
	·					
						♦ 50 100
						AMRO
					4	
D-On ground; A	-Below heig	vary from project	p; B-At heigh	t of blade swee	cī manager. P;	SOSP
-Above height	of blade swe	eep; D-Well abo	ve neight of b	lade sweep		
2	5	1	1			
Page <u>3</u> of			1	and the second		Quality Control: This form is complete 🖬 & legible 🗐.
Signat	ure:	///	 Number of state of the state of			Signature:

(Field Personnel)

Statio				Featu	re:	UTM:
Start Tim	e: 08	?://		End Tin	ne: 08	: 16 .
Habita		/ OSwamp	/ @Marsh	- / 🖸 Hay / 🖸 I		
pecies	<50m	1 aul	>100m	Fiyovers	Height*	N praying
RARS	-5011	50-10011	- 1000	2	IIeight	
HRINI		1		3		× 3 CHSW
RADP	E D					1 Horafit
WRI	्रा	1				
2+11 01						POID
6SP	5.11					
AVS		1				BUDA_
SLJA						ENB
SUFF						BBOR 50-1
						CHEWX3. 12 BHED SOSP
						Jawh Barster Bitto KWBY
					_	SAVS
leight of blac	le sweep will	vary from proje	ct to project; c	heck with proje	ct manager.	
On around: (A-Below heia	ht of blade swe eep; D-Well abo	ep: B- At heigh	t of blade swee	ip;	
						fan
Statior	n: 9			Featur	'e:	UTM: 1
Start Time	<u> </u>	:30		End Tim	e: 08	.35
Habita	t: DForest	/	/ OMarsh /	OHay / OF	Pasture / 🔾	Crop NI 7 a radio
ecies	< 50m	50-100m	>100m	Flyovers	Height*	Crop Shub? (MAM VIBARS SUCC) MAM Forceging
BARS						
Am 20	1	2.				
MODO				1		
AMGO	1					EWBL BARS
RWBU	3	2				
NIFL						
SOSP	·					ATTICE WIFE FWBL
						Mar Amao
						C Americo 10
						OTENIN RAVEL EWEL MAGO AMEDON RAVEL EWEL AMEDON 10 10 AMEDON 10 10 AMEDON 10 AMEDON 10 AMEDON 10 AMEDON 10 AMEDON 10 AMEDON 10 AMEDON 10 AMEDON 10
				İ		
						SOSP RNBC PWRE
leight of blad	e sweep will Below beint	vary from project	t to project; cl	heck with project	ct manager.	
Above height	of blade swe	ep; D-Well abo	ve height of bl	ade sweep	Mi	
ge of						Quality Control: This form is complete

(Field Personnel)

(Project Manager) REV: 2011-05-04 / FORM 020

Static	on:14			Featu	Ire:	UTM:
Start Tin	10: 09:	37		End Ti	me: 89	42
Habit		st / 🗆 Swamı	o / 🗆 Marsh	 / 🛛 Hay / 🖸		
Species	<50m	50-100m	>100m	Flyovers	Height*	
RADS	-50/11	30-10011	-100111	8	iteignt	
SAIK		1		0		
					1	
						POP /
		-				
						50 100
						T
						(BARSER
	-					
* Height of bla	de sweep will	vary from proje	ct to project:	check with proje	act manager.	SAVS
O-On ground;	A-Below heig	ht of blade swe sep; D-Well ab	ep; B-At heigl	ht of blade swe	ep;	571/3
Statio	n: 15			Featu	re:	UTM:
Start Time	e: 09	45		End Tin	1e: 101	67
Habita	t: DForesi	/ USwamp	/ DMarsh	– / DHay / DI		
				_		
Species	<50m	50-100m	>100m	Flyovers	Height*	
CAIN	1			0.		
CICD JUD	1					
AME						
ENBL		<u> </u>				FWBI
						STALL L'DATC
						CANS INTER
						Shine Millice
	da		-4.4.			STATUS LIDANES 100 STAVE AMIKO FISP
D-On ground; /	A-Below heigh	vary from project t of blade sweet	ep; B-At heigh	t of blade swee	ect manager. ep;	A AN
J-Above height	t of blade swe	ep; D-Well abo	ve height of b	iade sweep		
11	t	,				
Page 1 of		IN M				Quality Control: This form is complete 🔲 & legible 📮.

Signature:

WIL

(Field Personnel)

Signature:

	ح			Featu	re:	UTM: 0605757-
Start Time	: 09	:05		End Tin	ne: 09	UTM: 0605757- 4785545
Habitat	: OFores	t / OSwamp) / 🖬 Marsh	_ / OHay / OI		
pecies	<50m	50-100m	>100m	Flyovers	Height*	
2WBL						
HO	1					
mRO		1				
ME						FWBL
1000			8 -			
111	1					
VCA-						KHCO AMPLOYE
DGR	2					BHUG AT 50 MODOL
1						AMED! KILK
						Guilt Oblight Kill
						MIK WES
24				heck with proje		Gr I
Station:	_13	a		Featur		UTM:
Start Time:	_13 _09,: 	3D ∕⊡Swamp			e: 09	35 4 adult
Station: Start Time: Habitat:	13	3D ∕⊡Swamp		Featur End Tim	e: 09	35 Crop & BARS Brouging
Station: Start Time: Habitat:	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: 09 Pasture / 🗆	35 4 adult
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim	ne: 09 Pasture / 🗆	35 Crop & BARS Brouging
Station: Start Time: Habitat: Decies	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: 09 Pasture / 🗆	35 Crop & BARS Brouging
Station: Start Time: Habitat: Decies	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: <u>0</u> 9 Pasture / 🗆	35 Crop & BARS Brouging
Station: Start Time: Habitat: Decies	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: <u>0</u> 9 Pasture / 🗆	35 Crop & BARS Brouging
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: <u>0</u> 9 Pasture / 🗆	35 Crop # BARS Drawing +
Station: Start Time: Habitat:	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	ne: <u>0</u> 9 Pasture / 🗆	35 Crop & BARS Brouging
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	e: 09 Pasture / 0 Height*	-35 Crop W + BARS Horauging + - 4 juil for RTHA
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	e: 09 Pasture / 0 Height*	-35 Crop W + BARS Horauging + - 4 juil for RTHA
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	e: 09 Pasture / 0 Height*	3.5 Crop & BARS BARS Brauging +=-4juu for RTHA CUM/ SAVS
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	e: 09 Pasture / 0 Height*	3.5 Crop & BARS BARS Brauging +=-4juu for RTHA CUM/ SAVS
Station: Start Time: Habitat: Decies L7 HA- SARS	13 09,: Offorest	3D DSwamp	/ 🗆 Marsh /	Featur End Tim / OHay / OF Flyovers	e: 09 Pasture / 0 Height*	-35 Crop W + BARS Horauging + - 4 juil for RTHA
Station: Start Time: Habitat: Decies LTHA SARS SAVS	_[3 	3 D Swamp 50-100m	/ □Marsh / >100m	Featur End Tim / DHay / DF Flyovers	Pasture / C	3.5 Crop & BARS BARS Brauging +=-4juu for RTHA CUM/ SAVS
Station: Start Time: Habitat: Habitat: Habitat: SAVS SAVS	 DForest CU r <50m [3 D Swamp	/ □Marsh / >100m	Featur End Tim / OHay / OF Flyovers	e: 0 Q Pasture / 0 Height*	3.5 Crop & BARS BARS Brauging +=-4juu for RTHA CUM/ SAVS

Signature:

. .

Quality Control: This form is complete 🖬 & legible 🛄.

Signature:

(Field Personnel)

(Project Manager) REV: 2011-05-04 / FORM 020

Statio	n:	-	16	Featu	re:	UTM:
Start Tim	e: ^	7.56		End Tin	ne: /	0:01
Habita	t: DFores	L/ DSwamp	/ 🗆 Marsh	 / 🛛 Hay / 🔾 I		
		/	,			
pecies	<50m	50-100m	>100m	Flyovers	Height*	E
Amko						-
m60						
	····		2.01		i di l	
		ļ				FOD
		E	<u> </u>		2	
						AMKO
				5, ¹²		
		=	<u> </u>			50
			Li			Am60 ->
-				Ξ.	-	
						community white
Height of blac	le sweep will	vary from proje	ct to project; c	heck with proje	ct manager.	- Company
		ep; D-Well abo			; р;	Commente
ruovie neigin						
_						
Station	: 1	6 17		Featur	re:	UTM:
Station				Featur End Tim		UTM:
Station Start Time	"(t	:04	/ Q Marsh /	End Tim	e: ((UTM:
Station Start Time Habitat).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM:
Station Start Time Habitat	"(t	:04	/ 🛛 Marsh / >100m	End Tim	e: ((UTM:
Station Start Time Habitat).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM:
Station Start Time Habitat Decies WHO FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM:
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: 0:09 NCrop 4-2BA forad
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: 0:09 NCrop 4-2BA forad
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM:
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: 0:09 NCrop 4-2BA forad
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: 0:09 NCrop 4-2BA forad
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: D:09 ICrop K-ZBA Forad BUJA
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: 0:09 NCrop 4-2BA forad
Station Start Time Habitat pecies WHO FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: D:09 NCrop H-ZBA Forced BUJA BUJA BUJA BUJA 50
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: D:09 NCrop H-ZBA Forced BUJA BUJA BUJA BUJA 50
Station Start Time Habitat pecies WHO FDW FDW).'.() / ❑Swamp		End Tim	e: (() Pasture / 🖵	UTM: D:09 ICrop K-ZBA Forad BUJA
Station Start Time Habitat Pecies WGO XDW ZDW ZDA BARS	<pre></pre>	50-100m	>100m	End Tim	e: (() Pasture / D Height*	UTM: D:09 NCrop NCrop NCrop S Forrad BUJA BUJA BUJA BUJA S CEDW S S S S S S S S S S S S S
Station Start Time Habitat Pecies WHO EDW EDW EDW EDW EDW EDW EDW EDW EDW EDW		/ USwamp 50-100m	>100m	End Tim	e: (() Pasture / D Height*	UTM: D:09 NCrop H-ZBA Forced BUJA BUJA BUJA BUJA 50
Station Start Time Habitat Pecies WHO EDW EDW EDW EDW EDW EDW EDW EDW EDW EDW		/ QSwamp 50-100m	>100m	End Tim	e: (() Pasture / D Height*	UTM: D:09 NCrop NCrop NCrop S Forrad BUJA BUJA BUJA BUJA S CEDW S S S S S S S S S S S S S
Station Start Time Habitat Pecies WHO FDW FDW FDW FDW FDW FDW FDW FDW FDW FDW	<pre> e sweep will e sweep will Below heigh of blade swee </pre>	/ USwamp 50-100m	>100m	End Tim	e: (() Pasture / D Height*	UTM: D:09 NCrop NCrop NCrop S Forrad BUJA BUJA BUJA BUJA S CEDW S S S S S S S S S S S S S
Station Start Time Habitat Pecies WHO EDW FDW FDW FDW FDW FDW FDW FDW FDW FDW F	<pre> e sweep will e sweep will Below heigh of blade swee </pre>	/ USwamp 50-100m	>100m	End Tim	e: (() Pasture / D Height*	UTM: D:09 NCrop NCrop NCrop S Forrad BUJA BUJA BUJA BUJA S CEDW S S S S S S S S S S S S S

Stantec	Stantec Consulting Ltd 1 – 70 Southgate Drive Gueiph, ON Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493	l.	Bobolink and Eastern Meadowlark Breeding Survey Form				
Project Number	609500	443	Project Name: 7	mitland - Win	iona Secondary		
Date		012	Field Personnel:	Man 100	m. Oliveire		
Weather Conditions:	темр (°С): 17°с	WIND:	CLOUD: 20°6	PPT:	PPT (in last 24 hrs):		

Please mark transect location on map and indicate areas of species observations on map.

Transect No.:		Habitat:	NO	SUITABLE	HABITAT	SHRUB SUCCESSION AR
Start Time:	/	End Time:	*****	/		
Start Point UTM:		End Point UTM:				
Species		Tali	y			
Bobolink	0					
Eastern Meadowlark	0	nonnakanakanakan kan yang bertakan kan kan kan kan kan kan kan kan kan	0			
				 6 or efficiently bills to binded operations are asset 		

Transect No.:	2	Habitat:	NO SUITABLE HABITAT
Start Time:		End Time:	
Start Point UTM:		End Point UTM:	
Species	-	Tally	/
Bobolink	0		
Eastern Meadowiark	0		
920			

Pg of	11-0	Quality Control: This form is complete 🗖 & legible 📮
Signature:	Mullen	Signature:
	(Field Personnel)	(Project Manager)
		REV: 2011-06-03 / FORM 0146

dsg g:\resource\internal info and teams\field forms\birds\breeding bird\form_014c_bobolink-and-eame_sar_breeding-survey.docx

Transect No.:	3	Habitat: CROP FIELD (NOT SUITA	NE
Start Time:	06:	Habitat: CROP FIELD (NOT SUITA End Time: (HANBITTAT)	
Start Point UTM:		End Point UTM:	
Species		Tally	
Bobolink			
Eastern Meadowlark			

Transect No.:	4			Habitat:	HAG	FIELD	(UNGUT)
Start Time:	06:	22		End Time:	06 :	: 32	
Start Point UTM:	0606019	4	185708	End Point UTM:	0606132	47857-	14
Species				Tally	Y		
Bobolink		11	(PANR)				
Eastern Meadowlark	((>					

Transect No.:	5			Hat	bitat:	MAY FIELD	(UNCUT		
Start Time:	06:	39		End T	ime:	06:50		-	•
Start Point UTM:	06050	44	4785773	End Point U	JTM:	06057353	4785841		-
Species					Tally	7]
Bobolink		1	ୈ						
Eastern Meadowlark	(0						ě.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Pg of		Quality Control: Th	iis form is complete 🗳 & legible 📮.
Signature:		Signature:	
T -	(Field Personnel)		(Project Manager) REV: 2011-06-03 / FORM 014c

the second		
Transect No.:	6	Habitat: FIELD
Start Time:(77:31	End Time: 07:41
Start Point UTM:	605501 4785499	End Point UTM: 0605585 4785606
Species		Tally
Bobolink	1 67	
Eastern Meadowlark	0	
		DRUY/WET MEADON FALLON AR Habitat: FIELD / MIXED HAY/SCRUB
Transect No.:	1	Habitat: FIELD / MIXED HAY/SCRUT
Start Time:	08:16	End Time: 08:26
Start Point UTM: 060 9	732 4785631	End Point UTM: 0605910 4785646
Species		Taliy
Bobolink	100	
Eastern Meadowlark	0	
		· · · · · · · · · · · · · · · · · · ·
Transect No.:	8	Habitat: WET MEADOW 3 / FIELD
Start Time:	08:35	End Time: 08;45
Start Point UTM: 060 S	977 4785580	End Point UTM: 0606046 4785562
Species		Taily
Bobolink	0	
Eastern Meadowlark	0	
N		

Pg. ____ of ____

Signature:

10

Quality Control: This form is complete \Box & legible \Box .

Signature:

(Project Manager) REV: 2011-06-03 / FORM 014c

Stantec	Stantec Consulting Ltd. 1 – 70 Southgate Drive Guelph, ON Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493		nd Eastern I ding Survey	
Project Number:	160950443	Project Name:	Fouitland-	Winona
Date:	July 10, 2012	Field Personnel:	DGra	han
Weather Conditions:	темр (°С): WIND: 17-24°С (CLOUD:	PPT: None	PPT (in last 24 hrs): Light san

Please mark transect location on map and indicate areas of species observations on map.

Station	4	-	Habitat:	Wheat field
Start Time:	615		End Time:	Wheat tield 625
Start Point UTM:	606042	4786009	End Point UTM:	
Species		•	Tally	
Bobolink		ø		
Eastern Meadowla	ark	ø		

Station T ransect No.:	6			Habi	tat: CuHur	I neada
Start Time:	645			End Tir)
Start Point UTM:	60570	7,47858	372	End Point U1	'M:	
Species					Fally	
Bobolink		3:	Two na	les / +	enale / ju	esile
Eastern Meadowla	rk	Ø)		

Pg of	Quality Control: This form is complete 🗖 & legible 🖵			
Signature:		Signature:		
	(Field Personnel)	<u></u>	(Project Manager)	
dsg g:\resource\internal info and tea	ams\field forms\birds\breeding bird\form_014c_bobolink-ar	nd-eame_sar_breeding-survey.docx	REV: 2011-06-03 / FORM 014c	

Stantec	Stantec Consulting Lt 1 – 70 Southgate Drive Guelph, ON Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493	d.		and Eastern oding Survey	Meadowlark Form
Project Number:	6095044	13	Project Name:	Hamilton-	FNitland
Date:	June 25,	2012.	- Field Personnel:		
Weather Conditions:	TEMP (°C):	WIND: 2.	CLOUD:	РРТ: Ф	PPT (in last 24 hrs):
Please mark trans		and indicate area	ح as of species obsern Habitat: ال	(al dance a
Start Time: 00			End Time: 00		ghdene of
Start Point UTM:		178 5706	End Point UTM:	0.50 .	
	000121	10 5 100			
Species			Tally		
Bobolink					
Eastern Meadowlark	Ø				
->INDOOK	ed transee	the Maron	Sh Aipid -	OK GAMAG	0 0000
		TIVEY	Sh Aield - v	observed	UI BOBO
Sth/ Transect No.:	6.		Habitat:	m-high	dence of
Start Time: 🔿	7.00			7:10	friss
Start Point UTM: 00	5 109 / 47	85872	End Point UTM:	******	
Species			Tally		
Bobolink	Ø				
Eastern Meadowlark	ϕ				
	1	4 A	98 maileann tailean Bé _A 100 A _{2 A} briothan Allaideadh a an 20 a dhairte dhallanna a Canasaill Lagaa		

Pg. 1 of 1 Signature: Monto	Quality Control: This form is complete 🖵 & legib	le 🖬.
(Field Personnel)	(Project Manag	

*

ч,

Transect No.:	7.		Habitat:	WM
Start Time:	07:45		End Time:	07:55 -
Start Point UTM:	0605	506/4785507	End Point UTM:	
Species			Tally	
Bobolink		Ø		
Eastern Meadowlar		Ø		
COGIE	COBL.	- Mocks in field -		

Transect No.:	9 Habitat: CUW/CUM
Start Time:	081.30-08:40 End Time:
Start Point UTM:	2605974/4755591 End Point UTM:
Species	Tally ,
Bobolink	a not suitable habitat -
Eastern Meadowlar	Shrub/succ. habitat
	+ patches of mAm:
	V

Transect No.:		Habitat: CUM	
Start Time: 09:10		End Time: 09-20	
Start Point UTM: 0605	743/473580	End Point UTM:	
Species		Tally	
Bobolink	Ø		
Eastern Meadowlark	Ø		

Signature:

4

1

(Field Personnel)

May 17, 2012 1

Observer Details

Name Don Graham	Phone Number	51.51	Email Addres	S	in the second
Street Address		City		Prov.	Postal Code
THE STATE OF THE S					LARCE I

Building Details

Street Address	ton	City	Prov. Postal Code
Owner Name		Phone Number	Email Address
Type of building (please che	ck one):		
House	Church	Store	- 1941 - 3 - 1
Lowrise Apartment	School	Factory	
Highrise Apartment	Hospital	Other, please spec	ify:

Site Name 660 Frontland Borton	Chimney Code H - 660 - 0
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4786287 °N	City Initials - Site Initials - Chimney Number
Long. 605674 °W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	
Concrete Stone	
Other, please specify:	No chimney
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	15, 2-6 (100%) s
Cap 🗌 Terra Cotta Liner	
Animal Guard Spark Protector	and a summer of the
Metal Liner Other, please specify:	
Surrounding habitat (please check one):	
Residential Industrial	and a subscription of the second second second second second second second second second second second second s
Commercial 🗌 Natural	
Other, please specify:	-C.
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
	NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements:
Ler Rectangular → Width (cm):	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 Sw Observatio	
Project Number	0950443	Project Name: <u>Sc.</u>	be
Date: July 12	2012	Field Personnel:, (Grahan
Weather Conditions	s: Temp: Wind: 16-25°C 0-1	Cloud: PPT: 1076 No-	e PPT in last 24 hrs:

	Survey	Time	GPS	# BARS	Type of	Accessible			
	Station	Time AM	Coordinates	observed	structure (e.g.	nesting sites	Ne	ests]
					barn, culvert)	(Y or N)	Active	Inactive	1
	2	545	608483 4784921	2		1 wanna 1 a a and wil 1 w 0 v 1 100 wan an an 10 bigang	and frequencies and the difference in a series of		Foraging
	4	63	608758 4785292	3					E
	to to	645	4185272	1					Foraging g
	8	705	60065						Foraging
	- 0	745	610234						Foraging
		gis	4785771 609860 4785605						Foragina
	-14 15	905	4785605		,				Foraging
	15	835	4785550						Foraging
	16	0 <0	610787 478550 608784 4785104 61122-8 4785587						Foragen
5	1/1	850	4785587	4					Foragina
Boxey	lvert-on rvice Ry lvert-H-y8	- 117	(1) 2) 10			41			
jouth S	rvice Ry	1210	61,3785577	0	Box culvert	N.			
Bax cu	1007 - H-y8	1230	60 4 984950	б	Box alvert	-N			
	/								
				, <u></u>					
-									
-									
-									
-									
ſ									
							J		4

Quality Control: This form is complete () & legible ().		۱		
Signature:	Signature:	1		
(Field Personnel)			(Project Manager)	
			REV: June-09	FORM 034

Stantec	Stantec Consulti 70-1 Southgate I Guelph, Ontario, N1G 4P5 Tel: (519) 836-60 Fax: (519) 836-2	Drive Canada 050	Barn Swallow Observation Form			
Project Number	16095042	13	Project Name: _	Scube		
Date: July	4,2012		Field Personnel:	Michael C	liveira	
Weather Conditions	Temp:	Wind: 1-2	Cloud: So7a	PPT:	PPT in last 24 hrs:	

Survey	Time	GPS	#BARS	Type of	Accessible		
Station		Coordinates	observed	structure (e.g.	nesting sites	Ne	sts
				barn, culvert)	(Y or N)	Active	Inactive
1-	651-656	608587, 4785 610089, 4789	464 1	N.A.	Foraging	orb	
8	716 721	610089 4789	17 2	N.A.	Family	1	10 (I) (II) × 0
		, , , , , , , , , , , , , , , , , , , ,			33	01.7	
				4			
			ч. Н				
				log", no ≤o E.or			
55							_
331							

Quality Control: This form is complete (__) & legible (__). Signature:

Signature:

(Field Personnel)

Stantec	Stantec Consulting Ltd. 70-1 Southgate Drive Guelph, Ontario, Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493		Barn Swallow Observation Forr		
Project Number 6 Date: Jone 6	0950443 16, 2012	Project Name: Field Personnel: _	1, 1/	rysch	
Weather Conditions	Temp: Wind: 15 70 20°С 0 - 1	Cloud:	PPT:	PPT in last 24 hrs:	
			/	V.J. A	

Survey	Time	GPS	# BARS	Type of	Accessible		
Station		Coordinates	observed	structure (e.g.	nesting sites	Ne	ests
	· · ·		87	barn, culvert)	(Y or N)	Active	Inactive
15	650-655	610049,4785-		N.A.	Foragi	ng onl	4
8	704-709	610651,47850	97 2	N.A.	Forag	20 001	4
17	749-754	6087844785	104 1	N.A.	Foregi		{
5	835 - 840	60 8 294 47855	34 1	N.A.	Faragin		
6	845_850	608.587 478 5	464 3	NA.	Farac	he only	<u> </u>
18	900 905	610787 47855	50 (N.A.	Foragi	na on	L
		1			0	<u> </u>	
<u> </u>							_

Quality Control: This form is complete (__) & legible (__). Signature:

Signature:

(Field Personnel)

above roofline (m):		Number of Flues:		n-i Tilas	Colour of Chimney:	mander	Den Gr
Total Chimney Height (m) =	Number of stori	× es in	3 m	+ Heig	ht above roofline (=	m
If swifts are pres	building ent. are they:		of one story) esting	Roosti	ng 🗌 Un	known	
Additional Comments		1	- en al l		-	- Colorado	(isha)
	Nore	seer		- Ne			
	3.4	iggi - A		31	- A hat	had of	4
					1	() ² 대 (교 네리)	
	BIR		NDA.		n ce-partner of aire canadien de		
	Birds	ρ studies(^∦,\)					
Created by: In partnership wit	BIR BIR Lunde comp	D STUDIES CAN SE D'OISEAUX CANV stand appreciato cor					
Created by:	th:	D STUDIES CAN SE D'OISEAUX CANV stand appreciato cor	server	UN Parten	ONTARIO	FONDATION	

1 1

5

4

Observer Details

Name D. Graham	Phone Number		Email Address	5	n a share
Street Address	in the	City		Prov.	Postal Code

Building Details

Street Address	Barton	City	Hon 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 specif	ÿ:

Site Name 692 Barton	Chimney Code H - 692 - 1
GPS coordinates (DD.dddd): Lat. 1786235 °N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. (0588) °W	Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>
Number of years active (if known):	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):	And other sections
Commercial Natural Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
✓ Square → Width (cm): 40	ngth (cm):

a,

Chimney height above roofline (m): 2 ~	Number of Flues:	Colour of Chimney:	Brown	0
Total Chimney =	× 3 m	+ 2~	= 5m	m
Number of s buildin	tories in (approx hei	ght Height above roof	line (m)	m
If swifts are present, are the		Roosting	Unknown	
Additional Comments:	A. S. M. S. L. Park	1	1004-1001 (SPA)	10. T.
	None see	Ś		
- 1913) - 1913)			el an China and Shake and Shake and Shake and Shake and Shake and Shake and Shake and Shake and Shake and Shake	
			2 7 C 187 V	10, 11, 11, 11, 11, 11, 11, 11, 11, 11,
			194200	
17				
2				
	X			
Created by:		Canadian co-partner of		
Contraction of the second		un partenaire canadien de		
	IRD STUDIESCANADA			
-14	imprendre appråcter conserver	BirdLife		
n partnership with:				
()~				
	ntario	THE ONTARIO TRILLIUM FOUNDATION	TRILLIUM DE L'ONTARIO	
	ntario	TRILLIUM	TRILLIUM	
	ntario	TRILLIUM	TRILLIUM	
Environment Canada		TRILLIUM POUNDATION	TRILLIUM	in an

Observer Details

Name D. Graham	Phone Number		Email Address	5	
Street Address		City		Prov.	Postal Code
1 43 X				201	No, tikes

Building Details

Street Address 72	10 Barto	•	City Ham	Hon	Prov.	Postal Code	and transfer
Owner Name		Phone Number ()	14 A	Émail Addre	ISS		
Type of building (please check	k one):					2.00	
House	Church	Store					
Lowrise Apartment	School	Factory					
Highrise Apartment	Hospital	Dther, pl	ease specify:			a an l	

Site Name 720 Bartan	Chimney Code H - 72D - 1					
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:					
Lat. <u>4/86 69</u> °N	City Initials - Site Initials - Chimney Number No. of					
Long. <u>606102</u> ° W	Eg. City Name Site Name Chimneys Code					
Number of years active (if known):	London 141 Wortley 2 LO-141-1 LO-141-2					
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.					
💭 Brick 🗌 Stucco	\mathbb{N}					
Concrete Stone						
Other, please specify:						
and the second second second second						
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	Con Produced					
Cap Terra Cotta Liner						
Animal Guard Spark Protector						
Metal Liner Dother, please specify:						
	Lil					
Surrounding habitat (please check one):	filliw of le surbors					
Residential Industrial						
Commercial Natural	X					
Other, please specify:	^					
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:					
□ Round → Diameter (cm):						
Square → Width (cm): 40	NOTE: Measurements can sometimes be					
the strategical	estimated by counting bricks. Standard bricks have the following measurements:					
Rectangular → Width (cm): Ler	ngth (cm): 20cm x 9cm x 6cm (L x W x H)					

Chimney height above roofline (n	n):		Number of Flues:			o va HM	Colour o Chimney	f :	brown	30	a^{m}
Total Chimney Height (m)	=	2 Number of sto building		3 (approx of one	height	+ Heig	pht above ro	oofline (m)	=	7	_ m
If swifts are	presen			esting] Roost	ing [] Unki	nown		u s s
Additional Com	ments:	No	ne si	een		ladieu I.	્ય છે. સ		Cherry D	1	
		155~	H		ynami	i.		ante.	20 2	2	
	n Even	a di sun	i and state		21 0		50 94	2.00			15.94
		']]									
	-										
				ι.							
Created by:			and the second				n co-partner of				
		BIR	D STUDIES CANAL	DA		nn hatten	aire canadien d	E			
		unde	rstand eppreciate cons prendre apprécier conse			Bir	dLife				
	à					INTER	NATIONAL				
n partnership	with:										
	\sim	e									
	1	\geq_{\cap}	ntario			THE Fou	ONTARIO		ONDATION LIUM ONTARIO		
								277			
							. 6%				
	-	Environment Canada	Environneme Canada	ent			AM	Mcilw	raith		

Field

Naturalists

Canada

Ontario Region Région de l'Ontario

Observer Details

Name D. Graham	Phone Number	En	nail Address	1
Street Address	Ci	ty	Prov.	Postal Code

Building Details

Street Address 748 E	Barton	City	Ham the ON Postal Code	
Owner Name		Phone Number ()	Émail Address	
Type of building (please che	eck one):	THE REPORT OF A	ter and the first	
House	Church	Store		
Lowrise Apartment	School	Factory		
Highrise Apartment	Hospital	Other, please s	pecify:	

Site Name 148 Barton	Chimney Code H - 748 - 1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat ° N	City Initials - Site Initials - Chimney Number
Long. <u>297</u> ° W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🔲 Stucco	XN
Concrete Stone	
Other, please specify:	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification: Cap Cap Terra Cotta Liner Animal Guard Spark Protector Metal Liner Other, please specify:	
Surrounding habitat (please check one):	
Commercial Statural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
☐ Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
Rectangular → Width (cm): Ler	bricks have the following measurements: $20 \text{ cm} \times 9 \text{ cm} \times 6 \text{ cm} (L \times W \times H)$

Chimney height above roofline (m): Number of Colour of brown Flues: Chimney: **Total Chimney** = 3 m + = × Height (m) m Number of stories in (approx height Height above roofline (m) building of one story) If swifts are present, are they: Nesting **Roosting** Unknown **Additional Comments:** None seen

Created by:



Canadian co-partner of un cartenaire canadien de



In partnership with:





Environnement Canada Région de l'Ontario THE ONTARIO TRILLIUM FOUNDATION



McIlwraith Field Naturalists 4

Observer Details

-

Name D. Graham	Phone Number ()		Email Address	6	
Street Address	C	City		Prov.	Postal Code
	Ca				

Building Details

Street Address 789	Barto-	City Ham,	Han Drov. Postal Code
Owner Name			nail Address
Type of building (please check	k one):		
House	Church	Store	I Want
Lowrise Apartment	School	Factory	
Highrise Apartment	Hospital	Other, please specify:	

Site Name 789 Barton	Chimney Code H - 789 - 1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4786 043530 ° N	City Initials - Site Initials - Chimney Number
Long. 60 6 527 ° W	No. of
	Eg. City Name Site Name Chimneys Code Port Rowan Public Library 1 PR-PL-1
Number of years active (if known):	London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	× 4/-
Concrete Stone	
Other, please specify:	
If the obimpovic medified (cap lines ate) places shark the	-
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
Cap Grera Cotta Liner	
Animal Guard Spark Protector	
Metal Liner Other, please specify:	
Surrounding habitat (please check one):	
I Residential ☐ Industrial	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the appleters and	propriate estimated measurements:
□ Round → Diameter (cm):	
\square Square \rightarrow Width (cm): 40	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
	bricks have the following measurements:
Rectangular → Width (cm):	ngth (cm): 20cm x 9cm x 6cm (L x W x H)

5

Chimney height above roofline (m): 3	Number of Flues:	Colour of Chimney:	Brown
Total Chimney =	× 3m +	3	= <u>6</u> m
	of stories in (approx height (approx height)	Height above roofline (m)	and the suffer
If swifts are present, are t	hey: 🗌 Nesting 🗌 F	Roosting 🗌 Unkno	wn
Additional Comments:	10 parts and 1	- 11 Julio - 11 A STA 61	
	None seen		
	3(- J	157120	1 77
			130F
			1. C. 1. C.

Created by:



Canadian co-partner of un partenaire canadien de



In partnership with:



Environment Canada Ontario Region

Environnement Canada Région de l'Ontario THE ONTARIO TRILLIUM FOUNDATION LA FONDATION TRILLIUM DE L'ONTARIO



McIlwraith Field Naturalists

Observer Details

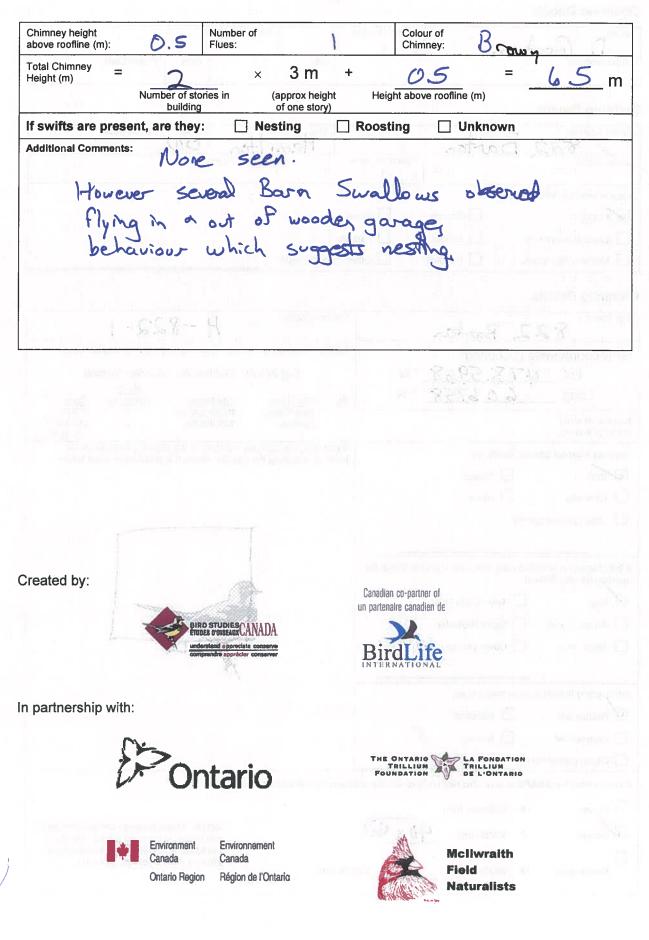
Name D Graham	Phone Number	t-1	Email Addres	s	
Street Address		City	lia area	Prov.	Postal Code
nit Car Maria	아무하				

Building Details

Street Address	Barton	City	Prov. Postal Code
Owner Name		Phone Number	Email Address
Type of building (please of	heck one):	stallense into	nd lease marshi
House	Church	Store	The word of words
Lowrise Apartment	School	Factory	ter t
Highrise Apartment	Hospital	Other, please specify	y:

Site Name 822 Bartan	Chimney Code H - 822-1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>478.5968</u> ° N	City Initials - Site Initials - Chimney Number
Long. 606758 °W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys</u> Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
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:	4
	-
Surrounding habitat (please check one):	
	a and a second a
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
$\Box Square \rightarrow Width (cm): 40 \times 40$	NOTE: Measurements can sometimes be
	estimated by counting bricks. Standard bricks have the following measurements:
L_I Rectangular → Width (cm): Ler	20cm x 9cm x 6cm (L x W x H)

6



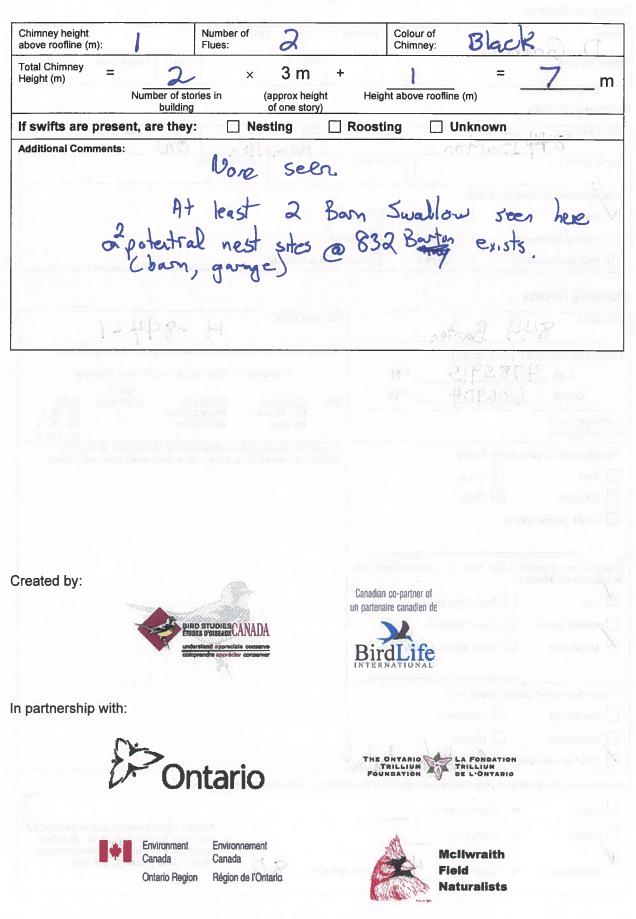
Observer Details

Name D. Graham	Phone Number	S	Email Address		
Street Address		City	F	Prov.	Postal Code
No No		1 AT 6-0	36	1	

Building Details

Street Address 44 Ba	rton	State of the second sec	City)too	Prov.	Postal Code	
Owner Name		Phone Number ()	iSe2 .	Email Addre	ess		
Type of building (please check	one):	31111			I. HE		
House the second	Church	Store		1919	10 10		
Lownse Apartment	School	Factory	and a		Aste	ton Ser	
Highrise Apartment	Hospital	Other, pl	ease specify	The second second second		1	

Site Name 844 Barton	Chimney Code +1 -844 - 1
GPS coordinates (DD.dddd): Lat. <u>4785915</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. 606904 °W	No. of Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	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:	nd balan 100 Constants of ¹⁰ Constants of ¹⁰
Surrounding habitat (please check one):	
Residential Industrial	13000 quistion this p
Commercial Natural Other, please specify:	
Please select the SHAPE of your chimney and provide the app	propriate estimated measurements:
Round \rightarrow Diameter (cm): Square \rightarrow Width (cm): Rectangular \rightarrow Width (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)



Observer Details

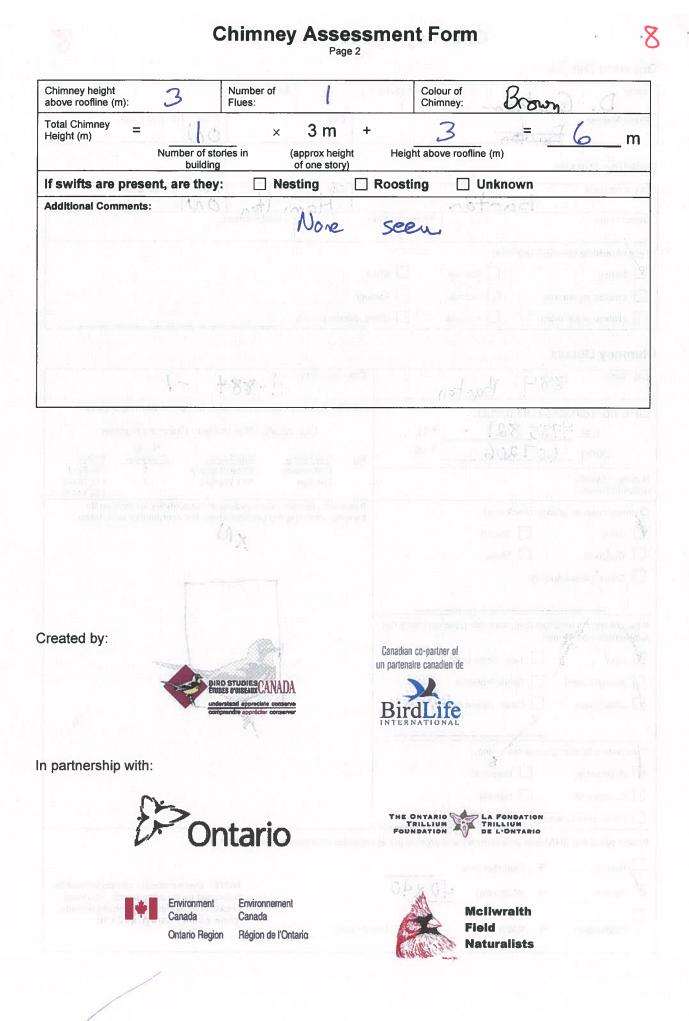
Name D.	Graham	Phone Number		Email Address	8	E. During
Street Address	Baston	E	City		Prov.	Postal Code

Building Details

Street Address	Barton		City	1 lto	Prov.	Postal Code
Owner Name		Phone Number	-Brista	Email Addres	SS	
Type of building (please of	heck one):	- 11+				
House	Church	Store				
Lownise Apartment	School	Factory				
Highrise Apartment	Hospital	🗌 Other, p	lease specify	:		

Site Name 884 Barton	Chimney Code H-884 -1
GPS coordinates (DD.dddd): Lat. <u>4785 821</u> ° N Long. <u>607206</u> ° 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 Chimneys Code Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chimney material (please check one): Brick Stucco Concrete Stone Other, please specify: If the chimney's modified (cap, liner, etc.), piease 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 the select the SHAPE of your chimney and provide the appropriate the select the selec	Propriate estimated measurements: 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)





Observer Details

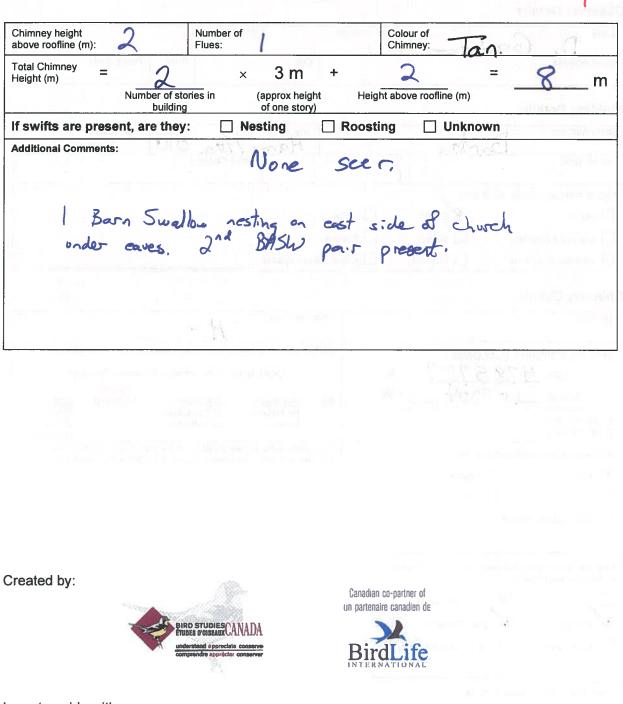
· (Q) ·

Name D.	Graham	Phone Number		Email Address	5	S
Street Address	k 12	ŝ.	City		Prov.	Postal Code

Building Details

Street Address	Barton	City Han, Iton ON Postal Code
Owner Name	Phone Number	Email Address
Type of building (please	check one):	
House	Church Store	have Swalan restrict on
Lowrise Apartment	School Factory	
Highrise Apartmen	t 🗌 Hospital 🗌 Other,	please specify:

Site Name	Chimney Code H -
GPS coordinates (DD.dddd): Lat. <u>478.5717</u> ° N Long. <u>607304</u> ° W	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number No. of Eg. City Name Chimneys Code Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1
active (if known):	LO-141-2
Chimney material (please check one):	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:	- 14 ₀ 03
Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Color Image: Color Color Image: Color Color Color Image: Color Color Image: Color Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color Image: Color Color	
Surrounding habitat (please check one):	
Residential Industrial	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
□ square → Width (cm): ☑ Rectangular → Width (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)



In partnership with:





Environnement Canada Région de l'Ontario THE ONTARIO LA FONDATION TRILLIUM DE L'ONTARIO



McIlwraith Field **Naturalists**

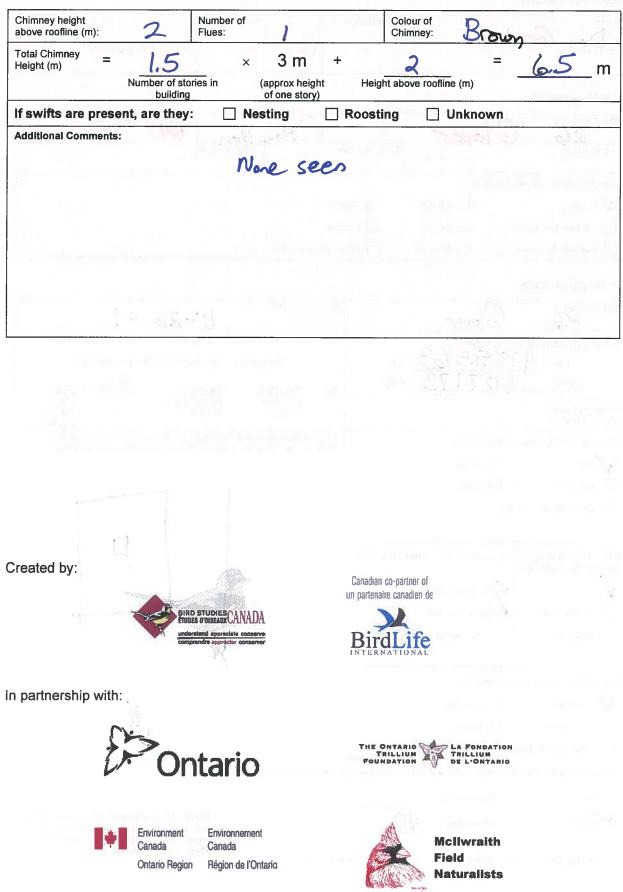
Observer Details

Name Dag Graham	Phone Number ()		Email Address		
Street Address	244	City		Prov.	Postal Code
Card Card		681.04		C.27	

Building Details

Street Address	loves	City Ha.	Prov. ON	Postal Code
Owner Name		Phone Number ()	Email Address	
Type of building (please check	cone):			
House	Church	Store		
Lowrise Apartment	School	Factory		
Highrise Apartment	Hospital	Other, please specif	y:	

Site Name 26 Gloves	Chimney Code H - 26 - 1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4785563 ° N	City Initials - Site Initials - Chimney Number
Long. <u>607173</u> ° W	No. of Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	
Concrete Stone	
C Other, please specify:	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
Cap Terra Cotta Liner	
Animal Guard Spark Protector	and herein a the
Metal Liner Other, please specify:	X
Surroynding habitat (please check one):	
Residential Industrial	appear of a resonance data in
Commercial Natural	N S
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
\square Square \rightarrow Width (cm): 40	NOTE: Measurements can sometimes be
	estimated by counting bricks. Standard bricks have the following measurements:
Rectangular → Width (cm):	ngth (cm):



Observer Details

· ·

Name D. Graham	Phone Number	Sec.	Email Address		
Street Address		City		Prov.	Postal Code
1 m C +	si yana sa sa sa sa				

Building Details

Street Address	-	C	Han	alter	Prov.	Postal Code
Owner Name		Phone Number ()		Email Addres	SS	
Type of building (please check	one):	Loz H - M				
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, pleas	e specify:	_ A	2	

Site Name 289 Gloves	Chimney Code H-239-1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4785327 °N	City Initials - Site Initials - Chimney Number
Long. 607101 °W	Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	building, molecung the position where the coordinates were taken.
Concrete Stone	
Other, please specify:	
If the chimney is medified (see lines etc.) should be	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	X
Cap II Terra Cotta Liner	
Animal Guard Spark Protector	
Metal Liner Other, please specify:	0
Surrounding habitat (please check one):	
	and the second sec
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
☐ ¢dquare → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
and increases that it is a second	bricks have the following measurements:
Rectangular \rightarrow Width (cm): 40 Ler	ngth (cm): 20cm x 9cm x 6cm (L x W x H)

Chimney height above roofline (m):	1,5 Num Flue	nber of es:	2		our of Ta	n	D. C
Total Chimney = Height (m)	Number of stories in building	× 3 n (approx h of one s	neight		1.5 ove roofline (m)	=	<u>45</u> m
If swifts are preser	nt, are they:	Nesting		Roosting	Unknow	wn	
Additional Comments:	129 C	None	Sec	en.	Ì	300) e	- 136
		•					
	- 280-1				"hand		22
				No. No.	1387 197	178.	
Created by:	understand e	NESCANADA peroclate conserve periodar conserve		Canadian co-par un partenaire cana BirdL	ther of tidien de		
n partnership with:							ilis tanting Magazin
Ð	Onta	ario		THE ONTAR Trilli Foundati	M STRILLIU	TARIO	
[+]	Canada Ca	nvironnement anada égion de l'Ontarlo			Mcliwrai Field Naturalis	ith	

Observer Details

Name D. Grahar	Phone Number	Em	ail Address	
Street Address		City	Prov.	Postal Code

Building Details

Street Address G la	sues	Difference e-	City	Iten	Prov.	Postal Code
Owner Name		Phone Number		Émail Addres	ss	pro a
Type of building (please chec	k one):		4	Kingdo m	4.00	of Tabank
House	Church	Store	Sycil.	ringen m		of Jehovah Witnesses
Lowrise Apartment	School	Factory				vv incoses
Highrise Apartment	Hospital	Other, ple	ease specify:			

Site Name Glover	Chimney Code H O						
GPS coordinates (DD.dddd): Lat. <u>4785169</u> ° N Long. <u>607057</u> ° W	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number No. of						
Number of years active (if known):	Eg. City Name Site Name Chimneys Code Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2 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:	None seen						
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 ap	propriate estimated measurements:						
□ Square → Width (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)						

12

Chimney height above roofline (m):		lumber of lues:	sin fi	Colour of Chimney:	marking	D. C
Total Chimney =		× 3 m	+		=	m
- 4n	Number of storie building	s in (approx heigi of one story	ht Heigh)	nt above rooflin	ie (m)	
If swifts are present	t, are they:	Nesting	🗌 Roosti	ng 🗌 I	Unknown	
Additional Comments:	0.0	T (Been Friday)	-		1985 69 79	n (non) ^a sea a
Accedents 1,12000		Nore.	seen			
	â.e	- H			See D	
				8. " 	(4.61%) (2.61%)	
	a Zale		÷.,			
Created by:		- 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900 - 1900	Panadiaa	co-partner of		



dian co-partner of un partenaire canadien de



In partnership with:



Environment Canada Ontario Region

Environnement Canada Région de l'Ontario THE ONTARIO TRILLIUM FOUNDATION



McIlwraith Field Naturalists

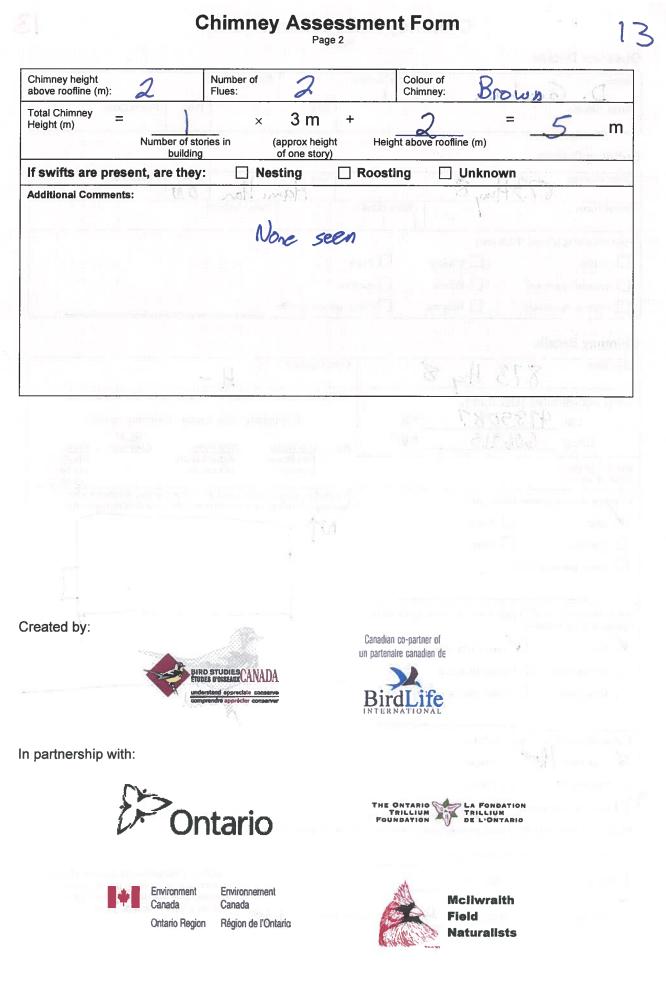
Observer Details

Name D. Grahan	Phone Number ()	2	Email Address		
Street Address		City		Prov.	Postal Code
100		114 (24)		-	

Building Details

Street Address 873+	War 8	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	City Han	lton	Prov.	Postal Code
Owner Name	7	Phone Number ()		Email Addres	SS	
Type of building (please check	one):	202	1972 Stor	外 准		
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, p	lease specify:			

Site Name 873 Huy 8	Chimney Code
GPS coordinates (DD.dddd): Lat. <u>418,5087</u> ° N	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4185087</u> ° N Long. <u>606915</u> ° W	City Initials - Site Initials - Chimney Number <u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Concrete Stone	N. T
Uther, please specify:	7
If the chimney is modified (cap, liner, etc.), please check the appgepriate modification:	
Cap I Terra Cotta Liner	
Animal Guard Spark Protector	X
Metal Liner Other, please specify:	road
Surrounding habitat (please check one):	
Commercia Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard bricks have the following measurements:
Rectangular \rightarrow Width (cm): $\underline{40}$ Ler	ngth (cm): 20cm x 9cm x 6cm (L x W x H)



Observer Details

Name D Graham	Phone Number		Email Address	5	S. marine
Street Address	1.01	City		Prov.	Postal Code
in fillen self states in the				1. 1917.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Building Details

Street Address 843 Hwy 8		City Man	e				
Owner Name	and a	Phone Number ()	1995	Email Addres	SS		231772
Type of building (please check	cone):			a	my C.	R. M.	
House	Church	Store		1. A.	20		
Lowrise Apartment	School	Factory		(D. 194		a fi 👘 👘	
Highrise Apartment	Hospital	Other, p	lease specify:		1.0		

Chimney Details

Site Name 843 Hwy 8	Chimney Code H - 843 -1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4185 187</u> ° N	City Initials - Site Initials - Chimney Number
Long. 606734 ° W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u> Port Rowan Public Library 1 PR-PL-1
Number of years active (if known):	London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
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:	road
Surrounding habitat (please check one):	
Residential	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
Round -> Diameter (cm):	
Square → Width (cm): 40cm	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)
Rectangular → Width (cm): Ler	ngth (cm):

Chimney Assessment Form Page 2 Chimney height Number of Colour of above roofline (m): Flues: Chimney: L 500 **Total Chimney** = 3 m + 8 х Height (m) 0 m Number of stories in (approx height Height above roofline (m) building of one story) If swifts are present, are they: Nesting Roosting Unknown Additional Comments: None seen. BASW Spen in area In aver. . Potential nest sites Created by: Canadian co-partner of un partenaire canadien de RD STUDIES Bird te In partnership with: THE ONTARIO LA FONDATION **Ontario** TRILLIUM DE L'ONTARIO Environnement Environment **McIlwraith** Canada Canada Field **Ontario Region** Région de l'Ontario **Naturalists**

Observer Details

1.

-

Name D. Grahan	Phone Number	5	Email Addres	s	S. Marin
Street Address		City		Prov.	Postal Code
POV SAL POVIDE			- 11 - V		

Building Details

Street Address	8		City Han	n. Iton	Prov.	Postal Code
Owner Name 7		Phone Number	trinet.	Email Addres	s	
Type of building (please check	one):	1.100 C 1.101				
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, pl	ease specify:			

Site Name 809 Hwy 8	Chimney Code H - 809							
GPS coordinates (DD.dddd): Lat. <u>43,13</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number							
Long. <u>79,41</u> ° W	No. of Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>							
Number of years active (if known):	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:	and ballens							
Animal Guard Spark Protector Metal Liner Other, please specify:								
Surrounding habitat (please check one): Residential Commercial Natural	a di karantere avara							
Other, please specify:								
Please select the SHAPE of your chimney and provide the application \rightarrow Diameter (cm): Square \rightarrow Width (cm): Rectangular \rightarrow Width (cm): 20 Ler	ngth (cm):							

Chimney height above roofline (m):	Number of Flues:	Colour of Chimney: Brown
Total Chimney Height (m) = Number of sto building		+ <u>3</u> = <u>6</u> m
If swifts are present, are they		Roosting Unknown
Additional Comments:	None	Seen.
		10 desember - Carlos Carlos -
- 40S	$= \{f_{i}^{\prime}\}_{i \in \mathbb{N}}$	3
ETUI Und	ID STUDIES CANADA BEB PUBBLAR CANADA entend approciate conserve prendre approciate conserver	Canadian co-partner of un partenaire canadien de
In partnership with:		
D. Or	ntario	THE ONTARIO TRILLIUM FOUNDATION DE L'ONTARIO
Environment Canada Ontario Regio	Environnement Canada n Région de l'Ontario	McIlwraith Field Naturalists

Observer Details

Name D. Gopham	Phone Number ()		Email Address			
Street Address		City		Prov.	Postal Code	

Building Details

Street Address 717	Hun 8	City	Prov. Postal Code
Owner Name		Phone Number	Email Address
Type of building (please cheo	ck one):		
House	Church	Store	
Lowrise Apartment	School	Factory	
Highrise Apartment	Hospital	Other, please specify:	Stoney Creek Municipal
Chimney Details			Building

Site Name 777 Huy 8	Chimney Code H - 777- O
GPS coordinates (DD.dddd): Lat. <u>4.3. 2.73</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. <u>79, 41, 500</u> ° W	No. of Eg. City Name Site Name Chimneys Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 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:	Genes
Surrounding habitat (please check one): Residential Commercial Other, please specify:	X Hay 8
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Dlameter (cm): □ Square → Width (cm): □ Rectangular → Width (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 height above roofline (m):	Number of Flues:		our of mney:	
Total Chimney =	× 3 m		=	m
	f stories in (approx he ding of one sto	ight Height abc ry)	ove roofline (m)	
If swifts are present, are t	ney: 🗌 Nesting		Unknown	
Additional Comments:	a stratt		S HOLD	
C . 7 M 83 /				
	A STAR			
a ribling				
j??	T+ H T		8. 1. 19	
-231				Sector Allocations
	30.0 m M			
reated by:				
reated by.		Canadian co-part		
	BIRD STUDIES (ANA DA	un partenaire cana	idien de	
	ETUDES O'OISEAUX GAIVAIJA	Dindl	· Co	
	comprendre apprécier conserver	INTERNATIO	NAL	
	1			
partnership with:	Al-			
15		THE ONTAR TRILLI		
V C	Intario	POUNDATI		
		A		
Environn Canada	ient Environnement Canada	Alle	McIlwraith	

17

Observer Details

Street Address C	City	Prov.	Postal Code

Building Details

Street Address 743H	. 8	A STREET, STRE	City Ha	milton	Prov.	Postal Code	
Owner Name	7	Phone Number	(av all	Email Addres	ŝŝ		
Type of building (please check	: one):	No na S		no a del			
House	Church	Store					
Lowrise Apartment	School	Factory					
Highrise Apartment	Hospital	Other, p	lease specify	<i>r</i> :			

Site Name 743 Hung 8	Chimney Code H -
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4785182 °N	City Initials - Site Initials - Chimney Number
Long. 605959 °W	Eg. <u>City Name Site Name Chimneys</u> Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chingney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🗌 Stucco	NY.
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:	
	X
Surrounding habitat (please check one):	
Residential	road
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the app	propriate estimated measurements:
□ Round → Diameter (cm):	
Square \rightarrow Width (cm): $\frac{50 \times 50}{50 \times 50}$	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
- Hermonia K.	bricks have the following measurements: 20cm x 9cm x 6cm (L x W x H)
Rectangular → Width (cm): Len	gth (cm):

Chimney height above roofline (m):	Number Flues:	er of	Colo Chir	nney: Brown	.a
Total Chimney = Height (m)	2 Number of stories in building	× 3 m (approx heigh of one story)	+ It Height abo	ve roofline (m)	<u>7</u> m
If swifts are preser	nt, are they:	Nesting		Unknown	
Additional Comments:		11 - 14 FT		A We Not	
		None	seen	1	
	-			2 43 May 8	
	india secondaria.		, il	49991992	111.2=3, 1776) 340
				[105.30s]	
	(P-7)[i i i
Created by:			Canadian co-part	ner of	
			un partenaire cana		
	BIRD STUDIES ETUDES D'OISEAUX			0	
	comprendre apprés		BIRD	Ite NAL	
n partnership with:	10 DO 10				
5	-			1.000	
0	Onta	rio	THE ONTAR TRILLIU FOUNDATIO	M TRILLIUM	
Let.	Unita				
				65	
+		onnement	An	McIlwraith	
	Canada Cana Ontario Region Régio	da on de l'Ontario		Field	
			Caller .	Naturalists	

18

Observer Details

Name D.	Graham	Phone Number ()	Email Address	
Street Address		City	Prov.	Postal Code

Building Details

Street Address 703 Hurs	3	City Ha	me 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		

Site Name 703 Huy 8	Chimney Code H - 703				
GPS coordinates (DD.dddd):	NOTE: (Chimney codes	are created using t	the following s	cheme:
Lat. <u>4785 & 31</u> ° N		City Initials	- Site Initials - Ch	imney Numb	ber
Long. 60570/ °W	Eg. C	city Name	Site Name	<u>No. of</u> Chimneys	Code
Number of years active (if known):	L	ort Rowan ondon	Public Library 141 Wortley	1 2	PR-PL-1 LO-141-1 LO-141-2
Chimney material (please check one):			a picture of the chi osition where the co		
Brick Stucco					
Concrete Stone		24	chine.		
Other, please specify:		100	chimney		
			•		
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 ap	propriate e	stimated measu	irements:		
Round → Diameter (cm):					
□ Square → Width (cm):			NOTE: Measu		
			estimated by co bricks have the	following mea	asurements:
Rectangular → Width (cm): Ler	ngth (cm):		20cm x 9cm x	6cm (L x W x	: H)

Chimney height above roofline (m):	Number of Flues:	Color Chim		5 6
	x 3 m	+ Height abov	e roofline (m)	m
If swifts are present, are t	hey: 🗌 Nesting [Roosting	🗍 Unknown	
Additional Comments:	No birds	s seen	75 243) V	
	an sai sa		S polles	Ϋ́,
	marka alla			
Created by:		Canadian co-partne	er of	
	BIRD STUDIESCANADA	un partenaire canadi	en de	
	understand approciate conserve comprendre apprécier conserver	BirdLi	fe	
n partnership with:				
(P)	Ontario	THE ONTARIC TRILLIUM FOUNDATION		
		sth		
Environr Canada Ontario	Canada		McIlwraith Field Naturalists	

19

Observer Details

91

Name D. Graham	Phone Number ()		Email Address	Cap	tinning series and the section of the
Street Address		City	Prov	. Postal	Code
			63 E 6		C

Building Details

Street Address 669 H	w 8	City Ha	Prov. Postal Code
Owner Name	7	Phone Number	Email Address
Type of building (please check	one):	Store	Born Swallow R.
Lowrise Apartment	School	Factory	61 Co. MOAL MAY
Highrise Apartment	Hospital	Other, please specify:	

Site Name 669 Huy 8	Chimney Code H - 669 - 1				
GPS coordinates (DD.dddd): Lat. <u>4785285</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number				
Long. <u>60 5459</u> ° W	No. of Eg. <u>City Name</u> Site Name Chimneys Code				
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2				
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.				
Concrete Stone					
Other, please specify:					
	n n				
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:					
Animal Guard Spark Protector					
Metal Liner Other, please specify:					
	road				
Surrounding habitat (prease check one):					
Residential (Control Industrial					
Commercial Natural					
Other, please specify:					
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:				
□ Round → Diameter (cm):					
Square → Width (cm): Rectangular → Width (cm): Ler	ngth (cm):				
LIST ENVIRENT					

Chimney height above roofline (m):	Number of) Flues:	Colour Chimne		a .d
Total Chimney Height (m) =) Number of strubuilding			=	<u>5</u> m
If swifts are present, are they			Unknown	S dead he takes
Additional Comments:	N Ham Har	line seen.	2 horal 1	CO)
Barn Sura shes ne	llow foraging arby		y suitable	resting
1- 95	\$ \{		8 241	atradui yan mi Mala atradui
			10453 (C) 10453 (C)	
	1 5			
Created by:		Canadian co-partner o un partenaire canadien		
En	RD STUDIESCANADA			
007	nprendre apprécier conserver	BIRGLII INTERNATIONA	9	
n partnership with:	The second		1	2.x1
e or	ntario	THE ONTARIO TRILLIUM FOUNDATION	LA FONDATION TRILLIUM DE L'ONTARIO	
Environment Canada Ontario Regio	Environnement Canada n Région de l'Ontario		McIlwraith Field Naturalists	

20

Observer Details

1.05

Name D. Graham	Phone Number	Email Address	10	
Street Address	City		Prov.	Postal Code

Building Details

Street Address	,tland	Rd	Ham	Han	Prov.	Postal Code
Owner Name		Phone Number		Email Addres	S	
Type of building (please chec	k one):	1.2530	31-616	1		
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	🗌 Other, pi	ease specify			

Site Name 196 Fruitland	Chimney Code H -
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4785502</u> ° N	City Initials - Site Initials - Chimney Number
Long. <u>605353</u> ° W	Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimpley material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🗌 Stucco	NT.
Concrete Stone	
Other, please specify:	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
🗹 Cap 🛛 Terra Cotta Liner	
Ariimal Guard Spark Protector	2
Metal Liner Dother, please specify:	X
Surrounding habitat (please check one):	
🗹 Residential 🔲 Industrial	tive soft essentiation
Commercial Natural	
Other, please specify:	4.74
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
□ Şquare → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
Rectangular → Width (cm): 15	bricks have the following measurements: 20cm x 9cm x 6cm (L x W x H)

Chimney Assessment Form Chimney height Number of Colour of Brown 0.5 above roofline (m): Flues: Chimney: **Total Chimney** 3 m = = + x Height (m) m (approx height of one story) Number of stories in Height above roofline (m) building Nesting If swifts are present, are they: **Roosting** Unknown **Additional Comments:** None seen Created by: Canadian co-partner of un partenaire canadien de BIRD STUDIES CANAD Вn te In partnership with: THE ONTARIO LA FONDATION TRILLIUM DE L'ONTARIO Intario Environnement Environment **McIlwraith** Canada Canada Field Ontario Region Région de l'Ontario **Naturalists**

21

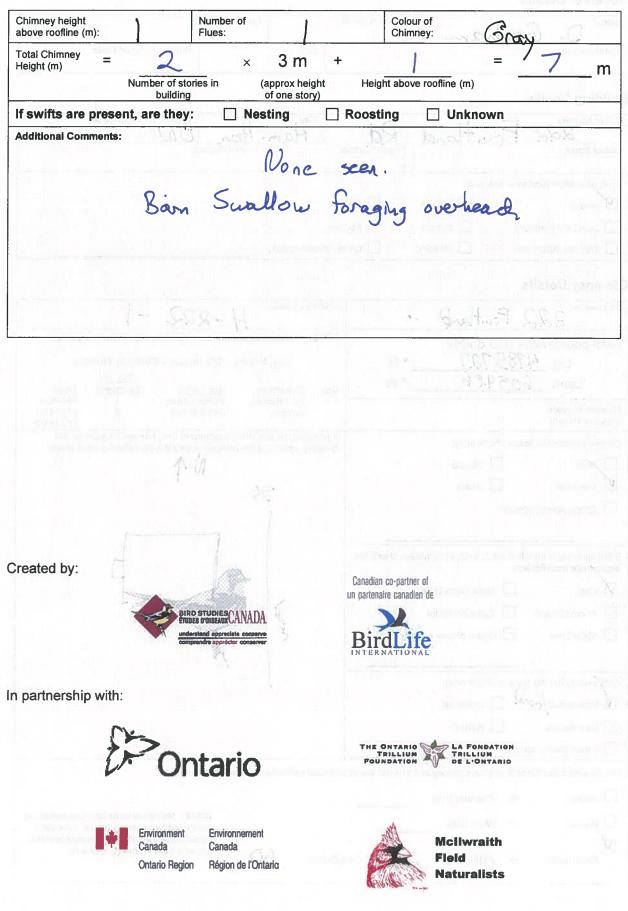
Observer Details

Name D. Graha.	Phone Number ()	Email Address	franktivning Sett in Deletereder
Street Address	City	Prov.	Postal Code
The second second second second second second second second second second second second second second second se			Net the second sec

Building Details

Street Address	Fuitland	Rd	City Ham.	Iton	Prov.	Postal Code
Owner Name		Phone Number	. S.	Email Addres	55	
Type of building (please cl	neck one):					
House	Church	Store	and the	aller and	in star	
Lownise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, p	ease specify:			

Site Name 222 Fruitland	Chimney Code H - 222 - 1
GPS coordinates (DD.dddd): Lat. <u>4985 727</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. <u>605406</u> ° W	No. of Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	~ 0
Concrete Stone	\times
Other, please specify:	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
Cap 🗌 Terra Cotta Liner	
Animal Guard Spark Protector	3
Metal Liner Other, please specify:	
Surrounding habitat (please check one):	
	allweit mit der
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
	bricks have the following measurements:
Rectangular → Width (cm): <u>20</u> Ler	ngth (cm): 60 20cm x 9cm x 6cm (L x W x H)



Observer Details

S.C

Name D. Graham	Phone Number	3	Email Addres		
Street Address	St. 12	City		Prov.	Postal Code
- TEL	3				

Building Details

Street Address 250 Fcu	tland 1	Rd	City Han	Hen	Prov.	Postal Code
Owner Name		Phone Number ()		Email Addres	s	
Type of building (please chec	k one):	10000	Thur -	(F		6 m 11
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, ple	ase specify:			

Site Name 250 Fruitland	Chimney Code H-25D -1
GPS coordinates (DD.dddd): Lat. <u>4785</u> 92 ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. <u>605457</u> ° W Number of years active (if known):	Eg. City Name Site Name Chimneys Code Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chimmey material (please check one): Brick Stucco Concrete Stone Other, please specify: If the chimmey is modified (cap, liner, etc.), please check the appropriate modification: Cap Terra Cotta Liner Animal Guard Spark Protector Metal Liner Other, please specify:	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Surrounding habitat (please check one): Residential Industrial Commercial Natural Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
Round \rightarrow Diameter (cm): Square \rightarrow Width (cm): Rectangular \rightarrow Width (cm):	ngth (cm): 50



Chimney Assessment Form Page 2 2 Chimney height above roofline (m): Number of 3 Colour of Brown Flues: Chimney: **Total Chimney** = 3 m + 3 = х Height (m) m Number of stories in (approx height Height above roofline (m) building of one story) If swifts are present, are they: Nesting Roosting Unknown **Additional Comments:** None geen Stip Twit Created by: Canadian co-partner of un partenaire canadien de IRD STUDIESCANADA Bird ite In partnership with: THE ONTARIO LA FONDATION TRILLIUM DE L'ONTARIO Ontario Environment Environnement **McIlwraith** Canada Canada Field Région de l'Ontario **Ontario Region** Naturalists

23

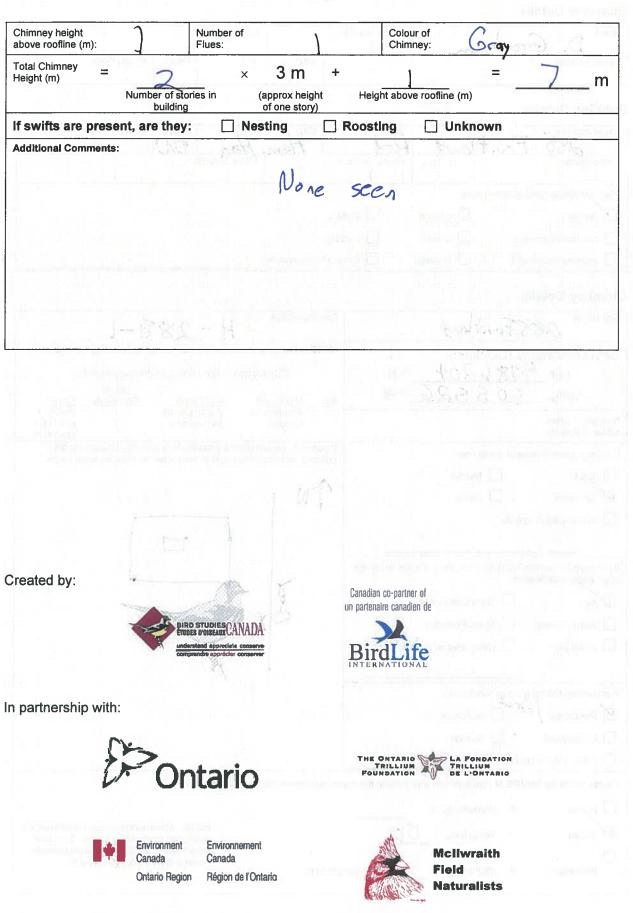
Observer Details

Name D.	Graham	Phone Number	<i>¶</i>	Email Addres	S	
Street Address			City	9	Prov.	Postal Code
1000 X			1 81 1		5	

Building Details

Street Address	w.tland	Rd	City	Han	Prov.	Postal Code
Owner Name		Phone Number ()		Émail Addres	SS	
Type of building (please of	check one):	(particular)	11 A 41	ю п. п.		12 million - 1
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	🗌 Other, p	lease specify:	-		

Site Name 288 Fruitland	Chimney Code H - 288-L
GPS coordinates (DD.dddd): Lat. 4786204 °N Long. 605526 °W Number of years active (if known): Chimney material (please check one): Brick Stucco	M - 288 - I NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number No. of City Initials - Site Initials - Chimney Number Eg. City Name Port Rowan London Site Name Public Library 141 Wortley Code 2 LO-141-1 LO-141-2 If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken. Code
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:	X
Surrounding habitat (please check one): Residential Commercial Other, please specify:	
Please select the SHAPE of your chimney and provide the app ☐ Round → Diameter (cm):	propriate estimated measurements:
Image: Square \rightarrow Width (cm): 50 Image: Rectangular \rightarrow Width (cm): Ler	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)



24

Observer Details

· - 125

D- Grahan	Phone Number	Email Address	
Street Address	City	Prov	Postal Code

Building Details

Street Address	s Rd.	City Han Iten Prov. Postal Code	
Owner Name [*]		Phone Number Email Address ()	I
Type of building (please check	(one):		
House	Church	Store	
Lowrise Apartment	School	Factory	
Highrise Apartment	Hospital	Other, please specify:	

Site Name 287 Fores	Chimney Code H-287
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4785965</u> ° N	City Initials - Site Initials - Chimney Number
Long. <u>606379</u> ° W	No. of Eg. <u>City Name</u> Site Name Chimneys Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
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:	8
STEPHEND	5
Surrounding habitat (please check one):	
Residential	illing quistions of
Commercial 🗌 Natural	1 N
Other, please specify:	\checkmark
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
Square → Width (cm): <u>50</u>	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
diffurneste lite	bricks have the following measurements: 20cm x 9cm x 6cm (L x W x H)
Rectangular → Width (cm): Ler	ngth (cm):

Chimney height above roofline (m):	Number of Flues:	Colour o Chimney		D. C.
Total Chimney = Height (m) = Number of sto building		eight Height above re	poffine (m)	<u> 4 </u> m
f swifts are present, are they:	: 🗌 Nesting		Unknown	
Additional Comments:	None 5	100 D	1997 - Lisado Alexandro Alexandro	• 184
	in one			
57	C H		3 / Bines	
the second second second second second second second second second second second second second second second s	49 AUL 344 7-11-1223	E.	Sat Bake	j≝ i Subbr Barasa
			10000	
(****				
reated by:	1			
		Canadian co-partner ol un partenaire canadien d		
unde	D STUDIESCANADA les d'USEAUX CANADA instand a poroclate conserve prendre apprécter conserver	BirdLife	and decomposition	
partnership with:			and the second second	
	ntario	THE ONTARIO TRILLIUM FOUNDATION	LA FONDATION TRILLIUM DE L'ONTARIO	
Environment Canada Ontario Regior	Environnement Canada Région de l'Ontarto		McIlwraith Field	

25

Observer Details

Name D. Grah	Phone Numi	per	Email Address		
Street Address		City	Prov.	Postal Code	RE-
No. of the second		1/1 6			

Building Details

Street Address 259 Jo	Thes Ro		Jam. Hon Prov. Post	al Code
Owner Name		Phone Number	Email Address	
Type of building (please chec	k one):	31 - Star		
House	Church	Store		
Lowrise Apartment	School	Factory		
Highrise Apartment	Hospital	Other, please s	specify:	

Site Name 259 Jones	Chimney Code H-259
GPS coordinates (DD.dddd): Lat. 4785796 °N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number
Long. 606335 ° W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u> Port Rowan Public Library 1 PR-PL-1
Number of years active (if known):	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:	The second
Surrounding habitat (pleas) check one):	niiko nHistoria ana
Commercial Natural Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
Round \rightarrow Diameter (cm): Square \rightarrow Width (cm): Rectangular \rightarrow Width (cm):	ngth (cm): <u>50</u> 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): Colour of Chimney: Number of 5 Brown Flues: d' **Total Chimney** 3 m = + 2.5 × Height (m) m Number of stories in (approx height Height above roofline (m) building of one story) If swifts are present, are they: Nesting **Roosting** Unknown **Additional Comments:** None Seen Created by: Canadian co-partner of un partenaire canadien de IRD STUDIES

In partnership with:

Ontario

Environment Canada Ontario Region

Environnement Canada Région de l'Ontario THE ONTARIO TRILLIUM FOUNDATION DE L'ONTARIO



Mcliwraith Field Naturalists

-



Observer Details

D. Grahan	Phone Number	J	Email Address	6	
Street Address		City		Prov.	Postal Code
	9(1)	111.6	- N 1	Sar	Carlos Carlos

Building Details

Street Address	ias Ra	City H	am. Has	Prov.	Postal Code
Owner Name		Phone Number	Email Addre	ess	
Type of building (please chec	k one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please spec	xify:		

Site Name 238 Jones	Chimney Code H - 238 -1
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>478 5562</u> ° N	City Initials - Site Initials - Chimney Number
Long. 606251 ° W	No. of Eg. <u>City Name Site Name Chimneys</u> Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick Stucco	
Concrete Stone	N
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:	E. I
Surrounding habitat (please check one):	1
Residential	the part of the pa
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
□ Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
development of the second seco	bricks have the following measurements:
Rectangular → Width (cm): <u>40</u> Ler	ngth (cm): 20cm x 9cm x 6cm (L x W x H)

Chimney Assessment Form Page 2 26 Number of Chimney height 05 Colour of Brown above roofline (m): Flues: Chimney: **Total Chimney** 3 m = + 0.5 х = Height (m) m (approx height of one story) Number of stories in Height above roofline (m) building If swifts are present, are they: Nesting **Roosting** Unknown Additional Comments: None seen 5.0 Created by: Canadian co-partner of un partenaire canadien de RD STUDIES Bır те In partnership with: THE ONTARIO LA FONDATION TRILLIUM DE L'ONTARIO Intario Environment Environnement **McIlwraith** Canada Canada Field Région de l'Ontario Ontario Region **Naturalists**



Name D. Graham	Phone Number		Email Address	S	
Street Address		City		Prov.	Postal Code
Jun Vet		ITI KI			

Building Details

Street Address 197	Jores	Rd	City Ha	n. Ita	Prov.	Postal Code
Owner Name		Phone Number ()		Email Addre	SS	di av
Type of building (please ch	eck one):	0.884	Ser Co	Ý.		
House	Church	Store				
Lowrise Apartment	School	Factory				
Highrise Apartment	Hospital	Other, p	ease specify	nd <u>ara</u> da		

Site Name 197 Jones	Chimney Code H - 197 -							
GPS coordinates (DD.dddd): Lat. <u>4185333</u> ° N	NOTE: Chimney codes are created using the following scheme: City Initials - Site Initials - Chimney Number							
Long. <u>606220</u> ° W	No. of Eg. <u>City Name Site Name Chimneys</u> Code Port Rowan Public Library 1 PR-PL-1							
Number of years active (if known):	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 Cap Terra Cotta Liner Animal Guard Spark Protector Metal Liner Other, please specify:	t star							
Surrounding habitat (please check one):								
Commercial Natural Other, please specify:								
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:							
□ Round → Diameter (cm):								
Square → Width (cm): Rectangular → Width (cm): 50	ngth (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 height above roofline (m):		Number of Flues:	1		Colour of Chimney:	Tan	- aler	di
Total Chimney = Height (m)	Number of sto building	ories in (app	3 m rox height one story)	+ Heigl) nt above roofline	=	4	_ m
if swifts are prese	ent, are they	: 🗌 Nestin	g [] Roosti	ng 🗌 U	nknown		
Additional Comments	014	Bart - Hong	A.	YC	A. 8.	St-R	1 .] . [
		01						
		100	ne	seen				
								House 14
1	1977	ALL STOR				25000	0	
()	2711	- 171 -				(C. 200 3 C. 20	711	
							ļi li	
					8			
								100
		A.						
	÷							
Created by:		(BA		Canadian	co-partner of			
	-				re canadien de			
	ÊTU	RO STUDIESCANADA DES D'OISEAUX CANADA Ierstand epprociate conserve			X			
		prendre apprécier conserver		BIR	dLife			
								and the basis
n partnership with	:					1.0		ŀ
~	N							
*	5			THE C		A FONDATION		
L	← Or	ntario				E L'ONTARIO		
	Environment Canada	Environnement Canada				llwraith		
	Ontario Regio	Billion 1		1	Fie	ld turalists		
				N THE	All the same	MI G11313		

Hamilton. 60950443 June 25 2012 - WIND 54 CH8W - 20°C. - 10°10 cloud - Ø preep. Stn 14 - 843 Huy 8. 10:15-10:30 - ØCHEW Observed.

€) Sth 15 - 809-Hwy 8 -> of CHSW Obs. BUT 10:35-10:50 on BBS#10 adjacent 40 This str (earlies)

44.9 ° ''		[Daytime Cl	nimney	Observat	ion Form	i -		
	Provinc	ce:	Dataria	r'd	Observer Name: _	D. (jahan		
	Ci	ity:	Hamlton	10000	Observer Address:	Start	ec Mark	han	
	Site Nan	ne: Pc	stland Wa	none	3	300-675	Cochrane	Dr. W	Vestilour
	Chimney Coo GPS Coo		$Q = S^{\dagger}$		Telephone: _	905-	415-6"	+17	
	(UTMs or Lat/Lon		<u>- S) bo</u> - G R		E-mail: _	dan.grah	and ston	tee	6~
	Date (dd/mm/yy)	Obs	ervation start time (hh:mm)		on end time mm)	Visit #	Estimated # using chi		
	31/05/1	12	14:45	21	:15				
	Precipitatio	on	Cloud	3111	Wind		Temperature (°C)	as L
	None	Rain	(¹) 2 3	4 5	0 1 2 3	4 5 6	18°0		She
	Additional Comment No Chimneys roosting off a at the foll a reconno May 20 conducted to Chimney Swith	suitable esting lowing	is additional	during	Wind (Beaufort 0 Calm, smoke 1 Light air move 2 Slight breeze, 3 Gentle breeze 4 Moderate bree 5 Fresh breeze, 6 Strong breeze	rises vertically ment, smoke dri wind felt on face , small twigs mo eze, small branc small trees swa	1 0-2: fts 2 25- e 3 50- ve 4 75- hes move 5 Fog y 5 Fog	50% 75% 100%	ended on 2 re
	Fruitland - We	Entra	Secondary P	Tan Area	r.	Ex	its		and the second
Station #	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	- · · · · · · · · · · · · · · · · · · ·	Time (hh:mm)	# Birds] Ly
1	14:45	0			14:45	\bigcirc			
2	15:00	\mathcal{O}			15:00				
3	15:15	\mathcal{O}			15:15				•
4		0			15:30				
° 5	15:45	0			15:45				
67	6:00	\mathcal{O}			6:00	\mathcal{O}			-
	16:40	$\overline{\mathbf{O}}$			(6:4				
89	17:00	· 0		•••••		00			
10	17:20	Õ			7:2				
11	17:40	D			17.	40 0			
12	18,00	0			18:	$\alpha 0$			
13	18:26	\mathcal{O}			ろう	0 0			
14	18:40	D D	2 pints they ou	er bit mai	Esite (8:4]
15	19:00	0	tor CHSW us	no calerta	institut 19:	∞ 0			
Tel	10		CHSW Menta	nty Prot	ocol.				
Incide				V					
	<u></u>		#7 #1 #	11 11	J 419				
Born Su Coopers	Haule: #	ne	#7, #6, # #22	14, #1	8, #19				

Daytime Chimney Observation Form

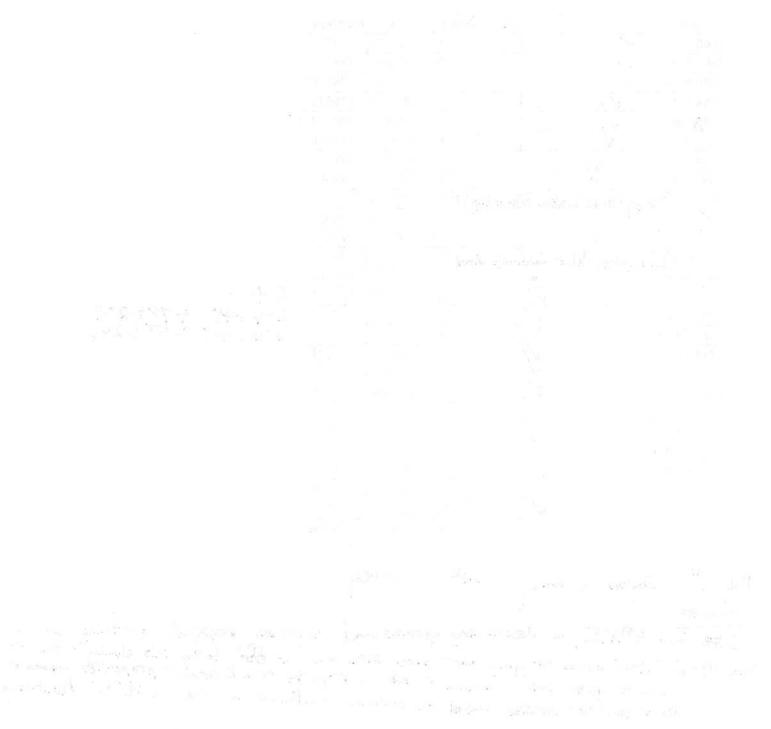
1 - 1

T		Entra				Ex		
	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Bird
	19:20	0	Speed St.		19:20	0	32	
	19:40	0	- m ²		19:40	0		
•	20:00	0			20:00	Ó		1
	20:15	0			20:05	D		
								······
?	20:30	0		•••••	20:30	0		
1	<u>d0:40</u>	0			20:40	0		
2	20:50				20:50	0		ļ
345	21:00	0			21:00	0		ļ
4								
5				11-5		(3)	d	piño.
								1
-								
-1		• • • • • • • • • •		•••••		100 0000	<u></u>	
ŀ								
ŀ					- Roff along	<u></u>	ndesirelision	
						del notera	intér a AR III.	4. 1
						1.5 8	1947 Y N. (1943)	10
			w,Ξ					
1								
ŀ				<u> - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - </u>			······	<u>.</u>
-			Ч					
-								
-								
-								
				1.10,				
			2.1	82			- L - 20	18
-		•••••	14					
-					÷			
-					þ			
-				- X - 2	·····			
-								
			- 25.0				2	
			.a 3.a	δ. Ι				111
-			43 AH	1	19 A. A. A. A. A. A. A. A. A. A. A. A. A.	2. 95.25		1.1.1
L	11		221	Y	State State			and the fi

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 (Stang, Cock Classing	Fellowship 1 9	607304	4785777		
26 Glover V	10	607173	4785563		
239 Glover 🗸	11	607101	4785327		
Gloverv (K) adom Hall of Je	home his Witness 12	607057	4785169		
873 Hwy 8	13		4785087		
843 Hwy 8 🗸	14	606734	4785187	CHSW	4785209 4785242
809 Hwy 8 🗸 🗸	15	43.12	79.41	606448,	4785209
777 Hwy 8 V	16	43.12	79.41	606241;	4785242
743 Hwy 8 🗸 🗸	17	605959	4785182	/	
703 Hwy 8 🗸 🗸	18	605701	4785231		
669 Hwy 8 🗸 🗸	19	605454	4785285		
196 Fruitland V	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		

10.1

May 31st Doptime Chinney SwiFt Survey Comments Sute 2: AMKE, a declining grassland species observed overflying stc.-Site 14: 2 CHSW aerial Foraging over site. Birds node no other to fly into chinney of this or Site 14: 2 CHSW aerial Foraging over site. Birds node no other to fly into chinney of this or adjacent properties. Chinneys of subject property a adjacent properties appeared insuitable for species bused on criteria cartained in the CHSW Manitoring Protocol. Site 15: As at site 14, only differing in 4 CHSW aerial foraging



Ontaria Hamilton	Observe	$\frac{1}{1}$	c Markha	opyst.
Frontland - Wa	AAAA	300-675	Cochrase Dr	tean
		1	415-6417	tore ec. com
Observation start time (hh:mm)	Observation end time (hh:mm)	Visit #	Estimated # of birds using chimney	
08:15	09:15	1		
		Ontaria Name <u>Hamiltea</u> Name Observe <u>Fau, Hand - Wanana</u> Telephone E-mai Observation start time Observation end time	Ontania Name: Hamilton Observer Address: Stante Stante 300-675 Telephone: 905 E-mail: 905 Observation start time Observation end time	Ontania Name: Hamilton Observer Address: Stantec Markha Faulton 300-675 Cochrane Dr Faulton 905 - 415 - 6417 Dr Dr E-mail: 905 - 415 - 6417 Dr Dr Observation start time Observation end time Vieit # Estimated # of birds

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) Cloud Cover
	0 Calm, smoke rises vertically 1 0-25%
	1 Light air movement, smoke drifts 2 25-50%
	2 Slight breeze, wind felt on face 3 50-75%
	3 Gentle breeze, small twigs move 4 75-100%
	4 Moderate breeze, small branches move 5 Fog
	5 Fresh breeze, small trees sway
	6 Strong breeze, large branches in motion

					1	· · · · · · · · · · · · · · · · · · ·			
Station #		Entrai	nces				Ex	its	_
	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds		Time (hh:mm)	# Birds	Time (hh:mm)	# Birds
24	08:15	Ø				09:15	Ø		
25	08:30	\mathcal{D}				08:30	Th.		
ab	08:45	Ø				08:45	Ø.		
27	09:00	И				09:00.	Ъ		
		φ		• •			φ		
				• • • • • • • • • • • • • • • • • • • •					
		• • • • • • • • • • • • •		•••••					••••••
	• • • • • • • • • • • • • • • • • • • •								
									*
	*****								1
	• • • • • • • • • • • • • • • • • • • •			• • • • • • • • • • • • • •					
l		I			1			L	L]

Daytime Chimney Observation Form

Page 2	
--------	--

	Entra	nces		Exits				
Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	Time (hh:mm)	# Birds	
All much	123	Sector Longer				i2		
C 19 3+							1	
<u></u>								
		7 al-14g						
		_						
							10 e	
						-	+	
]	
				•				
						19. 19 [.] -		
					ceret de			
							1	
	•••••	••••••						
	••••••		• • • • • • • • • • • • •		•		¦	
		••••••						
				L	L			

Sta	antec	Stantec Co 1 – 70 Sou Guelph, Ol Canada N Tei: (519) 8 Fax: (519)	1G 4P5 336-6050	td.			Point Counts servation Fo	
	ject Number	161	3950	+43	×.	Project Name:	Scobe 1	ancels
	Dates	· · · · · · · · · · · · · · · · · · ·	July 1:	2,201	2	Field Personnel:	D. Grahe	in.
Weather C	conditions:	темі 16-	P (°C): 25		IND: D -	CLOUD:	PPT: None	PPT (in last 24 hrs):
	GPS #:	T	1993 - 1993	101 [420]				
Static	on:		Sur Land	Featu	re:		UTM: 607	1994
Start Tim	ne:	530	5.2.2	- End Tin	ne:	535	<u> </u>	85266
Habit	at: DForest	/ 🗆 Swamp	/ Marsh /	- / 🗆 Hay / 🗔 I			τι	v - 2 6 6
Species	<50m	50-100m	>100m	Flyovers	Height*		· · · · ·	
MoDo		×	~ 10010	riyuvers	neight			J -
SOSP		sn						
GRCA	SM							
CHSP	Х				-		DISM	1000(x)
EUST	X			V			GRCACA	
AMRO	CF	N.				HOSP(X F	1	
HOSP		X				HOSTU F	UST/ >	
				5.0	• Constant and a second spatial management		1/1	50 100
		34	135 6 1				4MRO(CP)	
					Film of second contract state		15	
		2					$\langle /$	/
					Stor.			/
	de sweep varie A-Below heigh							
	ht of blade swe				2 4 1			200
		123						
	all and a	10,000						
	1 141.4							
2.15			Š. A					171154
								e
Page o						Quality Control: This form	n is complete 🛛 & legi	ble 🗖.
Signa	ature:					Signature:	······································	
			(Field Perso	nnel)			(Project Mana	ager)

als w:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

Þ

- 30

REV: 2011-05-04 / FORM 020

Statio	ו:	2		Featu	re:	UTM: 608483	
Start Time	e: 5	45		End Tin	ne:	550 4784921	-
Habita	t: DFores	t / 🗆 Swamp	/ 🗆 Marsh	_ / 🛛 Hay / 🔾	Pasture / 🗆		
Species	<50m	50-100m	>100m	Flyovers	Height*	UM(WT) N VEWOCSHOLSH	
YEWA	-oom		SM		mergine	- Cunica - N	
HowR		1	SM			HOWBUSH	
KILL		1	Y			KILLO HOW RESI	
AMRO	CF	X				AMRO(X) BASULOR (A) AMRO(X) BASULOR (A) BOSP(SH) BASULOR (A) CHSP(SH) BOSP(SH)	
CHSP		SM				HINTE SOSPERIE	
BASY	X	X				NOCH SHOW	\
SOSP	SM	SM				RUST	1
EAKT		Aq	1			GOSP(SH) EUET	1
AMGU		×		V		ANRO(CP) 50	100
COGR	X					apr bo Basw(*)	
EUST	X			V			/
	с ⁶						
O-On ground; /	A-Below heig	vary from proje ht of blade swe	ep; B-At heigh	nt of blade swee	e <i>ct manager.</i> ep;		
C-Above heigh	t of blade swe	eep; D-Well abo	ove height of b	lade sweep			
Station	: 3			Featu	re:	UTM: 608816	
Start Time		• 27.53		- End Tim	ne: ()	u™: <u>608816</u> 4785156	
	0	/ DSwamp	/ DMarsh /	-		4/85/56	
Species	<50m	50-100m	>100m	Flyovers	Height*		
			SM		•	5058(SM)	
SASP		X	SM				
MoDo					•=	9x50 WOUT MODO(X)	
WAUI		SM		V	r=11114111	- CUNCOT	
COGR EAKT		X X		V		9X50 WAVIGN	
	X	~			a, fartist harves als same set as par same same s	WAT GER(X)	
HOSP	< <u> </u>				a * * ******	N R HOSPON	1
AM60 RWBL				V			100
EUST	X X			~			Ĩ
BHCO	X					N EUSTICE) A MG OF T BHCO(X) EAKT(X)	/
NOCA		Œ				EAKTC)	/
- ma		4				Hay NOCACEF)	
* Height of blad							
O-On ground; A C-Above height					ep;		
						SASP (SM)	
Page of						Quality Control: This form is complete	
Signat	ure:					Signature:	
		(Field Perso	onnel)		(Project Manager)	

REV: 2011-05-04 / FORM 020

il a

UTM: 608758 Station: Feature: کا 20 Start Time: End Time: 4785292 0 6 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop RTHA NOFL(SM) <50m 50-100m >100m Species Flyovers Height* Fallow KILL 怒戶 RTHA SOSP(SM) School a cut gras SM NOFL KILL 50 SP(SM) Х AMROCSM Sost SM SM AMR 3 X ν 0 5 51 \$50 100 SM SM X EU 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; rennant to forby fo C-Above height of blade sweep; D-Well above height of blade sweep 608294 Station: Feature: UTM: 35 40 Start Time: End Time: 4785534 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Height* Flyovers NO CALSM) SOSP(SM) NACA SM CUM SM SM SOSP AMGU SM AMGO V X OGR L EUS CF AMRO BHCU SOSP(S) COGR 50 100 * 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:

Signature.

(Field Personnel)

UTM: 608587 Station: Feature: 45 50 4785464 Start Time: End Time: 6 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m Species 50-100m >100m Height* Flyovers S Ac EAKI Foullow rouxies SASP Si SM SASPLSM COGR (OGR V X X MODO V HOWR SM HOWR (SM EAKTCAS Х RWRL SASP Х CEWA V SOSP (SM) BASW X L 50 100 SOSP Road SM AMPO V R * 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 hybrid butternut noted NON Hornu 6 res, CON 05 TNO 609246 UTM: Station: Feature: 55 30 **Start Time:** End Time: 4785339 0 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m Species 50-100m >100m Flyovers Height* S CP 06A AMRO A Hay 5 HO X ~ P Resdire Ruag 50 100 * 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)

UTM: 610065 Station: 8 Feature: 4785097 3 10 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Municipal park with <50m 50-100m >100m retained ash a 5 Species Flyovers Height* BLJACX BLAD est grass V χ X P MODOLSA SM MODD EUSTUS (06R 65 Б AM60/5 M BREL AMRDI F EUST (X) rest nation HOSP/com carrying nestra BASI AM 50 100 * 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: 610535 720 25 Start Time: **End Time:** 478553 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop >100m <50m 50-100m Species Flyovers Height* S (Eh)A SM NOFL (SPO YEWO(SM NOF 51 CUW EARI Ha EAKT SOSPESM NOCALSH SM SOSP RWELCX CUM AMPOLOF NORA SM AMRI 4MR CF CEWA SASP CENA (54) Ark 50 100 ٧ * 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)

UTM: 610406 Station: Feature: D 30 735 4785845 **Start Time:** End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m Species >100m Flyovers Height* S A EAL CUW 2 AMRO X EWA AMRO CHWA(X) SOSP(SM) SOSP SM SM A MGD EAKI (A9 RWBL AM60(55) RW RWBL(Road 100 -11 * 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: 610234 45 7 50 Start Time: End Time: 4785771 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <50m 50-100m >100m Flyovers Height* SE -AWQ SM SM TEWA CAWR (SM AMCI SM CEWACSM CUN C AM60(SM Х Bt SOSF Ho BASU 4D BAS 100 50 Gas alla 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)

Statilitet Project Number: [60950443 Project Name: Scube Porcels Date: July 12, 2012 Field Personnel: Veather Conditions: TEMP (°C): WIND: CLOUD: PPT: PPT (in last 24 hrs) Veather Conditions: TEMP (°C): WIND: CLOUD: PPT: PPT (in last 24 hrs) Veather Conditions: (6-25 O-1 JDD, Wange None Station: /2 Feature: UTM: 6100037 Start Time: 7 ⁵⁵ 4785737 Habitat: Droget / Down / DMarsh / DHay / DPasture / DCrop End Time: 7 ⁵⁵ 4785 73,7 VCCA SM NocA(sr) NocA(sr) SM SM SM SM SM SM <th></th> <th>6</th> <th></th> <th>1G 4P5 836-6050</th> <th></th> <th></th> <th></th> <th>Point Count servation F</th> <th></th>		6		1G 4P5 836-6050				Point Count servation F	
Date: July 12, 2012 Field Personnel: Veather Conditions: TEMP (°C): WIND: CLOUD: PPT: PPT: PPT (in last 24 hrs) GPS #: T					1443		Project Name:	Sala	Papla
Veather Conditions: TEMP (°C): WIND: CLOUD: PPT: PPT (In last 24 hrs) (6-25 0-1 102 Maxe None None None GPS #: T Station: 2 Feature: UTM: 610037 Station: 2 Feature: UTM: 610037 Habitat: GPS #: T Habitat: GP for the provide the		Date		6	the second second second second second second second second second second second second second second second se	`		Scube	loncels
Veather Conditions: (6-25 0-1 157, Mane None GPS #: T Station:			(2014/0	l, auli	Д	-		
Station:	Weather Co	onditions:	1 /			IND:	i i		
Start Time: 7 50 End Time: 7 55 9 100-07 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop 4 785 73,7 Pecies <50m		GPS #:	т		- 1				
Start Time: 7 50 End Time: 7 55 9 100-07 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop 4 785 73,7 Pecies <50m 50-100m >100m Flyovers Height* VOCA SM SM SM NocA(srt) SA SP SM SM NocA(srt) WiFLSH SOSR SM V SosP(Str) WiFLSH OGR X V SosP(Str) WiFLSH MIEL SM V SosP(Str) WiFLSH WIFL SM V Nota WiFL WIFL SM V Nota WiFL Vota SosP(Str) V Nota WiFL Ord SosP(Str) V Not	Statio	n: 17			Featu	re'			0027
Habitat: Droest / DSwamp / DMarsh / DHay / DPasture / DCrop CON Pecies <		<u> </u>	-750		-		_ 55	01	11 X
Habitat: LiForest / LiSwamp / LiMarsh / LiHay / LiPasture / LiCrop pecies <50m 50-100m Flyovers Height* VACA SM SM NodA (SN) SA SP SM SM NodA (SN) So SP SM SM BHCO X V OGR X V MMGO SM V WIFL SM V MMGO SM V WIFL V V WIFL V V Value V V WIFL V V Value V V Value V V Value V <			1		-			47	8573,7
pecies < SUm SU-100m >100m Plyovers Height* VCA SM SM NocA(sn) SASP SM SM SoSP SM SOM OGR X V OGR X V MGO SM V WIFL WIFL WIFL WIFL WIFL SM WIFL WIFL WIFL WIFL WIFL SM WIFL SM On ground: A-Below height of blade sweep:	Habita	t: DForest	/ USwamp	/ UMarsh	/ 🗆 Hay / 🗆 I	Pasture / 🗆			7-1
VOCA SM SA SP SM So SP SM So SP SM BHCO X OGR X VAPI SM WIFL WIFL WIFL SM WIFL WIFL	Species	<50m	50-100m	>100m	Flyovers	Height*_	[(OW	B	
SASP SM SOSP SM BHCO X OGR X MFL SM WIFL SM	NOCA			SM					/ /
BHCO X OGR X MGO SM WIFL SM	SASP								≤ 1
BHCO X OGR X MGO SM WIFL SM	505P		SM					SASPUSY	X.
Obk X AMGO SM WIFL SM WAVI SM WBL X WIFL SM Work SM Work SM Work SM Wift SM <td>BHCO</td> <td>X</td> <td></td> <td></td> <td>VI</td> <td></td> <td></td> <td></td> <td>· /· · · · · · · · · · · · · · · · · ·</td>	BHCO	X			VI				· /· · · · · · · · · · · · · · · · · ·
MTIGU STI WIFL SM WAVI SM WBL X Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep;	OGR	X			V		M SHOU		WANI (SM)
WIFL SM WAVI SM WBL X Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep; -On ground; A-Below height of blade sweep;		SM							\times \
WHVI String WBL X WBL X Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep;			SM					maden /	$\langle \rangle$
WBL X 50 100 Height of blade sweep varies from project to project; check with project manager. 00 minutes from project to project; check with project manager.	MAVI		SM					ATT RA	WB6/09
Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep; B-At height of blade sweep;	WBL	X	1.31				Mad		50 100
Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep; B-At height of blade sweep;			<u> </u>						
Height of blade sweep varies from project to project; check with project manager. -On ground; A-Below height of blade sweep; B-At height of blade sweep;									IST ISMY
-On ground; A-Below height of blade sweep; B-At height of blade sweep;								\setminus \mid \prime	WITHCO
-On ground; A-Below height of blade sweep; B-At height of blade sweep;				- An		· · · · · · · · · · · · · · · · · · ·			/
-On ground; A-Below height of blade sweep; B-At height of blade sweep;	Height of blac	de sweep varie	es from project	to project; che	eck with project	manager.			
	-On ground; /	A-Below heigh	t of blade swe	ep; B-At heigh	t of blade swee	ep;			
								(
	000 -f						a		
								m is complete 🖵 & le	egible 🗳.
age of Quality Control: This form is complete 🛄 & legible 🗔.	Signat	ure:					Signature:		

(Field Personnel)

(Project Manager) REV: 2011-05-04 / FORM 020

als w:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

Station:	13	-100	Featu	re:		UTM: 610	049
tart Time:	800	in the second	End Tin	ne:			
	O Forest / □Swamp	/ 🗆 Marsh	_		ICrop	_ 7/8	538
ies <5	0m 50-100m	>100m	Flyovers	Height*	L - 19	B	
IBI-		SM				L H	
SP	SM						RW
58	SM,						
io SM						COR(SM	
PX		I				- KORM	2
O A						CHARSM) HORE	AND
186 -	9 SM				/	AM60(SA) NO	model
							T
					road		50
			-				/
						\mathbf{i}	/
und; A -Below height of bla	ep will vary from proje w height of blade swe de sweep; D-Well ab	ep; B-At heigh	nt of blade swee blade sweep	ep;			<u> </u>
ation:	w height of blade swe de sweep; D-Well ab	ep; B-At heigh	nt of blade sweep blade sweep Featur	ep; re:	820	UTM: 60 4-70	986
und; A-Belon height of bla ation: Time:	w height of blade swe	ep; B-At heigh	nt of blade sweep Plade sweep Featur End Tim	ep; re:	8-20 Crop	итм: <u>60</u> 478	0986 3560
nd; A-Belov eight of bla tion: 	w height of blade swe de sweep; D-Well ab 14 5 6 orest / □Swamp	ep; B-At heigh	nt of blade sweep Plade sweep Featur End Tim	ep; re:		utm: <u>60</u> 478	0986 3560
ind; A-Belon leight of bla tion: 'ime: bitat: □F	w height of blade swe de sweep; D-Well ab 14 5 6 orest / □Swamp	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur - End Tim / QHay / QF	re: ne: Pasture / 🗖	Сгор	K	0986
und; A-Belon height of bla ation: Time: bitat: □F <50	w height of blade swe de sweep; D-Well ab 14 5 6 orest / □Swamp	ep; B-At heigh ove height of b / OMarsh / >100m	Featur - End Tim / QHay / QF	re: ne: Pasture / 🗖	Сгор	K	986
ind; A-Belon height of bla ition: fime: bitat: DF	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur - End Tim / QHay / QF	re: ne: Pasture / 🖵	Сгор	K	9860
Ind; A-Belon height of bla ntion: fime: bitat: DF	w height of blade swe de sweep; D-Well ab 14 5 6 orest / □Swamp	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur - End Tim / QHay / QF	re: ne: Pasture / 🖵	Crop Fallew 257-		986
d; A-Belon light of bla ion: me: tat: □F	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-		986
ion: ime: itat: DF	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	K	986
round; A-Belon tation: tation: abitat: \Box F s <50 C C C C C C C C	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICSM BEER	Ref O
tation: tation: Time: abitat: $\Box F$ s <50 R ΞO ΞO	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN BESON RWBLCH BEST	THE SECTION
pround; A-Belov re height of bla Station: t Time: labitat: $\Box F$ es <50 P GO GO GO GO GO TH XST XSF X	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	RATA SSCA 50
ground; A-Belon ve height of bla Station: rt Time: Habitat: \Box F es <50 P A A B A A A A A A A A A A	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	HCA SECA 50
ground; A-Belon ve height of bla Station: rt Time: Habitat: \Box F es <50 P (R BL X ST X ST X SF X	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN BESON RWBLCH BEST	RATA SECA 50
pround; A-Belon ve height of bla Station: Tt Time: Habitat: $\Box F$ es <50 P C C C C C C C C	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	HCA SECA 50
round; A-Belon tation: tation: abitat: \Box F s <50 P Δ D Δ D Δ D Δ D Δ D Δ C Δ C	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of b / DMarsh / >100m SM	Featur End Tim / OHay / OF	re: ne: Pasture / 🖵	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	HCA SECA 50
nd; A-Belov eight of bla tion: ime: 	w height of blade swe de sweep; D-Well abo I g K orest / I Swamp Im 50-100m SM	ep; B-At heigh ove height of t >100m SM SM	Featur Featur End Tim / QHay / DF Flyovers	ep; re: Pasture / 🗆 Height*	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	RAN SECA 50
Ind; A-Belon height of bla tion: 'ime: poitat: □F CO V X L X T X CO V X L X CO V X D X CO V X CO V X CO CO CO CO CO CO CO CO CO CO CO CO CO CO CO	w height of blade swe de sweep; D-Well abo 14 5 5 orest / Swamp m 50-100m	ep; B-At heigh ove height of t / □Marsh / >100m SM SM	Featur Featur End Tim / OHay / OF Flyovers	ep; re: Pasture / Height* Ct manager.	Crop Fallew 257-	AMERICAN RWBLCH BRED RWBLCH BRIT	RCA A 05 TOA 58 CA 50

(Field Personnel)

UTM: 608784 4785104 Station: Feature: 840 Start Time: End Time: Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop orchard Species <50m 50-100m >100m Flyovers Height* E SM {م|/₽] Ŷ (RWA WIFL (SM) CEWA-CE BASI 3 BASW X 111 EAKICA F PU 5058(5 SA 20051 SAP(SM) 3X Bebo Sr SOGP 50 100 * 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 plade sweep; D-Well above height of blade sweep Freidental BAOI Station: Feature: UTM: 61 78 O P 00 Start Time: End Time: 4785550 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop 50-100m Species <50m >100m Flyovers Height* SM NGA NOCACSA 505P (5M R6/05 XG RWBLCX SM BÁSW (X) 3 I. EUST ≫ EU MEPTY and ses AMR ĤΟ EUSTO $\leq m$ 505 rd 50 100 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)

UTM: 611228 Station: Feature: 850 85 4785587 Start Time: **End Time:** Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m Species >100m Flyovers Height* BASIO BASH 3X X 1001 5 X P RSW(X) COSA C roac 51 100 * 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: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m >100m Species **Flyovers** Height* 100 50 * 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 Quality Control: This form is complete **Q** & legible **Q**.

Page ____ of ____

Signature:

(Field Personnel)

Sta	antec	Stantec Co 1 – 70 Sou Guelph, Of Canada N Tel: (519) 8 Fax: (519)	thgate Driv N 1G 4P5 336-6050			-	Point Count servation Fo	
	ect Number	-160	9504	142		Project Name:	HAMILTON -	Scube
	Date		4,2			Field Personnel:	MICHAEL O	
Weather C	onditions:	1	°°C): 1°C	W	IND:	CLOUD: 20 %	PPT:	PPT (in last 24 hrs):
	GPS #	:T N/	A	_				
Statio	n:	1		Featur	re:		UTM: 00	507994
Start Tim		5:43		End Tim	ne: 05	:48		85266
Habita			/ DMarsh	 / OHay / OF	Pasture / CCro		2 8	0.000
- n=-) (_	· [-		
		······		1				
	<50m	50-100m	>100m	Flyovers	Height*		E	
mgo	< 50m 2	1	>100m	Flyovers	Height*		E	
Amro	1	50-100m 	>100m	Flyovers	Height*		E	
Amgo Amro Fisp	1	1	>100m	Flyovers	Height*		T	
amro Fisp	1	1	>100m	Flyovers	Height*		FISP	
amro Fisp	1	1	>100m	Flyovers	Height*		FISP	IMGID
amro Fisp	1	1	>100m	Flyovers	Height*		FISP	(MGrD
amro Fisp	1	1	>100m	Flyovers	Height*	00082	FISP	
amro Fisp	1	1	>100m	Flyovers	Height*	AMRO	FISP	\sim
Amgo Amro Fisp	1	1	>100m	Flyovers	Height*		FISP	
amro Fisp	1	1	>100m	Flyovers	Height*		FISP	° 50 100
amro Fisp	1	1	>100m	Flyovers	Height*		FISP	0
ipecies AMGO AMRO FISP RWBL	1	1	>100m	Flyovers	Height*	RWBL	FISP	° 50 100

Page <u>of</u> of <u>9</u> Signature:	Millo	
-	(Field Personnel)	

Quality Control: This form is complete 🛄 & legible 🔲

Signature:

(Project Manager) REV: 2011-05-04 / FORM 020

als w:\resource\internal info and teams\field forms\birds\breeding bird\form_020_bird-point-counts-survey_2-sided.docx

014110	n:	2		Featur	re:		UTM:	0608483
Start Tim	e: ()	5:57		End Tim	ie: (06:0Z		4784921
Habita	it: DFores	st / OSwamp	/ CMarsh /	/ 🗆 Hay / 🗆 F				
pecies	<50m	50-100m	>100m	Flyovers	Height*]
AMRO	1.1							
RWBL								
BLIA		l						
OGR		1				-		AMRO
EUST	l						RWBL	
						RL	A	EUST
		1.25				BL CO	AMRO	50 100
				-		00	nr (
						- +	HWY	8
								~ /
		vary from projec			·····	Ì		
01-11-		2						
Station		3		Feature	B:		UTM:	0608813
				Feature End Time		: 14		0608813 4785148
Start Time	. 6	/ ; 09 :/□Swamp/	/ 🛛 Marsh /	End Time	e: 6	: 14 Crop		
Start Time Habitat vecies	. 6	: 09	/ 🗆 Marsh /	End Time	e: 6			4785148
Start Time Habitat pecies	:: GForest	: 09 / 🗆 Swamp /		End Time	e: 6 asture / 0			4785148
Start Time Habitat pecies EUST EAK [:: GForest	: 09 / □Swamp / 50-100m 7		End Time	e: 6 asture / 0			4785148
Start Time Habitat Decies EUST EAK I CAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛			4785148
Start Time Habitat Decies EUST EAK I EAK I	:: GForest	: 09 / □Swamp / 50-100m 7		End Time	e: 6 asture / 🛛			4785148 EUST x 5
Start Time Habitat Pecies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛		E	4785148
Start Time Habitat Pecies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛		E	HTBS148 EUSTX5 RWBL
Start Time Habitat Decies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛	Crop	RUBL	4785148 EUST x 5
Start Time Habitat Pecies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛		RUBL	EUST X S EAKI
Start Time Habitat Pecies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛	Crop	RUBL	EUST X S RWBL EAKI 50 HOFI
Start Time	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 🛛	Crop	RUBL	EUST X S RWBL EAKI 50 HOFI
Start Time Habitat Pecies EUST EAK I EAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 0	Crop	RUBL	EUST X S RWBL EAKI 50 HOFI
Start Time Habitat Decies EUST EAK I CAK I	:: GForest	: 09 / DSwamp / 50-100m 7 3		End Time	e: 6 asture / 0	Crop	RUBL	EUST X S RWBL EAKI 50 HOFI
Start Time Habitat	::(_ :: □Forest <50m] 9 sweep will -Below heigh	: 09 / DSwamp / 50-100m 7 3	>100m	End Time	e: 6 asture / Q Height*	Crop	RUBL LEWIS EUST	EUST X S RWBL EAKI 50 HOFI
Start Time Habitat	e:(: 09 :/ Swamp / 50-100m 7 3 1 1 / / / / / / / / / / / / /	>100m	End Time	e: 6 asture / Q Height*	Crop	RUBL LEWIS EUST	EUST X S RWBL EAKI 50 HOFI RD
Start Time Habitat	e:(: 09 :/ Swamp / 50-100m 7 3 1 1 / / / / / / / / / / / / /	>100m	End Time	e: 6 asture / Q Height*	Ruf	RUBL LEWIS EUST	EUST X S RWBL EAKI SO HOFI RD EUST
Start Time Habitat Pecies EUST EAK I RWBL DFI	e:(: 09 :/ Swamp / 50-100m 7 3 1 1 / / / / / / / / / / / / /	>100m	End Time	e: 6 asture / Q Height*	Ruf	RUBL LEWIS EUST	EUST X S EAKI RUBL EAKI SO HOFI RD EUST

Signature:

Statio	n:	4		Featu	re:	an Env		UTM:	0608764
Start Tim		: 29		End Tin	ne: D	6:34			4785285
Habita		t / OSwamp	/ CMarsh	_ / 🛛 Hay / 🖵 I	Contraction of the local distance of the loc		3 m		
Smooleo	<50m	50-100m	- 100	Flyovers	ET-J-LAW	1			
Species AMGO	<50m	30-100m	>100m	riyovers	Height*	1		5	
SAUS	-	2		2543 (1)					
KILL				-			/		SAVS
RWBL		5				-	SAV	is sosp	SUNS
SOSP							Su		RWBLXS
AMRO						-			INDERT
EAKI	1						RUBLX2	pomeo	EAKI
CINI	7.50.10						Run /		
			7				1 .	FENCE	50 10
						- 4	0.1	1.26	KILL AMRO /
			2				Parrik	or	
							\mathbf{n}	N	En c
			ang bagi dé sa katan mang pang da anang mang pang pang pang pang pang pang pang p					/ SCHO	DL SCHOL FARD
	n:	5		Featur	e:	-sefile		UTM:	0608293
Start Time	e:	5)6:40 1/@Swamp	/ 🗆 Marsh /	End Tim	e: ()6:45 Crop		UTM:	<u>0608293</u> 4785532
Start Time Habita	e:	6:40	/ 🖵 Marsh / >100m	End Tim	e: (4785532
Start Time Habita	e: () t: DForest)6:40 1/ DSwamp 50-100m		End Tim	e: Pasture / 🖵			UTM:	4785532
Start Time Habita Species EUST	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵				4785532
Start Time Habita Species EUST AMRO	e: () t: DForest)6:40 1/ DSwamp 50-100m		End Tim	e: Pasture / 🖵				4785532
Start Time Habita Species EUST AMRO SOSP	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵				4785532
Start Time Habita EUST AMRO SOSP VOCA SAVS	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵		5		4785532 5 Susp
Start Time Habita EUST AMRO SUSP NOCA SAVS	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵		5	OSP	4785532
Start Time Habita EUST AMRO SOSP VOCA SAVS	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵				4785532 5 Susp
Start Time Habita EUST AMRO SUSP NOCA SAVS	e: () t: DForest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵	Crop	NOCA	OSP	SUSP RWBQ AMRO
Start Time Habita Species EUST AMRO SOSP NOCA SAVS	e: <u>(</u> t: □Forest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖵	Crop	5	OSP	SUSP RWRD
Start Time Habita EUST AMRO SUSP NOCA SAVS	e: <u>(</u> t: □Forest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖸	Crop	NOCA	OSP EVST SAUS	4785532 SUSP RWBC AMRO 50 1
Start Time Habita EUST AMRO SUSP NOCA SAVS	e: <u>(</u> t: □Forest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖸	Crop	NOCA	OSP	4785532 SUSP RWBC AMRO 50 1
Start Time Habita EUST AMRO SUSP NOCA SAVS	e: <u>(</u> t: □Forest	06:40 2/⊡Swamp 50-100m 1 3		End Tim	e: Pasture / 🖸	Crop	NOCA	OSP EVST SAUS	4785532 SUSP RWRC AMRO 50 11
Start Time Habita Species EUST AMRO SOSP NOCA SAVS RWBL	e:	06:40 1050-100m 1 3 2 1 1	>100m	End Tim	e:	Crop	NOCA	OSP EUST SAUS (BARTE	SUSP RWRC AMRO 50 11 EUST
Start Time Habita EUST AMRO SOSP NOCA SAVS RWBL Height of blac	e:	06:40 50-100m 1 3 2 1 1 1 vary from project n of blade sweet	>100m	End Tim	e: () Pasture / D Height* Ct manager.	Crop	NOCA	OSP EVST SAUS	SUSP RWRC AMRO 50 11 EUST
Start Time Habita EUST AMRO SOSP NOCA SAVS RWBL Height of blac	e:	06: 40 1/□Swamp 50-100m 1 3 2 1 1 1 vary from project	>100m	End Tim	e: () Pasture / D Height* Ct manager.	Crop	NOCA	OSP EUST SAUS (BARTE	SUSP RWRC AMRO 50 11 EUST
Start Time Habita EUST AMRO SOSP VOCA SAVS RWBL Height of blac -On ground; A -Above height	e:	06:40 50-100m 1 3 2 1 1 1 vary from project n of blade sweet	>100m	End Tim	e: () Pasture / D Height* Ct manager.	Crop	NOCA	OSP EUST SAUS (BARTE	SUSP RWRC AMRO 50 11 EUST
Start Time Habita EUST AMRO SOSP VOCA SAVS RWBL Height of blac	e:	06:40 50-100m 1 3 2 1 1 1 vary from project n of blade sweet	>100m	End Tim	e: () Pasture / D Height* Ct manager.	Crop	NOCA	OSP EUST SAUS (BARTE	SUSP RWRC AMRO 50 11 RO EUST RO

Signature:

(Field Personnel)

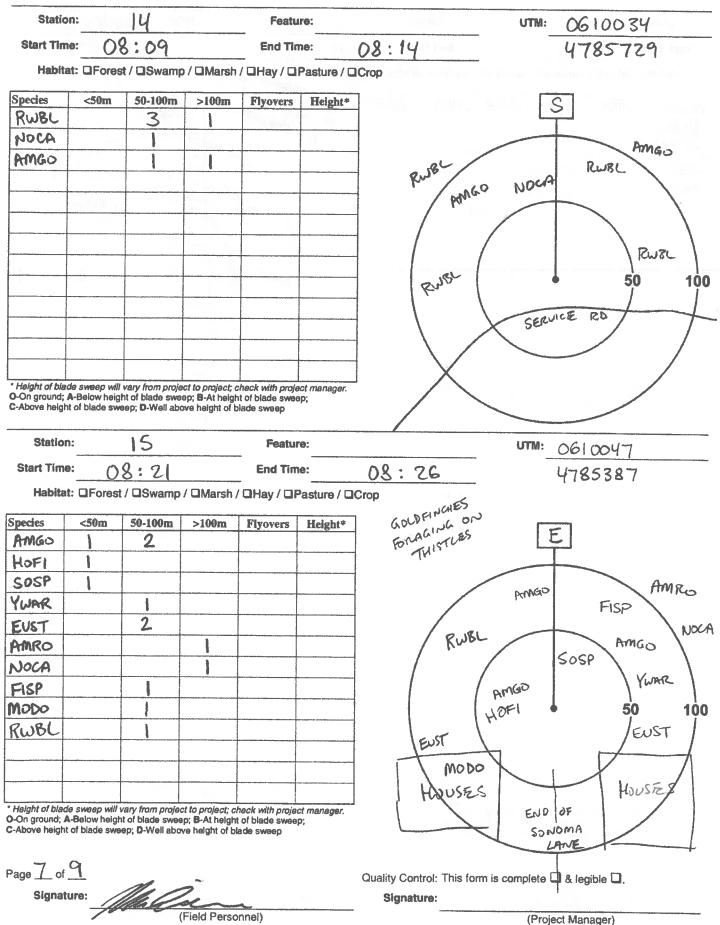
-	6		Featu	ire:	- And March	UTM: 0608587
ne: 0	6:51		End Tir	ne:	06:56	4785464
		/ 🗆 Marsh	/ 🖸 Hay / 🖸		Crop D	filew .
<50m	50-100m	>100m	Flyovers	Height*	* BATURNOUN	G
	2				BY	
						Sosp
2		-				SAUS
	5000				50	sp
	1				1 /	CHSPX2 DAGO
					1 /	AMGO
						*BARS
					EUST	EUST 50 10
		1 a 2				
					1 -1	BARTON ST
de sweep will	vary from proje	ect to project; o	check with proje	ect manager.	'	
nt of blade swi	eep; D-Well abo	ep; b-At heigh ove height of b	lade sweep	ab:		
	· · · · · · · · · · · · · · · · · · ·					
n:			Featu	re:		UTM: 0609227
e: (`	7.02		End Tim	ne: /	80:7	4785257
	/ . 03	>			11.00	7100001
	/ 🗆 Swamp		_ / 🖸 Hay / 🖸 f	Automatical and a second second second second second second second second second second second second second s		
t: DForest	/ 🗆 Swamp	/ OMarsh /	-	Pasture / 🖸		
	/		/ 🛛 Hay / 🖓 f Flyovers	August 100 100 100 100 100 100 100 100 100 10		S
t: DForest	/ 🗆 Swamp	/ OMarsh /	-	Sasture / 🖸		
t: □Forest	/	/ OMarsh /	-	Sasture / 🖸		S
t: DForest	/	/ OMarsh /	-	Sasture / 🖸		S RWBLYZ
<50m	/	/ OMarsh /	-	Sasture / 🖸		S SAUS RWBLYZ
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop	RWBLYZ
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop	S SAUS AMRO
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop Rw8L	S SAUS AMRO
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop	SAUS RWBLXZ AMRO RAORXZ RWBL
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop Rw8L	SAUS RWBLYZ AMRO BAORXZ SO RWBL 10 10
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop RWBL MMG	SAUS RWBLXZ BAORXZ BAORXZ SOSP MODO 10
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop Rw8L	SAUS RWBLYZ AMRO BAORXZ SOSP MODO 10
<50m	/	/ OMarsh /	-	Sasture / 🖸	Crop RWBL MMG	S SAUS BAORX2 BAORX2 BAORX2 CHSP CHSP SOSP House
<50m <50m 2 1 1 1 1 1 1 1 1 1	/ 🗆 Swamp 50-100m 4 1 1 1 1 1 1	/ 🖵 Marsh /	Flyovers	Pasture / 🗆 Height*	Crop RWBL MMG	S SAUS BAORX2 BAORX2 CHSP BARCIONS SOSP House BARCIONS ST
t: Forest	/	/ 🖵 Marsh / >100m	Flyovers	Pasture / D Height*	Crop RWBL MMG	S SAUS BAORX2 E CHSP BARCIONS SOSP House BARCIONS ST
t: Forest	I Swamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td>/ 🖵 Marsh / >100m</td> <td>Flyovers</td> <td>Pasture / D Height*</td> <td>Crop RWBL MMG</td> <td>S SAUS BAORX2 E CHSP BARCIONI ST BARCIONI ST</td>	/ 🖵 Marsh / >100m	Flyovers	Pasture / D Height*	Crop RWBL MMG	S SAUS BAORX2 E CHSP BARCIONI ST BARCIONI ST
t: Forest	I Swamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td>/ 🖵 Marsh / >100m</td> <td>Flyovers</td> <td>Pasture / D Height*</td> <td>Crop RWBL HOUST</td> <td>S SAUS RWBLXZ AMRO BAORXZ BAORXZ SOSP HOUSE BARCESSI ST HOUSE</td>	/ 🖵 Marsh / >100m	Flyovers	Pasture / D Height*	Crop RWBL HOUST	S SAUS RWBLXZ AMRO BAORXZ BAORXZ SOSP HOUSE BARCESSI ST HOUSE
t: Forest	I Swamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td>/ 🖵 Marsh / >100m</td> <td>Flyovers</td> <td>Pasture / D Height*</td> <td>Crop RWBL HOUST</td> <td>S SAUS BAORX2 E CHSP BARCIONI ST BARCIONI ST</td>	/ 🖵 Marsh / >100m	Flyovers	Pasture / D Height*	Crop RWBL HOUST	S SAUS BAORX2 E CHSP BARCIONI ST BARCIONI ST
	<50m	<50m	<50m 50-100m >100m 2_ 1 1 1 1 1 2_ 1 1 1 1 1 2_ 1 1 1 1 1 2_ 1 1 1 1 1 2_ 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 3 1 1 4 1	<50m 50-100m >100m Flyovers 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td< td=""><td><50m 50-100m >100m Flyovers Height* 2 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td><td>2 1 1 1 2 1 1 1 2 1 1</td></td<>	<50m 50-100m >100m Flyovers Height* 2 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 1 1 1 2 1 1 1 2 1 1

REV: 2011-05-04 / FORM 020

Static	on:	8		Featu	ıre:		UTM: 06100 89
Start Tim	ne: 🔿	7:16		End Tir	ne: 🔿	7:21	4785167
Habit	at: OFores		o / 🛛 Marsh	 / 🗆 Hay / 🖨			Provide Visit Andrease Andrease Andrease Andrease Andrease Andrease Andrease Andrease Andrease Andrease Andreas
Species BCCH AMRO RWBL YWAR SOSP BARS	<50m 1	50-100m 	>100m	Flyovers	Height*	SOSP	N BARS (FUYING DURALIES YWAR BCCH BCCH AMRO 50 100 BARTEN ST
-On ground;	A-Below heig	ht of blade swe eep; D-Well ab	ep; B-At heigh	check with proje nt of blade swee blade sweep	ect manager. ep;		
Station Start Time Habita	e: O			Featur End Tim / OHay / OF	ne: Pasture / 🗆	7:41 Crop	UTM: 0610501 4785518
Station Start Time Habita	e: ()		>100m	- End Tim	1e:		4785518
Station Start Time Habita Species EUST	e: O	/		End Tim 	ne: Pasture / 🗆		
Start Time Habita Species EUST AMRO	e: O	/ 🗆 Swamp	>100m	End Tim 	ne: Pasture / 🗆	Crop	4785518
Start Time Habita EUST AMRO SOSP	e: O	/	>100m	End Tim 	ne: Pasture / 🗆	Crop	4785518 NOCA W RWR
Start Time Habita Sipecies EUST AMRO SOSP YWAR	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop	4785518 NOCA W RUB
Start Time Habita Species EUST AMRO SOSP YWAR RWBL	e:	/	>100m	End Tim 	ne: Pasture / 🗆	Crop	HTROSER HTROSER RUBL FISP AMRO RUBL FISP RWBL
Start Time Habita Species EUST AMRO SOSP WAR KWBL NOCA	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST	4785518 NOCA W RUBL RUBL FISP AMRD RUBL FISP RWBL
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop	4785518 NOCA W RUBL RUBL FISP AMIRO RUBL FISP RWBL GO SDSP WWAR RWBL
Start Time Habita Species EUST AMRO SOSP WAR KWBL NOCA	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST AMI	HT85518 HT785518 NOCA W RWBL RWBL FISP AMIRO RWBL FISP AMIRO GO SOSP AMIRO
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST AMI	4785518 NOCA W RUBL RUBL FISP AMIRO RUBL FISP AMIRO GO SOSP AMIRO
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST AMI	4785518 NOCA W RUBL FISP AMRO RWBL FISP AMRO GO SOSP AMRO MRO 50 100
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST AMI	HTROSIER HTROSIER HTROSIER HTTP HTTP HTTP HTTP HTTP HTTP HTTP HTT
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP	e:	/ 🗆 Swamp 50-100m Z	>100m	End Tim 	ne: Pasture / 🗆	Crop SO EUST AMI	4785518 NOCA W RUBL FISP AMRO RWBL FISP AMRO GO SOSP AMRO MRO 50 100
Start Tim Habita EUST AMRO SOSP YWAR RWBL NOCA FISP AMGO	e:	/ □Swamp 50-100m Z 2 1 1	>100m 2_]]	End Tim	ne: Pasture / Do Height*	Crop SO EUST AMI	4785518 NOCA W RWBL RWBL FISP AMRO RWBL FISP AMRO MRO 505P AMRO MRO 50 100 ABANYLONED
Start Time Habita Species EUST AMRO SOSP YWAR RWBL NOCA FISP AMGO	e:	/ □Swamp 50-100m Z I I I Vary from project t of blade sweet	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop SO EUST AMI	4785518 NOCA W RWBL RWBL FISP AMRO RWBL FISP AMRO MRO 505P AMRO MRO 50 100 ABANYLONED
Start Time Habita Species EUST AMRO SOSP YWAR RWBL NOCA FISP AMGO	e:	/ □Swamp 50-100m 2 2 1 1 1 very from proje	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop SO EUST AMI	4785518 NOCA W RWBL RWBL FISP AMRO RWBL FISP AMRO MRO 505P AMRO MRO 50 100 ABANYLONED
Start Time Habita EUST AMRO SOSP (WAR RWBL NOCA FISP AMGO Height of blac -On ground; J -Above heigh	e:	/ □Swamp 50-100m Z I I I Vary from project of blade sweet	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop SO EUST AMI	4785518 NOCA W RUBL RUBL FISP AMRO RUBL FISP AMRO MRO 50 100 ABBANJONED HOUSE
Start Time Habita Species EUST AMRO SOSP YWAR RWBL NOCA FISP AMGO	e:	/ Swamp	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop EUST AMI EUST AMI	4785518 NOCA W RUBL RUBL FISP AMIRO RUBL FISP AMIRO MIRO 50 100 ABBANJONED HOUSE
Start Time Habita EUST AMRO SOSP (WAR RWBL NOCA FISP AMGO Height of blac -On ground; J -Above heigh	e:	/ Swamp	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop EUST AMI EUST AMI	4785518 NOCA W RUBL RUBL FISP AMIRO RUBL FISP AMIRO RUBL FISP AMIRO MIRO 50 100 AMIRO 50 100 HOUSE SOUTH SERVICE RD.
Start Time Habita Species EUST AMRO SOSP (WAR RWBL NOCA FISP AMGO Height of blac -On ground; J -Above heigh	e:	/ □Swamp 50-100m Z I I I Vary from project vol blade sweet ep; D-Well abo	>100m 2_]]]]]]]]]]]]]]]]]]	End Tim	ne: Pasture / Do Height*	Crop SO EUST AMI EUST AMI A Quality Control: Th	4785518 NOCA W RUBL RUBL FISP AMED RUBL FISP AMED RUBL FISP AMED RUBL FISP AMED RUBL FISP AMED SOSP AMED AMED 50 100 ABANJONED HUJJE

Signature:

Static	on:	12		Featu	re:		UTM: 0610405
Start Tin	ne: C	7:46		End Tin	ne:	07:51	4785844
Habit		st / USwamp	/ CMarsh	 / 🔾 Hay / 🔾	Pasture / 🗆	· · · · · · · · · · · · · · · · · · ·	
Species	<50m	50-100m	>100m	Flyovers	Height*	7	
AMGO	- J	50-10011	-100111	riyovers	Height.		W
SOSP	1			_	a		
RTHA	8						
YWAR		1					
TVITIC				_			RTHA
							(white
							SOSP AMGO
		-					
							<u> </u>
				=			SOUTH SERVICE RD
							QEW /
Height of bla	de sweep will	I vary from proje	ect to project; o	theck with proje	oct manager.	1	
-On ground; -Above heigi	A-Below heig ht of blade sw	ht of blade swe eep; D-Well ab	ep; B-At heigh ove height of t	nt of blade swee blade sweep	эр;		
Statio	n: 	13		Featu	re: 		UTM: 0610234
Start Tim	e: 08	:00		End Tim	ie: 08	:05	4785765
Habita	t: DFores	t / 🛛 Swamp	/ CMarsh	- / 🛛 Hay / 🔾 F	asture / 🔾	Crop	
pecies	<50m	50-100m	>100m	Flyovers	Height*] /	
RWBL	3	4					S
AMGO						S (a	SOSP
GRCA							RWBL XY
Susp						2 AMEO GREA	
						13 Amo 1	
		-				0	
					-	3 GRCA	RWBLX3
						~ G.	
							50 100
							RUBBLE
						$\langle \rangle$	T
Height of blac -On ground;	<i>te sweep will</i> A-Below heigl	vary from proje	ct to project; c ap; B -At heigh	heck' with proje t of blade swee	ct manager. Þ;		TRUCK
-Above heigh	t of blade swe	eep; D-Well abo	ve height of b	ade sweep	r '		Stop
<i>c</i>	0						
age $\underline{6}$ of	4	1	1			Quality Control: This for	rm is complete 🖵 & legible 🗔.
Signa	ture:	Alteric	'e-	_		Signature:	
	$ \rightarrow $		Field Perso	nnel)		<u></u>	(Project Manager)



	n:	16		Featu	re:		UTM:	0609848
Start Tim	ie: 0	8:36		End Tin	ne: 08	: 41 - TBM		4785592
Habit		t / DSwamp	/ CI Marsh	/ 🛛 Hay / 🗔 I			ma	
pecies	<50m	50-100m	>100m	Flyovers	Height*	BREEDINEAN	NS T	E
RWBL		Legality C				OF NOLLINDA BI		
AMGO						MOON	The second	
JOMO	1	1		1.2 ma		X	H	
000							ott	RWBL
				112			omo	Amao
F							Ti	
							1开	
							of the office	
						MODO.	8-1-3	50
	3. 14						1 Ha	- J
						a Standard	A a	
						$+\lambda$	K	
<u>.</u>							+1	
eight of ble	de sween vill	vary from proje	ct to project c	heck with proje	ct manager		17	5
Statio		17	ſŪ	Featu			UTM:	060877
Start Tim	e:	17)8:53 1/0Swamp	/ OMarsh /	End Tim	ie: 03	& : 5 &	UTM:	0608779 4785104
Start Tim Habita	e:		/ 🗆 Marsh /	End Tim	ie: 03		- -	4785104
itart Tim Habita ecies	e:	t / OSwamp		End Tim	ne: 0 S Pasture / 🗆		- -	0608779 4785104
itart Tim Habita ecies UST	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆		- -	4785104
Habita Habita ecies UST WBL	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop		4785104
Habita Habita ectes UST USL OSP	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆			4785104
Habita Habita NST WBL NSP NGR	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop		4785104
Habita Habita MST MBL DSP DCA	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop Ames	RWBL	UT85104
Habita Habita Mabita MBL MBL DSP NGR NCA MRO	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop Ames	RWBL	4785104
Start Tim Habita	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop	RWBL	UT85104
Habita Habita Mecies JUST WBL JUSP JUSP JUSR DOCA MRO	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop Ames	RWBL	UT85104
Start Tim Habita	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop Ames	RWBL	4785 104
Start Tim Habita Decies SUST WBL SOSP SOGR DOCA HMRO	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop AMRO EUST	RWBL	UT85104
Habita Habita Mecies JUST WBL JUSP JUSP JUSR DOCA MRO	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop AMRO EUST AMRO	RwBL	4785 IDY EVST SOSP CU
Habita Habita Mecies JUST WBL JUSP JUSP JUSR DOCA MRO	e:	t / CISwamp 50-100m		End Tim	ne: 0 S Pasture / 🗆	Crop AMRO EUST AMRO	RwBL	4785 IDY EVST SOSP CU
Start Tim Habita SUST WBL SOSP COGR JOCA HMRO IOSP	e:	t / 🗆 Swamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim / 🛛 Hay / 🖓 F	ne: OS Pasture / D Height*	Crop AMRO EUST AMRO	RWBL	4785 IDY EVST SOSP CU
Start Tim Habita Pecies EUST RUBL DOSP LOGR JOCA HMRO IDSP	e: () tt: QForest <50m <50m de sweep will A-Below heig	t / OSwamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim / DHay / DF Flyovers	ne: OS Pasture / D Height*	Crop AMRO EUST AMRO	RwBL	4785 IDY EVST SOSP CU
Start Tim Habita Pecies EUST KUBL SOSP SOGR JOCA HMRO 10SP	e: () tt: QForest <50m <50m de sweep will A-Below heig	t / 🖵 Swamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim / DHay / DF Flyovers	ne: OS Pasture / D Height*	Crop AMRO EUST AMRO	RwBL	4785 IDY EVST SOSP CU
Start Tim Habita Decies SUST WBL DOCA DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA MRO DOCA	e:	t / OSwamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim / DHay / DF Flyovers	ne: OS Pasture / D Height*	Crop AMRO EUST AMRO	RWBL LEWIS ROO	4785 IDY EVST SOSP CU HOSP
Bitart Tim Habita eccies UST WBL OSP UGR MRO OSP	e:	t / OSwamp 50-100m 4 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim / DHay / DF Flyovers	ne: OS Pasture / D Height*	Crop AMRO EUST AMRO	RWBL LEWIS ROO	4785 IDY EVST SOSP CU HOSP

Statio	n:	18		Featu	re:	i Gerre -	UTI	1: 06107°	13
Start Tim	ie: C	A:08		End Tim	ne:	09:13	12	478554	
Habita				_ / 🛛 Hay / 🗔 f	Pasture / C				
pecies	<50m	50-100m	>100m	Flyovers	Height*			5	
SAVS	2	2							
RWBL	1.5	2						+	
AMGO									
					-				
						$+ \setminus /$	SAVS		
	- 19 - T						Sr		
	- 7	-				$+ \chi$	RUBL	AMGO	
						-			RWBL
								• 5	RWBL 0 X 2 100
							Sola		
	<u> </u>					- \	SOUTH SER	ICE ROAD /	T
E									AUS
				heck with proje					/
Statio	n:	19		Featur	'A'		LETIN	- AG11271	
Station Start Time		19 9:35	n jan l	Featur End Tim		09:40	UTN	4785578	
Start Time	e:	9:35	/ @Marsh /	01-01010103	e:		UTN		
Start Time Habita pecies	e:	9:35	/ 🗆 Marsh / >100m	End Tim	e:		UTN	4785578	
Start Time Habita pecies	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		UTN		
Start Time Habita pecies {WAR	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		UTN	4785578	
Start Time Habita pecies {WAR WAV }	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		UTN	4785578	
Start Time Habita pecies YWAR WAV I MRD	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		UTN	4785578	
Start Time	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C			4785578	
Start Time Habita pecies YWAR WAV 1 MRD SOSP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		WAVI	4785578 S Amco SOSP	
Start Time Habita pecies (WAR WAV 1 MRD SOSP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		WAVI	4785578 S Amco SOSP	
Start Time Habita pecies (WAR WAV 1 MRD SOSP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		WAVI	4785578 Amco SOSP	
Start Time Habita pecies YWAR WAV 1 MRD 30 SP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		WAVI	4785578 S Amco SOSP	3
Start Time Habita pecies YWAR WAV I MRD 30 SP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		NAVI RD YWAR	4785578 Amaco Amaco	0 100
Start Time Habita pecies YWAR WAV 1 MRD SOSP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		NAVI RD YWAR	4785578 S Amao 5	3
Start Time Habita pecies YWAR WAV 1 MRD SOSP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		NAVI RD YWAR	4785578 Amaco Amaco	0 100
Start Time Habita pecies YWAR WAV I MRD 30 SP	e: O t: OForest	9:35 / DSwam p	7.	End Tim OHay / OP	e: Pasture / C		NAVI RD YWAR	4785578 Amaco Amaco	0 100
Start Time Habita pecies YWAR WAV 1 AMRO SOSP AMGO	e:	9:35 / □Swamp 50-100m 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim	e: (Pasture / C Height*		NAVI RD YWAR	4785578 Amaco Amaco	0 100
Start Time Habita pecies YWAR WAV I MRD SOSP AMGO	e:	9:35 / □Swamp 50-100m 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim	e: (Pasture / C Height*	Prop	NAVI RD YWAR	4785578 Amaco Amaco	0 100
Start Time Habita pecies (WAR VAV 1 MRO SOSP AMGO	e:	9:35 / □Swamp 50-100m 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim	e: (Pasture / C Height*	Prop 60	RD YWAR South	4785578 S Amao Sosp Amao S A SERVICE R	0 100
Start Time Habita pecies (WAR WAV 1 MRD SOSP AMGD	e:	9:35 / □Swamp 50-100m 1 1 1 1 1 1 1 1 1 1 1 1 1	>100m	End Tim	e: (Pasture / C Height*	Prop	RD YWAR South	4785578 S Amao Sosp Amao S A SERVICE R	0 100

REV: 2011-05-04 / FORM 020

Station:		5,5 L I	Au	Featu	re:		UTM:	
Start Time:			0	End Tim	10:			
Habitat:		/ OSwamp	/ DMarsh	 / OHay / Of	Pasture / Crop	NAME OF CAR		
pecies	<50m	50-100m	>100m	Flyovers	Height*			
							L.J.	
			_					
	2							
1 2 2							- 17 1	
			3.5		8			
			the state			/		
								50
							-	Ĩ
	-						`	
							\mathbf{i}	
								/
Height of blade	SWADD Will	vary Imm omio	at to project /	hack with provide	ct manager			
-On around: A-E	server mill t	t of blodo wwo	a. to projool, t	n of blade aver	ar managan			
Above height o	felow neigh blade swa	eo: D-Well abo	ve height of t	il of diade swee	ap;			
Above height o	f blade swe	ep; D-Well abo	ve height of t	lade sweep	эр;			
Above height o Station:	f blade swe	ep; D-Well abo	ve height of t	Featur			UTM:	
Above height of Station:	f blade swe	ep; D-Well abo	ep, io-At neigh we height of t	lade sweep	re:		UTM:	
Above height o Station: Start Time:	f blade swe	ep; D-Well abo	ive height of t	Featur End Tim	re:		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	ve height of t	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	f blade swe	ep; D-Well abo	ive height of t	Featur End Tim	re:		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	ve height of t	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	ve height of t	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	ve height of t	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop			
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	50
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop			50
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	50
Above height o Station: Start Time: Habitat:	Forest	ep; D-Well abo	/ DMarsh	Featur Featur End Tim	re: ne: Pasture / @Crop		UTM:	50
Above height o Station: Start Time: Habitat: pecies	DForest	ep; D-Well abo	/ □Marsh / >100m	Featur Featur End Tim / DHay / DF Flyovers	re: Pasture / □Crop Height*		UTM:	50
Above height o Station: Start Time: Habitat:	□Forest <50m	sp; D-Well abo	/ DMarsh / >100m	Featur Featur End Tim / □Hay / □F Flyovers	re: Pasture / DCrop Height*			50

Signature:

(Field Personnel)

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:	(0095044	3	Project Name: Hamilton - SCLIBE
Date	and the second se		Field Personnel: N. KOPYSH .
Weather Conditions:	TEMP (°C): 1537 1909	WIND: 0-1	CLOUD: PPT: PPT (in last 24 hrs): 20° Ø Ø
GPS #:	T		
Station:		Feature:	UTM: 0(110535
Start Time: 05',	50.	End Time: 15	UTM: 0610535 4785535
	/ 🛛 Swamp / 🖾 Marsh / 🕻		
Species <50m NOCA- EWBL- AMGO LUST. (AMRO SAUS HOWE- 	50-100m >100m - - - - - - - - - - - - -	Flyovers Height*	Crop fallow @ In south saurice led abandoned house House Kubi full Amago Eust River full Amago Eust River full Amago 100
O-On ground; A-Below heigh	s from project to project; check t of blade sweep; B-At height of ep; D-Well above height of blad	with project manager. I blade sweep; e sweep	south nd SAVS

note: huy+ south schuice vol. noise

Quality Control: This form is complete \Box & legible \Box .

Signature:

(Field Personnel)

Page 1 of 5 Signature: MHOMM

> (Project Manager) REV: 2011-05-04 / FORM 020

als w/vesource/internal info and teams/lield forms/birds/breeding bird/form_020_bird-point-counts-survey_2-sided.docx

Statio	n: 12			Featu	re:	UTM:0610406/47858
Start Tim	e: 06	:05		End Tin	ne: 06 .	10 UTM: 06 10406/47858 Note hwy Note
Habita		st / USwamp	/ @Marsh	~ / 🛛 Hay / 🖓 I		Crop
pecies	<50m	50-100m	>100m	Flyovers	Height*	fallow - on S. schile
MODO	Som	30-10010	~100111	2	rieight	vd.
Mala						
				1		
UST						Alexa
WBL				200 00.0		MODOX2 AMIRO
						eutre l
			ē augej			KWBY 50 10
					Π' Π	50 10
						sservice r/1/
_			1.77			A DEN
12 17						
leight of bla	de sweep wil	I vary from proje	ct to project; c	heck with proje	ct manager.	
Above heigh	t of blade sw	reep; D-Well abo	we height of b	lade sweep	· 4- 1	
Start Time Habita		t / 🗆 Swamp	/ 🗆 Marsh /	End Tim - / QHay / QF	_00	Crop
pecies	<50m	50-100m	>100m	Flyovers	Height*	-fallow atruckstop
Arl						Conoccorr S
AUS			et 1.	10.1		
m60				1		
SP					######################################	
NRI	Ý					FAKE SAVS
mpD		1				
		1				
						AWEXY 2050 50 10
						AMP RWER 50 10
						8
						truckship
						a Eu /
On ground: /	A-Below heig	vary from project	p: B-At height	t of blade swee		acre
Above height	of blade sw	eep; D-Well abo	ve height of bl	ade sweep		
ge of						Quality Control: This form is complete $oldsymbol{\Box}$ & legible $oldsymbol{\Box}$,
Signat	ure:					Signature:
			Field Perso	nnel)		(Project Manager)

REV: 2011-05-04 / FORM 020

	/			Featu	re:		UTM: GIKN37
	ie: 06	25		End Tin	ne: 06	. 30	UTM: 616037 478573
Habit	at: 🛛 Fores	it / 🗆 Swamp	/ CMarsh	- / 🛛 Hay / 🖵 I		Crop	
Species	<50m	50-100m	>100m	Flyovers	Height*	fallow	5
INBU	-50111	1	-10011	Fiyovers	treight.	not-suiteble	2
SAVS					1	BOBO/CAME	
- 11 -						-grassestoo shint	
COGR	5					-too many	INBO
RINBL	2					-too many forlas/ Shrubs	SAVS COGR
Ambo						Shrow	SALCOGIK
3 HCB							
							RWBL high
							ENDE
							Amão
					I	1000	
						ro l	
Start Tim Habita	00	38	1014	End Tim	$-\mathcal{O}($	e:42	UTM: <u>660986</u> 478560
11000					Desture / Ch		
					Pasture / 🖸		
Species	<50m	50-100m	>100m	Flyovers	Pasture / 🖾 Height*		Cox D
Species MODD	<50m						A curs
MODO RWB,	< 50m					old bld (EUST new	Smy P
Species MODO RWB, HOSP	< 50m						IPMBL \
MODO RWBL, HOSP GUST	< 50m						MODO RWEL
MODO RWB, HOSP GUST COGR	<50m					leust nar	MODO RWBL
Species MODO RWB,	< 50m					leust nar	MODE RWEL HOSP GRG
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m						MODE RWEL HOSP GRG
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m					leust nar	MODE RWEL HOSP GRG
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m					leust nar	Mapo RWBL HOSP GRG AMGOXZ RWBL NOMO 50
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m					leust nar	MOSE RWEL HOSE GRG AMGOXZ RWEL
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m					leust nar	MODE RWEL HOSP GRG AMGONZ RWEG NOMO 50 ailway Jrack
Species MODO RWG, HOSP GUST COGR AMGO NOMO	< 50m					leust nar	Mapo RWBL HOSP GRG AMGOXZ RWBL NOMO 50
Species MODD RWB, HOSP GUST COGR	< 50m					leust nar	MODE RWEL HOSP GRG AMGONZ RWEG NOMO 50 ailway Jrack
Species MODD RWB, HOSP GUST COGR AMGO NOMO GRCA	2 1	50-100m 2 1 1 1 1 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2	>100m	Flyovers	Height*	leust nar	MODE RWEL HOSP GRG AMGONZ RWEG NOMO 50 ailway Jrack
Species MODD RWB, HOSP GUST COGR AMGO NOMO GRLA	2 2 1 2 e sweep will A-Below heig	50-100m	>100m	Flyovers	Height*	leust nar	MODE RWEL HOSP GRG AMGONZ RWEG NOMO 50 ailway Jrack
Species (MODD RWBL, HOSP GUST COGR AMGO NOMO GRCA Height of blac Don ground;	2 2 1 2 e sweep will A-Below heig	50-100m 2 1 1 1 1 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2	>100m	Flyovers	Height*	leust nar	MODE RWEL HOSP GRG AMGONZ RWEG NOMO 50 ailway Jrack

Signature:

÷

Ma (Field Personnel)

UTM: 6100491 Station: IS Feature: Start Time: 06:50 End Time: 06:55 4185387 1 BARS Habitat: OForest / OSwamp / OMarsh / OHay / OPasture / OCrop shrub I 50-100m <50m >100m Species Flyovers Height* ł٨ BARS 2 OSP 1XBARS amph SOSP SOSP praspy 2 EWELZ 200 AM60 FISP rmf0-2 WR BHO COGREZA NOCA 50 100 5 qUST NOCA HOU * 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 UTM: 610065/ 4785097 Station: Feature: **Start Time:** 07:04 End Time: 07.09 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Shrubi cuw Stace. + old ?? ordnand? Species <50m 50-100m >100m Flyovers Height* FISD 21NB Cart FT.SP amen RWBL anier MODD RES 1727 2 AM6D 2 BARS SEUST AMRO JA HOSF 2 100: Bant RARSS HOSP NMONA park * 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; BLTA C-Above height of blade sweep; D-Well above height of blade sweep Page ____ of ____ Quality Control: This form is complete 2 & legible 2. Signature: Signature:

(Field Personnel)

UTM: 609246/ 4785339 Station: Feature: FEAME Start Time: 🔿 .16 1 End Time: 17:21 pot for capita BOBD step voouside Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop <50m 50-100m >100m Flyovers Species Height* FAME HCC ß MODA EAME 2 BHCO. l 2 mrch MODO HOSP SUSP CHSP Ampeox2 BARTA 50 100 HOSP. SOSP * 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 UTM: 0608758/ 4785292 4 Station: Feature: Start Time: End Time: 32 77 д 7 1 Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop pr Quest <50m 50-100m Species >100m **Flyovers** Height* Amka rohool lawn SUJA RTHA mpo 4 いら schoo FOST 3410 PAK EAME FAMG 50 100 64100 * 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 Quality Control: This form is complete 2 & legible 2.

Signature:

(a)

nge

(Field Personnel)

Station:	3		1.00	Featu	re:		UTM: 0608816/
Start Time:	07:	.42		End Tin	ne: O	7.47	UTM: 0608816/ 4785156,
			/ OMarsh	- / 🛛 Hay / 🗔 I			*EAME
paging 1	<50m	50-100m	>100-	Trillerenter	I BE-L-R-A+	A field)	
Mat	<50m	50-100m	>100m	Flyovers	Height*	A	IW
GIKT	2	2			1		
	<u> </u>	6				-	EAMIE
CACH		1				-	
COGR			-			_	EUSTA
SOST	-						DOK 2
						- /0	
						-	sole COGIR ECUST*3
						Winona	- SOLE - 50 10
						pa	
						- \	
						- \	
						\	
-On ground; A-B	Below heigh			lade sweep		•••••	
-On ground; A-E -Above height of Station:	Below heigh f blade swe	eep; D-Well abo		lade sweep Featur	re:	·····	UTM: 0608784
-On ground; A-E -Above height of Station:	Below heigh f blade swe [7	eep; D-Well abo		lade sweep	re:	-54	UTM: <u>0608784</u> 4785104
On ground; A-E Above height of Station: 	Below heigh f blade swe [7 67:	eep; D-Well abo	ve height of b	Featur Featur End Tim	re: 10: 07		UTM: <u>0608784</u> 4785104
On ground; A-B Above height of Station: 	Below heigh f blade swe [7 67:	eep; D-Well abo	ve height of b	Featur Featur End Tim	re: ne:7 Pasture / C		
-On ground; A-B Above height of Station: 	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: 10: 07		4785104 E
On ground; A-B Above height of Station: Start Time: Habitat: (pecies	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C		
Station: Station: Start Time: Habitat: 1 pecies BADR BUJA	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C		4785104 E
On ground; A-B Above height of Station: Start Time: Habitat: Habitat: Becies ADR BUJA AM RO	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C		4785104 E COGRK3
On ground; A-E Above height of Station: Start Time: Habitat: (pecies BADR BUJA AM RO NOCA-	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C		4785104 E
On ground; A-E Above height of Station: Start Time: Habitat: (pecies BADR BUJA AM RO NOCA-	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C	Adda Shrubs	EUSTR 3 RWB HO
Station: Station: Start Time: Habitat: (pecies BAOR BLJA AM RO NOCA-	i f blade swe i f f blade swe i f blade swe i f f f f f f f f f f f f f f f f f f	9 9 1 Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C	Adda Shrubs	EUSTR 3 RWB HO
Station: Station: Start Time: Habitat: 1 pecies BADR BLJA Am RO NOCA- GMCAD	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C	Adda Shrubs	EUSTR 3 RUBL HO FMRO AMGO
Start Time: Habitat: BADR BLJA AM RO NOCA- MCA- MCA WST	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	lade sweep Featur End Tim / 🛛 Hay / 🖵 F Flyovers	re: ne:7 Pasture / C	Allor Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
Station: Station: Start Time: Habitat: 1 pecies BADR BLJA Am RO NOCA- MAD	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	Featur Featur End Tim 'OHay / OF	re: ne:7 Pasture / C	Allor Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
Station: Station: Start Time: Habitat: 1 Pecies BADR BUJA AM RO NOCA- MAD	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	lade sweep Featur End Tim / 🛛 Hay / 🖵 F Flyovers	re: ne:7 Pasture / C	Alldw Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
Station: Station: Start Time: Habitat: 1 pecies BADR BLJA Am RO NOCA- GMCAD	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	lade sweep Featur End Tim / 🛛 Hay / 🖵 F Flyovers	re: ne:7 Pasture / C	Allow Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
Station: Station: Start Time: Habitat: 1 pecies BADR BLJA Am RO NOCA- MAD	3elow heigh f blade swe (7) 67: DForest <50m	49 /⊡Swamp	ve height of b	lade sweep Featur End Tim / 🛛 Hay / 🖵 F Flyovers	re: ne:7 Pasture / C	Allow Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
Station: Station: Station: Start Time: Habitat: 1 Pecies BADR BLJA AMRO NOCA- AMRO USI USI USI USI USI USI	Below heigh f blade swe [7] □Forest <50m]]]]	¥ep; D-Well abc	/ 🖾 Marsh /	Featur Featur End Tim DHay / DF Flyovers	re: Pasture / C Height*	Allow Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND
On ground; A-E Above height of Station: Start Time: Habitat: (pecies BADR BUJA Am RO NOCA- MACD US	Jelow heigh f blade swe [7] 67: GForest <50m]]]]]]]]]]]]]]]]]]]	49 / DSwamp 50-100m	/ CIMarsh / >100m	Featur Featur End Tim UHay / OF Flyovers	re: Pasture / C Height* Ct manager. p;	Allow Shrubs BA	EUSTR 3 EUSTR 3 DR AMRO NOCA AUSTED WALLAND

Signature:

Quality Control: This form is complete 🗳 & legible 📮

Signature:

(Field Personnel)

UTM: 060829L Station: Feature: . 35 8 1 4785534 Start Time: 18:40 End Time: * I BARS Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop WM Par BOBO - Poor Par BOBO - Babdominatu 065 <50m 50-100m >100m Height* Species Flyovers 3 115 EUST 13 3 7 KEWBLX3 AMGO SOSP PINBLEZ AMR_O 100 Danth JA H qUST7 MOR BUJA * 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: 0 UTM: Start Time: 2:50 Ч **End Time:** likely same from str Habitat: DForest / DSwamp / DMarsh / DHay / DPasture / DCrop Species <**5**0m 50-100m >100m **Flyovers** Height* 0 HA POOV BOBON FOR 0% 814580 ZTHA XIVILL 2 EAKI ANA Ame EUST BAR 3 50^BHCa 100 barb HOWR * 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-Vell above height of blade sweep - Cablack White - SWI Phum Buttoger Page 4 of Quality Control: This form is complete 2 & legible 2. Signature: Signature: (Field Personnel) (Project Manager)

REV: 2011-05-04 / FORM 020

	n: Q			Featu	re:		UTM: 608484	
Start Tim	. 68	10		End Tim	ne: 08	:15.	<u> </u>	
		t / 🗆 Swamp	/ DMarsh	- / 🖸 Hay / 🖸 I		Сгор		
pecies	<50m	50-100m	>100m	Flyovers	Height*	Jum		
DST	8	7		2				
scett								
AMKE						-	BORH AMES	
FAPH				6.5			LOST 3	
JOCA	×		17 LU				Capit Capit	
Nomo					Ľ	1. 1	COGRXZ COGRXZ AMED EUSTX8 NOMO 50 KILL	
RAR	2	L Bok				1 /	OHSP AMED EUSTRE NOC	4- \
ImRO						HWIL	ATT ATT COSTANT	
KILL		1				Hwy 8!	· NOVNO 50	100
tm 60				2		1	KILL	
						1 \	Am60KZ	
Ī	-					4	,	
							\backslash	
Height of bla	le sweep will Below beig	vary from proje	ct to project; c	heck with proje	ct manager.	2		
		eep; D-Well abo						
Station	1:	(Featur	19:		UTM: 6207994	
Station Start Time		:20		Featur End Tim		.25	UTM: 0607994 478 5266	
Start Time	: 08	 : 2_0 !/Swamp	/ OMarsh /	End Tim	le: _ 08:	•	UTM: 0607994 4785266	
Start Time Habita	: 08		/ 🗆 Marsh / >100m	End Tim	ne:	Crop	10?	
Start Time Habita	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	le: _ 08:			
Start Time Habita	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	ne:	Crop	10?	
Start Time Habita pecies 10 FC V2 CA	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	ne:	Crop	10?	
Start Time Habita pecies 10 FC 10 FC 10 FC 10 FC 10 FC	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	ne:	Crop	nd?	
Start Time Habita pecies 10 FC 10 FC 10 FC 10 FC 10 FC	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	ne:	Crop 0 veha	nd?	
Start Time Habita pecies 10 FC 10 FC 10 FC 10 FC 10 FC	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	e: Pasture / 🖵	Crop	no?	
Start Time Habita pecies 10 FC 10 FC 10 FC 10 FC 10 FC	: 08 t: 06	t/□Swamp		End Tim - / OHay / OF	e: Pasture / 🖵	Crop 0 veha	ND? NEWA EUSTXZ	
Start Time Habita pecies 10 FC WRCA MRD	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop 0 veha	ND? NEWA EUSTXZ	20
Start Time Habita pecies 10 FC WRCA MRD	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop Oveha houses	HEWA EUSTREZ	20
Start Time Habita pecies 10 FC WRCA MRD	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop 0 veha	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time Habita pecies JOFC WRCA	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop Oveha houses	10? VEWA EUSTER GRCA AMED FUER AMED FUER AMED	1
Start Time Habita pecies 10 FC WRCA MRD	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time	: 08 t: 06	t/□Swamp		End Tim / OHay / OF Flyovers	e: Pasture / 🖵	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time Habita JOFC JOFC WRD WBL (DGR ADNA WBL (DGR ADNA WST Height of blac	e: 08 <50m 	t / Swamp	>100m	End Tim	ne:& ; Pasture / □ Height*	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time Habita pecies 10 FC WRD WRD WBL DGR DGR DGR DGR Height of blac On ground, i	e: 08 t: 08 <50m 1 1 1 1 1 1 1 1 1 1 1 1 1	t / 🗆 Swamp	>100m	End Tim	ne:& ; Pasture / □ Height*	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time Habita Decies OFC V2CA MRD WBL DGR ENA DGR ENA DGR ENA OST	e: 08 t: 08 <50m 1 1 1 1 1 1 1 1 1 1 1 1 1	t / Swamp	>100m	End Tim	ne:& ; Pasture / □ Height*	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1
Start Time Habita Decies OFC V2CA MRD WBL DGR ENA DGR ENA DGR ENA OST	e: 08 t: Forest <50m 1 1 1 1 4 sweep will A-Below height of blade sweep	t / Swamp	>100m	End Tim	ne:& ; Pasture / □ Height*	Crop Oveha houses	10? VEWA EUSTER GRCA AMIED FWBL 50 MANE	1

(Field Personnel)

(Project Manager)

Station	: 10			Featu	re:	UTM: 6610787
Start Time	: 09'	.00		End Tin	ne: 09'	05 4785550
Habitat	: OFores	t / 🗆 Swamp	/ OMarsh	/ 🗆 Hay / 🗔	Pasture / C	ICrop ALOO
pecies	<50 m	50-100m	>100m	Flyovers	Height*	oum 5 (foraging
AUBL				See Show		
BARS						
EUST	1 -	Lini				RUBL BREEF
Am60		THE F	1	2		RUBL BR
SAUS	1		-			
nage de			2	1.10		MASUL (15T
						AT U Sauce A
						service
						VO
	3.					
leight of blad	e sweep will	vary from proie	ct to project: c	check with proje	ct manager	NEW
Station: Start Time:	: 09	10		Featur - End Tim	e: 09	UTM: 611228/ 15. 4785587
Habitat	<50m	50-100m	>100m	Flyovers	'asture / U Height*	
MRO	-5011	Julion	- 10010	riyovers	meight	S
40		1				
ZWBL	3	k			h hildi Alifa Billi af ny daoina hilan yiny a	
-von						Amro
						BHCO
	·····					ewely3
					1 is in a fair of the state of	
			· · · · · · · · · · · · · · · · · · ·			
					anigen gibles i ha sin fin gette a fin dette anter a tet remajorer og samertik a	
						s.service vol
						0.2000
)n ground; A	-Below heig!	vary from proje It of blade swe rep; D-Well abo	ep; B-At heigh	heck with proje t of blade swee lade sweep	<i>ct manager.</i> p;	l gen
6	C					
geof _	\sum	/			12	Quality Control: This form is complete 🔲 & legible 🛄.
Signatu	are:	MAN	1			Signature:

Stantec	Stantec Consulting Lt 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:	Sabe R	arel 5	
Date:	July 12, 2012		Field Personnel:	D. Graha		
Weather Conditions:	темр (°С): 16-25	WIND: 0-1	CLOUD: 1070	PPT: Nore	PPT (in last 24 hrs): None	

Please mark transect location on map and indicate areas of species observations on map.

HANDECT No.: 3		Habitat:	
Start Time: 5 ⁻⁴⁵		End Time:	545
Start Point UTM: 608483 4784921		End Point UTM:	San 2
Species		Tally	
Bobolink	Ø		
Eastern Meadowlark	ø		

Station Transect No.:	16		Habitat:	1	
Start Time:	835		End Time:	840	••••••••••••••••••••••••••••••••••••••
Start Point UTM:	608784	4785104	End Point UTM:		
Species		- <u> </u>	Tally		<u> </u>
Bobolink		3	(Flyo	wers	
Eastern Meadowla	ark	ø	7-		
		L			

Pg of	Quality Control: This form is complete 🗖 & legible 📮.				
Signature:		Signature:			
	(Field Personnel)	(Project Manager)		
			REV: 2011-06-03 / FORM 014c		

Stantec	Stantec Consulting 1 – 70 Southgate Dri Guelph, ON Canada N1G 4P5 Tel: (519) 836-6050 Fax: (519) 836-2493	ve	~	Bobolink and Eastern Meadowiark Breeding Survey Form			
Project Number:	160950443		20 International	Project Name:	HAMILTON	I- Scube	
Date:	te: JULY 4 2012			Field Personnel:	MICHAEL	OLIVEIRA	
Weather Conditions:	темр (°С): 20° с		WIND: 1-2	сloud: 50°2	PPT:	PPT (in last 24 hrs):	

Please mark transect location on map and indicate areas of species observations on map.

PT.#3			Habitat:	OPEN FIELD		
06:1	5		End Time:	06:25	- initia and initia	
		CHATERAN -	End Point UTM:		ALC: NOT THE OWNER OF	
			Tally			
	ø				-	
(Ø					
1			<u>, , , , , , , , , , , , , , , , , , , </u>	******		
			Allan			
		06:15 Ø	06:15 Ø	06:15 End Time: End Point UTM: Tally	DG:15 End Time: OG:25 End Point UTM: Tally	

Transect No.:	Habitat:	
Start Time:	End Time:	1977. But
Start Point UTM:	End Point UTM:	
Species	Tally	
Bobolink		
Eastern Meadowlark		- 80 miles
		Nanatara akternia

Pg. 1 of 1 Quality Control: This form is complete \Box & legible \Box . Signature: Signature: (Field Personnel) (Project Manager) REV: 2011-06-03 / FORM 014c

Stantec	Stantec Consulting Lt 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	6095044	3	Project Name:	amilton	-Winona/	
Date: JUNE 26 2012			Field Personnel:	N. Kopys	H SWBE	
Weather Conditions:	темр (°С): (%)	WIND: 0 - 1	CLOUD: 20%	PP T :	PPT (in last 24 hrs):	

Please mark transect location on map and indicate areas of species observations on map

Pt. Locath Transact No.: 3	bn	Habitat:	Open field
Start Time: 07	55	End Time:	08:05
Start Point UTM:		End Point UTM:	
Species		Tally	,
Bobolink	Ø		
Eastern Meadowlark			
	by roadside o	nly	
A. location Frances No .:	7	Habitat:	onefold (it as al
Start Time:	7 ¹⁶	End Time:	- openfield (can't see wel
Start Point UTM: 60 92	461, 478533	End Point UTM:	
Species		Taily	
Bobolink	Ø		
Eastern Meadowlark)		
		·····	

-all then habitat in Study area = mayinal = CUM (for 6 drminetter - field at stn 7 not well villble from voad - potential?

Pq.	of

Quality Control: This form is complete 🚨 & legible 📮

Signature:

Signature:

(Field Personnel)

(Project Manager) REV: 2011-06-03 / FORM 014c

dsg g:/resource\internal info and teams\field forms\birds\breeding bird\form_014c_bobolink-and-eame_sar_breeding-survey.docx

Rf. location T ransect No. : Start Time: 72	4	Habitat: F_{ie}		
Start Point UTM: 608758, 4785292		End Point UTM:		
Species	,	Tally		
Bobolink	Ø			
Eastern Meadowlark	1		40009900000000000000000000000000000000	
			Million Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom Bloom B	

Pt. location. -Transect No: 3		Habitat:	Open field	
Start Time:	742		End Time:	747
Start Point UTM:	608816	4785156	End Point UTM:	
Species			Tally	
Bobolink		ø		
Eastern Meadowlar	k	· [
		•		

Transect No.:	Habitat:			
Start Time:	End Time:			
Start Point UTM:	End Point UTM:			
Species	Tally			
Bobolink				
Eastern Meadowlark				

Quality Control: This form is complete \Box & legible \Box .

Signature:

(Field Personnel)

Chimney Assessment Form Four Page 1

Observer Details	Page 1		July 12, 20	12 10:050
Name D. Graham	Phone Number ()	Email Address		
Street Address	City	Prov.	Postal Code	

Building Details

Street Address	Victoria	Cit	Wigong	Prov.	Postal Code
Owner Name		Phone Number ()	Email Ad	dress	
Type of building (please of	check one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please	e specify:		

Chimney Details

Site Name	Chimney Code
	SC - WI
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>\$785637</u> ° N	City Initials - Site Initials - Chimney Number
Long. 60 801 °W	Eg. <u>City Name</u> Site Name Chimneys Code
Number of years active (if known):	Eg. City Name Site Name Chimneys Code Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2 LO-141-2
Chipnney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🗌 Stucco	
Concrete Stone	
Other, please specify:	
	2
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	1. 100 mg
Cap 🗌 Terra Cotta Liner	(P)
Animal Guard Spark Protector	I P
Metal Liner Dother, please specify:	
Surrounding habitat (please check one):	
Commercial Naturel	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
✓ Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
	bricks have the following measurements:
Rectangular \rightarrow Width (cm): $\underline{70}$ Ler	ngth (cm): 70 Loom Com Com (CAWAN)

Ÿ---

.

Chimney height above roofline (m):	Number of Flues:	Cole Chi	nney: Brown		
	of stories in (approx ilding of one	cheight Height abo	yve roofline (m)	5	_ m
If swifts are present, are t	they: 🗌 Nesting	Roosting	Unknown		
Additional Comments:	New Jan Gray MA		- Per Bi N	10	
	Nonc				

Created by:



Canadian co-partner of un partenalre canadien de



In partnership with:





Environnement Canada Région de l'Ontario





McIlwraith Field Naturalists

Observer Details

A

.

Name	Phone Number	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	Barton	City		Prov.	Postal Code
Owner Name	Pho (one Number	Email Addres	S	
Type of building (please check o	ine):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specify			

Site Name	Chimney Code SC - B - 2
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4785369</u> ° N	City Initials - Site Initials - Chimney Number
Long. <u>609 379</u> ° W	No. of Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chinney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🗌 Stucco	
Concrete Stone	Xobs pt.
Other, please specify:	Darton
If the chimney is modified (cap, liner, etc.), please check the appropriate modification: /	
🗆 Cap 🚺 Terra Cotta Liner	
Animal Guard Spark Protector	
Metal Liner Dther, please specify:	
Surrounding habitat (plaase check one):	
Residential	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
☐/ Round → Diameter (cm):	
Square → Width (cm):	NOTE: Measurements can sometimes be
	estimated by counting bricks. Standard bricks have the following measurements:
Rectangular \rightarrow Width (cm): 10 Ler	ngth (cm): 20cm x 9cm x 6cm (L x W x H)

Chimney height above roofline (m):	1	Number of Flues:	1		Colour of Chimney:	Beige	,	
Total Chimney = Height (m)	Number of sto building		3 m (approx heigi of one story	+ ht He	ight above roo	= fline (m)	<u></u>	m
If swifts are pres			sting		iting	Unknown		
Additional Comments	:				6.8-12			
	N/c	ne						
	· · · · · · · · · · · · · · · · ·							

Created by:



Canadian co-partner of un partenaire canadien de



In partnership with:





Environnement Canada Ontario Region Région de l'Ontaric THE ONTARIO



McIlwraith Field **Naturalists**

Observer Details

÷.

Name	Phone Number	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	Barton	City	-	Prov.	Postal Code
Owner Name		Phone Number	Email Address	S	
Type of building (please check of	one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specify:			

Site Name	Chimney Code
3	SC-B-3
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4785399</u> ° N	City Initials - Site Initials - Chimney Number
Long. <u>(09098</u> ° W	No. of Eg. City Name Site Name Chimneys Code
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
🗹 Brick 🗌 Stucco	
Concrete Stone	Baston Rd-
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	
Commercia Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
☐ Aound → Diameter (cm):	
Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
Rectangular → Width (cm): 40 Ler	ngth (cm):

	Fli	umber of ues:		Colour of Chimney:	Brown	4
Total Chimney = Height (m)	2. Number of stories building	× 3 r in (approx of one s	height H	eight above roofi	=	m
If swifts are present		Nesting		sting 🗌	Unknown	
Additional Comments:		0.0.0		p dia	8,0	мт.
	None					
	vone					
		an andra w				1.12
Created by:	еў Д			dian co-partner of		
Created by:	Birdd STL	JOJES (CANADA		dian co-partner of tenaire canadien de		
Created by:	understand	JONESCANADA BEAUXCANADA Heptreclate conserve				
Created by: n partnership with:	understand	a poroclate conserve				
	understend	l eporoclato conserve a apprécier conserver				
	understend	a poroclate conserve	UN PART		LA FONDATION TRILLIUM OF L'ONTARIO	
	Ont	l eporoclato conserve a apprécier conserver	UN PART		TRILLIUM	

Observer Details

 \mathbf{F}

Name	Phone Number ()	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	Lewis	City		Prov.	Postal Code
Öwner Name		Phone Number	Email Addres	S	
Type of building (please check	k one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specify			

Site Name	Chimney Code
	NOTE: Chimney codes are created using the following scheme:
GPS coordinates (DD.dddd): Lat. 4795 2 うう °N	City Initials - Site Initials - Chimney Number
Long. (68803 °W	No. of
	Eg. City Name Site Name Chimneys Code Port Rowan Public Library 1 PR-PL-1
Number of years active (if known):	London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
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:	N Lewig
Surrounding habitat (please check one):	
Residential	
Other, please specify:	
Please select the SHAPE of your chimney and provide the app	propriate estimated measurements.
☐ Round → Diameter (cm):	
✓ Square → Width (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)
Rectangular \rightarrow Width (cm): $2 0$ Ler	ligth (cm):

Total Chimney Height (m)	Number of Flues: 2 = × 3 Number of stories in building (approx of one building	cheight Height above roofline (m)
If swifts are pre		🗌 Roosting 🔄 Unknown
Additional Comme	nts:	
	None.	
		i kad
Created by:		Canadian co-partner of
Created by:		Canadian co-partner of un partenaire canadien de
Created by:	BIRD STUDIESCANADA PROBS PUISEAUX CANADA understand appreciato conserve comprendre appreciato conserve	
	BIRD STUDIESCANADA ETEBES D'USEAUX CANADA understand appreciato conserve comprondre appreciato conserve	un parienalie canadien de BirdLife
Created by: n partnership wi	BIRD STUDIESCANADA ETEBES D'USEAUX CANADA understand appreciato conserve comprondre appreciato conserve	un parienalie canadien de BirdLife
	THE	un partenalie canadien de BirdLife INTERNATIONAL
	BIRD STUDIESCANADA ETEBES D'USEAUX CANADA understand appreciato conserve comprondre appreciato conserve	un parienalie canadien de BirdLife
	THE	un partenalie canadien de BirdLife INTERNATIONAL
n partnership wi	<image/> <text><text><text></text></text></text>	un partenalie canadien de BirdLife INTERNATIONAL
n partnership wi	the	THE ONTARIO FOUNDATION TRILLIUM FOUNDATION

Observer Details

Name	Phone Number ()	Email Addres	S	
Street Address	Ci	ity	Prov.	Postal Code

Building Details

Street Address	43 Hav	City		Prov.	Postal Code
Owner Name	Pr (nbne Number)	Email Addres	s	
Type of building (please check	cone):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please spe	ecify:	lotel	

Site Name 5	Chimney Code SC - 8 - 5
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. 4184962 °N	City Initials - Site Initials - Chimney Number
Long. <u>608720</u> ° W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
Brick 🖸 Stucco	
Concrete Stone	
Other, please specify:	
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
Cap II Terra Cotta Liner	
Animal Guard Spark Protector	
Metal Liner Other, please specify:	H S I
	ind of
	•
Surrounding habitat (please check one):	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□/Round → Diameter (cm):	
Square → Width (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)
Rectangular \rightarrow Width (cm): <u>40</u> Ler	ngth (cm):

	1			
himney height oove roofline (m):	Number of Flues:	Colour o Chimney	Brown	
Total Chimney = 2 Height (m) Number of st building		+ 2 ht Height above re	= pofline (m)	<u>8</u> m
If swifts are present, are they		Roosting	Unknown	ی۔ رائ
Additional Comments:				
	None-			
			198.0	
Created by:				
Created by:		Canadian co-partner of un partenaire canadian d		
un	RD STUDIESCANADA IDES gruteLaux Canadian derstand approciato conserve morendes approciato conserver		ε	
BI	derstand eporecisto conserve	un partenalte canadien d	ε	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
n partnership with:	derstand approciato conserve ngrendre approciae conserver	un partenalte canadien d	ε	
n partnership with:	derstand eporecisto conserve	un partenalie canadien d BirdLife	e	

Observer Details

×.

Name	Phone Number ()	Email Address	5	a.,
Street Address	C	City	Prov.	Postal Code
	12 X 1			

Building Details

Street Address	Huy 8	City		Prov.	Postal Code
Owner Name	/ Pi (none Number)	Email Addr	ess	•
Type of building (please check	one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please spe	ecify:		

Site Name	Chimney Code
6	SC - 8 - 6
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4784 905</u> ° N	City Initials - Site Initials - Chimney Number
Long. <u>608404</u> ° W	Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
M Brick Stucco	building, including the position where the coordinates were taken.
Concrete Stone	
Other, please specify:	4
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	
Animal Guard Spark Protector	11.8
	Hwy 8
Metal Liner Dother, please specify:	
Sumounding habitat (plaase check one):	
Residential	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
□/ Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
V	bricks have the following measurements:
	ngth (cm):0 0 20cm x 9cm x 6cm (L x W x H)

			i age	2				
Chimney height above roofline (m):	0.5	Number of Flues:	1		Colour of Chimney:	Brown		
Total Chimney = Height (m)	2 Number of sto building		3 m (approx height of one story)	+ Heig	0.5 ht above roof	=	62	<u>2</u> m
If swifts are pres			esting	Roost	ing 🗌	Unknown		
Additional Comment	ts:				10 Mar		44	
			None					
			10011-0					1000 - 1000 1000 - 1000
								erro Di
						San Is		
		1						
Created by:								
Sicula by:					co-partner of ive canadien de			1
	BIR	D STUDIES CANAL	DA	on partono				
	unde	erstand appreciate conse prendre appréciat conse		Bir	dLife			
				INTER	NATIONAL			
n partnership wit	h:							
	5			THE	ONTARIO	LA FONDATION TRILLIUM DE L'ONTARIO		
1	「 Or	ntaric)	Fou	NDATION	DE L'ONTARIO		
	Emilianan	Carlana			.M			
	· · · · · · · · · · · · · · · · · · ·	Environneme Canada		Ŕ	20 10 20	lcllwraith ield		
	Ontario Regio	n Région de l'O	Intaria		Contraction in the second	laturalists		
				A.M. 1.	4			

Observer Details

A.

Name	Phone Number	Email Address	
Street Address	City	Prov.	Postal Code

Building Details

Street Address	Hur 8	City		Prov.	Postal Code
Owner Name		Phone Number	Email Addres	S	·
Type of building (please che	eck one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specif	y:		

Site Name § 7	Chimney Code
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:
Lat. <u>4184859</u> ° N	City Initials - Site Initials - Chimney Number
Long. 608145 °W	Eg. <u>City Name</u> <u>Site Name</u> <u>Chimneys</u> <u>Code</u>
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.
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 D Spark Protector	
Metal Liner Other, please specify:	Huy. 8
No modifications	
Surrounding habitat (please check one):	
Residential	
Commercial Natural	
Other, please specify:	
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:
□ Round → Diameter (cm):	
□/Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard
$\overrightarrow{\mathbf{M}}$ Rectangular \rightarrow Width (cm): 50 Ler	ngth (cm): 00

4

Chimney height above roofline (m): Total Chimney Height (m) =	3 3	Number of Flues:	2 3 m	+	Colour of Chimney:	Brown =	K	_ m
	Number of sto building	ries in	(approx heig of one stor		Height above roofli	ne (m)	er ar Tre	
If swifts are pres	ent, are they	. 🗌 Ne	esting	🗌 Ro	osting	Unknown	S	
	None that I chim.	observe ooks ley Swind	al. (suitade	chim de fe	osting []	ocube por	Cells	

Created by:



Canadian co-partner of un partenaire canadieri de



In partnership with:



Environment -Canada Ontario Region

Environnement Canada Région de l'Ontario THE ONTARIO TRILLIUM FOUNDATION



McIlwraith Field Naturalists

Observer Details

r

Name	Phone Number	Email Addre	SS	
Street Address	City		Prov.	Postal Code

Building Details

Street Address	Mc Neilly	City		Prov.	Postal Code
Owner Name	/ Pi (hone Number)	Email Addres	S	
Type of building (please che	eck one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specify			

Site Name	Chimney Code SC - M - 8					
GPS coordinates (DD.dddd): Lat. <u>4784984</u> ° N	NOTE: Chimney codes are created using the following scheme:					
Long. <u>607878</u> ° W	City Initials - Site Initials - Chimney Number <u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>					
Number of years active (if known):	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:	Mc Neith P					
Surrounding habitat (please check one):						
Commercial Other, please specify:						
Please select the SHAPE of your chimney and provide the application of the select the se	propriate estimated measurements:					
Round \rightarrow Diameter (cm): Square \rightarrow Width (cm): Rectangular \rightarrow Width (cm):	ngth (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 height above roofline (m):	Number of Flues:	Colour o Chimney	Beier	•)
Total Chimney = Height (m) Number	of stories in (approx he	+ ight Height above ro	poofline (m)	<u>#</u> m
If swifts are present, are	ilding of one sto they: Nesting	ry) ☐ Roosting [Unknown	
Additional Comments:				7¥.5
	None			
	None			
	· · ·		Vacuet	n ya Miraji Sali Port Mir
	67			
reated by:	F.	Canadian co-partner of		
reated by:	E anomeno a construction of the second secon	Canadian co-partner of un partenaire canadien d		
reated by:	BIRD STUDIES CANADA TRUBES D'DISEAUX CANADA	un partenaire canadieri d	6	
reated by:			6	
	understand appreciate conserve	un partenaire canadien d	6	
	understand appreciate conserve	un partenaire canadien d	6	
partnership with:	understand approciate conserver comprendre appricier conserver	un partenaire canadian d BirdLife		
partnership with:	understand approciate conserver comprendre appricier conserver	un partenaire canadien d	6	
partnership with:	understand appreciate conserve	un partenaire canadian d BirdLife INTERNATIONAL	LA FONDATION TRILLIUM	
partnership with:	understand approciate conserver comprendre appricier conserver	un partenaire canadian d BirdLife INTERNATIONAL	LA FONDATION TRILLIUM	
partnership with:	Comprendre appreciate conserver comprendre appreciae conserver	un partenaire canadian d BirdLife INTERNATIONAL	LA FONDATION TRILLIUM	

Observer Details

 (\mathbf{r})

Name	Phone Number ()	Email	Address	
Street Address	C	ity	Prov.	Postal Code

Building Details

Street Address 252	Mo Nei	Ihy City		Prov.	Postal Code
Owner Name	Pho	one Number	Email Addre	SS	• • • •
Type of building (please check	one):	/			
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please spec	cify:		

Site Name	Chimney Code SC - M - 9					
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:					
Lat. <u>4785 167</u> ° N	City Initials - Site Initials - Chimney Number					
Long. <u>(07937</u> °W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u>					
Number of years active (if known):	Port Rowan Public Library 1 PR-PL-1 London 141 Wortley 2 LO-141-1 LO-141-2 LO-141-2 LO-141-2					
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.					
Brick Stucco						
Concrete Stone	1					
Other, please specify:						
If the chimney is modified (cap, liner, etc.), please check the	XV					
appropriate modification:						
Cap Terra Cotta Liner	Cheil					
Animal Guard Spark Protector	AC					
L Metal Liner Dther, please specify:	5					
Surrounding habitat (please check one):	1					
Commercial Natural						
Other, please specify:						
Please select the SHAPE of your chimney and provide the ap	propriate estimated measurements:					
□						
☑ Square → Width (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)					
Rectangular \rightarrow Width (cm): Len	ngth (cm): 10					

Chimney height above roofline (m):	Number of Flues:		Colour of Chimney:	Grey	
Total Chimney Height (m) =	× 3 I stories in (approx		ight above roofli	=	<u>5</u> m
build					filment menal
If swifts are present, are th	ey: 🗌 Nesting	C Roos	ting 🗌	Unknown	
Additional Comments:			1 Britsh	-V	
	Λ.				
	None				

Created by:



Canadian co-partner of un partenaire canadien de



In partnership with:





Environnement Canada Région de l'Ontaric THE ONTARIO TRILLIUM FOUNDATION



McIlwraith Field Naturalists

27							
4	Name	Phone Number		Email Address	S		
		()				A. 1	
	Street Address		City		Prov.	Postal Code	

Building Details

Street Address 276	Mr. Neil	City		Prov.	Postal Code
Owner Name	Phy (ne Number	Email Addres	S	
Type of building (please check of	one):				
House	Church	Store			
Lowrise Apartment	School	Factory			
Highrise Apartment	Hospital	Other, please specify	/:		

Site Name	Chimney Code SC - M - 16							
GPS coordinates (DD.dddd):	NOTE: Chimney codes are created using the following scheme:							
Lat. <u>4785345</u> ° N	City Initials - Site Initials - Chimney Number							
Long. <u>607989</u> ° W	<u>No. of</u> Eg. <u>City Name Site Name Chimneys Code</u> Port Rowan Public Library 1 PR-PL-1							
Number of years active (if known):	London 141 Wortley 2 LO-141-1 LO-141-2							
Chimney material (please check one):	If possible, please draw a picture of the chimney location on the building, including the position where the coordinates were taken.							
🗹 Brick 🗌 Stucco								
Concrete Stone								
Other, please specify:	2) [7]							
If the chimney is modified (cap, liner, etc.), please check the appropriate modification:	3							
Cap Terra Cotta Liner	c Neill							
Animal Guard Spark Protector	2							
Metal Liner Other, please specify:	2							
Surrounding habitat (please check one):								
Residential								
Commercial 🔲 Natural								
Other, please specify:								
Please select the SHAPE of your chimney and provide the appropriate estimated measurements:								
□ Round → Diameter (cm):								
Square → Width (cm):	NOTE: Measurements can sometimes be estimated by counting bricks. Standard							
Rectangular → Width (cm): <u></u> 40 Ler	ngth (cm):							

×.

Chimney height above roofline (m): 05	Number of Flues:	1	Colour of Chimney:	Brow	1	
	 er of stories in (appro	m + ex height e story)	0.5 Height above roo	=	3.5	m
If swifts are present, are			Roosting	Unknown		
Additional Comments:			5 J. Sel 1	25 h	, C	
	None					
						. 80
	10.					
reated by:						
ioutou by:			Canadian co-partner of un partenaire canadien de			
	BIRD STUDIESCANADA					
	comprendre appreciate conserver		BirdLife			
n partnership with:						





Environnement Canada Région de l'Ontaric THE ONTARIO TRILLIUM FOUNDATION



Mcllwraith Field Naturalists

	CHSW	160950443	JULY 4, 2012	HAMILTON- SCUBE		
TIME:	STATION:	UTM :	# OF SUTABLE CHIMNEYS	# CHSW Observed:		
10:35	Ū	0609819 4785639	Ø	Ø		
10:52	T	0609305 4785335	Ø	ø		
11:08	3	0609056 4785414	ø	ø		
11:26	T	0608835 4785328	Ø	ø		
11:43	5	0608591 4784942	ø	Ø BARS (3)		
11:58	6	0608322 4784897	Ø.	ø		
12:15	\bigcirc	0608135 4784860	Ø	Ø		
12:30	3	0607825 4784837	Ø	B		
12:45	9	0607909 4785077	Ø	Ø		
13:00	(10)	0607970 4785277	Ø	Ø		
13:15		0608046 4785539	ø	Ø		
13:30	(12)	0608636 4785483	Ø	ø		
13:47	13	0609256 4784859	ø	ø		

AtSW Hamilton-SCUBE. 60950443 June 26 2012 location # suiterble Time station utm # GHSWobs. chimneys) 0609.819 09:30 none. Whonakde 4785639 -all=narrow, Winana NUM or capped Equip 0609305/ 2 09:45 10 nove - new housing to nove no comme to w- does yours - sme/capped 1216 4785335 Barton 0609056/ 10:00 inone 1178 47.85414 Barton 0608835 10'.15 house acrossist A. 4785328 School nore (no other This on Lewis -#265-> Ingwide \oslash Chimney-not-Visible if accer no other pot, structures-all visible from #4 str.) 10:30 5 60 85911 #1123 has 1123 Huys. 4784942 long nanow brick Ŕ (Shotminey as stacks Shotapparen if allos, 6683221 10:456 478 4897 Memphistire BBQ. Ø none - capped/ Thai cuisine. 0608135/ 1065 HWY8 4184860 11:00 7 ? older house-1059 nange long (bnck-no caps topnot. Visible 11:15 8 201 06078257 menericly Kd. 4784837 nong 11:30 9 0607909 235 meneily RO 4785077 6667970 hore 263 A) 4785277 mencily Ke 06080461 12:00 11 297. mchaily hohe. (mineily/barton) 478 5539

Scube Jone 26 2012 CHSW Time Station # soitable UTM # OISW chimneys observed 12 (1095 Berlon) 608636 12 15 None Ø 4785483 13 (1226 Huy 8) 1230 609256 None Ø 4784859

Stantec

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

APPENDIX D: Correspondence

One Team. Infinite Solutions. Project No. 160950443