PROPOSED ST. CLAIR SOMBRA SOLAR FARM
LAMBTON COUNTY, ONTARIO
NATURAL HERITAGE ASSESSMENT

Submitted to:
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Bridgewater, NJ 08807
USA

Submitted by:
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February 2011

SW04090572

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1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by First Solar Development (Canada), Inc. (First Solar) to conduct a Natural Heritage Assessment (NHA) and Environmental Impact Study (EIS) for a proposed photovoltaic (solar) electrical power generating facility, the St. Clair Sombra Solar Farm. The NHA consists of a records review, site investigation and evaluation of significance. The NHA consists of a Records Review, Site Investigation and Evaluation Of Significance. In addition to the NHA, an EIS has been prepared to meet the requirements of Section 38 of Ontario Regulation 359/09 (O.Reg. 359/09) Renewable Energy Approvals made under the *Environmental Protection Act*.

The Project Location is in St. Clair Township in the County of Lambton on Part Lots 1 and 2 Concession 11 and Part Lot 1, Concession 10 (Figure 1). The contiguous land parcels which represent the "Project Location" are approximately 140 hectares (ha) in size and currently under agricultural land use (Figure 2). The Project Location consists of approximately 59 ha to be use for development of solar arrays and associated roads, associated power transmission infrastructure, temporary laydown areas and structures (Figure 2).

This NHA intends to provide a detailed identification and evaluation of the natural features consistent with the requirements of O.Reg. 359/09. Specific deliverables associated with the NHA documentation include:

- Undertaking a **Records Review** to evaluate the presence or absence of natural features near the development site based on available sources of information;
- Completing a physical **Site Investigation** to confirm the presence and the boundaries of the natural features within 120 m of the Project Location and identify any additional natural features not identified during the records review;
- Preparing a **Evaluation of Significance** to confirm the significance of any natural features within 120 m of the Project Location; and,
- Preparing an **Environmental Impact Study** to ensure no negative Project effects occur where the development is planned in an area that is subject to a prohibition.

Each of these deliverables has been assembled in this NHA document to provide a single comprehensive and detailed overview submission for review of the St. Clair Sombra Solar Farm Project by the Ministry of Natural Resources. Based on this documentation MNR is required to confirm the following under the Renewable Energy Approval Regulation 359/09:

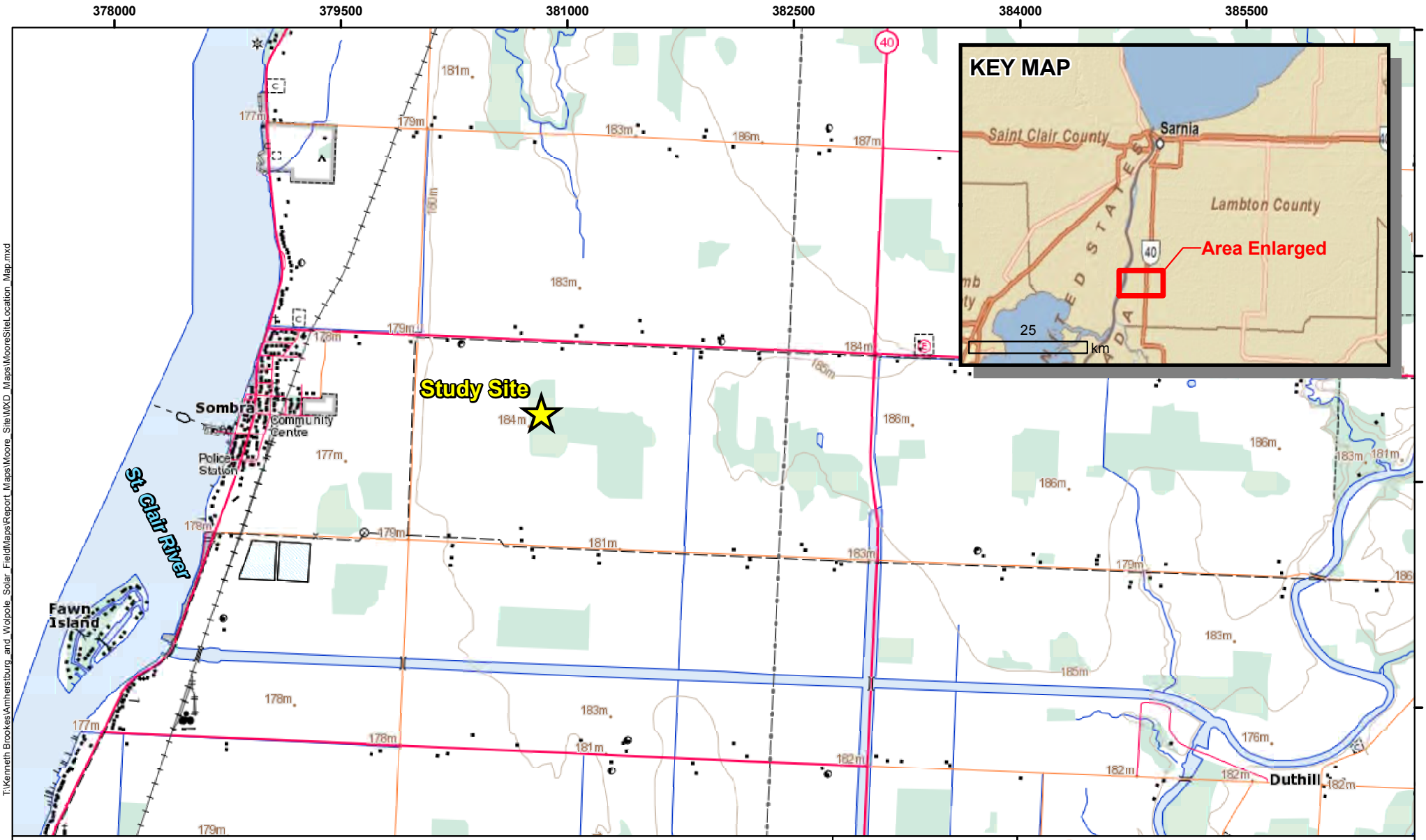
- That the site investigation and records review were conducted using applicable evaluation criteria or procedures established or accepted by the MNR, even if no natural features are identified.
- That the evaluation of significance or provincial significance of natural features was conducted using applicable evaluation criteria or procedures established or accepted by the MNR.
- That the Project Location is not in a provincial park or conservation reserve.

- That the EIS documentation has been prepared in accordance with the procedures established or accepted by the MNR.

It should be noted that the Solar Farm is not located within the Oak Ridges Moraine or Niagara Escarpment planning areas and as such, their further consideration is not applicable in this NHA.

While not specifically included under REA approval consideration by the MNR, water bodies assessment and oil, gas and salt resource, relevant records searches and site reconnaissance have been conducted as part of this project. The water bodies assessment for submission to the Ministry of Environment as well as the Oil, Gas and Salt Resources documentation has been appended (Appendices D and G, respectively). These additional documents included in this NHA document represent additional investigative and research efforts to satisfy requirements outlined in the *Approval and Permitting Requirements Document* (APRD), issued 24 September 2009 by the MNR, supporting REA submissions. The documents are provided herein as a point of cross reference to facilitate review context, and not linked directly to the review and approvals associated with the NHA.

Threatened and Endangered species protected under Ontario's Endangered Species Act (ESA 2007) are also considered separately from the REA, and are addressed as a component of the APRD. Archaeological and cultural heritage assessments are also presented in separate document submissions.



T:\Kenneth Brookes\Amherstburg and Wolpole Solar FieldMaps\Report Maps\Moore Site\MXD Maps\MooreSiteLocation Map.mxd

LEGEND

★ Study Site Location

NOTES:
- Road information extracted from the Ontario Road Network Database
- Railroad information extracted from Ontario Base Map Database
- Topo map information extracted from Geogratis NRCan
- Key map data provided by ESRI world street maps

Datum: NAD83
Projection: UTM Zone 17N

0 0.5 1 2 3 4 5 Kilometres

First Solar. amec

FIRST SOLAR DEVELOPMENT (CANADA) INC.
NATURAL HERITAGE SITE INVESTIGATION

Sombra Solar 1
Site Location Map

PROJECT N°: SW0409575	**FIGURE: 1**
SCALE: 1:35,000	DATE: September 2010

1.1 Project Development Proposal

First Solar hopes to initiate construction of its Solar Farm in early 2011 and plans to have the development operational by the end of 2011. The proposed facility will be designed to convert sunlight to electricity through a photovoltaic process thereby providing a renewable source of electricity to the local power grid. The Solar Farm will utilize highly-efficient and proven technology to generate up to 20 MWac of power for delivery to the electricity system.

The Project Location is located on Part Lots 1 and 2, Concession 11 and Part Lot 1, Concession 10, St. Clair Township and consists of approximately 59 ha which would be utilized for solar arrays and associated roads, transmission infrastructure, temporary laydown areas and structures. General photographs of the proposed development site are presented in Appendix A. The Project Location lies in an area of mixed residential and agricultural land use within St. Clair Township. The Project Location is provided in Figure 2. The proposed site layout is presented in Figure 3.

The Project Location is bounded by agricultural land, remnant forested features, and is in proximity of a distribution of intermittent rural residential developments along the surrounding road network. A natural gas terminal facility was observed to the west of the Project Location on the northwest corner of the Smith Line and Baseline Road intersection. The Project Location is located approximately 600 m east of the Village of Sombra and the access drive will enter off Bentpath Line (Figure 3).

As part of the solar farm development, First Solar is also considering additional options for the on-going encouragement of the natural communities and visual impacts around the Project Location. One of these considerations includes the enhancement of habitat adjacent to the woodland located within the 120 m set back as a component of the development plan to encourage plant and wildlife viability and sustainability as well as the reinforcement of the already existing natural buffer area which exists within and adjacent to the Project Location.

There is one residential dwelling with associated structures (i.e. barns) located within the 120 m setback at the north extent of the proposed arrays and south of Bentpath Line (Figure 2). The structures are inferred to have been utilized for historical farming efforts on the Project Location.

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LEGEND

- Project Location Boundary
- 120 m Setback from Project Location Boundary

NOTES:
- Road information extracted from the Ontario Road Network Database
- Imagery was extracted from Google Earth Pro

Datum: NAD83
Projection: UTM Zone 17N

0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

First Solar. amec

FIRST SOLAR DEVELOPMENT (CANADA) INC.
NATURAL HERITAGE SITE INVESTIGATION

Project Location

PROJECT N^{o}: SW0409575	**FIGURE: 2**
SCALE: 1:10,500	DATE: December 2010

ARRAY PERSPECTIVE

SITE IMPROVEMENT PLAN

SCALE: 1m = 3000m

30m 0m 60m 180m

LEGEND:

- MNR PROTECTED AREA
- PROPERTY BOUNDARY
- EXISTING BUILDING
- ARRAY
- UGT — UNDER GROUND ELECTRICAL WIRING
- x — PROPOSED PROTECTION FENCE
- PROPOSED PERMANENT FENCE
- MO — PROPOSED MOVE-ON FENCE
- PROPOSED UTILITY POLE

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
H	12-02-2010	NEW LAYOUT TO FIT MNR PROTECTED AREA	FWD	HK	MP
G	08-24-2010	RE-ISSUED FOR REA PERMIT	JRR	HK	MP
F	06-22-2010	RE-ISSUED FOR REA PERMIT	JRR	AJT	MP
E	04-28-2010	RE-ISSUED FOR REA PERMIT	DHD	MP	TZ
D	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	RE-ISSUED FOR LAYOUT CHANGE	FWD	MP	TZ
B	12-14-2009	ISSUED FOR REA PERMIT	RAR	MP	TZ
A	12-10-2009	ISSUED FOR APPROVAL	DA	MP	TZ

First Solar.

FIRST SOLAR DEVELOPMENT (CANADA), INC.

5115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: SITE IMPROVEMENT PLAN

PROJ. MGR.	PROJ. ENGR.	DR. BY	CHK. BY	SCALE:
KEITH SYMMERS	TOM ZACARRIA	FWD	MP	AS SHOWN

PROJ. DIRECTOR: MARK LANGDON

DRAWING NO.: REA-05

REV.: H

FS ELEC. JOB No: 5028-0102-22

THIS PRINT IS NOT TO BE USED FOR CONSTRUCTION UNLESS NOTED AND SIGNED OK FOR CONSTRUCTION ABOVE LAST REVISION.

1.2 Renewable Energy Approvals

The purpose of this report is to provide an NHA with an EIS (where required) in support of obtaining approval for the project under O.Reg. 359/09 Renewable Energy Approvals of the *Environmental Protection Act*. According to O.Reg. 359/09, the Solar Farm is considered to be a Class 3 solar facility as it has a name plate capacity of greater than 10 KW. This NHA has been undertaken specifically to address the requirements outlined in Sections 24-28 of O.Reg. 359/09 and where required, provide an EIS for specified Natural Features as required under Section 38.

Under this NHA preparation process and associated information gathering, the Ministry of Natural Resources and the St. Clair Region Conservation Authority have been contacted for consultation and input where required. It is understood that NHA review by regulatory stakeholders and consultation may result in the recognition of additional assessment requirements in support of approval process outside of the REA requirement. This would include any process and permitting requirements associated with the *ESA 2007* that may be defined by MNR through the application review process, and fall outside of REA jurisdiction.

In addition to the approval of the St. Claire Sombra Solar Farm under REA, the proponent will also be responsible for any federal, provincial or municipal approvals or permits associated with land development as required.

2.0 NATURAL HERITAGE ASSESSMENT

The NHA and associated EIS were based on a review of existing natural heritage feature records within proximity to the Project Location and site investigations undertaken in spring and fall to characterize and confirm aspects of natural features present on and immediately adjacent to the Project Location within the 120 m setback including details of vegetation community and structure, wildlife, wildlife habitat, as well as potential linkage and corridor functions. Natural features identified within the Project Location and the 120 m set back were then evaluated for significance using MNR criteria.

2.1 Records Review

The Records Review as outlined in paragraph 1 of subsection 24 (1) of O.Reg. 359/09 involved a review and analysis of existing records as set out in Column 1 of the Section 25 Table. This was undertaken to confirm that appropriate information is reviewed relative to available organized sources and applied relative to the Project Location for the purpose of making the determinations set out opposite the records in Column 2 of the Table. The information in Column 2 identifies potential prohibition considerations for the NHA. A summary of the required records search consistent with the format of the section 25 table, the documentation encountered, and preliminary determinations concluded on the basis of this review is provided in Table 1.

Table 1: Summary of Natural Heritage Assessment
Records Review and Primary Determinations

Records Review based on Table from Section 25 of O. Reg. 350/09				
Item	**Records to be Search and Analyzed**	**Records Searched**	**Determination to be Made**	**Determination**
1	Records that relate to provincial parks and conservation reserves and that are maintained by the Ministry of Natural Resources	• County of Lambton Official Plan • MNR Natural Heritage Information Centre (NHIC) website (Dec 2009)	Whether the project location is in a provincial park or conservation reserve or within 120 metres of a provincial park or conservation reserve.	Project Location is not within a provincial park or conservation reserve or within 120 m of the same.
2	Records that relate to natural features and that are maintained by:		Whether the project location is: in a natural feature; within 50 metres of an area of natural and scientific interest (earth science); or, within 120 metres of a natural feature that is not an area of natural and scientific interest (earth science).	
	Ministry of Natural Resources	• MNR Natural Heritage Information Centre (NHIC) website (Dec 2009) • MNR Biodiversity Explorer website (July 2010). • LIO data layers		Project Location is not within 50 m of an ANSI or PSW; however, it is within 120 m of a woodland. This woodland is not an ANSI.
	Crown in Right of Canada	• Environment Canada SAR lists and associated range maps.		Inconclusive relative to site-specific locations of several SAR and associated consideration of wildlife habitat
	Conservation Authority	• Project Location within area of jurisdiction of St. Clair Region Conservation Authority (SCRCA). Staff was contacted to request information related to their knowledge of the presence of any ANSI, wetland, ESA, fish habitats, municipal drain classification, benthic data and water chemistry near or on the proposed development site. A response with detailed maps and information (Appendix B & C) were provided		Project Location is not within 50 metres of an ANSI, PSW or ESA. It is within 120 m of a woodland. This woodland is not designated as an ANSI or ESA. One classified drain Type C - is located outside the Project Location but within the 120 m setback. Other identified drains/ditches bordering the Project Location are not afforded a classification according to SCRCA records.

Records Review based on Table from Section 25 of O. Reg. 350/09				
Item	**Records to be Search and Analyzed**	**Records Searched**	**Determination to be Made**	**Determination**
		by the SCRCA on 11 December 2009.		
	Local and Upper-Tier Municipality	• The County of Lambton and St. Clair Township are the upper and lower-tier municipalities in which the project location is situated. Each was contacted regarding Natural Heritage information. County of Lambton Official Plan and supplements pertaining to existing natural heritage features were reviewed.		Project Location is not within 50 metres of an ANSI, ESA or PSW. The Project Location is within 120 m of a significant woodland 35 ha in size. Under Official Plan Section 8.1.3 - Woodlands subsection 2; this woodland is considered to be significant. Significant Woodlots are those located in a Primary Corridor or Significant Natural Area designations, or any contiguous forested area that is 4 ha, or greater in size.
	Planning Board	• N/A: Project Location not within area of jurisdiction of planning board.		N/A
	Municipal Planning Authority	• N/A: Project Location in area of jurisdiction of Lambton County and St. Clair Township.		N/A
	Local Roads Board	• N/A: Project Location not within area of jurisdiction of local roads board.		N/A
	Local Services Board	• N/A: Project Location not within area of jurisdiction of local services board.		N/A
	Niagara Escarpment Commission	• N/A: Project Location not within area of Niagara Escarpment Plan		N/A

To further confirm and characterize the natural heritage attributes in and around the Project Location, additional data sources were reviewed. Such sources included species distribution data from the most recent Breeding Bird Atlas, Ontario Herpetological Atlas, NHIC database,

LIO forest cover and SCRCA. A summary of secondary sources information applied in the NHA is provided in Table 2.

Table 2: Summary of Records Review Sources

Organization	Data Type	Natural Features/Values
Environment Canada	*Species at Risk Act* (SARA 2002) and wildlife and plant species.	SAR lists and associated range maps. http://www.sararegistry.gc.ca/species/default_e.cfm
St Clair Region Conservation Authority	Aquatic and Terrestrial Species and drainage classifications	Regional presence/absence data. Drainage classes.
St Clair Region Conservation Authority	Forest Inventory (Craig 2008)	Species composition and structure of woodland within 120 m of the Project.
Ontario Ministry of Natural Resources	*Endangered Species Act (ESA 2007),* Species at Risk in Ontario list	Species at Risk in Ontario lists http://www.mnr.gov.on.ca/en/Business/Species/ 2ColumnSubPage/246809.html
Ontario Ministry of Natural Resources	Natural Heritage Information Centre (NHIC)	Lists and locations of ANSI's, PSW's and ESA's, lists provincial ranks for species and plant communities found in Ontario. Locations and lists of SAR for a given area. http://nhic.mnr.gov.on.ca/nhic_.cfm
Ontario Ministry of Natural Resources	LIO forest cover	Woodlots, wetlands other natural features.
Ontario Ministry of Natural Resources	Ontario Herpetofaunal Summary Atlas	Amphibian and Reptile species conservation ranks and range maps. http://nhic.mnr.gov.on.ca/mnr/nhic/herps/ohs.html
Bird Studies Canada, Nature Canada, Bird Life International	Important Bird Areas (IBA's)	Species lists, maps and locations. http://www.ibacanada.com/
Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada, Ontario Nature, Ontario Field Ornithologists.	Atlas of Breeding Birds of Ontario	Species lists and maps for local survey squares; http://www.birdsontario.org/atlas/index.jsp
Ontario Parks	Parks Locator	List of parks located proximate to Sarnia; http://www.parkreports.com/locator/show_distance.php
Ministry of Natural Resources	Crown Land Use Policy Atlas	Review mapping data layer for Conservation Reserve locations: http://crownlanduseatlas.mnr.gov.on.ca/
Site Geology/Soils and Groundwater	Maps	Ministry of Northern Development and Mines, "Map 2544 Bedrock Geology of Ontario Southern Sheet", 1991.

Organization	Data Type	Natural Features/Values
		Ministry of Northern Development and Mines, "Map 2556Quarternary Geology of Ontario Southern Sheet", 1991. AMEC, "Phase I & II Environmental Site Assessment, St. Clair Solar 1 & 2, 500 Acres on Rokeby Line (at Highway 40), Sarnia-Lambton, Ontario", 5 November 2008.

In addition to the above noted information sources, a review of detailed aerial photographs was also undertaken to further define the woodland, its associated boundaries and any other potential natural features that were contiguous with the woodland to serve either as forest cover, or provide some form of linkage or corridor functions. The LIO forest cover was also reviewed to confirm the woodland feature details within 120 m of the Project Location.

Based on spatial GIS analysis, the woodland is approximately 35 ha in size and was confirmed to meet the municipal criteria to be considered a woodland under Schedule H of the Official Plan for the County of Lambton and under definition of the municipal Woodlands Conservation By-law (Feb 2008). Consistent with the O.Reg. 359/09 definition of Natural Features ((h) a woodland), this significant woodland has been confirmed and included as a recognized natural feature in this report.

Therefore, the Project Location is within 120 m of candidate Significant Wildlife Habitat (woodland and hedgerows).

Records review did not reveal any Areas of Natural or Scientific Interest (ANSIs) or Provincially Significant Wetlands (PSWs) within 120 m of the Project Location. The following records from the NHIC database were determined to be the closest provincially designated natural heritage features:

- Three ANSI woodlot areas (Duthill Woodlot, Duthill Woodlot #1 and Duthill Woodlot #3) were identified as being present to east of the Project Location, all at a distances greater than 4 km; and,
- One Non-Provincial wetland, Charlie Grant's Wetland, was identified as being present to the east of the Project Location, respectively at a distance greater than 4 km.

The Project Location is not within 120 m of a valleyland.

A meeting with MNR personnel to discuss additional information on SAR, ANSIs and any other applicable data was undertaken in December 2009. The meeting included preliminary review and discussion of development plans, review of site plan and details pertaining to NHIC species identification around the Project Location and other features; such as, woodlots and natural

areas. Details of the preliminary search of NHIC and SCRCA information were provided to the MNR for review and discussion.

A review of Provincial Parks and Conservation Reserve databases at the MNR website as indicated in Table 2, confirmed that the Project Location is not located within or proximate to either of these land use designations.

It should be noted that although a number of the above agencies were contacted to obtain information related to natural features, or ANSIs, most deferred to the MNR as being the primary authority for this information. Furthermore, it is noted that additional contacts with the above agencies are on-going as related to other Project Location development matters; including, engineering design, permitting and approvals, public consultation, and stormwater management.

2.1.1 Land Use

AMEC reviewed the current land uses of neighbouring properties from publicly accessible locations to assess possible environmental impacts to the Project Location that may arise from off-site operations. Properties in the general area surrounding the Project Location are primarily mixed residential, and agricultural in use. Properties surrounding the Project Location are summarized as follows:

North of the Project Location:

North of the Project Location is the Bentpath Line right-of-way beyond which agricultural and scattered rural residential properties can be observed.

East of the Project Location:

East of the Project Location are woodlots, agricultural and scattered residential properties.

South of the Project Location:

South of the Project Location is the Smith Line right-of-way beyond which agricultural lands, woodlots and associated hedgerows, scattered rural residential properties and the McKeough Diversion Channel can be observed.

West of the Project Location:

Immediately to the west of the Project Location is the Baseline Road right-of-way. Beyond this road right-of-way, a Union Gas natural gas terminal, agricultural fields, scattered woodlots beyond 120 m set back, rural residential properties, sewage lagoons and the village of Sombra located 600 m to the west were observed.

2.2 Site Investigation

A biophysical Site Investigation was undertaken within the Project Location and 120 m setback. This Site Investigation was conducted for the purpose of determining: 1) whether the results of the information analysis summarized in the Records Review report are accurate or require correction; 2) whether any additional natural features exist, other than those that were identified during the Records Review; 3) the boundaries of any natural features identified in the Records Review or revealed as a component of the site investigation; and; 4) the distance from the Project Location to the boundaries of any natural feature that was identified in the Records Review or the Site Investigation. A component of the Site Investigation was to review the vegetation units including and any southern wetlands and associated features present within 120 m of the Project Location to confirm their functionality as wildlife habitat, and establish whether this habitat in itself meets the O. Reg. 359/09 definition of Natural Features under subsection 1 (1) (g) wildlife habitat.

With the Records Review revealing the presence of a significant woodland within 120 m of the Project Location, a site investigation was undertaken on October 14, 2009 to confirm and update general status of the woodland presence, boundaries and surrounding features relative to most recent available air-photo records dating to 2008. Follow-up site reconnaissance was conducted on December 17 2009 (both site visits completed by Mike Crabb, BES, CET, CCEP, an Environmental Scientist with AMEC Earth & Environmental). Through these preliminary site reconnaissance visits, conditions were surveyed for the purposes of confirmation of the locations of natural features, watercourses and any other relevant environmental features or characteristics within and beyond 120 m of the Project Location (i.e. drains and connections, buildings, right-of-ways, signs of environmental impact). These preliminary site visits and review of the Project Location was not for the direct applicability under Section 26 of O.Reg. 359/09 but rather for the purposes of assessing a larger more broad review of site, water and natural feature conditions so as to allow scoping of future general site investigation efforts. The site reconnaissance investigation was conducted between approximately 1:00 PM and 2:00 PM on both days.

More detailed vegetation and wildlife Site Investigations within the Project Location and 120 m setback were undertaken on May 5, 2010 between 9:00 AM and 11:00 AM and on September 21, 2010 between 11:00 AM and 6:00 PM. Weather conditions on May 5 were cloudy, windy, and at times rainy and on September 21 conditions were sunny, with little wind and no precipitation. The principal field biologist that undertook the Site Investigations was William McIlveen (Ph.D., Senior Terrestrial Biologist for AMEC Earth & Environmental with over 30 years of applicable and related experience). Dr. McIlveen assessed the Natural Heritage Features within the Project Location and the 120 m setback as required under Section 26 of O.Reg. 359/09 and provided details as per the requirements of Section 26 within the attached Natural Heritage Feature Site Investigation Field Report (Appendix B). Credentials of professional staff are provided in Appendix E.

Details with respect to the May (spring) and September (late summer/fall) Site Investigation surveys of the significant woodland, agricultural fields, hedgerow and other potential natural features or areas providing some form of wildlife habitat function are provided in Appendix B. Methods included the classification of distinct vegetation communities using protocols established by the Ecological Land Classification (ELC) system for Southern Ontario (Lee et al., 1998). All plant and wildlife species observed during each of the spring and fall surveys were recorded. Data recorded includes species composition and the approximate size, age, health and condition of trees as well as candidate significant wildlife habitat (Appendix B). Plants were inventoried as they were encountered during the ELC classification and wildlife habitat assessments. Visual searches were undertaken for rare plant species within 120 m setback portion of the wetland but none was were observed. Amphibians and birds were identified using visual searches and listening surveys where species were identified using their unique vocalizations. Mammals were identified through visual searches and the presence of scat, tracks or scrapes. Visual searches of reptiles were undertaken in areas suitable for basking and open areas where snakes may be foraging.

MNR defines significant wildlife habitat (SWH) *as ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System* (MNR 2000, MNR 2010). Snake hibernacula, bat roosts, cavity nesting trees, rare vegetation communities, interior forest habitat, animal movement corridors and woodlands supporting amphibian breeding habitat are all examples of SWH.

Candidate SWH within the Project Location and 120 m setback were assessed and mapped using the guidelines and criteria outlined in the *Significant Wildlife Habitat Technical Guide* (MNR 2000). Vernal pools were measured (length, width and depth), the identification and distribution of submergent and emergent aquatic vegetation as well as presence and distribution of coarse woody debris along the edge of the ponds was recorded. Location of each cavity tree was mapped, estimated size and location of cavity (lower, middle, top section of tree) and tree species were recorded. Location and species of each mast producing tree including beech, oaks and hickories were recorded. Locations of candidate snake hibernacula such as burrows, building foundations, wells and any suitable bases of telephone poles were mapped. Locations of snake thermoregulation and/or nesting sites such as piles of rock, brush or other organic materials, table rocks, exposed roots, hollow logs as well as anthropogenic sites such as piles of shingles and other types of construction or structural debris materials were mapped. Visual searches for raptor stick nests were undertaken during the May survey before extensive leaf out.

2.2.1 Existing Natural Heritage Features

2.2.1.1 General Site Conditions

The Project Location has been utilized for the production of corn in the northern half and soybeans in the southern half. The Records Review indicated the presence of a woodland

within 20 m of the Project Locations eastern border but closer examination of this feature during the Site Investigation revealed that the western portion of this feature located within the 120 m setback is a swamp consisting of two distinct ELC vegetation types (SWD3-3 and SWD2-2, discussed below and shown in Figure 4) and is now referred to as a “swamp” or “wetland” through-out the remainder of this NHA Report. Two small linear vegetated features representing partial hedgerows extend out from the swamp and terminate in the agricultural fields, 150 m to the west and 70 m to the north.

Three smaller woodlands are located to the southwest of the Project Location and range from 5 ha to 10 ha in size. These are located from approximately 130 and 250 m beyond the Project Location and as a result are outside the 120 m setback. Based on aerial photograph interpretation, another adjacent woodland approximately 400 m south of the Project Location is associated with old field meadows, early successional habitats and mature hedgerows that extend to Smith Line. These features and any associated corridor functions terminate at the Meyers Drain on the south side of Smith Line, opposite to the Project Location. No continuous corridors continue from the Project Location to the wetland within the 120 m setback, however, a narrow north-south oriented hedgerow located about 195 m to the east of the Project Location provides some potential corridor function from natural areas to the south and this wetland.

Although within the 120 m set back the River Lapish Drains are separated from the Project Location by at least one road right-of-way. All drainage ditches and buried drains observed at the site investigation confirmed the presence of three municipal (ditches) drains in the general vicinity and bordering the perimeter of the Project Location, as identified in the Record Review (Section 2.1). The Rivers Lapish (open municipal ditch), Watson Tulloch (open municipal ditch) and Myers Drains (open municipal ditch) are located adjacent/along the Site’s northern, western and southern property extents, respectively. These three drains are inferred to transfer water from the site and surrounding properties into the St. Clair River located approximately 1 km west of the Project Location. In addition, along the western border of the Project Location, the Watson Tulloch transfers the north half of its drainage into the Rivers Lapish Drain and the southern half into the Myers Drain. Drainage to the north of the Project Location reports to the Bergula Drain and ultimately to the River Lapish Drain.

Evidence of a below-grade drainage tile/features were observed transecting the Project Location and based on the level agricultural development it would be assumed that tiling carries the majority of Project Location infiltration runoff water into both the Rivers Lapish and Myers Drains. During the Site Investigation, a catch basin assembly with drainage tile inlets was observed at the northwest corner of the property. Follow-up discussions with the St. Clair Township Drainage Superintendent noted that subgrade field drainage entering that catch basin was responsible from draining the north half of Lot 1, Concession 11 into the adjacent municipal drains.

No other water bodies were identified on the site as part of the site investigation. There are no lakes, streams, or rivers present at the Project Location.

A recently abandoned rural residential property including a house and shed foundation is located along the northern border of the Project Location (Figure 2). The areas around this building are still comprised of mown grass and ornamental plantings, however given more time early successional habitat such as old field meadow and cultural thicket would be expected to encroach into this area. These abandoned building structures have the potential to serve a wildlife habitat function; the structural elements provide conditions suitable for snakes as cover, thermoregulation and possibly hibernation. Roosting bats may also use the building structures.

2.2.1.2 Vegetation Communities

The Site Investigation revealed a swamp comprised of two distinct ELC vegetation types within the 120 m setback. This swamp is part of a larger wooded area (35 ha), the western block (13.6 ha) of which is within the 120 m setback and as such was assessed during the Site Investigations. The eastern block (21.4 ha) is beyond the 120 m setback and is on private property, and as such was not assessed in detail, though it appeared to be more upland forest habitat types (Table 3, Figure 4, Appendix B).

In both swamp vegetation types, the soils are clay loam and depth to mottles is 10 cm indicating poor soil drainage with a moisture regime of 6 (very moist) (Lee et al. 1998); shallow pools of water were also present in several areas during the spring survey. Polygon 1 (Figure 4) is dominated by Freeman's (hybrid) Maple (*Acer* x *freemani*) which is a Red Maple (Swamp Maple) X Silver Maple hybrid classifying it as Swamp Maple Mineral Deciduous Swamp Type (SWD3-3). Polygon 2 (Figure 4) is slightly wetter and dominated by ash trees, classified as a Green Ash Mineral Deciduous Swamp Type (SWD2-2) (Table 3, Figure 4). Some of the larger ash trees had been infected by Emerald Ash Borer (*Agrilus planipennis*) and were in decline or dead

The trees in both ELC vegetation units are semi-mature, though not notably large in diameter (Table 4). The understory in Polygon 1 has a fairly extensive cover of healthy White Ash (*Fraxinus americana*) saplings. These saplings were noted to have fairly advanced shoot and leaf development. Small trees are not typically attacked by the Ash Borer, whereas larger trees are highly vulnerable to attack. The understory in Polygon 2 is comprised of Red Raspberry (*Rubus idaeus* ssp. *melanolasius*), Dwarf Raspberry (*Rubus pubescens*) and Northern Prickly-Ash (*Zanthoxylum americanum*).

Table 3: ELC Codes Assigned to Woodland Units

Area	ELC Habitat Description	Code
1	Swamp Maple Mineral Deciduous Swamp Type	SWD3-3
2	Green Ash Mineral Deciduous Swamp Type	SWD2-2

Table 4: Typical Size of Canopy Trees in Woodland
Diameter at Breast Height (DBH) (cm)

Species	Polygon 1	Polygon 2
Freeman's Maple	38.1, 47.3, 36.0, 25.9, 26.4	36.0
Ash sp.		30.8
Bur Oak		19.8
Shagbark Hickory		33.2

None of the plant species observed during the May or September field surveys Project Location and 120 m setback were identified as Species at Risk (Appendix B). One provincially rare species (S3), Shellbark Hickory *(Carya laciniosa)* was recorded in Polygon 1.

2.2.1.3 Wildlife

Mammals:

Direct evidence of mammal species encountered during the site investigations include the skull of a Raccoon (*Procyon lotor)* and tracks of a White-tailed Deer (*Odocoileus virginianus*); however, other common mammal species such as Coyote (*Canis latrans*) and Eastern Cottontail (*Sylvilagus floridanus*) would also be expected to occur. The presence of Shagbark and Shellbark Hickories would also be able to sustain Gray Squirrels (*Sciurus carolinensis*).

Birds:

Six species of birds were noted during the May and September surveys (Appendix B). None of the species are considered to be rare or uncommon. Note that as the site investigations were undertaken outside of the breeding bird season, these survey results cannot be considered a comprehensive representation of species using the Project Location or 120 m setback for breeding. Review of the most recent breeding bird atlas revealed several more species that have been recorded in the area (Appendix B).

Reptiles:

No reptiles were observed during the field surveys, but it is noted that quantitative and detailed sampling procedures were not applied during the survey. Accordingly, records review and

inferred habitat use have been applied to establish potential use of the area. Common snake species expected to occur in the area include Eastern Gartersnake (*Thamnophis sirtalis*) and Little Brown Snake (*Storeria dekayi*). Eastern Milksnake (*Lampropeltis triangulum)* is a provincial Species of Special Concern (S3) and are also known to occur in the region.

The rural residential/farm property at the northern border of the 120 m setback has the potential to provide foraging and cover habitat opportunities for snakes. The abandoned house, barn foundation structures provide suitable thermo-regulation and cover sites for snakes. Provided that remaining materials extend below the frost line and have openings that are accessible to snakes for suitable ingress and egress the house and barn could be used as hibernacula.

No turtle nests or scrapes were observed during the field survey. Permanent aquatic habitat for turtles is more than 2 km (St. Clair River) and 700 m (Lagoons) away from the study area. With relatively dry roadside ditches and drains, and extensive fragmentation of these features by the local road network and open agricultural fields, turtles are not expected to occur within the Project Location.

Amphibians:

American Toads were recorded in the wetland during the site investigations though other species including Spring Peepers (*Pseudacris crucifer*), Green Frogs (*Rana clamitans*) and Gray Tree Frogs (*Hyla versicolor*) would also be expected to occur in the wet areas of the wetland.

The wetland supports amphibian breeding habitats, including five vernal pools and over 25 transient pools (Figure 5). Transient pools were defined as shallow depressions that may hold water temporarily in the spring but likely not long enough to support breeding amphibians. Vernal pools were deeper depressions retaining water into the summer to facilitate successful amphibian breeding. Vernal pools ranged in size from 60 m^2 to 375 m^2 and were, on average, 20-25 cm deep. Transient pools had the same range in size but were slightly shallower, averaging about 10 cm deep.

The majority of the pool edges were surrounded by dense herbaceous vegetation, shrubs and/or coarse woody debris. The vernal pools are located within a forest stand thus amphibians do not need to move long distances to locate breeding ponds. The stand has a closed canopy structure in most areas providing a shaded, moist understory particularly in the deciduous swamp area of the wetland (Figure 4). Coarse woody debris is abundant in the understory providing cover opportunities for amphibians.

Invertebrates:

Silver-spotted Skipper (*Epargyreus clarus*) and Meadow Crayfish (*Cambarus diogenes*) were recorded during the field surveys. Monarch Butterfly (*Danaus plexippus*) were not recorded but

are expected to occur in the old field meadow and early successional habitats within the 120 m setback.

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LEGEND

Project Location Boundary

Vegetation Community Types

1) SWD3-3 - Swamp Maple Mineral Deciduous Swamp Type (5.1 ha)
2) SWD2-2 - Green Ash Mineral deciduous Swamp Type (11.2 ha)

NOTES:
- Road information extracted from the Ontario Road Network Database
- Railroad information extracted from Ontario Base Map Database
- Imagery was extracted from Google Earth Pro

Datum: NAD83
Projection: UTM Zone 17N

0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

First Solar. amec

FIRST SOLAR DEVELOPMENT (CANADA) INC.
NATURAL HERITAGE SITE INVESTIGATION

Existing Natural Features

PROJECT N°: SW0409575	**FIGURE: 4**
SCALE: 1:10,000	DATE: December 2010

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LEGEND

- Mast Trees
- Nest Cavities
- Snags
- Transient Pool
- Vernal Pool
- Meadow Crayfish Chimneys

0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

NOTES:
- Road information extracted from the Ontario Road Network Database
- Railroad information extracted from Ontario Base Map Database
- Imagery was extracted from Google Earth Pro

Datum: NAD83
Projection: UTM Zone 17N

N W E S

First Solar. amec

FIRST SOLAR DEVELOPMENT (CANADA) INC.
NATURAL HERITAGE SITE INVESTIGATION

Mast Trees, Snags, Nest Cavities, Vernal Pools, Transient Pools and Meadow Crayfish Chimneys

PROJECT N^{o}: SW0409575	**FIGURE: 5**
SCALE: 1:8,000	DATE: September 2010

2.3 Evaluation of Significance

2.3.1 Significant Wetland

The swamp located within the 120 m setback is an unevaluated wetland. As stated in the *Natural Heritage Assessment Guide* (MNR, 2010) "*applicants proposing projects with 120 m of an unevaluated wetland (but not within the wetland itself) can choose to treat the wetland as provincially significant and conduct an EIS*". Therefore, this approach was used and the wetland found within the 120 m setback of the Project Location proceeded to an EIS (Section 4). The swamp was evaluated following the Wetland Characteristics and Ecological Functions Assessment for Renewable Energy Projects in Appendix C of the Natural Heritage Assessment Guide (MNR 2010) and is presented in Table 5. No ranking or rating of this wetland feature (as either provincially significant or not significant) was calculated, as requested by MNR.

Table 5: Wetland Characteristics and Ecological Functions Assessed (taken from MNR 2010)

Characteristic/ Ecological Function	Details	Swamp	Comments
Actual Wetland Size (ha)	- Necessary to understand magnitude of impacts on area affected by project	- 16.3 ha - Polygon 1 = 5.1 ha) - Polygon 2 = 11.2 ha	- The swamp is within the 120 m REA setbacks but is 14 m from the Project Location. - No development will take place within the swamp. - No direct impacts on the swamp are expected.
Wetland Type	- Assists in understanding whether changes in hydrology will impact wetland function - Provides a gauge for the presence of Species at Risk or provincially significant species	Swamp: - Polygon 1 = SWD3-3 - Polygon 2 = SWD2-2	- No changes to the hydrology are expected. - Some SAR could reside in the area, as discussed in Section 2.1 and 2.2.
Site Type	- Assists in understanding if changes in hydrology will impact wetland function	Palustrine	- Surrounded by agricultural lands - This palustrine swamp experiences intermittent overland inflow but there appears to be no outflow from this site. - No alterations to local topography and water flow are expected.
Vegetation Communities	- Can be used to predict faunal types in order to assess varying impacts - Provides a gauge for the presence of Species at Risk and special features - Can be estimated through ortho-photography if property cannot be accessed	Deciduous trees (h), tall shrubs (ts), herbs (gc), mosses (m)	- Vegetation communities are described in detail in Section 2.2.
Proximity to Other Wetlands	- Provides hydrological connections in order to estimate downstream impacts		- Wetlands are within 1 km of other wetlands (to the east) but are not hydrologically connected by surface water.

Characteristic/ Ecological Function	Details	Swamp	Comments
Interspersion	- Can be used to predict faunal types in order to assess varying impacts - Can be estimated once vegetation communities known		- Less than 26 intersections for each polygon (41 - 60 intersections for the two Polygons combined as one). - Vegetation communities are described in detail in Section 2.2.
Open Water Types	- Assists in understanding whether changes in hydrology will impact wetland function - Can be estimated through ortho-photography		- Open water in vernal pools is ephemeral and occupies 5-25% of the wetland area, occurring in a central area. - No changes to the hydrology are expected.
Flood Attenuation (Total)	- Assists in understanding whether changes in hydrology will impact wetland function (e.g. isolated wetlands have high flood retention which could be altered due to grading etc.)		- The swamp is palustrine with overland inflow but no apparent outflow. The swamp is a part of a 35 ha natural feature that is surrounded by agricultural fields where surface water flows from northeast to southwest (Appendix D). Due to the location of this swamp's catchment within the watershed and the relatively large size of this swamp compared to the catchment area, and being palustrine, it is believed that this swamp has high flood retention. - No alterations to local topography and hydrology are expected.
Water Quality Improvement (Total)	- Assists in understanding whether changes in hydrology will impact wetland function - Provides information to determine whether activities will change components of wetlands water budget - Must be assessed on site unless property cannot be accessed (some sub- components can be assessed using desktop procedures)		- No development will take place within the swamp. - No changes to the hydrology are expected and therefore, no changes to wetlands' water budgets or functioning are expected.
Shoreline Erosion Control	- Relevant for shoreline vegetation removal - Activities that change topography and slope can change vegetation that grows in the wetland and affect erosion		- The swamp is palustrine and no shoreline is present.
Groundwater Recharge (Total)	- Assists in understanding whether changes in hydrology will impact wetland function - Particularly important to understanding effects of alterations to topography and water flow - Must be assessed on site unless property cannot be accessed		- The swamp is palustrine with intermittent overland inflow but no outflow. - No alterations to inflow water sources to this swamp are expected. - No alterations to local topography and water flow are expected.
Species Rarity (Total)	- Must be assessed on site unless property cannot be accessed		- Unknown as only two rare species were recorded during the surveys.

Characteristic/ Ecological Function	Details	Swamp	Comments
	- Where property cannot be accessed, applicants should use information obtained from district/NHIC during records review		However, Section 2.1 and 2.2 indicate that other rare species may be present. - Shellbark Hickory (S3) and Meadow Crayfish (S3) were recorded in the wetland. - Eastern Milksnake (S3) are known to occur in the region and are known to use these habitat types.
Significant Features and Habitats (Total)	- Essential to determining whether fundamental changes to habitat could occur - Must be assessed on site unless property cannot be accessed - Where property cannot be accessed, applicants should use information obtained from district/NHIC during records review		According to the MNR OWES Manual (1993) the following habitat evaluations must be scored by MNR. However, for the purposes of this NHA, AMEC has evaluated them based on information gathered during Site Investigation surveys: For both Polygon 1 and 2: 1) Winter Cover for Wildlife, Score by AMEC = 0. 2) Colonial Waterbirds, Score = 0; 3) Waterfowl Staging/Moulting Areas, Score = 0; 4) Waterfowl Breeding, Score = 0; 5) Migratory P/S/R Stopover, Score = 0; 6) Fish Habitat, Score = 0.
Fish Habitat (Total)	- Must be assessed on site unless property cannot be accessed - Provides understanding necessary to devise strategies for ensuring that discharges and mean concentration of sediments do not affect fish habitat - Provides understanding of water temperature which could be affected		Fish habitat is not present in the swamp.

2.3.2 Significant Wildlife Habitat

With the presence of candidate Significant Wildlife Habitat identified within the 120 m setback, a further evaluation to confirm significance of this wildlife habitat was undertaken. MNR defines significant wildlife habitat *as ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System* (MNR, 2000). Features such as snake hibernacula, bat roosts, cavity nesting trees, rare vegetation communities, interior forest habitat, animal movement corridors and wetlands supporting amphibian breeding habitat are all examples of what could be considered significant wildlife habitat. As a component of this NHA, wildlife habitat was categorized and accordingly assessed using guidelines and criteria outlined

the *Significant Wildlife Habitat Technical Guide* Appendix Q (MNR 2000) and in accordance with *Natural Heritage Reference Manual* (MNR 2010). The evaluation of significance was undertaken by Megan Hazell, M.Sc., Senior Wildlife Biologist at AMEC Earth & Environmental for the Great Lakes Region.

Under this evaluation process, wildlife habitat is divided into four broad categories (MNR 2000):

- Seasonal concentration areas;
- Rare vegetation communities or specialised habitats for wildlife;
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species; and,
- Animal movement corridors.

As suggested, not all available criteria need to be applied to complete an accurate assessment (MNR 2000). The most relevant criteria with respect to each category were used and are outlined in Tables 6 through 8.

2.3.2.1 Seasonal Concentration Areas

The natural features and vegetation units associated with the 120 m setback provide some habitat opportunities for seasonal concentrations of wildlife including snake hibernacula and maternity/day roosts for bats (Table 6). These are confined to areas outside the Project Location either within or adjacent to the 120 m setback.

2.3.2.2 Rare Vegetation Communities or Specialized Habitats for Wildlife

There were no rare vegetation communities observed within the Project Location or 120 m setback. The swamp communities and associated structural cover elements were considered to provide a diversity of specialised wildlife habitat opportunities (Table 7). The evaluation revealed amphibian breeding habitat, hard mast food sources that could support a wide variety of wildlife, as well as structural diversity including cover and cavity trees (Table 7). The swamp within the 120 setback and adjacent woodland area (35 ha in total) also provides habitat for area - sensitive species (Table 7).

2.3.2.3 Habitats of Species of Conservation Concern, Excluding the Habitats of Endangered and Threatened Species

The wetland provides habitat for species of conservation concern such as Shellbark Hickory (S3) and Meadow Crayfish (S3).

2.3.2.4 Animal Movement Corridors

Wildlife movement corridors are largely limited to the narrow vegetated road margins associated with Bentpath, Baseline and Smith Line, and the ditches and drains associated with the Rivers Lapish and Meyers Drains. In combination, the vegetation on these margins and drains forms a

linear meadow along the Right-of-Ways (ROWs). These features provide some linkage function between the swamp in the 120 m setback and the woodlands approximately 1 km south-west and south of Project Location. This linkage function is fragmented by the roadways and is limited due to narrow width (3-10 m) and is not directly contiguous with significant adjacent natural features (Table 8).

Cover is limited along these linear meadows, with no brush piles, rock piles, or areas of coarse woody debris recorded during the field surveys. Vegetation ground cover comprised of old field meadow species largely dominated by grasses. These linear meadows would provide cover for small mammals, amphibians and some reptile species.

The swamp itself forms part of a series of relatively continuous wooded areas running east-west through the region and is therefore part of a larger, more regional east-west corridor that extends from the Project Location east to North Sydenham River. This regional corridor is largely dependent on narrow hedgerow linkages for continuity and is fragmented in places by road and power transmission lines as well as cultivated agriculture fields. This east-west corridor functionally links these forest blocks to the north-south regional Primary Corridor, as designated in the Lambton Natural Heritage System, represented by the North Sydenham River Valley.

Table 6: Evaluation of Seasonal Concentration Habitats

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
Winter Deer Yards	Not applicable.	The Project Location and areas within 120 m setbacks are not known Deer Yards. The swamp does not have high densities of coniferous trees which are required in the winter.	*The Project Location and 120 m setback do not provide significant habitat for over-wintering deer.*
Colonial Bird Nesting Site	Not applicable.	There are no known records of colonial nesting species using this wetland, nor is there available nesting habitat for these species due to a lack of proximity to a large water course (required by most colonial nesting species). No evidence of colonial nests sites were observed.	*The Project Location and 120 m setback do not provide significant nesting habitat for colonial birds.*
Waterfowl Stopover and Staging Area	Not applicable	No documented history of use.	*The Project Location and 120 m setback do not provide significant habitat for staging waterfowl*.
Waterfowl Nesting Area	Not applicable.	No suitable open water/aquatic habitat is available for these species within the Project Location or 120 m setback.	*The Project Location and 120 m setback do not provide significant habitat for nesting waterfowl.*
Shorebird Migratory Stop over Area	Not applicable.	No suitable open water/aquatic habitat is available for these species within the Project Location or within 120 m setback.	*The Project Location and 120 m setback do not provide significant habitat for migratory shorebirds*.
Landbird Migratory Stopover Area	• Relative importance of the site; • Presence of species of conservation concern; • Species diversity; • Abundance; • Size of site; • Habitat diversity; • Historical use of site;	The Project Location is not within 5 km of Lake Ontario and/or Lake Erie which are recognized as migratory stopover zones. Migratory species may move through the region in association with the Lake Huron/St. Clair River corridor and periodically make use of the wetland to stop and forage for short periods of time. However relative to the evaluation criteria, this wetland does not provide significant migratory stopover habitat.	*The Project Location and 120 m setback do not provide significant stopover habitat for migratory birds.*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	• Location of site.		
Raptor Winter Feeding and Roosting Area	• relative importance of the site; • Presence of species of conservation concern; • Species diversity; • Abundance; • Size of site; • Habitat diversity; • Historical use of site; • Location of site.	No documented history of use.	*The Project Location and 120 m setback do not provide significant winter habitat for raptors.*
Bald Eagle Winter Feeding and Roosting Area	• Relative importance of the site; • Abundance; • Size of site; • Habitat quality; • Level of disturbance; • Location of roost; • Historical use of site;	No suitable open water is available for this species within the Project Location or 120 m setback. St. Clair River is within 1 km of the Project Location, however the landscape matrix between the Project Location and the river is highly disturbed and not high quality habitat for Bald Eagles. NHIC did not reveal any known occurrence of this species within 5 km of the Project Location.	*The Project Location and 120 m setback do not provide significant winter habitat for Bald Eagle.*
Wild Turkey Winter Range	• Relative importance of the site; • Abundance; • Size of site; • Habitat quality; • Location of habitat; • Level of disturbance.	Wild Turkeys do occur in the area. However, based on existing data review, this location is not a known wild turkey winter range area. Typically, sites with high quality Turkey habitat including large conifer trees, springs and seeps are the most significant. The Project Location does not have any of these attributes.	*The Project Location and the 120 m setback provide general habitat opportunities for Wild Turkeys. However the Project Location and 120 m setback do not provide significant winter habitat for Wild Turkeys*
Turkey Vulture Summer Roosting Areas	• Relative importance of the site; • Abundance;	Turkey Vultures do occur in the area. However based on existing data review, this site is not a known summer roosting area.	*The Project Location and areas within 120 m setback do not provide significant habitat for roosting Turkey*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	• Level of disturbance; • Historical use of area; • Level of disturbance; • Historical use of area.		*Vultures.*
Reptile Hibernacula	• Relative importance of the site; • Abundance; • Size of site; • Habitat quality; • Location of habitat; • Level of disturbance.	Mammal burrows were not recorded within the swamp A recently abandoned house and shed located along the northern border of the Project Location could be used as snake hibernacula by species such as Eastern Gartersnake and Eastern Milksnake.	*The Project Location and wetland located in the 120 m setback does not provide significant hibernacula habitat.* *The recently abandoned house and barn located in the 120 m setback contain habitat features such as building foundations used as snake hibernacula. Based on this assessment it is considered significant habitat.*
Bat Hibernacula and Maternity Roosts.		Cavity trees and/or abandoned house/barn structures provide opportunities for use as bat maternity roosts and/or day roosts. However there are only a limited number of cavity trees within the 120 m setback (Figure 5). There are no bat hibernacula within the swamp.	*The wetland located in the 120 m setback is not considered significant wildlife habitat for bat maternity roosts or hibernacula.*
Migratory Butterfly Stopover Area	• Relative importance of the site; • Abundance; • Size of site; • Habitat quality; • Location of habitat; • Level of disturbance.	Migratory butterflies such as Monarchs do occur in the area. However the site is not within 5 km of Lake Ontario and/or Lake Erie which is one of the main criterions for recognition as a migratory stopover area. Migratory species may move through the general region of the Project Location and opportunistically make use of the wetland and adjacent naturalized areas for brief stopover and foraging. However, due to the geographic location of this wetland it does not provide attributes for significant migratory	*The Project Location and 120 m setback do not provide significant migratory butterfly stopover habitat.*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
		stopover habitat.	
Bull Frog Habitat	Not applicable.	There are intermittent drain features north and west of the Project Location on the opposite side of Baseline Road and Bentpath Line. These features are not suitable, permanent aquatic habitats for Bull Frogs.	*The Project Location and 120 m setback do not provide significant bullfrog habitat.*

Table 7: Evaluation of Specialized Wildlife Habitat

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
Site Supporting Area Sensitive Species	• Presence of rare, uncommon, area sensitive, or declining species; • Overall area of site; • Presence of interior forest habitat; • Age and tree composition of forest stand; • Amount of vertical stratification; • Amount of contiguous canopy cover; • Degree of disturbance on site; • Amount of adjacent residential development; • Current representation of specialized habitat; in planning area; • Provision of significant wildlife habitat.	The swamp within the 120 m setback is part of a larger contiguous wooded area that is big enough to support some of the area-sensitive bird species. A calculation using a 200 m buffer around the edge of the forested wetland (MNR 2000) found that no interior portion of the forest would be considered "interior forest habitat". The swamp within the 120 m setback contains several significant wildlife habitats including structural diversity (cavity trees, mast trees and coarse woody debris (CWD)) and amphibian breeding habitat. Though the majority of trees within the 120 m setback were between 25 cm to 40 DBH the trees is the larger woodland outside the 120 m setback are larger with the majority of canopy trees exceeding 40 cm DBH providing suitable nesting habitat for many species of song birds and raptors (MNR 2000). Given the low percent forest cover within Essex County (<5%), any remaining woodland interior habitat is regionally unique.	*The wetland located within the 120 m setback provides habitat for area sensitive species.*
Forest stands providing a diversity of habitats	• Provision of significant wildlife habitat; • Size of site; • Age and condition of trees; • Vegetation composition and Diversity; • Cavity size, abundance and location;	The portion of the larger wooded area within the 120 m setback was solely comprised of swamp habitat types. However areas in the eastern portion of this larger area outside the 120 m setback were comprised of upland deciduous forest habitat types (though these were not evaluated in detail). Thus the swamp is part of the larger contiguous wooded area that provides both upland forest and swamp/wetland habitats. The swamp is structurally diverse, providing standing snags,	*The wetland is considered to contain significant wildlife habitat because it contains a structurally diverse forest stand.*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	• Location – proximity to water and moist soil conditions; • History of forest management.	coarse woody debris, cavity nesting trees and vernal pools. The Green Ash swamp had many ash trees that were infected by Emerald Ash Borer which will continue to provide abundant snags, cavities as well as coarse woody debris (CWD) cover in the future. The distribution of shrubs was heterogeneous; patches of Prickly Ash and Raspberry were interspersed with more open understory areas, providing nesting opportunities within the wetland. Dense shrubs also occurred along the forest edges providing nesting habitat for species tolerant of edge environments. In both Polygon 1 and 2, trees were generally mid-aged to mature. Though the majority of trees within the 120 m setback were between 25 cm to 40 DBH, the trees is the larger woodland outside the 120 m setback are larger with the majority of canopy trees exceeding 40 cm DBH. Cavity trees were present in both living trees and standing snags. Mast trees within the 120 m setback include Red Oak, Shagbark Hickory, Shellbark Hickory and Bur Oak often had cavities excavated within them as well. Cavities tended to be located in the bottom to middle portions of the trees and were various sizes (though size was not always discernable). Numerous vernal pools which provide breeding habitat for amphibians and local water sources for other terrestrial wildlife were present.	
Woodlands supporting amphibian breeding ponds	• Provision of significant wildlife habitat; • Degree of permanence; • Species diversity of pond; • Presence of rare species; • Size and number of ponds; • Diversity of submergent	The wetland supports amphibian breeding habitats, including 5 vernal pools and over 25 transient pools (Figure 5) It contains several significant wildlife habitats including raptor nesting sites, structural diversity (cavity trees, mast trees and CWD). Transient pools were defined as shallow depressions that may hold water temporarily in the spring but likely not long enough to support breeding amphibians. Vernal pools were deeper	*The wetland contains significant wildlife habitat in the form of amphibian breeding habitat.*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	and emergent vegetation; • Presence of shrubs and logs at edge of pond; • Adjacent forest habitat; • Water quality; • Level of disturbance.	depressions retaining water into the summer to facilitate successful amphibian breeding. Vernal pools ranged in size from 60 m^2 to 375 m^2 and were, on average, 20-25 cm deep. Transient pools had the same range in size but were slightly shallower, averaging about 10 cm deep. Neither transient pools nor vernal pools contained any water during the September surveys, though both types of pools contained water in May. The majority of the pool edges were surrounded by dense herbaceous vegetation, shrubs and/or coarse woody debris. The vernal pools are located within a forest stand thus amphibians do not need to move long distances to locate breeding ponds. The stand has a closed canopy structure in most areas providing a shaded, moist understory particularly in the deciduous swamp area of the wetland (Figure 4). Coarse woody debris is abundant in the understory providing cover opportunities for amphibians. The majority of the pools were surrounded by dense herbaceous vegetation and/or coarse woody debris that could be used for cover. American Toads were recorded in the wetland during the September survey other species including Spring Peepers, Green Frogs and Grey Treefrogs would also be expected to occur in this wetland.	
Old growth or mature forest stands	• Current representation of mature or old growth stands in planning area; • Age of trees; • Age classes of trees in stand; • Presence of old growth characteristics; • Species diversity;	There are areas within the wetland with some large trees; however these stands would not be considered old growth. Most of the stands would be considered mid-age to mature.	*This wetland is not significant in the provision of an old growth or mature forest stand.*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	• Presence of significant wildlife habitat.		
Foraging areas producing fruit, hard mast	• Presence of significant wildlife habitat; • Area and abundance of food source; • Size, age and health of trees; • Species diversity of site; • Permanence of food source; • Access to foraging areas; • Consistent historical use by wildlife.	The wetland is structurally diverse, providing standing snags, coarse woody debris cavity nesting trees and vernal pools in close proximity to foraging and mast supply sources. The swamp has mature, large mast trees including Red Oak, Bur Oak, Shellbark Hickory and Shagbark Hickory which all provide abundant hard mast food sources for wildlife (Figure 5). Over 25 mast trees were recorded within the western portion of this wetland (portion within the 120 m setback and directly adjacent to setback) (Figure 5). With the wetland being municipality designated as significant, it has a long term policy related protection and accordingly, would represent a permanent food source. There are regional east-west movement corridors that provide associated cover that wildlife can use to access this food source from adjacent natural heritage features.	*The wetland contains significant wildlife habitat through the provision of foraging areas producing hard mast.*
Raptor Nesting Habitat;	• Presence of large sturdy trees; • Access to foraging areas; • Degree of disturbance.	In the larger woodland outside the 120 m setback, there are many large trees suitable for raptor nests as well as perches for foraging. Open meadows, fallow land, Highway ROW areas and agricultural lands provide access to foraging areas and small mammal food sources. No stick nests were observed within the portion of the woodland within the 120 m setback. However raptors known to occur in the area and who may nest in this wetland include Eastern Screech Owl, Great Horned Owl, Red-tailed Hawk and Coopers Hawk. All of these species were detected in the area during the last Breeding Bird Atlas (Cadman et. al. 2007).	*No stick nests were observed within the 120 m setback or Project Location and as such do not provide significant nesting habitat for raptors.*
Turtle Nesting Habitat	• Size of habitat; • Location of site;	Some turtle species will travel several kilometres to their nest sites; North Sydenham River is 5.3 km east of the Project	*The Project Location and 120 setback do*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	• Substrate; • Evidence of use; • Presence of rare species; • Level of predation; • Presence of movement corridor; • Degree of disturbance; • Degree of threat.	Location, Clay Creek is 2 km north of the Project site and St. Clair River is 1.6 km west of the site. The McKeough Diversion Channel runs east-west from North Sydenham river into the St. Clair River 3 km south of the site. Turtles would be expected to occur in any of these adjacent drainage features. During the spring, Rivers and Meyers drains may become temporarily suitable for turtles. Soils within the Project Location and associated wetland in the 120 m setback were not sandy or gravelly substrates which are preferred by nesting turtles (MNR 2002). Any local species inhabiting the related drainage systems could travel from these areas to the wetland to nest, however, these distances are longer than most species typically travel. It should also be noted that the aquatic corridors are limited and potential overland routes are substantially fragmented by open agricultural fields and roadways. This fragmentation could increase susceptibility to adult and hatchling mortality, including predation by raccoons which may be high due to the proximity to agricultural fields and disturbed areas.	*not provide significant turtle nesting habitat*.
Areas of high diversity	• Current representation of areas in planning area; • Natural community diversity; • Species diversity; • Presence of rare species; • Size of site.	The area that was ELC evaluated for the NHA was comprised of solely swamp habitat types. Craig (2008) evaluation indicates that there may be other areas within the greater wetland that are drier, more upland deciduous forest habitat types. Thus the larger, 35 ha woodland, provides a diverse matrix of forest and swamp habitat. Shellbark Hickory (*Carya laciniosa*) is a provincially rare species that was recorded within the 120 m setback.	*Complete inventories for plants and wildlife have not been undertaken for this wetland and significance to high diversity cannot be assessed at this time.*
Seeps/Springs	Not applicable.	No discernable seeps/springs were observed.	*The Project Location and 120 m setback do not provide significant seeps or*

Specific Habitat	Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
			springs
Cliffs	Not applicable.	Cliffs are not present in the Project site.	*The Project Location and 120 m setback do not provide significant cliffs.*
Caves	Not applicable.	Caves are not present in the Project site.	*The Project Location and 120 m setback do not provide significant caves.*

Note: Table guidelines and criteria are based on the Significant Wildlife Habitat Technical Guide, Table 10-1 and Appendix Q (MNR 2000).

Table 8: Evaluation of Animal Movement Corridors

Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
• Importance of areas linked by corridor	Corridors providing local linkages between natural heritage features such as woodlands are largely limited to drains, linear corridor Right of Ways or farm windbreaks/hedgerows. Given the level of habitat fragmentation in this region of Ontario, these local corridors provide opportunities for wildlife movement between the remnant woodlands. Relative to the immediate Project Location and 120 m setback, wildlife movement corridors are largely limited to the narrow vegetated road margins associated with Bentpath, Baseline and Smith Line Roads, as well as the ditches and drains associated with the Rivers Lapish and Meyers Drains. In combination, the vegetation on the margins and drains forms a linear meadow along the ROWs. These features provide some linkage functions between the wetland within the 120 m setback and the woodlands approximately 1 km southwest and south of the Project Location. This linkage function is fragmented by the roadways and is limited due to narrow width (3-10 m) and is not directly contiguous with significant adjacent natural features. The wetland itself forms part of a series of relatively continuous woodlands running east-west through the region and therefore is part of a larger, more regional east-west corridor that extends from the Project site east to North Sydenham River. This regional corridor is largely dependent on narrow hedgerow linkages for continuity and is fragmented in places by road and power transmission lines as well as cultivated agriculture fields. This east-west corridor functionally links these forest blocks to the north-south regional Primary Corridor, as designated in the Lambton Natural Heritage System, represented by the North Sydenham River valley. The wetland is also linked by the narrow vegetated margins of road ROWs and drains to an identified Primary Natural Heritage Corridor (McKeough Diversion Channel) on Map 2 of the Official Plan for the County of Lambton located 2 km to the south.	*There are no significant local linkages within the Project Location which consists of fully of cultivated agricultural fields.* *The wetland within the 120 m setback makes up the western edge of a regional matrix of forest blocks running east-west through the area. These woodlands are linked through local hedgerows or other linear vegetated features. Through narrow corridors associated with hedgerows, drains and vegetated road margins, the swamp within the 120 m setback is linked to the designated Primary Corridors represented by the McKeough Diversion Channel and North Sydenham River on Map 2 of the Official Plan for the County of Lambton; as such it is part of a significant east-west regional linkage.*

Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
• Importance of corridor to survival of target species	The narrow vegetated road margin, drain ROWs, and hedgerows that provide potential linkage functions between the wetland in the 120 m setback and offsite natural heritage features would facilitate wildlife movement through the area. Although limited and fragmented, this linkage function would be important for species dispersion and movements between seasonal and more specialized habitats within a restricted natural heritage system. To the west of the Project Location, fragmentation increases and linkages to other woodlots, ponds and the St. Clair River corridor are limited to road/drain margins and small hedgerows. The larger, more regional east-west linkage is significant as it links east forest blocks as well as the St. Clair River to the north-south regional corridor created by the North Sydenham River. Such linkage supports species that require larger ranges and/or a matrix of riparian and upland habitats.	
• Dimensions and contiguity of corridor	The narrow vegetated road margin and drain ROWs and hedgerows are relatively narrow (5-10 m wide) and are fragmented by roads. They provide moderate contiguous corridors between natural heritage features in otherwise heavily disturbed landscape. North-south connections provide linkage to the McKeough Diversion Channel running into St. Clair River. The east-west regional corridor running from the Project Location to the North Sydenham River is approximately 5.5 km long. This series of woodlands form a corridor a minimum of 40-160 m in width, but fragmented in places by linear features such as roads, transmission lines as well as agricultural fields about 40-115 m in width.	
• Habitat and habitat structure of corridor	The regional east-west linkage including the wetland within the 120 m setback is structurally complex, consisting of mature forest and treed swamp blocks that provide cover and food sources for wildlife. The narrow vegetated road margin and drain ROWs are comprised of	

Evaluation Criteria	Assessment Based on Suggested MNR Guidelines	Conclusion
	old field meadow vegetation, scattered shrubs and small trees. Adequate cover is limited by the narrow width (3-10 m) and vegetation complexity along these ROWs, but some species including snakes, small mammals, birds and insects may use the corridor given limited availability of more substantive movement corridors within the largely disturbed landscape.	
• Species found using corridor	Surveys of the swamp have detected several mammalian, bird, amphibian and invertebrate species including White-tailed Deer, Northern Flicker, American Goldfinch and American Toad which could move between neighbouring woodlands. Snakes may use the wetter areas or the cultural meadow communities along the drains and roadway margin, as well as naturalized areas and hedgerows within the east-west forest matrix.	
• Risk of mortality for species using corridor	Due to the level of habitat disturbance in the lands adjacent to the described corridors, including residential and agricultural land uses, proximity to roads and other linear features adjacent to the corridors, mortality risk is high for many species. The narrow nature of described corridors would result in some wildlife species becoming relatively susceptible to predation and increased risk of mortality.	
• Opportunity for protection	The forest is municipally designated as significant which provides it some long term protection to maintain its function in the east-west forest matrix and associated corridor function. The narrow vegetated road margin and drain ROWs will be largely avoided with exception of minor access crossings to the site.	

Note: Table guidelines and criteria are based on the Significant Wildlife Habitat Technical Guide, Table 10-1 and Appendix Q (MNR 2000).

2.3.2.5 Evaluation Conclusion

Based upon the results of the Records Review (Section 2.1), the Site Investigation (Section 2.2), and consultations conducted under Section 16, 17 & 18 of O.Reg. 359/09 (see Aboriginal, Municipal and Public Consultation Reports), there is significant wildlife habitat located within the 120m setback as per Section 27 of O.Reg. 359/09. Evaluation of habitat features indicated the presence significant wildlife habitat including; amphibian breeding habitat, habitat for species of conservation concern, habitat for area-sensitive species, structurally diverse forest stand and foraging areas producing fruit and hard mast. The wetland is also a part of a regional matrix of forest blocks running east-west contributing a portion of a significant regional corridor and associated linkage functions.

With respect to seasonal concentration evaluation criteria, significant wildlife habitat was noted within the abandoned house and barn structure located along the northern border of the Project Location. Here, abandoned building structures associated with a rural residential farm could serve as hibernacula for various snake species, including species of special conservation concern such as Eastern Milksnake.

There are no significant movement corridors within the Project Location however the swamp within the 120 m setback is also a part of a local to regional matrix of forest blocks running east-west through the area contributing a portion of a more extensive regional corridor and associated linkage functions. The Significant Wildlife Habitat evaluation criteria, findings and conclusions are summarized in Tables 6 - 8.

T:\Kenneth Brookes\Amherstburg and Wolpole Solar FieldMaps\Report Maps\Sombra SiteMXD Maps\SigNaturalFeatures and WildlifeHab.mxd

LEGEND

- Significant Wetland supporting Significant Wildlife Habitat
- Significant Wildlife Habitat - Snake Hibernacula
- Project Location Boundary
- 120 m Setback from Project Location Boundary

NOTES:
- Road information extracted from the Ontario Road Network Database
- Imagery was extracted from Google Earth Pro

0 0.1 0.2 0.4 0.6 0.8 1 Kilometres

Datum: NAD83
Projection: UTM Zone 17N

N W E S

First Solar. amec

FIRST SOLAR DEVELOPMENT (CANADA) INC.
NATURAL HERITAGE SITE INVESTIGATION

Significant Natural Features and Wildlife Habitat within the Project Location and the 120 m Setback

PROJECT N°: SW0409575	**FIGURE: 6**
SCALE: 1:10,500	DATE: December 2010

3.0 SUMMARY OF NATURAL HERITAGE ASSESSMENT

Table 9 serves as a conformance summary to identify the various steps of the NHA, how these steps have been applied in the development of natural feature determination and how the information was applied to establish a level of significance of such features.

Table 9: Summary of Natural Heritage Assessment, Records Review, Site Investigations and Evaluation of Significance

Natural Heritage Assessment	
Records review (Section 25)	
Search for and analysis of the records set out in Column 1 of the Table to section 25 was conducted in respect of the project location for the purpose of making the determinations set out opposite the records in Column 2 of the Table.	Yes: Each record under column 1, Sec 25 of the Regulation was searched and analyzed and determinations made under column 2 in Section 2.1. of the Report.
Report was prepared setting out a summary of the records searched and the results of the analysis conducted above, and report was submitted to the Ministry of Natural Resources.	Yes: Each record under column 1, Sec 25 of the Regulation was searched and analyzed and determinations made under column 2 in Section 2.1 of the Report and submitted to MNR.
Site Investigation (Section 26)	
1. A physical investigation of the air, land and water within 120 metres of the project location was conducted for the purpose of determining,	
(a) whether the results of the analysis summarized in the "records review" report are correct or require correction, and identifying any required corrections;	Yes: Section 2.2 (Site Investigation) notes that results of the analysis summarized in the records review report are correct relative to Woodland designation under O.Reg 359/09 definitions.
(b) whether any additional natural features exist, other than those that were identified in the "records review" report;	Yes: Section 2.2 (Site Investigation) notes that results of the analysis summarized in the records review report required update. Investigation identified further natural features in the form of wildlife habitat and associated level of significance of habitat within the significant wetland and adjacent areas.
(c) the boundaries, located within 120 metres of the project location, of any natural feature that was identified in the records review or the site investigation; and	Yes: Section 2.2 (Site Investigation) clarifies boundaries (Figure 4) of all natural heritage features that were identified in the Records Review and further confirmed during the Site Investigation. These boundaries are in conformance and have been mapped based on image from Google Earth Pro License Image extraction with resolution that varies from 20 cm for wetland).
(d) the distance from the project location to the boundaries determined under clause I.	Yes: Section 2.2 (Site Investigation) notes project location relative to natural features (see Figure 4 and 7) with distances recorded based on site plans and air photo resolution as noted above).
2. A report was prepared and submitted to the Ministry of Natural Resources that sets out the following,	
(1) A summary of any corrections to the "records review" report and the determinations made as a	Yes: Section 2.2 (Site Investigation) notes the woodland discussed in the Records Review is

Natural Heritage Assessment	
result of conducting the site investigation.	actually a forested wetland with two ELC habitat types (Figure 4).
(2) Information relating to each natural feature identified in the records review and in the site investigation, including the type, attributes, composition and function of the feature.	Yes: Section 2.2 (relative to Natural Heritage Features Found Within 120 m of Project Location) and technical support documentation of the Natural Features Assessment site investigation effort (Appendix B) provide required information relating to natural features identified in the records review and in the site investigation, including the type, attributes, composition and function of the feature.
(3) A map showing,	
i. the boundaries located within 120 metres of the project location, of any natural feature that was identified in the records review or the site investigation,	Yes: Section 2.2 (relative to Natural Heritage Features Found Within 120 m of Project Location) and technical support documentation of the Natural Features Assessment site investigation effort (Appendix B) provide required information relating to natural features identified in the records review and in the site investigation, including the type, attributes, composition and function of the feature.
ii. the location and type of each natural feature identified in relation to the project location, and	Yes: Natural Features Assessment report associated with the Site Investigation (Appendix B) and the Water Features Assessment Report figures (Appendix D) contain maps showing location and type of each natural feature identified in relation to the project. Features are also outlined in Figures 4, 5 and 6, but detailed boundaries and setbacks associated with the Significant Woodland have been refined to confirm greater setbacks.
iii. the distance from the project location to the boundaries determined under clause I.	Yes: Section 2.2 (Site Investigation) notes project location relative to natural features (see Figure 4 and 6) with distances recorded based on site plans and air photo resolution as noted above).
(4) The dates and times of the beginning and completion of the site investigation.	Yes: Section 2.2 notes site investigation undertaken on May 5, 2010 between 2:00 PM – 5:00 PM and September 21 between 11:00 am and 6:00 pm.
(5) The duration of the site investigation.	Yes: Section 2.2 notes focused site investigation was undertaken on May 5, 2010 between 2 pm – 5:00 pm (3 hours) and September 21 between 11:00 am and 6:00 pm (7 hrs).
(6) The weather conditions during the site investigation.	Yes: Section 2.2 and Appendix B (Raw ELC Datasheets) note that the conditions were cloudy, with moderate wind and brief precipitation.
(7) A summary of methods used to make observations for the purposes of the site investigation.	Yes: Section 2.2 (and Appendix B) summarizes methods to make observations for the purpose of the site investigation.
(8) The name and qualifications of any person conducting the site investigation.	Yes: Section 2.2 notes that the Site Investigation was conducted by William David McIlveen, Ph.D., Senior Terrestrial Biologist for AMEC Earth &

Natural Heritage Assessment	
	Environmental with terrestrial technical support of a wildlife biologist. Credentials of professional staff are provided in Appendix E.
(9) Field notes kept by the person conducting the site investigation.	Yes: Appendix B (ELC Datasheets) includes field notes taken by the person(s) conducting the site investigation.
Natural Heritage, Evaluation of Significance (Section 27)	
If the project location is NOT (a) at least 50 m outside of all areas of natural and scientific interest (earth science); and (b) at least 120 m outside of all natural features that are not areas of natural and scientific interest (earth science), a report setting out the following was prepared and submitted to the Ministry of Natural Resources.	
1. For each natural feature shown on the map mentioned in paragraph 3 of subsection 26 (3), a determination of whether the natural feature is provincially significant, significant, not significant or not provincially significant.	Yes: In Section 3.0 (Evaluation of Significance) the unevaluated wetland is assumed to be significant and proceeds to an EIS (Section 4). An evaluation of the wetland was conducted using Appendix C of the Natural Heritage Assessment Guide (MNR 2000). The abandoned house and associated barn structures along the northern corner of the Project Location was also evaluated for significance using MNR criteria. This wetland is contains several significant wildlife habitats. The abandoned house and barn also contain significant wildlife habitat.
2. A summary of the evaluation criteria or procedures used to make the determinations mentioned in paragraph 1 of the section of the Act.	Yes: Section 3.0 (Evaluation of Significance) includes a summary of the evaluation criteria or procedures used to make the determinations of natural feature significance.
3. The name and qualifications of any person who applied the evaluation criteria or procedures mentioned in paragraph 2 of the section of the Act.	Yes: Section 3.0 (Evaluation of Significance) includes name and qualifications of person that applied evaluation criteria or procedures. Megan Hazell, M.Sc. Credentials of professional staff are provided in Appendix E.
4. The dates of the beginning and completion of the evaluation.	Yes: Section 3.0 (Evaluation of Significance) includes dates of the beginning and completion of the evaluation.

Based on the MNR criteria, areas within 120 m setback provide several types of significant wildlife habitat. The swamp located in the 120 m setback is an unevaluated wetland and as such is assumed to be significant. The contiguous swamp-woodland complex (35 ha) (swamp portion located within the 120 m setback) meets municipal significance criteria for woodlands. Accordingly, it was concluded that an EIS is necessary to identify any potential negative environmental effects on these significant natural features and ascertain how they can be avoided or mitigated.

4.0 ENVIRONMENTAL IMPACT STUDY

First Solar recognizes the fact that the proposed construction and operation of the solar facility is planned within the 120 m setback of the identified natural features:

- Municipally significant woodland (35 ha contiguous swamp – forest complex);
- Significant wetland (provincially un-evaluated therefore assumed to be significant);
- Wetland supporting amphibian breeding habitat;
- Wetland supporting area sensitive species;
- Wetland containing a structurally diverse forest stand;
- Wetland containing foraging areas with hard mast; and;
- Snake hibernacula.

Consistent with Section 38 of O. Reg. 359/09, the encroachment of the Project Location within the prohibition setbacks of 120 m of a significant wetland and significant wildlife habitat has resulted in the requirement for an Environmental Impact Study (EIS). This EIS and associated assessment of Project effects on natural features, is principally focussed on the wetland given the recognition of municipal significance designation and characterization of significant wildlife habitats within the wetland.

This EIS presentation has been organized on the basis of environmental components, all of which define the ecosystem of the natural heritage features identified. These components include abiotic components such as air, soil, and surface water, as well as biotic components of vegetation communities and their habitat functions, and the wildlife that reside in them. Through an impact evaluation relative to potential Project interactions with these environmental components, a conclusion regarding net residual effects after mitigation was determined. A summary of key potential project/environment interactions have been summarized in Table 9.

First Solar recognizes the fact that the proposed construction and operation of the solar facility is planned within the 120 m buffer setback of the significant wetland. Key Project structures and work activities to occur within the 120 m setback include temporary construction lay down areas to the immediate west of the wetland (Figure 3). The minimum distance between the wetland and the perimeter of the laydown areas is approximately 20 m (Figure 4). This setback provides a separation distance from the wildlife habitat of the wetland, further minimizing the potential for interactions between project activities and wildlife residing in the wetland and their associated significant wildlife habitat attributes.

Following Project development, the temporary facilities will be removed and the area restored to a grassland condition, resulting in a vegetated setback area greater than 120 m to the west and north of the wetland. The permanent facilities including the solar arrays, access roads and associated infrastructure will be located in areas previously under active agricultural land use (cultivated fields). On completion of construction, these areas will also be vegetated with a permanent low maintenance groundcover expanding on the Cultural Meadow conditions that will persist through the operations phase. Permanent aesthetic berms will be located along

Bentpath Line and to the north of Smith Line to provide visual screening of the Project Location during operations. These berms will be constructed in land area presently under agricultural cultivation, and will not encroach on vegetated areas of the roadside margins and municipal drains/ditches. The completed berms will be fully vegetated with a grass dominated groundcover. Accordingly, the area around the north and west perimeter of the wetland will develop into a naturalized vegetation buffer, a condition considered beneficial to the local wildlife.

Table 10: Potential Project-Environment Interactions

	Significant Natural Features / Key Project Works And Activities	Significant Wetland (includes contiguous forest-swamp)	Wetland Supporting Amphibian breeding habitat	Wetland supporting area sensitive species	Wetland containing a structurally diverse forest stands	Wetland containing forage areas with hard mast	Snake hibernacula
1							
	Site clearing and grading	O	O	O	O	O	O
	Operation of storage and laydown areas	O	O	O	O	O	O
	Operation of temporary storm water management system	--	O	--	--	--	--
	Construction vehicle operation and traffic	O	O	O	O	O	O
	Development of permanent road access	O	O	O	--	--	O
	Temporary storage of fuels	--	O	--	--	--	--
2							
	Operation of utilities	--	O	O	--	--	O
	Storm water management	--	O	--	--	--	--
	Array and vegetation maintenance	--	O	O	--	--	O

O Potential for adverse effect (+) Potential for beneficial effect -- No effect expected

The EIS and associated evaluation of impacts has been further organized in a tabular format relative to significant natural feature interactions and identifies the anticipated project effects on these features and the mitigation strategies that are proposed (Table 10). It should be noted that general consideration of effects and mitigation associated with the Site Preparation/Construction Phase and the Operations Phase have been provided. It is anticipated that the Decommissioning Phase will involve a combination of the recognized site preparation and construction activities, effects and mitigation measures as outlined, and as such has not

been defined separately. It is also anticipated that the decommissioning phase represents an activity that will not occur over a long term temporal scale and as such, consideration involving best management practices consistent with the regulations and guidelines that will be available to direct the project activities at that time.

The EIS has also applied the determination of the net residual effect of the interaction, and any monitoring requirements that may be required in order to effectively apply the proposed mitigation measures and ensure performance requirements are achieved.

Under REA, a formal effects monitoring plan is not required to be part of the Construction Plan (CP) for the site (See Table 1, REA) and as such monitoring plans have not been detailed as part of the EIS relative to potential site preparation and construction phase effects on Significant Wildlife Habitat and the Significant Woodland. During the operations phase, monitoring of significant natural features and significant wildlife habitat is only required when a negative effect is anticipated. Accordingly, monitoring during the operations phase is also not required for this Project as effects to significant wildlife habitat or the significant wetland have been avoided.

Irrespective of Significant Wildlife Habitat and Significant Features considerations First Solar has committed to environmental monitoring during the construction phase through the CP and associated Environmental Effects Monitoring Plan (EEMP) (see section 6.3). This CP has been approved by MOE, commitments relating to general wildlife concerns are outlined in section 6.3, however they do not specifically apply to significant wildlife habitat or significant features and no specific EEMP will be developed for these significant features as negative effects from Project activities are not anticipated.

Table 11: Identification of Environmental Effects and Proposed Mitigation Measures

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
Significant Wetland (and adjacent, contiguous forest stand).	Disturbance and loss of existing vegetation and associated habitat functions.	There will be no vegetation removal from the significant wetland. The site preparation activities and construction activities completely avoid the wetland. **Site Preparation/Construction Phase** • Demarcate the 20 m separation distance between Significant Woodland and the perimeter of the Project Location and isolate with fencing such that construction activities are excluded from this area. **Operational Phase** • A minimum 20 m separation distance will be maintained between the Project Location and the significant wetland within the120 m setback. The majority of the wetland boundary will be separated from the Project Location by a buffer of 30 – 90 m.	Due to the designed separation distance between the Project Location and the Significant Woodland, and avoidance of direct effects to wetland features, no adverse effects are anticipated.	General inspection of BMPs will be applied during construction. Periodic operational/ maintenance inspections to ensure site conditions are maintained as per design.
	Air - Potential for air emissions from construction vehicles, machinery and equipment and impacts to air quality.	**Site Preparation/Construction Phase** • Maintain vehicles, machinery and equipment in good repair, equipped with emission controls, as applicable, and operate them within regulatory requirements. • Comply with operating specifications for heavy equipment and machinery. • No burning of waste or excess materials.	Some emissions will be generated during Project activities with no net adverse effect to significant natural features.	General inspection of BMPs will be applied during construction.
	Dust - Potential for the release of dust and soil particles into significant wetland during Site Preparation/Construction Phase.	**Site Preparation/Construction Phase** • Suppress releases of dust using water mist or other appropriate methods of control during soil disturbance activities if required. • Use controlled work procedures in order to eliminate release of dust from construction works. • Minimize activities with potential to release airborne particulates during windy and prolonged dry periods. • Stabilize areas of stockpiled or exposed soils. • Cover or otherwise contain loose materials that have potential to release airborne particulates during their transport, installation or removal. • Minimize vehicle traffic on exposed soils and stabilize high traffic areas with clean gravel surface layer or other suitable cover material. • Restore disturbed areas as soon as possible to minimize the duration of soil exposure. • Work shall be carried out in compliance with the Canadian Environmental Protection Act (CEPA), and applicable air emission regulations and by-laws. • A crushed stone-tracking pad will be installed at the site access to reduce tracking of sediment onto adjacent roadways during construction activities. Street sweeping and cleaning will be scheduled as necessary, should the adjacent roadway become dirty.	Some fugitive dust during preparation from Project activities will be generated. No adverse effects on significant wetland are anticipated with implementation of mitigation measures. Site preparation activities will be temporary and of short (months) duration. No effects from dust are anticipated in operations phase of Project.	General inspection of BMPs will be applied during construction. No monitoring of dust during operations phase is required as negative effects on significant wetland are not anticipated during this phase.
	Noise - Temporary noise generated from Project activities during the Site Preparation/Construction Phase has the potential to disturb terrestrial biota in the significant wetland	**Site Preparation/Construction Phase** • Conduct work during normal business hours in accordance with local noise bylaw By Law No. 55-70 and amended. • Noise abatement devices will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.	Low potential for residual effect as generation of noise will be temporary, and activities are largely separated from significant wetland Any wildlife avoidance would be temporary. Effects from noise are not anticipated during the operations phase.	General inspection of BMPs will be applied during construction. No monitoring of noise during operations phase is required as negative effects are not anticipated during this phase.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
	Erosion - Project activities will result in portions of the Project Location and stockpiled material being exposed to erosion processes, including wind and surface run-off.	**Site Preparation/Construction Phase** • Stabilize soil upon completion of work activities to prevent its erosion and transport. • Cover stockpiled material in order to prevent its erosion and transport. • To minimize land disturbance, the construction envelope will be clearly demarcated and kept as small as possible. • Develop and implement an erosion control plan.	Low potential for residual effect if mitigation measures applied. Erosion effects are not anticipated during operations phase as Project Location will be planted with a permanent vegetation groundcover on all disturbed areas.	General inspection of BMPs will be applied during construction. No monitoring of erosion during operations phase is required as negative effects are not anticipated during this phase.
	Leaks or Spills - Potential for leak or spill of petroleum products and other deleterious substances from vehicles and machinery to contaminate the soil in significant wetland.	**Site Preparation/Construction Phase** • Ensure that absorbent materials are available on Project Location in the event that a spill of deleterious substances should occur. All spills and leaks of deleterious substances must be immediately contained and cleaned up in accordance with Provincial regulatory requirements and reported immediately to the Ontario Spills Action Centre (1-800-268-6060). • All equipment fuelling and maintenance will occur in the construction staging area. • Fuelling activities will be undertaken in designated areas well removed from boundaries in proximity to reported natural features. • Maintain log book of any spills and mitigation measures.	Low potential for residual effect if mitigation measures applied.	General inspection of BMPs will be applied during construction. Monitoring of leaks or spills during operations phase will be undertaken under BMPs. In the event of a reportable spill during operations any monitoring requirements will be specified by MOE.
	Changes to Surface Water - the predominant historic use of the Project Location was agricultural and farming. In order to develop the Project Location as a solar farm the land will be prepared including, grubbing, levelling, and compacting areas as needed to provide a suitable base for the solar arrays. Disturbed condition can lead to soil erosion and sediment loads to the significant wetland. Compaction can decrease the infiltration and absorption rates of the existing land. This could lead to ponding and saturated soil conditions, which can alter the site characteristics and require temporary dewatering. Potential for leak or spill of petroleum products and other deleterious substances from vehicles and machinery to contaminate surface water that runs off site to surrounding drainage systems	**Overall Project and Operational Phase** • The proposed preparation activities will be designed and implemented so as not to alter historic drainage patterns and will not significantly alter the elevations throughout the Project Location. • The Project Location will be stabilized with permanent vegetation ground cover which will attenuate run-off. **Site Preparation/Construction Phase** • Existing topography will be maintained to the greatest extent possible to minimize the amount of grading required. However, when grading is necessary, top soil will be removed and temporarily stockpiled (with silt fence around the base of the pile) while the subsurface soil is graded to ensure that potential mixing of the subsurface and top soil is minimized. • The proposed preparation activities will be designed and implemented so as not to alter historic drainage patterns and will not significantly alter the elevations throughout the Project Location. • The project's design includes a "Soil Erosion and Sediment Control Plan" specifically developed to minimize potential adverse impacts including measures such as, silt fences erected around and/or down slope of disturbed areas to prevent sediment from being transported off-site. All work will be done in accordance with the "Erosion & Sediment Control Guideline for Urban Construction", dated December 2006. Silt fence will apply specifications to avoid any potential tangling by snakes (i.e. no reinforcement netting) that may travel along the perimeter of the Project Location. • Upon completion of final land preparations, all disturbed areas will receive a final seeding in accordance with the conceptual site plans and stabilize the Project Location over both the short and long term time frame. • Any dewatering will be pumped to a contained sediment trap or to a filter bag treatment system. • Erosion and sedimentation control measures will be regularly inspected to ensure they are functioning and are maintained as required. If the control measures are not functioning properly, mitigation improvements will be applied. • All equipment fuelling and maintenance will occur in the designated construction staging areas at least 15 m from municipal ditches or drains.	Low potential for residual effect if mitigation measures applied. Short term measures will avoid any impacts to adjacent natural features or municipal drains. Long term maintenance of existing local drainage patterns will ensure no offsite changes to wetland or municipal drainage system. Use of gravel roads and planting site with permanent vegetation groundcover to establish a cultural meadow condition will improve attenuation of run-off over existing agricultural land use condition.	General inspection of BMPs will be applied during construction. Periodic operational/ maintenance inspections to ensure site conditions are maintained as per design.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
		• Ensure that absorbent materials are available on site in the event that a spill of deleterious substances should occur. All spills and leaks of deleterious substances must be immediately contained and cleaned up in accordance with Provincial regulatory requirements and reported immediately to the Ontario Spills Action Centre (1-800-268-6060). Maintain a logbook detailing any such measures. **Supplemental Note for Decommissioning Phase** • Long term screening berms will be implemented to ensure that during decommissioning activities native soils are available to fill the voids created by removing the gravel roadways and shelters. To the greatest extent practical, the soil material will be reused within the Project Location. If the material is not suitable for re-use, it will be disposed of in accordance with all applicable local, provincial, and federal rules and regulations.		
Wetland supporting amphibian breeding habitat	Potential temporary habitat loss due to site preparation and construction activities.	**Site Preparation/Construction Phase** • Demarcate the 20 m separation distance between the wetland supporting amphibian breeding habitat and the Project Location such that construction activities are excluded for this area. • Existing topography will be maintained to the greatest extent possible to minimize the amount of grading required. The proposed preparation activities will be designed and implemented so as not to alter historic drainage patterns and will not significantly alter the elevations throughout the site. Accordingly, surface water supply to municipal drains, ditches and vernal pools within the wetland supporting the amphibian breeding habitat will be maintained. • The open areas of the Project Location amongst the Solar Arrays will be planted with a low height permanent vegetation groundcover. This will convert existing active agricultural cropland to a cultural meadow condition which will be maintained as such for the duration of the Project. This will add approximately 59 ha of available habitat opportunities for species that can pass through perimeter safety fencing. An additional area of about 26 ha within and around the Project Location including area areas disturbed by construction, will be planted for soil stabilization providing additional Cultural Meadow habitat opportunities for amphibian use. This will aid in ensuring drainage patterns are maintained and sedimentation is attenuated such that no adverse effects occur at the amphibian ponds in the wetland. **Operational Phase** • A minimum 20 m separation distance will be maintained between the Project Location and the significant wetland within the120 m setback. The majority of the wetland boundary will be separated from the Project Location by a buffer of 30 – 90 m.	Low potential for residual effect if mitigation measures applied. Maintenance of existing topography and associated drainage patterns will maintain surface water supply to municipal drains, ditches and vernal pools identified within 120 m setback therefore no residual effect.	General inspection of BMPs will be applied during construction. Periodic operational/ maintenance inspections to ensure site conditions are maintained as per BMP design.
	Potential encounters with amphibians moving to breeding habitat during construction and operational/maintenance activities that could result in incidental mortality.	**Site Preparation/Construction Phase** • A silt fence will be placed around active construction site to reduce potential mortality to amphibians moving to breeding habitat. Silt fence will apply specifications to avoid any potential tangling by other wildlife that may travel along the perimeter of the Project Location (i.e. no reinforcement netting). **Operational Phase** • During mowing maintenance of the Cultural Meadow established within the Solar Farm, the use of heavy machinery shall be avoided. Mowing blade height will be set at a minimum of 15 cm to reduce amphibian mortality. • Access to site will involve slow vehicular speeds and site personnel and contractors will be trained to recognize and avoid encounters with snakes and amphibians. • Amphibians move more frequently at night, as mowing is conducted during the day, encounters with amphibians will be minimal.	Low potential for residual effect if mitigation measures applied. Construction is conducted during the day, so encounters with nocturnal amphibian predominant movement will be minimal.	No monitoring during construction or operational phase is required.
	Inaccessibility to amphibian breeding areas due to barriers.	**Site Preparation/Construction Phase** • A silt fence will be placed to isolate the construction work areas and reduce potential mortality to amphibians moving to breeding habitat. Silt fence will apply specifications to avoid any potential tangling by other wildlife that may travel along the perimeter of the Project Location (i.e. no reinforcement netting). Availability of the	No adverse effects are anticipated.	No specific monitoring during construction or operational phase is required.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
		existing naturalized corridors along the roads will be maintained to facilitate linkage functions to wetland and associated breeding ponds. **Operational Phase** • The fence around the Project Location will be permeable to amphibians and other small wildlife.		General inspection of BMPs will be applied during construction.
	Dust - Potential for the release of dust and soil particles into amphibian breeding habitat during Site Preparation/ Construction Phase. Dust can alter water quality within the vernal pools altering habitat quality.	**Site Preparation/Construction Phase** • Suppress releases of dust using water mist or other appropriate methods of control during soil disturbance activities if required. • Use controlled work procedures in order to eliminate release of dust from construction works. • Minimize activities with potential to release airborne particulates during windy and prolonged dry periods. • Stabilize areas of stockpiled or exposed soils. • Cover or otherwise contain loose materials that have potential to release airborne particulates during their transport, installation or removal. • Minimize vehicle traffic on exposed soils and stabilize high traffic areas with clean gravel surface layer or other suitable cover material. • Restore disturbed areas as soon as possible to minimize the duration of soil exposure. • Work shall be carried out in compliance with the Canadian Environmental Protection Act (CEPA), and applicable air emission regulations and by-laws. • A crushed stone-tracking pad will be installed at the site access to reduce tracking of sediment onto adjacent roadways during construction activities. Street sweeping and cleaning will be scheduled as necessary, should the adjacent roadway become dirty.	Some fugitive dust during preparation, Project activities will be generated. No adverse effects on amphibian breeding habitat are anticipated with implementation of mitigation measures. Site preparation activities will be temporary and of short (months) duration.	No specific monitoring during construction phase is required. General inspection of BMPs will be applied during construction. No monitoring of dust during operations phase is required as negative effects are not anticipated during this phase.
	Noise - Temporary noise generated from Project activities during the Site Preparation/Construction Phase has the potential to disturb breeding amphibians which use calls to attract potential mates.	**Site Preparation/Construction Phase** • Standard noise abatement devices consistent with industry standards will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.	Low potential for residual effect as generation of noise will be temporary, and activities are largely separated from significant natural features. Any wildlife avoidance would be temporary.	No monitoring during construction phase is required. General inspection of BMPs will be applied during construction. No monitoring of noise during operations phase is required as negative effects are not anticipated during this phase.
	Erosion - Project activities will result in portions of the Project Location and stockpiled material being exposed to erosion processes, including wind and surface run-off. This surface run off could alter water quality within vernal pools reducing habitat quality.	**Site Preparation/Construction Phase** • Stabilize soil upon completion of work activities to prevent its erosion and transport. • Cover stockpiled material in order to prevent its erosion and transport. • To minimize land disturbance, the construction envelope will be clearly demarcated and kept as small as possible. • Develop and implement an erosion control plan.	Low potential for residual effect if mitigation measures applied.	No specific monitoring during construction phase is required. General inspection of BMPs will be applied during construction. No monitoring of erosion during operations phase is required as negative effects are not anticipated during this phase.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
	Leaks or Spills - Potential for leak or spill of petroleum products and other deleterious substances from vehicles and machinery to contaminate the vernal pools in the wetland reducing habitat quality.	**Site Preparation/Construction Phase** • Ensure that absorbent materials are available on site in the event that a spill of deleterious substances should occur. All spills and leaks of deleterious substances must be immediately contained and cleaned up in accordance with Provincial regulatory requirements and reported immediately to the Ontario Spills Action Centre (1-800-268-6060). • All equipment fuelling and maintenance will occur in the construction staging area. • Fuelling activities will be undertaken in designated areas well removed from boundaries in proximity to reported natural features.	Low potential for residual effect if mitigation measures applied.	General inspection of BMPs will be applied during construction. Monitoring of leaks or spills during operations phase will be undertaken under BMPs. In the event of a reportable spill during operations any monitoring requirements will be specified by MOE.
	Changes to Surface Water - The predominant historic use of the Project Location was agricultural and farming. In order to develop the Project Location as a solar farm the land will be prepared including, grubbing, levelling, and compacting areas as needed to provide a suitable base for the solar arrays. Disturbed condition can lead to soil erosion and sediment loads into the wetland containing amphibian breeding habitat. Compaction can decrease the infiltration and absorption rates of the existing land. This could lead to ponding and saturated soil conditions, which can alter the site characteristics and/or changes to the surface water which can affect the vernal pools within the wetland.	**Overall Project and Operational Phase** • The proposed preparation activities will be designed and implemented so as not to alter historic drainage patterns and will not significantly alter the elevations throughout the Project Location. • The Project Location will be stabilized with permanent vegetation ground cover which will attenuate run-off. **Site Preparation/Construction Phase** • Existing topography will be maintained to the greatest extent possible to minimize the amount of grading required. However, when grading is necessary, top soil will be removed and temporarily stockpiled (with silt fence around the base of the pile) while the subsurface soil is graded to ensure that potential mixing of the subsurface and top soil is minimized. • The proposed preparation activities will be designed and implemented so as not to alter historic drainage patterns and will not significantly alter the elevations throughout the site. • The project's design includes a "Soil Erosion and Sediment Control Plan" specifically developed to minimize potential adverse impacts including measures such as, silt fences erected around and/or down slope of disturbed areas to prevent sediment from being transported off-site. All work will be done in accordance with the "Erosion & Sediment Control Guideline for Urban Construction", dated December 2006. Silt fence will not include reinforcement netting so as to avoid any potential tangling by snakes that may travel along the perimeter of the Project Location. • Upon completion of final land preparations, all disturbed areas will receive a final seeding in accordance with the conceptual site plans and stabilize site both for short and long term. • Any dewatering will be pumped to a contained sediment trap or to a filter bag treatment system. • Erosion and sedimentation control measures will be regularly inspected to ensure they are functioning and are maintained as required. If the control measures are not functioning properly, mitigation improvements will be applied. **Supplemental Note for Decommissioning Phase** • Long term screening berms will be implemented to ensure that during decommissioning activities native soils are available to fill the voids created by removing the gravel roadways and shelters. To the greatest extent practical, the soil material will be reused on site. If the material is not suitable for re-use, it will be disposed of in accordance with all applicable local, provincial, and federal rules and regulations.	Low potential for residual effect if mitigation measures applied. Short term measures will avoid any impacts to adjacent natural features or municipal drains. Long term maintenance of existing local drainage patterns will ensure no offsite changes to terrestrial natural features or municipal drainage system. Use of gravel roads and planting site with permanent vegetation groundcover to establish a cultural meadow condition will improve attenuation of run-off over existing agricultural land use condition.	General inspection of BMPs will be applied during construction. Periodic operational/ maintenance inspections to ensure site conditions are maintained as per design.
Wetland containing foraging areas with hard mast	Potential temporary habitat loss due to site preparation and construction activities.	There will be no vegetation removal from the wetland containing forage areas with hard mast. The site preparation activities and construction activities completely avoid this wetland containing foraging areas with hard mast. **Site Preparation/Construction Phase** • Demarcate the 20 m separation distance between Significant Woodland and the Project Location such that construction activities are excluded for this area.	No adverse effects on the wetland with hard mast are anticipated.	No monitoring during construction or operational phase is required.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
		Operational Phase • A minimum 20 m separation distance will be maintained between the Project Location and the significant wetland within the120 m setback. The majority of the wetland boundary will be separated from the Project Location by a buffer of 30 – 90 m.		
	Potential encounters with wildlife moving to mast areas during construction and operational/maintenance activities that could result in incidental mortality.	**Site Preparation/ Construction and Operations Phase** • Access to site will involve slow vehicular speeds so that wildlife encounters can be minimized. • Silt fencing will be used around the active construction site to aid in the prevention of mortality of wildlife moving to the wetland with hard mast.	Low potential for residual effect if mitigation measures applied.	General inspection of BMPs will be applied during construction.
	Inaccessibility to hard mast foraging areas due to fencing barriers.	**Site Preparation/Construction Phase** • A silt fence will be placed around active construction site to reduce potential mortality to wildlife moving to foraging areas with hard mast. Silt fence will apply specifications to avoid any potential tangling by other wildlife that may travel along the perimeter of the Project Location (i.e. no reinforcement netting). This will temporarily limit access from some areas for wildlife trying to moving across field. However they will be able to move to this area along the edge of this silt fence and/or use the naturalized corridor along the highway 40 ROW and/or the CN rail line. **Operational Phase** • The fence around the Project Location will be permeable to small mammals. Larger species such as Deer will jump over this fence and medium sized animals will have to use alternative corridors along the ROWs running parallel to the Project Location.	No adverse effects are anticipated.	General inspection of BMPs will be applied during construction.
Wetland supporting area sensitive species	Potential habitat loss and disruption due to Project activities.	There will be no vegetation removal from the significant wetland. The site preparation activities/construction activities and operations completely avoid the wetland supporting area sensitive species. **Site Preparation/Construction Phase** • Demarcate the 8 m separation distance between wetland supporting area sensitive species and the Project Location such that construction activities are excluded for this area. **Operational Phase** • A minimum 20 m separation distance will be maintained between the Project Location and the significant wetland within the120 m setback. The majority of the wetland boundary will be separated from the Project Location by a buffer of 30 – 90 m.	Low potential for residual effect if mitigation measures applied.	General inspection of BMPs will be applied during construction.
	Noise - Temporary noise generated from Project activities during the Site Preparation/Construction Phase has the potential to disturb breeding birds which use calls to attract potential mates.	**Site Preparation/Construction Phase** • Noise abatement devices to industry standard will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.	Low potential for residual effect as generation of noise will be temporary, and activities are largely separated from wetland supporting the area sensitive species Any wildlife avoidance would be temporary.	General inspection of BMPs will be applied during construction.
Wetland supporting a structurally diverse forest stand	Disturbance and loss of existing vegetation and associated habitat functions.	There will be no vegetation removal from the significant wetland. The site preparation activities and construction activities completely avoid the wetland. **Site Preparation/Construction Phase** • Demarcate the 20 m separation distance between Significant Woodland and the perimeter of the Project Location such that construction activities are excluded for this area.	No adverse effects on the significant wetland are anticipated.	General inspection of BMPs will be applied during construction.

Significant Natural Feature	Potential Negative Environmental Effect	Proposed Mitigation Measures & Best Management Practices[1]	Net Residual Effects	Further Study or Monitoring
		• Trees removed the hedgerow will be placed in brush piles within proposed naturalization area adjacent to the structurally diverse forest stand enhancing structural diversity of wetland and providing new cover opportunities for wildlife. A restoration area adjacent to the wetland will also be established. This will result in a net benefit to the existing wetland and associated habitats. **Operational Phase** • A minimum 20 m separation distance will be maintained between the Project Location and the significant wetland within the120 m setback. The majority of the wetland boundary will be separated from the Project Location by a buffer of 30 – 90 m.		
Snake Hibernacula	Potential temporary habitat loss due to site preparation and construction activities near snake hibernacula	**Site Preparation/Construction** • The abandoned house/barn structure that contains the snake hibernacula will not be disturbed or altered during the construction. A separation distance of 15 m between the snake hibernacula and the Project Location will be maintained. • The open areas of the Project Location amongst the Solar Arrays will be planted with a low height permanent vegetation groundcover. This will convert existing active agricultural cropland to a cultural meadow condition which will be maintained as such for the duration of the Project. This will add 58 ha of available habitat opportunities for snake species that can pass through perimeter safety fencing. An additional area of about 26 ha around the Project Location and in areas disturbed by construction, will be planted for soil stabilization providing additional Cultural Meadow habitat opportunities for snake use before and after hibernation.	Low potential for residual effect if mitigation measures applied. Conversion of agricultural lands to Cultural Meadow will enhance the functionality of the snake hibernacula by providing more habitat opportunities for snakes where none were previously available representing a net benefit.	No specific monitoring during construction or operational phase is required. General inspection of BMPs will be applied during construction.
	Potential encounters with snakes during construction and operational/maintenance activities that could result in incidental mortality.	**Site Preparation/Construction Phase** • The snake hibernacula will not be disturbed or altered during the construction maintaining a natural buffer around the snake hibernacula. A separation distance of 15 m between the snake hibernacula and the Project Location will be maintained. • A silt fence will be placed around active construction site to reduce potential mortality to snakes moving to cultural meadow. Silt fence will not apply specifications that include reinforcement netting so as to avoid any potential tangling by other wildlife that may travel along the perimeter of the Project Location. **Operations Phase** • During mowing maintenance of the Cultural Meadow established within the Solar Farm, the use of heavy machinery shall be avoided. Mowing blade height will be set at a minimum of 15 cm to reduce mortality of snakes moving to and from the hibernacula. • Access to the site will involve slow vehicular speeds and site personnel and contractors will be trained to recognize and avoid encounters with snakes.	Low potential for residual effect if mitigation measures applied.	General inspection of BMPs will be applied during construction and operations phases.

5.0 ENVIRONMENTAL MANAGEMENT PLAN

The mitigation measures as identified in Table 11, specifically target identified interactions between site preparation, construction and operations activities and significant natural features and wildlife habitats within the Project Location and the 120 m setback. In terms of effective overall environmental management of the Project Location, additional environmental components beyond those associated with significant natural features will be accommodated. First Solar will apply Best Management Practices (BMPs) through the development of Environmental Management Plans (EMPs) to organize and control work activities through all phases of Project development. The BMPs and natural heritage specific mitigation measures to be applied for environmental protection have been integrated in planning and design documentation, and development of the CP. The following provides an outline of the management plans that will guide overall protection of the environment to provide further context for review of protection measures relative to natural heritage.

5.1 Environmental Management Plan (Construction)

To avoid adverse environmental effects and to minimize unavoidable negative effects, an EMP will be prepared by First Solar Development (Canada) Inc., specifically for the construction phase of the project. The EMP will prescribe all environmental management measures, mitigation measures, spill prevention protocols, contingency measures, responsibilities, supervision, and reporting.

The EMP is an essential tool for minimizing adverse environmental effects. Key provisions of the EMP will include but will not necessarily be limited to such topics as:

- Temporary storm water management;
- Erosion Control Plan;
- Storage of fuels and lubricants;
- Material storage;
- Spill prevention;
- Spill containment and clean up protocols and equipment;
- Maintenance of machinery;
- Housekeeping protocols;
- Construction waste management;
- Dust management;
- Encounter of finds of potential archaeological interest;
- Encounter of contaminated soils;
- Site access and construction traffic routing;
- Construction envelop;
- Tree protection;
- Environmental supervision;
- Health and Safety standards and protocols; and
- Reporting.

5.2 Environmental Management Plan (Operation Phase)

Similar to the EMP for the construction phase, an EMP will be developed by First Solar Development (Canada) Inc. for operation of the Solar Farm. The overall objective of the EMP is to ensure the Solar Farm operates in compliance with regulatory standards and permits issued by the Ministry of the Environment.

The EMP will become integral part of the Solar Farm operation manuals and protocols and will be subject to periodic reviews and updating. Solar Farm management and maintenance personnel will be required to be familiar with the provisions of the EMP and will be responsible for its implementation including staff training and reporting.

Key provisions of the EMP will include but will not necessarily be limited to such topics as:

- Responsibilities;
- Environmental Procedures;
  - Storm Water discharges;
  - Traffic management;
  - Chemical management;
  - Shut down policies;
  - Inspections;
  - Spill prevention;
  - Monitoring;
- Equipment;
  - Preventative maintenance;
- Health and safety;
  - Policies;
  - Standards and protocols;
  - Requirements for contractors and suppliers;
  - Incident reporting;
- Emergency preparedness and response plan;
  - Responsibilities;
  - Spill containment and clean up procedures and equipment;
- Management of Environmental Program;
  - Training;
  - Documentation;
  - Reporting;
  - Continuous Improvement; and
  - Management review.

The EMP will be periodically reviewed and updated.

5.3 Monitoring Plan

The Construction Plan Report, EMPs and all associated contract specifications contain the implementation and mitigation measures to avoid effects to the environment and outline the Environmental Monitoring that will be undertaken. Consistent with the Table 11 mitigation measures, during Site Preparation/Construction and the Operations Phases general inspection of BMPs will be an important component of successful delivery of the Project. The following summary outlines the monitoring measures that are anticipated for this development:

Construction Inspection/Monitoring: Environmental inspection/monitoring will be applied to Contractor's activities during implementation through field inspection and oversight. This will involve monitoring of implementation operations to ensure protection of adjacent natural heritage features, watercourses, soil, groundwater, and air quality. With respect to the nature and magnitude of this project, this monitoring would include, but not be limited to, monitoring of construction boundaries and exclusion measures, erosion and sedimentation control measures, dewatering activities, excess material management, refuelling operations, and control of emissions. A critical component of the environmental inspection will include the monitoring of sedimentation control measures.

Under the EMP, First Solar will assign an environmental inspector/monitor to advise construction personnel of the BMP requirements and to insure adherence during construction to the Plan and to all permits and specifications. The monitor will report any deviations and will coordinate immediate mitigation efforts as required.

Wildlife Monitoring: Wildlife monitoring would involve the site inspection of certain activities that may result in disturbance to wildlife or wildlife habitat during the implementation and operations phases of the project. This could include review of sites, structures or vegetation units requiring removal or maintenance to ensure these features are not occupied by wildlife protected under provincial or federal regulation. Such monitoring would be undertaken on an as required basis depending on the nature of the work and disturbance schedules falling within wildlife timing constraints as defined by regulations.

Operations Monitoring: As a component of Best Management Practices and regular maintenance of the Solar Farm, the project site will be monitored to ensure that environmental protection measures are maintained as designed to protect and promote the sustainability of the natural heritage features at the site, and that operational activities are undertaken to regulatory standards.

Table 11 is a component of the CP (Appendix H). The CP and associated environmental BMP inspection/monitoring (included in CP) address, in a practical sense, all the potential negative effects on the significant features and significant wildlife habitat through detailed mitigation measures. With the implementation of the mitigation measures outlined in the CP (including the associated mitigation outlined in the EIS - Table 11), no negative environmental effects on

significant features or significant wildlife habitat are anticipated during the construction or operations phase of this Project

Under REA, a formal effects monitoring plan is not required to be part of the Construction Plan for the site (See Table 1 of REA) and as such monitoring plans have not been detailed as part of the EIS relative to potential site preparation and construction phase effects on Significant Wildlife Habitat and the Significant Woodland. During the operations phase, monitoring of significant natural features and significant wildlife habitat is only required when a negative effect is anticipated. Accordingly, monitoring during the operations phase is also not required for this Project as effects to significant wildlife habitat or the significant wetland have been avoided.

Other general mitigation measures for wildlife will include the use of timing windows to avoid direct impacts to nesting birds protected under the Migratory Birds Convention Act (1994). Disturbance to vegetation, where feasible, will take place outside of the breeding bird window from May 15th to July 31st. Any disturbance to vegetation that must be undertaken within the breeding bird season will include the inspection by a biologist of for nests, nesting birds and/or fledgling young.

5.4 Environmental Effects Monitoring Plan

First Solar has committed to environmental monitoring during the construction phase through the CP and associated Environmental Effects Monitoring Plan (EEMP) (see section 6.3). This CP has been approved by MOE, commitments relating to general wildlife concerns are outlined in section 6.3, however they do not specifically apply to significant wildlife habitat or significant features and no specific Environmental Effects Monitoring Plan (EEMP) will be developed for these significant features as negative effects from Project activities are not anticipated. General environmental monitoring will be undertaken (Appendix H). There will be an individual responsible for implementing the EEMP and monitoring of all construction practices involving the any of the following areas:

- Erosion Control
- Noise and Vibration
- Waste Management/minimization
- Contaminated Materials and Wastes
- Emergency Response Procedures
- Air Quality
- Water Quality
- Litter
- Storage of Chemicals and Fuels
- Cleanliness of the road from site traffic;
- Hours of work in the vicinity of residential dwellings;
- Movement and generation of surface water;
- Pedestrian and vehicle diversion and safety;

- Siltation and blockage of drains and water courses

The Environmental Monitor will ensure contractor compliance with the EMP as well as all local, provincial, and federal permits (Appendix F).

6.0 CONCLUSIONS & RECOMMENDATIONS

The Records Review with respect to the Natural Heritage Assessment revealed that there is a Significant Woodland as defined under the County of Lambton Official Plan designation criteria, within the 120 m setback. No other natural features were defined from this record review. The site investigation revealed the portion of this woodland within the 120 m setback to be a wetland and confirmed the boundaries of this wetland, and also revealed several candidate significant wildlife habitats within the wetland as well as an abandoned house and barn in the 120 m setback. An evaluation of significance was then undertaken on these candidate significant wildlife habitats through application of site investigation data, and the guideline document *Significant Wildlife Habitat Technical Guide (MNR 2000)*.

In review of four broad categories including seasonal concentration areas; rare vegetation communities or specialised habitats for wildlife; habitats of species of conservation concern, excluding the habitats of endangered and threatened species and animal movement corridors, it was determined that the wetland and the abandoned house and barn within the 120 m setback contained significant wildlife habitats. This wetland was confirmed to provide a variety of habitats for species that require forest or swampy areas including standing snags, coarse woody debris, cavities, vernal pools for amphibian breeding, oak and hickory trees which provide hard mast food sources. Other features, although recognized as providing local wildlife habitat attributes, were not defined as significant. Significant wildlife habitat in the form of snake hibernacula was identified in the abandoned house and barn structure along the northern border of the 120 m setback.

The significant wildlife habitats within the 120 m setback include:

- Wetland supporting amphibian breeding habitat;
- Wetland supporting area sensitive species;
- Wetland containing a structurally diverse forest stand;
- Wetland containing foraging areas with hard mast; and,
- Snake hibernacula.

There are no significant wildlife habitats or features within the Project Location as the majority of the Project has been planned to occupy previously disturbed agricultural cropland and avoid natural features. However a portion of the Project Location is located within 120 m of the Significant Wetland and the associated Significant Wildlife Habitats. As such, an EIS was prepared. The EIS addressed aspects of both the significant wetland as well as the significant wildlife habitats within the wetland and abandoned house and barn structures. The Project

Location is located between 20 - 97 m of the significant wetland and 15 m of the abandoned house and barn structures; however, development would be occurring in previously disturbed agricultural croplands. Through application of BMPs and prescribed mitigation measures, no residual effects to the significant wetland or significant wildlife habitats were concluded occur.

The Project has been planned to maximize occupation and use of previously disturbed agricultural cropland and avoid natural heritage features. Only a small portion of the development is located within 120 m of the Significant Wetland and the associated Significant Wildlife Habitat. As a result of this setback encroachment, an Environmental Impact Study (EIS) was prepared. The EIS addressed aspects of both the significant wetland as well as the other natural features recorded in and immediately adjacent to the site in recognition of local area linkage functions with respect to wildlife habitat. The location for temporary activities would be approximately 20 m from the significant wetland at the closest proximity. On removal of the temporary facilities and restoring them to a grassland or Cultural Meadow condition, the Project infrastructure would be located beyond 120 m of the wetland and would only occupy previously disturbed agricultural cropland areas (Appendix F – Note: Road infrastructure indicated in this Landscape Plan as occurring immediately north of the Significant Wetland and through the abandoned house and barn structures has been removed from further consideration and is now consistent with Figure 2 and Figure 4). Through application of BMP sand prescribed mitigation measures, no residual effects to the wetland or wetland wildlife habitat were concluded to occur. Only minor encroachments in vegetated areas of a ditch would be required for one minor access crossing off of the Bentpath Line. This ditch is not a classified drain based on SRCA records.

The restoration plan has the objective of enhancing the spatial extent of the significant wetland through a natural successional process. Other areas around the Project Location that become disturbed or are under agricultural practice can be converted to Cultural Meadow, with approximately 26 ha becoming available as potential wildlife habitat. Within the Project Location and amongst the Solar Arrays, a total of approximately 59 ha will be converted from disturbed agricultural cropland to a short grass ground cover. These mitigative plantings will greatly offset the disturbance to existing features. The restoration efforts will be undertaken through consultation with the St. Clair Region Conservation Authority and MNR to ensure that target habitat enhancement is consistent with regional objectives.

Other mitigation measures to address temporary disturbance issues related to natural heritage protection are accommodated in the CP and associated EMP for the project. It is concluded through the application of the mitigation measures identified and application of the management plans, no adverse significant residual effect will result as a result of Project implementation and operation.

7.0 CLOSURE

This report was prepared for the exclusive use of First Solar Development (Canada) Inc. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. Should additional parties require reliance on this report, written authorization from AMEC will be required. With respect to third parties, AMEC has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up action and costs.

The report is based on data and information collected during the Natural Heritage Assessment between the dates specified within the report. Except as otherwise may be specified, AMEC disclaims any obligation to update this report for events taking place, or with respect to information that becomes available to AMEC after the time during which AMEC conducted the investigation.

AMEC makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

This Report is also subject to the further Standard Limitations contained in Technical Services Agreement dated 24 September 2009.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact the undersigned.

Yours truly,

AMEC Earth & Environmental, a division of AMEC Americas Limited

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APPENDIX A
GENERAL SITE PHOTOGRAPHS

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 1

PHOTOGRAPH	1

Description

Looking north across the proposed development site towards the adjacent woodlot bordering the northeast corner.

PHOTOGRAPH	2

Description

Looking west along Smith Line towards the intersection with Baseline Road and the off-site natural gas terminal. The corner of the north portion of the Site can be observed on the right side of the photograph.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 2

PHOTOGRAPH	3

Description

Looking north across the southern portion of the development Site from Baseline Road. The southern portion of the Watson Tulloch drain can be observed along the east side of the road.

PHOTOGRAPH	4

Description

Looking east from the Baseline Road bridge over the McKeough Diversion Channel south of the Site.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 3

PHOTOGRAPH	5

Description

Looking east at the Myers drain along the south side of Smith Line. The residential property and agricultural land observed in the photograph make up a portion of the southern development lands.

PHOTOGRAPH	6

Description

Looking west along the Rivers Lapish Drain at the north extent of Bentpath Line and north of the Site. View includes the open ditch drain trending under Baseline Road and the connection originating from under Bentpath Line from the Watson Tulloch drain adjacent to the Site.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 4

PHOTOGRAPH	7

Description

Looking southwest across Bentpath Line at the Watson Tulloch open ditch and catchbasin associated with the drainage of the north half of the development Site.

PHOTOGRAPH	8

Description

Looking south at the catch basin which includes the subgrade drainage tile associated with the north half of the development site.

APPENDIX B
SITE INVESTIGATION

PROPOSED ST. CLAIR SOMBRA SOLAR FARM
LAMBTON COUNTY, ONTARIO

SITE INVESTIGATION REPORT

Submitted to:
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February 2011

SW04090575

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1.0 INTRODUCTION

First Solar, Inc. is proposing to develop a new photovoltaic solar park west of the community of Sombra in Lambton County, Ontario. The proposed facility is located south and east of Bentpath Line and Baseline Road. The property is formally identified as Lot 1, Concession 10 and 11 in the St. Clair Township (formerly Sombra Township), Lambton County (Figure 1 in the Natural Heritage Assessment Report).

One of the components of the Natural Heritage Assessment (NHA) is a Site Investigation. This report summarizes the methods used and the results obtained during Site Investigations conducted on May 6 and September 21, 2010. A Records Reviewed indicated that a woodland existed within the 120 m setback limits of the Project Location (Figure 2 in the NHA Report) and therefore, this Natural Heritage Feature was considered to be candidate Significant Wildlife Habitat (SWH) and was examined more closely during the Site Investigation.

2.0 METHODS

Detailed vegetation and wildlife site investigations within the Project Location and 120 m setback were undertaken on May 5, 2010 between 9:00 AM and 11:00 AM in the morning and on September 21, 2010 between 11:00 AM and 6:00 PM. Weather conditions on May 5 were cloudy, windy, and at times rainy and on September 21 conditions were sunny with little wind and no precipitation. The principal field biologist that undertook the site investigations was Dr. William McIlveen (Ph. D, Senior Terrestrial Biologist for AMEC Earth & Environmental with over 30 years of applicable and related experience). Dr. McIlveen assessed the natural heritage features within the Project Location and the 120 m setback as required under Section 26 of O.Reg. 359/09. Credentials of professional staff are provided in Appendix E of the NHA.

Methods included the classification of distinct vegetation communities using protocols established by the Ecological Land Classification (ELC) system for Southern Ontario (Lee et al., 1998). All plant and wildlife species observed during each of the spring and fall surveys were recorded. Data recorded includes species composition and the approximate size, age, health and condition of trees as well as candidate SWH. Amphibians and birds were identified using visual searches and listening surveys where species were identified using their unique vocalizations. Mammals were identified through visual searches and the presence of scat, tracks or scrapes. Visual searches of reptiles were undertaken in areas suitable for basking and open areas where snakes may be foraging.

MNR defines SWH *as ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System* (MNR 2000, 2010). Snake hibernacula, bat roosts, cavity nesting trees, rare vegetation communities, interior forest habitat, animal movement corridors and woodlands supporting amphibian breeding habitat are all examples of SWH.

Candidate SWH within the Project Location and 120 m setback were assessed and mapped using the guidelines and criteria outlined in the *Significant Wildlife Habitat Technical Guide*

(MNR 2000). Vernal pools were measured (length, width and depth), the identification and distribution of sub-mergent and emergent aquatic vegetation as well as presence and distribution of coarse woody debris along the edge of the ponds were recorded. The location of each cavity tree was mapped, and the estimated size and location of cavity (lower, middle, top section of tree) and tree species were recorded. The location and species of each mast producing tree including beech, oaks and hickories was also recorded. Locations of candidate snake hibernacula such as burrows, building foundations, wells and any suitable bases of telephone poles were mapped. Locations of snake thermoregulation and/or nesting sites such as piles of rock, brush or other organic materials, table rocks, exposed roots, hollow logs as well as anthropogenic sites such as piles of shingles and other types of construction or structural debris materials were mapped. Visual searches for raptor stick nests were undertaken during the May survey before extensive leaf out.

3.0 RESULTS

An air photo of the candidate Natural Heritage Feature located within the 120 m setbacks of the Project Location is provided in Figure 4 in the NHA Report. Figure 4 also delineates this feature into two habitat units (Polygons 1 and 2) which are described further in Section 3.1.2 below.

A photo record of the site, including candidate SWH is included in Appendix A of this Site Investigation Report and in Appendix A of the NHA. A listing of all plant and wildlife species observed is included in Appendices B and C of this report and the raw ELC data sheets are included in Appendix D of this report.

3.1.1 General Site Conditions

The Project Location has been utilized for the production of corn in the northern half and soybeans in the southern half. The Records Review indicated the presence of a woodland within 20 m of the Project Locations eastern border but closer examination of this feature during the Site Investigation revealed that the western portion of this feature located within the 120 m setback is a swamp consisting of two distinct ELC vegetation types (SWD3-3 and SWD2-2, Figure 4 of NHA Report). Two small linear vegetated features representing partial hedgerows extend out from the swamp and terminate in the agricultural fields, 150 m to the west and 70 m to the north.

Three small woodlands are located to the southwest of the Project Location and range from 5 ha to 10 ha in size. These are located approximately 130 and 250 m beyond the Project Location and are outside the 120 m setback. Based on aerial photograph interpretation, another woodland is located 400 m south of the Project Location and is associated with old field meadows, early successional habitats and mature hedgerows that extend to Smith Line. These features and any associated corridor functions terminate at the Meyers Drain on the south side of Smith Line, opposite to the Project Location. No continuous corridors continue from the Project Location to the wetland within the 120 m setback, however, a narrow north-south oriented hedgerow located about 195 m to the east of the Project Location provides some potential corridor function from natural areas to the south and to this wetland.

Although the River Lapish Drains are within 120 m setback, they are separated from the site by at least one road right-of-way. All drainage ditches and buried drains observed at the site investigation confirmed the presence of three municipal drains in the general vicinity and bordering the perimeter of the Project Location, as identified in the Records Review. The Rivers Lapish (open municipal ditch), Watson Tulloch (open municipal ditch) and Myers Drains (open municipal ditch) are located adjacent/along the site's northern, western and southern property extents, respectively. These three drains are inferred to transfer water from the site and surrounding properties into the St. Clair River located approximately 1 km west of the Project Location. In addition, along the west side of the Property, the Watson Tulloch transfers the northern half of its drainage into the Rivers Lapish Drain and the southern half into the Myers Drain. Drainage to the north of the site reports to the Bergula Drain and ultimately to the River Lapish Drain.

Evidence of a below-grade drainage tile/features were observed transecting the Project Location and based on the level of agricultural development it would be assumed that the tiling carries the majority of infiltration runoff water into both the Rivers Lapish and Myers Drains. During the Site Investigation, a catch basin assembly with drainage tile inlets was observed at the northwest corner of the property. Follow-up discussions with the St. Clair Township Drainage Superintendent noted that subgrade field drainage entering that catch basin was responsible from draining the northern half of Lot 1, Concession 11, into the adjacent municipal drains.

No other water bodies were identified on the site as part of the site investigation. There are no lakes, streams, or rivers present at the Project Location.

A recently abandoned rural residential property including a house and shed foundation is located along the northern border of the Project Location. The areas around this building are still comprised of mown grass and ornamental plantings, however given more time early successional habitat such as old field meadow and cultural thicket would be expected to encroach into this area. These abandoned building structures have the potential to serve a wildlife habitat function as the structural elements provide conditions suitable for snakes as cover, thermoregulation and possibly hibernation. Roosting bats may also use these buildings. General habitat use for other wildlife common in the area can also be anticipated and are evaluated in the NHA.

3.1.2 Wetland

The swamp is part of a larger, contiguous woodland complex that appears to include more upland forest communities to the east. The larger woodland is 35 ha in size, however, only the western portion (13.h ha) in proximity to the 120 m setback 13.6 ha was evaluated. The eastern portion outside of the 120 m setbacks is 21.4 ha and is on private property where access was not granted. Therefore, the eastern portion the lies outside of the REA setbacks was not examined during the Site Investigation surveys.

The western portion of the wetland is composed of two deciduous swamp habitats (wetlands) (Figure 4 of NHA Report and Appendix A Photos 1 and 2).

In both swamp vegetation types, the soils are clay loam and depth to mottles is 10 cm indicating poor soil drainage with a moisture regime of 6 (very moist) (Lee et al. 1998); shallow pools of water were also present in several areas during the spring survey. Polygon 1 (Figure 4) is dominated by Freeman's (hybrid) Maple (*Acer* x *freemani*) which is a Red Maple (Swamp Maple) X Silver Maple hybrid classifying it as Swamp Maple Mineral Deciduous Swamp Type (SWD3-3). Polygon 2 (Figure 4) is slightly wetter and dominated by ash trees, classified as a Green Ash Mineral Deciduous Swamp Type (SWD2-2) (Table 3, Figure 4). Some of the larger ash trees had been infected by Emerald Ash Borer (*Agrilus planipennis*) and were in decline or dead

The trees in both ELC vegetation units are semi-mature, though not notably large in diameter (Table 1). The understory in Polygon 1 has a fairly extensive cover of healthy White Ash (*Fraxinus americana*) saplings. These saplings were noted to have fairly advanced shoot and leaf development. Small trees are not typically attacked by the Ash Borer, whereas larger trees are highly vulnerable to attack. The understory in Polygon 2 is comprised of Red Raspberry (*Rubus idaeus* ssp. *melanolasius*), Dwarf Raspberry (*Rubus pubescens*) and Northern Prickly-Ash (*Zanthoxylum americanum*).

Table 1: Typical Size of Canopy Trees in Woodlot
Diameter at Breast Height (DBH) (cm)

Species	Polygon 1	Polygon 2
Freeman's Maple	38.1, 47.3, 36.0 25.9, 26.4	36.0
Ash sp.		30.8
Bur Oak		19.8
Shellbark Hickory		35.1
Shagbark Hickory		33.2

3.1.3 Wildlife

Direct evidence of mammal species encountered during the site visit included the skull of a Raccoon (*Procyon lotor)* and tracks of a White-tailed Deer (*Odocoileus virginianus*); however other common mammal species such as Coyote (*Canis latrans*) and Eastern Cottontail (*Sylvilagus floridanus*) would also be expected to use this woodlot. The presence of oaks and hickories would also be able to sustain Gray Squirrels (*Sciurus carolinensis*).

Six species of birds were noted during the May and September surveys (Appendix C). None of the species are considered to be rare or uncommon. Review of the most recent breeding bird atlas revealed several more species that have been recorded in the area. These species have been distinguished within the table (Appendix C).

American Toads were recorded in the woodland during the September survey though other species including Spring Peepers (*Pseudacris crucifer*), Green Frogs (*Rana clamitans*) and Gray Tree Frogs (*Hyla versicolor*) would also be expected to occur (NHIC 2010).

No reptiles were observed during the field surveys. Common snake species expected to occur in the area include Eastern Gartersnake (*Thamnophis sirtalis*) and Little Brown Snake (*Storeria dekayi*) (NHIC 2010). The Milksnake (*Lampropeltis triangulum),* Butler's Gartersnake (*Thamnophis butleri*) and Eastern Foxsnake (Pantherophis gloydi) are also known to occur in the region. No turtle nests or scrapes were observed during the field survey. Aquatic habitat for turtles is more than 2 km away from the study area and turtles are not expected to occur within the Project site.

3.1.4 Significant Wildlife Habitat

The wetland found within the 120 m setbacks is an unevaluated wetland. As stated in the *Natural Heritage Assessment Guide* (MNR, 2010) "*applicants proposing projects with 120 m of an unevaluated wetland (but not within the wetland itself) can choose to treat the wetland as provincially significant and conduct an EIS*". Therefore, this approach was used for in the NHA when evaluated this Natural Heritage Feature. The wetland was evaluated in the NHA following the Wetland Characteristics and Ecological Functions Assessment for Renewable Energy Projects in Appendix C of the Natural Heritage Assessment Guide (MNR 2010) (see Table 5 of NHA Report). However, no conclusive ranking or rating of this wetland was calculated (as requested by MNR; Heather Riddell, personal communications), but as mentioned above, for the purposes of this REA application, the wetland was assumed to be significant and an EIS was conducted on it.

Based on MNR criteria, the Project Location and areas within the 120 m setbacks may provide several other types of SWH. Wildlife habitat was recorded and assessed using guidelines and criteria outlined in the *Significant Wildlife Habitat Technical Guide*, Table 10-1 and Appendix Q. Wildlife habitat is divided into four broad categories (MNR 2000);

- Seasonal concentration areas
- Rare vegetation communities or specialised habitats for wildlife
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species
- Animal movement corridors.

As suggested, not all available criteria need to be applied to complete an accurate assessment (MNR 2000), the most relevant criteria with respect to each category were used (Tables 6 - 8 in the NHA Report).

3.1.4.1 Seasonal Concentration Areas

The natural features and vegetation units associated with the 120 m setback provide some habitat opportunities for seasonal concentrations of wildlife including snake hibernacula and maternity/day roosts for bats. These are confined to areas outside the Project Location either within or adjacent to the 120 m setback.

3.1.4.2 Rare Vegetation Communities or Specialized Habitats for Wildlife

There were no rare vegetation communities observed within the 120 m of the Project Location. The vegetation communities and structural cover elements found within the wetland were considered to provide a diversity of specialised wildlife habitat opportunities. The evaluation revealed the wetland provides amphibian breeding habitat in the form of vernal pools, hard mast food sources that could support a wide variety of wildlife, and structural diversity including cover and cavity trees. The wetland also provides habitat for area-sensitive species.

3.1.4.3 Habitats of Species of Conservation Concern, Excluding the Habitats of Endangered and Threatened Species

The wetland provides habitat for species of conservation concern such as Shellbark Hickory (S3) and Monarch Butterfly (Special Concern)

3.1.4.4 Animal Movement Corridors

Wildlife movement corridors are largely limited to the narrow vegetated road margins associated with Bentpath, Baseline and Smith Line, and the ditches and drains associated with the Rivers Lapish and Meyers Drains. In combination, the vegetation on these margins and drains forms a linear meadow along the right-of-ways. These features provide some linkage function between the wetland in the 120 m setback and the woodlands approximately 1 km southwest and south of Project Location. This linkage function is fragmented by the roadways and is limited due to narrow width (3-10 m) and is not directly contiguous with significant adjacent natural features.

Cover is limited along these linear meadows, with no brush piles, rock piles, or areas of coarse woody debris recorded during the field surveys. Vegetation ground cover comprised of old field meadow species largely dominated by grasses. These linear meadows would provide cover for small mammals, amphibians and some reptile species.

The wetland itself forms part of a series of relatively continuous woodlands running east-west through the region and is therefore part of a larger, more regional east-west corridor that extends from the Project Location east to North Sydenham River. This regional corridor is largely dependent on narrow hedgerow linkages for continuity and is fragmented in places by road and power transmission lines as well as cultivated agriculture fields. This east-west corridor functionally links these forest blocks to the north-south regional Primary Corridor, as designated in the Lambton Natural Heritage System, represented by the North Sydenham River Valley.

4.0 DISCUSSION AND RECOMMENDATIONS

Evaluation of habitat features represented within the wetland indicated the presence significant wildlife habitat including; amphibian breeding habitat, habitat for species of conservation concern, habitat for area-sensitive species, structurally diverse forest stand and foraging areas producing fruit and hard mast. The wetland is also a part of a regional matrix of forest blocks running east-west contributing a portion of a significant regional corridor and associated linkage functions.

With respect to seasonal concentration evaluation criteria, significant wildlife habitat was noted within the abandoned house and barn structure located along the northern border of the Project Location. Here, abandoned building structures associated with a rural residential farm could serve as hibernacula for various snake species, including species of special conservation concern such as Eastern Milksnake.

There are no significant movement corridors within the Project Location however the wetland within the 120 m setback is also a part of a local to regional matrix of forest blocks running east-west through the area contributing a portion of a more extensive regional corridor and associated linkage functions.

With the notable exception of the ash trees that may have been affected by Emerald Ash Borer, in general, the woodlot appeared to be in fairly healthy condition. The wetland is comprised of semi-mature deciduous swamp and forest types typical of southwestern Ontario. It is a significant size and provides a variety of habitats for species that require forest or swampy areas including interior forest, standing snags, coarse woody debris, cavities, vernal pools for amphibian breeding and hard mast food sources. Although the planned development of the property is not assumed to extend into the woodlot some general mitigation measures to consider include:

- Keeping major construction away from the woodlot during the breeding bird nesting season (May 1 to July 31);
- Rehabilitation of work areas immediately upon completion of the work, with non-invasive, indigenous species (seed mix to be developed in consultation with local Conservation Authority);
- Installing tree protection fencing at the onset of the construction activity to protect specimen trees from construction damage; and
- Promote the removal of any invasive non-native species.

5.0 REFERENCES

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APPENDIX A

PHOTO RECORD

Photo 1: Typical vegetation within the Freeman's Maple swamp (Polygon 1, Figure 2).

Photo 2: Typical vegetation within Green Ash Swamp (Polygon 2, Figure 2).

Photo 3: Cavity tree in woodland.

Photo 4: Meadow Crayfish Burrow in woodland.

Photo 5: Vernal Pool present in Green Ash swamp in May 2010 (Polygon 2, Figure 3).

Appendix B
Compiled Plant Species List

Family	Latin Name	Common Name	Global Rank	Provincial Rank
Aceraceae	*Acer x freemanii*	Freeman's Maple	HYB	S?
Araceae	*Arisaema triphyllum ssp. triphyllum*	Jack-in-the-pulpit	G5	S5
Berberidaceae	*Berberis vulgaris*	Common Barberry	G?	SE5
Juglandaceae	*Carya ovata*	Shagbark Hickory	G5	S5
Juglandaceae	*Carya laciniosa*	Shellbark Hickory	G5	S3
Portulaceae	*Claytonia virginica*	Narrow-leaved Spring Beauty	G5	S5
Cornaceae	*Cornus foemina ssp. racemosa*	Red-panicled Dogwood	G5	S5
Rosaceae	*Fragaria virginiana ssp. glauca*	Wild Strawberry	G5	S5
Oleaceae	*Fraxinus americana*	White Ash	G5	S5
Rubiaceae	*Galium asprellum*	Rough Bedstraw	G5	S5
Solanaceae	*Geranium maculatum*	Wild Geranium	G5	S5
Caprifoliaceae	*Lonicera tatarica*	Tartarian Honeysuckle	G?	SE5
Vitaceae	*Parthenocissus inserta*	Thicket Creeper	G5	S5
Berberidaceae	*Podophyllum peltatum*	Mayapple	G5	S5
Rosaceae	*Prunus serotina*	Black Cherry	G5	S5
Fagaceae	*Quercus macrocarpa*	Bur Oak	G5	S5
Ranunculaceae	*Ranunculus abortivus*	Kidney-leaved Buttercup	G5	S5
Grossulariaceae	*Ribes americanum*	Wild Black Currant	G5	S5
Rosaceae	*Rubus idaeus* ssp *melanolasius*	Wild Red Raspberry	G5T5	S5
Rosaceae	*Rubus pubescens*	Dwarf Raspberry	G5	S5
Apiaceae	*Sanicula marilandica*	Black Snakeroot	G5	S5
Asteraceae	*Taraxacum officinale*	Common Dandelion	G5	SE5
Tiliaceae	*Tilia americana*	American Basswood	G5	S5
Anacardaceae	*Toxicodendron rydbergii*	Western Poison Ivy	G5T5	S5
Ulmaceae	*Ulmus americana*	American Elm	G5?	S5
Caprifoliaceae	*Viburnum lentago*	Nannyberry	G5	S5
Violaceae	*Viola* sp.	Violet sp.		
Rutaceae	*Zanthoxylum americanum*	American Prickly-ash	G5	S5

G5 Globally Very Common Species
G? Unranked
S5 Provincially Secure Species
SE Exotic/Introduced Species
S? Unranked

Appendix C
Compiled Wildlife Species List

Family	Latin Name	Common Name	Global Rank	Provincial Rank
Birds				
Turdidae	*Turdus migratorius*	American Robin	G5	S5B
Icteridae	*Icterus galbula*	Baltimore Oriole	G5	S4B
Corvidae	*Cyanocitta cristata*	Blue Jay	G5	S5
Picidae	*Colaptes auratus*	Northern Flicker	G5	S4B
Icteridae	*Agelaius phoeniceus*	Red –winged Blackbird	G5	S4
Fringillidae	*Carduelis tristis*	American Goldfinch	G5	S5B
Phasianidae	*Phasianus colchicus*	Ring-necked Pheasant†	G5	SNA
Phasianidae	*Meleagris gallopavo*	Wild Turkey†	G5	S5
Icteridae	*Molthrus ater*	Brown-headed Cowbird†	G5	S4B
Icteridae	*Quiscalus quiscula*	Common Grackle†	G5	S5B
Picidae	*Picoides pubescens*	Downy Woodpecker	G5	S5
Mimidae	*Dumetella carolinensis*	Gray Catbird†	G5	S4B
Troglodytidae	*Troglodytes aedon*	House Wren†	G5	S5B
Accipitridae	*Buteo jamaicensis*	Red-tailed Hawk†	G5	S5
Emberizidae	*Melospiza melodia*	Song Sparrow†	G5	S5B
Sittidae	*Sitta carolinensis*	White-breasted Nuthatch†	G5	S5
Cathartidae	*Cathartes aura*	Turkey Vulture†	G5	S5B
Sturnidae	*Sturnus vulgaris*	European Starling†	G5	SNA
Passeridae	*Passer domesticus*	House Sparrow†	G5	SNA
Columbidae	*Zenaida macroura*	Mourning Dove†	G5	S5
Falconidae	*Falco sparverius*	American Kestrel†	G5	S4
Paridae	*Poecile atricapillus*	Black-capped Chickadee†	G5	S5
Cardinalidae	*Cardinalis cardinalis*	Northern Cardinal†	G5	S5
Charadriidae	*Charadrius vociferous*	Killdeer†	G5	S5B,S5N
Picidae	*Picoides villosus*	Hairy Woodpecker†	G5	S5
Tyrannidae	*Contopus virens*	Eastern Wood-pewee†	G5	S4B
Bombycillidae	*Bombycilla cedrorum*	Cedar Waxwing†	G5	S5B
Cardinalidae	*Passerina cyanea*	Indigo Bunting†	G5	S4B
Trochilidae	*Archilochus colubris*	Ruby-throated Hummingbird†	G5	S5B1
Picidae	*Melanerpes carolinensis*	Red-bellied Woodpecker†	G5	S4
Tyrannidae	*Sayornis phoebe*	Eastern Phoebe†	G5	S5B
Tyrannidae	*Myiarchus crinitus*	Great-crested Flycatcher†	G5	S4B
Vireonidae	*Vireo flavifrons*	Yellow-throated vireo†	G5	S4B
Sylviidae	*Polioptila caerulea*	Blue-gray Gnatcatcher†	G5	S4B
Cardinalidae	*Pheucticus ludovicianus*	Rose-breasted Grosbeak†	G5	S4B
Turdidae	*Hylocichla mustelina*	Wood Thrush†	G5	S4B
Turdidae	*Catharus fuscescens*	Veery†	G5	S4B
Strigidae	*Megascops asio*	Eastern Screech-owl†	G5	S4
Strigidae	*Bubo virginianus*	Great Horned Owl†	G5	S4
Amphibians				

Family	Latin Name	Common Name	Global Rank	Provincial Rank
Bufonidae	*Bufo americanus*	American Toad	G5	S5
Ranidae	*Rana sylvatica*	Wood Frog*	G5	S5
Ranidae	*Rana clamitans*	Green Frog*	G5	S5
Ranidae	*Rana pipiens*	Northern Leopard Frog*	G5	S5
Hylidae	*Hyla versicolor*	Gray Treefrog*	G5	S5
Hylidiae	*Pseudacris crucifer crucifer*	Spring Peeper*	G5	S5
Reptiles				
Colubridae	*Thamnophis sirtalis sirtalis*	Eastern Gartersnake*	G5T5	S5
Colubridae	*DeKay's Brownsnake*	Little Brown Snake*	G5	S5
Mammals				
Cervidae	*Odocoileus virginianus*	White-tailed Deer	G5	S5
Sciuridae	*Sciurus carolinensis*	Eastern Gray Squirrel	G5	S5
Sciuridae	*Tamias striatus*	Eastern Chipmunk	G5	S5
Procyonidae	*Procyon lotor*	Raccoon	G5	S5
Invertebrates				
Hesperidae	*Epargyreus clarus*	Silver – spotted Skipper	G5	S4
Cambaridae	*Cambarus diogenes*	Meadow Crayfish	G5	S3

Globally		**Provincially**	
G1	Extremely Rare	S1	Critically Imperilled
G2	Very Rare	S2	Imperilled
G3	Rare to Uncommon	S3	Vulnerable
G4	Common	S4	Apparently Secure
G5	Very Common	S5	Secure
GNR	Unranked (not yet assessed)	SNA	Not Applicable (not suitable for conservation activities)
T	Denotes subspecies	S#S#	Range Rank
†	Species seen during recent (2001-2005) Breeding Bird Atlas; not observed during AMEC surveys	S#B	Breeding Migrants
*	Amphibian and reptile species occurrences from the Ontario Reptile and Amphibian Database (NHIC 2010)	S#N	Non-breeding Migrants

APPENDIX D

RAW ELC DATASHEETS

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: SOMBRA TWP	POLYGON: 1		
SURVEYOR(S): WDM	DATE: May 5, 2010	UTME:	
START: 11:00	END: 15:45	UTMZ: 17	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☑ NATURAL	☐ PLANKTON	☐ LAKE
☑ WETLAND	☑ MINERAL SOIL	☐ RIVERINE	☐ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN.	☐ BOTTOMLAND		☐ FLOATING-LVD.	☐ RIVER
	☐ ACIDIC BEDRK.	☐ TERRACE		☐ GRAMINOID	☐ STREAM
SITE	☐ BASIC BEDRK.	☑ VALLEY SLOPE	COVER	☐ FORB	☐ MARSH
☐ OPEN WATER	☐ CARB. BEDRK.	☐ TABLELAND	☐ OPEN	☐ LICHEN	☑ SWAMP
☐ SHALLOW WATER		☐ ROLL. UPLAND	☐ SHRUB	☐ BRYOPHYTE	☐ FEN
☑ SURFICIAL DEP.		☐ CLIFF	☑ TREED	☑ DECIDUOUS	☐ BOG
☐ BEDROCK		☐ TALUS		☐ CONIFEROUS	☐ BARREN
		☐ CREVICE / CAVE		☐ MIXED	☐ MEADOW
		☐ ALVAR			☐ PRAIRIE
		☐ ROCKLAND			☐ THICKET
		☐ BEACH / BAR			☐ SAVANNAH
		☐ SAND DUNE			☐ WOODLAND
		☐ BLUFF			☐ FOREST
					☐ PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	1	3	HYB MAPLE > WHITE ASH
2	SUB-CANOPY	2	3	HYB MAPLE > SHAG HICKORY > W ASH
3	UNDERSTOREY	4	3	WHITE ASH > HYB. MAPLE > RASPBERRY
4	GRD. LAYER	5	1	WILD GERANIUM

HT CODES: 1 = >25 m 2 = 10<HT<25 m 3 = 2<HT<10 m 4 = 1<HT<2 m 5 = 0.5<HT<1 m 6 = 0.2<HT<0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR < 10% 2= 10 < CVR < 25% 3= 25 < CVR < 60% 4= CVR > 60%

STAND COMPOSITION:						BA:	
SIZE CLASS ANALYSIS:	0	< 10	A	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:	0	< 10	0	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	0	< 10	0	10 - 24	N	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE: clay loam	DEPTH TO MOTTLES / GLEY	g = 10	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITYCLASSIFICATION:

COMMUNITY CLASS:		CODE:
COMMUNITY SERIES:		CODE:
ECOSITE:		CODE:
VEGETATION TYPE: SWAMP MAPLE MINERAL DECIDUOUS SWAMP TYPE		CODE: SWD3-3
INCLUSION		CODE:
COMPLEX		CODE:

Notes: Most large ash apparently dead

ELC MANAGEMENT / DISTURBANCE

SITE: SOMBRA TWP

POLYGON: 1

DATE: ~~WDM~~ May 5, 2010

SURVEYOR(S): WDM

DISTURBANCE / EXTENT	0	1	2	3	SCORE †
TIME SINCE LOGGING	> 30 YRS	15 - 30 YRS	5 - 15 YRS	0 - 5 YEARS	
INTENSITY OF LOGGING	NONE	FUEL WOOD	SELECTIVE	DIAMETER LIMIT	
EXTENT OF LOGGING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
SUGAR BUSH OPERATIONS	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF OPERATIONS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
GAPS IN FOREST CANOPY	NONE	SMALL	INTERMEDIATE	LARGE	
EXTENT OF GAPS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
LIVESTOCK (GRAZING)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF LIVESTOCK	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ALIEN SPECIES	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF ALIEN SPECIES	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
PLANTING (PLANTATION)	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF PLANTING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
TRACKS AND TRAILS	NONE	FAINT TRAILS	WELL MARKED	TRACKS OR ROADS	
EXTENT OF TRACKS/TRAILS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DUMPING (RUBBISH)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DUMPING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
EARTH DISPLACEMENT	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISPLACEMENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
RECREATIONAL USE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF RECR. USE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
NOISE	NONE	SLIGHT	MODERATE	INTENSE	
EXTENT OF NOISE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DISEASE/DEATH OF TREES	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISEASE / DEATH	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
WIND THROW (BLOW DOWN)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF WIND THROW	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BROWSE (e.g. DEER)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BROWSE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BEAVER ACTIVITY	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BEAVER ACTIVITY	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FLOODING (pools & puddling)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FLOODING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FIRE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FIRE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ICE DAMAGE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF ICE DAMAGE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
OTHER	NONE	LIGHT	MODERATE	HEAVY	
EXTENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	

† INTENSITY x EXTENT = SCORE

ELC — PLANT SPECIES LIST

SITE:	SOMBRA TWP
POLYGON:	1
DATE:	May 5, 2010
SURVEYOR(S):	WDM

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COLL.
HYB. MAPLE	D	A	A		
SHAGBARK HICKORY	O	O	O		
WHITE ASH	O	O	A		
BUR OAK	R				
PRICKLY ASH			O		
RASPBERRY			O		

SPECIES CODE	LAYER 1	2	3	4	COLL.
WILD GERANIUM				A	
POISON IVY			A		

ELC — WILDLIFE

SITE:	SOMBRA TWO
POLYGON:	1
DATE:	MAY 5, 2010
SURVEYOR(S):	WDM
START TIME: 14.00	END TIME: 15.00

TEMP (°C):	CLOUD (10th): 10	WIND: 4	PRECIPITATION: RAIN
CONDITIONS:	Thunderstorm moved in		

POTENTIAL WILDLIFE HABITAT:

✓	VERNAL POOLS	✓	SNAGS
	HIBERNACULA	✓	FALLEN LOGS

SPECIES LIST:

TY	SP. CODE	EV	NOTES	#
	BLJA			
	AMRO			

TY	SP. CODE	EV	NOTES	#

FAUNAL TYPE CODES (TY):
B = BIRD M = MAMMAL H = HERPETOFAUNA L = LEPIDOPTERA F = FISH O = OTHER

EVIDENCE CODES (EV):

BREEDING BIRD - POSSIBLE:
SH = SUITABLE HABITAT
SM = SINGING MALE

BREEDING BIRD - PROBABLE:
T = TERRITORY
A = ANXIETY BEHAVIOUR
D = DISPLAY
N = NEST BUILDING
P = PAIR
V = VISITING NEST

BREEDING BIRD - CONFIRMED:
DD = DISTRACTION
NE = EGGS
AE = NEST ENTRY
NU = USED NEST
NY = YOUNG
FY = FLEDGED YOUNG
FS = FOOD/FAECAL SACK

OTHER WILDLIFE EVIDENCE:
OB = OBSERVED
DP = DISTINCTIVE PARTS
TK = TRACKS
SI = OTHER SIGNS (specify)
VO = VOCALIZATION
HO = HOUSE/DEN
FE = FEEDING EVIDENCE
CA = CARCASS
FY = EGGS OR YOUNG
SC = SCAT

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: SOMBRA TWP	POLYGON: 2		
SURVEYOR(S): WDM	DATE: MAY 5, 2010	UTME:	
START: 11:00	END: 13:45	UTMZ: 17	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☑ NATURAL	☐ PLANKTON	☐ LAKE
☑ WETLAND	☑ MINERAL SOIL	☐ RIVERINE	☐ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN.	☐ BOTTOMLAND TERRACE		☐ FLOATING-LVD.	☐ RIVER
	☐ ACIDIC BEDRK.	☐ VALLEY SLOPE		☐ GRAMINOID	☐ STREAM
SITE	☐ BASIC BEDRK.	☑ TABLELAND		☐ FORB	☐ MARSH
☐ OPEN WATER	☐ CARB. BEDRK.	☐ ROLL. UPLAND	COVER	☐ LICHEN	☑ SWAMP
☐ SHALLOW WATER		☐ CLIFF	☐ OPEN	☐ BRYOPHYTE	☐ FEN
☑ SURFICIAL DEP.		☐ TALUS	☐ SHRUB	☑ DECIDUOUS	☐ BOG
☐ BEDROCK		☐ CREVICE / CAVE	☑ TREED	☐ CONIFEROUS	☐ BARREN
		☐ ALVAR		☐ MIXED	☐ MEADOW
		☐ ROCKLAND			☐ PRAIRIE
		☐ BEACH / BAR			☐ THICKET
		☐ SAND DUNE			☐ SAVANNAH
		☐ BLUFF			☐ WOODLAND
					☐ FOREST
					☐ PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	1	3	ASH SP > HYB MAPLE
2	SUB-CANOPY	2	3	ASH SP > HYB MAPLE > BUR OAK
3	UNDERSTOREY	4	2	RASPBERRY > DWARF RASP > PRICKLY ASH
4	GRD. LAYER	5	3	SPRING BEAUTY > JACK-PULPIT > SNAKE ROOT

HT CODES: 1 = >25 m 2 = 10<HT<25 m 3 = 2<HT<10 m 4 = 1<HT<2 m 5 = 0.5<HT<1 m 6 = 0.2<HT<0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR < 10% 2= 10 < CVR < 25% 3= 25 < CVR < 60% 4= CVR > 60%

STAND COMPOSITION:		BA:

SIZE CLASS ANALYSIS:	O	< 10	A	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	O	10 - 24	N	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER		YOUNG	✓	MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE: Clay loam	DEPTH TO MOTTLES / GLEY	g = 10 G=
MOISTURE:	DEPTH OF ORGANICS:	(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:	(cm)

COMMUNITY CLASSIFICATION:

COMMUNITY CLASS:		CODE:
COMMUNITY SERIES:		CODE:
ECOSITE:		CODE:
VEGETATION TYPE: GREEN ASH MINERAL DECIDUOUS SWAMP TYPE		CODE: SWD2-2
INCLUSION	VERNAL POOL	CODE:
COMPLEX		CODE:

Notes: Most large ash apparently dead.

ELC MANAGEMENT / DISTURBANCE

SITE: SOMBRA TWP E

POLYGON: 2

DATE: May 5, 2010

SURVEYOR(S): WDM

DISTURBANCE / EXTENT	0	1	2	3	SCORE †
TIME SINCE LOGGING	> 30 YRS	15 - 30 YRS	5 - 15 YRS	0 - 5 YEARS	
INTENSITY OF LOGGING	NONE	FUEL WOOD	SELECTIVE	DIAMETER LIMIT	
EXTENT OF LOGGING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
SUGAR BUSH OPERATIONS	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF OPERATIONS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
GAPS IN FOREST CANOPY	NONE	SMALL	INTERMEDIATE	LARGE	
EXTENT OF GAPS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
LIVESTOCK (GRAZING)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF LIVESTOCK	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ALIEN SPECIES	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF ALIEN SPECIES	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
PLANTING (PLANTATION)	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF PLANTING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
TRACKS AND TRAILS	NONE	FAINT TRAILS	WELL MARKED	TRACKS OR ROADS	
EXTENT OF TRACKS/TRAILS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DUMPING (RUBBISH)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DUMPING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
EARTH DISPLACEMENT	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISPLACEMENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
RECREATIONAL USE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF RECR. USE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
NOISE	NONE	SLIGHT	MODERATE	INTENSE	
EXTENT OF NOISE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DISEASE/DEATH OF TREES	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISEASE / DEATH	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
WIND THROW (BLOW DOWN)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF WIND THROW	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BROWSE (e.g. DEER)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BROWSE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BEAVER ACTIVITY	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BEAVER ACTIVITY	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FLOODING (pools & puddling)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FLOODING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FIRE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FIRE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ICE DAMAGE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF ICE DAMAGE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
OTHER	NONE	LIGHT	MODERATE	HEAVY	
EXTENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	

† INTENSITY x EXTENT = SCORE

ELC — PLANT SPECIES LIST

SITE: SOMBRA TWP
POLYGON: 2
DATE: May 5, 2010
SURVEYOR(S): WDM

LAYERS: 1 = CANOPY > 10m 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COMM.
ASH SP	A	A	O		
AM ELM		O			
BASSWOOD		O			
HYB. MAPLE	O	O	O		
BLACK CHERRY		R			
BUR OAK		O			
RASPBERRY			O		
GRAY DOGWOOD			O		
CURRANT			R		
PRICKLY ASH			O		
COM. BARBERRY			R		
TART. HONEYSUCKLE			R		
DWARF RASPBERRY			O		
NANNY BERRY			R		

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COMM.
JACK-IN-THE-PULPIT				O	
DANDELION				R	
KIDNEY-LV BUTTERCUP				R	
WILD STRAWBERRY				R	
BLACK SNAKEROOT				O	
NARROW SPRING BEAUTY				O	
MAY APPLE				O	
STEMLESS VIOLET				R	
ROUGH BEDSTRAW				R	
POISON IVY			A		
THICKET CREEPER			O		

ELC — WILDLIFE

SITE: SOMBRA TWP
POLYGON: 2
DATE: May 5, 2010
SURVEYOR(S): WDM
START TIME: 1[illegible]:10 END TIME:

TEMP (°C):	CLOUD (10th): 10	WIND: 4	PRECIPITATION: NONE
CONDITIONS:	Cloudy, windy		

POTENTIAL WILDLIFE HABITAT:

✓	VERNAL POOLS	✓	SNAGS
	HIBERNACULA	✓	FALLEN LOGS
	_____		_____

SPECIES LIST:

TY	SP. CODE	EV	NOTES	#
B	AMGD			
B	RWBL			
B	BAOR			
L	SILVER-SPOTTED SKIPPER			

TY	SP. CODE	EV	NOTES	#

FAUNAL TYPE CODES (TY):
B = BIRD M = MAMMAL H = HERPETOFAUNA L = LEPIDOPTERA F = FISH O = OTHER

EVIDENCE CODES (EV):

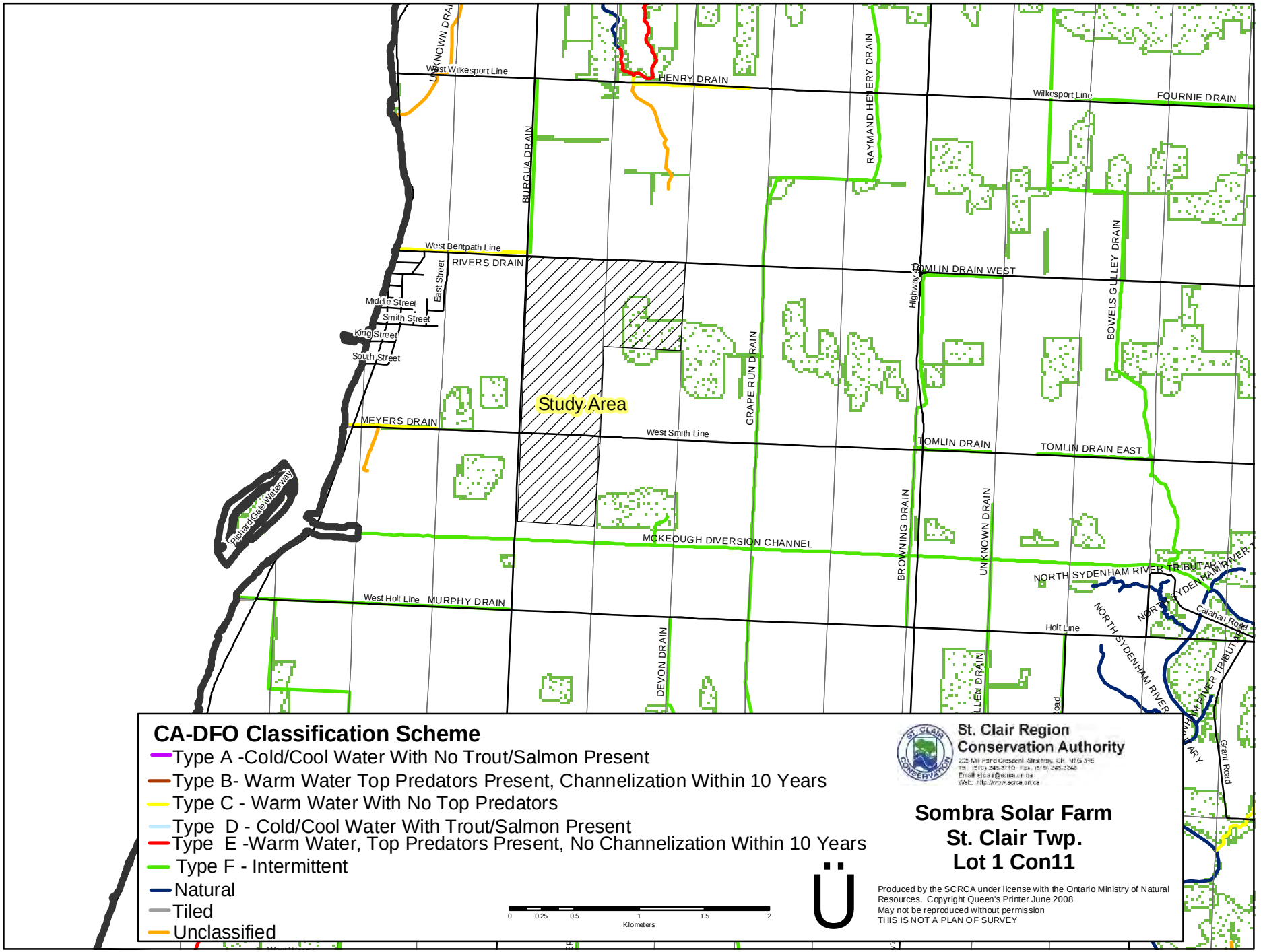
BREEDING BIRD - POSSIBLE:
SH = SUITABLE HABITAT
SM = SINGING MALE

BREEDING BIRD - PROBABLE:
T = TERRITORY
A = ANXIETY BEHAVIOUR
D = DISPLAY
N = NEST BUILDING
P = PAIR
V = VISITING NEST

BREEDING BIRD - CONFIRMED:
DD = DISTRACTION
NE = EGGS
AE = NEST ENTRY
NU = USED NEST
NY = YOUNG
FY = FLEDGED YOUNG
FS = FOOD/FAECAL SACK

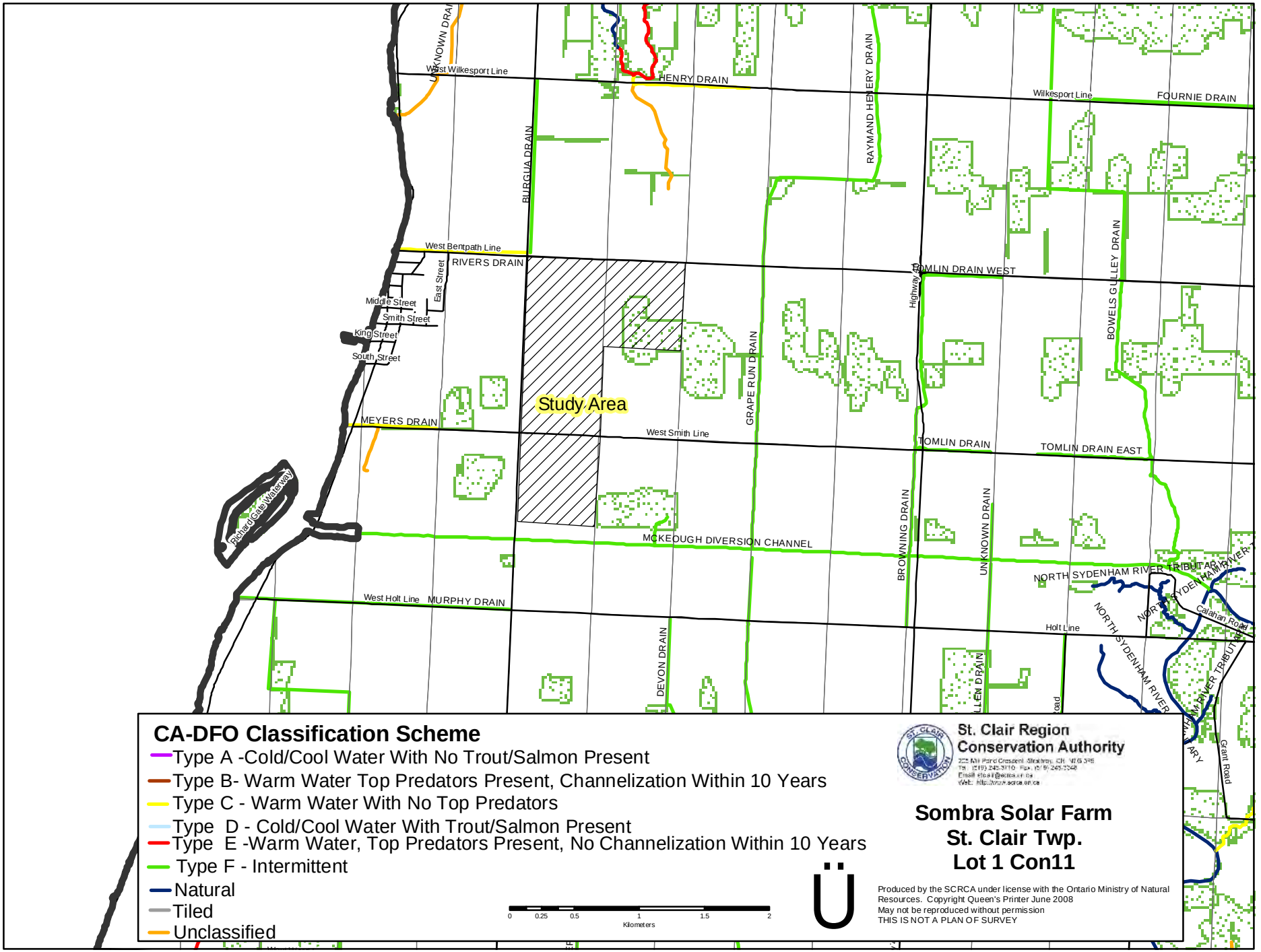
OTHER WILDLIFE EVIDENCE:
OB = OBSERVED
DP = DISTINCTIVE PARTS
TK = TRACKS
SI = OTHER SIGNS (specify)
VO = VOCALIZATION
HO = HOUSE/DEN
FE = FEEDING EVIDENCE
CA = CARCASS
FY = EGGS OR YOUNG
SC = SCAT

Figure 3 - St. Clair Region Conservation Authority Drain Classification Map



APPENDIX C
ST. CLAIR REGION CONSERVATION AUTHORITY – DRAINAGE CLASSIFICATION MAPS

Figure 3 - St. Clair Region Conservation Authority Drain Classification Map



APPENDIX D
WATER FEATURES ASSESSMENT REPORT

PROPOSED ST. CLAIR SOMBRA SOLAR FARM
LAMBTON COUNTY, ONTARIO

WATER FEATURES ASSESSMENT

Submitted to:
First Solar Development (Canada) Inc.
400 Somerset, Corporate Boulevard
Bridgewater, NJ 08807
USA

Submitted by:

AMEC Earth & Environmental
a division of AMEC Americas Limited
870 Confederation Street
Sarnia, Ontario
N7T 2E5

October 2010

SW04090572

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1.0 INTRODUCTION

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by First Solar Development (Canada) Inc. (First Solar) to conduct a Water Feature Assessment (WFA) for a proposed photovoltaic (solar) electrical power generating facility, the St. Clair Sombra Solar Farm (Solar Farm). The project location is located in St. Clair Township in the County of Lambton on Part Lots 1 and 2 Concession 11 and Part Lot 1, Concession 10. The contiguous land parcels of which the project location is located on is approximately 140 hectares (ha) in size (of which the project location consists of approximately 59 ha which would be utilized for solar arrays and associated roads, temporary laydown areas and structures) and is currently in agricultural use (Figure 1).

This WFA includes water bodies assessment as required by Ontario Regulation 359/09 (O.Reg. 359/09) Renewable Energy Approvals made under the *Environmental Protection Act*. Specific objectives of the WFA is to identify water bodies near the development site and determine the distance to the development from the features, if present.

1.1 Project Development Proposal

First Solar hopes to initiate construction of its Solar Farm in early 2011 and plans to have the development operational by the end of 2011. The proposed facility will be designed to convert sunlight to electricity through a photovoltaic process thereby providing a renewable source of electricity to the local power grid. The Solar Farm will utilize highly-efficient and proven technology to generate up to 20 MWac of power for delivery to the electricity system.

The project location is located on Part Lots 1 and 2 Concession 11 and Part Lot 1, Concession 10, St. Clair Township and consists of approximately 59 ha which would be utilized for solar arrays and associated roads, temporary laydown areas and structures. General photographs of the proposed development site are presented in Appendix A. The project location lies in an area of mixed residential and agricultural land use within St. Clair Township. Figure 1 presents the project location and preliminary facility layout.

The project location is bound by agricultural land and intermittent residential developments in all directions. A natural gas terminal facility was observed to the west of the project location and located on the northwest corner of Smith Line and Baseline Road intersection. The project location is located approximately 600 m east of the Village of Sombra. The Project's access drive will enter off Bentpath Line.

There is one residential dwelling with associated structures (i.e. barns) located within the project location, at the north extent of the proposed arrays and south of Bentpath Line (Figure

1). The structures are inferred to have been utilized for historical farming efforts on the project location.

2.0 Renewable Energy Approvals (Ontario Regulation 359/09)

The purpose of this report is to provide a WFA obtaining approval for the project under O.Reg. 359/09 Renewable Energy Approvals of the *Environmental Protection Act*. According to O.Reg. 359/09, the Solar Farm is considered to be a Class 3 solar facility as it has a name plate capacity of greater than 10 kW. This WBA has been undertaken specifically to address the requirements outlined in Sections 29 to 31 of O.Reg. 359/09.

In addition to the land use planning process reported herein, the facility will also require permits issued by the Ontario Ministry of Environment. Under this permitting process, the Ministry of Natural Resources and the St. Clair Region Conservation Authority have also been contacted for consultation with approvals pending upon their review. It is understood that additional review by government stakeholders may drive the need for additional assessment.

2.1 Water

Table 1 – Summary of Water Feature Assessment Criteria

Water Assessment (Section 30)				
Item	**Records to be searched and analyzed**	**Records Searched**	**Determination to be Made**	**Determination**
1	Records that relate to water bodies and that are maintained by:		Whether the project location is: in a water body; within 120 m of the average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity; within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity; within 120 m of the average annual high water mark of a permanent or intermittent stream; or, within 120 m of a seepage area.	
	Ministry of Natural Resources	• MNR Natural Heritage Information Centre (NHIC) website (Dec 2009) • MNR Biodiversity Explorer website (July 2010) • Meeting with MNR personnel in December 2009 to obtain additional information on species at risk, ANSI and any other applicable data. Meeting included preliminary review and discussion of development plans, review of site plan and details pertaining to NHIC species identification around the project location and other features; such as, woodlots and natural areas. Details of the preliminary search of NHIC and SCRCA information were provided to the MNR for review.		Project location not in a water body; within 120 m of the average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity; within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity; within 120 m of a seepage area However, the Site is within 120 m of the average annual

		MNR indicated at meeting of December 2009, that they would defer to the St. Clair Region Conservation Authority's setback distances and requirements under the *Conservation Authorities Act* regarding municipal drains. • Meeting with MNR on June 18, 2010 to discuss the revised structure of associated document and information contained within based on guidelines and support documentation not previously available in December 2009.		high water mark of a classified permanent or intermittent stream.
	Crown in Right of Canada	• N/A – Project location not on, or within, 300 m of Crown Land.		N/A
	Conservation Authority	• St. Clair Region Conservation Authority (SCRCA) personnel were contacted to request information related to their knowledge of the presence of any water bodies near the proposed development site; • Response from the SCRCA indicates that the drainage system present at the development site is subject to Ontario Regulation 178/06 (O.Reg. 178/06) of the *Conservation Authorities Act*. • The SCRCA has provided information related to the setbacks required under O.Reg. 178/06. • According to the SCRCA, the Site does fall within a flood regulated concern zone (under dated mapping); however, based on a subsequent review of records and detailed within a 26 June 2009 letter, the regulated flood area does not apply to the Site. In addition, the array development plan includes all work outside of the 30m setback required under the REA.		Project location not in a water body; within 120 m of the average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity; within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity; within 120 m of a seepage area However, the Site is within 120 m of the average annual high water mark of a classified permanent or intermittent stream.
	Local and Upper-Tier Municipality	• The County of Lambton and St. Clair Township are the upper and lower-tier municipalities in		Project location not in a water body; within 120 m of the

		which the project location is situated. Each were contacted to request information related to the presence of any water bodies near the proposed development site; • Response from the St. Clair Township/County of Lambton Senior Planner and Drainage Superintendent (as referenced in Section 2.1.1) indicated that the drains on the proposed development property are municipal drains and are maintained by the municipality and not designated by SCRCA;		average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity; within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity; within 120 m of a seepage area However, the Site is within 120 m of the average annual high water mark of a classified permanent or intermittent stream.
	Planning Board	• N/A: Project location not within area of jurisdiction of planning board.		N/A
	Municipal Planning Authority	• N/A: Project location in area of jurisdiction of Lambton County and St. Clair Township.		N/A
	Local Roads Board	• N/A: Project location not within area of jurisdiction of local roads board.		N/A
	Local Services Board	• N/A: Project location not within area of jurisdiction of local services board.		N/A
	Niagara Escarpment Commission	• N/A: Project location not within area of Niagara Escarpment Plan		N/A

2.1.1 Records Review

Table 2 – Summary of Water Assessment Features

Water Assessment (Sections 29-31)	
Records review	
Search for and analysis of the records set out in Column 1 of the Table to section 30 was conducted in respect of the project location for the purpose of making the determinations set out	Yes: Each record under column 1. Sec 30 of the Regulation was searched and analyzed and determinations made under Column 2 of the table in Section 2.1 of the Report.

opposite the records in Column 2 of the Table	
Report was prepared setting out a summary of the records searched and the results of the analysis conducted above	Yes: Each record under column 1. Sec 25 of the Regulation was searched, analyzed and determinations made under Column 2 in of the table Section 2.1 of the Report and submitted to MNR.
Site Investigation	
1. A physical investigation of the land and water located within 120 metres of the project location was conducted for the purpose of determining,	
(a) whether the results of the analysis summarized in the "records review" report are correct or require correction, and identifying any required corrections;	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes that results of the analysis summarized in the records review report are correct.
(b) whether any additional water bodies exist, other than those identified in the records review;	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes that results of the analysis summarized in the records review report are correct; however, it also notes the existence of additional unclassified municipal drainage features/unmarked ditches.
(c) the boundaries, located within 120 metres of the project location, of any water body that was identified in the records review or the site investigation; and	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes that results of the analysis summarized in the records review report and includes review notes for the Site investigation of all water features including additional unclassified municipal drainage features/unmarked ditches.
(d) the distance from the project location to the boundaries determined under clause (c).	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes the results of the analysis summarized in the records review report which finds that two classified water features (SCRCA designated Type C drain and a SCRCA Intermittent drain) exist within 120 m of the Project Location and makes note of the closest features to the Project Location and the measured distance.
2. If, as a result of the records review, the average annual high water mark of a lake trout lake that is at or above development capacity, was identified within 300 metres of the project location, a physical investigation of the land and water located within 300 metres of the project location was conducted for the purpose of determining,	
(a) whether the results of the analysis summarized in the "records review" report are correct or require correction, and identifying any required corrections;	N/A
(b) whether any additional water bodies exist, other than those that were identified in the "records review" report;	N/A
(c) the boundaries of any lake trout lake that is at or above development capacity, if, (i) the lake was identified in the records review or the site investigation, and (ii) the boundaries are within 300 metres of the project location;	N/A
(d) the boundaries of any water body other than a lake trout lake that is at or above development capacity, if, (i) the water body was identified in the records review or the site investigation, and (ii) the boundaries are within 120 metres of the project location; and	N/A

(e) the distance from the project location to the boundaries determined under clause (c) and (d).	N/A
3. A report was prepared that sets out the following,	
(1) A summary of any corrections to the "records review" report and the determinations made as a result of conducting the site investigation.	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes that results of the analysis summarized in the records review report are correct with no additions required.
(2) Information relating to each water body identified in the records review and in the site investigation, including the type of water body, plant and animal composition and the ecosystem of the land and water investigated.	Yes: Section 2.1.3 (Water Bodies Found Within 120 m of Project Location) notes that results of the analysis summarized in the records review report which finds that two classified water features (SCRCA designated Type C drain and a SCRCA Intermittent drain) exist within 120 m of the Project Location and includes review notes for the Site investigation of all water features including additional unclassified municipal drainage features/unmarked ditches.
(3) A map showing,	
i. the boundaries mentioned in clause (1) (c) or (2) (c) and (d) of the section of the Act,	Yes: REA-05 (Site Improvement Plan) shows boundaries located within 120 m of project location of all natural features identified in records review and site investigation.
ii.the location and type of each water body identified in relation to the project location, and	Yes: REA-05 (Site Improvement Plan) shows boundaries located within 120 m of project location of all natural features identified in records review and site investigation which does not include any classified water bodies within 300m. However, two classified water features (SCRCA designated Type C drain and a SCRCA Intermittent drain) exist within 120 m of the Project Location and have been identified.
iii.the distances mentioned in clause (1) (d) or (2) (e) of the section of the Act.	Yes: REA-05 (Site Improvement Plan) shows boundaries located within 120 m of project location of all natural features identified in records review and site investigation.
(4) The dates and times of the beginning and completion of the site investigation.	Yes: Section 2.1.2 notes site investigation undertaken on October 14, 2009 between 2:30 PM – 3:30 PM (1 hour) and on December 17, 2009 between 2:30 PM – 3:30 PM (1 hour).
(5) The duration of the site investigation.	Yes: Section 2.1.2 notes site investigation undertaken on October 14, 2009 between 2:30 PM – 3:30 PM (1 hour) and on December 17, 2009 between 2:30 PM – 3:30 PM (1 hour).
(6) The weather conditions during the site investigation.	Yes: Section 2.1.2 notes that the conditions on October 14, 2009 were partly cloudy with a northeast wind (20km/h) and approximately 7 ºC. Conditions on December 17, 2009 were cloudy with a southerly breeze (10km/h) and approximately -1 ºC.
(7) A summary of methods used to make observations for the purposes of the site investigation.	Yes: Section 2.1.2 summarizes methods to make observations for the purpose of the site investigation.
(8) The name and qualifications of any person conducting the site investigation.	Yes: Section 2.1.2 notes that the site investigation was conducted by Mike Crabb, BES, CET, CCEP, an Environmental Scientist with AMEC Earth & Environmental.
(9) Field notes kept by the person conducting the site investigation.	Yes: Appendix B includes field notes takes by the person conducting the site investigation.

2.1.2 Site Investigation – Water Features

As required by Sec. 29 of O.Reg. 359/09, a physical investigation of the land and water located within 120 metres of the project location was conducted for the purpose of determining whether the results of the analysis summarized in the "records review" are correct or require correction; whether any additional water bodies exist, other than those identified in the records review; the boundaries, located within 120 metres of the project location, of any water body that was identified in the records review or the site investigation; and, the distance from the project location to the boundaries of the water body. The site investigation was undertaken as part of a general review and stormwater management site visit on 14 October 2009 between 2:30PM and 3:30PM with a follow-up Site reconnaissance conducted on 17 December 2009 between 2:30PM – 3:30PM both completed by Mike Crabb, BES, CET, CCEP, an Environmental Scientist with AMEC Earth & Environmental. Weather conditions during the site investigation of October 14th were partly cloudy with a northeast wind (20 km/h) and approximately 7 ºC. Weather conditions during the site investigation of December 17th were cloudy with a southerly breeze (10 km/h) and approximately -1 ºC. Procedures for the Site investigation included standard visual assessment with the inclusion of a detailed map to reference locations of features geographically.

2.1.3 Water Bodies Found Within 120 m of Project Location

The site investigation confirmed the presence of three municipal (ditches) drains in the general vicinity and bordering the perimeter of the Project Location, as identified in the record review (Section 2.1.1). The Rivers Lapish (open municipal ditch and partially classified by the SCRCA), Watson Tulloch (open municipal ditch) and Myers Drains (open municipal ditch) are located adjacent/along the Site's northern, western and southern property extents, respectively. These three drains are inferred to transfer water from the site and surrounding properties into the St. Clair River located approximately 1 km west of the Site. In addition, along the west side of the Site, the Watson Tulloch transfers the north half of it's drainage into the Rivers Lapish Drain and the southern half into the Myers Drain.

Furthermore as identified in Figure 3 and beginning northwest of the Site across the intersection of Bentpath Line and Base Line Road, the Rivers Lapish municipal drain is classified by the SCRCA as a Type C Warm Water Drain with No Top Predators from that point westerly to its connection into the St. Clair River. In addition to this location, a north south trending drain identified as the Burgua Drain and terminating into the Rivers Lapish drain has been classified by the SCRCA as an intermittent drain.

All other drains discussed above and surrounding the Site have been noted to be unclassified by the SCRCA within 120m of the Project Location.

Evidence of a below-grade drainage tile/features were observed transecting the Site, and based on the agricultural development of the Site area would be assumed that the Site tiling carries the majority of Site infiltration runoff water into both the Rivers Lapish and Myers Drains. During the site investigation, a catchbasin assembly with drainage tile inlets was observed at the northwest corner of the property. Follow-up discussions with the St. Clair Township Drainage Superintendent noted that subgrade field drainage entering that catch basin was responsible from draining the north half of Lot 1, Concession 11 into the adjacent municipal drains.

No other water bodies were identified on the site as part of the site investigation. There are no lakes, Lake Trout lakes, streams, or rivers present at the Project Location. All drainage ditches and buried drains observed at the Project Location or within 300m of its extent are maintained by the municipality and for perimeter and roadside drainage in layout type and not classified by the SCRCA beyond the noted features above. Furthermore, the McKeough Diversion Channel can be observed approximately 1 km or more south of the Project Location. The McKeough Diversion Channel is a drain utilized during times of flooding. Additionally, the Grape Run Drain was observed approximately 1 km east of the Site which connects into the McKeough Diversion Channel. Both of these additional drains are the closest additional classified drains on the SCRCA mapping and noted to be intermittent in classification type.

During the records review, it was noted that according to SCRCA mapping (Figures 2) that a large portion of the Project Location was located within a Regulated Zone. However, information provided by the SCRCA for the Stormwater Management Plan (produced under separate cover) on 26 June 2009 noted that this zone would not be a concern relative to flooding or development. A copy of this letter from the SCRCA authority on 26 June 2009 is attached in Appendix C.

3.0 EXISTING NATURAL ENVIRONMENT

3.1 Site Geology

The subject property is located on the St. Joseph's Clay Plain, an area of glaciolacustrine silty clay overburden deposits, more commonly identified as Brookston Clay. These heavy silty clay soils were laid down under glacial period over Devonian limestone bedrock. The overburden thickness is typically 56 m to 60 m at the proposed development site.

The water table is generally found in the overburden several metres below ground surface and the shape of the water table surface is similar to the ground surface, but underlying it.

3.2 Soil and Groundwater Quality

A Phase I Environmental Site Assessment (AMEC, 2008) conforming to the Provincial requirements documented that the site is located in a primarily agricultural area and that the property has been in agricultural use since at least the 1960s and has not had a residential, commercial or industrial development registered beyond a typical farm house and barn development.

No investigation of the soil and groundwater quality was undertaken as part of the EIS. However, the only compounds likely to impact the soil or groundwater are residues from pesticides/herbicides which are used at the site as part of the agricultural practice and possibly nitrates from excess application of fertilizers. It is considered unlikely that unacceptable concentrations of either of these can be detected in the groundwater in the bedrock aquifer. The site would be assumed to be of good environmental quality from a soil and groundwater perspective.

In order to confirm this conclusion with more confidence, sampling and analysis of soil and groundwater would be required.

3.3 Surface Water Drainage

A portion of the site is traversed by three open ditch drains, namely, the Rivers Lapish, Watson Tulloch and Myers Drains. These drains form part of the municipal drainage system maintained by St. Clair Township and the County of Lambton. Drainage from the site flows from the Watson Tulloch Drain into both the Rivers Lapish and Myers Drains eventually conveying water into the St. Clair River. Details of the stormwater management for the development will be presented under separate cover in the Stormwater Management Plan report currently being assessed and completed for the Site.

Generally speaking, surface water drainage is not expected to be drastically modified by the proposed development, as the solar farm will continue to use the historical Site elevations and existing drainage contours under the current development plan.

In addition to the WFA review completed, a detailed Stormwater Management Plan has been completed by AMEC for the project development and is available under separate cover and attached in Appendix D. The Stormwater Management plan takes into consideration the data provided by the St. Clair Region Conservation Authority and requirements related to Site development to support Site-specific drainage considerations throughout the project development.

3.4 Land Use

AMEC reviewed the current land uses of neighbouring properties from publicly accessible locations to assess possible environmental impacts to the Site that may arise from off-site operations. Properties in the general area surrounding the Site are primarily mixed residential, and agricultural in use. Properties surrounding the Site are summarized as follows:

North of the Site

North of the Site is the Bentpath Line right-of-way beyond which agricultural and scattered residential properties can be observed.

East of the Site

East of the Site are woodlots, agricultural and scattered residential properties.

South of the Site

South of the Site is the Smith Line right-of-way beyond which agricultural lands, woodlots, scattered residential properties and the McKeough Diverson Channel can be observed.

West of the Site

West of the Site is the Baseline Road right-of-way, a Union Gas natural gas terminal, agricultural fields, woodlots and scattered residential properties.

4.0 CONCLUSIONS & RECOMMENDATIONS

Impacts associated with development of the site are primarily concerned with potential impacts to the Rivers Lapish, Watson Tulloch and Myers Drains, along with potential impacts to the woodlot located along the eastern extent of the Project Location. It is noted that with the exception of the Rivers Lapish Drain (classified as a Type C Warm Water No Top Predator drain trending westerly from the Site) all other aforementioned water features are not considered Significant; however, require consideration for municipal and county related permits and approvals.

The Solar Farm arrays are expected to be positioned such that they will be located outside of the SCRCA Regulated areas (by a minimal margin of 30 metres or where already allotted by SCRCA review) and St. Clair Township Municipal Drains (by a minimal margin of 15 metres from the top of bank on open drains or natural watercourse & 5 metres from buried municipal drains) thereby avoiding any encroachment on the SCRCA Regulated Area and the Rivers Lapish, Watson Tulloch and Myers Drains.

It is further noted that no expected work will occur within 300 m or more of a classified water feature by the SCRCA with the exception of the portion of the Rivers Lapish Drain and associated Burgua Drain located north and west of the Site but within 120 m of the Project Location boundary. As these locations are found to be within 120m of the Project Location, an EIS review component should be completed to review potential impacts on classified drains as required by REA.

5.0 CLOSURE

This report was prepared for the exclusive use of First Solar Development (Canada) Inc. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. Should additional parties require reliance on this report, written authorization from AMEC will be required. With respect to third parties, AMEC has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up action and costs.

The report is based on data and information collected during the Natural Heritage Assessment between the dates specified within the report. Except as otherwise may be specified, AMEC disclaims any obligation to update this report for events taking place, or with respect to information that becomes available to AMEC after the time during which AMEC conducted the investigation.

AMEC makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

This Report is also subject to the further Standard Limitations contained in Technical Services Agreement dated 24 September 2009.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact the undersigned.

Yours truly,

AMEC Earth & Environmental
a division of AMEC Americas Limited

Mike Crabb, BES, CET, CCEP
Environmental Scientist

J. Brian Fogg, P.Eng.
Senior Engineer

6.0 REFERENCES

Corporation of the County of Lambton, *County of Lambton Official Plan*, approved September 1982.

Province of Ontario, *Ontario Regulation 359/09 – Renewable Energy Approvals Under Part V.0.1. of the Environmental Protection Act*, filed 23 September 2009.

St. Clair Region Conservation Authority (SCRCA), *Website*, http://www.scrca.on.ca, January 2010.

FIGURES

TRUE NORTH

SMITH LINE

EXISTING MUNICIPAL DRAIN

FROM ARRAY TO PROPERTY LINE

PROPERTY BOUNDARY

APPROXIMATE EXTENT OF SOLAR ARRAYS (TYP.)

FROM BLDG. TO PROPERTY LINE

PVIS (TYP)

FROM FENCE TO PROPERTY LINE

EXISTING HYDRO ONE POLE

COMMUNICATION TOWER

LATERAL POLE

METERING POLE

METERING POLE

LATERAL POLE

EXISTING HYDRO ONE POLE

FROM ARRAY TO CENTER LINE OF ROAD

WATSON TULLOCH DITCH

PROPOSED FENCE (TYP.)

PROPOSED GRAVEL ROAD (TYP.)

FROM PROPERTY LINE TO CENTER LINE OF ROAD

ROAD WIDTH

FROM ARRAY TO PROPERTY LINE

BASELINE ROAD

BASELINE ROAD

N 2 ° 32 ' 20 " E

N 2 ° 32 ' 20 " E 213.50'

120m [393.70']

PVIS

30.7m [100.72']

7.38m [24.21']

22.35m [73.27']

17.51m [57.45']

5.36m [18.15']

7.98m [26.17']

30.7m [100.72']

51.35m [168.46']

FROM ARRAY TO CENTER LINE OF ROAD

17.51m [57.45']

FROM PROPERTY LINE TO BERM

N 1°24'50"E 88.439

27.24m [89.36']

N87°40'10"W 91.540

N2°25'30"E 146.292

N87°33'55"W 54.864

FROM PROPERTY LINE TO FENCE

S 2°28'10"E 58.327

N2°25'30"E 146.292

59.27m [194.46']

82.57m [270.90']

FROM ARRAY TO PROPERTY LINE

PCS SHELTER AND TRANSFORMER (TYP.)

N 87 ° 35 ' 00 " W 237.270

211.410

285.015

302.986

MYERS DRAINS

T004320

T002770

T009349

T002950

10 9 8 7 6 5 4 3 2 1

20 19 18 17 16 15 14 13 12 11

BENTPATH LINE

22.8m [74.79']

FROM ARRAY TO CENTER LINE OF ROAD

N 87 ° 32 ' 40 " W

RIVERS LAPISH DITCH

PCS SHELTER AND TRANSFORMER (TYP.)

51.98m [170.55']

FROM ARRAY TO PROPERTY LINE

229.229

170.3m [558.73']

29.43m [96.57']

17.45m [57.25']

27.88m [91.48']

N2°51'00"E 194.810

N 2 ° 20 ' 50 " E 674.027

DISTRIBUTION LINE

FROM ARRAY TO PROPERTY LINE

PROPOSED CONSTRUCTION ENTRANCE

PROPOSED LANDSCAPE BERM SEE REA-10B FOR DETAIL (TYP.)

FROM ARRAY TO PROPERTY LINE

PROPERTY BOUNDARY

FROM ARRAY TO CENTER LINE OF ROAD

APPROXIMATE EXTENT OF SOLAR ARRAYS (TYP.)

100m [328.08']

N87°55'00"W

PROPOSED LANDSCAPE BERM SEE REA-10B FOR DETAIL (TYP.)

SMITH LINE

BENTPATH LINE

332.5m [1090.87']

PROPOSED CONSTRUCTION STAGING AND LAYDOWN AREA

6.67m [22.54']

100m [328.08']

304.49m

FROM ARRAY TO PROPERTY LINE

N2°52'40"E 94.853

N2°30'45"E

N2°45'55"E 43.854

N2°30'25"E 197.756

54.6m [179.15']

EXISTING DITCH

100m [328.08']

15.73m [51.62']

PROPOSED CONSTRUCTION LAY-DOWN AREA SEE REA-06 FOR MORE DETAILS

EXISTING WOODLAND "A"

REQUIRED SET BACK WITH AN EIS – 0m

EXISTING WOODLAND TO REMAIN

ARRAY PERSPECTIVE

LEGEND:

- PROPERTY BOUNDARY
- EXISTING BUILDING
- ARRAY
- UNDER GROUND ELECTRICAL WIRING
- PROPOSED FENCE
- PROPOSED UTILITY POLE
- WOODED AREA (LIO, MNR 2010)
- WATERBODY (LIO, MNR 2010)
- WATERCOURSE (LIO, MNR 2010)
- 120 m PERIMETER BUFFER
- T002950 HISTORICAL OIL, GAS OR SALT RESOURCE LOCATION

SITE IMPROVEMENT PLAN

SCALE: 1m = 3000m

30m 0m 60m 180m

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
G	08-24-2010	RE-ISSUED FOR REA PERMIT	JRR	HK	MP
F	06-22-2010	RE-ISSUED FOR REA PERMIT	JRR	AJT	MP
E	04-28-2010	RE-ISSUED FOR REA PERMIT	DHD	MP	TZ
D	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	RE-ISSUED FOR LAYOUT CHANGE	FWD	MP	TZ
B	12-14-2009	ISSUED FOR REA PERMIT	RAR	MP	TZ
A	12-10-2009	ISSUED FOR APPROVAL	DA	MP	TZ

First Solar.

FIRST SOLAR DEVELOPMENT (CANADA), INC.

5115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: SITE IMPROVEMENT PLAN

PROJ. MGR.	PROJ. ENGR.	DR. BY	CHK. BY	SCALE:
KEITH SYMMERS	TOM ZACARRIA	FWD	MP	AS SHOWN

PROJ. DIRECTOR: MARK LANGDON

FS ELEC. JOB No: 5028-0102-22

DRAWING NO.: REA-05

REV.: G

THIS PRINT IS NOT TO BE USED FOR CONSTRUCTION UNLESS NOTED AND SIGNED OK FOR CONSTRUCTION ABOVE LAST REVISION.

P:\2010\Other Offices Projects\2010SarniaSW\04096672 First Solar Sombra\Drawings\5028-0102-22 REA-05 (Rev G).dwg dave.cole Oct 08, 2010 - 7:51am

FIGURE 2 - St. Clair Region Conservation Authority Regulated Areas Map

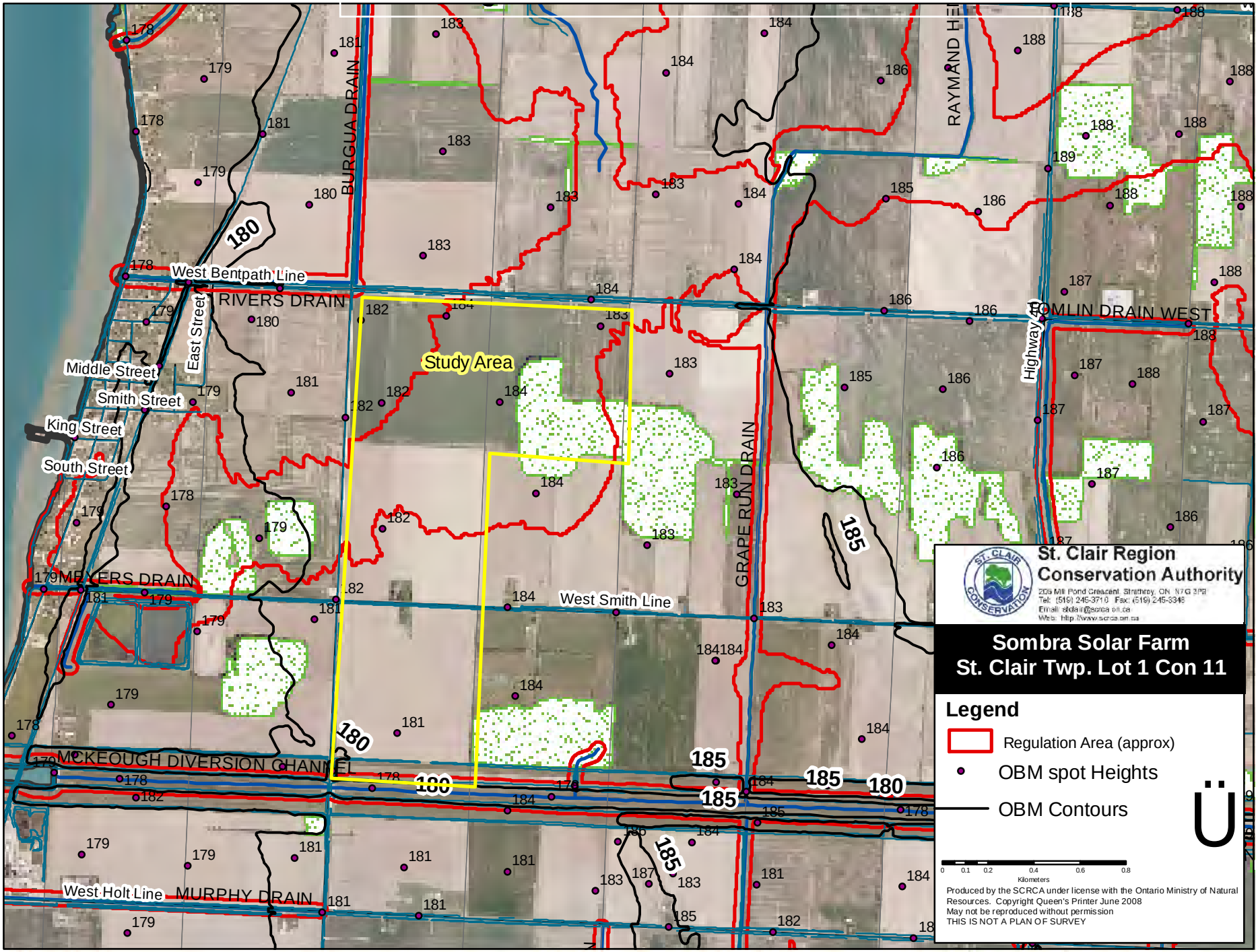
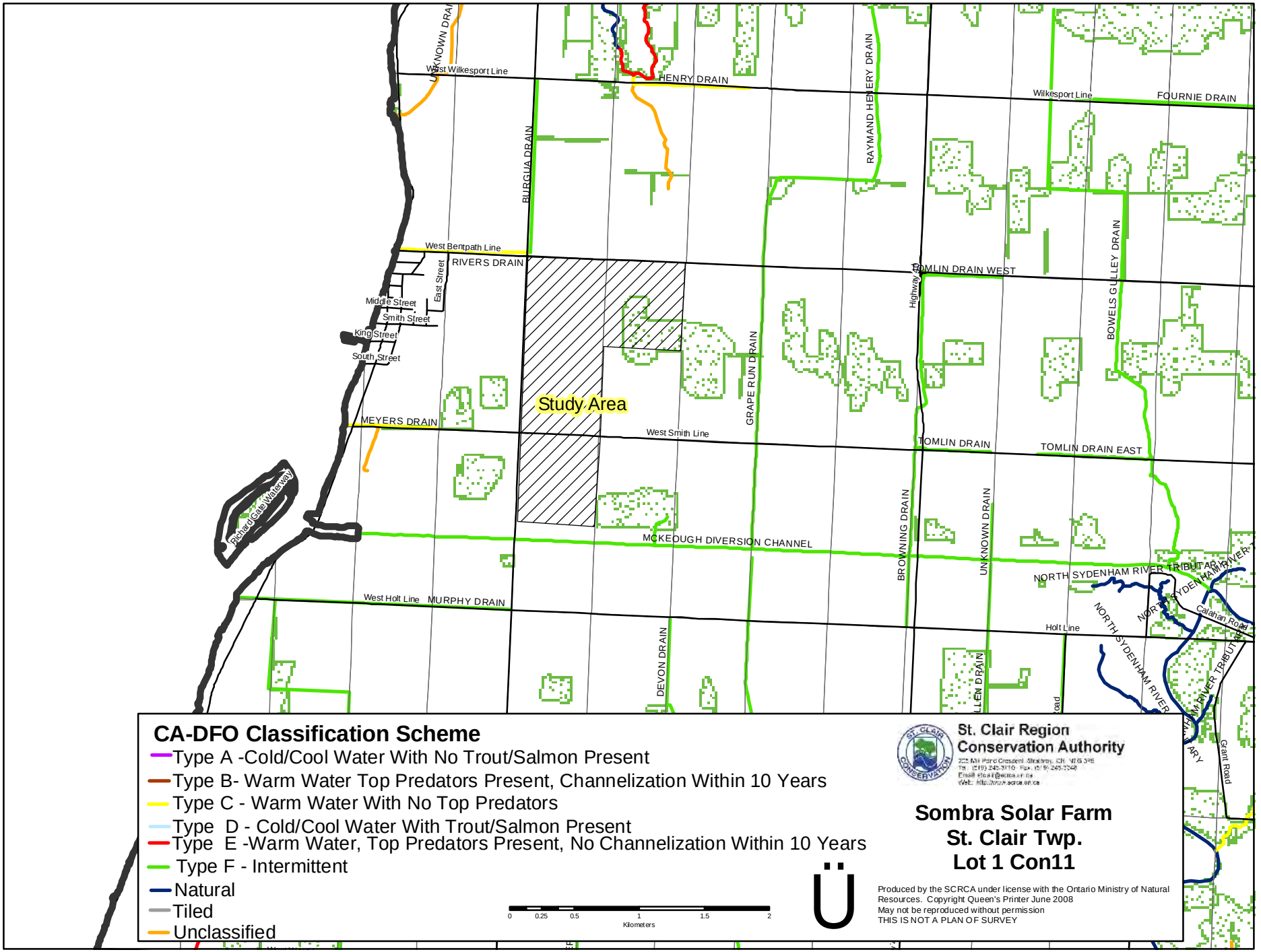


Figure 3 - St. Clair Region Conservation Authority Drain Classification Map



Appendix A
General Site Photographs

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 1

PHOTOGRAPH	1

Description

Looking north across the proposed development site towards the adjacent woodlot bordering the northeast corner.

PHOTOGRAPH	2

Description

Looking west along Smith Line towards the intersection with Baseline Road and the off-site natural gas terminal. The corner of the north portion of the Site can be observed on the right side of the photograph.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 2

PHOTOGRAPH	3

Description

Looking north across the southern portion of the development Site from Baseline Road. The southern portion of the Watson Tulloch drain can be observed along the east side of the road.

PHOTOGRAPH	4

Description

Looking east from the Baseline Road bridge over the McKeough Diversion Channel south of the Site.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 3

PHOTOGRAPH	5

Description

Looking east at the Myers drain along the south side of Smith Line. The residential property and agricultural land observed in the photograph make up a portion of the southern development lands.

PHOTOGRAPH	6

Description

Looking west along the Rivers Lapish Drain at the north extent of Bentpath Line and north of the Site. View includes the open ditch drain trending under Baseline Road and the connection originating from under Bentpath Line from the Watson Tulloch drain adjacent to the Site.

APPENDIX A - SITE PHOTOGRAPHS

PROJECT NO. SW04090572

PROJECT Environmental Impact Study

LOCATION Sombra Site - St. Clair Township, Ontario **ENCLOSURE** 4

PHOTOGRAPH	7

Description

Looking southwest across Bentpath Line at the Watson Tulloch open ditch and catchbasin associated with the drainage of the north half of the development Site.

PHOTOGRAPH	8

Description

Looking south at the catch basin which includes the subgrade drainage tile associated with the north half of the development site.

Appendix B
Field Notes

☑ FIELD MEMO
☐ INSPECTION REPORT

amec

☐ LONDON 1940 OXFORD STREET E. UNIT 7, N5V 4L8 PHONE: (519) 681-2400 FAX: (519) 668-1754
☑ SARNIA 870 CONFEDERATION STREET, N7T 2E5 PHONE: (519) 337-5409 FAX: (519) 337-2514
☐ TECUMSEH 11865 COUNTY ROAD 42, N8N 2M1 PHONE: (519) 735-2499 FAX: (519) 735-9669

SUBJECT: Water Feature Follow-up Inspection	DATE: 17 Dec. 2010 PAGE 1 OF 1
PROJECT NO.: SN04090572	CLIENT: First Solar
PROJECT NAME: Sombra Solar Park.	CONTRACTOR:
AREA INSPECTED: Pt. Lots 1 & 2 Conc 11 + Pt. Lots 1, Conc 10 St. Clair Twp.	

OBSERVATIONS: Conditions approx -1°C., south. light breeze 10 km/h. + Cloudy
- on-site. approx 2:30pm to 3:30 PM
- Follow-up visit conducted to confirm information provided by David Neely (Drainage Superintendent) in his email of Dec 17/09.
- All drains on-site appeared general dry or containing no water with exception of Rivers Lapish drain with standing water noted in concrete channel running under Baseline Road N of Site.
- North municipal drain identified as Rivers Lapish, west identified as Watson Tulloch & south identified as MYERS DRAIN.
- The watson Tulloch drain was noted to have a high point all site draining partially water north & part south; however the could not be observed as conditions were dry
- concrete basin with Field tile identified by David Neely as draining N. half of Lot 1 & into adjacent open drains. (some water noted in bottom of catchbasin)
- Additional Field tiling inferred to drain south of site into adjacent open ditches.
- In general all adjacent site ditches were heavily vegetated with little water a no observed wildlife.
- A group of wild turkeys (approx 5) were observed off-site to the west & just N of the McKeough channel walking along tree line..
- No wildlife observed on-Site.

Corrective action is required	☐	RECEIVED BY:		INSPECTED BY:	
No corrective action is required	☐	PRINT NAME:		PRINT NAME:	Mike Crabb

☐ THIS REPORT SHOULD BE CONSIDERED PRELIMINARY

IF THE BOX INDICATING A PRELIMINARY REPORT IS CHECKED, THE ABOVE INFORMATION IS PRELIMINARY AND MUST BE REVIEWED BEFORE IT CAN BE CONSIDERED AS AN ENGINEERING EVALUATION OR OPINION OF THE SUBJECT WORK OR MATERIALS. IF YOU HAVE ANY QUESTIONS OR REQUIRE CLARIFICATION PLEASE CONTACT THE ISSUING OFFICE.

☑ FIELD MEMO
☐ INSPECTION REPORT

amec

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☐ TECUMSEH 11865 COUNTY ROAD 42, N8N 2M1 PHONE: (519) 735-2499 FAX: (519) 735-9669

SUBJECT: Initial Site Recon.	DATE: Oct 14/2010 PAGE 1 OF 1
PROJECT NO.: SWA090572	CLIENT: First Solar.
PROJECT NAME: Sombra Solar Park	CONTRACTOR:
AREA INSPECTED: Pt Lots. 1 & 2 Conc. 11 & Pt. Lot 1, Conc 10. St. Clair Twp	

OBSERVATIONS: Conditions. Pl. Cloudy, Approx. 7°C. NE wind @ ≅ 20 km/h
ON-SITE: Approx 2:30 PM OFF-SITE: Approx: 3:30 PM

- Site observed to be generally flat & agricultural in use. (Corn crop covering most of property - inferred)
- Two residential (+ farm structures + barns) noted along south of Bentpath Line + north of Smith Line on-site)
- A large woodlot appears along east extent of site, with the majority of lot continuing east onto adjacent lands.
- no standing water or low lands observed. Surrounding properties appeared similar. (agricultural + residential to north, east, west + south)
  ↳ gas (natural gas) ~~Transfer terminal~~/facility west of the site @ SW corner.
- Mckeough Diversion channel noted ≅ 1km south of site,
- Perimeter, shallow, open drainage ditches (inferred municipal) noted along north, west & south extents of site. Drainage anticipated to flow west to St. Clair River (Approx 1km W) or to the Diversion Channel.
- Concrete. Drainage Basin with apparent field tile connections into it noted @ NW corner of site. (Follow-up req'd on what & where to).
- Buildings appeared old + unused. (Follow up req'd for demolition)
- Nobody or animals observed or ~~noted~~ encountered during site visit.

Corrective action is required		RECEIVED BY:		INSPECTED BY:	
No corrective action is required		PRINT NAME:		PRINT NAME:	Mike Crabb

☐ THIS REPORT SHOULD BE CONSIDERED PRELIMINARY

IF THE BOX INDICATING A PRELIMINARY REPORT IS CHECKED, THE ABOVE INFORMATION IS PRELIMINARY AND MUST BE REVIEWED BEFORE IT CAN BE CONSIDERED AS AN ENGINEERING EVALUATION OR OPINION OF THE SUBJECT WORK OR MATERIALS. IF YOU HAVE ANY QUESTIONS OR REQUIRE CLARIFICATION PLEASE CONTACT THE ISSUING OFFICE.

Appendix C
St. Clair Region Conservation Authority – Correspondence

St. Clair Region Conservation Authority

205 Mill Pond Cr., Strathroy, ON, N7G 3P9
(519) 245-3710 (519) 245-3348 FAX
E-Mail stclair@scrca.on.ca
Website www.scrca.on.ca

June 26, 2009

RECEIVED June 29/09

Lakeshore Group
250 Wellington Street West
Suite 130
Toronto, Ontario
M5V 3P6

Attention: **Rick Pennycooke, M.C.I.P., R.P.P., President**

Re: **Property Inquiry**
Proposed Solar Farm Development
Lot 1 & Part Lot 2, Concession 11
Geographic Township of Sombra

Staff of the St. Clair Region Conservation Authority (SCRCA) have reviewed the subject lands with regard to the matter outlined within your correspondence of June 16, 2009.

We understand that your client (First Solar Development (Canada) Inc) is proposing to develop a solar farm on the subject property. From the information provided, we understand the proposal includes the construction of a solar farm and associated infrastructure that would cover a majority of Lot 1, Concession 11, Sombra.

We can confirm that the subject lands are not impacted by "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses" Regulations (O.R. 171/06) implemented by the Authority pursuant to Section 28 of the *Conservation Authorities Act*. As such, permission of the Authority is not required to complete the proposed development on the subject lands.

If you have any questions with regard to the above, do not hesitate to contact the undersigned.

Yours truly,

Jeff Lawrence
Environmental Planner/Regulations Officer

Encl.

"working together for a better environment"


West Bentpath Line
St. Clair Avenue
North Street
East Street
John Street
Duke Street
Water Street
Bentpath Line
Subject Property
(approx)
St. Clair Parkway
West Smith Line
Baseline Road
St. Clair Region
Conservation Authority
205 Mill Pond Crescent, Strathroy, ON N7G 3P9
Tel: (519) 245-3710 Fax: (519) 245-3348
Email: stclair@scrca.on.ca
Web: http://www.scrca.on.ca
Proposed Site Plan
Legend
Subject Property (approx)
N
0 125 250 500 750 1,000
Meters
Produced by the SCRCA under license with the Ontario Ministry of Natural Resources. Copyright Queen's Printer June 2009
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THIS IS NOT A PLAN OF SURVEY

St. Clair Region Conservation Authority

205 Mill Pond Cr., Strathroy, ON, N7G 3P9
(519) 245-3710 (519) 245-3348 FAX
E-Mail stclair@scrca.on.ca
Website www.scrca.on.ca

December 11, 2009

AMEC Earth & Environmental Ltd.
870 Confederation Street
Sarnia, Ontario
N7T 2E5

Attention: Brian Fogg

Re: Environmental Information Request – Sombra Solar Farm

Dear Mr. Fogg:

The St. Clair Region Conservation Authority (SCRCA) acknowledges your request to proceed with a background natural heritage data search and retrieval as outlined in your letter dated November 24, 2009. After performing a search for evaluated wetlands, ESA's, ANSI's, fish habitat/municipal drain classification data, benthic data, water chemistry and regulations - as they apply to the *Conservation Authorities Act*, the following information is provided in this email:

Municipal Drain Classification Map for Study Area

- SCRCA_DFO_Drain_Classification_Map.pdf

SCRCA Regulations

- A recent flood line delineation study estimates that the subject property is within the area of jurisdiction of this Authority's 'Development, Interference with Wetlands and Alterations to Shorelines and Watercourses' Regulation passed pursuant to Section 28 of the *Conservation Authorities Act*, (Ontario Regulation 171/06). This means that the owner may require written permission of this Authority prior to commencement of any construction activity or placement/removal of fill of any kind within the regulated area or any alterations to the watercourse. Should future development be proposed within the limits of the flood line estimation, further investigation would be required to assess the flood susceptibility of the subject property.

- SCRCA_Regulated_Areas_Map.pdf

Species at Risk

- NHIC_Table_for_Speceis_at_Risk._Sombra.xlsx

- SCRCA has made initial contact with the Ministry of Natural Resources (MNR) on your behalf, for information pertaining to provincial species at risk listed under the Endangered Species Act (2007). A map of the proposed Sombra Twp. Solar Farm study area was provided to the MNR office located in Aylmer, Ontario for screening. Your contacts are Daraleigh Irving, District Planner, Andrea Fleischhauer the Planning Ecologist who handles Renewable Energy, as well as Ron Gould Aylmer Species at Risk Biologist at 519-773-9241or ron.gould@ontario.ca. Aylmer District MNR Office, 615 John St. N. Aylmer, ON N5H 2S8

Do not hesitate to contact the undersigned, if you have any questions or if you require further information.

Sincerely,

Heather MacKenzie

Heather MacKenzie,
Aquatic Systems Biologist

Appendix D
Stormwater Management Plan

CONCEPTUAL STORMWATER MANAGEMENT PLAN

Proposed Photovoltaic Power Plant Development
St. Clair - Sombra Solar Farm
Lambton County, Ontario

Prepared for:

First Solar Development (Canada) Inc.
5115 Blackwell Sideroad
Sarnia, Ontario, N7T 7H3

Prepared by:

AMEC Earth & Environmental
(a division of AMEC Americas Limited)
160 Traders Blvd East, Suite 110
Mississauga, Ontario, L4Z 3K7

Report No.: 04090565

December 2009
(Updated April 2010)

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APPENDICES

LIST OF TABLES

LIST OF FIGURES

APPROVALS

Prepared by: Kevin Chen	April 30, 2010 Date
Checked by: Peter Nimmrichter, P.Eng.	April 30, 2010 Date
Approved by: J. Brian Fogg, P. Eng., Project Manager	April 30, 2010 Date

SECTION 1

INTRODUCTION

1.0 INTRODUCTION

This report summarizes the development of a conceptual Stormwater Management Plan for a proposed photovoltaic power plant development to be located in the Township of St. Clair, Ontario (see Figure 1-1). St. Clair - Sombra Solar Farm site ("Site") is approximately 84 ha in total area located on the east side of Baseline Road, and is bound to the north by Bentpath Line and to the south by the Smith Line. The Site consists of a field planted with soybeans (northern portion) and winter wheat (southern portion). Woodlot areas are located along the northeast portion of the site. Residential structures are located along Bentpath Line and Smith Line (see Figure 1-2).

The site lies within the jurisdiction of the St. Clair Region Conservation Authority, in the St. Clair River Tributary watershed.

This report has been prepared for First Solar Development (Canada) Inc. ("First Solar").

Figure 1-1: Site Location, Regional Context
(Source: Background image from Google Maps)

Figure 1-2: Site Location, Local Context
(Source: Background image from Google Maps)

1.1 Project Description

The proposed St. Clair – Sombra Solar Farm will collect the energy from the sun using thin film photovoltaic modules and convert it to electrical energy for distribution to the local electricity distribution system. The proposed solar farm will be capable of producing 20 MW of electricity and will be developed on a parcel of land located east of Sombra Village in Township of St. Clair (south of Bentpath Line, east of Baseline Road). The solar farm is designated as a "class 3" solar facility as defined by Section 4 of O. Reg. 359/09 regarding Renewable Energy Approvals. A class 3 solar facility is a renewable energy facility with a name plate power capacity greater than 10kW situated at any location other than being mounted on the roof or wall of a building. (First Solar, 2009)

The construction of the St. Clair – Sombra Solar Farm will be on existing ground to the extent possible. After construction, the site will be seeded and plantings will be encouraged under the solar panels. It is the intent of First Solar to keep the terrain as natural as possible.

Figure 1-3 illustrates the development proposal for St. Clair - Sombra Solar Farm.

1.2 Existing Site Geology Conditions
(Substantially from AMEC, 2008)

The proposed development St. Clair - Sombra site is flat-lying agricultural properties consisting of several separate parcels of land that have been assembled by First Solar for the purposes of the development of solar farms. Drainage ditches are present along the roads that bound the site.

Agricultural soils mapping indicates that the near surface soils at the site are "Brookston Clay" and "Clyde Clay." St. Clair Sombra site lies within the subregion called the Chatham Flats, which, at its northern end, consists of stratified clays. Geotechnical Investigation shows the major deposits of soils within the sites are silty clay with trace sand and gravel. At St. Clair Sombra site, however, the consistency decreases more dramatically below the crust to firm then soft with increasing depth.

The groundwater levels were monitored during and at completion of drilling and are recorded. Based on the record of the seven (7) boreholes on-site, all of the boreholes were dry and open upon completion of drilling.

Figure 1-3: Post Development Site Layout

The following information is relevant for this site:

- No wetlands are identified on the proposed development site (St. Clair River Tributaries Watershed Report Card, 2008)
- No Environmentally Significant Areas are identified on the proposed development site (St. Clair River Tributaries Watershed Report Card, 2008)
- Soils at the site generally described as silty and clay (St. Clair River Tributaries Watershed Report Card, 2008)
- The Regulated Area Limits, provided by the St. Clair Region Conservation Authority (SCRCA) as shown in Figure 1-4, indicates that part of the site is located inside of the Regulated Area. However, based on the confirmation letter of SCRCA on June 26, 2009, *"the subjects lands are not impacted by "Development, interference with Wetlands and Alterations to Shorelines and Watercourses" Regulations (O.R. 171/06) implements by the Authority pursuant to Section 28 of the Conservation Authorities Act."* (see Appendix B)

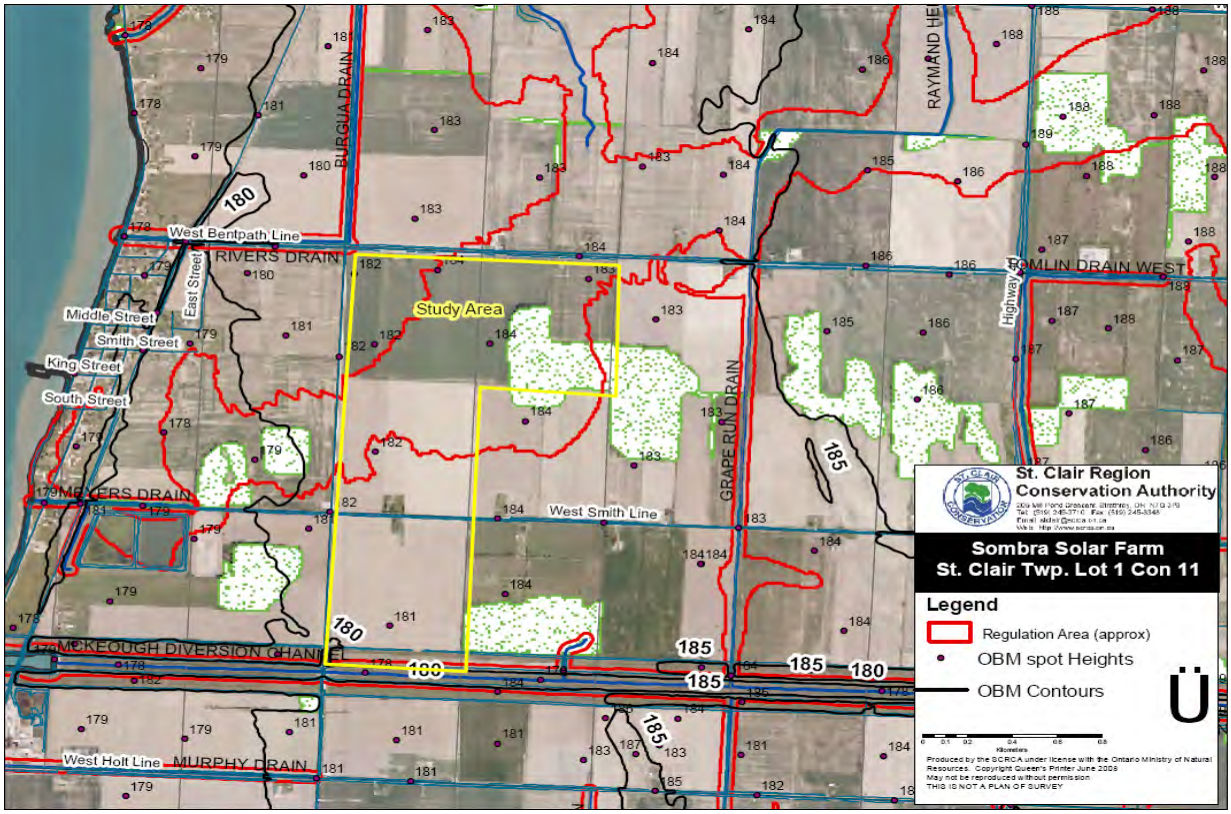

Figure 1-4: St. Clair Region Conservation Authority Regulation Areas
(Source: St. Clair Region Conservation Authority)

1.3 Stormwater Management Plan Overview

The primary objective of a Stormwater Management (SWM) Plan is to control stormwater runoff from development. The plan is designed to improve the stormwater quality (i.e., sediment removal) and control runoff directly discharging from the site.

Some considerations regarding stormwater management planning for this site include:

- the construction of the St. Clair - Sombra site will be on existing ground (i.e., existing topography will be maintained) to the extent possible, particularly in areas designated for solar arrays/panels

- after construction, the site will be seeded and plantings will be encouraged under the solar panels

  As such, although the solar panels are an impervious surface, the underlying soils and topography will not have changed from pre-development conditions. Rain water flowing off the solar panels will fall to a pervious surface, runoff will travel an un-changed path therefore maintaining the opportunity to infiltrate in a manner equaling pre-development. Therefore, areas to be covered by solar arrays are not considered to change between pre-development and post-development.

- only minimal hard surfaces (access roads) will be constructed for this development

The drainage boundaries from Figure 1-3 were transcribed onto the OBM drawing as illustrated in Figure 1-5. Based on the updated topographic information provided by First Solar, the surface runoff from Catchment 101 drains overland to the Baseline Road ditch on the west of the site and eventually into W. Darcy McKeough Floodway on the south of the site. The total drainage area is approximately 84 hectares.

As noted previously, overall site grades for the post-development condition will not vary significantly from the existing grades. Therefore, the drainage area of the proposed development site will be the same as the existing condition (see Figure 1-6). Based on the proposed access road layout, a comparison of the catchment condition between pre-development and post development is outlined in Table 1-1.

Table 1-1: Catchment Condition Comparison

Site Location	Development Condition	Catchment Area IDs	Catchment Area (ha)	% Impervious Area
St. Clair - Sombra	Pre-development	101	83.94	0
	Post development	201	83.94	5.8

LEGEND

FLOW DIRECTION

101 / 94.67ha — CATCHMENT AREA ID; AREA

CATCHMENT AREA BOUNDARY

0 100 200m

1:5000 SCALE

First Solar.	CLIENT FIRST SOLAR DEVELOPMENT (CANADA) INC	DWN BY: KC	ST CLAIR SOMBRA SOLAR FARM DEVELOPMENT CONCEPTUAL STORMWATER MANAGEMENT	REV. NO.: A
		CHK'D BY: PN		DATE: APRIL 2010
AMEC Earth & Environmental 160 Traders Boulevard East Mississauga, Ontario, Canada L4Z 3K7 amec		DATUM:	TITLE PRE DEVELOPMENT CATCHMENT AREA	PROJECT NO:
		PROJECTION:		FIGURE No. 1-5
		SCALE: AS SHOWN		

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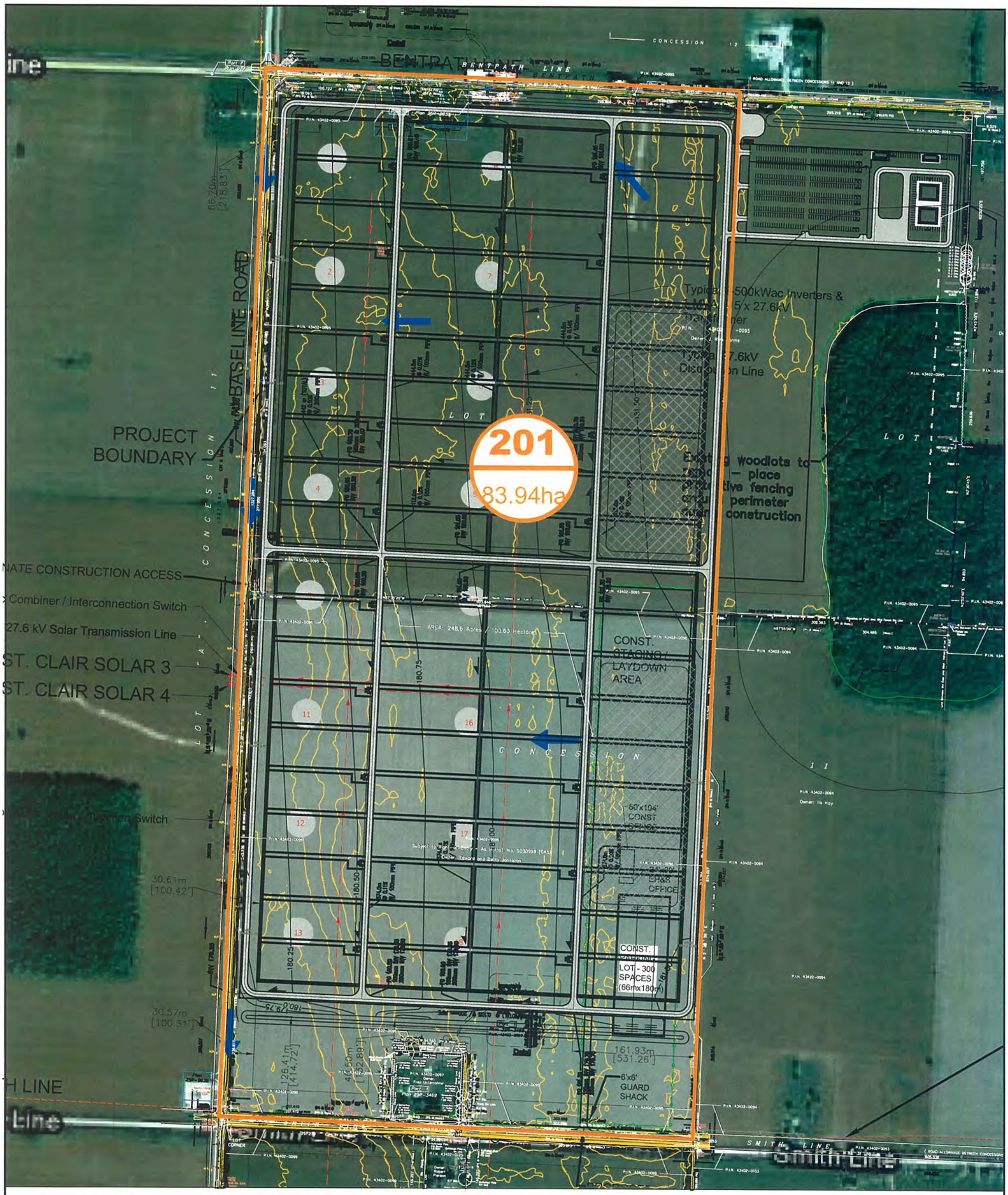

LEGEND

FLOW DIRECTION

CATCHMENT AREA BOUNDARY

201 — CATCHMENT AREA ID

97.44ha — AREA

0 100 200m

1:5000 SCALE

First Solar.	CLIENT FIRST SOLAR DEVELOPMENT (CANADA) INC	DWN BY: KC	ST CLAIR SOMBRA SOLAR FARM DEVELOPMENT	REV. NO.: A
		CHK'D BY: PN	CONCEPTUAL STORMWATER MANAGEMENT	DATE: APRIL 2010
AMEC Earth & Environmental 160 Traders Boulevard East Mississauga, Ontario, Canada L4Z 3K7	amec	DATUM:	TITLE POST DEVELOPMENT CATCHMENT AREA	PROJECT NO:
		PROJECTION:		FIGURE No. 1-6
		SCALE: AS SHOWN		

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As indicated in Table 1-1, post development site imperviousness conditions do not change significantly from pre-development. The impervious areas represent hard surfaces introduced to the site through construction of gravel access roads.

Given the minor increases in imperviousness and the flat surface under post-development condition, it is anticipated that the new development will not adversely affect downstream flood risk, negating the requirement for quantity control. Therefore, the primary theme of the conceptual stormwater management plan is the control for stormwater runoff quality from the site.

SECTION 2

HYDROLOGIC MODELLING

2.0 HYDROLOGIC MODELLING

Single event hydrologic modelling has been used to obtain quantitative estimates of stormwater runoff rates and volumes for pre-development and post-development conditions for the Site.

2.1 Model Selection

The surface runoff has been calculated using the computer model Visual OTTHYMO v2.0. OTTHYMO is a successful hydrologic management model that has been used for: Watershed Studies, Sub-watershed Studies, Master Drainage Plans, Functional Stormwater Management Plans, Site Plans, and Stormwater Management Pond Design. Visual OTTHYMO v2.0 (VO2) is the second version of the INTERHYMO – OTTHYMO hydrologic model simulation software package designed for Microsoft Windows OS. VO2 has been accepted by the MOE, the Ministry of Natural Resources, the Ministry of Transportation, the Ministry of Municipal Affairs, the Association of Conservation Authorities of Ontario, and most municipal governments, as a valid hydrologic simulation model.

2.2 Design Storms

Precipitation data from the Atmospheric Environment Services' IDF90 publication for the Sarnia Airport (Ontario) weather station were used to develop the design storms used in this assessment. Design storms with return periods of 2, 5, 10, 25, 50, and 100-years were developed to determine design hydrographs to enable evaluation of the flow capacity/conveyance requirements for the grass swales and culverts. The Soil Conservation Service (SCS) Type II storm distribution was selected for the design storms due to its applicability in rural and urban settings and to maintain consistency with other hydrologic calculations, such as the effective rainfall and overland routing calculations. A time increment of 5 minutes was selected for all design storms. A 24-hour duration was selected since this provides a more conservative estimate of volume storage and flow capacity requirements. Table 2-1 is the summary of total rainfall depth for the SCS 24-hour 2, 5, 10, 25, 50, and 100 year storm events.

Table 2-1: Total Rainfall Depth

Return Period	Depth (mm)
2 year	52.5
5 year	67.6
10 year	77.6
25 year	90.2
50 year	99.6
100 year	108.9

The MNR Flood Plain Management in Ontario, Technical Guidelines indicate the site is located within Regulatory Flood Zone 1. As such, The Hurricane Hazel design storm was used as the

Regional (extreme) design rainfall event for this site. The Regional design rainfall event has a total depth of 211mm.

2.3 Hydrologic Modelling Results

Modeling notes:

- Based on the geotechnical report (AMEC, 2008), the native soil at the site generally consists of silty clay till material, which are classified as Hydrologic Soil Groups CD. A base CN number of 85 is used to describe pervious areas for modeling purposes.
- For post development modeling, the rainfall on the solar panel will fall onto pervious ground and travel overland to the existing drainage ditch around the site. As a result, the stormwater runoff from the solar panel arrays is considered to be clean.

The computed peak flows discharging the site are summarized in Table 2-2.

Table 2-2: Computed Peak Flows from Areas 101

Rainfall Event	Pre-development (m^3/s)	Post development (m^3/s)	Change (%)
2 year	2.12	2.18	2.8
5 year	3.26	3.37	3.4
10 year	4.07	4.19	3.0
25 year	5.11	5.26	2.9
50 year	5.90	6.08	3.1
100 year	6.69	6.90	3.1
Regional	11.60	11.75	1.3

As indicated in the Table above, in comparison to the pre-development condition, the overall post-development peak flows do not change significantly. Therefore, no negative impact to downstream flood risk is anticipated as a result of this proposed development. As such, stormwater 'quantity' control features are not considered necessary for this SWM Plan.

2.4 Stormwater Management Plan

As noted previously, 'quantity' control is not considered necessary for this SWM Plan. Therefore, the focus of the SWM Plan becomes stormwater 'quality' control.

Grassed filter strips are a low-cost Best Management Practice (BMP) designed to improve the quality of stormwater runoff by using biological and chemical processes in soils and vegetation to filter out constituents. They function by slowing runoff velocities and filtering out sediment and

other pollutants, and providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice.

As noted previously, after construction, the site, for areas under and within approximately 30m of the array blocks, will be seeded with ‘pasture’ grass varieties. The preferred grass species will be those that reach a moderately short height (under 18”) at maturity. These plantings will essentially act as grassed filter strips for the site. This will be true for the new access roads as well. A review of Figure 1-3 indicates that the closest access road to an existing Drain is approximately 30m. The proposed plantings over a 10m flow length will provide effective stormwater runoff quality control given the minimal contributing impervious area.

SECTION 3

MAINTENANCE AND MONITORING PROGRAM

3.0 MAINTENANCE AND MONITORING PROGRAM

The stormwater management works will be owned, maintained and monitored by the owner in accordance with any specified requirements of the St. Clair Region Conservation Authority.

3.1 Maintenance

Proper maintenance is required for maximum filter-strip effectiveness. The maintenance requirements for the grass filter strips within this development will be based on information provided in MOE (2003). The following minimal maintenance items are recommended:

- Inspect the filter strip frequently, especially after intense rainfall events and runoff events of long duration. Small breaks in the sod and small erosion channels quickly become large problems.
- Minimize the development of erosion channels within the filter. Even small channels may allow much of the runoff from the field to bypass the filter. These areas should be repaired and reseeded immediately to help ensure proper flow of runoff through the filter.
- Reseed or inter-seed bare areas of the filter. Since it may be difficult to re-establish vegetation in an established filter strip, the use of mulch or sod can help to reduce some problems.
- Mow and remove hay as required to maintain moderate vegetation height.
- Soil test periodically and apply soil amendments according to test results and recommendations.
- Control trees, brush, noxious weeds, and Canada thistle in the filter using either mechanical means or herbicides.

3.2 Monitoring

Monitoring will consist of visual inspections of the vegetated areas adjacent to drainage ditches. The monitoring program will include regular inspections of the erosion and sediment control features described in the following section.

SECTION 4

EROSION AND SEDIMENT CONTROL

4.0 EROSION AND SEDIMENT CONTROL

Erosion and sedimentation are naturally occurring processes that involve particle detachment, sediment transport and deposition of soil particles. Construction activities commonly alter the landscapes where they are located, exacerbating these natural processes.

The transport of sediment overland and deposition into surrounding natural areas, including watercourses (fish habitat), woodlots and wetlands as well as adjacent private lands, needs to be prevented. The erosion and sediment control measures described in this section are focused on the features of the Stormwater Management Plan only. The erosion and sediment control plan for the entire site, completed by others, should be compliant with the MOE design manual (2003).

To minimize the potential operation and environmental impacts, the grass filter areas should be inspected frequently to identify any erosion areas and make timely repairs to the grade. The build-up sediments should be removed when it has accumulated to 25% of the original capacity.

SECTION 5

SUMMARY

5.0 SUMMARY

This report summarizes the development of a conceptual stormwater management plan for the development site based on current site layout plans. This plan demonstrates that the post-development conditions for this proposed solar farm development satisfy the requirements for stormwater management established by the SCRCA and MOE (2003).

It has been confirmed that the development site does not lie within the Regulatory Flood Plain.

Hydrological modelling completed for this assessment indicates no significant changes between pre-development condition and post-development stormwater runoff peak flow conditions. Therefore, quantity control of stormwater runoff is not a component of this SWM Plan. Further, no impacts to downstream flood conditions are anticipated.

As no significant changes between pre-development condition and post-development stormwater runoff peak flow conditions are anticipated, the recommended conceptual stormwater management plan focuses on stormwater runoff quality control. Pasture grass varieties, which will substantially cover the Site after construction, will provide water quality control through filtering (in a similar manner to grassed filter strips) for stormwater runoff from the Site.

A preliminary Stormwater Management facility maintenance and monitoring strategy, based on the conceptual stormwater management plan, has also been provided.

A preliminary Stormwater Management facilities erosion and sedimentation control strategy, based on the conceptual stormwater management plan, has also been provided.

SECTION 6

REFERENCES

6.0 REFERENCES

AMEC, 2008	**Final Report, Geotechnical Investigation, Optisolar Inc. St. Clair Solar Power Project, St. Clair Township, Ontario,** AMEC Earth & Environmental, November 2008.
First Solar, 2009	**Project Description Report, Twp. Of St. Clair – St. Clair - Sombra Solar Farm**, First Solar Development (Canada), Inc., November 24, 2009.
MOE, 2003	**Stormwater Management Planning and Design Manual**, Ministry of the Environment, 2003.
MTO, 2008	Ontario Ministry of Transportation, **Highway Drainage Design Standards,** January 2008.
MTO, 1984	Ontario Ministry of Transportation, **Drainage Manual**, 1984.
MTO, 1980	Ontario Ministry of Transportation and Communications, **Directive B-100**
OMNR, 1988	**Flood Plain Management in Ontario Technical Guidelines**, Ontario Ministry of Natural Resources, 1988
Sarnia, 2001	**Official Plan of the City of Sarnia,** City of Sarnia, 2001.
SCRCA, 2008	**St. Clair River Tributaries Watershed Report Card,** St. Clair Region Conservation Authority, 2008

APPENDIX A

HYDROLOGY MODELING INPUT AND OUTPUT

```
       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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

Input filename: C:\Program Files\Visual OTTHYMO 2.2.4\voin.dat
Output filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Pre-development.out
Summary filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Pre-development.sum

DATE: 12/22/2009 TIME: 12:04:53 PM

USER:

COMMENTS: _____

**** SIMULATION NUMBER: 1 ****

MASS STORM	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Scs24h.mst
Ptotal= 52.50 mm	Comments: SCS 24 HR MASS CURVE

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min
New Storm time step = 5.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.24	6.08	.88	12.08	45.36	18.08	.95
.17	.47	6.17	.91	12.17	26.46	18.17	.94
.25	.71	6.25	.95	12.25	7.56	18.25	.94
.33	.71	6.33	.95	12.33	7.56	18.33	.94
.42	.71	6.42	.95	12.42	7.56	18.42	.95
.50	.71	6.50	.95	12.50	7.56	18.50	.95
.58	.71	6.58	.95	12.58	6.34	18.58	.95
.67	.71	6.67	.95	12.67	5.11	18.67	.94
.75	.71	6.75	.95	12.75	3.88	18.75	.94
.83	.71	6.83	.94	12.83	3.88	18.83	.94
.92	.71	6.92	.94	12.92	3.89	18.92	.95
1.00	.71	7.00	.94	13.00	3.89	19.00	.95
1.08	.71	7.08	1.01	13.08	3.54	19.08	.95
1.17	.71	7.17	1.09	13.17	3.18	19.17	.94
1.25	.71	7.25	1.16	13.25	2.83	19.25	.94
1.33	.71	7.33	1.16	13.33	2.83	19.33	.94
1.42	.71	7.42	1.15	13.42	2.84	19.42	.95
1.50	.71	7.50	1.15	13.50	2.84	19.50	.95
1.58	.71	7.58	1.15	13.58	2.63	19.58	.95
1.67	.71	7.67	1.16	13.67	2.41	19.67	.94
1.75	.71	7.75	1.16	13.75	2.20	19.75	.94
1.83	.71	7.83	1.16	13.83	2.20	19.83	.94
1.92	.71	7.92	1.15	13.92	2.20	19.92	.95
2.00	.71	8.00	1.15	14.00	2.21	20.00	.95
2.08	.66	8.08	1.22	14.08	2.00	20.08	.84
2.17	.60	8.17	1.29	14.17	1.79	20.17	.73
2.25	.55	8.25	1.36	14.25	1.57	20.25	.63
2.33	.55	8.33	1.37	14.33	1.57	20.33	.63
2.42	.55	8.42	1.37	14.42	1.57	20.42	.63
2.50	.55	8.50	1.37	14.50	1.57	20.50	.63
2.58	.55	8.58	1.40	14.58	1.57	20.58	.63
2.67	.55	8.67	1.44	14.67	1.57	20.67	.63
2.75	.55	8.75	1.47	14.75	1.57	20.75	.63
2.83	.55	8.83	1.47	14.83	1.58	20.83	.63
2.92	.55	8.92	1.47	14.92	1.58	20.92	.63
3.00	.55	9.00	1.47	15.00	1.58	21.00	.63

3.08	.55	9.08	1.54	15.08	1.58	21.08	.63
3.17	.55	9.17	1.61	15.17	1.58	21.17	.63
3.25	.55	9.25	1.68	15.25	1.57	21.25	.63
3.33	.55	9.33	1.68	15.33	1.57	21.33	.63
3.42	.55	9.42	1.68	15.42	1.57	21.42	.63
3.50	.55	9.50	1.68	15.50	1.57	21.50	.63
3.58	.55	9.58	1.75	15.58	1.57	21.58	.63
3.67	.55	9.67	1.82	15.67	1.57	21.67	.63
3.75	.55	9.75	1.89	15.75	1.57	21.75	.63
3.83	.55	9.83	1.89	15.83	1.57	21.83	.63
3.92	.55	9.92	1.89	15.92	1.57	21.92	.63
4.00	.55	10.00	1.89	16.00	1.57	22.00	.63
4.08	.65	10.08	2.06	16.08	1.36	22.08	.63
4.17	.74	10.17	2.24	16.17	1.16	22.17	.63
4.25	.84	10.25	2.41	16.25	.95	22.25	.63
4.33	.84	10.33	2.41	16.33	.95	22.33	.63
4.42	.84	10.42	2.41	16.42	.94	22.42	.63
4.50	.84	10.50	2.41	16.50	.94	22.50	.63
4.58	.84	10.58	2.69	16.58	.94	22.58	.63
4.67	.84	10.67	2.98	16.67	.94	22.67	.63
4.75	.84	10.75	3.26	16.75	.94	22.75	.63
4.83	.84	10.83	3.26	16.83	.94	22.83	.63
4.92	.84	10.92	3.25	16.92	.95	22.92	.63
5.00	.84	11.00	3.25	17.00	.95	23.00	.63
5.08	.84	11.08	3.85	17.08	.95	23.08	.63
5.17	.84	11.17	4.44	17.17	.94	23.17	.63
5.25	.84	11.25	5.04	17.25	.94	23.25	.63
5.33	.84	11.33	5.04	17.33	.94	23.33	.63
5.42	.84	11.42	5.04	17.42	.95	23.42	.63
5.50	.84	11.50	5.04	17.50	.95	23.50	.63
5.58	.84	11.58	8.54	17.58	.95	23.58	.63
5.67	.84	11.67	12.04	17.67	.94	23.67	.63
5.75	.84	11.75	15.54	17.75	.94	23.75	.63
5.83	.84	11.83	31.78	17.83	.94	23.83	.63
5.92	.84	11.92	48.02	17.92	.95	23.92	.63
6.00	.84	12.00	64.26	18.00	.95	24.00	.63

CALIB			
NASHYD (0102)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.24	6.083	.88	12.083	45.36	18.08	.95
.167	.47	6.167	.91	12.167	26.46	18.17	.94
.250	.71	6.250	.95	12.250	7.56	18.25	.94
.333	.71	6.333	.95	12.333	7.56	18.33	.94
.417	.71	6.417	.95	12.417	7.56	18.42	.95
.500	.71	6.500	.95	12.500	7.56	18.50	.95
.583	.71	6.583	.95	12.583	6.34	18.58	.95
.667	.71	6.667	.95	12.667	5.11	18.67	.94
.750	.71	6.750	.95	12.750	3.89	18.75	.94
.833	.71	6.833	.94	12.833	3.88	18.83	.94
.917	.71	6.917	.94	12.917	3.89	18.92	.95
1.000	.71	7.000	.94	13.000	3.89	19.00	.95
1.083	.71	7.083	1.02	13.083	3.54	19.08	.95
1.167	.71	7.167	1.09	13.167	3.19	19.17	.94
1.250	.71	7.250	1.16	13.250	2.84	19.25	.94
1.333	.71	7.333	1.16	13.333	2.83	19.33	.94
1.417	.71	7.417	1.15	13.417	2.84	19.42	.95
1.500	.71	7.500	1.15	13.500	2.84	19.50	.95
1.583	.71	7.583	1.15	13.583	2.63	19.58	.95
1.667	.71	7.667	1.16	13.667	2.42	19.67	.94
1.750	.71	7.750	1.16	13.750	2.21	19.75	.94
1.833	.71	7.833	1.16	13.833	2.20	19.83	.94
1.917	.71	7.917	1.15	13.917	2.20	19.92	.95
2.000	.71	8.000	1.15	14.000	2.21	20.00	.95
2.083	.66	8.083	1.23	14.083	2.00	20.08	.84
2.167	.60	8.167	1.30	14.167	1.79	20.17	.73
2.250	.55	8.250	1.37	14.250	1.58	20.25	.63
2.333	.55	8.333	1.37	14.333	1.57	20.33	.63
2.417	.55	8.417	1.37	14.417	1.57	20.42	.63
2.500	.55	8.500	1.37	14.500	1.57	20.50	.63
2.583	.55	8.583	1.40	14.583	1.57	20.58	.63
2.667	.55	8.667	1.44	14.667	1.57	20.67	.63
2.750	.55	8.750	1.47	14.750	1.57	20.75	.63
2.833	.55	8.833	1.47	14.833	1.58	20.83	.63
2.917	.55	8.917	1.47	14.917	1.58	20.92	.63
3.000	.55	9.000	1.47	15.000	1.58	21.00	.63
3.083	.55	9.083	1.54	15.083	1.58	21.08	.63
3.167	.55	9.167	1.61	15.167	1.58	21.17	.63

3.250	.55	9.250	1.68	15.250	1.57	21.25	.63
3.333	.55	9.333	1.68	15.333	1.57	21.33	.63
3.417	.55	9.417	1.68	15.417	1.57	21.42	.63
3.500	.55	9.500	1.68	15.500	1.57	21.50	.63
3.583	.55	9.583	1.75	15.583	1.57	21.58	.63
3.667	.55	9.667	1.82	15.667	1.57	21.67	.63
3.750	.55	9.750	1.89	15.750	1.57	21.75	.63
3.833	.55	9.833	1.89	15.833	1.57	21.83	.63
3.917	.55	9.917	1.89	15.917	1.57	21.92	.63
4.000	.55	10.000	1.89	16.000	1.57	22.00	.63
4.083	.65	10.083	2.06	16.083	1.37	22.08	.63
4.167	.74	10.167	2.24	16.167	1.16	22.17	.63
4.250	.84	10.250	2.41	16.250	.95	22.25	.63
4.333	.84	10.333	2.41	16.333	.95	22.33	.63
4.417	.84	10.417	2.41	16.417	.94	22.42	.63
4.500	.84	10.500	2.41	16.500	.94	22.50	.63
4.583	.84	10.583	2.69	16.583	.94	22.58	.63
4.667	.84	10.667	2.97	16.667	.94	22.67	.63
4.750	.84	10.750	3.25	16.750	.94	22.75	.63
4.833	.84	10.833	3.26	16.833	.94	22.83	.63
4.917	.84	10.917	3.25	16.917	.95	22.92	.63
5.000	.84	11.000	3.25	17.000	.95	23.00	.63
5.083	.84	11.083	3.85	17.083	.95	23.08	.63
5.167	.84	11.167	4.44	17.167	.94	23.17	.63
5.250	.84	11.250	5.04	17.250	.94	23.25	.63
5.333	.84	11.333	5.04	17.333	.94	23.33	.63
5.417	.84	11.417	5.04	17.417	.95	23.42	.63
5.500	.84	11.500	5.04	17.500	.95	23.50	.63
5.583	.84	11.583	8.54	17.583	.95	23.58	.63
5.667	.84	11.667	12.04	17.667	.94	23.67	.63
5.750	.84	11.750	15.54	17.750	.94	23.75	.63
5.833	.84	11.833	31.78	17.833	.94	23.83	.63
5.917	.84	11.917	48.02	17.917	.95	23.92	.63
6.000	.84	12.000	64.26	18.000	.95	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= .585 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 23.067
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0101)	Area	(ha)=	83.94	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia	(mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=		1.02		

Unit Hyd Qpeak (cms)= 3.143

PEAK FLOW (cms)= 1.549 (i)
TIME TO PEAK (hrs)= 13.083
RUNOFF VOLUME (mm)= 23.067
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0103)	Area	(ha)=	13.45	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia	(mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=		.45		

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= .452 (i)
TIME TO PEAK (hrs)= 12.417
RUNOFF VOLUME (mm)= 23.066
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0102):	26.90	.585	12.83	23.07
	+ ID2= 2 (0101):	83.94	1.549	13.08	23.07
	==========				

```
         ID = 3 (0301):   110.84   2.115    13.00    23.07

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0301):   110.84   2.115    13.00    23.07
       + ID2= 2 (0103):    13.45    .452    12.42    23.07
         ================================================
         ID = 3 (0302):   124.29   2.394    12.92    23.07

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
  ****************************
  ** SIMULATION NUMBER:   2 **
  ****************************

--------------------
| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 67.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .30 |  6.08    1.13 | 12.08   58.41 | 18.08    1.22
                 .17     .61 |  6.17    1.17 | 12.17   34.07 | 18.17    1.22
                 .25     .91 |  6.25    1.22 | 12.25    9.73 | 18.25    1.22
                 .33     .91 |  6.33    1.22 | 12.33    9.73 | 18.33    1.22
                 .42     .91 |  6.42    1.22 | 12.42    9.73 | 18.42    1.22
                 .50     .91 |  6.50    1.22 | 12.50    9.73 | 18.50    1.22
                 .58     .91 |  6.58    1.22 | 12.58    8.16 | 18.58    1.22
                 .67     .91 |  6.67    1.22 | 12.67    6.58 | 18.67    1.22
                 .75     .91 |  6.75    1.22 | 12.75    5.00 | 18.75    1.22
                 .83     .91 |  6.83    1.22 | 12.83    5.00 | 18.83    1.22
                 .92     .91 |  6.92    1.22 | 12.92    5.00 | 18.92    1.22
                1.00     .91 |  7.00    1.22 | 13.00    5.00 | 19.00    1.22
                1.08     .91 |  7.08    1.31 | 13.08    4.55 | 19.08    1.22
                1.17     .91 |  7.17    1.40 | 13.17    4.10 | 19.17    1.22
                1.25     .91 |  7.25    1.49 | 13.25    3.65 | 19.25    1.22
                1.33     .91 |  7.33    1.49 | 13.33    3.65 | 19.33    1.22
                1.42     .91 |  7.42    1.49 | 13.42    3.65 | 19.42    1.22
                1.50     .91 |  7.50    1.49 | 13.50    3.65 | 19.50    1.22
                1.58     .91 |  7.58    1.49 | 13.58    3.38 | 19.58    1.22
                1.67     .91 |  7.67    1.49 | 13.67    3.11 | 19.67    1.22
                1.75     .91 |  7.75    1.49 | 13.75    2.84 | 19.75    1.22
                1.83     .91 |  7.83    1.49 | 13.83    2.84 | 19.83    1.22
                1.92     .91 |  7.92    1.49 | 13.92    2.84 | 19.92    1.22
                2.00     .91 |  8.00    1.49 | 14.00    2.84 | 20.00    1.22
                2.08     .84 |  8.08    1.58 | 14.08    2.57 | 20.08    1.08
                2.17     .78 |  8.17    1.67 | 14.17    2.30 | 20.17     .95
                2.25     .71 |  8.25    1.76 | 14.25    2.03 | 20.25     .81
                2.33     .71 |  8.33    1.76 | 14.33    2.03 | 20.33     .81
                2.42     .71 |  8.42    1.76 | 14.42    2.03 | 20.42     .81
                2.50     .71 |  8.50    1.76 | 14.50    2.03 | 20.50     .81
                2.58     .71 |  8.58    1.80 | 14.58    2.03 | 20.58     .81
                2.67     .71 |  8.67    1.85 | 14.67    2.03 | 20.67     .81
                2.75     .71 |  8.75    1.89 | 14.75    2.03 | 20.75     .81
                2.83     .71 |  8.83    1.89 | 14.83    2.03 | 20.83     .81
                2.92     .71 |  8.92    1.89 | 14.92    2.03 | 20.92     .81
                3.00     .71 |  9.00    1.89 | 15.00    2.03 | 21.00     .81
                3.08     .71 |  9.08    1.98 | 15.08    2.03 | 21.08     .81
                3.17     .71 |  9.17    2.07 | 15.17    2.03 | 21.17     .81
                3.25     .71 |  9.25    2.16 | 15.25    2.03 | 21.25     .81
                3.33     .71 |  9.33    2.16 | 15.33    2.03 | 21.33     .81
                3.42     .71 |  9.42    2.16 | 15.42    2.03 | 21.42     .81
                3.50     .71 |  9.50    2.16 | 15.50    2.03 | 21.50     .81
                3.58     .71 |  9.58    2.25 | 15.58    2.03 | 21.58     .81
                3.67     .71 |  9.67    2.34 | 15.67    2.03 | 21.67     .81
                3.75     .71 |  9.75    2.43 | 15.75    2.03 | 21.75     .81
                3.83     .71 |  9.83    2.43 | 15.83    2.03 | 21.83     .81
                3.92     .71 |  9.92    2.43 | 15.92    2.03 | 21.92     .81
                4.00     .71 | 10.00    2.43 | 16.00    2.03 | 22.00     .81
                4.08     .83 | 10.08    2.66 | 16.08    1.76 | 22.08     .81
                4.17     .96 | 10.17    2.88 | 16.17    1.49 | 22.17     .81
                4.25    1.08 | 10.25    3.11 | 16.25    1.22 | 22.25     .81
                4.33    1.08 | 10.33    3.11 | 16.33    1.22 | 22.33     .81
                4.42    1.08 | 10.42    3.11 | 16.42    1.22 | 22.42     .81
                4.50    1.08 | 10.50    3.11 | 16.50    1.22 | 22.50     .81
```

4.58	1.08	10.58	3.47	16.58	1.22	22.58	.81
4.67	1.08	10.67	3.83	16.67	1.22	22.67	.81
4.75	1.08	10.75	4.19	16.75	1.22	22.75	.81
4.83	1.08	10.83	4.19	16.83	1.22	22.83	.81
4.92	1.08	10.92	4.19	16.92	1.22	22.92	.81
5.00	1.08	11.00	4.19	17.00	1.22	23.00	.81
5.08	1.08	11.08	4.96	17.08	1.22	23.08	.81
5.17	1.08	11.17	5.72	17.17	1.22	23.17	.81
5.25	1.08	11.25	6.49	17.25	1.22	23.25	.81
5.33	1.08	11.33	6.49	17.33	1.22	23.33	.81
5.42	1.08	11.42	6.49	17.42	1.22	23.42	.81
5.50	1.08	11.50	6.49	17.50	1.22	23.50	.81
5.58	1.08	11.58	11.00	17.58	1.22	23.58	.81
5.67	1.08	11.67	15.50	17.67	1.22	23.67	.81
5.75	1.08	11.75	20.01	17.75	1.22	23.75	.81
5.83	1.08	11.83	40.92	17.83	1.22	23.83	.81
5.92	1.08	11.92	61.83	17.92	1.22	23.92	.81
6.00	1.08	12.00	82.74	18.00	1.22	24.00	.81

CALIB			
NASHYD (0102)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.30	6.083	1.13	12.083	58.41	18.08	1.22
.167	.61	6.167	1.17	12.167	34.07	18.17	1.22
.250	.91	6.250	1.22	12.250	9.74	18.25	1.22
.333	.91	6.333	1.22	12.333	9.73	18.33	1.22
.417	.91	6.417	1.22	12.417	9.73	18.42	1.22
.500	.91	6.500	1.22	12.500	9.73	18.50	1.22
.583	.91	6.583	1.22	12.583	8.16	18.58	1.22
.667	.91	6.667	1.22	12.667	6.58	18.67	1.22
.750	.91	6.750	1.22	12.750	5.00	18.75	1.22
.833	.91	6.833	1.22	12.833	5.00	18.83	1.22
.917	.91	6.917	1.22	12.917	5.00	18.92	1.22
1.000	.91	7.000	1.22	13.000	5.00	19.00	1.22
1.083	.91	7.083	1.31	13.083	4.55	19.08	1.22
1.167	.91	7.167	1.40	13.167	4.10	19.17	1.22
1.250	.91	7.250	1.49	13.250	3.65	19.25	1.22
1.333	.91	7.333	1.49	13.333	3.65	19.33	1.22
1.417	.91	7.417	1.49	13.417	3.65	19.42	1.22
1.500	.91	7.500	1.49	13.500	3.65	19.50	1.22
1.583	.91	7.583	1.49	13.583	3.38	19.58	1.22
1.667	.91	7.667	1.49	13.667	3.11	19.67	1.22
1.750	.91	7.750	1.49	13.750	2.84	19.75	1.22
1.833	.91	7.833	1.49	13.833	2.84	19.83	1.22
1.917	.91	7.917	1.49	13.917	2.84	19.92	1.22
2.000	.91	8.000	1.49	14.000	2.84	20.00	1.22
2.083	.84	8.083	1.58	14.083	2.57	20.08	1.08
2.167	.78	8.167	1.67	14.167	2.30	20.17	.95
2.250	.71	8.250	1.76	14.250	2.03	20.25	.81
2.333	.71	8.333	1.76	14.333	2.03	20.33	.81
2.417	.71	8.417	1.76	14.417	2.03	20.42	.81
2.500	.71	8.500	1.76	14.500	2.03	20.50	.81
2.583	.71	8.583	1.80	14.583	2.03	20.58	.81
2.667	.71	8.667	1.85	14.667	2.03	20.67	.81
2.750	.71	8.750	1.89	14.750	2.03	20.75	.81
2.833	.71	8.833	1.89	14.833	2.03	20.83	.81
2.917	.71	8.917	1.89	14.917	2.03	20.92	.81
3.000	.71	9.000	1.89	15.000	2.03	21.00	.81
3.083	.71	9.083	1.98	15.083	2.03	21.08	.81
3.167	.71	9.167	2.07	15.167	2.03	21.17	.81
3.250	.71	9.250	2.16	15.250	2.03	21.25	.81
3.333	.71	9.333	2.16	15.333	2.03	21.33	.81
3.417	.71	9.417	2.16	15.417	2.03	21.42	.81
3.500	.71	9.500	2.16	15.500	2.03	21.50	.81
3.583	.71	9.583	2.25	15.583	2.03	21.58	.81
3.667	.71	9.667	2.34	15.667	2.03	21.67	.81
3.750	.71	9.750	2.43	15.750	2.03	21.75	.81
3.833	.71	9.833	2.43	15.833	2.03	21.83	.81
3.917	.71	9.917	2.43	15.917	2.03	21.92	.81
4.000	.71	10.000	2.43	16.000	2.03	22.00	.81
4.083	.83	10.083	2.66	16.083	1.76	22.08	.81
4.167	.96	10.167	2.88	16.167	1.49	22.17	.81
4.250	1.08	10.250	3.11	16.250	1.22	22.25	.81
4.333	1.08	10.333	3.11	16.333	1.22	22.33	.81
4.417	1.08	10.417	3.11	16.417	1.22	22.42	.81
4.500	1.08	10.500	3.11	16.500	1.22	22.50	.81
4.583	1.08	10.583	3.47	16.583	1.22	22.58	.81
4.667	1.08	10.667	3.83	16.667	1.22	22.67	.81

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               4.750    1.08 |10.750    4.19 |16.750    1.22 | 22.75     .81
               4.833    1.08 |10.833    4.19 |16.833    1.22 | 22.83     .81
               4.917    1.08 |10.917    4.19 |16.917    1.22 | 22.92     .81
               5.000    1.08 |11.000    4.19 |17.000    1.22 | 23.00     .81
               5.083    1.08 |11.083    4.96 |17.083    1.22 | 23.08     .81
               5.167    1.08 |11.167    5.72 |17.167    1.22 | 23.17     .81
               5.250    1.08 |11.250    6.49 |17.250    1.22 | 23.25     .81
               5.333    1.08 |11.333    6.49 |17.333    1.22 | 23.33     .81
               5.417    1.08 |11.417    6.49 |17.417    1.22 | 23.42     .81
               5.500    1.08 |11.500    6.49 |17.500    1.22 | 23.50     .81
               5.583    1.08 |11.583   11.00 |17.583    1.22 | 23.58     .81
               5.667    1.08 |11.667   15.50 |17.667    1.22 | 23.67     .81
               5.750    1.08 |11.750   20.01 |17.750    1.22 | 23.75     .81
               5.833    1.08 |11.833   40.92 |17.833    1.22 | 23.83     .81
               5.917    1.08 |11.917   61.83 |17.917    1.22 | 23.92     .81
               6.000    1.08 |12.000   82.74 |18.000    1.22 | 24.00     .00

     Unit Hyd Qpeak  (cms)=   1.253

     PEAK FLOW       (cms)=    .902 (i)
     TIME TO PEAK    (hrs)=  12.833
     RUNOFF VOLUME    (mm)=  34.969
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0101) |   Area    (ha)=  83.94   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.02

     Unit Hyd Qpeak  (cms)=   3.143

     PEAK FLOW       (cms)=   2.388 (i)
     TIME TO PEAK    (hrs)=  13.083
     RUNOFF VOLUME    (mm)=  34.969
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0103) |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW       (cms)=    .697 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  34.967
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0301) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0102):    26.90    .902    12.83    34.97
        + ID2= 2 (0101):    83.94   2.388    13.08    34.97
          ================================================
          ID = 3 (0301):   110.84   3.263    13.00    34.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0301):   110.84   3.263    13.00    34.97
        + ID2= 2 (0103):    13.45    .697    12.42    34.97
          ================================================
          ID = 3 (0302):   124.29   3.692    12.92    34.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 77.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.35	6.08	1.29	12.08	67.05	18.08	1.40
.17	.70	6.17	1.35	12.17	39.11	18.17	1.40
.25	1.05	6.25	1.40	12.25	11.17	18.25	1.40
.33	1.05	6.33	1.40	12.33	11.17	18.33	1.40
.42	1.05	6.42	1.40	12.42	11.17	18.42	1.40
.50	1.05	6.50	1.40	12.50	11.17	18.50	1.40
.58	1.05	6.58	1.40	12.58	9.36	18.58	1.40
.67	1.05	6.67	1.40	12.67	7.55	18.67	1.40
.75	1.05	6.75	1.40	12.75	5.74	18.75	1.40
.83	1.05	6.83	1.40	12.83	5.74	18.83	1.40
.92	1.05	6.92	1.40	12.92	5.74	18.92	1.40
1.00	1.05	7.00	1.40	13.00	5.74	19.00	1.40
1.08	1.05	7.08	1.50	13.08	5.23	19.08	1.40
1.17	1.05	7.17	1.60	13.17	4.71	19.17	1.40
1.25	1.05	7.25	1.71	13.25	4.19	19.25	1.40
1.33	1.05	7.33	1.71	13.33	4.19	19.33	1.40
1.42	1.05	7.42	1.71	13.42	4.19	19.42	1.40
1.50	1.05	7.50	1.71	13.50	4.19	19.50	1.40
1.58	1.05	7.58	1.71	13.58	3.88	19.58	1.40
1.67	1.05	7.67	1.71	13.67	3.57	19.67	1.40
1.75	1.05	7.75	1.71	13.75	3.26	19.75	1.40
1.83	1.05	7.83	1.71	13.83	3.26	19.83	1.40
1.92	1.05	7.92	1.71	13.92	3.26	19.92	1.40
2.00	1.05	8.00	1.71	14.00	3.26	20.00	1.40
2.08	.97	8.08	1.81	14.08	2.95	20.08	1.24
2.17	.89	8.17	1.91	14.17	2.64	20.17	1.09
2.25	.82	8.25	2.02	14.25	2.33	20.25	.93
2.33	.82	8.33	2.02	14.33	2.33	20.33	.93
2.42	.81	8.42	2.02	14.42	2.33	20.42	.93
2.50	.81	8.50	2.02	14.50	2.33	20.50	.93
2.58	.81	8.58	2.07	14.58	2.33	20.58	.93
2.67	.82	8.67	2.12	14.67	2.33	20.67	.93
2.75	.82	8.75	2.17	14.75	2.33	20.75	.93
2.83	.82	8.83	2.17	14.83	2.33	20.83	.93
2.92	.81	8.92	2.17	14.92	2.33	20.92	.93
3.00	.81	9.00	2.17	15.00	2.33	21.00	.93
3.08	.81	9.08	2.28	15.08	2.33	21.08	.93
3.17	.82	9.17	2.38	15.17	2.33	21.17	.93
3.25	.82	9.25	2.48	15.25	2.33	21.25	.93
3.33	.82	9.33	2.48	15.33	2.33	21.33	.93
3.42	.81	9.42	2.48	15.42	2.33	21.42	.93
3.50	.81	9.50	2.48	15.50	2.33	21.50	.93
3.58	.81	9.58	2.59	15.58	2.33	21.58	.93
3.67	.82	9.67	2.69	15.67	2.33	21.67	.93
3.75	.82	9.75	2.79	15.75	2.33	21.75	.93
3.83	.82	9.83	2.79	15.83	2.33	21.83	.93
3.92	.81	9.92	2.79	15.92	2.33	21.92	.93
4.00	.81	10.00	2.79	16.00	2.33	22.00	.93
4.08	.96	10.08	3.05	16.08	2.02	22.08	.93
4.17	1.10	10.17	3.31	16.17	1.71	22.17	.93
4.25	1.24	10.25	3.57	16.25	1.40	22.25	.93
4.33	1.24	10.33	3.57	16.33	1.40	22.33	.93
4.42	1.24	10.42	3.57	16.42	1.40	22.42	.93
4.50	1.24	10.50	3.57	16.50	1.40	22.50	.93
4.58	1.24	10.58	3.98	16.58	1.40	22.58	.93
4.67	1.24	10.67	4.40	16.67	1.40	22.67	.93
4.75	1.24	10.75	4.81	16.75	1.40	22.75	.93
4.83	1.24	10.83	4.81	16.83	1.40	22.83	.93
4.92	1.24	10.92	4.81	16.92	1.40	22.92	.93
5.00	1.24	11.00	4.81	17.00	1.40	23.00	.93
5.08	1.24	11.08	5.69	17.08	1.40	23.08	.93
5.17	1.24	11.17	6.57	17.17	1.40	23.17	.93
5.25	1.24	11.25	7.45	17.25	1.40	23.25	.93
5.33	1.24	11.33	7.45	17.33	1.40	23.33	.93
5.42	1.24	11.42	7.45	17.42	1.40	23.42	.93
5.50	1.24	11.50	7.45	17.50	1.40	23.50	.93
5.58	1.24	11.58	12.62	17.58	1.40	23.58	.93
5.67	1.24	11.67	17.80	17.67	1.40	23.67	.93
5.75	1.24	11.75	22.97	17.75	1.40	23.75	.93
5.83	1.24	11.83	46.97	17.83	1.40	23.83	.93
5.92	1.24	11.92	70.98	17.92	1.40	23.92	.93
6.00	1.24	12.00	94.98	18.00	1.40	24.00	.93

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--------------------
| CALIB            |
| NASHYD    (0102) |   Area    (ha)=  26.90   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
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---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.35	6.083	1.29	12.083	67.05	18.08	1.40
.167	.70	6.167	1.35	12.167	39.11	18.17	1.40
.250	1.05	6.250	1.40	12.250	11.18	18.25	1.40
.333	1.05	6.333	1.40	12.333	11.17	18.33	1.40
.417	1.05	6.417	1.40	12.417	11.17	18.42	1.40
.500	1.05	6.500	1.40	12.500	11.17	18.50	1.40
.583	1.05	6.583	1.40	12.583	9.36	18.58	1.40
.667	1.05	6.667	1.40	12.667	7.55	18.67	1.40
.750	1.05	6.750	1.40	12.750	5.74	18.75	1.40
.833	1.05	6.833	1.40	12.833	5.74	18.83	1.40
.917	1.05	6.917	1.40	12.917	5.74	18.92	1.40
1.000	1.05	7.000	1.40	13.000	5.74	19.00	1.40
1.083	1.05	7.083	1.50	13.083	5.23	19.08	1.40
1.167	1.05	7.167	1.60	13.167	4.71	19.17	1.40
1.250	1.05	7.250	1.71	13.250	4.19	19.25	1.40
1.333	1.05	7.333	1.71	13.333	4.19	19.33	1.40
1.417	1.05	7.417	1.71	13.417	4.19	19.42	1.40
1.500	1.05	7.500	1.71	13.500	4.19	19.50	1.40
1.583	1.05	7.583	1.71	13.583	3.88	19.58	1.40
1.667	1.05	7.667	1.71	13.667	3.57	19.67	1.40
1.750	1.05	7.750	1.71	13.750	3.26	19.75	1.40
1.833	1.05	7.833	1.71	13.833	3.26	19.83	1.40
1.917	1.05	7.917	1.71	13.917	3.26	19.92	1.40
2.000	1.05	8.000	1.71	14.000	3.26	20.00	1.40
2.083	.97	8.083	1.81	14.083	2.95	20.08	1.24
2.167	.89	8.167	1.91	14.167	2.64	20.17	1.09
2.250	.82	8.250	2.02	14.250	2.33	20.25	.93
2.333	.82	8.333	2.02	14.333	2.33	20.33	.93
2.417	.81	8.417	2.02	14.417	2.33	20.42	.93
2.500	.81	8.500	2.02	14.500	2.33	20.50	.93
2.583	.81	8.583	2.07	14.583	2.33	20.58	.93
2.667	.82	8.667	2.12	14.667	2.33	20.67	.93
2.750	.82	8.750	2.17	14.750	2.33	20.75	.93
2.833	.82	8.833	2.17	14.833	2.33	20.83	.93
2.917	.81	8.917	2.17	14.917	2.33	20.92	.93
3.000	.81	9.000	2.17	15.000	2.33	21.00	.93
3.083	.81	9.083	2.28	15.083	2.33	21.08	.93
3.167	.82	9.167	2.38	15.167	2.33	21.17	.93
3.250	.82	9.250	2.48	15.250	2.33	21.25	.93
3.333	.82	9.333	2.48	15.333	2.33	21.33	.93
3.417	.81	9.417	2.48	15.417	2.33	21.42	.93
3.500	.81	9.500	2.48	15.500	2.33	21.50	.93
3.583	.81	9.583	2.59	15.583	2.33	21.58	.93
3.667	.82	9.667	2.69	15.667	2.33	21.67	.93
3.750	.82	9.750	2.79	15.750	2.33	21.75	.93
3.833	.82	9.833	2.79	15.833	2.33	21.83	.93
3.917	.81	9.917	2.79	15.917	2.33	21.92	.93
4.000	.81	10.000	2.79	16.000	2.33	22.00	.93
4.083	.96	10.083	3.05	16.083	2.02	22.08	.93
4.167	1.10	10.167	3.31	16.167	1.71	22.17	.93
4.250	1.24	10.250	3.57	16.250	1.40	22.25	.93
4.333	1.24	10.333	3.57	16.333	1.40	22.33	.93
4.417	1.24	10.417	3.57	16.417	1.40	22.42	.93
4.500	1.24	10.500	3.57	16.500	1.40	22.50	.93
4.583	1.24	10.583	3.98	16.583	1.40	22.58	.93
4.667	1.24	10.667	4.40	16.667	1.40	22.67	.93
4.750	1.24	10.750	4.81	16.750	1.40	22.75	.93
4.833	1.24	10.833	4.81	16.833	1.40	22.83	.93
4.917	1.24	10.917	4.81	16.917	1.40	22.92	.93
5.000	1.24	11.000	4.81	17.000	1.40	23.00	.93
5.083	1.24	11.083	5.69	17.083	1.40	23.08	.93
5.167	1.24	11.167	6.57	17.167	1.40	23.17	.93
5.250	1.24	11.250	7.45	17.250	1.40	23.25	.93
5.333	1.24	11.333	7.45	17.333	1.40	23.33	.93
5.417	1.24	11.417	7.45	17.417	1.40	23.42	.93
5.500	1.24	11.500	7.45	17.500	1.40	23.50	.93
5.583	1.24	11.583	12.62	17.583	1.40	23.58	.93
5.667	1.24	11.667	17.80	17.667	1.40	23.67	.93
5.750	1.24	11.750	22.97	17.750	1.40	23.75	.93
5.833	1.24	11.833	46.97	17.833	1.40	23.83	.93
5.917	1.24	11.917	70.98	17.917	1.40	23.92	.93
6.000	1.24	12.000	94.98	18.000	1.40	24.00	.00

Unit Hyd Qpeak (cms)=   1.253

```
     PEAK FLOW       (cms)=   1.124 (i)
     TIME TO PEAK    (hrs)=  12.833
     RUNOFF VOLUME    (mm)=  43.306
     TOTAL RAINFALL   (mm)=  77.445
     RUNOFF COEFFICIENT   =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0101) |   Area    (ha)=  83.94   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   1.02

     Unit Hyd Qpeak  (cms)=   3.143

     PEAK FLOW       (cms)=   2.975 (i)
     TIME TO PEAK    (hrs)=  13.083
     RUNOFF VOLUME    (mm)=  43.306
     TOTAL RAINFALL   (mm)=  77.445
     RUNOFF COEFFICIENT   =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0103) |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW       (cms)=    .867 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  43.303
     TOTAL RAINFALL   (mm)=  77.445
     RUNOFF COEFFICIENT   =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0301) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0102):    26.90   1.124    12.83    43.31
        + ID2= 2 (0101):    83.94   2.975    13.08    43.31
          ================================================
          ID = 3 (0301):   110.84   4.065    13.00    43.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0301):   110.84   4.065    13.00    43.31
        + ID2= 2 (0103):    13.45    .867    12.42    43.30
          ================================================
          ID = 3 (0302):   124.29   4.602    12.83    43.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ***************************
  ** SIMULATION NUMBER:   4 **
  ***************************

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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 90.20 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .41 |  6.08    1.50 | 12.08   77.93 | 18.08    1.62
                 .17     .81 |  6.17    1.56 | 12.17   45.46 | 18.17    1.62
```

.25	1.22	6.25	1.62	12.25	12.99	18.25	1.62
.33	1.22	6.33	1.62	12.33	12.99	18.33	1.62
.42	1.22	6.42	1.62	12.42	12.99	18.42	1.62
.50	1.22	6.50	1.62	12.50	12.99	18.50	1.62
.58	1.22	6.58	1.62	12.58	10.88	18.58	1.62
.67	1.22	6.67	1.62	12.67	8.78	18.67	1.62
.75	1.22	6.75	1.62	12.75	6.67	18.75	1.62
.83	1.22	6.83	1.62	12.83	6.67	18.83	1.62
.92	1.22	6.92	1.62	12.92	6.67	18.92	1.62
1.00	1.22	7.00	1.62	13.00	6.67	19.00	1.62
1.08	1.22	7.08	1.74	13.08	6.07	19.08	1.62
1.17	1.22	7.17	1.86	13.17	5.47	19.17	1.62
1.25	1.22	7.25	1.98	13.25	4.87	19.25	1.62
1.33	1.22	7.33	1.98	13.33	4.87	19.33	1.62
1.42	1.22	7.42	1.98	13.42	4.87	19.42	1.62
1.50	1.22	7.50	1.98	13.50	4.87	19.50	1.62
1.58	1.22	7.58	1.98	13.58	4.51	19.58	1.62
1.67	1.22	7.67	1.98	13.67	4.15	19.67	1.62
1.75	1.22	7.75	1.98	13.75	3.79	19.75	1.62
1.83	1.22	7.83	1.98	13.83	3.79	19.83	1.62
1.92	1.22	7.92	1.98	13.92	3.79	19.92	1.62
2.00	1.22	8.00	1.98	14.00	3.79	20.00	1.62
2.08	1.13	8.08	2.10	14.08	3.43	20.08	1.44
2.17	1.04	8.17	2.22	14.17	3.07	20.17	1.26
2.25	.95	8.25	2.35	14.25	2.71	20.25	1.08
2.33	.95	8.33	2.35	14.33	2.71	20.33	1.08
2.42	.95	8.42	2.35	14.42	2.71	20.42	1.08
2.50	.95	8.50	2.35	14.50	2.71	20.50	1.08
2.58	.95	8.58	2.41	14.58	2.71	20.58	1.08
2.67	.95	8.67	2.47	14.67	2.71	20.67	1.08
2.75	.95	8.75	2.53	14.75	2.71	20.75	1.08
2.83	.95	8.83	2.53	14.83	2.71	20.83	1.08
2.92	.95	8.92	2.53	14.92	2.71	20.92	1.08
3.00	.95	9.00	2.53	15.00	2.71	21.00	1.08
3.08	.95	9.08	2.65	15.08	2.71	21.08	1.08
3.17	.95	9.17	2.77	15.17	2.71	21.17	1.08
3.25	.95	9.25	2.89	15.25	2.71	21.25	1.08
3.33	.95	9.33	2.89	15.33	2.71	21.33	1.08
3.42	.95	9.42	2.89	15.42	2.71	21.42	1.08
3.50	.95	9.50	2.89	15.50	2.71	21.50	1.08
3.58	.95	9.58	3.01	15.58	2.71	21.58	1.08
3.67	.95	9.67	3.13	15.67	2.71	21.67	1.08
3.75	.95	9.75	3.25	15.75	2.71	21.75	1.08
3.83	.95	9.83	3.25	15.83	2.71	21.83	1.08
3.92	.95	9.92	3.25	15.92	2.71	21.92	1.08
4.00	.95	10.00	3.25	16.00	2.71	22.00	1.08
4.08	1.11	10.08	3.55	16.08	2.35	22.08	1.08
4.17	1.28	10.17	3.85	16.17	1.98	22.17	1.08
4.25	1.44	10.25	4.15	16.25	1.62	22.25	1.08
4.33	1.44	10.33	4.15	16.33	1.62	22.33	1.08
4.42	1.44	10.42	4.15	16.42	1.62	22.42	1.08
4.50	1.44	10.50	4.15	16.50	1.62	22.50	1.08
4.58	1.44	10.58	4.63	16.58	1.62	22.58	1.08
4.67	1.44	10.67	5.11	16.67	1.62	22.67	1.08
4.75	1.44	10.75	5.59	16.75	1.62	22.75	1.08
4.83	1.44	10.83	5.59	16.83	1.62	22.83	1.08
4.92	1.44	10.92	5.59	16.92	1.62	22.92	1.08
5.00	1.44	11.00	5.59	17.00	1.62	23.00	1.08
5.08	1.44	11.08	6.61	17.08	1.62	23.08	1.08
5.17	1.44	11.17	7.64	17.17	1.62	23.17	1.08
5.25	1.44	11.25	8.66	17.25	1.62	23.25	1.08
5.33	1.44	11.33	8.66	17.33	1.62	23.33	1.08
5.42	1.44	11.42	8.66	17.42	1.62	23.42	1.08
5.50	1.44	11.50	8.66	17.50	1.62	23.50	1.08
5.58	1.44	11.58	14.67	17.58	1.62	23.58	1.08
5.67	1.44	11.67	20.69	17.67	1.62	23.67	1.08
5.75	1.44	11.75	26.70	17.75	1.62	23.75	1.08
5.83	1.44	11.83	54.60	17.83	1.62	23.83	1.08
5.92	1.44	11.92	82.50	17.92	1.62	23.92	1.08
6.00	1.44	12.00	110.40	18.00	1.62	24.00	1.08

CALIB			
NASHYD (0102)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.41	6.083	1.50	12.083	77.94	18.08	1.62
.167	.81	6.167	1.56	12.167	45.47	18.17	1.62
.250	1.22	6.250	1.62	12.250	12.99	18.25	1.62
.333	1.22	6.333	1.62	12.333	12.99	18.33	1.62

.417	1.22	6.417	1.62	12.417	12.99	18.42	1.62
.500	1.22	6.500	1.62	12.500	12.99	18.50	1.62
.583	1.22	6.583	1.62	12.583	10.88	18.58	1.62
.667	1.22	6.667	1.62	12.667	8.78	18.67	1.62
.750	1.22	6.750	1.62	12.750	6.68	18.75	1.62
.833	1.22	6.833	1.62	12.833	6.67	18.83	1.62
.917	1.22	6.917	1.62	12.917	6.67	18.92	1.62
1.000	1.22	7.000	1.62	13.000	6.67	19.00	1.62
1.083	1.22	7.083	1.74	13.083	6.07	19.08	1.62
1.167	1.22	7.167	1.86	13.167	5.47	19.17	1.62
1.250	1.22	7.250	1.98	13.250	4.87	19.25	1.62
1.333	1.22	7.333	1.98	13.333	4.87	19.33	1.62
1.417	1.22	7.417	1.98	13.417	4.87	19.42	1.62
1.500	1.22	7.500	1.98	13.500	4.87	19.50	1.62
1.583	1.22	7.583	1.98	13.583	4.51	19.58	1.62
1.667	1.22	7.667	1.98	13.667	4.15	19.67	1.62
1.750	1.22	7.750	1.98	13.750	3.79	19.75	1.62
1.833	1.22	7.833	1.98	13.833	3.79	19.83	1.62
1.917	1.22	7.917	1.98	13.917	3.79	19.92	1.62
2.000	1.22	8.000	1.98	14.000	3.79	20.00	1.62
2.083	1.13	8.083	2.10	14.083	3.43	20.08	1.44
2.167	1.04	8.167	2.22	14.167	3.07	20.17	1.26
2.250	.95	8.250	2.35	14.250	2.71	20.25	1.08
2.333	.95	8.333	2.35	14.333	2.71	20.33	1.08
2.417	.95	8.417	2.35	14.417	2.71	20.42	1.08
2.500	.95	8.500	2.35	14.500	2.71	20.50	1.08
2.583	.95	8.583	2.41	14.583	2.71	20.58	1.08
2.667	.95	8.667	2.47	14.667	2.71	20.67	1.08
2.750	.95	8.750	2.53	14.750	2.71	20.75	1.08
2.833	.95	8.833	2.53	14.833	2.71	20.83	1.08
2.917	.95	8.917	2.53	14.917	2.71	20.92	1.08
3.000	.95	9.000	2.53	15.000	2.71	21.00	1.08
3.083	.95	9.083	2.65	15.083	2.71	21.08	1.08
3.167	.95	9.167	2.77	15.167	2.71	21.17	1.08
3.250	.95	9.250	2.89	15.250	2.71	21.25	1.08
3.333	.95	9.333	2.89	15.333	2.71	21.33	1.08
3.417	.95	9.417	2.89	15.417	2.71	21.42	1.08
3.500	.95	9.500	2.89	15.500	2.71	21.50	1.08
3.583	.95	9.583	3.01	15.583	2.71	21.58	1.08
3.667	.95	9.667	3.13	15.667	2.71	21.67	1.08
3.750	.95	9.750	3.25	15.750	2.71	21.75	1.08
3.833	.95	9.833	3.25	15.833	2.71	21.83	1.08
3.917	.95	9.917	3.25	15.917	2.71	21.92	1.08
4.000	.95	10.000	3.25	16.000	2.71	22.00	1.08
4.083	1.11	10.083	3.55	16.083	2.35	22.08	1.08
4.167	1.28	10.167	3.85	16.167	1.98	22.17	1.08
4.250	1.44	10.250	4.15	16.250	1.62	22.25	1.08
4.333	1.44	10.333	4.15	16.333	1.62	22.33	1.08
4.417	1.44	10.417	4.15	16.417	1.62	22.42	1.08
4.500	1.44	10.500	4.15	16.500	1.62	22.50	1.08
4.583	1.44	10.583	4.63	16.583	1.62	22.58	1.08
4.667	1.44	10.667	5.11	16.667	1.62	22.67	1.08
4.750	1.44	10.750	5.59	16.750	1.62	22.75	1.08
4.833	1.44	10.833	5.59	16.833	1.62	22.83	1.08
4.917	1.44	10.917	5.59	16.917	1.62	22.92	1.08
5.000	1.44	11.000	5.59	17.000	1.62	23.00	1.08
5.083	1.44	11.083	6.61	17.083	1.62	23.08	1.08
5.167	1.44	11.167	7.64	17.167	1.62	23.17	1.08
5.250	1.44	11.250	8.66	17.250	1.62	23.25	1.08
5.333	1.44	11.333	8.66	17.333	1.62	23.33	1.08
5.417	1.44	11.417	8.66	17.417	1.62	23.42	1.08
5.500	1.44	11.500	8.66	17.500	1.62	23.50	1.08
5.583	1.44	11.583	14.67	17.583	1.62	23.58	1.08
5.667	1.44	11.667	20.69	17.667	1.62	23.67	1.08
5.750	1.44	11.750	26.70	17.750	1.62	23.75	1.08
5.833	1.44	11.833	54.60	17.833	1.62	23.83	1.08
5.917	1.44	11.917	82.50	17.917	1.62	23.92	1.08
6.000	1.44	12.000	110.40	18.000	1.62	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.411 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 54.175
TOTAL RAINFALL (mm)= 90.020
RUNOFF COEFFICIENT = .602

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
NASHYD (0101)	Area (ha)= 83.94	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 1.02		

Unit Hyd Qpeak (cms)= 3.143

```
     PEAK FLOW      (cms)=   3.735 (i)
     TIME TO PEAK   (hrs)=  13.083
     RUNOFF VOLUME   (mm)=  54.175
     TOTAL RAINFALL  (mm)=  90.020
     RUNOFF COEFFICIENT  =    .602

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0103) |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW      (cms)=   1.087 (i)
     TIME TO PEAK   (hrs)=  12.417
     RUNOFF VOLUME   (mm)=  54.171
     TOTAL RAINFALL  (mm)=  90.020
     RUNOFF COEFFICIENT  =    .602

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0301) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0102):    26.90   1.411    12.83    54.17
       + ID2= 2 (0101):    83.94   3.735    13.08    54.18
         ================================================
         ID = 3 (0301):   110.84   5.105    13.00    54.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0301):   110.84   5.105    13.00    54.17
       + ID2= 2 (0103):    13.45   1.087    12.42    54.17
         ================================================
         ID = 3 (0302):   124.29   5.785    12.83    54.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   5 **
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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 99.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .45 |  6.08    1.66 | 12.08   86.05 | 18.08    1.79
                 .17     .90 |  6.17    1.73 | 12.17   50.20 | 18.17    1.79
                 .25    1.35 |  6.25    1.79 | 12.25   14.34 | 18.25    1.79
                 .33    1.35 |  6.33    1.79 | 12.33   14.34 | 18.33    1.79
                 .42    1.34 |  6.42    1.79 | 12.42   14.34 | 18.42    1.79
                 .50    1.34 |  6.50    1.79 | 12.50   14.34 | 18.50    1.79
                 .58    1.34 |  6.58    1.79 | 12.58   12.02 | 18.58    1.79
                 .67    1.35 |  6.67    1.79 | 12.67    9.69 | 18.67    1.79
                 .75    1.35 |  6.75    1.79 | 12.75    7.37 | 18.75    1.79
                 .83    1.35 |  6.83    1.79 | 12.83    7.37 | 18.83    1.79
                 .92    1.34 |  6.92    1.79 | 12.92    7.37 | 18.92    1.79
                1.00    1.34 |  7.00    1.79 | 13.00    7.37 | 19.00    1.79
                1.08    1.34 |  7.08    1.93 | 13.08    6.71 | 19.08    1.79
                1.17    1.35 |  7.17    2.06 | 13.17    6.04 | 19.17    1.79
                1.25    1.35 |  7.25    2.19 | 13.25    5.38 | 19.25    1.79
                1.33    1.35 |  7.33    2.19 | 13.33    5.38 | 19.33    1.79
                1.42    1.34 |  7.42    2.19 | 13.42    5.38 | 19.42    1.79
                1.50    1.34 |  7.50    2.19 | 13.50    5.38 | 19.50    1.79
                1.58    1.34 |  7.58    2.19 | 13.58    4.98 | 19.58    1.79
                1.67    1.35 |  7.67    2.19 | 13.67    4.58 | 19.67    1.79
```

1.75	1.35	7.75	2.19	13.75	4.18	19.75	1.79
1.83	1.35	7.83	2.19	13.83	4.18	19.83	1.79
1.92	1.34	7.92	2.19	13.92	4.18	19.92	1.79
2.00	1.34	8.00	2.19	14.00	4.18	20.00	1.79
2.08	1.24	8.08	2.32	14.08	3.78	20.08	1.59
2.17	1.15	8.17	2.46	14.17	3.39	20.17	1.39
2.25	1.05	8.25	2.59	14.25	2.99	20.25	1.20
2.33	1.05	8.33	2.59	14.33	2.99	20.33	1.20
2.42	1.05	8.42	2.59	14.42	2.99	20.42	1.20
2.50	1.04	8.50	2.59	14.50	2.99	20.50	1.20
2.58	1.05	8.58	2.66	14.58	2.99	20.58	1.20
2.67	1.05	8.67	2.72	14.67	2.99	20.67	1.20
2.75	1.05	8.75	2.79	14.75	2.99	20.75	1.20
2.83	1.05	8.83	2.79	14.83	2.99	20.83	1.20
2.92	1.05	8.92	2.79	14.92	2.99	20.92	1.20
3.00	1.04	9.00	2.79	15.00	2.99	21.00	1.20
3.08	1.05	9.08	2.92	15.08	2.99	21.08	1.20
3.17	1.05	9.17	3.05	15.17	2.99	21.17	1.20
3.25	1.05	9.25	3.19	15.25	2.99	21.25	1.20
3.33	1.05	9.33	3.19	15.33	2.99	21.33	1.20
3.42	1.05	9.42	3.19	15.42	2.99	21.42	1.20
3.50	1.04	9.50	3.19	15.50	2.99	21.50	1.20
3.58	1.05	9.58	3.32	15.58	2.99	21.58	1.20
3.67	1.05	9.67	3.45	15.67	2.99	21.67	1.20
3.75	1.05	9.75	3.59	15.75	2.99	21.75	1.20
3.83	1.05	9.83	3.59	15.83	2.99	21.83	1.20
3.92	1.05	9.92	3.59	15.92	2.99	21.92	1.20
4.00	1.04	10.00	3.59	16.00	2.99	22.00	1.20
4.08	1.23	10.08	3.92	16.08	2.59	22.08	1.20
4.17	1.41	10.17	4.25	16.17	2.19	22.17	1.20
4.25	1.59	10.25	4.58	16.25	1.79	22.25	1.20
4.33	1.59	10.33	4.58	16.33	1.79	22.33	1.20
4.42	1.59	10.42	4.58	16.42	1.79	22.42	1.20
4.50	1.59	10.50	4.58	16.50	1.79	22.50	1.20
4.58	1.59	10.58	5.11	16.58	1.79	22.58	1.20
4.67	1.59	10.67	5.64	16.67	1.79	22.67	1.20
4.75	1.59	10.75	6.18	16.75	1.79	22.75	1.20
4.83	1.59	10.83	6.18	16.83	1.79	22.83	1.20
4.92	1.59	10.92	6.18	16.92	1.79	22.92	1.20
5.00	1.59	11.00	6.18	17.00	1.79	23.00	1.20
5.08	1.59	11.08	7.30	17.08	1.79	23.08	1.20
5.17	1.59	11.17	8.43	17.17	1.79	23.17	1.20
5.25	1.59	11.25	9.56	17.25	1.79	23.25	1.20
5.33	1.59	11.33	9.56	17.33	1.79	23.33	1.20
5.42	1.59	11.42	9.56	17.42	1.79	23.42	1.20
5.50	1.59	11.50	9.56	17.50	1.79	23.50	1.20
5.58	1.59	11.58	16.20	17.58	1.79	23.58	1.20
5.67	1.59	11.67	22.84	17.67	1.79	23.67	1.20
5.75	1.59	11.75	29.48	17.75	1.79	23.75	1.20
5.83	1.59	11.83	60.29	17.83	1.79	23.83	1.20
5.92	1.59	11.92	91.10	17.92	1.79	23.92	1.20
6.00	1.59	12.00	121.91	18.00	1.79	24.00	1.20

CALIB			
NASHYD (0102)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.45	6.083	1.66	12.083	86.06	18.08	1.79
.167	.90	6.167	1.73	12.167	50.20	18.17	1.79
.250	1.35	6.250	1.79	12.250	14.35	18.25	1.79
.333	1.35	6.333	1.79	12.333	14.34	18.33	1.79
.417	1.34	6.417	1.79	12.417	14.34	18.42	1.79
.500	1.34	6.500	1.79	12.500	14.34	18.50	1.79
.583	1.34	6.583	1.79	12.583	12.02	18.58	1.79
.667	1.35	6.667	1.79	12.667	9.69	18.67	1.79
.750	1.35	6.750	1.79	12.750	7.37	18.75	1.79
.833	1.35	6.833	1.79	12.833	7.37	18.83	1.79
.917	1.34	6.917	1.79	12.917	7.37	18.92	1.79
1.000	1.34	7.000	1.79	13.000	7.37	19.00	1.79
1.083	1.34	7.083	1.93	13.083	6.71	19.08	1.79
1.167	1.35	7.167	2.06	13.167	6.04	19.17	1.79
1.250	1.35	7.250	2.19	13.250	5.38	19.25	1.79
1.333	1.35	7.333	2.19	13.333	5.38	19.33	1.79
1.417	1.34	7.417	2.19	13.417	5.38	19.42	1.79
1.500	1.34	7.500	2.19	13.500	5.38	19.50	1.79
1.583	1.34	7.583	2.19	13.583	4.98	19.58	1.79
1.667	1.35	7.667	2.19	13.667	4.58	19.67	1.79
1.750	1.35	7.750	2.19	13.750	4.18	19.75	1.79
1.833	1.35	7.833	2.19	13.833	4.18	19.83	1.79

1.917	1.34	7.917	2.19	13.917	4.18	19.92	1.79
2.000	1.34	8.000	2.19	14.000	4.18	20.00	1.79
2.083	1.24	8.083	2.32	14.083	3.78	20.08	1.59
2.167	1.15	8.167	2.46	14.167	3.39	20.17	1.39
2.250	1.05	8.250	2.59	14.250	2.99	20.25	1.20
2.333	1.05	8.333	2.59	14.333	2.99	20.33	1.20
2.417	1.05	8.417	2.59	14.417	2.99	20.42	1.20
2.500	1.04	8.500	2.59	14.500	2.99	20.50	1.20
2.583	1.05	8.583	2.66	14.583	2.99	20.58	1.20
2.667	1.05	8.667	2.72	14.667	2.99	20.67	1.20
2.750	1.05	8.750	2.79	14.750	2.99	20.75	1.20
2.833	1.05	8.833	2.79	14.833	2.99	20.83	1.20
2.917	1.05	8.917	2.79	14.917	2.99	20.92	1.20
3.000	1.04	9.000	2.79	15.000	2.99	21.00	1.20
3.083	1.05	9.083	2.92	15.083	2.99	21.08	1.20
3.167	1.05	9.167	3.05	15.167	2.99	21.17	1.20
3.250	1.05	9.250	3.19	15.250	2.99	21.25	1.20
3.333	1.05	9.333	3.19	15.333	2.99	21.33	1.20
3.417	1.05	9.417	3.19	15.417	2.99	21.42	1.20
3.500	1.04	9.500	3.19	15.500	2.99	21.50	1.20
3.583	1.05	9.583	3.32	15.583	2.99	21.58	1.20
3.667	1.05	9.667	3.45	15.667	2.99	21.67	1.20
3.750	1.05	9.750	3.59	15.750	2.99	21.75	1.20
3.833	1.05	9.833	3.59	15.833	2.99	21.83	1.20
3.917	1.05	9.917	3.59	15.917	2.99	21.92	1.20
4.000	1.04	10.000	3.59	16.000	2.99	22.00	1.20
4.083	1.23	10.083	3.92	16.083	2.59	22.08	1.20
4.167	1.41	10.167	4.25	16.167	2.19	22.17	1.20
4.250	1.59	10.250	4.58	16.250	1.79	22.25	1.20
4.333	1.59	10.333	4.58	16.333	1.79	22.33	1.20
4.417	1.59	10.417	4.58	16.417	1.79	22.42	1.20
4.500	1.59	10.500	4.58	16.500	1.79	22.50	1.20
4.583	1.59	10.583	5.11	16.583	1.79	22.58	1.20
4.667	1.59	10.667	5.64	16.667	1.79	22.67	1.20
4.750	1.59	10.750	6.18	16.750	1.79	22.75	1.20
4.833	1.59	10.833	6.18	16.833	1.79	22.83	1.20
4.917	1.59	10.917	6.18	16.917	1.79	22.92	1.20
5.000	1.59	11.000	6.18	17.000	1.79	23.00	1.20
5.083	1.59	11.083	7.30	17.083	1.79	23.08	1.20
5.167	1.59	11.167	8.43	17.167	1.79	23.17	1.20
5.250	1.59	11.250	9.56	17.250	1.79	23.25	1.20
5.333	1.59	11.333	9.56	17.333	1.79	23.33	1.20
5.417	1.59	11.417	9.56	17.417	1.79	23.42	1.20
5.500	1.59	11.500	9.56	17.500	1.79	23.50	1.20
5.583	1.59	11.583	16.20	17.583	1.79	23.58	1.20
5.667	1.59	11.667	22.84	17.667	1.79	23.67	1.20
5.750	1.59	11.750	29.48	17.750	1.79	23.75	1.20
5.833	1.59	11.833	60.29	17.833	1.79	23.83	1.20
5.917	1.59	11.917	91.10	17.917	1.79	23.92	1.20
6.000	1.59	12.000	121.91	18.000	1.79	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.630 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 62.486
TOTAL RAINFALL (mm)= 99.401
RUNOFF COEFFICIENT = .629

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0101)	Area (ha)=	83.94	Curve Number (CN)=	85.0	
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	1.02			

Unit Hyd Qpeak (cms)= 3.143

PEAK FLOW (cms)= 4.314 (i)
TIME TO PEAK (hrs)= 13.083
RUNOFF VOLUME (mm)= 62.487
TOTAL RAINFALL (mm)= 99.401
RUNOFF COEFFICIENT = .629

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0103)	Area (ha)=	13.45	Curve Number (CN)=	85.0	
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.45			

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.255 (i)

```
    TIME TO PEAK    (hrs)=  12.417
    RUNOFF VOLUME    (mm)=  62.482
    TOTAL RAINFALL   (mm)=  99.401
    RUNOFF COEFFICIENT   =    .629

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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ADD HYD (0301)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0102):	26.90	1.630	12.83	62.49
	+ ID2= 2 (0101):	83.94	4.314	13.08	62.49
	ID = 3 (0301):	110.84	5.896	13.00	62.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	5.896	13.00	62.49
	+ ID2= 2 (0103):	13.45	1.255	12.42	62.48
	ID = 3 (0302):	124.29	6.686	12.83	62.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   6 **
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MASS STORM	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Scs24h.mst
Ptotal=108.90 mm	Comments: SCS 24 HR MASS CURVE

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                    Duration of storm    = 24.00 hrs
                    Mass curve time step = 15.00 min
                    New Storm time step  =  5.00 min
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TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.49	6.08	1.82	12.08	94.09	18.08	1.96
.17	.98	6.17	1.89	12.17	54.89	18.17	1.96
.25	1.47	6.25	1.96	12.25	15.68	18.25	1.96
.33	1.47	6.33	1.96	12.33	15.68	18.33	1.96
.42	1.47	6.42	1.96	12.42	15.68	18.42	1.96
.50	1.47	6.50	1.96	12.50	15.68	18.50	1.96
.58	1.47	6.58	1.96	12.58	13.14	18.58	1.96
.67	1.47	6.67	1.96	12.67	10.60	18.67	1.96
.75	1.47	6.75	1.96	12.75	8.06	18.75	1.96
.83	1.47	6.83	1.96	12.83	8.06	18.83	1.96
.92	1.47	6.92	1.96	12.92	8.06	18.92	1.96
1.00	1.47	7.00	1.96	13.00	8.06	19.00	1.96
1.08	1.47	7.08	2.11	13.08	7.33	19.08	1.96
1.17	1.47	7.17	2.25	13.17	6.61	19.17	1.96
1.25	1.47	7.25	2.40	13.25	5.88	19.25	1.96
1.33	1.47	7.33	2.40	13.33	5.88	19.33	1.96
1.42	1.47	7.42	2.40	13.42	5.88	19.42	1.96
1.50	1.47	7.50	2.40	13.50	5.88	19.50	1.96
1.58	1.47	7.58	2.40	13.58	5.45	19.58	1.96
1.67	1.47	7.67	2.40	13.67	5.01	19.67	1.96
1.75	1.47	7.75	2.40	13.75	4.57	19.75	1.96
1.83	1.47	7.83	2.40	13.83	4.57	19.83	1.96
1.92	1.47	7.92	2.40	13.92	4.57	19.92	1.96
2.00	1.47	8.00	2.40	14.00	4.57	20.00	1.96
2.08	1.36	8.08	2.54	14.08	4.14	20.08	1.74
2.17	1.25	8.17	2.69	14.17	3.70	20.17	1.52
2.25	1.15	8.25	2.83	14.25	3.27	20.25	1.31
2.33	1.14	8.33	2.83	14.33	3.27	20.33	1.31
2.42	1.14	8.42	2.83	14.42	3.27	20.42	1.31
2.50	1.14	8.50	2.83	14.50	3.27	20.50	1.31
2.58	1.14	8.58	2.90	14.58	3.27	20.58	1.31
2.67	1.14	8.67	2.98	14.67	3.27	20.67	1.31
2.75	1.15	8.75	3.05	14.75	3.27	20.75	1.31
2.83	1.14	8.83	3.05	14.83	3.27	20.83	1.31
2.92	1.14	8.92	3.05	14.92	3.27	20.92	1.31
3.00	1.14	9.00	3.05	15.00	3.27	21.00	1.31
3.08	1.14	9.08	3.19	15.08	3.27	21.08	1.31
3.17	1.14	9.17	3.34	15.17	3.27	21.17	1.31

3.25	1.15	9.25	3.48	15.25	3.27	21.25	1.31
3.33	1.14	9.33	3.48	15.33	3.27	21.33	1.31
3.42	1.14	9.42	3.48	15.42	3.27	21.42	1.31
3.50	1.14	9.50	3.48	15.50	3.27	21.50	1.31
3.58	1.14	9.58	3.63	15.58	3.27	21.58	1.31
3.67	1.14	9.67	3.78	15.67	3.27	21.67	1.31
3.75	1.15	9.75	3.92	15.75	3.27	21.75	1.31
3.83	1.14	9.83	3.92	15.83	3.27	21.83	1.31
3.92	1.14	9.92	3.92	15.92	3.27	21.92	1.31
4.00	1.14	10.00	3.92	16.00	3.27	22.00	1.31
4.08	1.34	10.08	4.28	16.08	2.83	22.08	1.31
4.17	1.54	10.17	4.65	16.17	2.40	22.17	1.31
4.25	1.74	10.25	5.01	16.25	1.96	22.25	1.31
4.33	1.74	10.33	5.01	16.33	1.96	22.33	1.31
4.42	1.74	10.42	5.01	16.42	1.96	22.42	1.31
4.50	1.74	10.50	5.01	16.50	1.96	22.50	1.31
4.58	1.74	10.58	5.59	16.58	1.96	22.58	1.31
4.67	1.74	10.67	6.17	16.67	1.96	22.67	1.31
4.75	1.74	10.75	6.75	16.75	1.96	22.75	1.31
4.83	1.74	10.83	6.75	16.83	1.96	22.83	1.31
4.92	1.74	10.92	6.75	16.92	1.96	22.92	1.31
5.00	1.74	11.00	6.75	17.00	1.96	23.00	1.31
5.08	1.74	11.08	7.99	17.08	1.96	23.08	1.31
5.17	1.74	11.17	9.22	17.17	1.96	23.17	1.31
5.25	1.74	11.25	10.45	17.25	1.96	23.25	1.31
5.33	1.74	11.33	10.45	17.33	1.96	23.33	1.31
5.42	1.74	11.42	10.45	17.42	1.96	23.42	1.31
5.50	1.74	11.50	10.45	17.50	1.96	23.50	1.31
5.58	1.74	11.58	17.71	17.58	1.96	23.58	1.31
5.67	1.74	11.67	24.97	17.67	1.96	23.67	1.31
5.75	1.74	11.75	32.23	17.75	1.96	23.75	1.31
5.83	1.74	11.83	65.92	17.83	1.96	23.83	1.31
5.92	1.74	11.92	99.61	17.92	1.96	23.92	1.31
6.00	1.74	12.00	133.29	18.00	1.96	24.00	1.31

CALIB			
NASHYD (0102)	Area (ha)=	26.90	Curve Number (CN)= 85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	.82	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.49	6.083	1.82	12.083	94.09	18.08	1.96
.167	.98	6.167	1.89	12.167	54.89	18.17	1.96
.250	1.47	6.250	1.96	12.250	15.69	18.25	1.96
.333	1.47	6.333	1.96	12.333	15.68	18.33	1.96
.417	1.47	6.417	1.96	12.417	15.68	18.42	1.96
.500	1.47	6.500	1.96	12.500	15.68	18.50	1.96
.583	1.47	6.583	1.96	12.583	13.14	18.58	1.96
.667	1.47	6.667	1.96	12.667	10.60	18.67	1.96
.750	1.47	6.750	1.96	12.750	8.06	18.75	1.96
.833	1.47	6.833	1.96	12.833	8.06	18.83	1.96
.917	1.47	6.917	1.96	12.917	8.06	18.92	1.96
1.000	1.47	7.000	1.96	13.000	8.06	19.00	1.96
1.083	1.47	7.083	2.11	13.083	7.33	19.08	1.96
1.167	1.47	7.167	2.25	13.167	6.61	19.17	1.96
1.250	1.47	7.250	2.40	13.250	5.88	19.25	1.96
1.333	1.47	7.333	2.40	13.333	5.88	19.33	1.96
1.417	1.47	7.417	2.40	13.417	5.88	19.42	1.96
1.500	1.47	7.500	2.40	13.500	5.88	19.50	1.96
1.583	1.47	7.583	2.40	13.583	5.45	19.58	1.96
1.667	1.47	7.667	2.40	13.667	5.01	19.67	1.96
1.750	1.47	7.750	2.40	13.750	4.57	19.75	1.96
1.833	1.47	7.833	2.40	13.833	4.57	19.83	1.96
1.917	1.47	7.917	2.40	13.917	4.57	19.92	1.96
2.000	1.47	8.000	2.40	14.000	4.57	20.00	1.96
2.083	1.36	8.083	2.54	14.083	4.14	20.08	1.74
2.167	1.25	8.167	2.69	14.167	3.70	20.17	1.52
2.250	1.15	8.250	2.83	14.250	3.27	20.25	1.31
2.333	1.14	8.333	2.83	14.333	3.27	20.33	1.31
2.417	1.14	8.417	2.83	14.417	3.27	20.42	1.31
2.500	1.14	8.500	2.83	14.500	3.27	20.50	1.31
2.583	1.14	8.583	2.90	14.583	3.27	20.58	1.31
2.667	1.14	8.667	2.98	14.667	3.27	20.67	1.31
2.750	1.15	8.750	3.05	14.750	3.27	20.75	1.31
2.833	1.14	8.833	3.05	14.833	3.27	20.83	1.31
2.917	1.14	8.917	3.05	14.917	3.27	20.92	1.31
3.000	1.14	9.000	3.05	15.000	3.27	21.00	1.31
3.083	1.14	9.083	3.19	15.083	3.27	21.08	1.31
3.167	1.14	9.167	3.34	15.167	3.27	21.17	1.31
3.250	1.15	9.250	3.48	15.250	3.27	21.25	1.31
3.333	1.14	9.333	3.48	15.333	3.27	21.33	1.31

3.417	1.14	9.417	3.48	15.417	3.27	21.42	1.31
3.500	1.14	9.500	3.48	15.500	3.27	21.50	1.31
3.583	1.14	9.583	3.63	15.583	3.27	21.58	1.31
3.667	1.14	9.667	3.78	15.667	3.27	21.67	1.31
3.750	1.15	9.750	3.92	15.750	3.27	21.75	1.31
3.833	1.14	9.833	3.92	15.833	3.27	21.83	1.31
3.917	1.14	9.917	3.92	15.917	3.27	21.92	1.31
4.000	1.14	10.000	3.92	16.000	3.27	22.00	1.31
4.083	1.34	10.083	4.28	16.083	2.83	22.08	1.31
4.167	1.54	10.167	4.65	16.167	2.40	22.17	1.31
4.250	1.74	10.250	5.01	16.250	1.96	22.25	1.31
4.333	1.74	10.333	5.01	16.333	1.96	22.33	1.31
4.417	1.74	10.417	5.01	16.417	1.96	22.42	1.31
4.500	1.74	10.500	5.01	16.500	1.96	22.50	1.31
4.583	1.74	10.583	5.59	16.583	1.96	22.58	1.31
4.667	1.74	10.667	6.17	16.667	1.96	22.67	1.31
4.750	1.74	10.750	6.75	16.750	1.96	22.75	1.31
4.833	1.74	10.833	6.75	16.833	1.96	22.83	1.31
4.917	1.74	10.917	6.75	16.917	1.96	22.92	1.31
5.000	1.74	11.000	6.75	17.000	1.96	23.00	1.31
5.083	1.74	11.083	7.99	17.083	1.96	23.08	1.31
5.167	1.74	11.167	9.22	17.167	1.96	23.17	1.31
5.250	1.74	11.250	10.45	17.250	1.96	23.25	1.31
5.333	1.74	11.333	10.45	17.333	1.96	23.33	1.31
5.417	1.74	11.417	10.45	17.417	1.96	23.42	1.31
5.500	1.74	11.500	10.45	17.500	1.96	23.50	1.31
5.583	1.74	11.583	17.71	17.583	1.96	23.58	1.31
5.667	1.74	11.667	24.97	17.667	1.96	23.67	1.31
5.750	1.74	11.750	32.23	17.750	1.96	23.75	1.31
5.833	1.74	11.833	65.92	17.833	1.96	23.83	1.31
5.917	1.74	11.917	99.60	17.917	1.96	23.92	1.31
6.000	1.74	12.000	133.29	18.000	1.96	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.848 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 70.844
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0101)	Area (ha)=	83.94	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	1.02		

Unit Hyd Qpeak (cms)= 3.143

PEAK FLOW (cms)= 4.893 (i)
TIME TO PEAK (hrs)= 13.000
RUNOFF VOLUME (mm)= 70.844
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0103)	Area (ha)=	13.45	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.45		

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.423 (i)
TIME TO PEAK (hrs)= 12.417
RUNOFF VOLUME (mm)= 70.839
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)

1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0102):	26.90	1.848	12.83	70.84
+ ID2= 2 (0101):	83.94	4.893	13.00	70.84
ID = 3 (0301):	110.84	6.689	13.00	70.84

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	6.689	13.00	70.84
	+ ID2= 2 (0103):	13.45	1.423	12.42	70.84
	ID = 3 (0302):	124.29	7.588	12.83	70.84

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

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      V    V   I    SSSSS  U   U    A    L
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

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Output filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Pre-development - Regional.out
Summary filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Pre-development - Regional.sum

DATE: 12/22/2009 TIME: 12:06:05 PM

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 7 **
****

MASS STORM Ptotal=211.00 mm	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Hazel12.mst Comments: Hurricane Hazel (last 12 h)

Duration of storm = 12.00 hrs
Mass curve time step = 60.00 min
New Storm time step = 10.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	1.06	3.17	7.39	6.17	14.42	9.17	19.34
.33	2.11	3.33	8.44	6.33	16.18	9.33	26.02
.50	3.16	3.50	9.50	6.50	17.93	9.50	32.71
.67	4.22	3.67	10.55	6.67	19.69	9.67	39.39
.83	5.28	3.83	11.61	6.83	21.45	9.83	46.07
1.00	6.33	4.00	12.66	7.00	23.21	10.00	52.75
1.17	5.98	4.17	13.36	7.17	21.45	10.17	50.29
1.33	5.63	4.33	14.07	7.33	19.69	10.33	47.83
1.50	5.28	4.50	14.77	7.50	17.94	10.50	45.36
1.67	4.92	4.67	15.47	7.67	16.18	10.67	42.90
1.83	4.57	4.83	16.18	7.83	14.42	10.83	40.44
2.00	4.22	5.00	16.88	8.00	12.66	11.00	37.98
2.17	4.57	5.17	16.18	8.17	12.66	11.17	33.76
2.33	4.92	5.33	15.47	8.33	12.66	11.33	29.54
2.50	5.28	5.50	14.77	8.50	12.66	11.50	25.32
2.67	5.63	5.67	14.07	8.67	12.66	11.67	21.10
2.83	5.98	5.83	13.36	8.83	12.66	11.83	16.88
3.00	6.33	6.00	12.66	9.00	12.66	12.00	12.66

CALIB NASHYD (0102) ID= 1 DT= 5.0 min	Area (ha)= 26.90 Curve Number (CN)= 93.5 Ia (mm)= 3.50 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= .82

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	1.06	3.083	7.38	6.083	14.42	9.08	19.34
.167	1.06	3.167	7.39	6.167	14.42	9.17	19.34
.250	2.11	3.250	8.44	6.250	16.18	9.25	26.02
.333	2.11	3.333	8.44	6.333	16.18	9.33	26.02

.417	3.17	3.417	9.49	6.417	17.93	9.42	32.71
.500	3.17	3.500	9.50	6.500	17.94	9.50	32.71
.583	4.22	3.583	10.55	6.583	19.69	9.58	39.39
.667	4.22	3.667	10.55	6.667	19.69	9.67	39.39
.750	5.27	3.750	11.60	6.750	21.45	9.75	46.07
.833	5.28	3.833	11.61	6.833	21.45	9.83	46.07
.917	6.33	3.917	12.66	6.917	23.21	9.92	52.75
1.000	6.33	4.000	12.66	7.000	23.21	10.00	52.75
1.083	5.98	4.083	13.36	7.083	21.45	10.08	50.29
1.167	5.98	4.167	13.36	7.167	21.45	10.17	50.29
1.250	5.63	4.250	14.07	7.250	19.69	10.25	47.83
1.333	5.63	4.333	14.07	7.333	19.69	10.33	47.83
1.417	5.28	4.417	14.77	7.417	17.94	10.42	45.37
1.500	5.27	4.500	14.77	7.500	17.93	10.50	45.36
1.583	4.92	4.583	15.47	7.583	16.18	10.58	42.90
1.667	4.92	4.667	15.47	7.667	16.18	10.67	42.90
1.750	4.57	4.750	16.18	7.750	14.42	10.75	40.44
1.833	4.57	4.833	16.18	7.833	14.42	10.83	40.44
1.917	4.22	4.917	16.88	7.917	12.66	10.92	37.98
2.000	4.22	5.000	16.88	8.000	12.66	11.00	37.98
2.083	4.57	5.083	16.18	8.083	12.66	11.08	33.76
2.167	4.57	5.167	16.18	8.167	12.66	11.17	33.76
2.250	4.92	5.250	15.47	8.250	12.66	11.25	29.54
2.333	4.92	5.333	15.47	8.333	12.66	11.33	29.54
2.417	5.27	5.417	14.77	8.417	12.66	11.42	25.32
2.500	5.28	5.500	14.77	8.500	12.66	11.50	25.32
2.583	5.63	5.583	14.07	8.583	12.66	11.58	21.10
2.667	5.63	5.667	14.07	8.667	12.66	11.67	21.10
2.750	5.98	5.750	13.36	8.750	12.66	11.75	16.88
2.833	5.98	5.833	13.36	8.833	12.66	11.83	16.88
2.917	6.33	5.917	12.66	8.917	12.66	11.92	12.66
3.000	6.33	6.000	12.66	9.000	12.66	12.00	12.66

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 2.961 (i)
TIME TO PEAK (hrs)= 11.250
RUNOFF VOLUME (mm)= 185.984
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0101)	Area (ha)=	83.94	Curve Number (CN)=	93.5	
ID= 1 DT= 5.0 min	Ia (mm)=	3.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	1.02			

Unit Hyd Qpeak (cms)= 3.143

PEAK FLOW (cms)= 8.675 (i)
TIME TO PEAK (hrs)= 11.500
RUNOFF VOLUME (mm)= 185.985
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0103)	Area (ha)=	13.45	Curve Number (CN)=	93.5	
ID= 1 DT= 5.0 min	Ia (mm)=	3.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.45			

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.672 (i)
TIME TO PEAK (hrs)= 10.750
RUNOFF VOLUME (mm)= 185.971
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0102):	26.90	2.961	11.25	185.98
+ ID2= 2 (0101):	83.94	8.675	11.50	185.98
ID = 3 (0301):	110.84	11.597	11.42	185.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	11.597	11.42	185.98
	+ ID2= 2 (0103):	13.45	1.672	10.75	185.97
	ID = 3 (0302):	124.29	13.033	11.33	185.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

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       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

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Output filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Post development.out
Summary filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Post development.sum

DATE: 4/26/2010 TIME: 1:53:06 PM

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 1 **
****

MASS STORM	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Scs24h.mst
Ptotal= 52.50 mm	Comments: SCS 24 HR MASS CURVE

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min
New Storm time step = 5.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.24	6.08	.88	12.08	45.36	18.08	.95
.17	.47	6.17	.91	12.17	26.46	18.17	.94
.25	.71	6.25	.95	12.25	7.56	18.25	.94
.33	.71	6.33	.95	12.33	7.56	18.33	.94
.42	.71	6.42	.95	12.42	7.56	18.42	.95
.50	.71	6.50	.95	12.50	7.56	18.50	.95
.58	.71	6.58	.95	12.58	6.34	18.58	.95
.67	.71	6.67	.95	12.67	5.11	18.67	.94
.75	.71	6.75	.95	12.75	3.88	18.75	.94
.83	.71	6.83	.94	12.83	3.88	18.83	.94
.92	.71	6.92	.94	12.92	3.89	18.92	.95
1.00	.71	7.00	.94	13.00	3.89	19.00	.95
1.08	.71	7.08	1.01	13.08	3.54	19.08	.95
1.17	.71	7.17	1.09	13.17	3.18	19.17	.94
1.25	.71	7.25	1.16	13.25	2.83	19.25	.94
1.33	.71	7.33	1.16	13.33	2.83	19.33	.94
1.42	.71	7.42	1.15	13.42	2.84	19.42	.95
1.50	.71	7.50	1.15	13.50	2.84	19.50	.95
1.58	.71	7.58	1.15	13.58	2.63	19.58	.95
1.67	.71	7.67	1.16	13.67	2.41	19.67	.94
1.75	.71	7.75	1.16	13.75	2.20	19.75	.94
1.83	.71	7.83	1.16	13.83	2.20	19.83	.94
1.92	.71	7.92	1.15	13.92	2.20	19.92	.95
2.00	.71	8.00	1.15	14.00	2.21	20.00	.95
2.08	.66	8.08	1.22	14.08	2.00	20.08	.84
2.17	.60	8.17	1.29	14.17	1.79	20.17	.73
2.25	.55	8.25	1.36	14.25	1.57	20.25	.63
2.33	.55	8.33	1.37	14.33	1.57	20.33	.63
2.42	.55	8.42	1.37	14.42	1.57	20.42	.63
2.50	.55	8.50	1.37	14.50	1.57	20.50	.63
2.58	.55	8.58	1.40	14.58	1.57	20.58	.63
2.67	.55	8.67	1.44	14.67	1.57	20.67	.63
2.75	.55	8.75	1.47	14.75	1.57	20.75	.63
2.83	.55	8.83	1.47	14.83	1.58	20.83	.63
2.92	.55	8.92	1.47	14.92	1.58	20.92	.63
3.00	.55	9.00	1.47	15.00	1.58	21.00	.63

3.08	.55	9.08	1.54	15.08	1.58	21.08	.63
3.17	.55	9.17	1.61	15.17	1.58	21.17	.63
3.25	.55	9.25	1.68	15.25	1.57	21.25	.63
3.33	.55	9.33	1.68	15.33	1.57	21.33	.63
3.42	.55	9.42	1.68	15.42	1.57	21.42	.63
3.50	.55	9.50	1.68	15.50	1.57	21.50	.63
3.58	.55	9.58	1.75	15.58	1.57	21.58	.63
3.67	.55	9.67	1.82	15.67	1.57	21.67	.63
3.75	.55	9.75	1.89	15.75	1.57	21.75	.63
3.83	.55	9.83	1.89	15.83	1.57	21.83	.63
3.92	.55	9.92	1.89	15.92	1.57	21.92	.63
4.00	.55	10.00	1.89	16.00	1.57	22.00	.63
4.08	.65	10.08	2.06	16.08	1.36	22.08	.63
4.17	.74	10.17	2.24	16.17	1.16	22.17	.63
4.25	.84	10.25	2.41	16.25	.95	22.25	.63
4.33	.84	10.33	2.41	16.33	.95	22.33	.63
4.42	.84	10.42	2.41	16.42	.94	22.42	.63
4.50	.84	10.50	2.41	16.50	.94	22.50	.63
4.58	.84	10.58	2.69	16.58	.94	22.58	.63
4.67	.84	10.67	2.98	16.67	.94	22.67	.63
4.75	.84	10.75	3.26	16.75	.94	22.75	.63
4.83	.84	10.83	3.26	16.83	.94	22.83	.63
4.92	.84	10.92	3.25	16.92	.95	22.92	.63
5.00	.84	11.00	3.25	17.00	.95	23.00	.63
5.08	.84	11.08	3.85	17.08	.95	23.08	.63
5.17	.84	11.17	4.44	17.17	.94	23.17	.63
5.25	.84	11.25	5.04	17.25	.94	23.25	.63
5.33	.84	11.33	5.04	17.33	.94	23.33	.63
5.42	.84	11.42	5.04	17.42	.95	23.42	.63
5.50	.84	11.50	5.04	17.50	.95	23.50	.63
5.58	.84	11.58	8.54	17.58	.95	23.58	.63
5.67	.84	11.67	12.04	17.67	.94	23.67	.63
5.75	.84	11.75	15.54	17.75	.94	23.75	.63
5.83	.84	11.83	31.78	17.83	.94	23.83	.63
5.92	.84	11.92	48.02	17.92	.95	23.92	.63
6.00	.84	12.00	64.26	18.00	.95	24.00	.63

CALIB			
NASHYD (0202)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.24	6.083	.88	12.083	45.36	18.08	.95
.167	.47	6.167	.91	12.167	26.46	18.17	.94
.250	.71	6.250	.95	12.250	7.56	18.25	.94
.333	.71	6.333	.95	12.333	7.56	18.33	.94
.417	.71	6.417	.95	12.417	7.56	18.42	.95
.500	.71	6.500	.95	12.500	7.56	18.50	.95
.583	.71	6.583	.95	12.583	6.34	18.58	.95
.667	.71	6.667	.95	12.667	5.11	18.67	.94
.750	.71	6.750	.95	12.750	3.89	18.75	.94
.833	.71	6.833	.94	12.833	3.88	18.83	.94
.917	.71	6.917	.94	12.917	3.89	18.92	.95
1.000	.71	7.000	.94	13.000	3.89	19.00	.95
1.083	.71	7.083	1.02	13.083	3.54	19.08	.95
1.167	.71	7.167	1.09	13.167	3.19	19.17	.94
1.250	.71	7.250	1.16	13.250	2.84	19.25	.94
1.333	.71	7.333	1.16	13.333	2.83	19.33	.94
1.417	.71	7.417	1.15	13.417	2.84	19.42	.95
1.500	.71	7.500	1.15	13.500	2.84	19.50	.95
1.583	.71	7.583	1.15	13.583	2.63	19.58	.95
1.667	.71	7.667	1.16	13.667	2.42	19.67	.94
1.750	.71	7.750	1.16	13.750	2.21	19.75	.94
1.833	.71	7.833	1.16	13.833	2.20	19.83	.94
1.917	.71	7.917	1.15	13.917	2.20	19.92	.95
2.000	.71	8.000	1.15	14.000	2.21	20.00	.95
2.083	.66	8.083	1.23	14.083	2.00	20.08	.84
2.167	.60	8.167	1.30	14.167	1.79	20.17	.73
2.250	.55	8.250	1.37	14.250	1.58	20.25	.63
2.333	.55	8.333	1.37	14.333	1.57	20.33	.63
2.417	.55	8.417	1.37	14.417	1.57	20.42	.63
2.500	.55	8.500	1.37	14.500	1.57	20.50	.63
2.583	.55	8.583	1.40	14.583	1.57	20.58	.63
2.667	.55	8.667	1.44	14.667	1.57	20.67	.63
2.750	.55	8.750	1.47	14.750	1.57	20.75	.63
2.833	.55	8.833	1.47	14.833	1.58	20.83	.63
2.917	.55	8.917	1.47	14.917	1.58	20.92	.63
3.000	.55	9.000	1.47	15.000	1.58	21.00	.63
3.083	.55	9.083	1.54	15.083	1.58	21.08	.63
3.167	.55	9.167	1.61	15.167	1.58	21.17	.63

3.250	.55	9.250	1.68	15.250	1.57	21.25	.63
3.333	.55	9.333	1.68	15.333	1.57	21.33	.63
3.417	.55	9.417	1.68	15.417	1.57	21.42	.63
3.500	.55	9.500	1.68	15.500	1.57	21.50	.63
3.583	.55	9.583	1.75	15.583	1.57	21.58	.63
3.667	.55	9.667	1.82	15.667	1.57	21.67	.63
3.750	.55	9.750	1.89	15.750	1.57	21.75	.63
3.833	.55	9.833	1.89	15.833	1.57	21.83	.63
3.917	.55	9.917	1.89	15.917	1.57	21.92	.63
4.000	.55	10.000	1.89	16.000	1.57	22.00	.63
4.083	.65	10.083	2.06	16.083	1.37	22.08	.63
4.167	.74	10.167	2.24	16.167	1.16	22.17	.63
4.250	.84	10.250	2.41	16.250	.95	22.25	.63
4.333	.84	10.333	2.41	16.333	.95	22.33	.63
4.417	.84	10.417	2.41	16.417	.94	22.42	.63
4.500	.84	10.500	2.41	16.500	.94	22.50	.63
4.583	.84	10.583	2.69	16.583	.94	22.58	.63
4.667	.84	10.667	2.97	16.667	.94	22.67	.63
4.750	.84	10.750	3.25	16.750	.94	22.75	.63
4.833	.84	10.833	3.26	16.833	.94	22.83	.63
4.917	.84	10.917	3.25	16.917	.95	22.92	.63
5.000	.84	11.000	3.25	17.000	.95	23.00	.63
5.083	.84	11.083	3.85	17.083	.95	23.08	.63
5.167	.84	11.167	4.44	17.167	.94	23.17	.63
5.250	.84	11.250	5.04	17.250	.94	23.25	.63
5.333	.84	11.333	5.04	17.333	.94	23.33	.63
5.417	.84	11.417	5.04	17.417	.95	23.42	.63
5.500	.84	11.500	5.04	17.500	.95	23.50	.63
5.583	.84	11.583	8.54	17.583	.95	23.58	.63
5.667	.84	11.667	12.04	17.667	.94	23.67	.63
5.750	.84	11.750	15.54	17.750	.94	23.75	.63
5.833	.84	11.833	31.78	17.833	.94	23.83	.63
5.917	.84	11.917	48.02	17.917	.95	23.92	.63
6.000	.84	12.000	64.26	18.000	.95	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= .585 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 23.067
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB NASHYD (0201) ID= 1 DT= 5.0 min	Area (ha)= 83.94	Curve Number (CN)= 85.0
	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .97	

Unit Hyd Qpeak (cms)= 3.305

PEAK FLOW (cms)= 1.608 (i)
TIME TO PEAK (hrs)= 13.083
RUNOFF VOLUME (mm)= 23.067
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB NASHYD (0203) ID= 1 DT= 5.0 min	Area (ha)= 13.45	Curve Number (CN)= 85.0
	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .45	

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= .452 (i)
TIME TO PEAK (hrs)= 12.417
RUNOFF VOLUME (mm)= 23.066
TOTAL RAINFALL (mm)= 52.395
RUNOFF COEFFICIENT = .440

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)

1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	26.90	.585	12.83	23.07
+ ID2= 2 (0201):	83.94	1.608	13.08	23.07

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         ID = 3 (0301):   110.84   2.184    13.00    23.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0301):   110.84   2.184    13.00    23.07
       + ID2= 2 (0203):    13.45    .452    12.42    23.07
         ================================================
         ID = 3 (0302):   124.29   2.472    12.92    23.07

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   2 **
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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 67.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .30 |  6.08    1.13 | 12.08   58.41 | 18.08    1.22
                 .17     .61 |  6.17    1.17 | 12.17   34.07 | 18.17    1.22
                 .25     .91 |  6.25    1.22 | 12.25    9.73 | 18.25    1.22
                 .33     .91 |  6.33    1.22 | 12.33    9.73 | 18.33    1.22
                 .42     .91 |  6.42    1.22 | 12.42    9.73 | 18.42    1.22
                 .50     .91 |  6.50    1.22 | 12.50    9.73 | 18.50    1.22
                 .58     .91 |  6.58    1.22 | 12.58    8.16 | 18.58    1.22
                 .67     .91 |  6.67    1.22 | 12.67    6.58 | 18.67    1.22
                 .75     .91 |  6.75    1.22 | 12.75    5.00 | 18.75    1.22
                 .83     .91 |  6.83    1.22 | 12.83    5.00 | 18.83    1.22
                 .92     .91 |  6.92    1.22 | 12.92    5.00 | 18.92    1.22
                1.00     .91 |  7.00    1.22 | 13.00    5.00 | 19.00    1.22
                1.08     .91 |  7.08    1.31 | 13.08    4.55 | 19.08    1.22
                1.17     .91 |  7.17    1.40 | 13.17    4.10 | 19.17    1.22
                1.25     .91 |  7.25    1.49 | 13.25    3.65 | 19.25    1.22
                1.33     .91 |  7.33    1.49 | 13.33    3.65 | 19.33    1.22
                1.42     .91 |  7.42    1.49 | 13.42    3.65 | 19.42    1.22
                1.50     .91 |  7.50    1.49 | 13.50    3.65 | 19.50    1.22
                1.58     .91 |  7.58    1.49 | 13.58    3.38 | 19.58    1.22
                1.67     .91 |  7.67    1.49 | 13.67    3.11 | 19.67    1.22
                1.75     .91 |  7.75    1.49 | 13.75    2.84 | 19.75    1.22
                1.83     .91 |  7.83    1.49 | 13.83    2.84 | 19.83    1.22
                1.92     .91 |  7.92    1.49 | 13.92    2.84 | 19.92    1.22
                2.00     .91 |  8.00    1.49 | 14.00    2.84 | 20.00    1.22
                2.08     .84 |  8.08    1.58 | 14.08    2.57 | 20.08    1.08
                2.17     .78 |  8.17    1.67 | 14.17    2.30 | 20.17     .95
                2.25     .71 |  8.25    1.76 | 14.25    2.03 | 20.25     .81
                2.33     .71 |  8.33    1.76 | 14.33    2.03 | 20.33     .81
                2.42     .71 |  8.42    1.76 | 14.42    2.03 | 20.42     .81
                2.50     .71 |  8.50    1.76 | 14.50    2.03 | 20.50     .81
                2.58     .71 |  8.58    1.80 | 14.58    2.03 | 20.58     .81
                2.67     .71 |  8.67    1.85 | 14.67    2.03 | 20.67     .81
                2.75     .71 |  8.75    1.89 | 14.75    2.03 | 20.75     .81
                2.83     .71 |  8.83    1.89 | 14.83    2.03 | 20.83     .81
                2.92     .71 |  8.92    1.89 | 14.92    2.03 | 20.92     .81
                3.00     .71 |  9.00    1.89 | 15.00    2.03 | 21.00     .81
                3.08     .71 |  9.08    1.98 | 15.08    2.03 | 21.08     .81
                3.17     .71 |  9.17    2.07 | 15.17    2.03 | 21.17     .81
                3.25     .71 |  9.25    2.16 | 15.25    2.03 | 21.25     .81
                3.33     .71 |  9.33    2.16 | 15.33    2.03 | 21.33     .81
                3.42     .71 |  9.42    2.16 | 15.42    2.03 | 21.42     .81
                3.50     .71 |  9.50    2.16 | 15.50    2.03 | 21.50     .81
                3.58     .71 |  9.58    2.25 | 15.58    2.03 | 21.58     .81
                3.67     .71 |  9.67    2.34 | 15.67    2.03 | 21.67     .81
                3.75     .71 |  9.75    2.43 | 15.75    2.03 | 21.75     .81
                3.83     .71 |  9.83    2.43 | 15.83    2.03 | 21.83     .81
                3.92     .71 |  9.92    2.43 | 15.92    2.03 | 21.92     .81
                4.00     .71 | 10.00    2.43 | 16.00    2.03 | 22.00     .81
                4.08     .83 | 10.08    2.66 | 16.08    1.76 | 22.08     .81
                4.17     .96 | 10.17    2.88 | 16.17    1.49 | 22.17     .81
                4.25    1.08 | 10.25    3.11 | 16.25    1.22 | 22.25     .81
                4.33    1.08 | 10.33    3.11 | 16.33    1.22 | 22.33     .81
                4.42    1.08 | 10.42    3.11 | 16.42    1.22 | 22.42     .81
                4.50    1.08 | 10.50    3.11 | 16.50    1.22 | 22.50     .81
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4.58	1.08	10.58	3.47	16.58	1.22	22.58	.81
4.67	1.08	10.67	3.83	16.67	1.22	22.67	.81
4.75	1.08	10.75	4.19	16.75	1.22	22.75	.81
4.83	1.08	10.83	4.19	16.83	1.22	22.83	.81
4.92	1.08	10.92	4.19	16.92	1.22	22.92	.81
5.00	1.08	11.00	4.19	17.00	1.22	23.00	.81
5.08	1.08	11.08	4.96	17.08	1.22	23.08	.81
5.17	1.08	11.17	5.72	17.17	1.22	23.17	.81
5.25	1.08	11.25	6.49	17.25	1.22	23.25	.81
5.33	1.08	11.33	6.49	17.33	1.22	23.33	.81
5.42	1.08	11.42	6.49	17.42	1.22	23.42	.81
5.50	1.08	11.50	6.49	17.50	1.22	23.50	.81
5.58	1.08	11.58	11.00	17.58	1.22	23.58	.81
5.67	1.08	11.67	15.50	17.67	1.22	23.67	.81
5.75	1.08	11.75	20.01	17.75	1.22	23.75	.81
5.83	1.08	11.83	40.92	17.83	1.22	23.83	.81
5.92	1.08	11.92	61.83	17.92	1.22	23.92	.81
6.00	1.08	12.00	82.74	18.00	1.22	24.00	.81

CALIB			
NASHYD (0202)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.30	6.083	1.13	12.083	58.41	18.08	1.22
.167	.61	6.167	1.17	12.167	34.07	18.17	1.22
.250	.91	6.250	1.22	12.250	9.74	18.25	1.22
.333	.91	6.333	1.22	12.333	9.73	18.33	1.22
.417	.91	6.417	1.22	12.417	9.73	18.42	1.22
.500	.91	6.500	1.22	12.500	9.73	18.50	1.22
.583	.91	6.583	1.22	12.583	8.16	18.58	1.22
.667	.91	6.667	1.22	12.667	6.58	18.67	1.22
.750	.91	6.750	1.22	12.750	5.00	18.75	1.22
.833	.91	6.833	1.22	12.833	5.00	18.83	1.22
.917	.91	6.917	1.22	12.917	5.00	18.92	1.22
1.000	.91	7.000	1.22	13.000	5.00	19.00	1.22
1.083	.91	7.083	1.31	13.083	4.55	19.08	1.22
1.167	.91	7.167	1.40	13.167	4.10	19.17	1.22
1.250	.91	7.250	1.49	13.250	3.65	19.25	1.22
1.333	.91	7.333	1.49	13.333	3.65	19.33	1.22
1.417	.91	7.417	1.49	13.417	3.65	19.42	1.22
1.500	.91	7.500	1.49	13.500	3.65	19.50	1.22
1.583	.91	7.583	1.49	13.583	3.38	19.58	1.22
1.667	.91	7.667	1.49	13.667	3.11	19.67	1.22
1.750	.91	7.750	1.49	13.750	2.84	19.75	1.22
1.833	.91	7.833	1.49	13.833	2.84	19.83	1.22
1.917	.91	7.917	1.49	13.917	2.84	19.92	1.22
2.000	.91	8.000	1.49	14.000	2.84	20.00	1.22
2.083	.84	8.083	1.58	14.083	2.57	20.08	1.08
2.167	.78	8.167	1.67	14.167	2.30	20.17	.95
2.250	.71	8.250	1.76	14.250	2.03	20.25	.81
2.333	.71	8.333	1.76	14.333	2.03	20.33	.81
2.417	.71	8.417	1.76	14.417	2.03	20.42	.81
2.500	.71	8.500	1.76	14.500	2.03	20.50	.81
2.583	.71	8.583	1.80	14.583	2.03	20.58	.81
2.667	.71	8.667	1.85	14.667	2.03	20.67	.81
2.750	.71	8.750	1.89	14.750	2.03	20.75	.81
2.833	.71	8.833	1.89	14.833	2.03	20.83	.81
2.917	.71	8.917	1.89	14.917	2.03	20.92	.81
3.000	.71	9.000	1.89	15.000	2.03	21.00	.81
3.083	.71	9.083	1.98	15.083	2.03	21.08	.81
3.167	.71	9.167	2.07	15.167	2.03	21.17	.81
3.250	.71	9.250	2.16	15.250	2.03	21.25	.81
3.333	.71	9.333	2.16	15.333	2.03	21.33	.81
3.417	.71	9.417	2.16	15.417	2.03	21.42	.81
3.500	.71	9.500	2.16	15.500	2.03	21.50	.81
3.583	.71	9.583	2.25	15.583	2.03	21.58	.81
3.667	.71	9.667	2.34	15.667	2.03	21.67	.81
3.750	.71	9.750	2.43	15.750	2.03	21.75	.81
3.833	.71	9.833	2.43	15.833	2.03	21.83	.81
3.917	.71	9.917	2.43	15.917	2.03	21.92	.81
4.000	.71	10.000	2.43	16.000	2.03	22.00	.81
4.083	.83	10.083	2.66	16.083	1.76	22.08	.81
4.167	.96	10.167	2.88	16.167	1.49	22.17	.81
4.250	1.08	10.250	3.11	16.250	1.22	22.25	.81
4.333	1.08	10.333	3.11	16.333	1.22	22.33	.81
4.417	1.08	10.417	3.11	16.417	1.22	22.42	.81
4.500	1.08	10.500	3.11	16.500	1.22	22.50	.81
4.583	1.08	10.583	3.47	16.583	1.22	22.58	.81
4.667	1.08	10.667	3.83	16.667	1.22	22.67	.81

```
               4.750    1.08 |10.750    4.19 |16.750    1.22 | 22.75     .81
               4.833    1.08 |10.833    4.19 |16.833    1.22 | 22.83     .81
               4.917    1.08 |10.917    4.19 |16.917    1.22 | 22.92     .81
               5.000    1.08 |11.000    4.19 |17.000    1.22 | 23.00     .81
               5.083    1.08 |11.083    4.96 |17.083    1.22 | 23.08     .81
               5.167    1.08 |11.167    5.72 |17.167    1.22 | 23.17     .81
               5.250    1.08 |11.250    6.49 |17.250    1.22 | 23.25     .81
               5.333    1.08 |11.333    6.49 |17.333    1.22 | 23.33     .81
               5.417    1.08 |11.417    6.49 |17.417    1.22 | 23.42     .81
               5.500    1.08 |11.500    6.49 |17.500    1.22 | 23.50     .81
               5.583    1.08 |11.583   11.00 |17.583    1.22 | 23.58     .81
               5.667    1.08 |11.667   15.50 |17.667    1.22 | 23.67     .81
               5.750    1.08 |11.750   20.01 |17.750    1.22 | 23.75     .81
               5.833    1.08 |11.833   40.92 |17.833    1.22 | 23.83     .81
               5.917    1.08 |11.917   61.83 |17.917    1.22 | 23.92     .81
               6.000    1.08 |12.000   82.74 |18.000    1.22 | 24.00     .00

     Unit Hyd Qpeak  (cms)=   1.253

     PEAK FLOW       (cms)=    .902 (i)
     TIME TO PEAK    (hrs)=  12.833
     RUNOFF VOLUME    (mm)=  34.969
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0201) |   Area    (ha)=  83.94   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .97

     Unit Hyd Qpeak  (cms)=   3.305

     PEAK FLOW       (cms)=   2.481 (i)
     TIME TO PEAK    (hrs)=  13.000
     RUNOFF VOLUME    (mm)=  34.969
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD    (0203) |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW       (cms)=    .697 (i)
     TIME TO PEAK    (hrs)=  12.417
     RUNOFF VOLUME    (mm)=  34.967
     TOTAL RAINFALL   (mm)=  67.465
     RUNOFF COEFFICIENT   =    .518

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0301) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0202):    26.90    .902    12.83    34.97
        + ID2= 2 (0201):    83.94   2.481    13.00    34.97
          ================================================
          ID = 3 (0301):   110.84   3.365    13.00    34.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0301):   110.84   3.365    13.00    34.97
        + ID2= 2 (0203):    13.45    .697    12.42    34.97
          ================================================
          ID = 3 (0302):   124.29   3.819    12.83    34.97

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ****************************
  ** SIMULATION NUMBER:   3 **
  ****************************

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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 77.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.35	6.08	1.29	12.08	67.05	18.08	1.40
.17	.70	6.17	1.35	12.17	39.11	18.17	1.40
.25	1.05	6.25	1.40	12.25	11.17	18.25	1.40
.33	1.05	6.33	1.40	12.33	11.17	18.33	1.40
.42	1.05	6.42	1.40	12.42	11.17	18.42	1.40
.50	1.05	6.50	1.40	12.50	11.17	18.50	1.40
.58	1.05	6.58	1.40	12.58	9.36	18.58	1.40
.67	1.05	6.67	1.40	12.67	7.55	18.67	1.40
.75	1.05	6.75	1.40	12.75	5.74	18.75	1.40
.83	1.05	6.83	1.40	12.83	5.74	18.83	1.40
.92	1.05	6.92	1.40	12.92	5.74	18.92	1.40
1.00	1.05	7.00	1.40	13.00	5.74	19.00	1.40
1.08	1.05	7.08	1.50	13.08	5.23	19.08	1.40
1.17	1.05	7.17	1.60	13.17	4.71	19.17	1.40
1.25	1.05	7.25	1.71	13.25	4.19	19.25	1.40
1.33	1.05	7.33	1.71	13.33	4.19	19.33	1.40
1.42	1.05	7.42	1.71	13.42	4.19	19.42	1.40
1.50	1.05	7.50	1.71	13.50	4.19	19.50	1.40
1.58	1.05	7.58	1.71	13.58	3.88	19.58	1.40
1.67	1.05	7.67	1.71	13.67	3.57	19.67	1.40
1.75	1.05	7.75	1.71	13.75	3.26	19.75	1.40
1.83	1.05	7.83	1.71	13.83	3.26	19.83	1.40
1.92	1.05	7.92	1.71	13.92	3.26	19.92	1.40
2.00	1.05	8.00	1.71	14.00	3.26	20.00	1.40
2.08	.97	8.08	1.81	14.08	2.95	20.08	1.24
2.17	.89	8.17	1.91	14.17	2.64	20.17	1.09
2.25	.82	8.25	2.02	14.25	2.33	20.25	.93
2.33	.82	8.33	2.02	14.33	2.33	20.33	.93
2.42	.81	8.42	2.02	14.42	2.33	20.42	.93
2.50	.81	8.50	2.02	14.50	2.33	20.50	.93
2.58	.81	8.58	2.07	14.58	2.33	20.58	.93
2.67	.82	8.67	2.12	14.67	2.33	20.67	.93
2.75	.82	8.75	2.17	14.75	2.33	20.75	.93
2.83	.82	8.83	2.17	14.83	2.33	20.83	.93
2.92	.81	8.92	2.17	14.92	2.33	20.92	.93
3.00	.81	9.00	2.17	15.00	2.33	21.00	.93
3.08	.81	9.08	2.28	15.08	2.33	21.08	.93
3.17	.82	9.17	2.38	15.17	2.33	21.17	.93
3.25	.82	9.25	2.48	15.25	2.33	21.25	.93
3.33	.82	9.33	2.48	15.33	2.33	21.33	.93
3.42	.81	9.42	2.48	15.42	2.33	21.42	.93
3.50	.81	9.50	2.48	15.50	2.33	21.50	.93
3.58	.81	9.58	2.59	15.58	2.33	21.58	.93
3.67	.82	9.67	2.69	15.67	2.33	21.67	.93
3.75	.82	9.75	2.79	15.75	2.33	21.75	.93
3.83	.82	9.83	2.79	15.83	2.33	21.83	.93
3.92	.81	9.92	2.79	15.92	2.33	21.92	.93
4.00	.81	10.00	2.79	16.00	2.33	22.00	.93
4.08	.96	10.08	3.05	16.08	2.02	22.08	.93
4.17	1.10	10.17	3.31	16.17	1.71	22.17	.93
4.25	1.24	10.25	3.57	16.25	1.40	22.25	.93
4.33	1.24	10.33	3.57	16.33	1.40	22.33	.93
4.42	1.24	10.42	3.57	16.42	1.40	22.42	.93
4.50	1.24	10.50	3.57	16.50	1.40	22.50	.93
4.58	1.24	10.58	3.98	16.58	1.40	22.58	.93
4.67	1.24	10.67	4.40	16.67	1.40	22.67	.93
4.75	1.24	10.75	4.81	16.75	1.40	22.75	.93
4.83	1.24	10.83	4.81	16.83	1.40	22.83	.93
4.92	1.24	10.92	4.81	16.92	1.40	22.92	.93
5.00	1.24	11.00	4.81	17.00	1.40	23.00	.93
5.08	1.24	11.08	5.69	17.08	1.40	23.08	.93
5.17	1.24	11.17	6.57	17.17	1.40	23.17	.93
5.25	1.24	11.25	7.45	17.25	1.40	23.25	.93
5.33	1.24	11.33	7.45	17.33	1.40	23.33	.93
5.42	1.24	11.42	7.45	17.42	1.40	23.42	.93
5.50	1.24	11.50	7.45	17.50	1.40	23.50	.93
5.58	1.24	11.58	12.62	17.58	1.40	23.58	.93
5.67	1.24	11.67	17.80	17.67	1.40	23.67	.93
5.75	1.24	11.75	22.97	17.75	1.40	23.75	.93
5.83	1.24	11.83	46.97	17.83	1.40	23.83	.93
5.92	1.24	11.92	70.98	17.92	1.40	23.92	.93
6.00	1.24	12.00	94.98	18.00	1.40	24.00	.93

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--------------------
| CALIB            |
| NASHYD    (0202) |   Area    (ha)=  26.90   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .82

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.
```

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.35	6.083	1.29	12.083	67.05	18.08	1.40
.167	.70	6.167	1.35	12.167	39.11	18.17	1.40
.250	1.05	6.250	1.40	12.250	11.18	18.25	1.40
.333	1.05	6.333	1.40	12.333	11.17	18.33	1.40
.417	1.05	6.417	1.40	12.417	11.17	18.42	1.40
.500	1.05	6.500	1.40	12.500	11.17	18.50	1.40
.583	1.05	6.583	1.40	12.583	9.36	18.58	1.40
.667	1.05	6.667	1.40	12.667	7.55	18.67	1.40
.750	1.05	6.750	1.40	12.750	5.74	18.75	1.40
.833	1.05	6.833	1.40	12.833	5.74	18.83	1.40
.917	1.05	6.917	1.40	12.917	5.74	18.92	1.40
1.000	1.05	7.000	1.40	13.000	5.74	19.00	1.40
1.083	1.05	7.083	1.50	13.083	5.23	19.08	1.40
1.167	1.05	7.167	1.60	13.167	4.71	19.17	1.40
1.250	1.05	7.250	1.71	13.250	4.19	19.25	1.40
1.333	1.05	7.333	1.71	13.333	4.19	19.33	1.40
1.417	1.05	7.417	1.71	13.417	4.19	19.42	1.40
1.500	1.05	7.500	1.71	13.500	4.19	19.50	1.40
1.583	1.05	7.583	1.71	13.583	3.88	19.58	1.40
1.667	1.05	7.667	1.71	13.667	3.57	19.67	1.40
1.750	1.05	7.750	1.71	13.750	3.26	19.75	1.40
1.833	1.05	7.833	1.71	13.833	3.26	19.83	1.40
1.917	1.05	7.917	1.71	13.917	3.26	19.92	1.40
2.000	1.05	8.000	1.71	14.000	3.26	20.00	1.40
2.083	.97	8.083	1.81	14.083	2.95	20.08	1.24
2.167	.89	8.167	1.91	14.167	2.64	20.17	1.09
2.250	.82	8.250	2.02	14.250	2.33	20.25	.93
2.333	.82	8.333	2.02	14.333	2.33	20.33	.93
2.417	.81	8.417	2.02	14.417	2.33	20.42	.93
2.500	.81	8.500	2.02	14.500	2.33	20.50	.93
2.583	.81	8.583	2.07	14.583	2.33	20.58	.93
2.667	.82	8.667	2.12	14.667	2.33	20.67	.93
2.750	.82	8.750	2.17	14.750	2.33	20.75	.93
2.833	.82	8.833	2.17	14.833	2.33	20.83	.93
2.917	.81	8.917	2.17	14.917	2.33	20.92	.93
3.000	.81	9.000	2.17	15.000	2.33	21.00	.93
3.083	.81	9.083	2.28	15.083	2.33	21.08	.93
3.167	.82	9.167	2.38	15.167	2.33	21.17	.93
3.250	.82	9.250	2.48	15.250	2.33	21.25	.93
3.333	.82	9.333	2.48	15.333	2.33	21.33	.93
3.417	.81	9.417	2.48	15.417	2.33	21.42	.93
3.500	.81	9.500	2.48	15.500	2.33	21.50	.93
3.583	.81	9.583	2.59	15.583	2.33	21.58	.93
3.667	.82	9.667	2.69	15.667	2.33	21.67	.93
3.750	.82	9.750	2.79	15.750	2.33	21.75	.93
3.833	.82	9.833	2.79	15.833	2.33	21.83	.93
3.917	.81	9.917	2.79	15.917	2.33	21.92	.93
4.000	.81	10.000	2.79	16.000	2.33	22.00	.93
4.083	.96	10.083	3.05	16.083	2.02	22.08	.93
4.167	1.10	10.167	3.31	16.167	1.71	22.17	.93
4.250	1.24	10.250	3.57	16.250	1.40	22.25	.93
4.333	1.24	10.333	3.57	16.333	1.40	22.33	.93
4.417	1.24	10.417	3.57	16.417	1.40	22.42	.93
4.500	1.24	10.500	3.57	16.500	1.40	22.50	.93
4.583	1.24	10.583	3.98	16.583	1.40	22.58	.93
4.667	1.24	10.667	4.40	16.667	1.40	22.67	.93
4.750	1.24	10.750	4.81	16.750	1.40	22.75	.93
4.833	1.24	10.833	4.81	16.833	1.40	22.83	.93
4.917	1.24	10.917	4.81	16.917	1.40	22.92	.93
5.000	1.24	11.000	4.81	17.000	1.40	23.00	.93
5.083	1.24	11.083	5.69	17.083	1.40	23.08	.93
5.167	1.24	11.167	6.57	17.167	1.40	23.17	.93
5.250	1.24	11.250	7.45	17.250	1.40	23.25	.93
5.333	1.24	11.333	7.45	17.333	1.40	23.33	.93
5.417	1.24	11.417	7.45	17.417	1.40	23.42	.93
5.500	1.24	11.500	7.45	17.500	1.40	23.50	.93
5.583	1.24	11.583	12.62	17.583	1.40	23.58	.93
5.667	1.24	11.667	17.80	17.667	1.40	23.67	.93
5.750	1.24	11.750	22.97	17.750	1.40	23.75	.93
5.833	1.24	11.833	46.97	17.833	1.40	23.83	.93
5.917	1.24	11.917	70.98	17.917	1.40	23.92	.93
6.000	1.24	12.000	94.98	18.000	1.40	24.00	.00

Unit Hyd Qpeak (cms)=   1.253

```
     PEAK FLOW      (cms)=   1.124 (i)
     TIME TO PEAK   (hrs)=  12.833
     RUNOFF VOLUME   (mm)=  43.306
     TOTAL RAINFALL  (mm)=  77.445
     RUNOFF COEFFICIENT  =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (0201)  |   Area    (ha)=  83.94   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .97

     Unit Hyd Qpeak  (cms)=   3.305

     PEAK FLOW      (cms)=   3.090 (i)
     TIME TO PEAK   (hrs)=  13.000
     RUNOFF VOLUME   (mm)=  43.306
     TOTAL RAINFALL  (mm)=  77.445
     RUNOFF COEFFICIENT  =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD   (0203)  |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW      (cms)=    .867 (i)
     TIME TO PEAK   (hrs)=  12.417
     RUNOFF VOLUME   (mm)=  43.303
     TOTAL RAINFALL  (mm)=  77.445
     RUNOFF COEFFICIENT  =    .559

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  (0301)  |
|  1 +  2 =  3     |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0202):    26.90   1.124    12.83    43.31
        + ID2= 2 (0201):    83.94   3.090    13.00    43.31
          ================================================
          ID = 3 (0301):   110.84   4.189    12.92    43.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD  (0302)  |
|  1 +  2 =  3     |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0301):   110.84   4.189    12.92    43.31
        + ID2= 2 (0203):    13.45    .867    12.42    43.30
          ================================================
          ID = 3 (0302):   124.29   4.759    12.83    43.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   4 **
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--------------------
| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 90.20 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .41 |  6.08    1.50 | 12.08   77.93 | 18.08    1.62
                 .17     .81 |  6.17    1.56 | 12.17   45.46 | 18.17    1.62
```

.25	1.22	6.25	1.62	12.25	12.99	18.25	1.62
.33	1.22	6.33	1.62	12.33	12.99	18.33	1.62
.42	1.22	6.42	1.62	12.42	12.99	18.42	1.62
.50	1.22	6.50	1.62	12.50	12.99	18.50	1.62
.58	1.22	6.58	1.62	12.58	10.88	18.58	1.62
.67	1.22	6.67	1.62	12.67	8.78	18.67	1.62
.75	1.22	6.75	1.62	12.75	6.67	18.75	1.62
.83	1.22	6.83	1.62	12.83	6.67	18.83	1.62
.92	1.22	6.92	1.62	12.92	6.67	18.92	1.62
1.00	1.22	7.00	1.62	13.00	6.67	19.00	1.62
1.08	1.22	7.08	1.74	13.08	6.07	19.08	1.62
1.17	1.22	7.17	1.86	13.17	5.47	19.17	1.62
1.25	1.22	7.25	1.98	13.25	4.87	19.25	1.62
1.33	1.22	7.33	1.98	13.33	4.87	19.33	1.62
1.42	1.22	7.42	1.98	13.42	4.87	19.42	1.62
1.50	1.22	7.50	1.98	13.50	4.87	19.50	1.62
1.58	1.22	7.58	1.98	13.58	4.51	19.58	1.62
1.67	1.22	7.67	1.98	13.67	4.15	19.67	1.62
1.75	1.22	7.75	1.98	13.75	3.79	19.75	1.62
1.83	1.22	7.83	1.98	13.83	3.79	19.83	1.62
1.92	1.22	7.92	1.98	13.92	3.79	19.92	1.62
2.00	1.22	8.00	1.98	14.00	3.79	20.00	1.62
2.08	1.13	8.08	2.10	14.08	3.43	20.08	1.44
2.17	1.04	8.17	2.22	14.17	3.07	20.17	1.26
2.25	.95	8.25	2.35	14.25	2.71	20.25	1.08
2.33	.95	8.33	2.35	14.33	2.71	20.33	1.08
2.42	.95	8.42	2.35	14.42	2.71	20.42	1.08
2.50	.95	8.50	2.35	14.50	2.71	20.50	1.08
2.58	.95	8.58	2.41	14.58	2.71	20.58	1.08
2.67	.95	8.67	2.47	14.67	2.71	20.67	1.08
2.75	.95	8.75	2.53	14.75	2.71	20.75	1.08
2.83	.95	8.83	2.53	14.83	2.71	20.83	1.08
2.92	.95	8.92	2.53	14.92	2.71	20.92	1.08
3.00	.95	9.00	2.53	15.00	2.71	21.00	1.08
3.08	.95	9.08	2.65	15.08	2.71	21.08	1.08
3.17	.95	9.17	2.77	15.17	2.71	21.17	1.08
3.25	.95	9.25	2.89	15.25	2.71	21.25	1.08
3.33	.95	9.33	2.89	15.33	2.71	21.33	1.08
3.42	.95	9.42	2.89	15.42	2.71	21.42	1.08
3.50	.95	9.50	2.89	15.50	2.71	21.50	1.08
3.58	.95	9.58	3.01	15.58	2.71	21.58	1.08
3.67	.95	9.67	3.13	15.67	2.71	21.67	1.08
3.75	.95	9.75	3.25	15.75	2.71	21.75	1.08
3.83	.95	9.83	3.25	15.83	2.71	21.83	1.08
3.92	.95	9.92	3.25	15.92	2.71	21.92	1.08
4.00	.95	10.00	3.25	16.00	2.71	22.00	1.08
4.08	1.11	10.08	3.55	16.08	2.35	22.08	1.08
4.17	1.28	10.17	3.85	16.17	1.98	22.17	1.08
4.25	1.44	10.25	4.15	16.25	1.62	22.25	1.08
4.33	1.44	10.33	4.15	16.33	1.62	22.33	1.08
4.42	1.44	10.42	4.15	16.42	1.62	22.42	1.08
4.50	1.44	10.50	4.15	16.50	1.62	22.50	1.08
4.58	1.44	10.58	4.63	16.58	1.62	22.58	1.08
4.67	1.44	10.67	5.11	16.67	1.62	22.67	1.08
4.75	1.44	10.75	5.59	16.75	1.62	22.75	1.08
4.83	1.44	10.83	5.59	16.83	1.62	22.83	1.08
4.92	1.44	10.92	5.59	16.92	1.62	22.92	1.08
5.00	1.44	11.00	5.59	17.00	1.62	23.00	1.08
5.08	1.44	11.08	6.61	17.08	1.62	23.08	1.08
5.17	1.44	11.17	7.64	17.17	1.62	23.17	1.08
5.25	1.44	11.25	8.66	17.25	1.62	23.25	1.08
5.33	1.44	11.33	8.66	17.33	1.62	23.33	1.08
5.42	1.44	11.42	8.66	17.42	1.62	23.42	1.08
5.50	1.44	11.50	8.66	17.50	1.62	23.50	1.08
5.58	1.44	11.58	14.67	17.58	1.62	23.58	1.08
5.67	1.44	11.67	20.69	17.67	1.62	23.67	1.08
5.75	1.44	11.75	26.70	17.75	1.62	23.75	1.08
5.83	1.44	11.83	54.60	17.83	1.62	23.83	1.08
5.92	1.44	11.92	82.50	17.92	1.62	23.92	1.08
6.00	1.44	12.00	110.40	18.00	1.62	24.00	1.08

CALIB			
NASHYD (0202)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.41	6.083	1.50	12.083	77.94	18.08	1.62
.167	.81	6.167	1.56	12.167	45.47	18.17	1.62
.250	1.22	6.250	1.62	12.250	12.99	18.25	1.62
.333	1.22	6.333	1.62	12.333	12.99	18.33	1.62

.417	1.22	6.417	1.62	12.417	12.99	18.42	1.62
.500	1.22	6.500	1.62	12.500	12.99	18.50	1.62
.583	1.22	6.583	1.62	12.583	10.88	18.58	1.62
.667	1.22	6.667	1.62	12.667	8.78	18.67	1.62
.750	1.22	6.750	1.62	12.750	6.68	18.75	1.62
.833	1.22	6.833	1.62	12.833	6.67	18.83	1.62
.917	1.22	6.917	1.62	12.917	6.67	18.92	1.62
1.000	1.22	7.000	1.62	13.000	6.67	19.00	1.62
1.083	1.22	7.083	1.74	13.083	6.07	19.08	1.62
1.167	1.22	7.167	1.86	13.167	5.47	19.17	1.62
1.250	1.22	7.250	1.98	13.250	4.87	19.25	1.62
1.333	1.22	7.333	1.98	13.333	4.87	19.33	1.62
1.417	1.22	7.417	1.98	13.417	4.87	19.42	1.62
1.500	1.22	7.500	1.98	13.500	4.87	19.50	1.62
1.583	1.22	7.583	1.98	13.583	4.51	19.58	1.62
1.667	1.22	7.667	1.98	13.667	4.15	19.67	1.62
1.750	1.22	7.750	1.98	13.750	3.79	19.75	1.62
1.833	1.22	7.833	1.98	13.833	3.79	19.83	1.62
1.917	1.22	7.917	1.98	13.917	3.79	19.92	1.62
2.000	1.22	8.000	1.98	14.000	3.79	20.00	1.62
2.083	1.13	8.083	2.10	14.083	3.43	20.08	1.44
2.167	1.04	8.167	2.22	14.167	3.07	20.17	1.26
2.250	.95	8.250	2.35	14.250	2.71	20.25	1.08
2.333	.95	8.333	2.35	14.333	2.71	20.33	1.08
2.417	.95	8.417	2.35	14.417	2.71	20.42	1.08
2.500	.95	8.500	2.35	14.500	2.71	20.50	1.08
2.583	.95	8.583	2.41	14.583	2.71	20.58	1.08
2.667	.95	8.667	2.47	14.667	2.71	20.67	1.08
2.750	.95	8.750	2.53	14.750	2.71	20.75	1.08
2.833	.95	8.833	2.53	14.833	2.71	20.83	1.08
2.917	.95	8.917	2.53	14.917	2.71	20.92	1.08
3.000	.95	9.000	2.53	15.000	2.71	21.00	1.08
3.083	.95	9.083	2.65	15.083	2.71	21.08	1.08
3.167	.95	9.167	2.77	15.167	2.71	21.17	1.08
3.250	.95	9.250	2.89	15.250	2.71	21.25	1.08
3.333	.95	9.333	2.89	15.333	2.71	21.33	1.08
3.417	.95	9.417	2.89	15.417	2.71	21.42	1.08
3.500	.95	9.500	2.89	15.500	2.71	21.50	1.08
3.583	.95	9.583	3.01	15.583	2.71	21.58	1.08
3.667	.95	9.667	3.13	15.667	2.71	21.67	1.08
3.750	.95	9.750	3.25	15.750	2.71	21.75	1.08
3.833	.95	9.833	3.25	15.833	2.71	21.83	1.08
3.917	.95	9.917	3.25	15.917	2.71	21.92	1.08
4.000	.95	10.000	3.25	16.000	2.71	22.00	1.08
4.083	1.11	10.083	3.55	16.083	2.35	22.08	1.08
4.167	1.28	10.167	3.85	16.167	1.98	22.17	1.08
4.250	1.44	10.250	4.15	16.250	1.62	22.25	1.08
4.333	1.44	10.333	4.15	16.333	1.62	22.33	1.08
4.417	1.44	10.417	4.15	16.417	1.62	22.42	1.08
4.500	1.44	10.500	4.15	16.500	1.62	22.50	1.08
4.583	1.44	10.583	4.63	16.583	1.62	22.58	1.08
4.667	1.44	10.667	5.11	16.667	1.62	22.67	1.08
4.750	1.44	10.750	5.59	16.750	1.62	22.75	1.08
4.833	1.44	10.833	5.59	16.833	1.62	22.83	1.08
4.917	1.44	10.917	5.59	16.917	1.62	22.92	1.08
5.000	1.44	11.000	5.59	17.000	1.62	23.00	1.08
5.083	1.44	11.083	6.61	17.083	1.62	23.08	1.08
5.167	1.44	11.167	7.64	17.167	1.62	23.17	1.08
5.250	1.44	11.250	8.66	17.250	1.62	23.25	1.08
5.333	1.44	11.333	8.66	17.333	1.62	23.33	1.08
5.417	1.44	11.417	8.66	17.417	1.62	23.42	1.08
5.500	1.44	11.500	8.66	17.500	1.62	23.50	1.08
5.583	1.44	11.583	14.67	17.583	1.62	23.58	1.08
5.667	1.44	11.667	20.69	17.667	1.62	23.67	1.08
5.750	1.44	11.750	26.70	17.750	1.62	23.75	1.08
5.833	1.44	11.833	54.60	17.833	1.62	23.83	1.08
5.917	1.44	11.917	82.50	17.917	1.62	23.92	1.08
6.000	1.44	12.000	110.40	18.000	1.62	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.411 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 54.175
TOTAL RAINFALL (mm)= 90.020
RUNOFF COEFFICIENT = .602

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
NASHYD (0201)	Area (ha)= 83.94	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .97		

Unit Hyd Qpeak (cms)= 3.305

```
     PEAK FLOW      (cms)=   3.882 (i)
     TIME TO PEAK   (hrs)=  13.000
     RUNOFF VOLUME   (mm)=  54.175
     TOTAL RAINFALL  (mm)=  90.020
     RUNOFF COEFFICIENT  =    .602

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| CALIB            |
| NASHYD    (0203) |   Area    (ha)=  13.45   Curve Number   (CN)= 85.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   6.70   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=   1.142

     PEAK FLOW      (cms)=   1.087 (i)
     TIME TO PEAK   (hrs)=  12.417
     RUNOFF VOLUME   (mm)=  54.171
     TOTAL RAINFALL  (mm)=  90.020
     RUNOFF COEFFICIENT  =    .602

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD   (0301) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0202):    26.90   1.411    12.83    54.17
       + ID2= 2 (0201):    83.94   3.882    13.00    54.17
         ================================================
         ID = 3 (0301):   110.84   5.264    12.92    54.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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--------------------
| ADD HYD   (0302) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (0301):   110.84   5.264    12.92    54.17
       + ID2= 2 (0203):    13.45   1.087    12.42    54.17
         ================================================
         ID = 3 (0302):   124.29   5.979    12.83    54.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   5 **
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| MASS STORM       |    Filename: P:\W&W\Projects\SW04090362 - First Solar
|                  |              \St. Clair\St. Clair3\VO2\Scs24h.mst
| Ptotal= 99.60 mm |    Comments: SCS 24 HR MASS CURVE
--------------------
                       Duration of storm    = 24.00 hrs
                       Mass curve time step = 15.00 min
                       New Storm time step  =  5.00 min


                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08     .45 |  6.08    1.66 | 12.08   86.05 | 18.08    1.79
                 .17     .90 |  6.17    1.73 | 12.17   50.20 | 18.17    1.79
                 .25    1.35 |  6.25    1.79 | 12.25   14.34 | 18.25    1.79
                 .33    1.35 |  6.33    1.79 | 12.33   14.34 | 18.33    1.79
                 .42    1.34 |  6.42    1.79 | 12.42   14.34 | 18.42    1.79
                 .50    1.34 |  6.50    1.79 | 12.50   14.34 | 18.50    1.79
                 .58    1.34 |  6.58    1.79 | 12.58   12.02 | 18.58    1.79
                 .67    1.35 |  6.67    1.79 | 12.67    9.69 | 18.67    1.79
                 .75    1.35 |  6.75    1.79 | 12.75    7.37 | 18.75    1.79
                 .83    1.35 |  6.83    1.79 | 12.83    7.37 | 18.83    1.79
                 .92    1.34 |  6.92    1.79 | 12.92    7.37 | 18.92    1.79
                1.00    1.34 |  7.00    1.79 | 13.00    7.37 | 19.00    1.79
                1.08    1.34 |  7.08    1.93 | 13.08    6.71 | 19.08    1.79
                1.17    1.35 |  7.17    2.06 | 13.17    6.04 | 19.17    1.79
                1.25    1.35 |  7.25    2.19 | 13.25    5.38 | 19.25    1.79
                1.33    1.35 |  7.33    2.19 | 13.33    5.38 | 19.33    1.79
                1.42    1.34 |  7.42    2.19 | 13.42    5.38 | 19.42    1.79
                1.50    1.34 |  7.50    2.19 | 13.50    5.38 | 19.50    1.79
                1.58    1.34 |  7.58    2.19 | 13.58    4.98 | 19.58    1.79
                1.67    1.35 |  7.67    2.19 | 13.67    4.58 | 19.67    1.79
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1.75	1.35	7.75	2.19	13.75	4.18	19.75	1.79
1.83	1.35	7.83	2.19	13.83	4.18	19.83	1.79
1.92	1.34	7.92	2.19	13.92	4.18	19.92	1.79
2.00	1.34	8.00	2.19	14.00	4.18	20.00	1.79
2.08	1.24	8.08	2.32	14.08	3.78	20.08	1.59
2.17	1.15	8.17	2.46	14.17	3.39	20.17	1.39
2.25	1.05	8.25	2.59	14.25	2.99	20.25	1.20
2.33	1.05	8.33	2.59	14.33	2.99	20.33	1.20
2.42	1.05	8.42	2.59	14.42	2.99	20.42	1.20
2.50	1.04	8.50	2.59	14.50	2.99	20.50	1.20
2.58	1.05	8.58	2.66	14.58	2.99	20.58	1.20
2.67	1.05	8.67	2.72	14.67	2.99	20.67	1.20
2.75	1.05	8.75	2.79	14.75	2.99	20.75	1.20
2.83	1.05	8.83	2.79	14.83	2.99	20.83	1.20
2.92	1.05	8.92	2.79	14.92	2.99	20.92	1.20
3.00	1.04	9.00	2.79	15.00	2.99	21.00	1.20
3.08	1.05	9.08	2.92	15.08	2.99	21.08	1.20
3.17	1.05	9.17	3.05	15.17	2.99	21.17	1.20
3.25	1.05	9.25	3.19	15.25	2.99	21.25	1.20
3.33	1.05	9.33	3.19	15.33	2.99	21.33	1.20
3.42	1.05	9.42	3.19	15.42	2.99	21.42	1.20
3.50	1.04	9.50	3.19	15.50	2.99	21.50	1.20
3.58	1.05	9.58	3.32	15.58	2.99	21.58	1.20
3.67	1.05	9.67	3.45	15.67	2.99	21.67	1.20
3.75	1.05	9.75	3.59	15.75	2.99	21.75	1.20
3.83	1.05	9.83	3.59	15.83	2.99	21.83	1.20
3.92	1.05	9.92	3.59	15.92	2.99	21.92	1.20
4.00	1.04	10.00	3.59	16.00	2.99	22.00	1.20
4.08	1.23	10.08	3.92	16.08	2.59	22.08	1.20
4.17	1.41	10.17	4.25	16.17	2.19	22.17	1.20
4.25	1.59	10.25	4.58	16.25	1.79	22.25	1.20
4.33	1.59	10.33	4.58	16.33	1.79	22.33	1.20
4.42	1.59	10.42	4.58	16.42	1.79	22.42	1.20
4.50	1.59	10.50	4.58	16.50	1.79	22.50	1.20
4.58	1.59	10.58	5.11	16.58	1.79	22.58	1.20
4.67	1.59	10.67	5.64	16.67	1.79	22.67	1.20
4.75	1.59	10.75	6.18	16.75	1.79	22.75	1.20
4.83	1.59	10.83	6.18	16.83	1.79	22.83	1.20
4.92	1.59	10.92	6.18	16.92	1.79	22.92	1.20
5.00	1.59	11.00	6.18	17.00	1.79	23.00	1.20
5.08	1.59	11.08	7.30	17.08	1.79	23.08	1.20
5.17	1.59	11.17	8.43	17.17	1.79	23.17	1.20
5.25	1.59	11.25	9.56	17.25	1.79	23.25	1.20
5.33	1.59	11.33	9.56	17.33	1.79	23.33	1.20
5.42	1.59	11.42	9.56	17.42	1.79	23.42	1.20
5.50	1.59	11.50	9.56	17.50	1.79	23.50	1.20
5.58	1.59	11.58	16.20	17.58	1.79	23.58	1.20
5.67	1.59	11.67	22.84	17.67	1.79	23.67	1.20
5.75	1.59	11.75	29.48	17.75	1.79	23.75	1.20
5.83	1.59	11.83	60.29	17.83	1.79	23.83	1.20
5.92	1.59	11.92	91.10	17.92	1.79	23.92	1.20
6.00	1.59	12.00	121.91	18.00	1.79	24.00	1.20

CALIB			
NASHYD (0202)	Area (ha)= 26.90	Curve Number (CN)= 85.0	
ID= 1 DT= 5.0 min	Ia (mm)= 6.70	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .82		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.45	6.083	1.66	12.083	86.06	18.08	1.79
.167	.90	6.167	1.73	12.167	50.20	18.17	1.79
.250	1.35	6.250	1.79	12.250	14.35	18.25	1.79
.333	1.35	6.333	1.79	12.333	14.34	18.33	1.79
.417	1.34	6.417	1.79	12.417	14.34	18.42	1.79
.500	1.34	6.500	1.79	12.500	14.34	18.50	1.79
.583	1.34	6.583	1.79	12.583	12.02	18.58	1.79
.667	1.35	6.667	1.79	12.667	9.69	18.67	1.79
.750	1.35	6.750	1.79	12.750	7.37	18.75	1.79
.833	1.35	6.833	1.79	12.833	7.37	18.83	1.79
.917	1.34	6.917	1.79	12.917	7.37	18.92	1.79
1.000	1.34	7.000	1.79	13.000	7.37	19.00	1.79
1.083	1.34	7.083	1.93	13.083	6.71	19.08	1.79
1.167	1.35	7.167	2.06	13.167	6.04	19.17	1.79
1.250	1.35	7.250	2.19	13.250	5.38	19.25	1.79
1.333	1.35	7.333	2.19	13.333	5.38	19.33	1.79
1.417	1.34	7.417	2.19	13.417	5.38	19.42	1.79
1.500	1.34	7.500	2.19	13.500	5.38	19.50	1.79
1.583	1.34	7.583	2.19	13.583	4.98	19.58	1.79
1.667	1.35	7.667	2.19	13.667	4.58	19.67	1.79
1.750	1.35	7.750	2.19	13.750	4.18	19.75	1.79
1.833	1.35	7.833	2.19	13.833	4.18	19.83	1.79

1.917	1.34	7.917	2.19	13.917	4.18	19.92	1.79
2.000	1.34	8.000	2.19	14.000	4.18	20.00	1.79
2.083	1.24	8.083	2.32	14.083	3.78	20.08	1.59
2.167	1.15	8.167	2.46	14.167	3.39	20.17	1.39
2.250	1.05	8.250	2.59	14.250	2.99	20.25	1.20
2.333	1.05	8.333	2.59	14.333	2.99	20.33	1.20
2.417	1.05	8.417	2.59	14.417	2.99	20.42	1.20
2.500	1.04	8.500	2.59	14.500	2.99	20.50	1.20
2.583	1.05	8.583	2.66	14.583	2.99	20.58	1.20
2.667	1.05	8.667	2.72	14.667	2.99	20.67	1.20
2.750	1.05	8.750	2.79	14.750	2.99	20.75	1.20
2.833	1.05	8.833	2.79	14.833	2.99	20.83	1.20
2.917	1.05	8.917	2.79	14.917	2.99	20.92	1.20
3.000	1.04	9.000	2.79	15.000	2.99	21.00	1.20
3.083	1.05	9.083	2.92	15.083	2.99	21.08	1.20
3.167	1.05	9.167	3.05	15.167	2.99	21.17	1.20
3.250	1.05	9.250	3.19	15.250	2.99	21.25	1.20
3.333	1.05	9.333	3.19	15.333	2.99	21.33	1.20
3.417	1.05	9.417	3.19	15.417	2.99	21.42	1.20
3.500	1.04	9.500	3.19	15.500	2.99	21.50	1.20
3.583	1.05	9.583	3.32	15.583	2.99	21.58	1.20
3.667	1.05	9.667	3.45	15.667	2.99	21.67	1.20
3.750	1.05	9.750	3.59	15.750	2.99	21.75	1.20
3.833	1.05	9.833	3.59	15.833	2.99	21.83	1.20
3.917	1.05	9.917	3.59	15.917	2.99	21.92	1.20
4.000	1.04	10.000	3.59	16.000	2.99	22.00	1.20
4.083	1.23	10.083	3.92	16.083	2.59	22.08	1.20
4.167	1.41	10.167	4.25	16.167	2.19	22.17	1.20
4.250	1.59	10.250	4.58	16.250	1.79	22.25	1.20
4.333	1.59	10.333	4.58	16.333	1.79	22.33	1.20
4.417	1.59	10.417	4.58	16.417	1.79	22.42	1.20
4.500	1.59	10.500	4.58	16.500	1.79	22.50	1.20
4.583	1.59	10.583	5.11	16.583	1.79	22.58	1.20
4.667	1.59	10.667	5.64	16.667	1.79	22.67	1.20
4.750	1.59	10.750	6.18	16.750	1.79	22.75	1.20
4.833	1.59	10.833	6.18	16.833	1.79	22.83	1.20
4.917	1.59	10.917	6.18	16.917	1.79	22.92	1.20
5.000	1.59	11.000	6.18	17.000	1.79	23.00	1.20
5.083	1.59	11.083	7.30	17.083	1.79	23.08	1.20
5.167	1.59	11.167	8.43	17.167	1.79	23.17	1.20
5.250	1.59	11.250	9.56	17.250	1.79	23.25	1.20
5.333	1.59	11.333	9.56	17.333	1.79	23.33	1.20
5.417	1.59	11.417	9.56	17.417	1.79	23.42	1.20
5.500	1.59	11.500	9.56	17.500	1.79	23.50	1.20
5.583	1.59	11.583	16.20	17.583	1.79	23.58	1.20
5.667	1.59	11.667	22.84	17.667	1.79	23.67	1.20
5.750	1.59	11.750	29.48	17.750	1.79	23.75	1.20
5.833	1.59	11.833	60.29	17.833	1.79	23.83	1.20
5.917	1.59	11.917	91.10	17.917	1.79	23.92	1.20
6.000	1.59	12.000	121.91	18.000	1.79	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.630 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 62.486
TOTAL RAINFALL (mm)= 99.401
RUNOFF COEFFICIENT = .629

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0201)	Area (ha)=	83.94	Curve Number (CN)=	85.0	
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.97			

Unit Hyd Qpeak (cms)= 3.305

PEAK FLOW (cms)= 4.484 (i)
TIME TO PEAK (hrs)= 13.000
RUNOFF VOLUME (mm)= 62.487
TOTAL RAINFALL (mm)= 99.401
RUNOFF COEFFICIENT = .629

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0203)	Area (ha)=	13.45	Curve Number (CN)=	85.0	
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.45			

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.255 (i)

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    TIME TO PEAK    (hrs)=  12.417
    RUNOFF VOLUME    (mm)=  62.482
    TOTAL RAINFALL   (mm)=  99.401
    RUNOFF COEFFICIENT   =    .629

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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ADD HYD (0301)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0202):	26.90	1.630	12.83	62.49
	+ ID2= 2 (0201):	83.94	4.484	13.00	62.49
	ID = 3 (0301):	110.84	6.083	12.92	62.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	6.083	12.92	62.49
	+ ID2= 2 (0203):	13.45	1.255	12.42	62.48
	ID = 3 (0302):	124.29	6.908	12.83	62.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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  ** SIMULATION NUMBER:   6 **
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MASS STORM	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Scs24h.mst
Ptotal=108.90 mm	Comments: SCS 24 HR MASS CURVE

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                    Duration of storm    = 24.00 hrs
                    Mass curve time step = 15.00 min
                    New Storm time step  =  5.00 min
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TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	.49	6.08	1.82	12.08	94.09	18.08	1.96
.17	.98	6.17	1.89	12.17	54.89	18.17	1.96
.25	1.47	6.25	1.96	12.25	15.68	18.25	1.96
.33	1.47	6.33	1.96	12.33	15.68	18.33	1.96
.42	1.47	6.42	1.96	12.42	15.68	18.42	1.96
.50	1.47	6.50	1.96	12.50	15.68	18.50	1.96
.58	1.47	6.58	1.96	12.58	13.14	18.58	1.96
.67	1.47	6.67	1.96	12.67	10.60	18.67	1.96
.75	1.47	6.75	1.96	12.75	8.06	18.75	1.96
.83	1.47	6.83	1.96	12.83	8.06	18.83	1.96
.92	1.47	6.92	1.96	12.92	8.06	18.92	1.96
1.00	1.47	7.00	1.96	13.00	8.06	19.00	1.96
1.08	1.47	7.08	2.11	13.08	7.33	19.08	1.96
1.17	1.47	7.17	2.25	13.17	6.61	19.17	1.96
1.25	1.47	7.25	2.40	13.25	5.88	19.25	1.96
1.33	1.47	7.33	2.40	13.33	5.88	19.33	1.96
1.42	1.47	7.42	2.40	13.42	5.88	19.42	1.96
1.50	1.47	7.50	2.40	13.50	5.88	19.50	1.96
1.58	1.47	7.58	2.40	13.58	5.45	19.58	1.96
1.67	1.47	7.67	2.40	13.67	5.01	19.67	1.96
1.75	1.47	7.75	2.40	13.75	4.57	19.75	1.96
1.83	1.47	7.83	2.40	13.83	4.57	19.83	1.96
1.92	1.47	7.92	2.40	13.92	4.57	19.92	1.96
2.00	1.47	8.00	2.40	14.00	4.57	20.00	1.96
2.08	1.36	8.08	2.54	14.08	4.14	20.08	1.74
2.17	1.25	8.17	2.69	14.17	3.70	20.17	1.52
2.25	1.15	8.25	2.83	14.25	3.27	20.25	1.31
2.33	1.14	8.33	2.83	14.33	3.27	20.33	1.31
2.42	1.14	8.42	2.83	14.42	3.27	20.42	1.31
2.50	1.14	8.50	2.83	14.50	3.27	20.50	1.31
2.58	1.14	8.58	2.90	14.58	3.27	20.58	1.31
2.67	1.14	8.67	2.98	14.67	3.27	20.67	1.31
2.75	1.15	8.75	3.05	14.75	3.27	20.75	1.31
2.83	1.14	8.83	3.05	14.83	3.27	20.83	1.31
2.92	1.14	8.92	3.05	14.92	3.27	20.92	1.31
3.00	1.14	9.00	3.05	15.00	3.27	21.00	1.31
3.08	1.14	9.08	3.19	15.08	3.27	21.08	1.31
3.17	1.14	9.17	3.34	15.17	3.27	21.17	1.31

3.25	1.15	9.25	3.48	15.25	3.27	21.25	1.31
3.33	1.14	9.33	3.48	15.33	3.27	21.33	1.31
3.42	1.14	9.42	3.48	15.42	3.27	21.42	1.31
3.50	1.14	9.50	3.48	15.50	3.27	21.50	1.31
3.58	1.14	9.58	3.63	15.58	3.27	21.58	1.31
3.67	1.14	9.67	3.78	15.67	3.27	21.67	1.31
3.75	1.15	9.75	3.92	15.75	3.27	21.75	1.31
3.83	1.14	9.83	3.92	15.83	3.27	21.83	1.31
3.92	1.14	9.92	3.92	15.92	3.27	21.92	1.31
4.00	1.14	10.00	3.92	16.00	3.27	22.00	1.31
4.08	1.34	10.08	4.28	16.08	2.83	22.08	1.31
4.17	1.54	10.17	4.65	16.17	2.40	22.17	1.31
4.25	1.74	10.25	5.01	16.25	1.96	22.25	1.31
4.33	1.74	10.33	5.01	16.33	1.96	22.33	1.31
4.42	1.74	10.42	5.01	16.42	1.96	22.42	1.31
4.50	1.74	10.50	5.01	16.50	1.96	22.50	1.31
4.58	1.74	10.58	5.59	16.58	1.96	22.58	1.31
4.67	1.74	10.67	6.17	16.67	1.96	22.67	1.31
4.75	1.74	10.75	6.75	16.75	1.96	22.75	1.31
4.83	1.74	10.83	6.75	16.83	1.96	22.83	1.31
4.92	1.74	10.92	6.75	16.92	1.96	22.92	1.31
5.00	1.74	11.00	6.75	17.00	1.96	23.00	1.31
5.08	1.74	11.08	7.99	17.08	1.96	23.08	1.31
5.17	1.74	11.17	9.22	17.17	1.96	23.17	1.31
5.25	1.74	11.25	10.45	17.25	1.96	23.25	1.31
5.33	1.74	11.33	10.45	17.33	1.96	23.33	1.31
5.42	1.74	11.42	10.45	17.42	1.96	23.42	1.31
5.50	1.74	11.50	10.45	17.50	1.96	23.50	1.31
5.58	1.74	11.58	17.71	17.58	1.96	23.58	1.31
5.67	1.74	11.67	24.97	17.67	1.96	23.67	1.31
5.75	1.74	11.75	32.23	17.75	1.96	23.75	1.31
5.83	1.74	11.83	65.92	17.83	1.96	23.83	1.31
5.92	1.74	11.92	99.61	17.92	1.96	23.92	1.31
6.00	1.74	12.00	133.29	18.00	1.96	24.00	1.31

CALIB			
NASHYD (0202)	Area (ha)=	26.90	Curve Number (CN)= 85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	.82	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	.49	6.083	1.82	12.083	94.09	18.08	1.96
.167	.98	6.167	1.89	12.167	54.89	18.17	1.96
.250	1.47	6.250	1.96	12.250	15.69	18.25	1.96
.333	1.47	6.333	1.96	12.333	15.68	18.33	1.96
.417	1.47	6.417	1.96	12.417	15.68	18.42	1.96
.500	1.47	6.500	1.96	12.500	15.68	18.50	1.96
.583	1.47	6.583	1.96	12.583	13.14	18.58	1.96
.667	1.47	6.667	1.96	12.667	10.60	18.67	1.96
.750	1.47	6.750	1.96	12.750	8.06	18.75	1.96
.833	1.47	6.833	1.96	12.833	8.06	18.83	1.96
.917	1.47	6.917	1.96	12.917	8.06	18.92	1.96
1.000	1.47	7.000	1.96	13.000	8.06	19.00	1.96
1.083	1.47	7.083	2.11	13.083	7.33	19.08	1.96
1.167	1.47	7.167	2.25	13.167	6.61	19.17	1.96
1.250	1.47	7.250	2.40	13.250	5.88	19.25	1.96
1.333	1.47	7.333	2.40	13.333	5.88	19.33	1.96
1.417	1.47	7.417	2.40	13.417	5.88	19.42	1.96
1.500	1.47	7.500	2.40	13.500	5.88	19.50	1.96
1.583	1.47	7.583	2.40	13.583	5.45	19.58	1.96
1.667	1.47	7.667	2.40	13.667	5.01	19.67	1.96
1.750	1.47	7.750	2.40	13.750	4.57	19.75	1.96
1.833	1.47	7.833	2.40	13.833	4.57	19.83	1.96
1.917	1.47	7.917	2.40	13.917	4.57	19.92	1.96
2.000	1.47	8.000	2.40	14.000	4.57	20.00	1.96
2.083	1.36	8.083	2.54	14.083	4.14	20.08	1.74
2.167	1.25	8.167	2.69	14.167	3.70	20.17	1.52
2.250	1.15	8.250	2.83	14.250	3.27	20.25	1.31
2.333	1.14	8.333	2.83	14.333	3.27	20.33	1.31
2.417	1.14	8.417	2.83	14.417	3.27	20.42	1.31
2.500	1.14	8.500	2.83	14.500	3.27	20.50	1.31
2.583	1.14	8.583	2.90	14.583	3.27	20.58	1.31
2.667	1.14	8.667	2.98	14.667	3.27	20.67	1.31
2.750	1.15	8.750	3.05	14.750	3.27	20.75	1.31
2.833	1.14	8.833	3.05	14.833	3.27	20.83	1.31
2.917	1.14	8.917	3.05	14.917	3.27	20.92	1.31
3.000	1.14	9.000	3.05	15.000	3.27	21.00	1.31
3.083	1.14	9.083	3.19	15.083	3.27	21.08	1.31
3.167	1.14	9.167	3.34	15.167	3.27	21.17	1.31
3.250	1.15	9.250	3.48	15.250	3.27	21.25	1.31
3.333	1.14	9.333	3.48	15.333	3.27	21.33	1.31

3.417	1.14	9.417	3.48	15.417	3.27	21.42	1.31
3.500	1.14	9.500	3.48	15.500	3.27	21.50	1.31
3.583	1.14	9.583	3.63	15.583	3.27	21.58	1.31
3.667	1.14	9.667	3.78	15.667	3.27	21.67	1.31
3.750	1.15	9.750	3.92	15.750	3.27	21.75	1.31
3.833	1.14	9.833	3.92	15.833	3.27	21.83	1.31
3.917	1.14	9.917	3.92	15.917	3.27	21.92	1.31
4.000	1.14	10.000	3.92	16.000	3.27	22.00	1.31
4.083	1.34	10.083	4.28	16.083	2.83	22.08	1.31
4.167	1.54	10.167	4.65	16.167	2.40	22.17	1.31
4.250	1.74	10.250	5.01	16.250	1.96	22.25	1.31
4.333	1.74	10.333	5.01	16.333	1.96	22.33	1.31
4.417	1.74	10.417	5.01	16.417	1.96	22.42	1.31
4.500	1.74	10.500	5.01	16.500	1.96	22.50	1.31
4.583	1.74	10.583	5.59	16.583	1.96	22.58	1.31
4.667	1.74	10.667	6.17	16.667	1.96	22.67	1.31
4.750	1.74	10.750	6.75	16.750	1.96	22.75	1.31
4.833	1.74	10.833	6.75	16.833	1.96	22.83	1.31
4.917	1.74	10.917	6.75	16.917	1.96	22.92	1.31
5.000	1.74	11.000	6.75	17.000	1.96	23.00	1.31
5.083	1.74	11.083	7.99	17.083	1.96	23.08	1.31
5.167	1.74	11.167	9.22	17.167	1.96	23.17	1.31
5.250	1.74	11.250	10.45	17.250	1.96	23.25	1.31
5.333	1.74	11.333	10.45	17.333	1.96	23.33	1.31
5.417	1.74	11.417	10.45	17.417	1.96	23.42	1.31
5.500	1.74	11.500	10.45	17.500	1.96	23.50	1.31
5.583	1.74	11.583	17.71	17.583	1.96	23.58	1.31
5.667	1.74	11.667	24.97	17.667	1.96	23.67	1.31
5.750	1.74	11.750	32.23	17.750	1.96	23.75	1.31
5.833	1.74	11.833	65.92	17.833	1.96	23.83	1.31
5.917	1.74	11.917	99.60	17.917	1.96	23.92	1.31
6.000	1.74	12.000	133.29	18.000	1.96	24.00	.00

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 1.848 (i)
TIME TO PEAK (hrs)= 12.833
RUNOFF VOLUME (mm)= 70.844
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0201)	Area (ha)=	83.94	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.97		

Unit Hyd Qpeak (cms)= 3.305

PEAK FLOW (cms)= 5.087 (i)
TIME TO PEAK (hrs)= 13.000
RUNOFF VOLUME (mm)= 70.844
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0203)	Area (ha)=	13.45	Curve Number (CN)=	85.0
ID= 1 DT= 5.0 min	Ia (mm)=	6.70	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.45		

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.423 (i)
TIME TO PEAK (hrs)= 12.417
RUNOFF VOLUME (mm)= 70.839
TOTAL RAINFALL (mm)= 108.682
RUNOFF COEFFICIENT = .652

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)

1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	26.90	1.848	12.83	70.84
+ ID2= 2 (0201):	83.94	5.087	13.00	70.84
ID = 3 (0301):	110.84	6.903	12.92	70.84

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	6.903	12.92	70.84
	+ ID2= 2 (0203):	13.45	1.423	12.42	70.84
	ID = 3 (0302):	124.29	7.838	12.83	70.84

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

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       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


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

Input filename: C:\Program Files\Visual OTTHYMO 2.2.4\voin.dat
Output filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Post-development - Regional.out
Summary filename: P:\W&W\Projects\SW0409~1\STA8EF~1.CLA\STDBEF~1.CLA\VO2\Post-development - Regional.sum

DATE: 4/26/2010 TIME: 1:53:55 PM

USER:

COMMENTS: _____

****
** SIMULATION NUMBER: 7 **
****

MASS STORM	Filename: P:\W&W\Projects\SW04090362 - First Solar \St. Clair\St. Clair3\VO2\Hazel12.mst
Ptotal=211.00 mm	Comments: Hurricane Hazel (last 12 h)

Duration of storm = 12.00 hrs
Mass curve time step = 60.00 min
New Storm time step = 10.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	1.06	3.17	7.39	6.17	14.42	9.17	19.34
.33	2.11	3.33	8.44	6.33	16.18	9.33	26.02
.50	3.16	3.50	9.50	6.50	17.93	9.50	32.71
.67	4.22	3.67	10.55	6.67	19.69	9.67	39.39
.83	5.28	3.83	11.61	6.83	21.45	9.83	46.07
1.00	6.33	4.00	12.66	7.00	23.21	10.00	52.75
1.17	5.98	4.17	13.36	7.17	21.45	10.17	50.29
1.33	5.63	4.33	14.07	7.33	19.69	10.33	47.83
1.50	5.28	4.50	14.77	7.50	17.94	10.50	45.36
1.67	4.92	4.67	15.47	7.67	16.18	10.67	42.90
1.83	4.57	4.83	16.18	7.83	14.42	10.83	40.44
2.00	4.22	5.00	16.88	8.00	12.66	11.00	37.98
2.17	4.57	5.17	16.18	8.17	12.66	11.17	33.76
2.33	4.92	5.33	15.47	8.33	12.66	11.33	29.54
2.50	5.28	5.50	14.77	8.50	12.66	11.50	25.32
2.67	5.63	5.67	14.07	8.67	12.66	11.67	21.10
2.83	5.98	5.83	13.36	8.83	12.66	11.83	16.88
3.00	6.33	6.00	12.66	9.00	12.66	12.00	12.66

CALIB		
NASHYD (0202)	Area (ha)= 26.90	Curve Number (CN)= 93.5
ID= 1 DT= 5.0 min	Ia (mm)= 3.50	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= .82	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.083	1.06	3.083	7.38	6.083	14.42	9.08	19.34
.167	1.06	3.167	7.39	6.167	14.42	9.17	19.34
.250	2.11	3.250	8.44	6.250	16.18	9.25	26.02
.333	2.11	3.333	8.44	6.333	16.18	9.33	26.02

.417	3.17	3.417	9.49	6.417	17.93	9.42	32.71
.500	3.17	3.500	9.50	6.500	17.94	9.50	32.71
.583	4.22	3.583	10.55	6.583	19.69	9.58	39.39
.667	4.22	3.667	10.55	6.667	19.69	9.67	39.39
.750	5.27	3.750	11.60	6.750	21.45	9.75	46.07
.833	5.28	3.833	11.61	6.833	21.45	9.83	46.07
.917	6.33	3.917	12.66	6.917	23.21	9.92	52.75
1.000	6.33	4.000	12.66	7.000	23.21	10.00	52.75
1.083	5.98	4.083	13.36	7.083	21.45	10.08	50.29
1.167	5.98	4.167	13.36	7.167	21.45	10.17	50.29
1.250	5.63	4.250	14.07	7.250	19.69	10.25	47.83
1.333	5.63	4.333	14.07	7.333	19.69	10.33	47.83
1.417	5.28	4.417	14.77	7.417	17.94	10.42	45.37
1.500	5.27	4.500	14.77	7.500	17.93	10.50	45.36
1.583	4.92	4.583	15.47	7.583	16.18	10.58	42.90
1.667	4.92	4.667	15.47	7.667	16.18	10.67	42.90
1.750	4.57	4.750	16.18	7.750	14.42	10.75	40.44
1.833	4.57	4.833	16.18	7.833	14.42	10.83	40.44
1.917	4.22	4.917	16.88	7.917	12.66	10.92	37.98
2.000	4.22	5.000	16.88	8.000	12.66	11.00	37.98
2.083	4.57	5.083	16.18	8.083	12.66	11.08	33.76
2.167	4.57	5.167	16.18	8.167	12.66	11.17	33.76
2.250	4.92	5.250	15.47	8.250	12.66	11.25	29.54
2.333	4.92	5.333	15.47	8.333	12.66	11.33	29.54
2.417	5.27	5.417	14.77	8.417	12.66	11.42	25.32
2.500	5.28	5.500	14.77	8.500	12.66	11.50	25.32
2.583	5.63	5.583	14.07	8.583	12.66	11.58	21.10
2.667	5.63	5.667	14.07	8.667	12.66	11.67	21.10
2.750	5.98	5.750	13.36	8.750	12.66	11.75	16.88
2.833	5.98	5.833	13.36	8.833	12.66	11.83	16.88
2.917	6.33	5.917	12.66	8.917	12.66	11.92	12.66
3.000	6.33	6.000	12.66	9.000	12.66	12.00	12.66

Unit Hyd Qpeak (cms)= 1.253

PEAK FLOW (cms)= 2.961 (i)
TIME TO PEAK (hrs)= 11.250
RUNOFF VOLUME (mm)= 185.984
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0201)	Area (ha)=	83.94	Curve Number (CN)=	93.5	
ID= 1 DT= 5.0 min	Ia (mm)=	3.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.97			

Unit Hyd Qpeak (cms)= 3.305

PEAK FLOW (cms)= 8.808 (i)
TIME TO PEAK (hrs)= 11.500
RUNOFF VOLUME (mm)= 185.985
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
NASHYD (0203)	Area (ha)=	13.45	Curve Number (CN)=	93.5	
ID= 1 DT= 5.0 min	Ia (mm)=	3.50	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	.45			

Unit Hyd Qpeak (cms)= 1.142

PEAK FLOW (cms)= 1.672 (i)
TIME TO PEAK (hrs)= 10.750
RUNOFF VOLUME (mm)= 185.971
TOTAL RAINFALL (mm)= 205.725
RUNOFF COEFFICIENT = .904

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0301)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0202):	26.90	2.961	11.25	185.98
+ ID2= 2 (0201):	83.94	8.808	11.50	185.98
ID = 3 (0301):	110.84	11.752	11.42	185.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0302)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0301):	110.84	11.752	11.42	185.98
	+ ID2= 2 (0203):	13.45	1.672	10.75	185.97
	ID = 3 (0302):	124.29	13.209	11.33	185.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

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APPENDIX B

REFERENCE DOCUMENTS

St. Clair Region Conservation Authority

205 Mill Pond Cr., Strathroy, ON, N7G 3P9
(519) 245-3710 (519) 245-3348 FAX
E-Mail stclair@scrca.on.ca
Website www.scrca.on.ca

June 26, 2009

RECEIVED June 29/09

Lakeshore Group
250 Wellington Street West
Suite 130
Toronto, Ontario
M5V 3P6

Attention: **Rick Pennycooke, M.C.I.P., R.P.P., President**

Re: **Property Inquiry**
Proposed Solar Farm Development
Lot 1 & Part Lot 2, Concession 11
Geographic Township of Sombra

Staff of the St. Clair Region Conservation Authority (SCRCA) have reviewed the subject lands with regard to the matter outlined within your correspondence of June 16, 2009.

We understand that your client (First Solar Development (Canada) Inc) is proposing to develop a solar farm on the subject property. From the information provided, we understand the proposal includes the construction of a solar farm and associated infrastructure that would cover a majority of Lot 1, Concession 11, Sombra.

We can confirm that the subject lands are not impacted by "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses" Regulations (O.R. 171/06) implemented by the Authority pursuant to Section 28 of the *Conservation Authorities Act*. As such, permission of the Authority is not required to complete the proposed development on the subject lands.

If you have any questions with regard to the above, do not hesitate to contact the undersigned.

Yours truly,

Jeff Lawrence
Environmental Planner/Regulations Officer

Encl.

"working together for a better environment"


West Bentpath Line
St. Clair Avenue
North Street
East Street
John Street
Duke Street
Water Street
Bentpath Line
Subject Property
(approx)
St. Clair Parkway
West Smith Line
Baseline Road
St. Clair Region
Conservation Authority
205 Mill Pond Crescent, Strathroy, ON N7G 3P9
Tel: (519) 245-3710 Fax: (519) 245-3348
Email: stclair@scrca.on.ca
Web: http://www.scrca.on.ca
Proposed Site Plan
Legend
Subject Property (approx)
N
0 125 250 500 750 1,000
Meters
Produced by the SCRCA under license with the Ontario Ministry of Natural Resources. Copyright Queen's Printer June 2009
May not be reproduced without permission
THIS IS NOT A PLAN OF SURVEY

APPENDIX E
CURRICULUM VITAE

William David McIlveen, Ph.D.

Senior Terrestrial Biologist

Professional Summary:
Mr. McIlveen is a Senior Terrestrial Biologist with over 30 years of experience. As a member of the Environmental Assessment Group and Natural Sciences Team at AMEC, he is responsible for undertaking various biological inventory, ecological land classification studies and terrestrial toxicology projects. During his recent career in environmental consulting, he has completed various biological inventory (flora and fauna in both southern and northern Ontario), ecological land classification, and terrestrial toxicology projects. Recent projects include inventories of rare (Species At Risk) vegetation species in preparation for vegetation management required on the former Ipperwash Military Base south of the Pinery Provincial Park, inventories of rare bird species on the Meaford Military Base, as well as documentation and monitoring of flora and fauna at Rattray Marsh Conservation Area in Mississauga. While in Sudbury, he was an adjunct professor at Laurentian University. He served on the Vegetation Enhancement Technical Advisory Committee for the Regional Municipality of Sudbury where significant improvements have occurred in the landscape previously damaged by industrial emissions. Bill has been involved with a large number of projects to monitor the state of the environment in Ontario (Forest Breeding Birds, Marsh Birds, amphibians monitoring, Christmas Bird Counts among others. He served as Regional Coordinator for the first Breeding Bird Atlas (Spanish Region) and for the Halton/Peel/ Dufferin Region of the most recent atlas project. He is the Regional Coordinator (Halton/Peel) for the Ontario Tree Atlas. He is a member of 20 naturalist organizations and has served on the executive of the Field Botanists of Ontario, the Ontario Bird Banding Association, and the Ontario Vernal Pools Association. He sat for 9 years on the Ecological and Environment Advisory Committee and currently sits on the Lake Ontario Shoreline Algae Action Committee for the Regional Municipality of Halton. He was the Chairman of the Steering Committee for the Natural Areas Inventory completed in Halton and serves in a similar capacity with the current Natural Areas Inventory initiated in the Region of Peel. He has authored or co-authored over 280 articles or reports relating to environmental matters ranging from naturalist club newsletters to government reports to refereed journals. He has also developed and delivered a number of presentations on diverse topics relating to environmental and social issues for presentations to public groups.

Education:
The Pennsylvania State University. University Park, PA, Ph.D. (Plant Pathology) 1977
University of Guelph, Guelph, Ontario, M.Sc. (Plant Pathology) 1971
University of Guelph, Guelph, Ontario, B.Sc. (Agr.) (Plant Protection) 1969

Summary of Core Skills

Environmental Assessment

Mr. McIlveen has experience in providing terrestrial technical support studies to serve as the foundation for assessing impact and developing mitigation strategies as a component of municipal, provincial and federal environmental assessments. His work has been undertaken in support of infrastructure projects in the municipal, mining, transportation, waste management and government project sectors.

Phytotoxicology

Mr. McIlveen has experience in assessing chemical toxicity to vegetation, documentation of injury to ornamental, crop and forest vegetation, conducting field investigations including terrestrial impact assessment of major spills, fires and accidents involving inorganic and organic contaminants, providing comments on various documents and proposals for research and industry, reviewing staff reports, preparation of quality assurance documentation and providing input to biomonitoring policy. From 1986 to 1993, he served as Chairman of the Terrestrial Effects Working Group and a member of the Science Committee of the Acidic Precipitation in Ontario Study (APIOS). That work involved conducting and contracting field investigations of the impacts of acidic precipitation on forest health and growth.

Ecological Inventory

Mr. McIlveen has extensive experience in conducting ecological inventories through academic and professional pursuits as well as personal interest and committee positions. With extensive knowledge in plant and wildlife identification, habitat delineation, and linkage/corridor functional evaluation, Mr. McIlveen undertakes detailed assessments of sites during the early planning phases to establish existing terrestrial ecosystem conditions. He is also called upon to undertake investigations for the identification of habitat use by species of concern and to support evaluation under the Species at Risk Act.

Employment History:
2002-current
AMEC Earth and Environmental, Senior Terrestrial Biologist

February 1991 to 2000
Ontario Ministry of Environment, Standards Development Branch, Ecological Standards and Toxicology Section, Toronto and Brampton, Ontario, Senior Terrestrial Toxicologist

October 1985 to February 1991
Ontario Ministry of Environment and Energy, Phytotoxicology Section, Supervisor, Diagnostic Support Unit

March, 1975 to September 1985
Ontario Ministry of the Environment, Northeast Region, Sudbury, Ontario, Terrestrial Biologist

September 1972 to March 1975
The Pennsylvania State University, Department of Plant Pathology, State College, Pennsylvania, USA, Graduate Assistant

March 1971 to September 1972
Ontario Ministry of the Environment, Phytotoxicology Section, Toronto, Histopathologist

September 1969 to March 1971
University of Guelph, Department of Environmental Biology, Guelph, Ontario, Graduate Student Assistant

Detailed Core Skills

Environmental Assessments

Ministry of Transportation, Waterdown, Ontario: Participated in highway project that required terrestrial ecosystem assessments associated with highway improvements along Highway 5 near Hamilton Ontario.

Porcupine Joint Venture, Timmins Ontario: Completed required terrestrial ecosystem baseline inventory and impact assessment for three project related EA process that included: expansion of the Pamour Pit (Canadian Environmental Assessment Agency), 12km haul road (Ontario Ministry of Natural Resources) and 6 km Highway 101 realignment (TESR) near the town of South Porcupine, City of Timmins, Ontario. Efforts included ELC study for vegetation features within the study area and spring nesting bird surveys.
Sundance Development Corporation, Scarborough, Ontario: Conducted ELC work on residential development site to determine habitat types and distribution within and adjacent to a Regionally Significant Wetland feature for environmental effects assessment and mitigation strategy preparation.

Toyota Motor Manufacturing Canada, Cambridge, Ontario: Conducted a Site Assessment Survey for the storm water management pond. The survey included ELC vegetation mapping and wildlife observations in and adjacent to the property site. During this period Mr. McIlveen attended the TMMC contractor training for safety and environmental certification.

Atomic Energy Canada Limited (AECL) – Port Hope Area Initiative (PHAI)
Production of a Terrestrial Environment Baseline Characterization Study. Responsible for the technical and field component of terrestrial ecosystem studies component of the Canadian Environmental Assessment Act (CEAA) Screening and Comprehensive EA Study for three Long-Term Low-Level Radioactive Waste Management Facilities in Port Hope Ontario. The objective was to describe and characterize the existing terrestrial environment. Efforts have included participation in consultation with stakeholder groups at public meetings relating to VECs and liaison with regulatory bodies.

Phytotoxicology

Ontario Ministry of Environment: Senior Terrestrial Toxicologist involving a number of incidents including Hagersville Tire Fire, Melbourne Train Derailment, Plastimet Fire in Hamilton, Alymer Plastics Fire, U.S.E. Hickson Fire in Scarborough, Quatics Fire in Guelph.

Ontario Ministry of Environment: Supervisor of the Diagnostic Support Section responsible for professional and seasonal staff conducting investigations of contaminant effects on vegetation and soils in southern Ontario.

Ontario Ministry of Environment: Phytotoxicologist involving planning and direction of study programs as well as for preparation of scientific and technical reports and papers on the results obtained. General activities included overseeing the collection and processing of vegetation and soil samples, diagnosis if causal agents of injury to vegetation submitted for pathological examination, maintaining a herbarium for documentation purposes as well as maintaining the corresponding files and records.

Ontario Ministry of the Environment: Histopathologist employed histological techniques as an aid in diagnosing the cause of injury to various types of vegetation. In addition to plant pathological diagnosis, the duties included responsibility for investigation of complaints of injury to vegetation by air pollutants, establishment and evaluation of indicator plots, execution of surveillance programs to investigate the influence of air quality on vegetation in selected areas and processing vegetation and soil samples for chemical, pathological and bioassay analysis.

Ontario Ministry of Environment: Special contaminant survey projects, involving collection of soils throughout Ontario to document the levels of beryllium and other chemicals in shale and sampling of blueberry fruit together with other vegetation (as wild food) and soil to ensure that arsenic levels in the Wawa area did not pose a health hazard for humans of wildlife that might consume this vegetation. Another major project completed under contract in 2001 examined the impact of metals, notably nickel and copper, on the ecological cycling of organic matter in woodlots in the vicinity of Port Colborne.

Ecological Inventory

Department of National Defence (DND) Species at Risk Surveys: Undertaking field work to determine the presence of avian species-at-risk at the DND Land Force Central Area Training Centre (LFCA TC) at Meaford and a biophysical survey for the Unexploded Ordnance (UXO), Environmental and Cultural Resource Investigations within the former Camp Ipperwash.

Rare Species Survey and Community Mapping, Northgate Project, Young Davidson Mine, Matachewan, Ontario: Conducting a terrestrial baseline survey for rare plants, reptiles, birds and mammals for the Young Davidson Mine in Matachewan, Ontario. Field work also included conducting wildlife surveys and mapping the vegetation communities.

Rare Species Survey and Community Mapping, Hollinger Mine Project, Timmins, Ontario: Conducting a terrestrial survey for rare plants, birds and ecosystem mapping for the Hollinger Mine in Timmins, Ontario.

Rare Species Survey and Community Mapping, Nanticoke Competitive Power Ventures Project, Nanticoke, Ontario: Conducting vegetation and wildlife surveys on the location of a proposed power generation station in Nanticoke, Ontario.

Rare Species Survey and Community Mapping, Cambridge Competitive Power Ventures Project, Cambridge, Ontario: Conducting vegetation and wildlife surveys on the location of a proposed power generation station near Cambridge, Ontario.

Blue Springs Creek biological inventory: Commenced inventory of a property of Boy Scouts of Canada and acted as the technical advisor to local environmental committee for this site.

Contributions to records: Contributed to sightings for a number of inventories and publications, including the Mammal Atlas of Ontario; the Ontario Herptofaunal Atlas; Ontario Nest Record scheme at the Royal Ontario Museum; Toronto Entomological Association for inclusion in annual reports; a series of publications on the natural history of Halton (Birds of Halton, Flora of Halton, Mammals of Halton) and the "Herptofaunal Atlas for the Halton Region" on behalf of the Halton/North Peel Naturalists and the Land Snails of Ontario Study.

Halton Region Ladybird Beetles Study: A project under development is the compilation of observations of Ladybird beetles and grasshoppers for Halton Region.

Vegetation Enhancement Technical Advisory Committee (VETAC), **Regional Municipality of Sudbury:** Technical Advisor involving planning and monitoring phases, for the revegetation of over 3000 hectares of industrially damaged lands around Sudbury and over 4,500,000 trees planted.

Additional Field Survey Experience:

- Organized and conducted annual surveys in Halton County
  - 1993-1994 Red-winged Blackbirds
  - 1992-1994 Eastern Kingbird
  - 1994-1996 Sticknest survey (hawk, owl, heron) Halton and Peel
  - 1991-2001 Surveys on for paper wasp nests in north Halton
  - 1990-1998 Inventories of flora at about 130 sites in Halton
  - 1990-1999 Surveys for bird use of grassy habitat at 25 sites in Halton

- Participant in birds surveys organized by Canadian Wildlife Service
  - 1992 Colonial Waterbird Survey - Bruce Peninsula
  - 1988-2002 Forest Bird Monitoring Program - Speyside
  - 1994-2002 Marsh Bird Monitoring Program - Nassagaweya and Esquesing
  - 1998-2002 Amphibian Counts at Marsh Bird Monitoring Program Sites - Nassagaweya and Esquesing
  - 1994-2002 Road Count of Amphibians - Halton

- Member of Rare Breeding Bird Project
  - 1989-1990 Wellington County Committee
  - 1989-1990 Observations for Halton County

Societies and Affiliations:

- Field Botanists of Ontario - Chairman of Membership Committee and Executive
- Ontario Breeding Bird Atlas (1982-1985) - Regional Co-ordinator for Spanish Region Presently Regional coordinator for Halton/Peel/ Dufferin Region in 2001-2005 atlas project
- Licensed bird bander by Canadian Wildlife Service
- Ontario Bird Banding Association - Former editor of journal Ontario Bird Banding and was former secretary and representative to Federation of Ontario Naturalists
- Toronto Entomological Association - member
- Guelph Field Naturalists - member
- Halton/North Peel Naturalists - member and editor of biological series publications
- Sudbury Horticultural Society - President 1982-1984
- Birds Studies Canada - member
- Ontario Tree Atlas - Regional Co-ordinator for Halton/Peel area
- Waterloo Wellington Wildflower Society - member
- Wellington Rare Bird Committee - member
- Pilot project for 2000 Ontario Breeding Bird Atlas - participant
- Federation of Ontario Naturalists - member
- Ottawa Field Naturalists - member
- Appointed (1995) to the Ecological and Environmental Advisory Committee (EEAC) of the Regional Municipality of Halton to advise the regional government on technical matters affecting the environment.
- Appointed to Management Board of Bronte Butterfly in 2001
- Lake Ontario Action Advisory Committee for the Regional Municipality of Halton – member.

Megan Hazell, B.Sc., M.Sc.

Terrestrial Ecologist

Professional summary

Ms. Hazell is a professional biologist with over 10 years of field and analytical experience in the area of wildlife ecology. Her main interest is mitigating the impacts of development on natural systems and developing species and park management plans. Her experience includes impact and cumulative effects assessment, and project management. She has conducted project work within northern tundra habitats, boreal forest, mixed forest, Carolinian forest, and rainforest. Projects have largely involved ecosystem and vegetation mapping, fine scale habitat and forage mapping, habitat suitability mapping, movement modelling, plant, bird and mammal surveys, species management plans, ecosystem design for parks and mitigation and recovery plans for plants and wildlife impacted during development projects. Selected projects which include ecological management plans are Oak Ridges Corridor Park Management Plan, Toronto and Region Conservation Authority, Toronto Natural Heritage Evaluation Tool and Management Plan, Toronto and Region Conservation Authority, Bluewater Beach Environmental Restoration Plan, Township of Tiny, Bob Hunter Memorial Park Management Plan, Rouge Park Management Plan, Centennial Park Management Plan, Ipperwash Rare species surveys, LFCA TC Meaford Avian Species at Risk Surveys, Blanding's Turtle Management Plan, James Bay Caribou Project, De Beers Canada, Attawapiskat, Rare Species Survey and Community Mapping, Northgate Project, Rare Species Survey and Community Mapping, Hollinger Project, Timmins, Rare Species Survey and Community Mapping, Nanticoke Competitive Power Ventures Project, Nanticoke, Ontario.

Strengths also include statistical analysis and interpretation. She has received academic training in the assessment of wildlife habitat quantity and quality through the application of habitat suitability modelling and statistical methods. She has also used quantitative analysis and modelling methods for assessing wildlife movement and potential impacts to movement corridors.

Education

M.Sc. Ecology, University of Guelph, May 2006
B.Sc. Ecology and Evolution, University of Toronto, April 2001

Memberships/Affiliations

Ecological Society of America
Society for Conservation Biology
Canadian Society for Ecology and Evolution
Canadian Society for Environmental Biology

Languages

English

Employment history

AMEC Earth & Environmental, Terrestrial Ecologist, Mississauga, Ontario (2006 to present)
University of Guelph, Department of Integrative Biology, Guelph, Ontario, Field Biologist and Teaching Assistant (2002 to 2006)
University of Toronto, Departments of Botany and Zoology, Field Biologist (1998 to 2002)

Representative projects

Environmental Management Plans

Ms. Hazell has considerable experience developing management and restoration plans for parks and species at risk. She has aided in the development of management plans for Oak Ridges Corridor Park, Toronto Natural Heritage System, Centennial Park, Bob Hunter Memorial Park, Rouge Park and Bluewater Beach. She has developed species at risk management plans for Blanding's Turtle, Least Bittern, Bald Eagle, Woodland Caribou, American Ginseng, Blue Hearts and Heart-leaved Plantain. Additionally, she has developed mitigation strategies for both wildlife and plant species on the large mining projects she has been involved in.

Wildlife Population and Environmental Surveys and Associated Mitigation, Restoration Strategies

Ms. Hazell has considerable experience managing studies and conducting baseline plant and wildlife inventories, including plant and vegetation community surveys and mapping, spring songbird point counts, waterfowl and raptor surveys, winter tracking, amphibian surveys, ungulate aerial surveys, carnivore studies, browse and pellet group counts and owl call-playback studies. Her experience includes habitat assessments and the use of statistical methods for developing models, including resource selection and movement modelling. Her academic background includes developing North American habitat and movement models for elk. As wildlife team discipline lead, she has contributed to numerous Environmental Impact Assessments and Environmental Screenings. Project experience includes discipline leads for EIAs for diamond mining, and road infrastructure, power plants and transmission lines in eastern Canada.

Park and Species at risk Management Plans and Monitoring Studies

- *Oak Ridges Moraine Corridor Park*, *Ontario*
  Ms. Hazell has undertaken a project to develop a management plan for the Oak Ridges Moraine Corridor Park. Project tasks include collection baseline ecological data and interpretation, restoration design and implementation.
- *Toronto Natural Heritage Study, City of Toronto, Ontario*
  Ms. Hazell undertook a project with the City of Toronto on developing their Natural Heritage Strategy. The intent of incorporating the natural heritage system into the city's Official Plan should ensure that the system components that contribute to the health of the city and its inhabitants be protected and sustained in the long term. Project tasks include developing the natural heritage strategy and evaluation framework and criteria, consulting with experts from academic, private and government institutions and conducting workshops.
- *Rouge Park, Markham East Lands, Ontario*
  In 2007 the Provincial government gave additional land to Rouge Park. Ms. Hazell worked on the management plan for incorporating this new land into the existing park, including habitat mapping and the resultant restoration plans and designs.

- *Bob Hunter Memorial Park, Markham, Ontario*
  In 2005 the Provincial government announced the creation of Bob Hunter Memorial Park, a 477 acre parcel of land located adjacent to Rouge Park in the Town of Markham. This Park is meant to honour Bob Hunter, the late lifelong environmentalist and co-founder of Greenpeace, as well as provide protection to the areas natural character and function. Ms. Hazell has assisted in the development of the management plan and restoration strategy of Bob Hunter Park.
- *Centennial Park, City of Toronto*
  Ms. Hazell has undertaken a project to develop a management plan for Centennial Park, an urban park located in Toronto, Ontario. Project tasks include collection baseline ecological data and interpretation, restoration design and implementation as well as public and stakeholder meetings and workshops.
- *Bluewater Beach Restoration Plan, Tiny Township, Ontario*
  The Township of Tiny required a restoration and management plan for Bluewater Beach. Megan was responsible for collecting field data and species inventories for the dune system located at Bluewater Beach and using this information in the development of a restoration and long term management plan for the Township.
- *Blanding's Turtle Management Plan, Ontario*
  Blanding's Turtles are a federal Species at Risk, designated a threatened within Ontario. Ms. Hazell developed a management plan designed to mitigate anthropogenic effects and improve protection for two populations of these turtles in Essex County and French River, Ontario.
- *Rare Species Survey and Ecological Evaluation of Canadian Forces Camp Ipperwash, Ontario*
  Ms. Hazell undertook a biological survey of Canadian Forces Camp Ipperwash. The project tasks include ecological mapping and identification of several provincially rare vegetation communities, as well as identification and development of mitigation strategies for several plant and avian Species at Risk. Megan was responsible for implementing the amphibian, avian and plant surveys as well as writing the final biophysical report and sections of the environmental assessment and management reports.
- *Biodiversity Management Plan, Inco Limited, Sudbury and Timmins, Ontario*
  Inco limited contracted AMEC to develop a land use plan for their properties that maximizes ecological function and biodiversity. Megan was responsible for designing the survey methodology, supervising the terrestrial field crew, conducting wildlife surveys and mapping the vegetation communities. She is also responsible for developing the criteria for assessment, the monitoring framework and writing the report.
- *Avian Species at Risk Survey LFCA TC, Meaford, Ontario*
  Ms. Hazell completed a survey of the avian species at risk present at the National Defence's Land Force Central Area Training Centre (LFCA TC) in Meaford, Ontario. Megan was responsible for designing and implementing a project to survey the area for several avian species at risk as well as developing the mitigation and management plan for the species at risk on site.
- *Species at Risk Survey, Niagara on the Lake, Ontario*
  Ms. Hazell completed a species at risk survey on behalf of Parks Canada for a former DND military training site the Lakeshore Property along the shores of Lake Ontario. This survey involved review for plant, avian and herpetile species as technical support documentation for a CEAA screening of the property for future development.

Linear Corridor Projects, Roads, Transmission Lines

- *Goreway Drive Project, Brampton, Ontario*
  The City of Brampton is widening Goreway Drive in Brampton, Ontario. Ms. Hazell undertook a project conducting a terrestrial survey for rare plants, birds and ecosystem mapping for the area around Goreway Drive to develop a constraints map and mitigation plan for the development activities of this Project.
- *Lakeshore West Corridor Rail Expansion, GO Transit, Ontario*
  Megan provided natural sciences support for a study that examined future operational and capacity improvements from Port Credit Station to Kerr Street. Megan assessed existing terrestrial and aquatic features within the study area and provided updated and detailed existing conditions and sensitivity descriptions.
- *Drew Road Project, Brampton, Ontario*
  The City of Mississauga is extending Drew Road. Ms. Hazell undertook a project conducting a terrestrial survey for rare plants, birds and ecosystem mapping for the area around Drew Road to develop a constraints map and mitigation plan for the development activities of this Project.
- *Highway 400, Ontario*
  The Ontario Ministry of Transportation (MTO) is proposing to widen 11.9 km of Highway 400 from King Road to South Canal Bridge in the Region of York, Ontario MTO. Ms. Hazell undertook a project writing the baseline existing conditions report including rare plants, birds and other wildlife and develop a constraints map and mitigation plan for the development activities of this Project.

Mining - Species at Risk Surveys and Management

- *James Bay Caribou Project, De Beers Canada, Attawapiskat, Ontario*
  In the mid 1980's, De Beers Canada Inc. (De Beers) identified a diamond resource within the James Bay lowlands of Ontario near the First Nation community of Attawapiskat. Concern was expressed that the mine may have a negative impact on the local woodland caribou population. Ms. Hazell is conducting a study to explore the ecology of these woodland caribou and analytically investigate the likelihood of adverse mining impacts on the James Bay Lowland herd. Analysis includes developing resource selection functions and associated habitat suitability analysis and movement modelling.
- *Rare Species Survey, Mitigation and Community Mapping, PhosCan Project, Hearst, Ontario*
  Ms. Hazell was the terrestrial lead to undertake a project conducting a terrestrial baseline survey for rare plants, reptiles, birds and mammals for the PhosCan Project, Ontario. Megan was responsible for designing the survey methodology, supervising the terrestrial field crew, conducting wildlife surveys and mapping the vegetation communities. She is also responsible for writing the biophysical and environmental assessment reports.
- *Rare Species Survey, Mitigation and Community Mapping, Detour Gold Project, Cochrane, Ontario*
  Ms. Hazell was the terrestrial lead to undertake a project conducting a terrestrial baseline survey for rare plants, reptiles, birds and mammals for the Detour Gold Project, Ontario. Megan was responsible for designing the survey methodology, supervising the terrestrial field crew, conducting wildlife surveys and mapping the vegetation communities. She is also responsible for writing the biophysical and environmental assessment reports.

- *Rare Species Survey and Community Mapping, Northgate Project, Young Davidson Mine, Matachewan, Ontario*
  Ms. Hazell was the terrestrial lead to undertake a project conducting a terrestrial baseline survey for rare plants, reptiles, birds and mammals for the Young Davidson Mine in Matachewan, Ontario. Megan was responsible for designing the survey methodology, supervising the terrestrial field crew, conducting wildlife surveys and mapping the vegetation communities. She is also responsible for writing the biophysical and environmental assessment reports.
- *Rare Species Survey and Community Mapping, Hollinger Mine Project, Timmins, Ontario*
  Ms. Hazell was the terrestrial lead to undertake a project conducting a terrestrial survey for rare plants, birds and ecosystem mapping for the Hollinger Mine in Timmins, Ontario. Megan is responsible for designing the survey methodology, conducting the field work and writing the biophysical and environmental assessment reports.
- *Rare Species Survey and Community Mapping, Nanticoke Competitive Power Ventures Project, Nanticoke, Ontario*
  Ms. Hazell was the terrestrial lead for the vegetation and wildlife surveys on the location of a proposed power generation station in Nanticoke, Ontario. Megan was responsible for reviewing the report and developing mitigation strategies for the development in association with a Provincially Significant Wetland on the property.
- *Rare Species Survey and Community Mapping, Cambridge Competitive Power Ventures Project, Cambridge, Ontario*
  Ms. Hazell was the terrestrial lead for the vegetation and wildlife surveys on the location of a proposed power generation station near Cambridge, Ontario. Megan was responsible for reviewing the report and developing mitigation strategies for the development in association with a Provincially Significant Wetland on the property.

Research Projects

- *North American Elk Project, Bancroft, Ontario*
  Ms. Hazell designed and implemented a project examining local elk movement dynamics in relation to environmental heterogeneity. Megan developed movement models to predict the local spatial dynamics of elk in relation to shifting resource distributions. These models will be used as tool in combination with GIS to investigate translatability of these spatial dynamics across scales. Key responsibilities included; gathering movement data through snow tracking, aerial telemetry flights and deployment and remote downloading of GPS collars, population and calf surveys, quantifying fine scale habitat characteristics, managing and summarizing 3 years of data for elk and vegetation characteristics at multiple scales.
- *Ontario Wolf Project, French River and Killarney Provincial Park, Ontario*
  Understanding the spatial interactions between elk and wolves is imperative for managing re-introduced elk populations. Megan assisted with a study investigating wolf movement patterns, habitat selection and predation on re-introduced elk populations. Responsibilities included; tracking collared individuals through aerial telemetry flights, remote downloading of GPS collars, snow tracking surveys for prey (elk, deer, moose, hare), scat collection and habitat assessments.
- *Habitat Quality Assessment, University of Guelph, Guelph, Ontario*
  Ms. Hazell designed and implemented a study evaluating the habitat quality of elk home-ranges through digestibility and forage quality analysis. Responsibilities included; sample processing

using in-vitro, acid and nitrogen detergent fibre digestibility techniques, managing database and analysis of results.

- *Hudson Bay Lowlands Study, La Perouse Bay and Wapusk National Park, Manitoba, University of Toronto*
  Over the last 3 decades the North American Snow goose population has increased at an unprecedented rate, resulting in the rapid deterioration of coastal marshes along the Hudson Bay Lowlands. Megan conducted research as part of the Hudson Bay Project investigating the relationship between escalating snow goose population numbers and recovery of artic salt march vegetation and impacts on avian community diversity. Responsibilities included; sampling and research design, bird, soil, plant and invertebrate sampling and identification, Snow Goose banding, Eider population surveys, nest searching, plant and soil chemical analysis and preliminary statistical analysis.
- *Phylogenetic Relationships of Peromyscus, Royal Ontario Museum, Toronto, Ontario, University of Toronto*
  Elucidating the degree of genetic similarity between closely related species is important for the conservation and management of that species. Ms. Hazell conducted research as part of the Biodiversity group at the ROM investigating the relationship between two closely related species of Peromyscus. Duties included; various lab techniques such as micro-satellite analysis, PCR amplification, DNA sequence reactions, gel electrophoresis, and DNA isolation procedures.
- *Species Diversity of Bats in Relation to Habitat Quality, Tiputini Biological Station, Ecuador; University of Toronto, Toronto, Ontario*
  Soladero habitat is important for many species of animals requiring the nutrients located in the clay rich soil for growth and reproduction. Megan participated in a study investigating bat species diversity in relation to local habitat characteristics at Tiputini Biological Station in Ecuador.
  Ms. Hazell performed field techniques such as mist netting birds and bats, species identification of local bird, plant and bat species, quantified vegetation, water and soil sampling.
- *Climate Change and Invertebrate Populations of Southern Ontario, Institute of Environmental Studies, Toronto, Ontario*
  Ms. Hazell undertook a project assessing the potential effects of climate change on southern Ontario invertebrate populations. Work entailed detailed primary and secondary literature review, as well as interviews with entomology specialists and local government resources.

Publications and presentations

“Two species or one? Using the cytochrome B gene to investigate the phylogenetic relationship between Peromyscus gymnotis and Peromyscus mexicanus”. Hazell, M.E., and Engstrom, M. Ontario Society of Ecologists conference. May 2002.
“The population dynamics and survivorship of re-introduced elk (Cervus elaphus) in Bancroft Ontario”. Hazell, M.E., and Haydon, D.T. Bancroft district Ministry of Natural Resources annual meeting. March 2003.
“Elk movement decisions as a response to shifting resource availability”. Hazell, M.E. North American Elk Project annual meeting, National Science Foundation, Nordegg, Alberta. April 2003.
“The importance of individual spatial dynamics in understanding population level processes”. Hazell, M.E. and Fryxell, J.F. Guest Lecturer, Zoology Series, University of Guelph. February 2004.
“The influence of competition in shaping population dynamics”. Hazell, M.E. and Fryxell, J.F. Guest lecturer, Ecology Series, University of Guelph November 2004.

"The local bi-phasic movement dynamics of elk (Cervus elaphus)". Hazell, M.E., and Fryxell, J.F. North American Elk Project annual meeting, National Science Foundation, Yellowstone Park, Montana. April 2005.
"Elk (Cervus elaphus) movement dynamics: linking individual behaviour to the spatial heterogeneity of resources". Hazell, M.E., and Fryxell, J.F. Ecological Society of America (ESA) conference. August 2005.
"Movements of Boreal Caribou in the James Bay Lowlands". Hazell, M.E., and Taylor. M.E. North American Caribou Conference, Goose Bay. November 2008.
"Movements of Boreal Caribou around Attawapiskta". Hazell, M.E. and Taylor, M.E. Species at Risk Workshop, Attawapiskat, Ontario. October 2008.

Academic
"Multiple movement modes by large herbivores at multiple spatio-temporal scales". Fryxell, J.M., Hazell, M.E., Borger, L., Dalziel, B.D., Haydon, D.T., Morales, D.T., Rosatte, R. Proceedings of the National Academy of Science (in press), 2008.

Technical Reports
"Movement Dynamics and Habitat Selection of Boreal Caribou around the Victor Mine". Hazell, M.E. and Taylor, M.E. Technical Report., De Beers Canada. June 2008.
"Movement Dynamics and Habitat Selection of Boreal Caribou around the Victor Mine". Hazell, M.E. and Taylor, M.E. Technical Report. De Beers Canada. June 2007.
"Blanding's Turtle Management Plan". Hazell, M.E., and Dietrich, J. Technical Report. Public Works and Government Services Canada. March 2007.

APPENDIX F
LANDSCAPE PLAN

TREE SCREENS & FIELD PLANTINGS

SCALE: 1m : 3000M

30m 0m 60m 180m

NOTES:

1. SEEDLINGS SHALL BE PLANTED BY CONSERVATION AUTHORITY. PLANT VARIETY TO BE DECIDED ON AT THE TIME OF PLANTING.
2. MULCH SHALL BE LOCAL SHREDDED BARK MULCH. SAMPLE TO BE PROVIDED TO THE LANDSCAPE ARCHITECT FOR INSPECTION PRIOR TO INSTALLATION.
3. PLANTINGS SOIL MIXTURE MUST BE A HEALTHY MIX OF TOPSOIL AND GOOD GROWING ORGANIC MATTER.
4. ALL TREES AND SHRUBS PLANTED IN PLANTING BEDS MUST HAVE A MINIMUM OF 100MM OF PLANTING SOIL MIXTURE.
5. ALL PLANTING BEDS MUST HAVE A MINIMUM OF 100 MM MULCH.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE CAUSED TO UTILITIES.
7. TREE STAKES AND TREE ANCHORS ARE NOT REQUIRED.
8. IF PLANTING IS COMPLETED IN LATE SEASON BURLAP AND STAKES MAY BE REQUIRED.
9. ALL LANDSCAPE WORKS ARE SUBJECT TO A TWO-YEAR WARRANTY PERIOD, FROM DATE OF COMPLETION. AT THE END OF THE WARRANTY PERIOD, THE LANDSCAPE ARCHITECT WILL INSPECT FOR FINAL APPROVAL. ANY WORKS REPLACED DURING THE WARRANTY PERIOD SHALL BE GUARANTEED FOR AN ADDITIONAL YEAR.
10. THIS AREA MAY REQUIRE RAISED PLANTING BEDS TO PROMOTE HEALTHY VEGETATION GROWTH. THE FINAL DESIGN WILL BE BASED UPON SOILS TESTING.

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
F	12-02-2010	NEW LAYOUT TO FIT MNR PROTECTED AREA	FWD	HK	MP
E	08-24-2010	RE-ISSUED FOR REA PERMIT	FWD	HK	MP
D	06-22-2010	RE-ISSUED FOR REA PERMIT	FWD	AJT	MP
C	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
B	03-01-2010	RE-ISSUED FOR REA PERMIT	EH	MP	TZ
A	01-12-2010	ISSUED FOR REA PERMIT	FWD	MP	TZ

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FIRST SOLAR DEVELOPMENT (CANADA), INC.
5115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: TREE SCREENS & FIELD PLANTINGS

PROJ. MGR.	PROJ. ENGR.	DR. BY	CHK. BY	SCALE:
KEITH SYMMERS	TOM ZACARRIA	EH	PC	AS SHOWN

PROJ. DIRECTOR: MARK LANGDON
DRAWING NO.: REA-10A
REV.: F
FS ELEC. JOB No.: 5028-0102-22

THIS PRINT IS NOT TO BE USED FOR CONSTRUCTION UNLESS NOTED AND SIGNED OK FOR CONSTRUCTION ABOVE LAST REVISION.

X:\Applications Engineering\Projects\2009\5028-0102-23 St. Clair Sombra 20MW, Ontario Canada\FS Drawings\REA Drawing Files\5028-0102-22 REA-10A.dwg C003984 Dec 03, 2010 - 12:04pm

APPENDIX G
OIL, GAS AND WELL RESEARCH MEMO

October 2010

Project Reference: SW04090572

Ministry of Natural Resources
615 John Street North
Aylmer, ON N5H 2S8

Attention: Heather Riddell, Renewable Energy Approvals

Re: Ontario Oil, Gas & Salt Resources Search Memo
St. Clair Sombra Solar Farm
St. Clair Township, Lambton County, Ontario

AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC) was retained by First Solar Development (Canada), Inc. (First Solar) to conduct an Natural Heritage Assessment (NHA) which consists of a records review, site investigation and Environmental Impact Study (EIS) (if necessary) for a proposed photovoltaic (solar) electrical power generating facility, the St. Clair Sombra Solar Farm (Solar Farm). The project location is located in St. Clair Township in the County of Lambton on Part Lots 1 and 2 Concession 11 and Part Lot 1, Concession 10. The contiguous land parcels of which the project location is located on is approximately 140 hectares (ha) in size (of which the project location consists of approximately 59 ha which would be utilized for solar arrays and associated roads, temporary laydown areas and structures) and is currently in agricultural use (Figure 1).

As part of the NHA process as required under O.Reg. 359/09, documents have been created to provide direction into and including additional considerations that need to be addressed in the review of the renewable project sites. As outlined in the *Approval and Permitting Requirements Document* (APRD), issued 24 September 2009 by the Ontario Ministry of Natural Resources (MNR), consideration for developments must include a search for Ontario oil, gas and salt resources. Review of these resources and proximity within 75m of the project components for active locations may require additional efforts and reporting to allow development of a Site. Review of these resources is conducted by the Petroleum Resources Centre of the MNR.

A search of the Ontario Oil, Gas & Salt Resources on-line library (http://www.ogsrlibrary.com) in November 2009, indicates there are no current oil or gas wells present on the proposed Project Location; however, the following historical resources were identified at or around the Project Location:

- T002770 – was an advanced and abandoned dry hole (located in the southeast quadrant of the Project Location) completed and sealed in 1969 by J. Harmon to a depth of 719m (NAD 83; Lat: 42.71583333, Lon:-82.46005556);

- T002950 – was an advanced and abandoned dry hole (located in the northwest quadrant of the Project Location) completed and sealed in 1970 by J. Harmon to a depth of 724m (NAD 83; Lat: 42.70952778, Lon:-82.46361111); and,
- T009349 – was an advanced and abandoned dry hole (located in the southeast quadrant of the Project Location) completed and sealed in 2000 by Manti Operating to a depth of 750m (NAD 83; Lat: 42.70693556, Lon:-82.45850028).

The locations of the aforementioned and identified historical resources at or within 75m of the Project Location are detailed on Figure 1 (Drawing REA-05 Rev. G) at their respective spatial UTM coordinates. Furthermore, several additional abandoned oil wells were observed to exist within 1 km of the Project Locations boundary. Figure 2 shows the locations of the nearest wells/resources to the Project Location as available through Ontario Oil, Gas & Salt Resources on-line library.

It is noted that no active locations were identified within 75m of the proposed project components of the Site and any locations identified have been abandoned and sealed. Review and confirmation of this information is requested of the Petroleum Resources Centre of the MNR.

If additional information is required pertaining to the location of the identified historical resource locations, please contact the undersigned.

Yours truly,

AMEC Earth & Environmental
a division of AMEC Americas Limited

Mike Crabb, BES, CET, CCEP
Environmental Scientist

J. Brian Fogg, P.Eng.
Senior Engineer

/attachments

FIGURES

TRUE NORTH

SMITH LINE

EXISTING MUNICIPAL DRAIN

FROM ARRAY TO PROPERTY LINE

PROPERTY BOUNDARY

APPROXIMATE EXTENT OF SOLAR ARRAYS (TYP.)

FROM BLDG. TO PROPERTY LINE

PVIS (TYP)

FROM FENCE TO PROPERTY LINE

EXISTING HYDRO ONE POLE

COMMUNICATION TOWER

LATERAL POLE

METERING POLE

METERING POLE

LATERAL POLE

EXISTING HYDRO ONE POLE

FROM ARRAY TO CENTER LINE OF ROAD

WATSON TULLOCH DITCH

PROPOSED FENCE (TYP.)

PROPOSED GRAVEL ROAD (TYP.)

FROM PROPERTY LINE TO CENTER LINE OF ROAD

ROAD WIDTH

FROM ARRAY TO PROPERTY LINE

BASELINE ROAD

BASELINE ROAD

N 2 ° 32 ' 20 " E

N 2 ° 32 ' 20 " E 213.50'

120m [393.70']

PVIS

30.7m [100.72']

7.38m [24.21']

22.35m [73.27']

17.51m [57.45']

5.36m [18.15']

7.98m [26.17']

30.7m [100.72']

51.35m [168.46']

FROM ARRAY TO CENTER LINE OF ROAD

17.51m [57.45']

FROM PROPERTY LINE TO BERM

N 1°24'50"E 88.439

27.24m [89.36']

N87°40'10"W 91.540

N2°25'30"E 146.292

N87°33'55"W 54.864

FROM PROPERTY LINE TO FENCE

S 2°28'10"E 58.327

N2°25'30"E 146.292

59.27m [194.46']

82.57m [270.90']

FROM ARRAY TO PROPERTY LINE

PCS SHELTER AND TRANSFORMER (TYP.)

N 87 ° 35 ' 00 " W 237.270

211.410

285.015

302.986

MYERS DRAINS

T004320

T002770

T009349

T002950

10 9 8 7 6 5 4 3 2 1

20 19 18 17 16 15 14 13 12 11

BENTPATH LINE

22.8m [74.79']

FROM ARRAY TO CENTER LINE OF ROAD

N 87 ° 32 ' 40 " W

RIVERS LAPISH DITCH

PCS SHELTER AND TRANSFORMER (TYP.)

51.98m [170.55']

FROM ARRAY TO PROPERTY LINE

229.229

170.3m [558.73']

29.43m [96.57']

17.45m [57.25']

27.88m [91.48']

N2°51'00"E 194.810

N 2 ° 20 ' 50 " E 674.027

DISTRIBUTION LINE

FROM ARRAY TO PROPERTY LINE

PROPOSED CONSTRUCTION ENTRANCE

PROPOSED LANDSCAPE BERM SEE REA-10B FOR DETAIL (TYP.)

FROM ARRAY TO PROPERTY LINE

PROPERTY BOUNDARY

FROM ARRAY TO CENTER LINE OF ROAD

APPROXIMATE EXTENT OF SOLAR ARRAYS (TYP.)

100m [328.08']

N87°55'00"W

PROPOSED LANDSCAPE BERM SEE REA-10B FOR DETAIL (TYP.)

SMITH LINE

BENTPATH LINE

332.5m [1090.87']

PROPOSED CONSTRUCTION STAGING AND LAYDOWN AREA

6.67m [22.54']

100m [328.08']

304.49m

FROM ARRAY TO PROPERTY LINE

N2°52'40"E 94.853

N2°30'45"E

N2°45'55"E 43.854

N2°30'25"E 197.756

54.6m [179.15']

EXISTING DITCH

100m [328.08']

15.73m [51.62']

PROPOSED CONSTRUCTION LAY-DOWN AREA SEE REA-06 FOR MORE DETAILS

EXISTING WOODLAND "A"

REQUIRED SET BACK WITH AN EIS – 0m

EXISTING WOODLAND TO REMAIN

ARRAY PERSPECTIVE

LEGEND:

- PROPERTY BOUNDARY
- EXISTING BUILDING
- ARRAY
- UNDER GROUND ELECTRICAL WIRING
- PROPOSED FENCE
- PROPOSED UTILITY POLE
- WOODED AREA (LIO, MNR 2010)
- WATERBODY (LIO, MNR 2010)
- WATERCOURSE (LIO, MNR 2010)
- 120 m PERIMETER BUFFER
- T002950 HISTORICAL OIL, GAS OR SALT RESOURCE LOCATION

SITE IMPROVEMENT PLAN

SCALE: 1m = 3000m

30m 0m 60m 180m

REV	DATE	REVISION DESCRIPTION	BY	CHK	APP
G	08-24-2010	RE-ISSUED FOR REA PERMIT	JRR	HK	MP
F	06-22-2010	RE-ISSUED FOR REA PERMIT	JRR	AJT	MP
E	04-28-2010	RE-ISSUED FOR REA PERMIT	DHD	MP	TZ
D	04-06-2010	RE-ISSUED FOR REA PERMIT	FWD	MP	TZ
C	03-01-2010	RE-ISSUED FOR LAYOUT CHANGE	FWD	MP	TZ
B	12-14-2009	ISSUED FOR REA PERMIT	RAR	MP	TZ
A	12-10-2009	ISSUED FOR APPROVAL	DA	MP	TZ

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FIRST SOLAR DEVELOPMENT (CANADA), INC.

5115 BLACKWELL SIDEROAD
SARNIA, ONTARIO, N7T 7H3

ST. CLAIR - SOMBRA
TOWNSHIP OF ST. CLAIR
LAMBTON COUNTY, ONTARIO

PROJECT: ST. CLAIR - SOMBRA SOLAR FARM

TITLE: SITE IMPROVEMENT PLAN

PROJ. MGR.	PROJ. ENGR.	DR. BY	CHK. BY	SCALE:
KEITH SYMMERS	TOM ZACARRIA	FWD	MP	AS SHOWN

PROJ. DIRECTOR: MARK LANGDON

FS ELEC. JOB No: 5028-0102-22

DRAWING NO.: REA-05

REV.: G

THIS PRINT IS NOT TO BE USED FOR CONSTRUCTION UNLESS NOTED AND SIGNED OK FOR CONSTRUCTION ABOVE LAST REVISION.

P:\2010\Other Offices Projects\2010SarniaSW\04096672 First Solar Sombra\Drawings\5028-0102-22 REA-05 (Rev G).dwg dave.cole Oct 08, 2010 - 7:51am

Map from Ontarion Ministry of Natural Resources Data - Oil and Gas Well Website
(http://maps.ogsrlibrary.com)

LEGEND:

Approximate Site Area

- Few Wells in Area
- Many Wells in Area
- Oil Pool - Active
- Oil Pool - Abandoned
- Natural Gas Pool - Active
- Natural Gas Pool - Suspended
- Natural Gas Pool - Abandoned
- Natural Gas Storage Pool
- Seismic Lines
- Fault, Cuts One Geologic Period
- Fault, Cuts Precambrian
- Fault, Cuts Precambrian - Trenton
- Fault, Cuts Trenton
- Fault, Cuts Precambrain - Rochester
- Licenced Well, Undrilled
- Well Location, Unknown Type
- Observation Well
- Dry Hole, Potential or Suspended
- Dry Hole, Abandoned
- Oil Producing Well
- Oil Producer, Abandoned
- Gas Producing Well
- Gas Producer, Abandoned
- Oil and Gas Well
- Oil and Gas Well, Abandoned
- Oil Show
- Oil Show, Abandoned
- Gas Show
- Gas Show, Abandoned
- Gas Show / Oil Show
- Gas Show / Oil Show, Abandoned
- Oil Well / Gas Show
- Oil Well / Gas Show, Abandoned
- Gas Well / Oil Show
- Source Well
- Source Well, Abandoned
- Injection Well
- Injection Well, Abandoned
- Solution Mining Well
- Brine Well
- Brine Well, Abandoned
- Brine Disposal Well
- Natural Gas Storage Well
- Natural Gas Storage, Abandoned
- Cavern Storage Well
- Cavern Storage Well, Abandoned
- Stratigraphic Test
- Stratigraphic Test, Abandoned

TITLE:

FIGURE 2
HISTORICAL OIL AND GAS - SOMBRA SITE

CLIENT:

FIRST SOLAR
DEVELOPMENT CANADA

PROJECT:

PROJECT #: SW04090572
DRAWN BY: MC
DATE: NOVEMBER 2009
SCALE: AS SHOWN

PREPARED BY:

870 Confederation Stre
Sarnia, Ontario
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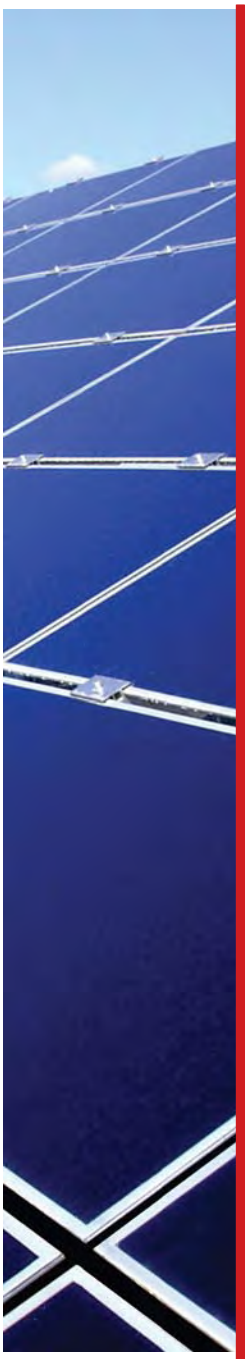
APPENDIX H
CONSTRUCTION PLAN



Construction Plan Report – St. Clair - Sombra

Prepared by: First Solar

Date: December 23 2009

REV 1 – March 1, 2010

REV 2 – APRIL 9, 2010

REV 3 – June 22, 2010

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Table of Contents

Executive Summary

The St. Clair - Sombra Solar Farm is proposed on an approximately 140 hectare tract of land located at Smith Line, Town of Sombra, County of Lambton, Province of Ontario, Canada, approximately 2 km east of the St. Clair River. The tract is generally bounded by Bentpath Line on the North, 670m to the South of Smith Line, Baseline Road on the West, and 600m to the East of Baseline Road on the East. The site abuts residential or agricultural properties on each boundary.

In general, the majority of the existing site is devoted to agriculture with the primary crop being corn. There are existing buildings on the site. A wood lot extends approximately 160m in from the eastern boundary on the North side of the property, which will remain during and after construction.

First Solar proposes to construct a 20 MW solar farm on the above tract. The proposed 20MW farm will deliver enough clean electricity to power approximately 2,800 homes. The proposed solar farm consists of approximately 61 hectares of solar arrays, mounted on fixed steel supports and arrayed in long rows. The arrays will be connected to a series of small, 15 square meter shelters housing electric current conversion equipment and switches. The electric power from the convertor shelters will be run via underground cable to electric utility intertie equipment at the edge of the arrays, and from that to the Lambton Township Transmission Line. A 31 meter high antenna tower will provide remote control capability of the solar farm from the electric utility.

The completed facility will be surrounded by a 2.1 meter high security fence (total height) and will be entered at locations off of Smith Line through a secured gate, which is continuous with the security fence.

To be consistent with First Solar's core value of environmental responsibility, the planning and designing of the solar farm has been conducted with a conscious effort to minimize any negative environmental impact. Studies and assessments of the existing animal and plant populations, the terrain and water drainage requirements, and surrounding properties have been undertaken. Terrain modifications and ground disturbances will be kept to the minimum extent practical in order to maintain existing water drainage patterns. Soil erosion and sediment control measures will be employed during construction. There will be no addition of paved surfaces, and only a minimal addition of gravel for site access roads.

At the end of construction, the entire facility except for the internal gravel access roads will be planted with grass. The perimeter of the site will be landscaped to reduce visibility of the solar farm from adjacent roadways and properties where necessary. Because of the long term ground cover and plantings in conjunction with reduced tillage, the value of the site as wildlife habitat will improve. First Solar will also consider future cropland leases for sections of the property outside of the array areas. The solar farm will be a passive facility with no emissions to the atmosphere, and minimal light and noise impacts. Any potential noise generated is required to be below Ministry of Environment (MOE) noise limits. After construction is complete, the site will not create any water demand. Once in operation, traffic to the solar farm will be extremely light, with less than one trip per day anticipated.

Proposed Project Construction Plan

Photovoltaic (PV) Arrays

PV Array

The St. Clair – Sombra Solar Farm Project involves the installation of 20 arrays of photovoltaic (PV) modules or panels, manufactured by First Solar, with the cumulative capacity to generate 20 MW_{AC} of power under peak solar conditions. Each 1 MW_{AC} PV array will consist of approximately 16,860 PV modules and one Power Conversion Station (PCS), which includes two 500 kilowatt (kW) inverters and one 1,000 kilovolt amp (kVA) isolation transformer. Each 1 MW_{AC} array covers approximately 3.0 hectares. The quantities listed are subject to change based on the time the project is designed and approved.

PV arrays consist of groups of PV modules called "tables". Each table consists of up to 16 modules and measures approximately 2.4 meters wide by 2.4 meters long. Tables will be mounted on an angle with respect to horizontal, to steel racking supported by vertical steel columns, spaced at approximately 3 meters center-to-center, and driven into the ground to an approximate depth of 1.1 meter below grade. Once mounted, the front of each table will reside approximately 600 mm above grade, while the rear will be no more than 2 meters above grade.

The arrays will be separated by access corridors (approximate width of 7 meters), dividing each array into quadrants. The PV modules will be electrically connected by wire harnesses and combiner boxes that feed the array's PCS via underground direct current (DC) cables. Each PCS will contain two 500 kilowatt (kWac) inverters located within a climate controlled inverter enclosure and one 1,000 kilovolt amp (kVA) transformer. The PV inverters convert the DC electric input into grid-quality AC electric output.

Inverter Enclosure

There will be two PV Interconnection Switchgear (PVIS) houses for St. Clair – Sombra. Each PVIS house is approximately 3.6 meters in height and is elevated 500 mm above grade. The PVIS houses will be located near the connection point to the local grid. A 27.6 kV high-capacity collection system line will then connect the power output from the PVIS to the Project Substation.

PV Interconnection Switchgear

The on-site electrical collection system is designed to minimize electrical losses within the Project Site prior to delivery to the Project Substation.

A meteorological station will be installed on site to track weather patterns. The meteorological station will include a data acquisition system (DAS) to collect data for analysis and system monitoring. The DAS system involves a network of data loggers and programmable logic controllers (PLC's). These will be connected to a Wide Area Network (WAN) and monitored onsite in the operations and maintenance (O&M) facility, as well as in a remote Network Operations Center.

Meteorological Station

Principal materials included in the PV arrays include glass, steel, and various semiconductor metals. At the end of their useful life, most of the Project materials will be recycled, including the PV modules themselves (which will be collected through First Solar's pre-funded module collection and recycling program), the steel tables and posts, and the wiring.

The First Solar modules used in the project employ the stable compound cadmium telluride (CdTe) as the semiconductor material. The unique advantages of CdTe PV technology include:

- Superior light absorption properties resulting in higher output, compared to traditional silicon modules, under cloudy and diffuse light conditions such as dawn and dusk;[1]
- Better performance at the high temperatures that modules are subject to under direct sunlight compared to traditional silicon modules;[2]
- Enhanced suitability for production of modules – high volume and low cost;
- Faster energy payback time – the fastest of existing PV technologies;[3] and
- Smallest carbon footprint among current PV technologies on a life cycle basis.[4]

As discussed more fully in the accompanying "Decommissioning Report", First Solar's industry-leading collection and recycling program ensures that PV module materials stay in the production cycle and out of municipal landfills. First Solar has commercial-scale recycling operations in place at all of its manufacturing facilities. Approximately 95% of the semiconductor material and 90% of the glass are recovered in First Solar's recycling program. The remaining materials (e.g. glass fines, dust) are collected and properly disposed of according to local regulations.

In 2009, an in-depth assessment of the environmental, health and safety aspects of First Solar's CdTe PV systems and manufacturing operations was carried out under the authority of the

[1] Mohring, H.D., et al., "Outdoor Performance of Polycrystalline Thin Film PV Modules in Different European Climates," European project 'PYTHAGORAS."

[2] Ibid.

[3] Fthenakis, V. M, Alsema, E., "Photovoltaics Energy Payback Times, Greenhouse Gas Emissions and External Costs: 2004 – Early 2005 status," Progress in Photovoltaics: Research and Applications, 2006; 14: 275-280.

4 Fthenakis, V.M, Kim, H.C., Alsema, E., "Emissions from Photovoltaic Life Cycles," Environmental Science & Technology, 2008; 42: 2168-2174.

French Ministry of Ecology, Energy, Sustainable Development and the Sea. It concluded that, "During standard operation of CdTe PV systems, there are no cadmium emissions – to air, to water, or to soil. In the exceptional case of accidental fires or broken panels, scientific studies show that cadmium emissions remain negligible. Accordingly, large-scale deployment of CdTe PV can be considered safe to human health and the environment"[5]

A peer review of three major published studies on the environmental profile of CdTe PV organized by the European Commission, Joint Research Center and sponsored by the German Environment Ministry concluded, "…CdTe used in PV is in an environmental stable form that does not leak into the environment during normal use or foreseeable accidents, and therefore can be considered the environmental safest current use of cadmium." This review also concluded that ***"…***Large scale use of CdTe photovoltaic modules does not present any risks to public health and the environment.*"*[6]

Independent analysis also indicates that CdTe modules do not pose a risk during fires. CdTe has an extremely low vapor pressure, high boiling and melting points and is almost completely encapsulated by molten glass when exposed to fire. Exposure of pieces of CdTe PV modules to flame temperatures from 760 to 1100^{o}C illustrated that CdTe diffuses into glass, rather than being released into the atmosphere. Higher temperatures produce further CdTe diffusion into the glass.[7]

First Solar modules have been tested in accordance with applicable waste characterization protocols and are non-hazardous waste at end-of-life in Canada, the United States and Europe

Reusable & Recyclable Materials

The project consists of numerous recyclable materials, including glass, semiconductor material, steel, and wiring. As the Project approaches the end of its useable life, the component parts will be dismantled and recycled. First Solar, as part of its commitment to the environmental philosophy of extended producer responsibility has a pre-funded collection and recycling program for all of its solar modules, which is discussed in detail in the accompanying "Decommissioning Report".

Efficient Land-Use Practices

The St. Clair - Sombra Solar Farm will make an efficient use of the land being taken out of agricultural production. Parcels within the project area are presently used for farming. The Project proposes to discontinue annual tilling and harvesting and replace it with a use that is more benign for certain species. Construction of the PV arrays will involve a one-time disturbance, followed by a low-impact maintenance schedule. The PV array clearance above the surface (600 mm at its lowest point) minimizes disruption to wildlife and allows passage through

5 Summary Report, "Environmental, Health, and Safety (EHS) Aspects of First Solar Cadmium Telluride (CdTe) Photovoltaic (PV) Systems," carried out under the authority of the French Ministry of Ecology, Energy, Sustainable Development, and the Sea, July 2009.

6 "Peer Review of Major Published Studies on the Environmental Profile of Cadmium Telluride (CdTe) Photovoltaic (PV) Systems," Arnulf Jager-Waldau

7 Fthenakis, V., Fuhrmann, M., Heiser, J., Lanzirotti, A., Fitts, J., and Wang, W.,""Emissions and Encapsulation of Cadmium in CdTe PV Modules During Fires," *Progress in Photovoltaics: Research and Applications*, 6, 99-103 (1998).

the site. The PV array infrastructure is non-permanent. As a result, upon decommissioning, all above grade facilities and all below grade near-surface facilities could be removed and the land could be returned to original agricultural production or placed into other permitted use, as desired.

Benefits to the County

The energy generated by the project will typically first be consumed by the nearest connected load centers, such as Lambton County and St. Clair - Sombra.

In addition to the benefits of clean energy generation, development of the St. Clair - Sombra Solar Farm would confer economic benefits to thousands of people across the County, region and province. It is expected to create approximately 300 direct jobs on average during the twelve-month construction period and a few permanent direct jobs. The County is expected to collect millions of dollars of new sales tax revenues from the Project during the construction period and increased property tax revenues throughout the project's operation, largely due to the change in land ownership and conversion to non-agricultural use.

In addition, the project and other similar projects in the region offer the opportunity for Lambton County and the southwestern Ontario region to become a world leader in supporting and educating about solar power.

Fencing

Subject to regulatory approval, the site will be fenced with a 1.8 meter-high chain link fence topped with three strands of barbed wire, for security purposes. A gated 2.4 meter-high chain link fences will be constructed around the high voltage switchgear.

Security

During construction, the site will be under continual surveillance by the supervising construction staff. In addition, 24-hour onsite security will be provided.

After the project is complete; the perimeter fencing with locked gates will act as a security barrier. Electronic surveillance will be evaluated for the project site.

Fire Hazard

There is limited potential for wildfire in the project site. Vegetation will be managed with minimal potential for vegetative fuel buildup. The PV modules and ancillary equipment result in a negligible increase in fire potential.

First Solar is available to work with local fire officials to provide information and education regarding this PV installation. As is the standard case involving fires involving electrical equipment, care must be taken in fighting such fires. Additional protective equipment beyond what is required when responding to other electrical fires is not required fighting fires involving solar PV modules, including those involving First Solar modules.

Buffer Zones

Buffer zones are incorporated into the site layout to minimize visual obtrusiveness from public roads and adjacent private lands. A buffer zone with a minimum width of 25 meters will be

maintained between the PV arrays and all surrounding properties. In many locations around the site, the buffer zone will be wider.

To keep the water consumption to a minimum, intensive landscape screening is not proposed. However, a row of evergreen screening may be considered between the facility and residential properties. In order to prevent soil erosion, provide dust control, and maintain an annual grassland appearance beneath the PV modules, the First Solar may plant a vegetated understory that will mimic annual grassland vegetation. This vegetation would require only minimal, if any, initial irrigation, and would help prevent the invasion of non-native plant species.

Utility Connection Facilities

Distribution Facilities

This section describes the project's distribution facilities proposed to interconnect the Project to the 27.6 kV distribution system located directly adjacent to the site. The proposed project includes a total of 20 MW, made out of two (2) 10 MW facilities. Each 10 MW facility will be connected individually to the distribution system with separate poles, metering and medium voltage switchgear equipment.

Project Transformation

The inverters output of 208 V will be stepped up to 27.6 kV at each Photovoltaic conversion station (PVCS) with a 1000 KVA step up liquid cooled transformer. Ten PVCS stations will be connected to each other in parallel and ultimately connected to the PVIS. An approximate 30 square meter control building and grid interconnection switchgear (PVIS) will be used to connect the solar project to the distribution system. The PVIS site will be graded and compacted to an approximately level grade. Several cement pads will be constructed as foundations for electrical equipment and the remaining area will be graveled. Electrical switchgear, dead end line structures, and related facilities will be present. There will also be trenching within the PVIS for grounding grid installation, buried power cables, and control cables.

Interconnection to Distribution Grid

Generation from each Project will be delivered to Hydro One's Distribution M3 distribution circuit. The 71M3 circuit is supplied from Lambton Transformer Station located near the community of Sombra Ontario approximately 10 km away from the project.

Interconnection Configuration

One PVIS will be required for each 10 MW project. The PVISs will be located perpendicular to the existing Hydro One's 71M3 distribution line located on Baseline Road, thus avoiding the visual impacts of an additional medium-voltage distribution line within or near the Project Site.

Structures

New 50 foot wooden poles will be installed to mount the overhead revenue metering equipment, and load break switch. The transition from an overhead circuit to an underground circuit will occur at the Load break switch connection the interconnection station (PVIS) to the Utility's 27.6 kV line.

Conductors

The Generation facility will be connected to the Utility's distribution grid with overhead 3/0 ACSR

conductors.

Construction of Interconnection Facilities

Each 10 MW project will be connected to the distribution system individually with its own poles, metering systems, and PVIS. Construction of the interconnection between the existing 27.6 kV line and the new St Clair Sombra PVIS's will be undertaken by local contractors. Construction of the distribution facilities will be scheduled to occur after the PVIS has been completed to allow the distribution circuit to be placed back in service immediately after it is interconnected to the new switching station.

Project Construction

The construction of the project will begin once all applicable approvals and permits have been obtained. It will take approximately twelve months from the commencement of the construction process to complete the project. During construction, the expected number of employees will be approximately 200 on average, with a peak workforce of approximately 300 employees. Once construction is completed, the Project will potentially be in operation for 25 years or more, given opportunities for equipment repowering and replacement.

First Solar's Engineering, Procurement, and Construction (EPC) group has considerable experience building solar farms. The 58 MW_{AC} El Dorado Energy Solar project, owned by Sempra Generation, was started in 2008, with 10 MW_{AC} complete to date. First Solar is also building the 80 MW_{AC} Sarnia solar farm, owned by Enbridge Ontario Wind Power, LP, with 20MW_{AC} completed to date. Blythe solar project (21 MW) was recently completed. Additional near-term projects include PV farms in Cimarron, New Mexico; and Tilbury, Ontario.

Construction will occur in two basic phases: (i) site preparation and (ii) construction and installation of the solar modules and electrical components.

Site Preparation

Site preparation involves improvement of most onsite construction access roads, installation of drainage crossings, setup of construction staging areas, storm-water management works, preparation of land areas for array installation, and other activities needed before installation of the solar arrays can begin. This work may involve removal or trimming of vegetation, agricultural rolling of PV array areas, selected compacting and leveling, and setup of modular offices and other facilities needed for construction.

The temporary construction staging areas will then be cleared and fenced, and the construction access roads will be improved. Existing structures on the property will be razed after all required permits are secured. All demolition materials will be recycled or disposed of in accordance with all applicable codes and regulations.

The PV arrays require a relatively level and stable surface for installation. Topographic, geotechnical, and hydrologic studies will be used to determine if any leveling or compaction is necessary to ensure safe and efficient PV array installation. Based on site visits and preliminary studies, First Solar believes that a portion of the site may be able to accommodate PV arrays after preparation by common agricultural techniques. However, grading and compaction will be required in select areas.

Construction access on the site will occur on newly constructed roads. These roads will be made of gravel, recycled concrete, or other suitable, pervious material. The use of gravel roads will not impact stormwater flow and will reduce water use for dust control during construction.

Trenching will occur within each 1 MW array to bury the AC and DC electrical cables. The trenches will vary from 0.5 meter to one meter in width and will be about one meter deep. Each 1 MW array will have three to four separate trenches for a total length of approximately 450 to 580 meters, depending on the array's proximity to the PVCS. Minimal ground disturbance will occur within the trenched corridors and they will be restored with backfill so that the corridor can conform to the surrounding surface contours. In the absence of annual tilling for agricultural purposes, the Project Site is expected to regain some habitat value.

Construction and Installation

The construction and installation phase involves installation of the PV solar modules and all the necessary electrical equipment to make the facility operational.

First, vertical support posts are driven into the ground. These will hold the support structures (tables) on which PV modules will be mounted. Trenches are dug for the underground AC and DC cabling, and the foundation for the inverter enclosures and transformers are prepared. While cables are being laid and combiner boxes are being installed, the prefabricated PV module support tables are installed. Tilt brackets connect the steel support tables to the vertical posts and provide for proper orientation to the sun. Rubber-padded clips attach the glass PV modules to the tables. The modules are connected electrically via wire harnesses and jumpers to the electrical collection system, through the combiner boxes, and on to the Power Collection Station (PCS). Underground cables connect the PCS's to the onsite AC electric infrastructure, and a single overhead circuit connects the solar farm to the adjacent distribution grid.

Upon completion of construction, the solar farm will undergo a final system validation and commissioning process. The Data Acquisition System (DAS) and monitoring systems are brought online, the equipment is tested, and operational readiness is verified. The project will be brought online and connected to the grid sequentially, in 10MW_{AC} increments, as each 10 MW_{AC} block is completed.

The construction workforce is estimated to be 200 employees on average for the approximately one-year construction period, with a peak of approximately 300 employees. The construction workforce will be recruited from within the local Ontario area to the greatest extent practicable.

Typical construction work hours are expected to be from 7:00am to 5:00pm, Monday through Friday. In the event that construction work takes place outside these typical hours, activities will comply with county and municipal standards for construction noise levels. Select tasks must be performed after dark for safety reasons since PV modules are active any time that they are exposed to sunlight. The project is expected to use restricted nighttime lighting during construction, and such uses would be limited to task-specific lighting. In addition, 24-hour onsite security will be provided.

During construction, the only wastes produced will be typical construction wastes, such as broken PV modules, wood, and miscellaneous packaging materials. Construction waste will be disposed of in accordance with local, provincial, and federal regulations and with a view to

maximizing recycle availability and minimizing landfill material. PV modules damaged or broken during construction will be returned to First Solar's manufacturing facility in Ohio USA, where they will be recycled into new modules or other products.

Safety is of primary concern to the company. The project will follow all applicable Canadian Centre for Occupational Health and Safety (CCOHS) requirements in its construction and operating activities. A safety and compliance director and a site nurse will be assigned to the Project. A site-specific Health and Safety Plan will be developed, identifying the roles and responsibilities of every employee with respect to safety and provide emergency contacts information for local first responders and emergency facilities.

There is limited potential for wildfire in the facility. Vegetation will be managed with minimal potential for vegetative fuel buildup. The PV modules and ancillary equipment result in a negligible increase in fire potential. The project will have a fire prevention plan in compliance with applicable local regulations.

During construction, the area will be under continual surveillance by the supervising construction staff. Special inspections will be conducted in conformance with the environmental protection measures adopted by the project.

Considerable engineering design has been completed that has sought to anticipate problems or issues that could arise prior to the start of construction. Should unforeseen problems occur; the construction department will identify them as early as possible and work with the county, municipality, and other agencies to implement any necessary changes in a manner that complies with all relevant regulations.

Seasonal Considerations

The above sequence of installation may be modified due to seasonal or weather constraints. Site preparation work will be scheduled to the greatest extent practicable to avoid disruption wildlife breeding patterns and to take advantage of drier conditions for road building and PV array area leveling activities.

Temporary Facilities/Construction Staging/ Water Usage

Part of the site includes a construction staging area of approximately seven hectares, which will be graded and fenced for security. The staging areas will include construction offices, a first aid station, worker parking, and truck loading and unloading facilities. Temporary toilet facilities and washing stations will serve the sanitary needs during the construction process. These staging areas will be decommissioned and removed when construction is completed.

During the construction period, water may be needed for dust control and temporary sanitary facilities. The project is expected to use a maximum of 100,000 liters per day (lpd) during very dry, dusty days. During normal rainfall, construction water usage will be minimal (approximately 500 liters per day). The maximum daily water demand is expected to be during the first 65 days of construction, before site preparation is complete and after array construction has commenced.

Site Access and Transportation

A large portion of the traffic generated by the Project will be for the delivery of Project

components and equipment during construction. The primary roadway to the St. Clair - Sombra area typically accessed off of Bentpath Line. A traffic study for the Project has been prepared as a part of the EIS process.

Table 1 describes the estimated number of daily traffic trips to and from the Project Site in each category during construction for a typical 20 MWac project.

Table 1: Estimated Construction Traffic

Purpose	Traffic During Site Preparation	Traffic During Construction and Installation
Workers (daily roundtrips)	40 vehicles, assuming each worker drives individual vehicle	200 vehicles, assuming workers are a mixture of car pools and drive individual vehicles
Trucks Delivering Road Aggregate (daily roundtrips)	10 (25-ton trucks)	0
Construction Vehicles (one way only)	10 vehicles	0
Deliveries (daily roundtrips)	8 - 10 vehicles	10 - 15 vehicles
Substation and Switching Station Equipment Deliveries (daily roundtrips; approx. 20 total)	5 vehicles (may require wide load trucks)	
Total	75 vehicles	215 vehicles

Upon reaching the site, delivery trucks will enter the construction access road as shown on the Site Plan. The trucks will use the onsite roads, improved with gravel, to deliver supplies to the area under construction. The trucks will exit the site at the same entrance on Smith Line.

Construction vehicles used for construction will be brought to the on-site at the beginning of the construction process, and will remain onsite throughout construction. These vehicles will generally not be used on public roads, and will be stored while not in use. Table 2 lists the type and maximum number of construction vehicles expected to be in use during the approximately twelve-month construction period.

Construction equipment and vehicles will access arrays under construction by driving across the Project Site. Approximately two to three vehicles will drive along each row of tables under construction, resulting in only slight temporary ground disturbance in ungraded areas away from the main construction access roads.

Table 2: Construction Equipment and Vehicles Located and Stored On-Site

Site Preparation and Clearing/Leveling			
Approximate Number of Units	Equipment	Purpose	Duration (Months)
1 – 2	8,000 Gal Water Truck	Dust Control / Compaction	5
2	Graders	Road/Staging Prep	2
2	25 Cubic Yard Paddle Scrapers	Road/Staging Prep	2
2	10 Ton Rollers	Road/Staging Prep	2
2	Farm Roller	Field Preparation	2

Underground work (boring, trenching, installing conduit)			
Approximate Number of Units	Equipment	Purpose	Duration (Months)
6	Small Backhoe	Excavation/Backfill	2
6	Small Sheepsfoot Roller	Compaction	2
6	5 CY Dump Truck	Excavation/Backfill	2
System Installation			
Approximate Number of Units	Equipment	Purpose	Duration (Months)
12	4x4 Forklift	Material Staging	5
12	ATV Vehicles	Material Staging / Transportation	6
20	Pick-Up Trucks	Material Staging / Transportation	6
6	Truck-Mounted Pile Driver	Post Installation	2
Testing			
Approximate Number of Units	Equipment	Purpose	Duration (Months)
12	Pick-Up Trucks	Transportation	2

Construction Noise/Dust

Construction will involve temporary use of construction equipment during site preparation, leveling activities, construction of the operations building, and assembly of PV module arrays, which includes driving foundation posts (similar to steel posts used in highway guard rails) to support the array tables.

The primary source of noise during construction will be driving foundation support posts. The Project will comply with applicable noise standards, which generally restrict construction noise impacts on neighboring residential properties before 7:00 am and after 5:00 pm on weekdays and before 8:00 am and after 5:00 pm on Saturdays and Sundays.

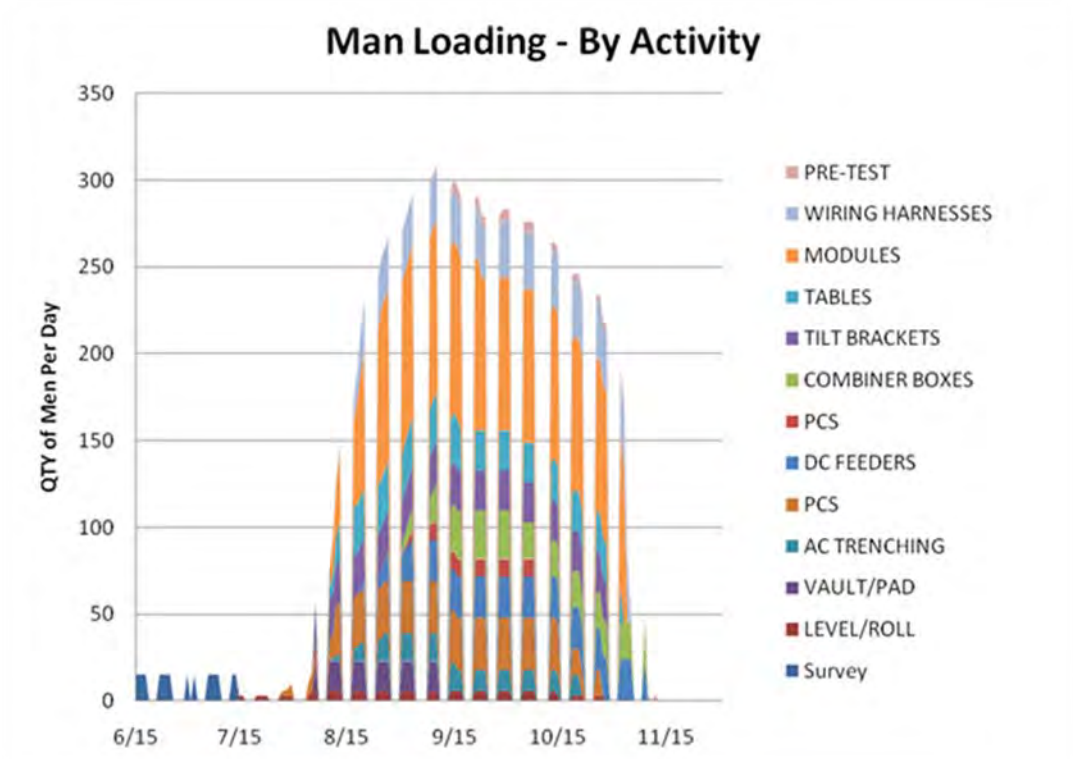
Depending on the prevailing weather conditions, construction vehicles can generate dust during travel over internal gravel access roads, similar to agricultural operations. In addition, clearing, grubbing, and leveling activities can also produce dust. First Solar maintains onsite water trucks to moisten the traveled roads in order to suppress any dust.

Construction Population and Housing

In order to minimize the impact on the local community, the project does not require temporary onsite housing for the construction workforce. First Solar will employ subcontractors expected to rely heavily on the local labour pool. The project is not expected to have a significant impact

on population or housing during operation.

Below represents a typical man-loading chart for a 20 MW_{AC} project, over a 5 month example construction schedule. This will vary depending on the length of the project and availability of local labor. For a typical 20 MW_{AC} project; the project will peak at approximately 300 craft workers over the course of the project with the majority associated with the installation of the solar modules.



Hazardous Products

The products described in Table 3 will be present during Project construction.

Table 3: Products Present On-site During Project Construction

Product	Use
Diesel	Vehicles
Gasoline	Vehicles
Motor Oil	Vehicles
Mineral oil	Transformers

Project Operations & Maintenance

There will be approximately two permanent employees of the facility. Employees will monitor and report the performance of the Project, conduct preventive and corrective maintenance, receive students and other visitors, and maintain the security.

While the project will largely be self-sufficient upon completion of construction, periodic operations and maintenance (O&M) activities will be required. Key elements of the O&M plan include management of lighting, reflectivity, noise, facility replacement materials storage, safety, and repair.

The PV arrays are designed to withstand code prescribed seismic activity and wind forces. Any realignment of the modules and structures will be handled on an as needed operational basis.

Electrical Maintenance and Fire Safety

The project is not located adjacent to either urbanized areas or wild-lands. There is no reasonably foreseen risk of the Project being the source of a fire, nor will it contribute to spreading an existing fire. As with all electrical installations, there is some electrical fault risk. However, this risk is mitigated during installation as a careful engineering review of all electrical components has been completed in accordance with all relevant requirements. Once operating, the facility is subject to a long-term operations and maintenance agreement. It will be regularly monitored to ensure proper power output. Regular on-site inspections and maintenance will also be performed and will ensure proper vegetation management. As the construction of the project is primarily glass, concrete, and steel, the facility is not flammable.

Traffic

The facility will employ a permanent workforce of approximately two people. Only limited deliveries will be necessary for replacement PV modules and equipment during operation. Table 4 details the expected daily traffic during operations.

Table 4: Daily Vehicle Trips during Operation

Purpose	Operations Traffic
Employees (daily roundtrips)	2 vehicles
Deliveries (daily roundtrips)	2 vehicles

Lighting

For security and maintenance purposes, shielded, task-specific lights will be installed at the construction offices, the construction staging areas, and possibly on or near each PCS station. These lights will be turned on either by a local switch, or by motion sensors that will be triggered by movement at a human's height during maintenance or emergency activities. No lights are currently planned around the Project perimeter to minimize the Project's visual impact on surrounding development and roads. All exterior lights will be shielded to minimize their impact to the night sky and neighbors.

Drainage Improvements

The Project will be designed such that the volume and quality of storm water runoff are maintained, if not improved, from the existing condition. This will be based on detailed hydrologic and topographic studies that will be performed in conjunction with the permitting process. Due to the limited increase in impervious areas, it is not expected that the PV arrays within the Project Site will affect site runoff.

The proposed Project is not expected to alter the site's pre-development hydrologic conditions. The Project has been designed to contain the following low environmental impact features:

- Hard-scape and impermeable surfaces are minimal;
- PV modules are elevated above grade, which preserves permeability of the Project Site;
- Existing natural drainage flows have been maintained; and
- Vegetated waterways provide filtration and increased percolation for storm-water runoff.
- By reverting to a non-agricultural use and a cessation in the use of pesticides, runoff water quality is improved.

Water

There is no annual demand for water supply for the operation of the facility. The Project uses no water for electricity generation or cooling. Water is not required for PV module washing; rain water and snow are sufficient for cleaning modules.

First Solar does not plan to drill any new water wells on site and will use a trucked in water supply during construction for dust control purposes, as needed.

Reflectivity

The PV modules used in the installation absorb over 90 percent of the light received; as a result, glare from reflected sunlight is not expected to be a concern. PV panels have been installed at numerous airports in the United States, including Denver International Airport and Nellis Air Force Base, and studies found that the reflections from PV installations would not cause problems for airplanes in the vicinity.

A Reflectivity Study prepared by First Solar examines potential reflections from PV modules at various key observation points. The study will be submitted as part of the visual analysis.

Operational Noise

The project will employ passive solar power generation through the use of fix-mounted PV solar modules. These PV modules do not require heat transfer fluids or mechanical equipment, and do not generate noise like other solar energy facilities can. Each 1 MW PV array occupies approximately 3 hectares, and is equipped with a Power Conversion Station (PCS), which includes two inverters and one transformer. The PCS serves to convert DC to AC at each 1 MW_{AC} array. The only noise sources associated will be from the PCS. The project proposes to use a type of inverter and transformer in the PCS that generate less than 60 A-weighted decibels free-standing (dBA) at the noise source. The heating, ventilation, and air-conditioning (HVAC) system if required on each inverter enclosure is rated to less than 65 dBA.

A detailed noise analysis has been prepared as part of the permit process, and meets all applicable local noise standards. A noise contour analysis of a solar farm in Sarnia using similar equipment indicated that the applicable local noise standards were met, even though noise receptors (residences) were more numerous and located closer to the solar farm than at this project. The project will not exceed Ministry of Environment noise level limits. For further

details please refer to the Acoustical Assessment report.

Power/Communication

The facility will consume a very small amount of power for security lighting during the nighttime while the facility is not in operation and for PCS shelter HVAC. This power will be supplied from the existing electrical distribution system in the area. The project will not require any additional power sources for standby or emergency power supply.

For transmission of operational data and to support any employees working on site, existing wired or wireless telecommunications facilities. In the event that these facilities are not available in the vicinity, the project will supplement with small aperture (less than one meter) satellite communication gear.

Vegetation Management & Maintenance

First Solar is currently undertaking testing at sites in the vicinity to evaluate vegetation types which can support the relevant local wildlife populations, and not interfere with ongoing operations.

The existing hydrologic conditions will be maintained and storm water will be able to travel in existing drainage patterns across the site beneath the PV modules. Shading under the modules may reduce evapo-transpiration of local plants and allow vegetation to grow taller than vegetation exposed to direct sunshine throughout the day. There will be a vegetation management plan implemented to control the height of vegetation and to control any invasive exotics. This plan will be established based on the First Solar's findings at the vegetation test site. Depending on the native and planted vegetation growth rates, occasional grass cutting may be required to avoid the panels being shaded. Maintenance will maintain the grass height at about 460 mm.

Environmental Effects Monitoring Plan

Identification of Sensitive Natural Features

Construction activities can be a significant source of stress to the natural environment. Pollutants that are commonly discharged from construction sites include: sediment, solid and sanitary wastes, various fertilizers and pesticides, oil and grease, fuels, construction chemicals, and debris. Review of the Project's Layout drawings and Site Plans indicates that disturbance via construction activity within the potentially environmentally sensitive areas, has been minimized through due diligence planning and design efforts. However, certain project activities must occur within and adjacent to some of the environmentally sensitive areas. Specifically, the following is noted:

- Significant Woodlot – Woodlot A is located in the north-eastern portion of the site and on the adjacent parcel (east). The woodlot will remain untouched throughout construction. Woodland B is located on an adjacent parcel to the west and will also be unaffected by our construction. Both Woodlands will be protected during construction so that they remain undamaged in their current state.
- A municipally identified Natural environmental area was located in the immediate area. The W. Darcy McKeough Floodway is located approximately 250 meters south of the

site. There will no short or long term impacts to either area.

- An endangered animal species, *Colinus virginianus* (S1) was located adjacent to the western side of the properties. The adjacent parcels are separated from our site by Baseline Road. The woodlots on both properties to the west contain a substantial amount of vegetation suitable for the bird's habitat. Since the woodlots are not immediately adjacent to the site. It is not believed that the development will not disrupt their activities. Additionally, as part of the environmental monitoring plan, should the spices be found on site, construction will cease until the animal can be safely relocated.

- A threatened plant species, *Carex emoryi* (S4) was identified greater than 200 meters northwest of the site. This plant will be unaffected by the proposed project.

- Several municipal drains are located along the property boundaries. A minimum 30 meter buffer to the array will be respected to the drain being used. Historical drainage patterns will be maintained. Water quality will be improved by converting the farm land into a grassed area. This will decrease pollutant and sediment to the receiving drain.

Potential Negative Impacts

The proposed solar farm will involve only minor physical changes to the site and the surrounding area, which can lead to potentially negative impacts of a minor nature. The majority of the potential impacts will be short-lived throughout the various stages of construction (between 8 and 12 months). Other impacts may remain throughout the life of the Project. The most intense construction will occur during the site preparation phase of the Project, lasting approximately 2 to 3 months. Construction will become less impactful as the solar panels are placed into the system.

An Environmental Management Plan will be generated for the site before construction starts. A First Solar environmental monitor will be assigned by the Construction Manager to advise construction personnel of the requirements and to insure adherence during construction to the Plan and to all permits and specifications. The monitor will report any deviations and will coordinate immediate mitigation efforts. Following are environmental effects and construction processes to be monitored. The potential impacts and changes that the site and surrounding area will go through are expected to be as follows:

<u>Stormwater Runoff Impacts -</u>

- Construction will require the removal of existing vegetation from a portion of the site. The loss of existing vegetative cover, temporarily during construction, can lead to soil erosion and sediment control problems if not properly designed for and actively managed.

- The predominant historic use of the site was agricultural and farming. In order to develop the site as a solar farm the land will be prepared including clearing, grubbing, leveling, and compacting areas as needed to provide a suitable base for the solar arrays.

- There is a potential for short-term negative water quality impacts during the construction of the project due to sedimentation and disturbance. Implementation of the project will necessitate the temporary disturbance of an estimated 78 hectares of

land.

- Compaction can decrease the infiltration and absorption rates of the existing land. This could lead to ponding and saturated soil conditions, which can drastically alter the site characteristics.

Dust & Noise Emissions -

- Introduction of construction machinery and activities which will increase the noise in the immediate area during the construction season will be limited to the hours of 7am to 5 pm (Monday through Friday), and as required on weekends.
- Construction equipment can release emissions into the air that can affect the air quality in the immediate area.
- Traffic in the immediate vicinity of the site will increase during the construction phase of the project this could lead to an increase in vehicular noise for the immediate area.

Destruction of Vegetation & Habitat –

- Wildlife may avoid the site during construction.
- Construction will require the removal of existing vegetation from a portion of the site. The loss of existing vegetative cover, temporarily during construction, can also lead to soil erosion and sediment control problems if not properly designed for and actively managed.

Impacts to Water bodies –

- Receiving waters can become contaminated with sediment, soils, and debris if the projects' *Soil Erosion Control Plan* is not properly designed. This could have a detrimental effect on wildlife which utilizes the water courses for food, water, and habitat, as well as, all downstream receiving waters.
- The introduction of culverts and/or bridges needed to traverse the sites. If not properly designed and maintained, these components could also have an effect on wildlife that makes use of the waters. In addition, the proposed infrastructure, if not implemented correctly could impact historic flow patterns and rates up and downstream of the subject property.

Impacts related to water takings –

- The use of water by taking it from ground or surface waters for the sole purpose to aid in construction activities could deplete the resources and lower anticipated flows.

Waste Management & Recycling -

- During construction, the system components are shipped from various locations and come in packing which protects them during transit. Without proper waste management, the site could be come over-run with litter and debris. This can lead to a safety hazards, pollution problems, and an aesthetics issues.

- In an effort to not stress the underlying soil surface with the addition of a septic system for all of the craft on-site, the site will use the implementation of portable bathrooms. Without proper installation and maintenance, these devices can prove to be an environmental nuisance.

Fuel Spills -

- The potential for fuel spills is increased with the addition of the construction machinery on site. If fuel spills adjacent to waterways there is a potential for contamination of the environmentally sensitive areas.

- Fuel storage, if not properly installed and maintained, could leak and compromise the surrounding areas.

Impacts to Archaeological Resources –

- Valuable artifacts from historical significant periods could become unearthed during construction. Without a proper procedure in place for potential discovery, these artifacts could become damaged.

Mitigation/Reduction of Impacts

While this type of facility and the methods of its construction are expected to have small short-term and minimal long-term effects to the environment First Solar will establish a program to insure maximum respect for the environment through monitoring and quick mitigation of environmental impacts. As indicated above, the Project will have certain unavoidable impacts. Several measures are being proposed to reduce the amount of temporary and permanent adverse impacts to the resources outlined above. Perhaps the biggest challenge will be to maintain the integrity of the site before and after construction especially with regard to sensitive features. In order to mitigate any unavoidable impacts, the following measures will be instituted to help maintain the integrity and viability of the land:

Stormwater Runoff Impacts –

- Existing topography will be maintained to the greatest extent possible to minimize the amount of grading required. However, when grading is necessary, top soil will be removed and temporarily stockpiled (with silt fence around the base of the pile) while the subsurface soil is graded to ensure that potential mixing of the subsurface and top soil is minimized. Long term screening berms will be implemented to ensure that during decommissioning activities native soils are available to fill the voids created by removing the gravel roadways and shelters. To the greatest extent practical, the soil material will be reused on-site. If the material is not suitable for re-use, it will be disposed of in accordance with all applicable local, provincial, and federal rules and regulations.

- The proposed preparation activities will not alter historic drainage patterns and will not significantly alter the elevations throughout the site.

- The project's design includes a "Soil Erosion and Sediment Control Plan" specifically developed to minimize potential adverse impacts. For example, filter fences will be erected around and/or down slope of disturbed areas to prevent sediment from being transported off-site. All work will be done in accordance with the "Erosion & Sediment Control Guideline for Urban Construction", dated December 2006.

- Upon completion of final land preparations, all disturbed areas will receive a final seeding in accordance with the conceptual site plans.
- Water quality will be improved on the site. Specifically, at the present time, storm water runoff from the existing farmed areas is conveyed overland and collected into the surrounding drain system. Once the site is stabilized and vegetation established, the site will act as a vegetated buffer strip by filtering pollutants. Additionally, farming activities which introduce chemicals and pesticides into the land will cease.
- By utilizing gravel access roads, the project can eliminate the need for asphalt and concrete drives. Concrete use will be limited to the fence post foundations, transformer pads, PCS shelters, and PVIS foundations. The fence posts will be cast-in-place concrete, while the transformer pads, PCS Shelters, and PVIS structures will have pre-cast bases.
- Geo-technical testing is being completed to verify the stability of the land. Compaction rates will be minimized to the greatest extent allowable and might not be required in certain areas throughout the site, since the majority of soil types are clays. Compaction will be required in areas under 75-85% compression under the arrays, and 85-95% compression under structure foundations and roadways.

Dust & Noise Emissions –

- A crushed stone-tracking pad will be installed at the site access to reduce tracking of sediment onto adjacent roadways during construction activities. Street sweeping and cleaning will be scheduled as necessary, should the adjacent roadway become dirty.
- In an effort to maintain traffic patterns, deliveries will mostly occur during off-peak hours so a direct impact to the surrounding area will be minimized during typical commuting times.
- Disposal of waste by open burning will not be permitted.
- Exhaust systems and emission control devices on all construction machinery will be maintained in good operating condition. Noise abatement devices will be utilized on construction and support equipment present on the site with the objective of keeping the noise level within the acceptable construction noise standards and help maintain air quality.

Destruction of Vegetation & Habitat –

- Long term impacts will be minimal since the wildlife present on site can be tolerant to the Projects' presence. The Project as developed will continue to offer food and shelter for these animals after the site is re-vegetated and the construction has ceased. The increased area of permanent grasslands and additional tree plantings on the site will provide increased wildlife forage opportunities and habitat.
- The impact of the loss of vegetation will be minimized through landscaping. This will be a permanent impact that will be mitigated by a compensation planting. In addition, landscaping is being proposed to enhance the aesthetics of the site. Trees, shrubs, and

grasses will provide a plethora of new vegetation dispersed throughout the site. Further landscaping details can be found in the Landscaping Plans, REA-10A & 10 B.

- The project's design includes a "Soil Erosion and Sediment Control Plan & Details" (See plans REA-08 and 13) specifically developed to minimize potential adverse impacts. All work will be done in accordance with the "Erosion & Sediment Control Guideline for Urban Construction", dated December 2006.

Impacts to Water bodies –

- Workers and machinery will avoid, wherever possible, working inside the drain buffers. Replacement compensation planting will be required to be completed by hand, should any damages occur.

- All soil erosion and sediment control measures shall be kept in place and in working condition until construction is complete and/or the disturbed area is stabilized. An Environmental Monitoring Plan (EMP) will be created and implemented and regular inspections will occur to insure soil erosion and sedimentation will be minimized.

- Where temporary bridges are proposed for construction activities only, the bridge shall be designed to "clear span" the watercourse past the top of bank. This will allow for the preservation of the watercourse, bed, and banks and with minimal impacts. Any permanent crossings will be designed to be of sufficient size as to not alter the current hydrologic conditions in the drains. Any work that needs to be completed in and around the watercourse will need to be approved prior to any work commencing. Additionally, improvements would need to be installed around any restrictions from the Department of Fisheries and Oceans (DFO) regarding wildlife activities.

Impacts related to water takings –

- During the construction period, water may be needed for dust control and temporary sanitary facilities. The project is expected to use a maximum of 100,000 liters per day (lpd) during very dry, dusty days. During normal rainfall, construction water usage will be minimal (approximately 500 liters per day). The maximum daily water demand is expected to be during the first 65 days of construction, before site preparation is complete and after array construction has commenced. Water trucks will be bought in as needed to control dust emissions.

Waste Management & Recycling -

- Proper trash receptacles will be stationed throughout the entire active construction site, including the trailers and staging areas. All materials will be recycled, as much as possible, in accordance with all applicable regulations and standards. Regular trash hauling will occur, with additional pick-ups added as necessary.

- Restroom facilities shall be inspected on a daily basis to ensure they are functioning correctly and are cleaned of debris and sanitary. If during the inspection the restrooms are found to be non functional (leaking, not flushing properly or in need of tank pumping services, etc.) the sanitary rental company will be contacted immediately to service the units.

- The mobile restroom facility trailers will be used for the duration of construction activity and remain onsite until the site's completion at which time they will be removed by the sanitary rental company.

Fuel Spills -

- Where an adverse effect may occur as a result of a spill, the Ontario Ministry of Environment (MOE) Spills Action Center will be notified at 1-800-268-6060.
- All re-fueling activities will occur in a designated "refueling area" inside the proposed construction staging and lay-down area, and away from environmentally sensitive areas. All fuels will be stored in locked storage container and be clearly demarcated for safety.

Impacts to Archaeological Resources –

On-site a Stage 1 archaeological assessment was previously conducted for the parcel identified in the various Archaeological Assessment Report prepared by Timmins Martelle Heritage Consultants (reports provided as part of the REA submission). The Stage 1 background review indicated the properties had potential for the discovery of archaeological resources. As such, a Stage 2 field survey was recommended for the various properties. A pedestrian survey of Property 3 resulted in the discovery of three artifact locations, two of which were isolated finds of single native artifacts for which no further work was required. The third location (AeHo-146) was a potentially significant scatter of mid-19th century artifacts that was later subject to Stage 3 testing. The latter work indicated the site was significant by provincial standards and Stage 4 mitigation of construction impacts was subsequently recommended. This work was conducted as part of planning and environmental approvals for the project. The AeHo-146 is now completely mitigated and there are no outstanding archaeological concerns for the property.

Environmental Monitoring Program

The overall objective of the project should be positive and beneficial. With environmentally-aware management and sensitive contractor implementation, all environmental risks can be avoided or significantly minimized. Maximum resource benefits will be achieved through the completion of environmental restoration and enhancement efforts. The Project as developed will also benefit the community through efforts to restore and enhance the environment

Throughout the construction period, regular site inspections will be made to monitor the effectiveness of environmental protection measures, as well as to check that no previously unforeseen impacts are occurring. In the event of the latter, recommendations will be made for additional environmental protection measures to be adopted. The frequency of site inspections will vary depending on the nature of works being carried out at any one time. Attention will be concentrated on those operations and locations where the most potentially damaging impacts can be anticipated.

There will be an individual responsible for environmental monitoring (Environmental Monitor). It is their duty to monitor all construction practices involving the any of the following areas:

- Erosion Control
- Noise and Vibration
- Waste Management/minimization
- Contaminated Materials and Wastes

- Emergency Response Procedures
- Air Quality
- Water Quality
- Litter
- Storage of Chemicals and Fuels
- Cleanliness of the road from site traffic;
- Hours of work in the vicinity of residential dwellings;
- Movement and generation of surface water;
- Pedestrian and vehicle diversion and safety;
- Siltation and blockage of drains and water courses

The frequency of inspection will be highest at the initiation of works at the site so that any problems can be recognized at an early stage and remedial works or procedures can be implemented before irreparable damage has occurred. Particular attention will be paid to checking that no undue erosion and sedimentation problems are occurring and that all temporary measures, such as silt traps, are functioning efficiently.

The Environmental Monitor will ensure contractor compliance with the Environmental Management Plan (EMP) as well as all local, provincial, and federal permits. The following responsibilities are assigned to the Environmental Monitor:

1. Surveillance of all construction activities to ensure that all work is completed in compliance with the site's EMP and satisfies requirements of all local, provincial, and federal regulatory requirements and permit approvals.

2. Insure that temporary and permanent sedimentation and erosion controls are installed and maintained in accordance with the Soil Erosion and Sediment Control Plan and the site's EMP.

3. Ensure that all construction personnel and equipment stay within the designated construction area and use only approved access roads.

4. Ensure that fuel handling and equipment maintenance operations are executed away from water bodies and drainage ways. Also, make sure that the contractor maintains the required spill response material as mandated by the EMP and the projects spill control plan.

5. Be familiar with previously identified sensitive areas where unique construction techniques will be required. Make certain that work in these areas is performed as per the specifications approved for these areas and in accordance with applicable l local, provincial, and federal regulatory requirements and permit conditions.

6. Ensure that all environmental mitigation and restoration plans (i.e. drainage crossings, seeding, erosion control, etc.) are properly implemented in accordance with specifications and in accordance with applicable local, provincial and federal regulatory requirements and permit conditions.

7. Train construction management and crew on various aspects of the environmental compliance program, including the EMP, and expectations.

The Environmental Monitor will need to also complete incident investigations, restoration projects, document preparation, and record- keeping. The Environmental Monitor will conduct routine environmental monitoring audits throughout the construction period to ensure that the EMP policy is implemented and adhered to. Where noncompliance with the EMP or local, provincial, and federal regulatory requirements and permit conditions occurs, corrective measures will be formulated and implemented accordingly. As part of the EMP plan, an "Environmental Contingency Plan" shall be created. An overview of this plan can be found in the "Design & Operations Report" which is part of this submission.

Conclusion

The proposed St. Clair Sombra solar farm will produce 20 MW of clean electricity to power homes in the Lambton County area. This solar farm has been designed with environmental and neighborly responsibilities in mind. Detailed erosion control, environmental monitoring and emergency response plans will be in place during construction and operation of the solar farm. This project will cause no long-term environmental damage, and will have positive environmental impacts of clean power and increased quality of runoff from the site.