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Final Report

For project:

Lake Huron LiDAR

Prepared for:

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Introduction

The Ontario Ministry of Agriculture, Food and Rural Affairs contracted Airborne Imaging in the spring of 2022 to acquire and deliver digital elevation data derived from airborne LiDAR (Light Detection and Ranging) to cover two regions in Ontario: Lake Huron and Lake Simcoe.

This report covers the Lake Huron area, collected in the spring of 2022. It focuses on LiDAR acquisition details, such as flight parameters, project control, ground truthing results, data processing technique and deliverables.

The contracted area for Lake Huron is 4,373 km².

Project Schedule & Personnel

The ground control and Lidar acquisition occurred in April 2022. The Lidar data for Lake Huron area was collected in four missions from April 12 to April 24. Tom Cooper was the operator on site responsible for collecting the Lidar data and Chris Johnson was the surveyor collecting ground truth points.

A typical Lidar acquisition crew consisted of one Lidar Operator (Tom Cooper) and one Pilot. The project management was done remotely by Allyson Fox.

LiDAR System & Flight Parameters

A Riegl VQ-1560ii was installed in KASI Aviation's Piper Navajo C-GMEC.

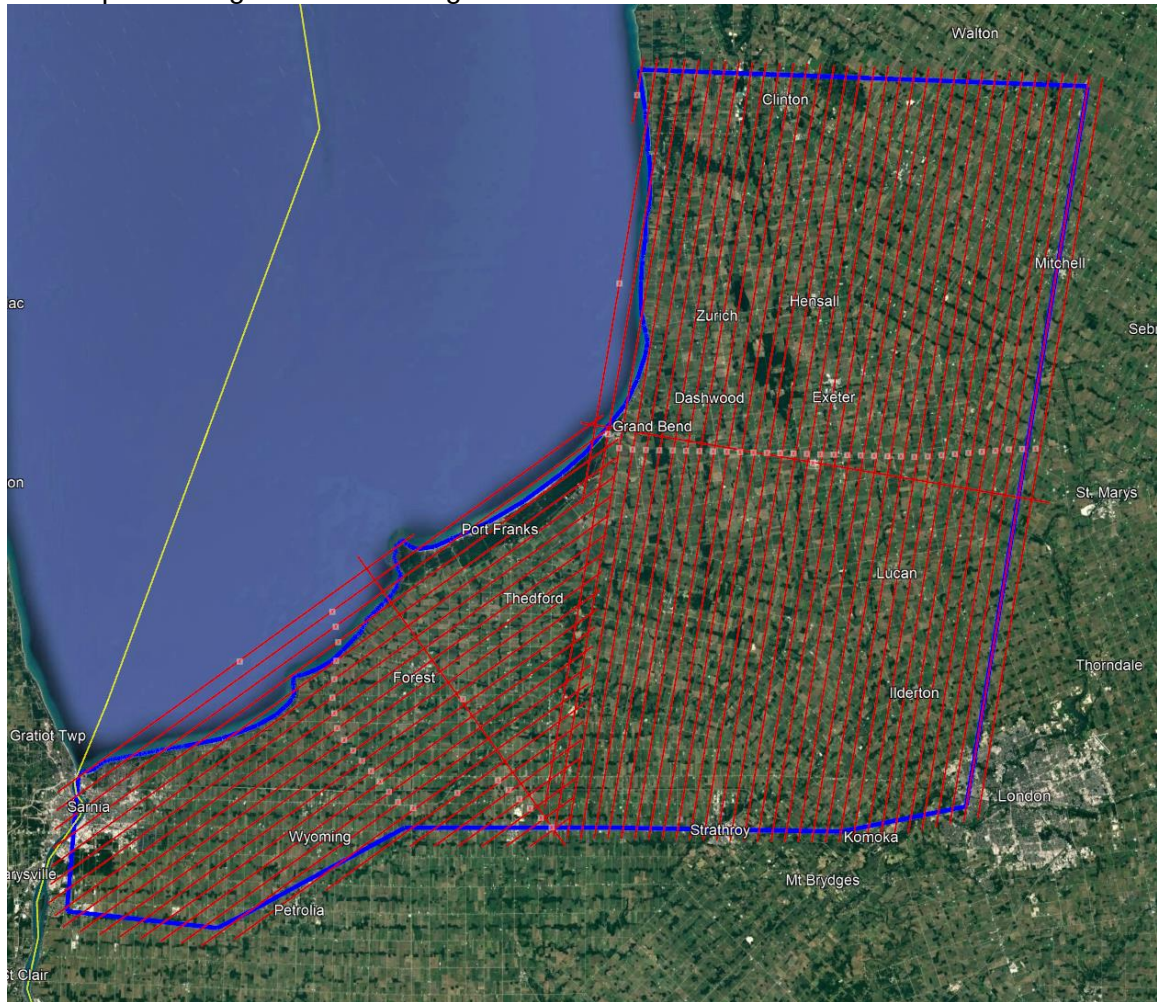
Below is a table of the lifts with their flight parameters.

Flight Date	Julian Day	Lift	Flt Hours	System	AGL_m	Speed kts	Pulse kHz	ScanRate Hz	FOV deg	Project Manager	Operator	Aircraft Co	Aircraft	Deliv.
04/12/2022	102a	3822102a	5.8	VQ-1560ii	1600	160	2100	346	60	A. Fox	T. Cooper	KASI	C-GMEC	1
04/22/2022	112a	3822112a	6.3	VQ-1560ii	1600	160	2100	346	60	A. Fox	T. Cooper	KASI	C-GMEC	1
04/23/2022	113a	3822113a	6.2	VQ-1560ii	1600	160	2100	346	60	A. Fox	T. Cooper	KASI	C-GMEC	1
04/24/2022	114a	3822114a	5.1	VQ-1560ii	1600	160	2100	346	60	A. Fox	T. Cooper	KASI	C-GMEC	1

Table 1: Project Parameters for the Lake Huron areas.

	Riegl VQ-1560-ii
Altitude	1600m AGL
Field of View (FOV)	60°
Air Speed	160 Kts
Pulse Rate	2100 kHz
Sidelap	20%
Point Density	> 8 pts/m ²

The flight lines were designed optimally to maximize time online versus time in turn. Below is a map of the flight lines including cross-ties.



Project Control / Datum

Several baselines were measured by GPS static occupation between the Cannet stations and existing NRCan, cosine points as well as newly established points by Airborne Imaging. The existing control used consisted of seven NRCan Cannet stations, three NRCan passive stations, five Cosine points and three newly established points to support our ground truth survey.

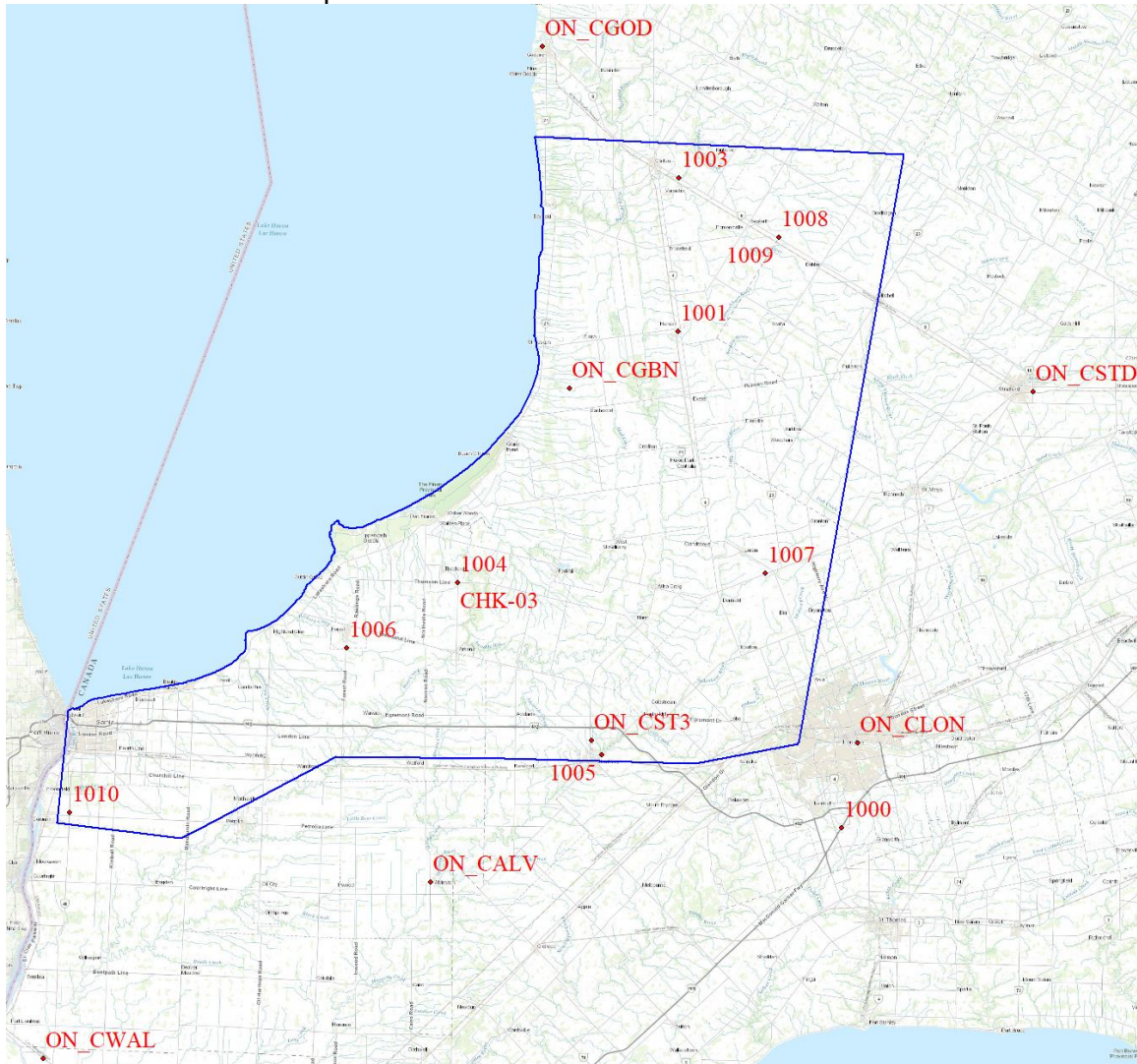
Appendix A contains a list of Control Points and their published coordinates.

Appendix B shows the checks performed between Cannet stations and passive stations with redundant checks.

Appendix C shows the published station coordinate sheets.

The datum used and therefore all subsequent Lidar data are based on the Nad83 CSRS (epoch 2010.0) horizontal datum and the CGVD2013 vertical datum (CGG2013 undulation model).

Below is an overview map of the control stations.



Check Points

Control check points were surveyed from different methods to use as vertical check and accuracy assessment. The kinematic method was used for calibration purposes and the RTK method for Non-Vegetated Vertical Accuracy Assessment (NVA) and Vegetated Vertical Accuracy Assessment (VVA).

Kinematic GPS

The first method called kinematic are profiles surveyed on open roads from a truck-mounted GPS receiver while driving. The post-processed kinematic coordinates, collected at an interval of one second are derived from a base station that is part of our control network.

Whenever possible, we try to select roads that are perpendicular to the flight line azimuth so the control points intersect as many Lidar strips as possible. Kinematic points were collected along the roads following the red dots on the map below.

The output coordinates are analyzed and filtered to ensure only very reliable positions are kept. All points collected while moving slower than 2 meters per second are rejected. This removes all points when the truck was stationary that could skew the statistics.

The following points are also rejected:

- Points with a Quality Level worse than 1.
- Points with a forward/reverse vertical separation worse than 3 cm.
- Points with less than two solutions (forward & reverse).
- Points with a standard deviation worse than 2sigma.

Many sections of road were surveyed throughout the project giving us more than 8,000 surveyed points on the road. We estimate that the vertical accuracy of these points is better than 5 cm.

During the calibration of the Lidar strips, the Lidar strips are matched vertically to these reliable kinematic points. These points are not used for the vertical accuracy assessment of the Lidar point cloud, but rather just for calibration monitoring and shifting.

RTK GPS

In order to meet the recommended ASPRS minimum number of points for a 4,373 square kilometer project, RTK points were surveyed in areas distributed throughout the project.

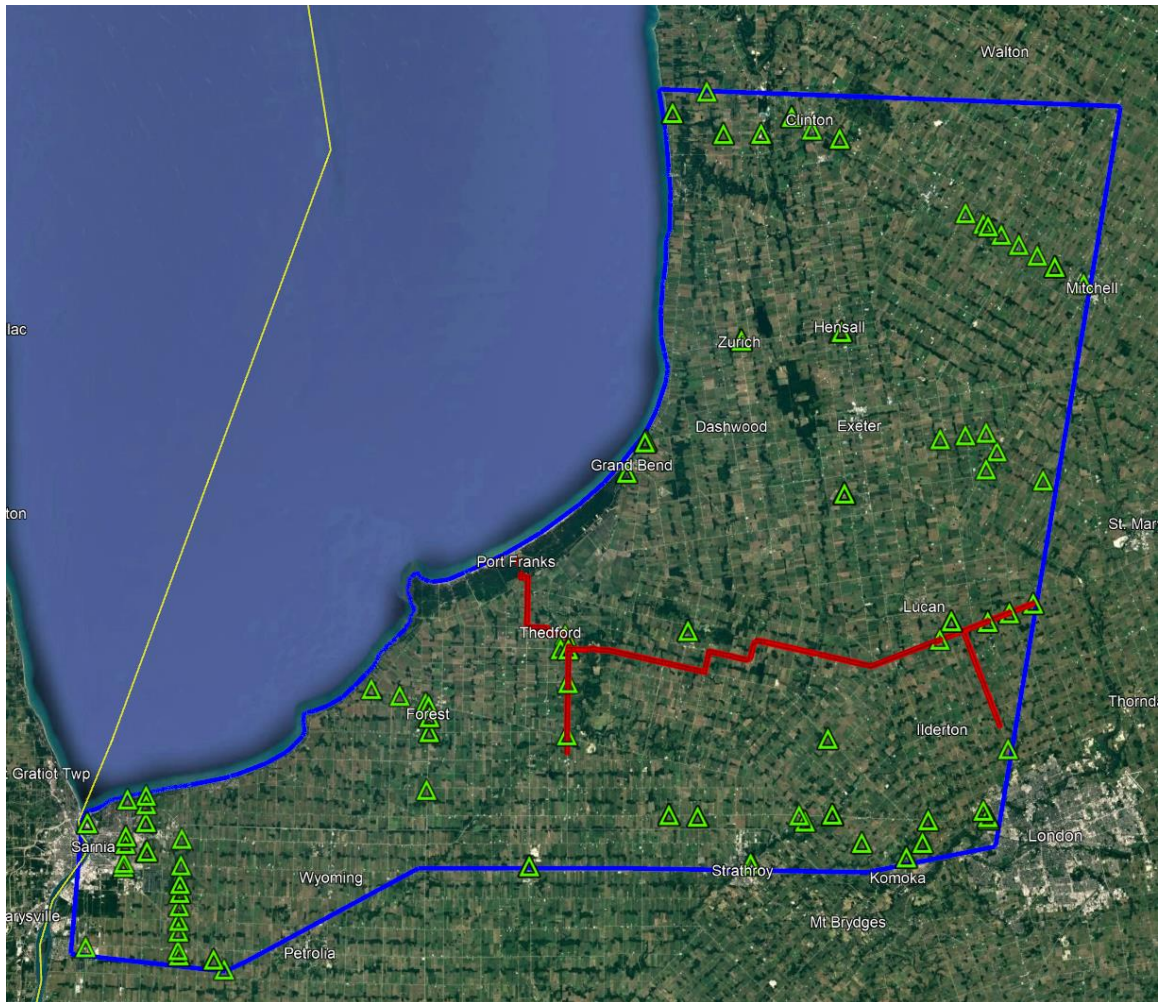
The second method called Real Time Kinematic are individual points surveyed on open terrain. Our surveyor collected GPS data mounted on a pole while receiving real time differential corrections from the GPS receiver positioned over a nearby control point.

144 points were surveyed on the Lake Huron project. Of these, 97 points were over non-vegetated ground conditions for NVA accuracy reporting and 47 of them were over vegetated areas for VVA accuracy reporting.

Pictures of these RTK points (as well as the existing control) are provided with this report in a folder called "LakeHuron\Control_Point_Pictures".

These points are used just for the vertical accuracy assessment of the Lidar point cloud and were not used to determine any vertical shift applied to the point cloud.

See the green triangles on the map below.



Blue = project outline
Green = Fast Static (NVA & VVA)
Red = Kinematic

Trajectory Processing

The aircraft trajectory positioning for the missions over the Lake Huron area was processed using the Precise Point Positioning (PPP) technique.

PPP is a positioning technique that removes and models GNSS system errors via precise satellite orbit data and clock corrections that are applied to the trajectory post mission, providing centimeter level positional accuracy without the use of ground base stations.

The TerraPOS software by Terratec was used to postprocess the PPP solutions to produce final kinematic trajectories accurate to 5 centimeters for each flight mission.

The horizontal datum used is Nad83 CSRS UTM zone 17 with the CGVD2013 vertical datum (CGG2013 undulation model).

LiDAR Data Processing

Calibration Procedures

After each mission, the field project manager creates the preliminary calibrated point cloud with each sensor's set boresight values for each mission. Proprietary QC tools using the Lastools software are run on each mission to check for coverage, relative accuracy, point density, etc... If any data is found to be not meeting specifications, or coverage missing, the field crew is immediately notified and the areas affected reflight as soon as possible.

This preliminary calibrated point cloud is inspected in conjunction with the kinematic ground truth points to apply bulk shifts if necessary and further refine the calibration by applying corrections to the preliminary calibrated strips. The refined calibration is done using Bayesmap's StripAlign software. Intensity values are also normalized by mission to be 16 bits (0 to 65535).

Data Tiling and Classification

The raw LiDAR data is processed into calibrated point cloud strips corresponding to flight lines. For ease of data manipulation, the strips are combined and saved in tiles of 1 km by 1 km. The format the strips and tiles are saved in is .Laz version 1.4. The tiling scheme is based on the UTM17 projection at the even kilometers.

The tiled point cloud is then processed with a series of algorithms to separate the "most-likely" ground returns from other returns. The point classification is done using a product by the TerraSolid software running on MicroStation Connect called TerraScan and TerraModeler.

In addition to our regular field QC and calibration procedures, we also generate various raster products using the Lastools software to assess coverage and calibration accuracy.

Point Cloud Manipulation

The TerraScan software uses macros that are set-up to measure the angles and distances between points to determine what classification a point should be: ground, vegetation, noise, other. The angle and distance values in the macros can be adjusted to be more or less aggressive with the classification of points by varying the incidence angles and estimated distances among neighboring points. The lower points are generally classified as ground returns, with the points above classified as undefined (class 1). Outliers and noise described in the table below are normally clouds, outliers or atmospheric noise in the data that are separated into above or below the ground level (high point or low points).

After the automated macro is run to determine classes, a systematic visual inspection is performed to fine tune the ground definition. To better understand areas for improvement for the ground surface, the points that are classified as ground are used to create viewable TINs and grid surfaces. These surfaces are inspected for areas that appear rough, artificially flattened or truncated, no data areas, or have other viewable errors.

In cleaning up ground points, the focus is concentrated in areas where few ground points have been left in the bare earth model and the ground appears rough or lower and flatter than it may be in reality. The scarcity of ground points may be a result from no penetration through a dense vegetation layer, water bodies, low reflectivity objects, or too aggressive values with the macro. A manual/visual inspection of these areas plays a major role in resolving any issues or irregularities with the bare earth model.

Once the first edits are completed, a one-meter grid of the ground surface is re-exported and hill shade images produced to QC the edited ground surface. This QC step is done iteratively as many times as necessary. Once the point cloud data has reached a satisfactory level of classification accuracy, the final deliverables are produced.

Water Classification & Hydro-Flattening

Once the ground class has reached the final level of classification accuracy, the water delineation process is initiated. The rivers and water bodies are digitized as break lines according to USGS specifications of a minimum of 8000 m² for water bodies and 30 m nominal width for streams and rivers. Ponds and lakes have their elevations set constant to just below ground. Stream and river hydro lines are collected using the downstream method. Once all hydro lines have been collected for an area, the ground points inside the hydro lines are classified to class 9 – Water. The ground points outside of the hydro lines but within 35 cm are classified to class 20 – Ignored ground (near breaklines). Using the TIN of class 2 (ground points), the hydro lines are used as constraints to generate the final 50 cm hydro-flattened DEMs in ESRI Ascii format, then converted to 32bit Geotiff format with the Global Mapper software.

Class definitions

The classification follows the ASPRS classification codes. The table below shows the classes for the delivered point cloud.

Table 2: ASPRS Point Classes

Classification Value	Description
1	Unclassified
2	Ground
7	Low Points
9	Water
17	Bridge Decks
18	High Points
20	Ignored Ground (breakline proximity)
21	Snow
22	Temporal exclusion

Deliverables

See below for a table of the folder structure and description of each deliverables.

2022_LAKEHURON_EPSG2958

DTM

Hydro-flattened 50cm Bare Earth DEMs, 1 X 1 km tiles in 32bit Geotiff format
e.g. 1km173820474802022LLAKEHURON_DTM.tif

METADATA

Metadata files for Breaklines, DEM, LAS and Project in .XML format
e.g. LakeHuron_Lidar_metadata_LAS.xml

POINTCLOUD

Point cloud data, 1 X 1 km tiles in .LAZ format 1.4
e.g. 1km174460477002022LLAKEHURON.laz

PROJECT_POLYGON

Shape files of: Lift_metadata, Hydro_breaklines, Project_extent & Tile_index
e.g. 3822114a_Lift_metadata.shp

Vertical Accuracy Assessment

Kinematic

Below is a summary of the statistics between the point cloud TIN from the ground class and the kinematic points surveyed on the road:

Number of points:	8247	
Average dz:	-0.008	m
Minimum dz:	-0.100	m
Maximum dz:	+0.096	m
Average magnitude:	0.021	m
Root mean square:	0.027	m
Std deviation:	0.026	m

Kinematic Vertical
Accuracy (95%): 0.053 m

For a complete listing of the kinematic points and their differences, please refer to the spreadsheet named "LakeHuron_NVA_Kinematic_comparisons_Final.xlsx" provided with the report.

This Kinematic vertical accuracy assessment is provided only as a reference. It is biased because during calibration, the point cloud was vertically shifted to these points. It should not be used as an independent check for accuracy assessments.

The independent assessment of vertical accuracy is made against the "Non-Vegetated" points surveyed (RTK).

RTK

Below is a summary of the statistics between the point cloud TIN from the ground class and the RTK points surveyed on flat hard surfaces:

Number of points:	97	
Average dz:	-0.015	m
Minimum dz:	-0.121	m
Maximum dz:	+0.091	m
Average magnitude:	0.031	m
Root mean square:	0.041	m
Std deviation:	0.038	m

RTK Vertical Accuracy (95%): 0.080 m

For a complete listing of the RTK points and their differences, please refer to the spreadsheet named "LakeHuron_NVA_RTK_comparisons_Final.xlsx" provided with the deliverables.

This RTK vertical accuracy assessment can be used as an independent check for the Non-Vegetated Accuracy (NVA).

As seen in the RTK NVA comparison above, the absolute accuracy observed of 0.080 m meets the project requirement of QL0 NVA vertical accuracy of 9.8 cm (95%).

Control Points

As an extra check, the points from the existing control were compared with the Lidar ground surface. Only six had elevations at ground level and were deemed reliable.

For a listing of the six control points and their differences, please refer to the spreadsheet named "LakeHuron_Control_comparisons_Final.xlsx" provided with the deliverables.

RTK (VVA)

The elevations of the points surveyed in various vegetated land cover types were compared to the Lidar ground surface. Since the elevation differences for this type of accuracy does not follow a normal distribution, the percentile method is used and not the 95% confidence level. For the 47 VVA points surveyed, sorting the absolute differences from the smallest to the largest gives the accuracy at the 95th percentile (using the linear interpolation between closest ranks method). For this sample, the 43rd and 44th largest difference are respectively 14.2 and 14.4 cm.

For this project, the VVA accuracy is therefore 14.34 cm.

This is slightly below the required specifications of 15.0 cm (the QL0 VVA specification).

For a complete listing of the kinematic points and their differences, please refer to the spreadsheet named "LakeHuron_VVA_RTK_comparisons_Final.xlsx" provided with the deliverables.

Conclusion

This is the final report covering the Lake Huron Lidar project. Topics such as field operations, control, data processing and final accuracy results were explained. The acquisition for this leaf off, snow off project was acquired fast thanks to good weather and the processing went as expected. Vertical accuracies of non-vegetated surfaces and vegetated surfaces meet the QL0 requirement for this project.

Appendix A - Control Points – Published Coordinates

Lake Huron Existing Control used						
Station	Easting	Northing	h	H (CGVD2013)	Status	Comments
Can-net_ON_CLON	481419.710	4758233.052	214.946	249.907	Published	Can-Net
Can-net_ON_CGBN	446060.504	4801766.879	186.993	221.779	Published	Can-Net
Can-net_ON_CGOD	442705.012	4843795.305	194.830	229.801	Published	Can-Net
Can-net_ON_CST3	448686.438	4758579.909	209.450	244.201	Published	Can-Net
Can-net_ON_CALV	428944.852	4741127.983	194.876	229.484	Published	Can-Net
Can-net_ON_CWAL	381327.006	4719517.262	147.777	182.188	Published	Can-Net
Can-net_ON_CSTD	503007.702	4801423.870	332.900	367.775	Published	Can-Net
NRCAN 813041 - PILLAR	479502.190	4747826.810	236.494	271.493	Published	1000
NRCAN 81U190 - Deep BM	459407.666	4808839.295	239.154	273.951	Published	1001
NRCAN 79U255 - Deep BM	450024.281	4756759.548	191.503	226.268	Published	1005
Cosine - 00820050122	459419.389	4827701.109			Published	1003
Cosine - 00820050116	418636.201	4769947.062			Published	1006
Cosine - 00820050123	471784.479	4820326.919			Published	1008
Cosine - 0011978U356				318.826	Published	1009
Cosine - 00819980479	384581.802	4749769.008			Published	1010
1004	432308.572	4777936.812	181.205	215.864	Newly Established	Aii Control - Nail (1885-03)
1007	470111.391	4779097.453	268.648	303.384	Newly Established	Aii Control - Nail (1885-01)
CHK-03	432308.568	4777936.822	181.224	215.882	Newly Established	Aii Control - Nail (1885-03)

Nad83 CSRS epoch 2010.0, CGVD2013 (CGG2013)

Appendix B – RTK Survey & Control Check

Lake Huron RTK Control Summary									
Station	Easting	Northing	h	H (CGVD2013)	Comments	Julian Day	E tie	N tie	H Tie
ON_CLON	481419.710	4758233.052	214.946	249.907	Can-Net	118			
4000	476222.344	4765262.198	237.276	272.144	CENTRE MANHOLE	118			
3000	476228.733	4765304.348	236.538	271.405	TALL GRASS	118			
4001	475443.891	4767745.228	238.704	273.545	PAINT LINE	118			
4002	475019.313	4761363.948	231.966	266.855	PAINT LINE	118			
3002	474987.185	4761373.573	235.329	270.218	UNDER CANOPY	118			
4003	473414.530	4761100.431	241.125	276.003	PAINT LINE	118			
3003	473387.190	4761102.464	241.279	276.157	SHORT GRASS	118			
3004	473478.600	4760885.092	241.310	276.190	UNDER CANOPY	118			
2000	473476.272	4760918.810	241.233	276.112	PAVED ROAD	118			
2001	466952.541	4758638.141	220.994	251.438	PACKED GRAVEL	118			
3005	466922.199	4758620.003	218.450	253.303	UNDER CANOPY	118			
1000	479502.190	4747826.809	236.508	271.507	NRCAN 813041 - PILLAR	118	0.000	-0.001	0.014
ON_CGBN	446060.504	4801766.879	186.993	221.779	Can-Net	119			
3006	459577.995	4792927.382	216.612	251.370	LOW BRUSH	119			
3007	459584.536	4792878.153	216.848	251.606	UNDER CANOPY	119			
2001B	459579.505	4792923.648	216.679	251.438	PAVED ROAD	119			
4004	459560.991	4792940.948	216.364	251.122	CENTRE MANHOLE	119			
1001	459407.727	4808839.312	239.093	273.890	NRCAN 81U190 - Deep BM	119	0.037	0.035	-0.041
4005	459433.977	4808831.000	239.592	274.388	CORNER HANDI PARKING	119			
4006	459446.354	4808800.909	239.241	274.037	PAINT LINE	119			
3008	459444.710	4808733.881	238.795	273.592	SWATHED CROP	119			
3009	459286.606	4808726.385	238.042	272.839	UNDER CANOPY	119			
2002	449604.078	4807976.211	219.317	254.113	PACKED GRAVEL	119			
3010	449603.663	4808041.976	218.693	253.490	HIGH BRUSH	119			
3011	449576.325	4808018.103	218.958	253.755	LOW GRASS	119			
ON_CGOD	442705.012	4843795.305	194.830	229.801	Can-Net	119			
4007	451960.928	4832338.778	220.638	255.506	CORNER PAVEMENT	119			

2003	451950.484	4832339.766	220.675	255.543	PAVED PARKING LOT	119			
4008	456739.362	4828599.467	245.768	280.619	PAINT LINE	119			
1003	459419.395	4827701.104	237.924	272.771	Cosine - 00820050122	119	0.006	-0.005	0.015
3012	459451.993	4827689.560	237.596	272.442	TALL GRASS	119			
4009	459468.887	4827667.350	239.070	273.916	PAINT LINE	119			
2004	454758.383	4829853.073	238.912	273.769	PAVED ROAD	119			
3013	454772.782	4829862.027	237.602	272.459	TALL GRASS	119			
3014	454738.945	4829889.759	237.339	272.197	LOW BRUSH	119			
4010	451730.085	4828248.983	223.236	258.094	FENCE CORNER - POST	119			
2005	451736.409	4828238.039	223.325	258.182	PAVED ROAD	119			
2006	448031.876	4828249.235	221.775	256.640	PAVED ROAD	119			
4011	448027.957	4828253.651	221.728	256.593	CENTRE METAL GRATE	119			
4012	446437.968	4832422.717	213.311	248.194	PAINT LINE	119			
4013	443063.217	4830365.705	166.791	201.687	PAINT LINE	119			
3015	443034.387	4830372.959	165.513	200.409	UNDER CANOPY	119			
4014	440137.298	4798264.174	151.692	186.467	PAINT LINE	119			
4015	440160.680	4798296.747	151.734	186.509	CENTRE MANHOLE	119			
3016	440036.146	4798112.215	152.298	187.073	UNDER CANOPY	119			
2007	440032.307	4798123.711	152.648	187.422	PAVED ROAD	119			
4016	438225.115	4795152.941	150.669	185.433	CENTRE MANHOLE	119			
3017	438175.569	4795199.495	149.979	184.742	UNDER CANOPY	119			
1004	432308.572	4777936.812	181.205	215.864	Aii Control - Nail (1885-02)	119	0.000	-0.008	0.035
4017	432334.013	4777977.301	182.171	216.830	PAINT LINE	119			
3018	432307.498	4777921.042	180.897	215.555	TALL GRASS	119			
ON_CST3	448686.438	4758579.909	209.450	244.201	Can-Net	119			
4018	457736.045	4768930.138	209.968	244.734	PAINT LINE	119			
3019	457726.910	4768924.895	209.230	243.996	TALL GRASS	119			
ON_CLON	481419.710	4758233.052	214.946	249.907	Can-Net	120			
3020	472959.378	4761730.022	238.645	273.515	UNDER CANOPY - SET CHECK POINT - NAIL	120			
4019	472949.936	4761734.227	238.586	273.456	CENTRE MANHOLE	120			
4020	467508.818	4760837.508	228.070	262.912	PAINT LINE	120			
3021	467518.764	4760850.229	226.069	260.912	TALL GRASS	120			
4021	465347.240	4757233.521	219.735	254.588	PAINT LINE	120			
3022	465353.724	4757213.825	219.949	254.801	UNDER CANOPY	120			
4022	463588.820	4756049.110	208.486	243.336	PAINT LINE	120			
ON_CST3	448686.438	4758579.909	209.450	244.201	Can-Net	120			
4023	460958.738	4758692.049	231.036	265.855	PAINT LINE	120			
3023	460975.891	4758700.081	230.456	265.274	LOW GRASS	120			
3024	458107.469	4761480.089	209.848	244.641	UNDER CANOPY	120			
3025	458118.554	4761490.286	210.061	244.854	UNDER CANOPY	120			
3026	458100.649	4761502.318	209.509	244.302	HIGH BRUSH	120			
2007	458118.010	4761446.711	209.434	244.228	PAVED ROAD	120			
4024	458103.827	4761449.397	209.008	243.801	CORNER HOME PLATE	120			
4025	454834.368	4761455.915	212.924	247.705	CENTRE MANHOLE	120			
4026	455416.845	4760845.006	210.572	245.358	PAINT LINE	120			
3027	455398.016	4760844.258	209.834	244.620	HIGH BRUSH	120			
1005	450024.298	4756759.538	191.460	226.225	NRCAN 79U255 - DEEP BM	120	-0.008	0.008	-0.020
4027	450023.580	4756775.796	191.746	226.511	CORNER HANDI PARKING	120			
3028	450174.726	4756661.395	192.657	227.423	UNDER CANOPY	120			
2008	450168.102	4756655.674	192.581	227.348	PAVED ROAD	120			
4028	444856.638	4761420.428	207.635	242.355	PAINT LINE	120			
3029	444873.454	4761423.142	207.745	242.465	UNDER CANOPY	120			
2009	444887.225	4761413.898	207.684	242.404	PAVED ROAD	120			
2010	442041.564	4761609.566	200.671	235.367	PACKED GRAVEL	120			
3030	442063.756	4761631.545	197.546	232.242	TALL GRASS	120			
3031	442056.111	4761644.449	196.610	231.305	TALL GRASS	120			
ON_CALV	428944.852	4741127.983	194.876	229.484	Can-Net	120			
4029	428274.302	4756722.143	203.064	237.640	CORNER HANDI PARKING	120			
4030	428259.037	4756709.559	203.125	237.700	PAINT LINE	120			
3032	428266.329	4756704.519	203.338	237.913	LOW GRASS	120			
1006	418636.193	4769947.079	179.130	213.650	Cosine - 00820050116	120	-0.008	0.017	-0.008
ON_CWAL	381327.006	4719517.262	147.777	182.188	Can-Net	120			
3033	388575.271	4759951.326	147.270	181.648	UNDER CANOPY	120			
2011	388581.091	4759973.930	147.507	181.885	PAVED ROAD	120			
4031	388531.939	4759244.279	148.111	182.491	CORNER HANDI PARKING	120			
4032	388540.980	4759266.994	148.050	182.430	PAINT LINE	120			
4033	388360.779	4757369.502	150.154	184.539	PAINT LINE	120			

3034	388306.832	4756978.620	150.763	185.149	HIGH BRUSH	120			
2012	388314.901	4756985.460	150.754	185.141	PAVED ROAD	120			
4034	390594.835	4758475.581	149.366	183.759	PAINT LINE	120			
3035	390591.079	4758460.926	149.510	183.902	UNDER CANOPY	120			
3036	390665.002	4758479.102	149.106	183.498	HIGH BRUSH	120			
4035	390553.823	4761371.434	144.256	178.643	CORNER PAVEMENT	120			
3037	390580.468	4761371.151	144.030	178.415	LOW BRUSH	120			
2013	390630.080	4763120.125	147.653	182.037	PAVED ROAD	120			
2014	390619.324	4763949.262	146.639	181.022	PAVED ROAD	120			
4036	388772.866	4763597.602	146.101	180.474	CORNER PAVEMENT	120			
4037	384781.994	4761292.184	144.006	178.358	PAINT LINE	120			
3038	384792.564	4761290.797	144.187	178.539	LOW GRASS	120			
4038	394104.640	4759691.480	149.885	184.289	PAINT LINE	120			
4039	393986.676	4757087.178	152.548	186.957	CORNER PAVEMENT	120			
2015	393878.120	4755272.392	153.974	188.387	PAVED ROAD	120			
3039	393869.693	4755273.859	153.340	187.752	SWATHED CROP	120			
3040	393832.057	4754390.769	152.876	187.290	HIGH BRUSH	120			
4040	393836.622	4754396.050	153.327	187.741	PAINT LINE	120			
2016	393775.836	4753066.712	158.678	193.095	PAVED ROAD	120			
4041	393704.999	4751635.574	162.004	196.424	PAINT LINE	120			
2017	393668.309	4750593.285	163.990	198.412	PACKED GRAVEL	120			
4042	393600.060	4748758.070	165.818	200.244	PAINT LINE	120			
3041	393683.644	4748252.005	167.170	201.597	TALL GRASS	120			
2018	393701.113	4748231.421	167.204	201.632	PACKED GRAVEL	120			
4043	397113.157	4747812.688	163.295	197.731	PAINT LINE	120			
3042	397106.618	4747810.561	163.155	197.590	LOW GRASS	120			
4044	398139.393	4746819.827	162.561	197.000	PAINT LINE	120			
ON_CLON	481419.710	4758233.052	214.946	249.907	Can-Net	121			
1007	470111.391	4779097.453	268.648	303.384	Aii Control - Nail (1885-01)	121	0.002	0.014	-0.010
4045	469965.280	4780324.595	279.087	313.819	CORNER PAVEMENT	121			
4046	469948.365	4780330.229	278.873	313.606	CENTRE GRATE	121			
4047	469968.772	4780315.842	278.960	313.692	CORNER PAVEMENT	121			
3043	469972.507	4780317.968	279.214	313.947	LOW GRASS	121			
4048	475670.583	4781054.083	270.162	304.910	PAINT LINE	121			
2019	475663.270	4781063.392	270.144	304.892	PAVED ROAD	121			
4049	478034.756	4781975.882	274.594	309.350	PAINT LINE	121			
2020	478036.288	4781959.357	274.255	309.011	PACKED GRAVEL	121			
4050	473545.635	4780211.125	276.709	311.453	PAINT LINE	121			
3036B	473541.376	4780224.688	275.968	310.713	UNDER CANOPY	121			
2021	468809.661	4778527.916	268.198	302.934	PACKED GRAVEL	121			
ON_CSTD	503007.702	4801423.870	332.900	367.775	Can-Net	121			
3037B	480473.357	4814921.577	305.453	340.283	TALL GRASS	121			
4051	480502.263	4814937.883	306.254	341.084	PAINT LINE	121			
2022	480471.594	4814914.972	305.409	340.239	PACKED GRAVEL	121			
ON_CGBN	446060.504	4801766.879	186.993	221.779	Can-Net	121			
1008	471784.469	4820326.938	283.921	318.756	Cosine - 00820050123	121	-0.010	0.019	-0.036
1009	471793.138	4820320.230	283.942	318.777	Cosine - 0011978U356	121	N/A	N/A	-0.049
2023	471750.581	4820262.130	283.388	318.224	PACKED GRAVEL	121			
4052	473485.434	4819196.758	296.800	331.635	PAINT LINE	121			
3038B	473961.282	4818956.158	300.118	334.953	UNDER CANOPY	121			
2024	473955.440	4818960.060	300.094	334.930	PAVED PARKING LOT	121			
4053	475247.073	4818116.437	299.453	334.288	PAINT LINE	121			
2025	476957.906	4817106.414	300.059	334.893	PAVED ROAD	121			
2026	478765.363	4816033.355	305.744	340.577	PACKED GRAVEL	121			
4054	483298.303	4813230.045	312.624	347.449	PAINT LINE	121			
4055	484301.324	4812659.280	307.899	342.722	PAINT LINE	121			
ON_CGBN	446060.504	4801766.879	186.993	221.779	Can-Net	122			
2027	431556.846	4777957.734	178.227	212.879	PACKED GRAVEL	122			
2028	432022.420	4779305.636	178.298	212.962	PAVED ROAD	122			
CHK-03	432308.568	4777936.822	181.224	215.882	Aii Control - Nail (1885-03)	122	-0.004	0.002	0.053
4056	432248.985	4774633.564	194.566	229.206	PAINT LINE	122			
4057	432090.271	4769513.058	189.813	224.432	PAINT LINE	122			
1006	418636.185	4769947.058	179.185	213.705	Cosine - 00820050116	122	-0.016	-0.004	0.047
2029	418553.589	4769943.070	177.414	211.934	PAVED ROAD	122			
3039B	418561.018	4769954.361	176.205	210.725	TALL GRASS	122			
2030	418247.793	4764295.524	190.153	224.658	PAVED ROAD	122			

4058	418602.096	4771419.183	181.171	215.696	PAINT LINE	122			
3040B	418596.251	4771409.844	181.064	215.589	UNDER CANOPY	122			
4059	418534.640	4772511.671	180.959	215.487	PAINT LINE	122			
4060	418240.036	4772783.388	174.523	209.050	PAINT LINE	122			
2031	415696.814	4773528.596	170.586	205.100	PACKED GRAVEL	122			
2032	412915.676	4774217.888	164.451	198.954	PAVED ROAD	122			
2033	444086.489	4779619.824	166.259	200.995	PAVED ROAD	122			
3041B	444086.761	4779662.339	166.111	200.847	TALL GRASS	122			
2034	473517.367	4795160.383	276.296	311.037	PAVED ROAD	122			
ON_CSTD	503007.702	4801423.870	332.900	367.775	Can-Net	122			
4061	479110.625	4794016.341	283.081	317.837	PAINT LINE	122			
2035	474596.130	4796912.641	269.054	303.802	PAVED ROAD	122			
2036	473557.315	4798743.259	276.176	310.929	PAVED ROAD	122			
2037	471514.430	4798511.242	270.884	305.634	PACKED GRAVEL	122			
2038	469033.884	4798154.349	261.264	296.014	PAVED ROAD	122			
1885-03	432308.572	4777936.820	181.172	215.829	Aii Base - 1885-03 (R8)	122			
2027	431556.857	477957.749	178.236	212.889	Check shot on 2027 from R8 Can-Net	122	0.011	0.015	0.010
2028	432022.426	4779305.642	178.303	212.967	Check shot on 2028 from R8 Can-Net	122	0.006	0.006	0.005
ON_CWAL	381327.006	4719517.262	147.777	182.188	Can-Net	123			
4034	390594.862	4758475.561	149.375	183.676	Check from JD 120	123	0.027	-0.020	0.009
4042	393600.081	4748758.061	165.804	200.230	Check from JD 120	123	0.021	0.009	0.014
1010	384581.803	4749768.997	158.750	193.155	Cosine - 00819980479	123	0.001	0.001	0.011
3042B	384494.616	4749112.543	160.096	194.504	TALL GRASS	123			

Appendix C – Published Station Coordinate Sheets



Government
of Canada

Gouvernement
du Canada

Natural Resources Canada

Station Report - CGBN

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-GBND	Ontario	040P05	CGBN		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSRS)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
446060.504	4801766.879	186.993
Scale	Combined	Convergence
0.99963579	0.99960648	0° 27' 25.75"
N (metres)	H (metres)	Published date and project ID
-34.786 ± 0.009	221.779	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None



Station Report - CGOD

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-GODE	Ontario	040P12	CGOD		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSRs)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
442705.012	4843795.305	194.830
Scale	Combined	Convergence
0.99964038	0.99960984	0° 29' 31.35"
N (metres)	H (metres)	Published date and project ID
-34.971 ± 0.008	229.801	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None



Station Report - CST3

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-STHR	Ontario	040I13	CST3		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSRS)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
448686.438	4758579.909	209.450
Scale	Combined	Convergence
0.99963239	0.99959956	0° 25' 44.52"
N (metres)	H (metres)	Published date and project ID
-34.751 ± 0.009	244.201	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None



Station Report - CALV

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-ALV2	Ontario	040I13	CALV		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSRs)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
428944.852	4741127.983	194.876
Scale	Combined	Convergence
0.99966211	0.99963156	0° 35' 26.94"
N (metres)	H (metres)	Published date and project ID
-34.608 ± 0.008	229.484	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None



Station Report - CWAL

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-WALL	Ontario	040J09	CWAL		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSR5)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
381327.006	4719517.262	147.777
Scale	Combined	Convergence
0.99977327	0.99975010	0° 58' 47.76"
N (metres)	H (metres)	Published date and project ID
-34.411 ± 0.008	182.188	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None



Station Report - CSTD

Station 1 of 1

Site Identification					
Name	Province	NTS map sheet	Unique Number	Provincial Identifier	Network
CANNET-STFD	Ontario	040P07	CSTD		CANNET

Station Coordinates				
Coordinates	Reference Frame	Vertical Datum	Geoid	Epoch
plan	NAD83(CSRs)	CGVD2013	CGG2013a	2010

Zone: UTM17

Easting (metres)	Northing (metres)	h (metres)
503007.702	4801423.870	332.900
Scale	Combined	Convergence
0.99960011	0.99954793	-0° 01' 31.76"
N (metres)	H (metres)	Published date and project ID
-34.875 ± 0.011	367.775	2015-09-24 M15-703

Vertical Data

Use the value of H from the coordinates above.



Station Marker				
Marker Type	Inspected in	Established by	Status	Comments
Unknown		Cannet		None

	Ontario Ministry of Natural Resources and Forestry	COSINE Station Report
		Retrieval Date: 2022-Oct-10
Control Survey Information Exchange		Station: 0011978U356
AKA Names: 00178U356, 78U356, VA253		Known Status: Existing
Number of Ref Sketches: 0		Last Reported Visit: -
Networks [usage]:		Monument Type: -
		Station Type: SPIR

Location Description:

Township: SEAFORTH CONCRETE BOX CULVERT UNDER PERTH-HURON COUNTY LINE ROAD, 4.1 KM SOUTHEAST OF MAIN INTERSECTION TO TOWN, 98 M NORTHEAST OF AN INTERSECTION WITH HIGHWAY NO. 8, TABLET IN TOP OF CULVERT, 6 M SOUTHEAST OF CENTRE LINE OF ROAD, 28 CM WEST OF EAST END, 27 CM NORTHEAST OF SOUTH SIDE OF CULVERT.

No Photo

Horizontal (Ellipsoidal) Control Data

Datum: NAD-1927:SCAL	Horiz order: Unclassified	Ellipsoidal order: Unclassified
Latitude: N43° 32' 09.0xxxxx"	Longitude: W81° 21' 00.0xxxxx"	Ellipsoidal elev: 320.xxx
*UTM Zone: 17 E: E471720.xxx	N: N4820164.xxx	c. s. f.: 0.99955967
		Mrdl convg: -0° 14' 27.9"
*MTM Zone: 11 E: E397746.xxx	N: N4822194.xxx	c. s. f.: 0.99995605
		Mrdl convg: 0° 47' 31.9"

Vertical (Geoidal) Control Data

Datum: CGVD2013	Vert order: First Order	Elevation: 318.826
Geoid:	Meridional defl:	Prime vert defl:
		Undulation:
Datum: CGVD28:78	Vert order: First Order	Elevation: 319.221
Geoid:	Meridional defl:	Prime vert defl:
		Undulation:

Maintenance / History

Date	Description
2019-Mar-20	GSC; last inspected: --

Reference Sketches

Reference sketch for 0011978U356 is not available.

	Ontario Ministry of Natural Resources and Forestry	COSINE Station Report Retrieval Date: 2022-Oct-10
	Control Survey Information Exchange	Station: 00819980479 Known Status: Existing Last Reported Visit: Monument Type: CAP Station Type: GPS
AKA Names: Number of Ref Sketches: 1 Networks [usage]: 3218 [FREE], 3218V [FREE], C2ANDD2 [FREE], CBN31D [FREE]		

Location Description:	No Photo
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Horizontal (Ellipsoidal) Control Data

Datum: NAD-1983:CSRS:CBNV6-2010.0	Horiz Order: CSRS Class D	Ellipsoidal order: Fourth Order
Latitude: N42° 53' 30.493048"	Longitude: W82° 24' 48.746123"	Ellipsoidal elev: 158.739
*UTM Zone: 17 E: E384581.802	N: N4749769.008	c. s. f.: 0.99973899
*MTM Zone: 11 E: E311861.635	N: N4750228.722	c. s. f.: 0.99987572
		Mrdl Conv: -0° 57' 43.9"
		Mrdl Conv: 0° 03' 31.8"

Datum: NAD-1983:CSRS:CBNV3-1997.0	Horiz Order: CSRS Class D	Ellipsoidal order: Fourth Order
Latitude: N42° 53' 30.493100"	Longitude: W82° 24' 48.747236"	Ellipsoidal elev: 158.764
*UTM Zone: 17 E: E384581.777	N: N4749769.010	c. s. f.: 0.99973899
*MTM Zone: 11 E: E311861.610	N: N4750228.724	c. s. f.: 0.99987571
		Mrdl Conv: -0° 57' 43.9"
		Mrdl Conv: 0° 03' 31.8"

Datum: NAD-1983:ORIG	Horiz Order: Second Order	Ellipsoidal order: Unclassified
Latitude: N42° 53' 30.516320"	Longitude: W82° 24' 48.772640"	Ellipsoidal elev: 158.xxx
*UTM Zone: 17 E: E384581.212	N: N4749769.736	c. s. f.: 0.99973898
*MTM Zone: 11 E: E311861.033	N: N4750229.440	c. s. f.: 0.99987571
		Mrdl Conv: -0° 57' 43.9"
		Mrdl Conv: 0° 03' 31.8"

Vertical (Geoidal) Control Data

No vertical data found.

Maintenance / History

No maintenance data found.

Reference Sketches

Sketch 1 of 1

Monument Position Sketch	
Date: <u>APRIL, 1999</u>	Job File: <u>20 99 907010</u>
Type of Monument: <u>S.I.B. CAP</u>	Relationship to ground: <u>-5cm</u>
Intervisible With: <u>001693002</u>	
MON. IS LOCATED ON THE EAST SIDE OF HIGHWAY 40 ± 480m N OF PETROLIA LINE (LAMBTON RD 4), 13.1 m E OF HWY E.P. 13.7 m W OF F/L. STATION IS @ 90° TO ROAD SIGN FOR UPCOMING INTA ON THE WEST SIDE OF THE HIGHWAY	
Purpose: Locate Point ☒ Precise Reference ☐	
Monument No.: <u>008980479</u>	
Marshall Macklin Monaghan 80 Commerce Valley Dr. E., Thornhill, ON. L3T 7N4	

	Ontario Ministry of Natural Resources and Forestry	COSINE Station Report
		Retrieval Date: 2022-Oct-10
Control Survey Information Exchange		Station: 00820050116
AKA Names: Number of Ref Sketches: 1 Networks [usage]: 3273 [FREE], C2ANDD2 [WTD], CBN31C [FREE]	Known Status: Existing Last Reported Visit: Monument Type: CAP Station Type: GPS	

Location Description:	
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Horizontal (Ellipsoidal) Control Data

Datum: NAD-1983:CSRS:CBNV6-2010.0		Horiz Order: CSRS Class C	Ellipsoidal order: Third Order
Latitude: N43° 4' 40.336942"	Longitude: W81° 59' 58.150194"	Ellipsoidal elev: 179.138	
*UTM zone: 17 E: E418636.201	N: N4769947.062	c. s. f.: 0.99965335	Mrdl Conv: -0° 40' 57.6"
*MTM zone: 11 E: E345556.764	N: N4771015.335	c. s. f.: 0.99989233	Mrdl Conv: 0° 20' 30.7"

Datum: NAD-1983:CSRS:CBNV3-1997.0		Horiz Order: CSRS Class C	Ellipsoidal order: Fourth Order
Latitude: N43° 4' 40.337122"	Longitude: W81° 59' 58.151338"	Ellipsoidal elev: 179.163	
*UTM zone: 17 E: E418636.175	N: N4769947.067	c. s. f.: 0.99965335	Mrdl Conv: -0° 40' 57.6"
*MTM zone: 11 E: E345556.738	N: N4771015.341	c. s. f.: 0.99989233	Mrdl Conv: 0° 20' 30.7"

Datum: NAD-1983:ORIG		Horiz Order: Second Order	Ellipsoidal order: Unclassified
Latitude: N43° 4' 40.362450"	Longitude: W81° 59' 58.169370"	Ellipsoidal elev: 179.xxx	
*UTM zone: 17 E: E418635.776	N: N4769947.854	c. s. f.: 0.99965335	Mrdl Conv: -0° 40' 57.7"
*MTM zone: 11 E: E345556.326	N: N4771016.120	c. s. f.: 0.99989233	Mrdl Conv: 0° 20' 30.7"

Vertical (Geoidal) Control Data

No vertical data found.

Maintenance / History

No maintenance data found.

Reference Sketches

Sketch 1 of 1

MONUMENT POSITION SKETCH				
DATE Oct 2005	WORK ORDER	2005-106	MTM Zone:	11
UPDATED	MONUMENT	00820050116	UTM Zone:	17
	HWY	21	Set By:	Everest Geodetics

TYPE OF MONUMENT Tablet set in Concrete Bridge	RELATIONSHIP TO GROUND Flush
INTERVISIBLE WITH	
LOCATION: TWP OF WARWICK	
MONUMENT IS LOCATED ON CONCRETE BRIDGE ON NORTH SIDE OF HICKORY CREEK RD., APPROX 100 M EAST OF HWY 21, SOUTH OF FOREST.	

PURPOSE:	LOCATE: X	PRECISE REFERENCE:
MONUMENT NUMBER 00820050116		

	Ontario Ministry of Natural Resources and Forestry	COSINE Station Report
		Retrieval Date: 2022-Oct-10
Control Survey Information Exchange		Station: 00820050122
AKA Names:		Known Status: Existing
Number of Ref Sketches: 1		Last Reported Visit:
Networks [usage]: 3273 [FREE], C2ANDD2 [WTD], CBN31C [FREE]		Monument Type: CAP
		Station Type: GPS

Location Description:	
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Horizontal (Ellipsoidal) Control Data

Datum: NAD-1983:CSRS:CBNV6-2010.0		Horiz Order: CSRS Class C	Ellipsoidal order: Third Order
Latitude: N43° 36' 04.247332"	Longitude: W81° 30' 10.079934"	Ellipsoidal elev: 237.909	
*UTM Zone: 17 E: E459419.389	N: N4827701.109	c. s. f.: 0.99958296	Mrdl Conv: -0° 20' 48.3"
*MTM Zone: 11 E: E385307.577	N: N4829510.344	c. s. f.: 0.99994239	Mrdl Conv: 0° 41' 15.9"

Datum: NAD-1983:CSRS:CBNV3-1997.0		Horiz Order: CSRS Class C	Ellipsoidal order: Fourth Order
Latitude: N43° 36' 04.247719"	Longitude: W81° 30' 10.081033"	Ellipsoidal elev: 237.939	
*UTM Zone: 17 E: E459419.364	N: N4827701.122	c. s. f.: 0.99958295	Mrdl Conv: -0° 20' 48.3"
*MTM Zone: 11 E: E385307.552	N: N4829510.356	c. s. f.: 0.99994238	Mrdl Conv: 0° 41' 15.9"

Datum: NAD-1983:ORIG		Horiz Order: Second Order	Ellipsoidal order: Unclassified
Latitude: N43° 36' 04.264880"	Longitude: W81° 30' 10.078370"	Ellipsoidal elev: 237.xxx	
*UTM Zone: 17 E: E459419.427	N: N4827701.650	c. s. f.: 0.99958295	Mrdl Conv: -0° 20' 48.3"
*MTM Zone: 11 E: E385307.605	N: N4829510.886	c. s. f.: 0.99994238	Mrdl Conv: 0° 41' 15.9"

Vertical (Geoidal) Control Data

No vertical data found.

Maintenance / History

No maintenance data found.

Reference Sketches

Sketch 1 of 1

MONUMENT POSITION SKETCH				
DATE Oct 2005	WORK ORDER	2005-106	MTM Zone:	11
UPDATED	MONUMENT	00820050122	UTM Zone:	17
	HWY	8	Set By:	Everest Geodetics

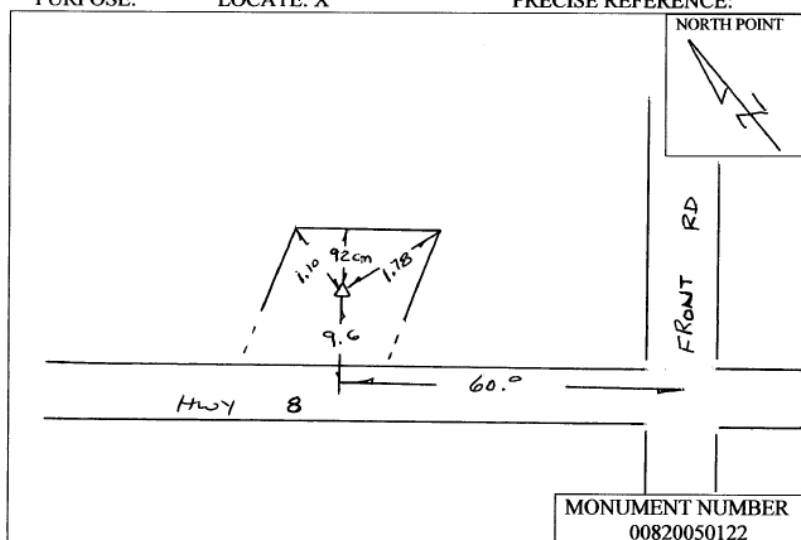
TYPE OF MONUMENT Tablet set in Concrete Culvert	RELATIONSHIP TO GROUND Flush
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INTERVISIBLE WITH

LOCATION: MUN. OF CENTRAL HURON

MONUMENT IS LOCATED ON CONCRETE CULVERT ON
NORTH SIDE OF HWY 8, AT FRONT RD, APPROX. 3.35 KMS
EAST HWY 4.
OF

PURPOSE: LOCATE: X PRECISE REFERENCE:



	Ontario Ministry of Natural Resources and Forestry	COSINE Station Report
		Retrieval Date: 2022-Oct-10
Control Survey Information Exchange		Station: 00820050123
AKA Names: Number of Ref Sketches: 1 Networks [usage]: 3273 [FREE], C2ANDD2 [FREE], CBN31D [FREE]	Known Status: Existing Last Reported Visit: Monument Type: CAP Station Type: GPS	

Location Description:	
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Horizontal (Ellipsoidal) Control Data

Datum: NAD-1983:CSRS:CBNV6-2010.0		Horiz Order: CSRS Class D	Ellipsoidal order: Fourth Order
Latitude: N43° 32' 07.272841"	Longitude: W81° 20' 57.171234"	Ellipsoidal elev: 283.957	
*UTM zone: 17 E: E471784.479	N: N4820326.919	c. s. f.: 0.99956528	Mrdl Conv: -0° 14' 25.9"
*MTM zone: 11 E: E397808.436	N: N4822357.761	c. s. f.: 0.99996184	Mrdl Conv: 0° 47' 33.8"

Datum: NAD-1983:CSRS:CBNV3-1997.0		Horiz Order: CSRS Class D	Ellipsoidal order: Fourth Order
Latitude: N43° 32' 07.273252"	Longitude: W81° 20' 57.172333"	Ellipsoidal elev: 283.989	
*UTM zone: 17 E: E471784.454	N: N4820326.932	c. s. f.: 0.99956527	Mrdl Conv: -0° 14' 25.9"
*MTM zone: 11 E: E397808.411	N: N4822357.773	c. s. f.: 0.99996184	Mrdl Conv: 0° 47' 33.8"

Datum: NAD-1983:ORIG		Horiz Order: Second Order	Ellipsoidal order: Unclassified
Latitude: N43° 32' 07.287070"	Longitude: W81° 20' 57.171650"	Ellipsoidal elev: 284.xxx	
*UTM zone: 17 E: E471784.472	N: N4820327.358	c. s. f.: 0.99956526	Mrdl Conv: -0° 14' 25.9"
*MTM zone: 11 E: E397808.421	N: N4822358.200	c. s. f.: 0.99996183	Mrdl Conv: 0° 47' 33.8"

Vertical (Geoidal) Control Data

No vertical data found.

Maintenance / History

No maintenance data found.

Reference Sketches

Sketch 1 of 1

MONUMENT POSITION SKETCH				
DATE Oct 2005	WORK ORDER	2005-106	MTM Zone:	11
UPDATED	MONUMENT	00820050123	UTM Zone:	17
	HWY	8	Set By:	Everest Geodetics

TYPE OF MONUMENT Tablet set in Concrete Culvert	RELATIONSHIP TO GROUND Flush
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INTERVISIBLE WITH

LOCATION: MUN OF HURON EAST

MONUMENT IS LOCATED ON CONCRETE CULVERT ON WEST SIDE OF ROAD 183 / MAPLE LINE, APPROX. 98.5 M NORTH OF HWY 8.

PURPOSE: LOCATE: X PRECISE REFERENCE:

