APPENDIX E

Supplementary Information

E.1 SUMMARY OF HYDRAULIC ANALYSIS

Komoka Provincial Park Pond - Hydraulic Analysis Results Summary

	Existing			Option 2			Option 5			Option 6		
Design Event	Max Active Storage Volume (m^2)	Max WSE (m)	Max Depth (m)	Max Active Storage Volume (m^2)	Max WSE (m)	Max Depth (m)	Max Active Storage Volume (m^2)	Max WSE (m)	Max Depth (m)	Max Active Storage Volume (m^2)	Max WSE (m)	Max Depth (m)
NWL		228			228			228			228	
2	10400	228.38	0.38	10400	228.38	0.38	13000	228.47	0.47	12700	228.46	0.46
5	11100	228.40	0.40	11200	228.41	0.41	13900	228.47	0.47	13700	228.47	0.47
10	13100	228.45	0.45	13200	228.46	0.46	16600	228.54	0.54	16400	228.54	0.53
25	15400	228.51	0.51	15400	228.51	0.51	19500	228.61	0.61	19300	228.61	0.61
50	17000	228.55	0.55	17100	228.55	0.55	21800	228.67	0.67	21600	228.65	0.65
100	18700	228.59	0.59	18800	228.60	0.59	24100	228.73	0.73	23900	228.69	0.69
250	24200	228.69	0.69	24300	228.70	0.70	34300	228.88	0.88	31100	228.82	0.82

V:\01656\active\165630134\design\analysis\civil\[anl_165630134_200312_workbook2.xlsx]Park Pond SSD

E.2 MEMOS

Stantec

Memo

To:	Stephanie Bergman London ON Office	From:	Nick Emery London ON Office
File:	165630134	Date:	August 27, 2018

Reference: **July 24th Storm Event**
Municipality of Middlesex Centre

A severe thunderstorm occurred on July 24th, 2018 that caused flooding in Kilworth and resulted in substantial rainfall in Ilderton.

STORM EVENT

Based on radar images from the Environment Canada Exeter Ontario station, thunderstorm cells formed sporadically over Middlesex Centre during the morning and afternoon of July 24th. An intense cell passed over Kilworth at approximately 2 PM, travelling northeastward, causing substantial flooding in an unassumed portion of the Kilworth Heights Subdivision. No heavy rainfall warnings were issued by Environment Canada for Middlesex County on the day of the storm.

RAINFALL SEVERITY

Approximately 37 mm of rain was recorded during the morning of July 24th at the Oxbow Creek stream gauge located approximately 1 km north of Kilworth. However, this gauge did not record any rainfall during the afternoon, when flooding was observed in Kilworth, which suggests the localized nature of the storm cell.

Based on information provided by Middlesex Centre staff, approximately 4.5” of rain was measured in Kilworth on July 24th at a backyard rain gauge, which is equivalent to 114 mm. However, it’s unclear whether this rainfall depth includes the rain that fell in the morning or solely rainfall from the short duration intense cell that occurred in the afternoon.

A comparison of the available rainfall data with the London Airport IDF curves was performed to estimate the storm event return period. Assuming the backyard rain gauge measurement is accurate and includes all rainfall that occurred on July 24th, the IDF data suggest that the storm event severity was well in excess of the 100-year design event, regardless of whether the measured rainfall depth includes the morning rainfall or not.

The recorded streamflow at the Oxbow Creek stream gauge peaked at approximately 2 AM on July 25th at approximately 17 cms, which is roughly equivalent to a 2-year design event, based on historical peak flows. This response is likely attributable to the storm cell that passed through Kilworth, as the Oxbow Creek watershed lies along the estimated storm track. The magnitude of the measured peak further confirms the significant rainfall volume that occurred during this storm, as the response time of the watershed is significantly longer than the storm duration.

FLOODING IMPACTS

Photos posted on social media of the Kilworth Heights Subdivision taken both during and immediately after the storm showed flooding within the local right-of-ways above the tops of curbs.

The municipality received the following flooding complaints:

- A resident on Baron Crescent noted the following:

  - Basement flooding occurred during July 24th storm and again during subsequent severe storms;
  - Sump pump could not keep up with flow, water filled sump and spilled in to basement;
  - Sump pump is connected to storm PDC.
- A resident on Pioneer Drive noted the following during the July 24th event:
  - Home is located at low point;
  - Water came up driveway and entered garage;
  - Water travelled along laneway at side of house and spilled to the Thames River;
  - Erosion occurred on property due to overland flow to Thames;
  - Owner reported that there is a French drain at the garage.
- A resident on Hyde Park Road in Ilderton reported flooding at the Van Bussel Agreement Drain
  - Hyde Park Road homeowner has made previous complaints;
  - IBI previously prepared design to implement drain improvements;
  - Municipality is working with homeowner to implement improvements.

The storm also had the following impacts:

- According to social media, an insurance claim was made for a personal vehicle that was damaged by the July 24th flooding;
- Aggregate washed from the Edgewater Subdivision site into the Thames River, creating a gravel bar – both MOECP and UTRCA are investigating.

CONTRIBUTING FACTORS

In addition to the severity of the storm event, the following factors likely contributed to the July 24th flooding:

- Construction is ongoing in the Kilworth Heights Subdivision and some catchbasins are blocked with filter cloth for ESC. The filter cloth reduces the catchbasin inlet capacity, forcing stormwater to travel overland;
- The Kilworth Heights Subdivision was designed with an orifice to restrict flows.

CONCLUSIONS

The July 24th flooding observations will be documented in the MOMC SWM EA, and the EA will identify mitigation measures to address the flooding concerns.

Stantec Consulting Ltd.

Nick Emery P.Eng.
Water Resources Engineer

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nick.emery@stantec.com

c. Adam Kristoferson (Stantec)

Stantec

Memo

To:	Stephanie Bergman London ON Office	From:	Nick Emery London ON Office
File:	165630134	Date:	April 5, 2019

Reference: April 4, 2019 Site Visit - Ilderton

Following the March 5, 2019 PIC, the residents at 156 Willow Ridge Road, Ilderton contacted Stantec to discuss surface water and basement flooding concerns. The following points outline the discussion and observations:

- Several sanitary backups have occurred into the home, resulting in basement flooding;
- A sanitary backup has occurred following the installation of a backflow preventer;
- The swale on the west side of the home is persistently wet – the sump pump discharges to the swale. Lawn is too wet to mow in the summer. Most recent recorded rainfall at London Airport was March 30 – swale had ponded water at time of site visit;
- Sump pumps within the subdivision discharge to surface causing icing on the sidewalks – some residents convey sump pump discharges to the curb using plastic drainage tile;
- Brick driveway is rutted – residents attribute to poor local drainage;
- Residents noted that ponding frequently occurs at the base of the driveway;
- Walkway east of home has been previously replaced due to heaving. Recent asphalt repairs have been completed to eliminate lip caused by heaving;
- Fence posts have been replaced due to rotting/heaving. Decay at base of fence posts was observed;
- Ponding/surface flows occur along rear fence line in the park block.

Site visit photos in project directory here:

V:\01656\active\165630134\preliminary\image\190404 - Ilderton

Stantec Consulting Ltd.

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Attachment: Attachment

c. C.C.

Stantec

Memo

To:	Stephanie Bergman London ON Office	From:	Nick Emery London ON Office
File:	165630134	Date:	April 2, 2019

Reference: March 28, 2019 Site Visit - Komoka

At the March 6, 2019 PIC, two residents on Union Avenue expressed concerns regarding flows in the Union Avenue Municipal Drain. A site visit was completed on March 28, 2019 evaluate whether any downstream restrictions may be affecting the water levels in their backyards. The following points outline the site visit observations:

- An elliptical CSP conveys stormwater westward across Komoka Road. The safety grate on the upstream side of the culvert was open on the left side and torn off on the right side and the culvert barrel culvert was unobstructed;
- The ditch inlet upstream of the Komoka Road culvert was partially obstructed with debris;
- The remnants of a rock check dam are located upstream of the ditch inlet;
- The Union Avenue culvert appears to have been extended on both the upstream and downstream sides with lengths of CSP. The upstream and downstream inverts appear to be higher than the middle section, creating a sag in the barrel. The barrel sections appear to be poorly aligned.

Site visit photos in project directory here:

V:\01656\active\165630134\preliminary\image\190328 - Komoka Kilworth

Stantec Consulting Ltd.

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Attachment: Attachment

c. C.C.

Arva Development Area

Prefered Solution - Alternative 3

SWM1 Regional Pond
Total Volume 2000m^3
Area 0.7 ha

Cost for construction
Using value calc'd in Background info \$50/m^3

Earth work	$	100,000.00		
OGS (2)	$	100,000.00		
	$	200,000.00		
Contingency	$	40,000.00		20%
	$	240,000.00		
Engineering	$	43,200.00		18%
	$	283,200.00		
	Total cost		$ 300,000.00	

Ballymote

Prefered Solution - Alternative 2

Highbury - Armitage Drain Realignment - 120m
Ballymote East Drain Realignment - 230m

Cost for construction
As per below Alternative 2

200mm drains and open channel works	$	52,100.00	
Contingency	$	10,420.00	20%
	$	62,520.00	
Engineering	$	15,630.00	25%
	$	78,150.00	

% engineering reflects smaller size project and base cost estimates for geotechnical

Total cost	$	100,000.00

Ilderton Drain No. 2

Prefered Solution - Alternative 2

Drain Improvements

Cost for construction
Design cost estimate (IBI, 2011) was $90,000

	Adjust as per above calculator			
Adjusted price per CPI	$	102,000.00		
Contingency	$	20,400.00		20%
		$122,400		
Engineering	$	8,568.00		7%
		$130,968		

*Note: Engineering design has been completed

Total cost	$	150,000.00

South Ilderton Development Area

Prefered Solution - Alternative 3

SWM1 Regional Pond
Total Volume 17,200m^3
Area 1.1 ha

SWM2 Regional Pond
Total Volume 17,200m3
Area 1.1ha

700m long 1200mm dia storm sewer

Cost for construction
Using value calc'd in Background info $50/m^3

Earth work	$	1,720,000.00		
Sewer	$	1,050,000.00		
MHs	$	280,000.00		
Headwall	$	50,000.00		
Hyde Park Road Crossing	$	17,500.00		
Traffic Control	$	15,000.00		
Landscaping	$	220,000.00		
Dewatering	$	350,000.00		
ESC Measures	$	50,000.00		
	$	3,752,500.00		
Contingency	$	750,500.00		20%
	$	4,503,000.00		
Engineering	$	810,540.00		18%
	$	5,313,540.00		
	Total cost		$	5,350,000.00

Komoka Drain No. 3

Prefered Solution - Alternative 2

SWM1 Regional Pond
Volume = 12,000 m^3
Area = 1.5ha

Cost for construction
Using value calc'd in Background info \$50/m^3

Earth work	$	600,000.00		
Landscaping	$	75,000.00		
Open Channel	$	140,000.00		
Box Culverts	$	68,000.00		
	$	883,000.00		
Contingency	$	176,600.00		20%
	$	1,059,600.00		
Engineering	$	190,728.00		18%
	$	1,250,328.00		
	Total cost		$	1,300,000.00

West Komoka Development Area

Prefered Solution - Alternative 2

SWM 1 Regional Pond
Volume = 20,000m^3
Area = 1.8 ha

SWM 2 Regional Pond
Volume = 14,000m^3
Area = 1.3 ha

Construction Cost
Using value calc'd in Background info \$50/m^3

Earth Work SWM1	$	1,000,000.00			
Earth Work SWM2	$	700,000.00			
Storm Sewer	$	560,000.00			
Landscaping	$	220,000.00			
Ditches	$	135,000.00			
	$	2,615,000.00			
contingency	$	523,000.00			20%
	$	4,053,000.00			
Engineering	$	729,540.00			18%
	$	4,782,540.00	Total Cost	$	4,800,000.00

Northeast Komoka Development Area

Prefered Solution - Alternative 3

SWM 1 Regional Pond
Volume - 2,500m^3
Area - 0.3 ha
Pretreatment - $80,000 (from email)

SWM 2
Volume - 10000m^3 (Existing Pond is being repurposed)
Pre Treatment - $80,000 (from emial)

Construction Cost
Using value calc'd in Background info $50/$m^3$

Earth Work	$ 625,000.00			
Pretreatment cost	$ 160,000.00			
Storm sewer	$ 450,500.00			
Landscaping	$ 220,000.00			
	$ 1,455,500.00			
contingency	$ 291,100.00			20%
	$ 1,746,600.00			
Engineering	$ 314,388.00			18%
	$ 2,060,988.00	Total Cost	$	2,250,000.00

Kilworth Glendon Drive Area

Prefered Solution - Alternative 3

SWM 1 Regional Pond
Volume = 21,000m3
Area = 1.3ha

Sewer 600m of 600mm dia (including 200m in green field and 400m on Tunks Lane

Construction Costs
Using value calc'd in Background info $50/m3

Earthwork	$ 1,050,000.00			
Greenfeild Sewer	$ 68,000.00			
Road Sewer	$ 280,000.00			
MHs	$ 31,500.00			
Landscaping	$ 220,000.00			
	$ 1,649,500.00			
Contingency	$ 329,900.00			20%
	$ 1,979,400.00			
Engineering	$ 356,292.00			18%
	$ 2,335,692.00	Total Cost	$	2,500,000.00

Kilworth East

Prefered Solution - Alternative 2

Kilworth East
800m enhanced grassed swale
1m deep ditch c/w 3:1 side slopes and rock check every 20m

Construction Costs			
Swale	$ 160,000.00		
Rock Checks	$ 48,000.00		
ESC Measures	$ 75,000.00		
	$ 283,000.00		
Contingency	$ 56,600.00		20%
	$ 339,600.00		
Engineering	$ 61,128.00		18%
	$ 400,728.00	Total Cost	$ 410,000.00

Cross sectional area with 1m flat bottom = $4m^2$ per m
Assume $1200 per rock check

Melrose

Prefered Solution - Alternative 2

Approximatley 700m new pipe and CB leads
200mm dia trenchless
7 CBs

Costruction cost			
Pipe	$ 175,000.00		
CBs	$ 21,000.00		
Restoration	$ 50,000.00		
	$ 246,000.00		
Contingency	$ 49,200.00		20%
	$ 295,200.00		
Engineering	$ 53,136.00		18%
	$ 348,336.00	Total Cost	$ 350,000.00

Stantec Consulting Ltd.
600-171 Queens Avenue, London ON N6A 5J7

June 3, 2020
File: 165630134

Attention: Rob Cascaden, P.Eng., Director of Public Works and Engineering
Municipality of Middlesex Centre
10227 Ilderton Road, RR#2
Ilderton, Ontario N0M 2A0

Dear Mr. Cascaden,

Reference: Stormwater Master Plan Additional Analysis
Land Requirement Estimate for Proposed Powell Property Pond

The preliminary preferred solution for the Komoka Drain No. 1 Catchment presented in the Municipality of Middlesex Centre Stormwater Master Plan includes a proposed stormwater management (SWM) pond located at 22447 Komoka Road. The proposed strategy involves retrofitting the existing pond as a SWM facility to provide both water quality and quantity treatment. Additionally, the proposed facility incorporates mitigation measures to address groundwater concerns identified by the UTRCA through the Environmental Assessment (EA) consultation process. The purpose of this letter is to identify the land requirements for the proposed SWM facility and to provide a more detailed breakdown of the anticipated construction costs.

STORAGE VOLUME ESTIMATION

Hydrologic calculations were completed as part of the Stormwater Master Plan to verify that the proposed pond location can provide sufficient active storage volume to achieve the necessary peak flow control. The hydrologic analysis was performed using SWMHYMO and peak flows and runoff volumes were calculated using the 250-year, 24-hour SCS storm distribution. A summary of the drainage areas that contribute runoff to the proposed SWM facility is provided in the following table.

Table 1 – Proposed Pond Contributing Drainage Areas

Description	Area (ha)	% Impervious
Existing development located south of Glendon Drive	9.0	74
Future development located south of Glendon Drive	6.2	70
Existing pond footprint	2.1	0
Existing development serviced by Komoka Drain No. 1	13.1	30
Existing/future development at Tunks Lane	23.8	80
Proposed Glendon Drive Corridor	5.4	80
TOTAL	**59.6**	**64%**

Reference: Stormwater Master Plan Additional Analysis Land Requirement Estimate for Proposed Powell Property Pond

The proposed pond design footprint was estimated based on the estimated required storage volume. A preliminary stage/storage/discharge curve for the active storage component of the proposed SWM facility was developed based on the following assumptions:

- Total active storage depth of 1.5 m;
- Freeboard depth of 0.3 m;
- 5:1 side slopes; and
- Flow controls to limit the peak discharge from the proposed facility to the capacity of a 600 mm diameter storm sewer.

The corresponding stage/storage/discharge curve results in a total active storage volume of approximately 39,000 m^3. In contrast, the required 250-year storage volume estimated from the hydrologic modelling results is approximately 34,500 m^3. Consequently, the preliminary stage/storage/discharge curve provides sufficient storage volume to accommodate both the runoff from the 250-year storm event and the 10% contingency storage volume identified in the Municipality's stormwater design standards.

While the 100-year storm event is the typically the maximum flood event used for stormwater pond design in the Municipality, the 250-year event is recommended as the maximum design event for this facility to mitigate UTRCA concerns regarding storage loss due to possible long-term local groundwater level increases.

Based on information provided by the Municipality, the existing pond depth likely ranges from 3.5 to 4 m. Preliminary design calculations were performed to estimate the proposed permanent pool depth required to achieve Enhanced Protection Level water quality treatment. Based on the guidance presented in the Stormwater Management Planning and Design Manual (MOE,2003), the proposed drainage area, and the calculated upstream impervious coverage, a design permanent pool volume of approximately 11,000 m^3 is required. In contrast, the proposed pond footprint provides a permanent pool volume of approximately 28,000 m^3, assuming an average permanent pool depth of approximately 1.5 m and a permanent pool area of approximately 2.3 ha. Thus, the proposed pond block appears to be sufficient to meet the water quality treatment requirements.

LAND REQUIREMENTS

The land requirements for the proposed SWM facility were estimated by applying a 10 m buffer around the anticipated pond footprint at the top of bank elevation to accommodate approach grading. The resulting calculated land requirement for the proposed SWM facility is approximately 3.8 ha. The corresponding limits for the proposed pond block are shown on the attached figure.

PRELIMINARY OPINION OF PROBABLE COSTS

The preliminary opinion of probable construction costs presented in the draft Stormwater Master Plan was developed based on the anticipated pond footprint and a lumped unit cost for the anticipated required items. As requested by the Municipality, a more detailed breakdown of the anticipated costs was developed, as summarized in the following table.

Reference: **Stormwater Master Plan Additional Analysis Land Requirement Estimate for Proposed Powell Property Pond**

Table 2 – SWM Facility Preliminary Opinion of Probable Costs

Item	Estimated Cost
Construction	$ 3,100,000
Engineering	$ 465,000
Contingency	$ 620,000
Additional Studies	$ 120,000
Total	$ 4,305,000

Notes:
1. The items included in the estimated construction cost and additional studies are identified in the attached summary.
2. Estimated engineering cost is calculated as 15% of the estimated construction cost.
3. Contingency cost is calculated as 20% of the estimated construction cost.

Note that the preliminary opinion of probable costs does not include the following:

- Land acquisition costs;
- MECP and UTRCA permit applications and associated fees;
- Upstream stormwater conveyance; and
- Significant pond earthwork beyond minor surface regrading.

CLOSURE

We trust that this information adequately identifies the estimated land requirements for the proposed SWM facility and the associated preliminary opinion of probable costs. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Regards,

Stantec Consulting Ltd.

Nick Emery P.Eng.
Water Resources Engineer
Phone: 519-675-6619
Fax: 519-645-6575
nick.emery@stantec.com

Attachment: Figure 1 – Komoka Drain No. 1 Proposed Pond Block
Preliminary Opinion of Probable Construction Costs Summary

c. Nelson Oliveira (Stantec)
Stephanie Bergman (Stantec)

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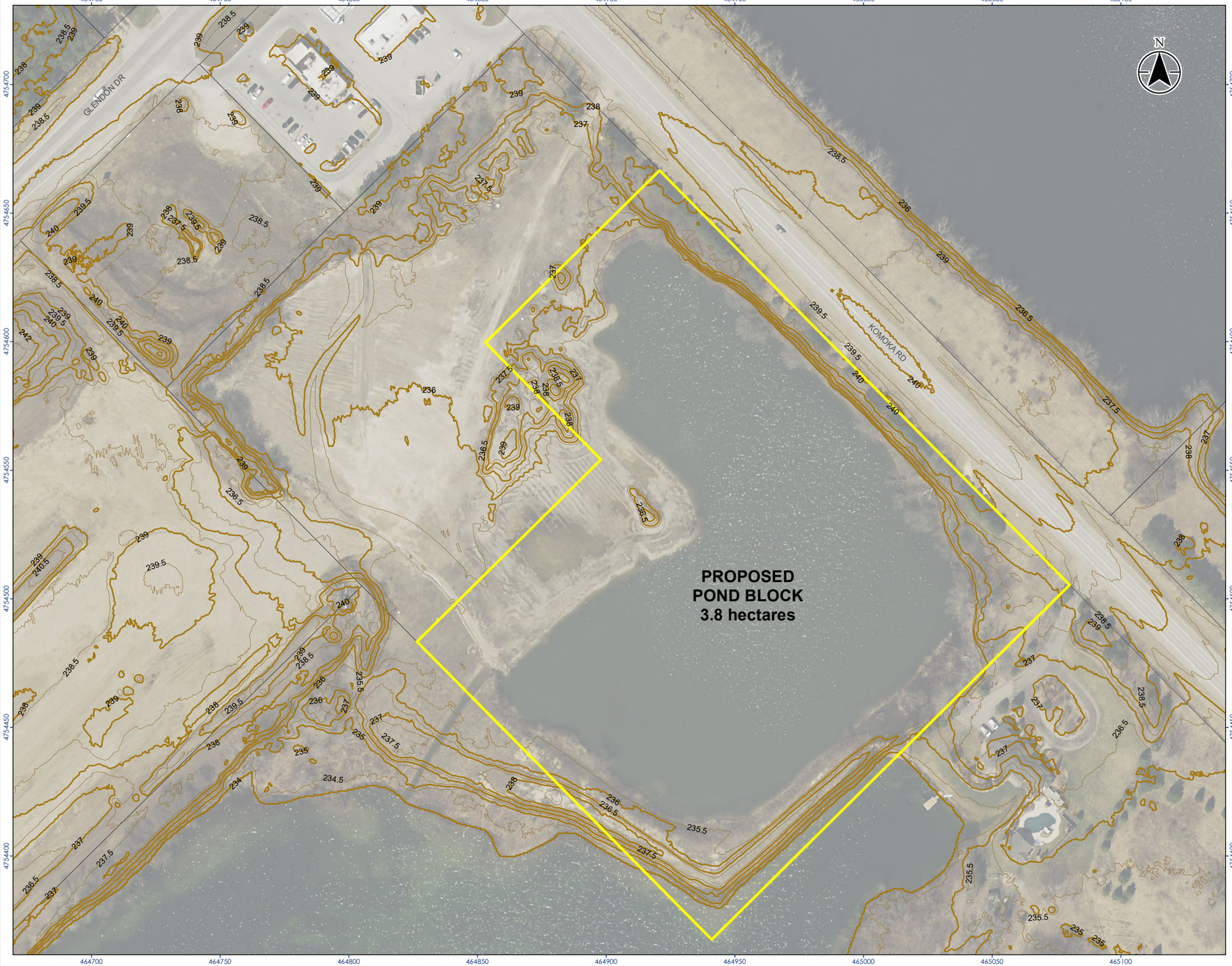


Stantec

Legend

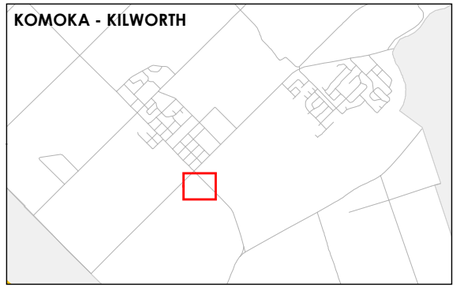
- Proposed Pond Block Limits
- Contour (1 metre)
- Contour (50 centimetre)
- Parcel

0 50 100 m

1:1,520 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Parcels © Teranet Enterprises Inc. and its suppliers. All rights reserved. Not a plan of survey.
3. 2015 orthoimagery © 2020 of the Queen's Printer for Ontario. All rights reserved.
4. Contours from 2017 OMAFRA LiDAR. Vertical datum CGVD 2013.



Project Location
Municipality of
Middlesex Centre

165630134 REVA
Prepared by KDB on 2020-05-14

Client/Project
MUNICIPALITY OF MIDDLESEX CENTRE
STORM DRAINAGE MASTER PLAN MUNICIPAL CLASS
ENVIRONMENTAL ASSESSMENT

Figure No.
1

Title
Komoka Drain No. 1
Proposed Pond Block

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Preliminary Opinion of Probable Construction Costs Summary

SWM Pond

Item	Estimated Quantity	Estimated Unit Cost	Estimated Cost
Clearing and grubbing pond perimeter	12,000 m^2	$3	$36,000
Grading around pond perimeter	12,000 m^2	$4	$48,000
Forebay berm	80 m	$900	$72,000
Forebay clay liner (imported)	8,000 m^2	$20	$160,000
Topsoil and seed (imported)	2 ha	$75,000	$150,000
Landscaping	1 l.s.	$225,000	$225,000
Inlet structure (1800 dia pipe c/w headwall)	1 l.s.	$200,000	$200,000
Outlet structure (600 diam PVC pipe c/w CSP outlet riser)	1 l.s.	$50,000	$50,000
3 m wide cable concrete access road	690 m^2	$150	$103,500
Cable concrete forebay bottom	4,000 m^2	$125	$500,000
Dewatering	1 l.s.	$500,000	$500,000
Mobilization/Demobilization (and Miscellaneous Items and Insurance)	1 l.s.	$500,000	$500,000
Erosion and Sediment Control	1 l.s.	$150,000	$150,000
Outlet storm sewer (750 m – 600 mm dia)	1 l.s.	$400,000	$400,000
		TOTAL	$3,094,500

Additional Studies

Item	Estimated Cost
Schedule B EA – not required	$0
Archaeology Assessment	$12,000
Natural Heritage Field Surveys/Reporting	$15,000
Hydrogeological/Geotechnical Assessment	$30,000
Permit to Take Water	$15,000
Provincial Parks and Conservation Reserve (PPCR) Record of Screening (RoS) Form Preparation and Coordination	$10,000
PPCR EA Consultation	$10,000
Infrastructure Ontario Approval	$10,000
Legal Survey & Easement Registration	$10,000
TOTAL	$112,000