ENVIRONMENTAL ASSESSMENT PROJECT FILE (DRAFT)

East London Sanitary Servicing Study

Prepared for

London
CANADA

City of London

DRAFT

March 2018

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Executive Summary

Introduction

Study Purpose

The City of London (City) is planning for future growth and development expected on the eastern side of the City, within the Vauxhall and Pottersburg sewersheds. To shape this strategy, the City has conducted the East London Servicing Study Environmental Assessment (the study) to identify the preferred approach for managing future wastewater flows collected and treated within these two sewersheds.

The expected population growth in the sewersheds, their current capacity, and the condition of the Vauxhall and Pottersburg wastewater treatment plants (WWTPs) were assessed. This capacity and condition assessment acted as the baseline against which potentially feasible alternatives were evaluated. The study followed the requirements for a Schedule B project under the Municipal Class Environmental Assessment (EA) process outlined in the Municipal Engineers Association's (MEA's) Municipal Class EA document (as amended in 2007, 2011, and 2015).

Problem Statements

The Pottersburg Service Area currently experiences the following issues, which the study aimed to address:

- The Pottersburg sewershed is a growth area, and the WWTP will require more treatment capacity.
- Substantial wet weather flows (WWF) in the sewershed cause capacity constraints in the collection system.
- Aging infrastructure at the WWTP will require substantial structural repairs and replacement of existing equipment. Recent stress testing demonstrated that the WWTP may not be able to treat the full amount of peak wastewater flows for which it was designed.
- The construction approach to repair and upgrade the WWTP will be complicated in order to maintain the wastewater treatment capacity.
- Lower phosphorus discharge limits to Lake Erie (via the Thames River) are pending – meaning that reduced levels of phosphorus in the WWTP effluent will be required in the future.
- Any additional flow from the Vauxhall WWTP via the planned Pottersburg-Vauxhall Interconnection would need to be treated at the Pottersburg WWTP.
- High flows from storm events cause bypasses of the Pottersburg WWTP to the Thames River or Pottersburg Creek.

The Vauxhall Service Area currently experiences the following issues, which the study aimed to address:

- Aging infrastructure, including equipment and physical structures, will require replacement and upgrades.
- Lower phosphorus discharge limits to Lake Erie (via the Thames River) are pending – meaning that reduced levels of phosphorus in the WWTP effluent will be required in the future.
- Any additional flow from the Pottersburg WWTP via the planned Pottersburg-Vauxhall Interconnection would need to be treated at the Vauxhall WWTP.

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- Optimization of the treatment processes is required to reduce the amount of new infrastructure needed to treat potential Pottersburg flows.
- High flows from storm events cause bypasses of the Vauxhall WWTP to the Thames River.
- Substantial WWFs in the sewershed cause capacity constraints in the collection system.
- Management of sludge generated at the Vauxhall WWTP needs to be reviewed to determine if transport through the Vauxhall neighbourhood can be reduced.

Study Area Conditions

20-Year and 50-Year Flow Projections

Potential treatment and collection system alternatives to address the study goals were developed based on 20-year and 50-year growth projections within each sewershed. Table ES-1 summarizes the ultimate (50-year) Pottersburg WWTP design flows. The total estimated ultimate residential population for the Pottersburg sewershed is 171,888 people; approximately 50,000 more people than predicted using *The London Plan* (City, 2016) and *Growth Management Implementation Strategy* (GMIS) boundary alternative approach. This value should continue to be refined with Official Plan and GMIS updates to more accurately outline the proportions of residential place types.

Based on the City design criteria, it is estimated that the ultimate average dry weather flow (ADWF) for the Pottersburg WWTP will be approximately 77,000 cubic metres per day (m^3/d). The ultimate average day flow (ADF), equivalent to ADWF and infiltration, is estimated to be approximately 103,000 m^3/d. Using land use characterization from the calibrated model prepared in support of the 2011 Pottersburg Sanitary Sewershed Improvements Study Update (CH2M, 2011), the 2011 ADWF and ADF for the Pottersburg WWTP were similarly estimated to be approximately 27,500 m^3/d and 46,700 m^3/d, respectively. The 2037 ADWF and ADF were linearly interpolated to be 50,600 m^3/d and 73,000 m^3/d, respectively.

The accuracy of the City's design criteria was checked against historical plant flows. The 2011 calculated ADF design flow is approximately 100 percent greater than historical flow to the Pottersburg WWTP. As a result, the ADFs to the Pottersburg WWTP in 2037 and 2067 will more realistically be in the range of 36,500 m^3/d and 51,600 m^3/d, respectively.

Vauxhall WWTP influent flows between 2012 and 2015 were relatively consistent with an average ADF of 14,960 m^3/d. It is assumed that the 2017 ADF is equivalent to this average due to minimal development within the sewershed during this timeframe. The population within the Vauxhall sewershed is anticipated to grow by 1,454 people between 2017 and 2037 due to residential infill of 16.15 hectares (ha) of greenfield space. Using a similar estimation approach as the Pottersburg sewershed, this growth in population is equivalent to an increase in ADF of approximately 474 m^3/d. No growth beyond 2037 is anticipated. As a result, the Vauxhall sewershed is expected to reach its maximum ADF of 15,434 m^3/d by 2037. Table ES-2 summarizes the estimated 20-year (and subsequently 50-year) increase in Vauxhall WWTP design flows.

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Table ES-1. Estimated Increase in Pottersburg WWTP Design Flows

Place Type	Area (ha)	City Design Criteria				Equivalent Population (people)	Harmon	Peaking Factor	ADWF (m^3/d)	ADF (m^3/d)	Peak DWF (m^3/d)	Peak WWF (m^3/d)
		People/ha	Per Capita Flow (Lpcd)	Uncertain Deviation Factor	Infiltration Allowance (L/s/ha)							
Neighbourhood	1,361	126[a]	230	1.1	0.1	171,690	2.00[b]	2.00	39,489	51,251	86,875	98,637
Rural Neighbourhood	2	90	230	1.1	0.1	198	4.15	4.15	46	65	208	227
Shopping Area	44	100	230	1.1	0.1	4,353	3.30	3.30	1,001	1,377	3,635	4,011
Institutional	10	100	230	1.1	0.1	1,006	3.80	3.80	231	318	967	1,054
Commercial Industrial	90	100	230	1.1	0.1	8,995	3.00	2.40	2,060	2,833	5,441	6,215
Light Industrial	983	100	230	1.1	0.1	98,258	2.01	1.61	22,599	31,089	39,900	48,389
Heavy Industrial	423[c]	100	230	1.1	0.1	42,341	2.33	1.87	9,738	13,397	19,989	23,647
Future Industrial Growth	92	100	230	1.1	0.1	9,246	2.99	2.39	2,127	2,925	5,592	6,391
Total	3,005	-	-	-	-	336,048	-	-	77,291	103,255	162,608	188,572

[a] Density proportion assumed to be the same as 2011 model proportions (83.2 percent light residential, 9.8 percent medium residential, 7 percent heavy residential). As a result, the neighbourhood density is 126 people/ha.

[b] Good practice that the Harmon Peaking Factor should be a minimum of 2. As a result, the calculated factor of 1.8 was increased to 2.

[c] Airport area (517 ha) not included.

Notes:

- = not applicable
DWF = dry weather flow
L/s/ha = litre(s) per second per hectare
Lpcd = litre(s) per capita per day

Table ES-2. Estimated Increase in Vauxhall WWTP Design Flows

Place Type	Area (ha)	City Design Criteria				Equivalent Population (people)	Harmon	Peaking Factor	ADWF (m^3/d)	ADF (m^3/d)	Peak DWF (m^3/d)	PWF (m^3/d)
		People/ha	Per Capita Flow (Lpcd)	Uncertain Deviation Factor	Infiltration Allowance (L/s/ha)							
Residential	16.15	90	230	1.1	0.1	1,454	3.69	3.69	334	474	1,357	1,496

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Development and Selection of Alternatives

Treatment System Alternatives

In consideration of the wastewater treatment opportunities and constrains identified in the report, a long list of potential management alternative components was created and is provided in Table ES-3, categorized as either short-term (next 20 years) or long-term (next 50 years) integrated solutions.

Table ES-3. Short- and Long-term Treatment System Alternatives

Alternative Number	Alternative	Description
Short-term		
1	Do-Nothing	Do nothing; leave as is
2	Minor capacity Increase at Vauxhall WWTP	Capacity increase to handle anticipated growth in the Vauxhall sewershed
3	Major capacity Increase at Vauxhall WWTP	Capacity increase to handle anticipated growth in both sewersheds
4	Minor capacity increase at Pottersburg WWTP	Capacity increase to handle anticipated growth in Pottersburg sewershed
5	Major capacity increase at Pottersburg WWTP	Capacity increase to handle anticipated growth in both sewersheds
Long-term		
1	Do-Nothing	Do nothing; leave as is
2	Replace Pottersburg WWTP	Replacement with new facility capable of handling anticipated growth in the Pottersburg sewershed
3	Replace Vauxhall WWTP	Replacement with new facility capable of handling anticipated growth in the Vauxhall sewershed
4	Replace Pottersburg and Vauxhall WWTP with two new WWTPs	Replacement with new facilities capable of handling anticipated growth in their respective sewershed
5	Replace Vauxhall and Pottersburg WWTPs with one new WWTP	Replacement with new facility capable of handling anticipated growth in both sewersheds
6	Replace Vauxhall and Pottersburg WWTPs with one new WWTP with capacity for additional flow from other sewersheds	Replacement with new facility capable of handling anticipated growth in both sewersheds, plus flow from outside the sewershed
7	Convert either Pottersburg or Vauxhall WWTPs to an Industrial Pre-treatment Facility	Focus industrial wastewater pre-treatment at one location while other location treats municipal wastewater and pre-treated industrial wastewater
8	Concentrate liquids treatment at Pottersburg WWTP	Focus liquids treatment from both sewersheds at Pottersburg WWTP and solids treatment at Vauxhall WWTP
9	Concentrate liquids treatment at Vauxhall WWTP	Focus liquid treatment from both sewersheds at Vauxhall WWTP and solids treatment at Pottersburg WWTP

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Collection System Alternatives

A long list of collection system alternatives was identified to mitigate the capacity constraints in the collection system and compliment the wastewater treatment preferred alternative. Alternatives were developed under existing, short-term, and long-term categories, and are presented in Table ES-4.

Table ES-4. Existing Collection System Alternatives

Alternative Number	Alternative	Description
1	Do-Nothing	Do nothing; leave as-is
2	Disconnect Weeping Tiles	This applies to homes built between 1920 to 1985. Weeping tile connections to sanitary and combined sewers are a source of I&I. The City has a Basement Flooding Grant Program available to residential homeowners, condominium corporations and non-profit housing co-operatives to help pay for the costs of installing a sump pit and pump, and backwater valve, once weeping tiles are disconnected from the sanitary system.
3	Disconnect Downspouts	Downspout disconnection programs are needed to educate and/or provide incentives and/or prohibit through municipal bylaw to home and building owners for disconnecting roof drains from the sanitary or combined sewers. Disconnection can reduce the volume of I&I to the sewer system. Downspout disconnection includes flat roof disconnection. The removal of these connections can be difficult to enforce.
4	Separate Sewers	This applies only to combined areas and involves separating combined sewers into separate storm and sanitary sewers.
5	Replace Pottersburg Trunk upstream of Dundas Street	The existing Pottersburg Trunk upstream of Dundas Street is in poor condition and through easements. The existing Pottersburg Trunk Realignment Study (CH2M, 2017) was a study completed to evaluate realigning and replacing the Pottersburg Trunk upstream of Dundas Street.
6	Implement Pump Capacity Upgrades for East Park PS	A recent EA recommended increasing the capacity of the East Park PS at its existing site (R.V. Anderson Associates Limited, 2016).
7	Implement Pottersburg-Vauxhall Interconnection	This was a Municipal Class EA Master Plan completed by AECOM that involves being able to transfer flow between the Vauxhall and Pottersburg WWTPs to utilize the available capacity at each.

Notes:

I&I = inflow and infiltration
PS = pumping station

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These existing alternatives align with the goal of improving the capacity of collection system. As these existing initiatives continue to be implemented, it is recommended that the collection system capacity is reassessed using updated flow monitoring and modelling. No further evaluation of the existing alternatives will be completed in this EA.

Table ES-5 describes the short-term collection system alternatives and identifies the technical, economic, social, and environmental impacts for each alternative.

Table ES-5. Short-term Collection System Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 1 – Do-Nothing				
Do nothing; leave as-is				
Alternative 2 – Inspect Sanitary Sewers for Cracks				
This applies to aging sanitary infrastructure in both sewersheds that may have cracks that allows infiltration into the sanitary sewers.	• Potential to decrease the I&I entering the sanitary sewers. • Could reduce the diameter of the sewer if sewer relining is implemented	• Moderate to high capital costs	• Sewer relining or new sewers could involve road closure • Reducing I&I in the sewer system could reduce downstream bypasses • Can reduce basement flooding risks	Reducing I&I in the sewer system could reduce downstream bypasses and sanitary sewer overflows. Reducing cracks in the sewer system could improve the surrounding environment. Construction should have a limited impact on the surrounding area.
Alternative 3 – Conduct Study to Upsize Eleanor STS				
This involves upsizing the Eleanor STS in the Vauxhall sewershed.	• Can be an effective means of reducing basement flooding and SSOs	• High capital costs	• Major disruptions to public including road closures • Can reduce upstream basement flooding risks	Construction should have a limited impact on the surrounding area.
Alternative 4 – Evaluate Available Capacity of Trunks in the Pottersburg Sewershed				
Model simulations in the Pottersburg Sewershed that account for population growth suggest that the Jackson Road Trunk, the Pottersburg Trunk (Downstream of Dundas Street), and the Hamilton Road Trunk have some capacity constraints. This alternative is to verify and evaluate the capacity of these trunks further.	• Can be an effective means of reducing basement flooding and SSOs	• High capital costs •	• Major disruptions to public including road closures • Can reduce upstream basement flooding risks	Construction should have a limited impact on the surrounding area.

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Table ES-5. Short-term Collection System Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 5 – Add Offline Storage along Pottersburg Trunk (downstream of Dundas Street)				
This alternative involves adding offline storage along the Pottersburg Trunk downstream of Dundas Street. Offline Storage combines a number of storage alternatives including offline storage (pipes or tanks), sewer replacement or twinning for additional storage capacity, or storage tank or tunnel. Specific storage alternative to be used will need to be confirmed using site-specific information at a future design stage.	• Typically most cost-effective means of controlling basement flooding related to WWF • Lack of appropriate design standard for sizing • Operational challenges to operate and maintain this type of infrastructure • Moderate difficulty to implement depending on land availability and site conditions	• High capital costs • High O&M costs	• Construction may significantly disrupt surrounding neighbourhood • If available open space used, impact on private property minimized	Impact during construction would be confined to the surrounding area.
Alternative 6 – Implement Pump Capacity Upgrades for Clarke Road PS				
Bypassed flow from the Clarke Road PS enters the upstream end of the Pottersburg Trunk, and the large majority of the Pottersburg Trunk is simulated to be surcharged during a 2-year design storm event. The Clarke Road PS currently pumps flows to the Admiral Drive Sub-Trunk, which feeds the Trafalgar Street Sub-Trunk that connects to the southern portion of the Pottersburg Trunk at Trafalgar Street. Increasing the capacity of the Clarke Road PS would increase the flows in the southern portion of the Pottersburg Trunk.	• Will increase flows to downstream system and treatment facility • Flexible pump operation	• Moderate capital costs due to cost of mechanical equipment • O&M costs similar to normal operation	• Implemented using existing infrastructure; impact on residents should be minimal • Increased risk of basement flooding downstream of PS	Construction should have a limited impact on the surrounding area.

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Table ES-5. Short-term Collection System Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 7 – Conduct Study to redirect pumped flows from the Clarke Road PS				
This alternative is to conduct a study to evaluate redirecting the flows from the Clarke Road PS to the Adelaide WWTP. It would involve installing a forcemain that can convey flows north along Clarke Road to the STS along Cheapside Street leading to the Adelaide WWTP.	• Will increase flows to the downstream Adelaide system and treatment facility • Will alleviate capacity constraints in the Pottersburg sewershed	• High capital costs due to forcemain design and construction • O&M costs similar to normal operation	• Increased risk of basement flooding downstream of PS in the Adelaide sewershed • Decreased risk of basement flooding in the Pottersburg sewershed • Major disruptions to public including road closures	Construction should have a limited impact on the surrounding area.
Alternative 8 – Conduct study to divert flow from Pottersburg Sewershed				
This alternative is to conduct a study to evaluate diverting flow from the Pottersburg Trunk at Dundas Street under the Pottersburg Creek to the Vauxhall sewershed. This alternative would require replacing approximately 750 m of the sanitary sewer along Dundas Street and Highbury Avenue in the Vauxhall sewershed to allow flow by gravity.	• Will increase flows to the downstream Vauxhall system and treatment facility • Will alleviate some capacity constraints along the Pottersburg Trunk	• High capital costs due to bridge work and downstream sewer replacement • Moderate O&M costs for potential required siphon	• Increased risk of basement flooding downstream of PS in the Adelaide sewershed • Decreased risk of basement flooding in the Pottersburg sewershed • Would disrupt traffic on arterial road	Implementation could have little to moderate impact on surrounding environment.

Notes:

m = metre(s)
O&M = operations and maintenance
SSO = sanitary sewer overflow
STS = sanitary trunk sewer

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The long-term alternatives are described in Table ES-6. Long-term alternatives were screened but were not evaluated in detail in this EA, as these alternatives are dependent on the location of the proposed new WWTP.

Table ES-6. Long-term Collection System Alternatives

Alternative Number	Alternative	Description
1	Do-Nothing	Do nothing; leave as-is
2	Conduct Study to Identify Collection System Efficiencies	Depends on the location of the proposed new WWTP and is to consider efficiencies in conveying the wastewater to the WWTP
3	Replace existing Vauxhall and Pottersburg WWTPs with PSs	Depends on the location of the proposed new WWTP and involves adding PSs to the existing WWTP locations that can pump flow to the proposed new WWTP
4	Reroute Collection System	Depends on the location of the proposed new WWTP and involves rerouting trunks and PSs in both sewersheds upstream of the proposed new WWTP

Preferred Alternatives and Recommendations

Preferred Treatment System Alternatives and Recommendations

Following screening and evaluation, Alternative 3 was identified as the only feasible short-term alternative, and Alternatives 5 and 6 were tied for the preferred long-term alternative. A preliminary cost estimate was developed to the minus 30 percent to plus 50 percent level and provides an overall estimate range of $34.8 million to $74.5 million to implement the short-term treatment alternative, based on proposals received by the City from Evoqua Water Technologies LLC (Evoqua) for the BioMag and CoMag systems.

The cost to implement either long-term treatment alternative was developed at a high level to provide an order-of-magnitude indication of the total project cost by implementing either Alternative 5 or 6. The costs are based on a dollar per litre (L) of treatment value ($3.3/L), as used by the City. Using this factor, the rough costs for implementing one of the two long-term alternatives are as follows:

- Alternative 5: $330 million for 100 million litres per day (MLD) of treatment
- Alternative 6: $462 million for 140 MLD of treatment

Additional work is recommended that will impact the overall cost estimates outlined above, including the following:

- Study and assess the options for conveying flow from outside sewersheds.
- Determine possible siting locations for the new facility.
- Evaluate costs, benefits, and drawbacks associated with each alternative.

Supporting studies or investigations, or both, recommended in the short-term are as follows:

- Review and evaluate technology to confirm the recommended approach for capacity upgrades at the Vauxhall WWTP.
- Complete a hydraulic study and debottlenecking to confirm that the flow paths within the Vauxhall WWTP can accommodate a re-rating.
- Review the solids handling capability at the Pottersburg WWTP, and identify recommended upgrades and improvements, as required. Consideration can be given to whether solids are dewatered at Pottersburg WWTP to reduce the number of trucks taking the solids for ultimate disposal at Greenway WWTP.
- Assess the condition of the existing equipment at the Vauxhall WWTP to determine if anything requires immediate repair or replacement for continuing service until the long-term preferred alternative is ultimately identified and implemented.

Further work is recommended during a future project phase to identify an ultimate preferred long-term treatment alternative, as follows:

- Study and assess the options for conveying flow from outside sewersheds, which will inform the feasibility of constructing Alternative 6 (140 MLD facility) over Alternative 5 (100 MLD facility). Considerations can include development potential of redirecting flow from outside sewershed(s) to a new, large facility (Alternative 6) and the costs associated with doing so.
- Determine possible siting locations for the new facility and whether significant environmental impacts would need to be mitigated as a result.
- Complete the design of a PS at the Pottersburg WWTP to forward flow to the new facility. Flow from Vauxhall WWTP could be sent to Pottersburg WWTP via the Vauxhall-Pottersburg Interconnection. The design of a PS at the Vauxhall WWTP will need to be completed as well.

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- Evaluate costs, benefits, and drawbacks associated with each alternative, based on the completion of additional work and studies.
- Timing to implement the ultimate preferred long-term solution is over 20 years away and will depend on the remaining life of the infrastructure at Pottersburg WWTP, the actual growth in Pottersburg sewershed, or the actual impacts of improvements to the collections systems (for example, a reduction of wet weather peak flows and I&I), or a combination thereof.

Preferred Collection System Alternatives and Recommendations

Collection system Alternatives 2 and 4 were the two short-term alternatives that scored favourably during the evaluation. Alternative 2 will identify cracks in aging sewers and prioritize sewers to be relined. This alternative may help reduce the I&I in the collection system. Alternative 4 will assess the capacity of the Jackson Road Trunk, the Pottersburg Trunk (downstream of Dundas Street) and the Hamilton Road Sub-Trunk. This study should include flow monitoring, consider population projections, and consider the implementation of the existing alternatives.

The long-term Alternatives 2 and 3 were recommended due to their complementary nature with the preferred long-term WWTP alternatives and are dependent on the location of the proposed new WWTP. Therefore, it was recommended that the two screened long-term alternatives be carried forward and revaluated when the location for the new proposed WWTP is selected. Consequentially, this EA did not evaluate these alternatives further.

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Acronyms and Abbreviations

ADF	average day flow
BOD_5	5-day biological oxygen demand
CAS	conventional activated sludge
CEPT	chemically enhanced primary treatment
City	City of London
CofA	Certificate of Approval
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
Dillon	Dillon Consulting Limited
DWF	dry weather flow
EA	environmental assessment
EAA	*Environmental Assessment Act*
ECA	Environmental Compliance Approval
ESR	*Environmental Study Report*
F/Mv	food to microorganism ratio
GMIS	*Growth Management Implementation Strategy*
ha	hectare(s)
HRT	hydraulic retention time
I&I	inflow and infiltration
kg/d	kilogram(s) per day
km	kilometre(s)
L	litre(s)
L/hr	litre(s) per hour
L/s	litre(s) per second
L/s/ha	litre(s) per second per hectare
Lpcd	litre(s) per capita per day
m	metre(s)
MBR	membrane bioreactor
mL/g	millilitre(s) per gram
mm	millimetre(s)
m^3/d	cubic metre(s) per day
m^3/hr	cubic metre(s) per hour
MDF	maximum daily flow
MEA	Municipal Engineers Association
MIGD	million imperial gallons per day
MLSS	mixed liquor suspended solids

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MOECC	Ontario Ministry of the Environment and Climate Change
O&M	operations and maintenance
OLR	organic loading rate
PHF	peak hour flow
PIC	Public Information Centre
PIF	peak instantaneous flow
PPCP	Pollution Prevention and Control Plan
PS	pumping station
RAS	return activated sludge
SOR	surface overflow rates
SSO	sanitary sewer overflow
SARA	*Species at Risk Act*
SLR	solids loading rate
SRT	solids retention time
Stantec	Stantec Consulting Limited
STS	sanitary trunk sewer
SVI	sludge volume index
SWD	side water depths
study	East London Servicing Study Environmental Assessment
TKN	total Kjeldahl nitrogen
TP	total phosphorus
TSS	total suspended solids
UTRCA	Upper Thames River Conservation Authority
UV	ultraviolet
VFD	variable frequency drive
WAS	waste activated sludge
WWF	wet weather flow
WWTP	wastewater treatment plant
XCG	XCG Consultants Limited

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SECTION 1

Introduction

1.1 Introduction and Study Purpose

The City of London (the City) is planning for future growth and development expected on its east side, within the Vauxhall and Pottersburg sewersheds. To shape this strategy, the City is conducting the East London Servicing Study Environmental Assessment (study) to identify the preferred approach for managing future wastewater flows collected and treated within these two sewersheds. The study will develop environmentally sound recommendations that reflect the current and future needs of the Vauxhall and Pottersburg sewersheds through a collaborative public and stakeholder consultation process.

The expected population growth in the sewersheds, their current capacities, and the condition of the Vauxhall and Pottersburg wastewater treatment plants (WWTPs) will be assessed. The capacity and condition assessment will act as the baseline against which potentially feasible alternatives are evaluated. The study will follow the requirements for a Schedule B project under the Municipal Class Environmental Assessment (EA) process outlined in the Municipal Engineers Association's (MEA's) Municipal Class EA document (as amended in 2007, 2011 and 2015).

1.2 Problem Statement

The Pottersburg and Vauxhall service areas (Figure 1-1) are currently experiencing several issues such as aging infrastructure and high flows. In addition, the City has grown in recent years and is forecasted to grow substantially in the future. Currently, the Pottersburg and Vauxhall sewersheds service approximately 21% of the City's total existing population; therefore, a preferred approach for managing future wastewater flows collected within these two sewersheds needs to be identified.

1.2.1 Pottersburg Service Area Issues

The following issues currently affect the Pottersburg Service Area:

- The sewershed is a growth area and the Pottersburg WWTP will require more treatment capacity.
- Substantial wet weather flows (WWFs) in the sewershed cause capacity constraints in the collection system.
- Aging infrastructure at the WWTP will require substantial structural repairs and replacement of existing equipment. Recent stress testing demonstrated that the WWTP may not be able to treat the full amount of peak wastewater flows for which it was designed.
- The construction approach to repair and upgrade the WWTP will be complicated to maintain the wastewater treatment capacity.
- Lower phosphorus discharge limits to Lake Erie (via the Thames River) are pending, meaning reduced levels of phosphorus in the WWTP effluent will be required in the future.
- Any additional flow from the Vauxhall WWTP via the planned Pottersburg-Vauxhall Interconnection would need to be treated at the Pottersburg WWTP.
- High flows from storm events cause WWTP bypasses to the Thames River or Pottersburg Creek.

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1.2.2 Vauxhall Service Area Issues

The following issues currently affect the Vauxhall Service Area:

- Aging infrastructure, including equipment and physical structures, will require replacement and upgrades.
- Lower phosphorus discharge limits to Lake Erie (via the Thames River) are pending, meaning reduced levels of phosphorus in the WWTP effluent will be required in the future.
- Any additional flow from the Pottersburg WWTP via the planned Pottersburg-Vauxhall Interconnection would need to be treated at the Vauxhall WWTP.
- Optimization of the treatment processes is required to reduce the amount of new infrastructure needed to treat potential Pottersburg flows.
- High flows from storm events cause bypasses of the Vauxhall WWTP to the Thames River.
- Substantial WWFs in the sewershed cause capacity constraints in the collection system.
- Management of sludge generated at the Vauxhall WWTP needs to be reviewed to determine if transport through the Vauxhall neighbourhood can be reduced.

1.3 General Study Area Description

The City's existing wastewater system collects and conveys sewage through over 1,230 kilometres (km) of sanitary sewer, distributing flows to one of the following five WWTPs for treatment:

- Adelaide
- Greenway
- Oxford
- Pottersburg
- Vauxhall

The City also has 38 pumping stations (PSs) and over 45 km of forcemain that facilitate the collection and conveyance of wastewater. The Pottersburg and Vauxhall sewersheds are approximately 4,260 and 1,200 hectares (ha), respectively.

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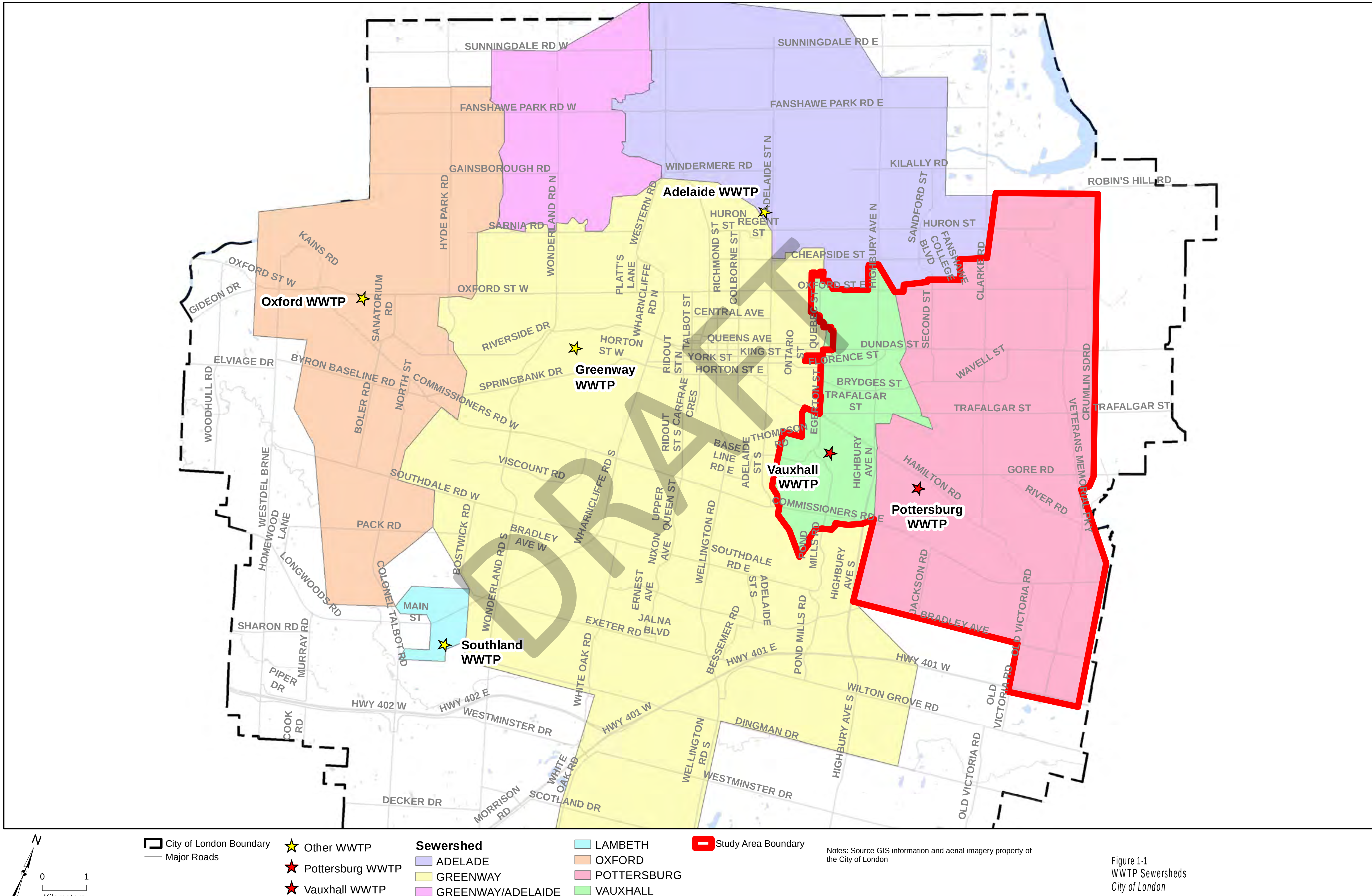

Notes: Source GIS information and aerial imagery property of the City of London

Figure 1-1
WWTP Sewersheds
City of London

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1.4 Ontario's Environmental Assessment Act

The following regulatory framework has been applied to the study.

Ontario's *Environmental Assessment Act* (EAA) was passed in 1975 and was first applied to municipalities in 1981. The EAA requires the study, documentation, and examination of the environmental effects that could result from projects or activities (Province of Ontario, 2010).

The objective of the EAA is to consider the possible effects of these projects early in the planning process, when concerns may be most easily resolved, and to select a preferred alternative with the fewest identified impacts.

The EAA defines "environment" very broadly:

- *Air, land, or water*
- *Plant and animal life, including humans*
- *Social, economic, and cultural conditions that influence the life of humans or a community*
- *Any building, structure, machine, or other device or thing made by humans*
- *Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities*
- *Any part or combination of the foregoing, and the interrelationships between any two or more of them, in or of Ontario*

In applying the requirements of the EAA to projects, two types of EA planning and approval processes are identified in the MEA's Municipal Class EA document (MEA, 2000, as amended in 2007, 2011, and 2015):

1. Individual EAs (Part II of the EAA): "*Projects for which Terms of Reference and an individual EA are carried out and submitted to the Minister of the Environment and Climate Change for review and approval"*
2. Class EAs: "*Projects are approved subject to compliance with an approved Class EA process; provided that the appropriate Class EA approval process is followed, a proponent will comply with the requirements of the EAA"*

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1.5 Class Environmental Assessment Process

This study will follow the MEA's Municipal Class EA document (MEA, 2000, as amended in 2007, 2011, and 2015) to meet, at a minimum, Phases one and two:

- *Phase One: Definition of the Problem*
- *Phase Two: Identification and Assessment of Alternative Solutions, and Selection of a Preferred Solution*
- Future phases of this study may include the following:
- Phase Three: Identification and Assessment of Alternative Sites/Design Concepts, and Selection of a Preferred Site/Design
- Phase Four: Preparation of an Environmental Study Report (ESR)
- Phase Five: Implementation

The Class EA document classifies projects undertaken by municipalities into one of four possible schedules depending on the project activities and associated anticipated environmental impact. The four schedules under which a project's EA process is determined are described below.

1. Schedule A projects are minor operational and upgrade activities and may go ahead without further assessment once Phase One of the Class EA process is complete (that is, the problem is reviewed, and a solution is confirmed).
2. Schedule "A+" projects are pre-approved but still require public notification prior to implementation of the project. Projects categorized as Schedule A+ include activities such as municipal infrastructure plans previously approved by a council member (Phase 1).
3. Schedule B projects must proceed through the first two phases of the process. Proponents must identify and assess alternative solutions to the problem, inventory impacts, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided that no significant impacts are found and no requests are received to elevate the project to Schedule C or undertake the project as an Individual EA (Part II Order), the project may proceed to the next phase.
4. Schedule C projects require more detailed study, public consultation, and documentation, as they may have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of an assessment. An ESR must be completed and available for a 30-day public review period, prior to proceeding to implementation.

If there are major issues that cannot be resolved upon completion of the final ESR, individuals may request the Minister of Environment and Climate Change to require the regions to comply with Part II of the EAA. Upon receiving a Part II Order Request, the Minister reviews the request and study information, and makes one of the following decisions: deny the request, refer the matter to mediation, or require completion of an Individual EA. Many factors are considered by the Minister in making decisions, including the adequacy of the planning process, the potential for significant adverse environmental effects after mitigation measures are considered, the participation of the requester in the planning process, and the nature of the request (MEA, 2000, as amended in 2007, 2011, and 2015).

The study is being carried out as a Schedule B project; therefore, Phases 1 and 2 of the MEA EA process will be followed.

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1.5.1 Current Environmental Assessment Tasks

The study followed the process outlined in the MEA's Municipal Class EA document (as amended in 2007, 2011, and 2015), and therefore, includes the following key public and stakeholder consultation activities:

- **Mailing List**: Agencies and other stakeholders were identified in consultation with the City, and a study mailing list was generated. The mailing list was updated periodically throughout the study. The mailing list is in Appendix B.
- **Notice of Commencement**: A notice was published in *The Londoner* and sent to agencies, First Nations, and stakeholders identified in the study mailing list by mail, email, or both.
- **Comments and Feedback:** Comments and feedback were collected and documented through each stage of the EA.
- **First Nations:** The City consulted with the local First Nations throughout the study, providing study updates. To date, no responses have been received.

Several project team meetings were held during the project. A summary of each project team meeting is in Appendix B and summarized as follows:

- **Site Visit:** CH2M visited the Vauxhall and Pottersburg WWTPs, in addition to several PSs within each sewershed with City staff on June 13, 2017. The site visit served as a venue for CH2M to take notes regarding the general condition of infrastructure at the WWTPs and PS visited, and the site layouts and potential available space for future expansion at each WWTP.

- **Project Kick-Off Meeting:** The project objectives, scope, and schedule were reviewed and discussed. CH2M and client point of contacts were assigned.
- **Client Progress Meeting:** Information to finalize Progress Report #1 was reviewed, and the requirements for alternatives development were discussed.
- **Alternatives Evaluation Workshop:** The long-list of WWTP alternatives and criteria were reviewed and the long-list was sorted into short-term and long-term alternatives. It was discussed that the collection system alternatives should be developed after the preferred WWTP alternatives are selected.

In addition, members of the public were invited to provide comments related to the project during the following:

- **Public Information Centre (PIC)**: Two PICs were held. The first PIC focused on providing the study background information and objectives. This also served as a platform for receiving public input on the study at the initiation phase and identifying additional stakeholders. The second PIC focused on presenting the preferred alternatives and study recommendations to the public for comment.
- **Notice of 30-day public Comment Period:** The City issued this notice to solicit comment from stakeholders and the general public on the draft EA report and recommendations.
- **Notice of Project Completion**: The City will issue this notice to the stakeholders and general public at the end of the 30-day review period, or after any Part Two Order requests are satisfied.

1.5.1.1 Data Collection and Review

Relevant background information was collected and reviewed, and is detailed in Section 2. This background information was reviewed to identify information gaps and, subsequently, to develop required additional scope of work.

1.5.1.2 Development and Evaluation of Alternatives

A long list of alternatives was developed that integrates alternatives from previous studies with the potential to meet current goals, objectives, and targets. The Municipal Class EA process requires that a reasonable range of alternatives be developed, including alternative methods of implementation and a Do-Nothing alternative which provides a benchmark for the evaluation of alternatives. The long list of alternatives for the Project represents individual components that, when combined, create a list of integrated, alternative solutions with both unique and common elements.

The evaluation of the integrated alternative solutions followed the standard EA approach through the development of a comprehensive set of evaluation criteria. This evaluation included technical, environmental, social and cultural, and economic criteria. Each criterion was described with unique attributes that address the particular opportunities and constraints associated with the Project.

A screening process then took place, in which each of the integrated alternative solutions were rated based on their ability to address the particular objectives and/or targets expressed in each of the criteria. A sensitivity analysis was also performed on the short-listed, integrated, alternative solutions so the evaluation could be shown to not be biased toward any one set of criteria.

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SECTION 2

Study Area Conditions

2.1 Historical Studies

Information from relevant previous studies and other background materials provided by the City has been incorporated into the EA, as appropriate. The information in Table 2-1 was reviewed and used to complete the characterizations described in the subsequent sections of this report.

Table 2-1. Sources of Information

Author	Title	Description
AECOM	City of London Treatment Optimization of the Vauxhall and Pottersburg Sewersheds Municipal Class EA Master Plan	Environmental assessment for the conceptual siting of new transfer PSs and wastewater linear infrastructure to connect Pottersburg and Vauxhall WWTPs.
AECOM	2014 Wastewater Servicing Master Plan Update and Development Charge Background Study	Summary of new-growth related works for the City's sanitary sewerage systems on a 5-year basis from 2014 through 2033.
Andrews Infrastructure	Trunk Sewer Condition Assessment Program -Pottersburg Trunk Sector Map.	Map
CH2M	Pollution Prevention and Control Plan Phase One Summary Report and Phase Two Summary Report	Development of an implementation plan for a long-term solution to limit the volume and frequency of untreated wastewater discharges to the receiving streams from sanitary sewer overflows and bypasses.
CH2M	2017 Pottersburg Trunk Sanitary Sewer Realignment and Replacement	Review of alternatives to realign the Pottersburg STS north of Dundas Street.
CH2M	2011 Pottersburg Sanitary Sewershed Improvements Study Update	Update the Pottersburg Sanitary Sewerage Improvements Study (Dillon, 1998).
City	Monthly Plant Summaries	Operating data for both Pottersburg and Vauxhall WWTPs, 2012 through 2015.
City	GMIS: 2018 Annual Review	Review of servicing projections and scheduling of infrastructure works to support development within the City.
City	2017 GMIS Update – Milestone #5a Minutes	Similar to the above. Includes details of GMIS core area boundaries.
City	The London Plan (City, 2016)	City's Official Plan.
City	2014 Development Charges Background Study	Growth forecasts, capital needs to support growth and computation of development charges.
City	2015-2019 Strategic Plan	Summary of Council and Administration vision, mission and values, and strategic areas of focus.
City	Lifecycle Renewal Capital Budget 2016 to 2025 Forecast	Planned expenditures by service program.
City	Business Plan: Wastewater Removal and Stormwater Management	Review of activities to support the Strategic Plan.

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Table 2-1. Sources of Information

Author	Title	Description
Dillon	2013 Infrastructure Renewal Contracts Tender T13-20: Contract #9 -Burbrook Place ES2414-13, EW3765-13 Draft Preliminary Design Report.	The report described the preliminary design of the Burbrook Place Reconstruction project. The report also described the Burbrook Place/Quebec Street Stormwater Management Strategy.
Dillon	City of London PPCP -Assignment 01 Hydraulic Modelling and Flow Monitoring Study.	A report describing the hydraulic model constructed for Assignment 01, which was a component of the PPCP. The hydraulic model focused on calibration at sewer system overflows in the Vauxhall sewershed.
R.V. Anderson	East Park Sewage Pumping Station Upgrades	Technical memorandum describing evaluation of alternative solutions for the East Park Sewage PS upgrade.
R.V. Anderson	London Solids Thickening and Dewatering Feasibility Options	Recommended upgrades to improve solids thickening and dewatering at the City's five major WWTPs.
Stantec	Pottersburg WWTP Stress Testing – Summary Report Draft	Summary of stress testing completed at the Pottersburg WWTP. Only Section 1 secondary clarifiers were stress tested.
Stantec	Vauxhall WWTP Stress Testing – Summary Report Draft	Summary of stress testing completed at the Vauxhall WWTP. Insufficient WWFs to test Section 1 secondary clarifiers.
Statistics Canada	2016 Census Profile for London, Ontario.	Population census data.
XCG	Capacity Assessment of the City of London's Wastewater Treatment Plants.	Presents a capacity assessment of all the City's WWTPs, including Pottersburg and Vauxhall. Based on data from 2008 through 2012.

Notes:

Dillon = Dillon Consulting Limited
GMIS = Growth Management Implementation Strategy
PPCP = Pollution Prevention and Control Plan
Stantec = Stantec Consulting Limited
STS = sanitary trunk sewer
XCG = XCG Consultants Limited

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2.2 Land Use

The Pottersburg sewershed is located on the far east side of the City, and services several types of land use. Most land use is industrial (light and heavy), residential neighbourhoods, and greenspace. The Vauxhall sewershed, immediately west of the Pottersburg sewershed, has mostly residential neighbourhoods with some greenspace, light industry, and transit-related land uses (rapid transit corridor and transit village). Figure A-1 in Appendix A illustrates the land use (by place type) within the Pottersburg and Vauxhall sewersheds based on the place type designations presented in *The London Plan* (City of London, 2016).

The Pottersburg WWTP is adjacent to the Pottersburg Park. An off-leash dog area and a paved area are located within the park. No sports fields are located within Pottersburg Park (AECOM, 2017).

The Vauxhall WWTP is adjacent to St. Julien Park, which has several designated activity areas including tennis courts, a basketball court, soccer fields, baseball fields, a skateboard park, and the River's Edge Disc golf course (AECOM, 2017).

Table 2-2 tabulates the City's designated place types based on sewershed.

Table 2-2. Pottersburg and Vauxhall Sewershed Place Type Characterization

Place Type	Pottersburg Sewershed (ha)	Vauxhall Sewershed (ha)
Green Space	737	176
Environmental Review	11	None
Downtown	None	None
Transit Village	9	69
Rapid Transit Corridor	4	24
Railway Corridor	40	36
Urban Corridor	81	34
Shopping Area	41	16
Main Street	None	1
Neighbourhoods	1,327	596
Institutional	10	13
Heavy Industrial	466	None
Light Industrial	860	84
Commercial Industrial	90	None
Future Community Growth	None	None
Future Industrial Growth	4	None
Farmland	197	None
Rural Neighbourhoods	8	None
Waste Management Resource Recovery Area	None	None
Water	31	8
Transportation Space (Road Easements)	342	102

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2.3 Natural Environment

2.3.1 Natural Heritage

Natural heritage features, areas, and linkages are intended to provide connectivity and support processes necessary to maintain biological and geological diversity, natural functions, viable populations of native species, and ecosystems. The City has policies in place that establish requirements for the identification, delineation, and protection of these natural heritage features (City of London, 2016). Figure A-2 in Appendix A illustrates the City's natural heritage system relative to the Pottersburg and Vauxhall sewersheds.

The Pottersburg sewershed contains several natural heritage features, including but not limited to the following features:

- South Thames
- Dingman Creek
- Pottersburg Creek

- Meadow Lily Woods Environmentally Significant Area
- Provincially significant wetlands and unevaluated wetlands
- Provincially significant woodlots and woodlands
- Provincially significant valleylands

Fewer natural heritage features are located within the Vauxhall sewershed. It contains the Thames River South Branch and bordering significant valleylands and woodlands.

The *Vauxhall-Pottersburg Interconnection Study* conducted desktop analyses and field investigations to thoroughly evaluate potential natural heritage features within the study area (Pottersburg WWTP, Vauxhall WWTP, and potential interconnection alignment area). An overview of the terrestrial environment evaluated as part of the study (AECOM, 2017) is provided as follows:

- Thames River is designated as a Significant Corridor (connects natural heritage features, provides habitat, and encourages species movement and diversity).
- Thames River Valley Corridor is near a Big Picture Meta-Corridor (connects this natural heritage system to other systems within and beyond the City's limits).
- Meadow Lily Woods is an Environmental Significant Area.
- There were 14 vegetation communities delineated within the study area (12 on the eastern portion of the study area).
- There were 105 plant species observed, 51 of which are native species.
- There were 3 wetland communities identified, including a marsh within Pottersburg Park and hydro corridor, a deciduous swamp, and an Alder Mineral Thicket Swamp located within the study area; and
- There were 92 bird species identified in the study area and 40 species observed during field surveys.

An overview of the aquatic environment evaluated as part of the study (AECOM, 2017) is provided as follows:

- The study area is within the Upper Thames River watershed.
- Silver shiner (listed as Special Concern on the *Species at Risk Act* [*SARA*] and Threatened by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC]) was identified within the study area.
- Round pigtoe (listed as Endangered under Schedule 1 of *SARA* and COSEWIC) and Wavy-rayed Lampmussel (listed as Special Concern under Schedule 1 of *SARA* and COSEWIC) were identified downstream of the study area.
- Butternut (listed as Endangered under Schedule 1 of SARA and COSEWIC, and a protected species under the *Endangered Species Act* of Ontario) was confirmed within the study area.
- Unevaluated vegetation patch within the study area was considered significant habitat.
- Unevaluated wetland within the study area could not be evaluated due to access restrictions on private property.
- Several parcels of land within the study area are owned and regulated by the Upper Thames River Conservation Authority (UTRCA).

Further details of the terrestrial and aquatic environment are provided in the *Vauxhall-Pottersburg Interconnection Study* report (AECOM, 2017). Similar to evaluating archeological potential, if wastewater servicing treatment alternatives include modification to sewer alignments or PSs, these areas will be further assessed for potential natural heritage features.

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2.3.2 Hazards and Natural Resources

2.3.2.1 Natural and Human-made Hazards

Natural and human made hazards include floodplain lands, riverine erosion, wetland hazards, unstable soils, steep slopes, contaminated lands, and abandoned resource wells. The City tracks these hazards to identify areas where there is an unacceptable risk to public health or safety or of property damage (City of London, 2016). Figure A-3 in Appendix A illustrates the City's identified hazards relative to the Pottersburg and Vauxhall sewersheds. Of significance, UTRCA-regulated lands are adjacent to the Thames River.

2.3.2.2 Natural Resources

Natural resources with which the City is concerned include aggregate resource areas, extractive industrial areas, and potential mineral and petroleum resources. These resources require protection from development until the resource is depleted and the area has been rehabilitated (City of London, 2016). Figure A-3 in Appendix A also illustrates the City's natural resources in conjunction with identified hazards. Of note, highly vulnerable aquifers and significant groundwater recharge areas are present throughout most of the sewersheds. Aggregate resource areas are located south of the Thames River within the Pottersburg sewershed.

2.4 Social Environment

As noted, the City has grown in recent years and is forecasted to grow substantially in the future. In 2016, the City's population was 383,822; an increase of over 17,000 people from 2011 (Statistics Canada, 2017). Based on dry weather flow (DWF) from the WWTPs, the Pottersburg and Vauxhall sewersheds service existing populations of 69,000 and 13,200 people respectively – meaning they service approximately 21% of the City's total population.
Detailed population growth projections are provided in Section 2.6.

2.5 Cultural Environment

2.5.1 Cultural Heritage

Conserving cultural heritage resources allows the City to preserve legacies inherited from previous generations. Tangible elements include buildings, monuments, streetscapes, landscapes, books, artifacts, and art. The *London Advisory Committee on Heritage* maintains a Register of properties that have cultural heritage value or interest – either according to the *Ontario Heritage Act* or Municipal Council. The aim of this Register is to ensure that new development and public works are sensitive to, and in some cases, enhance, the City's cultural heritage resources (City of London, 2016). The *London Plan* maps designated Heritage Conservation Districts as well as Cultural Heritage Landscapes throughout the City. Figure A-4 in Appendix A illustrates these areas relative to the Pottersburg and Vauxhall sewersheds. No districts or landscapes are located within the sewersheds.

2.5.2 Archeology

In addition to these designated areas, archeological assessments are often conducted as part of EAs and can provide further cultural information about the area. The *Vauxhall-Pottersburg Interconnection Study* included a Stage 1 Archeological Assessment. It was concluded that portions of the study area have high potential for recovery of both First Nation and Euro-Canadian archeological resources where land was not previously disturbed – mainly along the interconnection alignment between the two WWTPs. Note that the archeological potential at the WWTPs was removed due to heavy disturbance. As a result, a Stage 2 Archeological Assessment is recommended for undisturbed lands within the study area to further archive archeological potential (AECOM, 2017).

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The archeological potential along sewer alignments or near PSs may be further evaluated if wastewater servicing treatment alternatives include modification to this infrastructure.

2.6 Future Development

2.6.1 Population Projection References

2.6.1.1 The London Plan

The City's population is forecasted to grow substantially over the next 20 years. In 2016, London had a population of 383,822 (Statistics Canada, 2017). *The London Plan* projects that this will reach 458,380 by 2035 – an increase of almost 20 percent. This increase in population will be supported by additional homes being constructed within the City. Industrial, commercial, and institutional facilities will also be constructed to provide economic and social opportunities for the growing communities.

2.6.1.2 Development Charges Background Study and *Growth Management Implementation Strategy*

In 2012, Altus Group Economic Consulting prepared population, employment, housing and non-residential space projections. (City, 2014). These projections feed into the City's GMIS which aims to coordinate growth infrastructure with development approvals at a pace that is financially responsible (City, 2017a). As part of the annual update, the City reviews scheduled short-term (0 to 5 years) and long-term (6 to 10 years and 10+ years) capital projects to ensure they align with forecasted growth and development. As part of this strategy an Urban Growth Boundary has been developed and six core greenfield areas identified. Figure A-5 in Appendix A depicts this urban growth boundary and the six core GMIS areas relative to the Pottersburg and Vauxhall sewersheds. The southeast core area is located within the Pottersburg sewershed. There are no GMIS core areas within the Vauxhall sewershed as future growth is mainly attributed to infill. Figure A-6 in Appendix A illustrates the registered subdivisions and active subdivision applications in place throughout the City.

The *GMIS: 2018 Annual Review* noted that the southeast core area captures approximately 15 percent of the single-family lots of the defined GMIS areas. In general, demand for new housing increased in 2016 – although still below the *2014 Development Charges Background Study*. The City re-evaluated anticipated residential growth and determined that it is still on track overall. The City also anticipates several large commercial developments to be built in the coming years. Institutional developments are expected to taper off as several were constructed in 2016 (City, 2017a).

2.6.1.3 2011 Pottersburg Sanitary Sewershed Improvements Study Update

In 2011, the City retained CH2M to update the Pottersburg Sanitary Sewershed Improvements Study (Dillon, 1998), to assess the performance of the sanitary system. A part of this study included the modelling of future development scenarios as provided by the City. Figure A-7 in Appendix A depicts the future buildout for the southern portion of the Pottersburg sewershed described in this report (CH2M, 2011).

2.6.1.4 2017 London Solids Thickening and Dewatering Feasibility Options

R.V.A. recently completed a study in which they made recommendations for thickening and dewatering upgrades. As part of this study, R.V.A. reviewed existing populations and solids production and estimated future solids production. The Pottersburg and Vauxhall WWTPs were determined to contribute 12 percent and 4 percent, respectively, to the total solids from the City's five WWTPs. Solid production volumes were determined up to 2037 by applying the City's average projected growth rate to both the Pottersburg and Vauxhall sewersheds.

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The following summarizes the report's population forecasts based on the dry tonnes of solids being produced per day per 1,000 people:

- Pottersburg sewershed:
  - 2017: approximately, 45,970 people
  - 2037: approximately 55,650 people
  - 21 percent growth over 20 years
- Vauxhall sewershed:
  - 2017: 15,320 people
  - 2037: 18,550 people
  - 21 percent growth over 20 years

2.6.2 Population Projections

2.6.2.1 20-Year Population Projections

The 20-year population projections were determined using the following available background information:

- *The London Plan* overall population projections from 2015 through 2035
- 2011 DWF modelled measurements from residential lands
- GMIS core area single-family lot distribution (15 percent for southeast core area/Pottersburg sewershed)
- GMIS schedule of works

The following assumptions were made:

- The 2016 Pottersburg and Vauxhall sewershed populations are the same as the 2011 modelled residential populations, since the DWF at the plants remained relatively unchanged between the 2011 modelled flows and the measured flows in 2016.
- The 5-year overall growth rate for the City beyond 2035 is 4.1 percent (growth rates established in *The London Plan* stabilize over time).
- Vauxhall population growth is only due to infill of a 16.15-ha greenfield area (as identified in the *GMIS 2018 Annual Review*):
  - This area will provide space for the construction of 485 homes according to the City's *Design Specifications & Requirements Manual* (City, 2017b) chapter for Sanitary Sewer Collections (30 units per ha).
  - Three people reside in each home (according to the Manual for Sanitary Sewer Collections).
  - These homes will be built between 2018 and 2037 (30 units per year), since an active subdivision application is in place per GMIS schedule of works.

Tables 2-3 and 2-4 outline the 20-year growth forecast for the Pottersburg and Vauxhall sewersheds, respectively.

Table 2-3. 20-Year Growth Forecast for Pottersburg Sewershed

	Population	5-Year Growth	5-Year Growth Rate
2017	69,000		
2022	71,900	2,900	4.2%
2027	74,900	3,000	4.2%

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Table 2-3. 20-Year Growth Forecast for Pottersburg Sewershed

	Population	5-Year Growth	5-Year Growth Rate
2032	77,700	2,800	3.7%
2037	80,500	2,800	3.6%
Total		11,500	

Notes: 2017 sewershed population is assumed to be equivalent to the 2011 calibrated model population since the plant's historical ADFs have not changed significantly during this time frame. The 2011 calibrated model had a residential population of approximately 69,000 people.

The London Plan notes that the City is expected to grow in population by 4.1 percent every five years. This translates to approximately 20,000 people every five years. The exact populations are outlined in *The London Plan.*

The southeast GMIS core area represents the area within the Pottersburg sewershed which is anticipated to experience growth. This area is approximately 15 percent of the City's total GMIS area. As a result, the southeast GIS core area (Pottersburg sewershed) is anticipated to grow by approximately 3,000 people per year.

Table 2-4. 20-Year Growth Forecast for Vauxhall Sewershed

	Population	5-Year Growth	5-Year Growth Rate
2017	40,000		
2022	40,450	450	1.1%
2027	40,900	450	1.1%
2032	41,350	450	1.1%
2037	41,450	100	0.2%
Total		1,454	

Notes:

The neighbourhood place type within the Vauxhall sewershed is approximately 445 ha. Using the City's *Design Specifications & Requirements Manual* (City, 2017b), this area is estimated to have a density of 90 people per hectare resulting in a 2017 population of approximately 40,000 people.

Using the same design criteria, the designated infill area of 16.12 ha would result in a population increase of 1,454 people.

An active GMIS application suggests that these homes will be built soon. It was assumed that these homes would be built at a rate of 30 units per year, or 150 units every 5 years which is equivalent to a population increase of 450 people every five years.

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Based on these 2017 populations, the Pottersburg and Vauxhall sewersheds account for approximately 28 percent of the City's total population, which is greater than the 16 percent noted in the *2017 London Solids Thickening and Dewatering Feasibility Options* report. Since CH2M's populations were based on a calibrated hydraulic model, and are considered to be more accurate compared to the one dry tonne per day per 1,000 people estimate from the above-noted report.

The Pottersburg sewershed is anticipated to grow at a slightly lower rate compared to overall City forecasts (21 percent over 20 years). This approach is considered to be more accurate since it is based on GMIS planned residential growth for the Pottersburg sewershed in particular. The Vauxhall sewershed is not anticipated to grow much due to space restrictions. Limited infill will occur within the Vauxhall sewershed. As such, it was determined that *2017 Solids Thickening and Dewatering Feasibility Options* report overestimated population growth within this sewershed.

2.6.2.2 50-Year Population Projections

The Vauxhall sewershed is not anticipated to experience any growth between 2037 and 2067 due to infill capacity being reached by 2037. As a result, the 2067 population for Vauxhall is expected to remain at 14,650 individuals.

The Pottersburg sewershed is expected to be built out by 2067. The future development scenario details are included in the *2011 Pottersburg Sanitary Sewershed Improvements Study Update* provided to CH2M by the City. The City provided equivalent populations for each of the three phases so that wastewater flows could be estimated for all types of land use. Since no specific data on actual population (or land use) was available, CH2M could not use this data to estimate the Pottersburg sewershed population in 2067.

Instead, *The London Plan* place type designations and City sanitary sewer design parameters were used to estimate the population of the Pottersburg sewershed in 2067. The following assumptions were made:

- Pottersburg sewershed boundary will be expanded as depicted on Figure A-8 in Appendix A to include current GMIS boundaries.
- Place type designations from *The London Plan* represent ultimate buildout which will be achieved by 2067.
- Neighbourhood and rural neighbourhood will consist of low-density residences: 30 units per hectare with 3 people per unit (Manual for Sanitary Sewer Collections).

Figure A-8 in Appendix A depicts the 50-year place type designations within the Pottersburg sewershed. In the next 50 years, the population is anticipated to grow by 53,700, bringing the total population of the Pottersburg sewershed to 122,700.

2.6.3 20-Year and 50-Year Flow Projections

2.6.3.1 Pottersburg Sewershed

In 2011, the City retained CH2M to update the 1998 Pottersburg Sanitary Sewershed Improvements Study, to assess the performance of the sanitary system. This 2011 calibrated model was used to characterize the 2011 land use within the Pottersburg sewershed. *The London Plan* and the GMIS schedule of works was used to determine the ultimate land use within the Pottersburg sewershed.

2011 and ultimate design flows were calculated using the City's Design Criteria (City, 2017b). The following summarizes the design criteria applied:

- Low density residential – 30 units/ha with 3 people per unit
- Medium density residential – 75 units/ha with 2.4 people per unit
- High density residential – 150-300 units/ha with 1.6 people per unit
- Commercial/ institutional/ industrial – 100 people/ha
- Per capita flow – 230 litres per capita per day (Lpcd)
- Uncertain development factor – 1.1 (unitless)
- Infiltration – 8,640 L per ha per day (0.1 L per second per ha)
- Peaking factor – Harmon for residential and commercial/ institutional; 0.8 x Harmon for industrial
  - Harmon formula, M = $1 + \frac{14}{4+P^{1/2}}$

    where M is the ratio of peak flow to average flow; and
    P is the tributary population in thousands.

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Table 2-5 summarizes the ultimate (50-year) Pottersburg WWTP design flows. The total estimated ultimate residential population for the Pottersburg sewershed based on this approach is 171,888 people; approximately 50,000 more people than predicted using *The London Plan* and GMIS boundary approach. The ultimate population should be refined along with official plan and GMIS updates which will more accurately outline the proportions of residential place types.

Based on the City design criteria, it is estimated that the ultimate average dry weather flow (ADWF) for the Pottersburg WWTP will be approximately 77,000 cubic metres per day (m^3/d). The ultimate average day flow (ADF), equivalent to ADWF and infiltration, is estimated to be approximately 103,000 m^3/d. Using the 2011 land use from the 2011 calibrated model, the 2011 ADWF and ADF for the Pottersburg WWTP were similarly estimated to be approximately 27,500 m^3/d and 46,700 m^3/d. The 2037 ADWF and ADF were linearly interpolated to be 50,600 m^3/d and 73,000 m^3/d respectively.

The accuracy of the City's design criteria was checked against historical plant flows. The 2011 calculated ADF design flow is approximately 100 percent greater than historical flow to the Pottersburg WWTP. As a result, the ADFs to the Pottersburg WWTP in 2037 and 2067 will more realistically be in the range of 36,500 m^3/d and 51,600 m^3/d, respectively.

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Table 2-5. Estimated Ultimate Pottersburg WWTP Design Flows

Place Type	Area (ha)	City Design Criteria				Equivalent Population (people)	Harmon	Peaking Factor	ADWF (m^3/d)	ADF (m^3/d)	Peak DWF (m^3/d)	PWF (m^3/d)
		People/ha	Per Capita Flow (Lpcd)	Uncertain Deviation Factor	Infiltration Allowance (L/s/ha)							
Neighbourhood	1,361	126 [a]	230	1.1	0.1	171,690	2.00 [b]	2.00	39,489	51,251	86,875	98,637
Rural Neighbourhood	2	90	230	1.1	0.1	198	4.15	4.15	46	65	208	227
Shopping Area	44	100	230	1.1	0.1	4,353	3.30	3.30	1,001	1,377	3,635	4,011
Institutional	10	100	230	1.1	0.1	1,006	3.80	3.80	231	318	967	1,054
Commercial Industrial	90	100	230	1.1	0.1	8,995	3.00	2.40	2,060	2,833	5,441	6,215
Light Industrial	983	100	230	1.1	0.1	98,258	2.01	1.61	22,599	31,089	39,900	48,389
Heavy Industrial	423 [c]	100	230	1.1	0.1	42,341	2.33	1.87	9,738	13,397	19,989	23,647
Future Industrial Growth	92	100	230	1.1	0.1	9,246	2.99	2.39	2,127	2,925	5,592	6,391
Total	**3,005**	**-**	**-**	**-**	**-**	**336,048**	**-**	**-**	**77,291**	**103,255**	**162,608**	**188,572**

Airport area (517 ha) not included.

Density proportion assumed to be the same as 2011 model proportions (83.2 percent light residential, 9.8 percent medium residential, 7 percent heavy residential). As a result, the neighbourhood density is 126 people/ha.

Good practice that the Harmon Peaking Factor should be a minimum of 2. As a result, the calculated factor of 1.8 was increased to 2.

Notes:

L/s/ha = litre(s) per second per hectare

Table 2-6. Estimated Increase in Vauxhall WWTP Design Flows

Place Type	Area (ha)	City Design Criteria				Equivalent Population (people)	Harmon	Peaking Factor	ADWF (m^3/d)	ADF (m^3/d)	Peak DWF (m^3/d)	PWF (m^3/d)
		People/ha	Per Capita Flow (Lpcd)	Uncertain Deviation Factor	Infiltration Allowance (L/s/ha)							
Residential	16.15	90	230	1.1	0.1	1,454	3.69	3.69	334	474	1,357	1,496

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2.6.3.2 Vauxhall Sewershed

Vauxhall WWTP influent flows between 2012 and 2015 were relatively consistent with an average ADF of 14,960 m^3/d. It is assumed that the 2017 ADF is equivalent to this average due to minimal development within the sewershed during this timeframe. The population within the Vauxhall sewershed is anticipated to grow by 1,454 people between 2017 and 2037 due to residential infill of 16.15 ha of greenfield space. Using a similar estimation approach as the Pottersburg sewershed, this growth in population is equivalent to an increase in ADF of approximately 474 m^3/d. No growth beyond 2037 is anticipated. As a result, the Vauxhall sewershed is expected to reach its maximum ADF of 15,434 m^3/d by 2037. Table 2-6 summarizes the estimated 20-year (and subsequently 50-year) increase in Vauxhall WWTP design flows.

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SECTION 3

Characterization of Existing Infrastructure Conditions

3.1 Treatment Systems Background Information

3.1.1 Pottersburg Wastewater Treatment Plant

The Pottersburg WWTP was originally commissioned in 1955 with a rated capacity of approximately 6,800 cubic metres per day (m^3/d), or 1.5 million imperial gallons per day (MIGD). The original WWTP consisted of two primary tanks, four aeration tanks, two final tanks, a control building, and a digester. Subsequent expansions occurred as follows:

- 1965 – capacity increase to 12,700 m^3/d (approximately 2.8 MIGD) with the addition of a squircular final tank and two more aeration tanks, one more primary tank, a chlorine contact tank, a site office, a vacuum filter building, and sludge storage
- 1967 – capacity increase to 18,200 m^3/d (approximately 4.0 MIGD) with the addition of a fourth primary clarifier, two more aeration tanks, another squircular final clarifier, inlet sewer and bypass chamber upgrades, and a chlorine building
- 1975 – capacity increase to 23,600 m^3/d (approximately 5.2 MIGD) with the addition of a fifth primary clarifier, third squircular final clarifier, an equipment building, and an extension to the aeration tanks on the east side of the WWTP
- 1992 – capacity increase to 28,200 m^3/d (approximately 6.2 MIGD) with the addition of two aeration tanks to the west of the original WWTP, a Parshall flume, ultraviolet (UV) disinfection, and conversion of two original aeration tanks to final tanks
- 1999 – capacity increase to 39,100 m^3/d (approximately 8.6 MIGD) with the addition of the inlet building with mechanical screens and vortex grit removal, Section 1 primary clarifiers on the east side of the plant, aeration tanks to the west and north of the westerly tanks, and two Section 2 final clarifiers to the southeast corner of the WWTP

The Pottersburg WWTP is located in an older part of the City where combined sewers and sanitary sewers with weeping tile connections are common. As a result, bypasses can occur during wet weather or during a spring melt.

CH2M visited the Pottersburg WWTP with City staff on June 13, 2017. The following subsections were developed using information obtained during the site visit in addition to information contained in the Capacity Assessment of the City of London's Wastewater Treatment Plants report, dated November 18, 2013, authored by XCG, and provided to CH2M by City staff (the XCG Report).

3.1.1.1 Overview

The Pottersburg WWTP is located at 1141 Hamilton Road in the City of London, and is operated under the Ontario Ministry of the Environment and Climate Change (MOECC) Amended Environmental Compliance Approval (ECA) number 5451-9Y6KY7, issued on July 10, 2015. It provides secondary treatment for sewage generated within its sewershed at a rated ADF capacity of 39,100 m^3/d and is comprised of three conventional activated sludge plants, referred to as Section 1, Section 2, and Section 3. Final effluent produced by the Pottersburg WWTP is discharged into the Thames River.

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During the site visit and through discussions with City staff, CH2M noted the following key observations and findings regarding the Pottersburg WWTP:

- Treatment stages have been constructed in proximity to each other to minimize overall footprint, which resulted in a convoluted flow path through the system that likely contributes some amount of overall hydraulic inefficiency.
- Available land for potential future upgrades or expansion is limited, which indicates that demolition and removal of existing infrastructure is likely required to accommodate future plant expansions.
- Concrete infrastructure at the facility appeared to be nearing the point of requiring major repair or refurbishment.

The following subsections present a summary of the Pottersburg WWTP and its current operation.

Inlet Works. Raw sewage is received by the Pottersburg WWTP via three main sewers:

1. The Hamilton Road sewer
2. The Summerside sewer
3. The Fairmont sewer

Flows from the Hamilton Road sewer and the Summerside sewer are combined and enter the plant through a common inlet chamber, which is equipped with four adjustable weir gates as follows:

1. Main plant inlet gate
2. Bypass channel gate to the effluent Parshall flume
3. Bypass channel gate to Pottersburg Creek
4. Catch basin gate

The bypass weir gates allow flexibility for the WWTP to receive inflow that exceeds the plant's design capacity. During periods of time when the WWTP receives high inflow, operators may open the bypass channel gate to allow raw sewage to blend with final effluent at the effluent Parshall flume. Alternatively, if the Thames River water level is too high and plant flow is restricted, operators may open the bypass channel gate to allow direct discharge to Pottersburg Creek. Raw sewage from the Fairmont sewer enters the Pottersburg WWTP downstream of the common inlet chamber.

A mechanical bar screen, with a peak flow capacity of 60,000-m^3/d, provides preliminary treatment of the combined sewer flows that enter the Pottersburg WWTP. The plant is also equipped with a manual bar screen for preliminary treatment of any excess flows that are bypassed. Screen upgrades are currently planned for 2017/2018 to replace the bar screen with two step screens: one with 3-millimetre (mm) screens and one with 6-mm screens (sizing subject to change as design progresses). Screenings are dewatered in a 1-cubic metre per hour (1-m^3/hr) screw compactor.

Following screening, wastewater flows are evenly distributed between two vortex-type aerated grit removal units, each with a capacity of 30,000-m^3/d, which operate in parallel. Each vortex grit removal unit is equipped with a 110-m^3/hr air blower and an airlift pump to convey removed grit to a common 3.4-m^3/hr grit classifier for dewatering. Grit removed from the system is hauled off-site for disposal.

Following grit removal, wastewater enters a mixing tank equipped with one mechanical mixer. The mixing tank has been set up with the capability to dose ferric chloride to chemically enhance the performance of the downstream primary clarifiers; however, this functionality has not been part of normal operations to date.

Effluent from the mixing tank is directed into a splitter box for flow distribution to Section 1, Section 2, and Section 3. Flows into each section are manually controlled based on gate settings at the splitter box.

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Section 1. Section 1 has a rated treatment capacity of 12,700-m^3/d.

Primary Clarification. Wastewater flows received by Section 1 are split between two covered rectangular primary clarifiers, each approximately 20-metres (m) by 5-m with 4.6-m side water depth (SWD), which provide a total surface area of approximately 200 square metres (m^2). The Section 1 primary clarifiers are equipped with a scum removal system, one 6-litre per second (L/s) scum pump, and two 6.3-L/s primary sludge pumps (one duty, one standby). The primary sludge pumps transfer sludge collected by the primary clarifiers to the sludge storage tank.

Aerobic Treatment. Four aerobic bioreactors receive effluent from the primary clarifiers and return activated sludge (RAS) from the secondary clarifiers. The bioreactors provide a total aeration volume of approximately 3,561-m^3 and have the following approximate dimensions:

- Bioreactors 1 and 2: 24.4-m by 7.5-m with 4-m SWD
- Bioreactors 3 and 4: 24.4-m by 11-m with 4-m SWD

Aeration is provided via four 93.2-kilowatt (kW) blowers feeding fine bubble diffusion systems installed in each aerobic bioreactor.

Effluent from the aerobic bioreactors is dosed with ferric chloride prior to secondary clarification.

Secondary Clarification. Four rectangular secondary clarifiers, equipped with chain and flight collector mechanisms for sludge removal, receive effluent from the aerobic bioreactors. The secondary clarifiers provide a total surface area of 664-m^2 and have the following approximate dimensions:

- Clarifiers 1 and 2: 24.4-m by 6.1-m with 3-m SWD
- Clarifiers 3 and 4: 24.4-m by 7.5-m with 3-m SWD

Clarifiers 3 and 4 are equipped with grease troughs, while Clarifiers 1 and 2 are not. The Section 1 secondary clarifiers are equipped with a total of five secondary sludge pumps that control the RAS and waste activated sludge (WAS) flow rates:

- Clarifiers 1 and 2: two RAS/WAS pumps (one duty, one standby), each with a capacity of 102-L/s
- Clarifiers 3 and 4: three RAS/WAS pumps (two duty, one standby), each with a capacity of 65-L/s

WAS from Section 1 is conveyed to the sludge storage tank.

Section 2. Section 2 has a rated treatment capacity of 15,575-m^3/d.

Primary Clarification. Wastewater flows received by Section 2 are split between three covered rectangular primary clarifiers, which provide a total surface area of approximately 387-m^2 and have the following approximate dimensions:

- Clarifiers 1 and 2: 24.4-m by 4.9-m with 2.5-m SWD
- Clarifier 3: 24.4-m by 6.1-m with 2.5-m SWD

The Section 2 primary clarifiers are equipped with a scum removal system, one 7.6-L/s scum pump, and two 190-m^3/hr primary sludge pumps (one positive displacement and one rotary lobe), which are shared with the Section 3 primary clarifiers. The primary sludge pumps transfer sludge collected by the primary clarifiers to the sludge storage tank.

Aerobic Treatment. One aerobic bioreactor receives effluent from the primary clarifiers and RAS from the secondary clarifiers. The bioreactor provides a total aeration volume of approximately 4,180-m^3 and provides a SWD of 3.6-m (approximate dimensions not available).

Aeration is provided via three (two duty, one standby) 10,400-m^3/hr blowers feeding fine bubble diffusion systems installed in both Section 2 and Section 3 aerobic bioreactors.

Effluent from the aerobic bioreactor is dosed with ferric chloride prior to secondary clarification.

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Secondary Clarification. Two rectangular secondary clarifiers, equipped with chain and flight collector mechanisms for sludge removal, receive effluent from the aerobic bioreactors. The secondary clarifiers provide a total surface area of 1,240-m^2 and are each split in two sections with approximate dimensions of 51.8-m by 5.9-m with 4.7-m SWD.

The Section 2 secondary clarifiers are equipped with a total of three secondary sludge pumps that control the RAS and WAS flow rates, and one scum pump:

- RAS Pump No. 1: 500-m^3/hr
- RAS Pump No. 2: 457-m^3/hr
- WAS Pump: No capacity information available
- Scum Pump: 6-L/s

WAS from Section 2 is conveyed to the sludge storage tank.

Section 3. Section 3 has a rated treatment capacity of 10,825-m^3/d.

Primary Clarification. Wastewater flows received by Section 3 are split between two covered rectangular primary clarifiers, which provide a total surface area of approximately 297-m^2 with approximate dimensions of 24.4-m by 6-m with 2.5-m SWD.

The Section 3 primary clarifiers are equipped with a scum removal system, one 7.6-L/s scum pump, and two 190-m^3/hr primary sludge pumps (one positive displacement and one rotary lobe), which are shared with the Section 2 primary clarifiers. The primary sludge pumps transfer sludge collected by the primary clarifiers to the sludge storage tank.

Aerobic Treatment. One aerobic bioreactor receives effluent from the primary clarifiers and RAS from the secondary clarifiers. The bioreactor provides a total aeration volume of approximately 3,420-m^3, and provides a SWD of 3.6 m (approximate SWD dimensions not available).

Aeration is provided via three (two duty, one standby) 10,400-m^3/hr blowers feeding fine bubble diffusion systems installed in both Section 2 and Section 3 aerobic bioreactors.

Effluent from the aerobic bioreactor is dosed with ferric chloride prior to secondary clarification.

Secondary Clarification. Three square secondary clarifiers, equipped with chain and flight collector mechanisms for sludge removal, receive effluent from the aerobic bioreactors. The secondary clarifiers provide a total surface area of 733-m^2 and have the following approximate dimensions:

- Clarifiers 1 and 2: 13.7-m by 13.7-m with 3.2-m SWD
- Clarifier 3: 18.9-m by 18.9-m with 3.2-m SWD

The Section 3 secondary clarifiers are equipped with a total of five secondary sludge pumps that control the RAS flow rate and one separate WAS pump:

- Clarifiers 1 and 2: three RAS pumps (two duty, one standby), with capacities of 175-m^3/hr or 115-m^3/hr
- Clarifier 3: two RAS pumps (one duty, one standby), one with a capacity of 345-m3/hr and one with a capacity of 115-m^3/hr
- WAS Pump: No capacity information available

WAS from Section 3 is conveyed to the sludge storage tank.

Disinfection. Effluent from the Section 1, Section 2, and Section 3 secondary clarifiers is combined and then disinfected via two parallel open UV disinfection channels, each with approximate dimensions of 7.9-m by 1.2-m by 1.2-m, providing a total volume of 22.8-m^3. The UV disinfection process is operated seasonally, from April 1 to September 30 of each year.

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Final Effluent. Final effluent from the Pottersburg WWTP is discharged through a Tideflex Duckbill check valve (Tideflex valve) to the south branch of the Thames River. During periods of high water level in the Thames River, the river flow will back up into the effluent chamber and restrict or prevent flow from the Pottersburg WWTP to the Thames River through the Tideflex valve. Therefore, an effluent PS was constructed in 2012 to maintain effluent flows during periods of high water level in the Thames River. The effluent PS is comprised of one wet well with a firm pumping capacity of 1,130-L/s, approximate dimensions of 7-m by 7.5-m by 7.05-m deep, and three 565-L/s pumps (two duty, one standby).

Chemical Addition. The Pottersburg WWTP operates a ferric chloride dosing system, which doses ferric chloride into the effluent from the aerobic bioreactors in Section 1, Section 2, and Section 3, and has the capability to dose ferric chloride into the mixing tank downstream of the vortex grit removal units. The ferric chloride dosing system is comprised of one 18,000-litre (L) ferric chloride storage tank, two day tanks, and five 100-litre per hour (L/hr) dosing pumps (four duty, one standby).

Sludge Management. Primary sludge and WAS from each of the three sections are separately pumped to the sludge storage tank and blended. The sludge storage tank has approximate dimensions of 18-m in diameter with 7.25-m SWD, for a total storage capacity of approximately 1,850 m^3. Sludge is mixed within the sludge storage tank via two 145-L/s sludge mixing pumps. Mixed sludge is transferred from the sludge storage tank via two 38-L/s sludge transfer pumps to two 112-m^3/hr gravity belt thickeners. Polymer dosing is provided via three 820-L/hr polymer dosing pumps to enhance the operation of the gravity belt thickeners.

Thickened sludge is stored in two thickened sludge storage tanks, each with two storage cells that have approximate dimensions of 11.3-m by 10.25-m with 4-m SWD, for a total storage volume of 420-m^3. Ultimate disposal of stored thickened sludge is through incineration at the Greenway WWTP.

3.1.1.2 Summary of Current Operations

CH2M received and reviewed the following information from the City:

- Monthly Plant Summaries (operating data) from 2012 through 2015
- The XCG Report
- A draft version of a report authored by Stantec, entitled Pottersburg WWTP Stress Testing – Summary Report, and dated February 14, 2017 (the Stantec Pottersburg Report)

The following subsections present a summary of the Pottersburg WWTP current operations. CH2M compared the operating data received (2012 through 2015) with the information presented in the XCG Report, which summarized operating data from 2008 through 2012. The purpose of the comparison was to identify if any significant changes had occurred with respect to the influent characterization and/or treatment system performance since the XCG Report was completed that may impact the findings presented in either the XCG Report or the Stantec Pottersburg Report.

Raw Sewage Characteristics. The ADF through the Pottersburg WWTP between the years of 2012 through 2015 was only 6.4% less than the ADF presented in the XCG Report, and likely within a reasonable error band for the flow measurement instrumentation. Therefore, no significant impact to influent flow was observed since the XCG Report was completed. Table 3-1 presents a summary of the flow information received from the City.

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Table 3-1. Pottersburg WWTP Influent Flows, 2012 through 2015

Year	Average Day Flow (m^3/d)	Maximum Day Flow		Peak Instantaneous Flow		Minimum Day Flow (m^3/d)
		(m^3/d)	MDF Factor	(m^3/d)	PIF Factor	
2012	23,377	37,486	1.6	75,082	3.2	16,456
2013	27,015	43,514	1.6	124,502	4.6	18,067
2014	25,903	49,020	1.9	123,034	4.7	17,597
2015	23,360	60,390	2.6	167,875	7.2	13,065
Overall Average	24,914	47,603	1.9	122,623	4.9	N/A
XCG Average	26,627	39,072	1.5	75,082	3.2	N/A

Notes:

MDF = maximum daily flow
PIF = peak instantaneous flow

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MDFs and PIFs were larger than those presented in the XCG Report, which may be due to the installation of the effluent PS that was installed in 2012 to overcome hydraulic issues with high water level in the Thames River.

CH2M reviewed the flow data reported for Section 1, Section 2, and Section 3, and observed issues related to the PIF reported values, as illustrated in Figure 3-1.

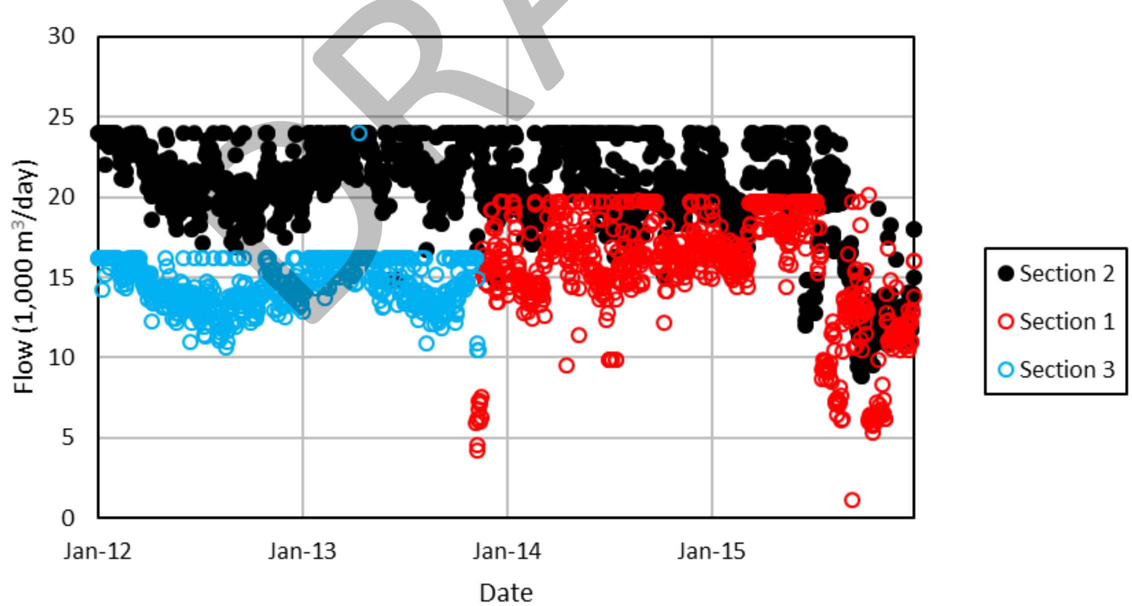

Figure 3-1. Pottersburg WWTP Section PIFs, 2012 through 2015

It appears the measurement range of the individual section flow meters may not be programmed high enough to accurately measure and record PIFs. Due to this issue, the PIF for individual sections was estimated by splitting the PIF of the plant between each section according to the average flow splits observed in the daily flow data provided, which matches the method used in the XCG Report. For the MDF of individual sections the recorded data was used rather than the flow split assumption. Please refer to Table 3-2 for a summary of the flow information for each section.

Table 3-2. Pottersburg WWTP Summary of Section Flows

Parameter	Section 1	Section 2	Section 2 (XCG)	Section 3	Section 3 (XCG)
ADF (m^3/d)	10,804	14,345	15,944	9,720	10,683
Average Flow Split[a]	40%	60%	60%	40%	40%
MDF (m^3/d)	27,046	26,958	23,710	16,140	15,807
PIF (m^3/d)	67,1502	100,725[b]	45,049	49,801[c]	30,033

[a] Flow split for Sections 2 and 3 occurred when both sections were operating from January 1, 2012 to November 6, 2013, flow split for Sections 1 and 2 occurred when both sections were operating from November 7, 2013 to December 31, 2015

[b] Based on the 2015 Peak Instantaneous Flow of 167,875-m3/d and assuming the estimated flow split

[c] Based on the 2013 Peak Instantaneous Flow of 124,502-m3/d and assuming the estimated flow split

Average influent raw wastewater quality values between the years of 2012 through 2015 were observed to be higher than those presented in the XCG Report. Within the 2012 through 2015 dataset, CH2M noted that the influent quality values recorded in 2015 were substantially higher than those recorded in 2012 through 2014. The values recorded in 2012 through 2014 were observed to more closely agree with the values presented in the XCG Report. It is unclear why the raw sewage characteristics recorded in 2015 differ from those recorded in 2008 to 2014. One possible explanation is that changes occurred in the industrial loads discharged to the Pottersburg WWTP in 2015; however, confirmation from the City has not been received. Table 3-3 presents a summary of the raw sewage 5-day biological oxygen demand (BOD_5), total suspended solids (TSS), pH, total phosphorus (TP), and total Kjeldahl nitrogen (TKN) concentrations.

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Table 3-3. Pottersburg WWTP Raw Sewage Quality, 2012 through 2015

	BOD_5 (mg/L)	TSS (mg/L)	pH	TP (mg/L)	TKN (mg/L)
2012	190	257	7.5	5.8	30.0
2013	199	268	7.5	5.4	27.7
2014	206	267	7.5	5.2	23.9
2015	438	544	7.3	9.7	52.8
Overall Average	258	334	7.5	6.5	33.6
XCG Report Overall Average	183	253	N/A	5.6	33.4
% Difference	41%	32%	N/A	17%	1%

Note:

mg/L = milligram(s) per litre

Figures 3-2, 3-3, 3-4, and 3-5 illustrate the changes observed in BOD_5, TSS, TP, and TKN concentrations in the raw sewage between 2014 and 2015. CH2M notes that the values trend upward in the latter half of 2015.

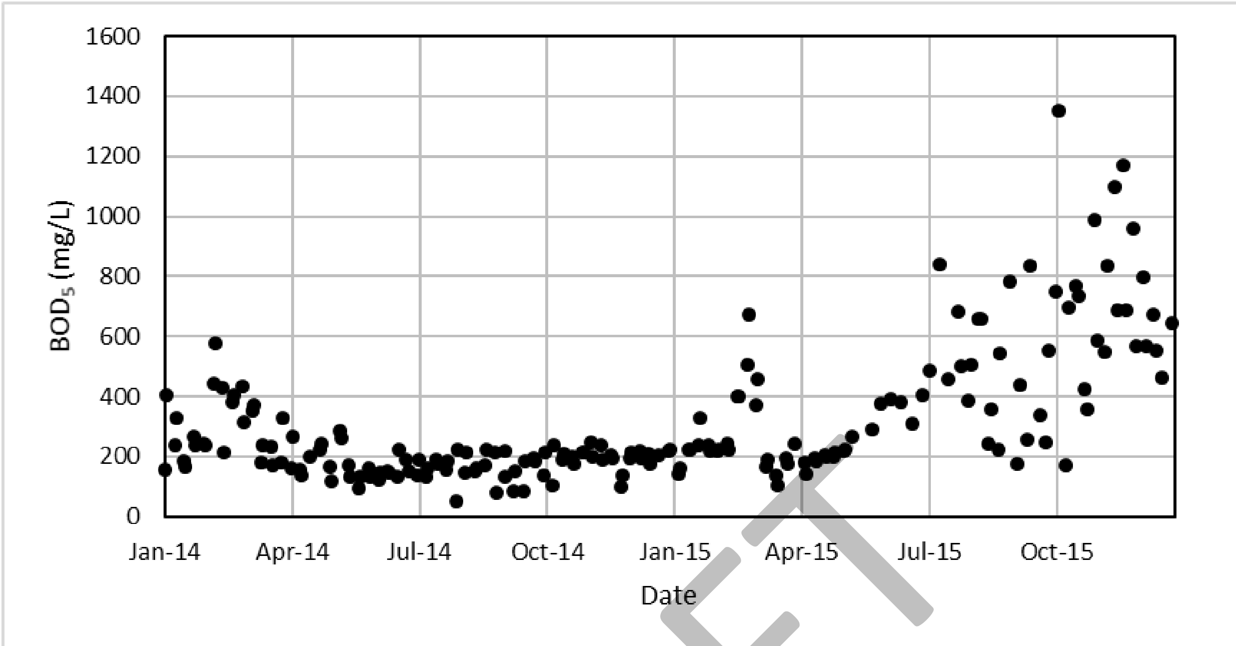

Figure 3-2. Pottersburg WWTP Raw Wastewater BOD5, 2014 and 2015

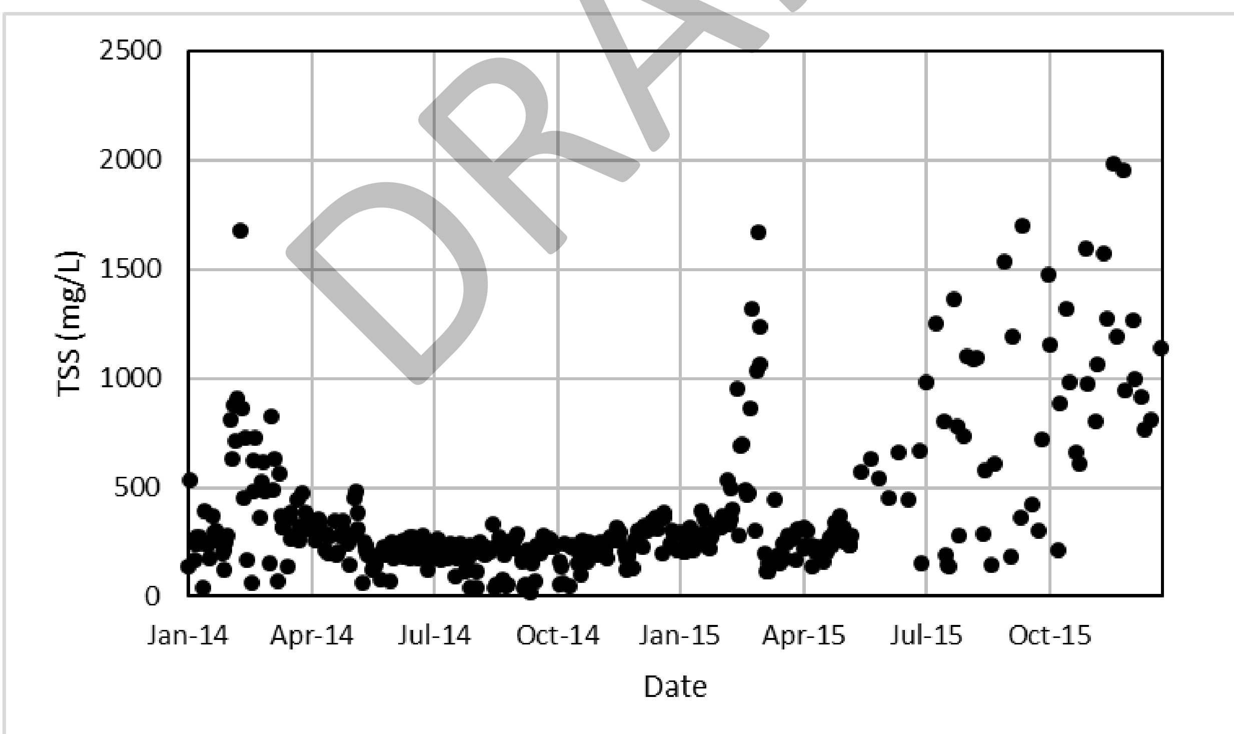

Figure 3-3. Pottersburg WWTP Raw Wastewater TSS, 2014 and 2015

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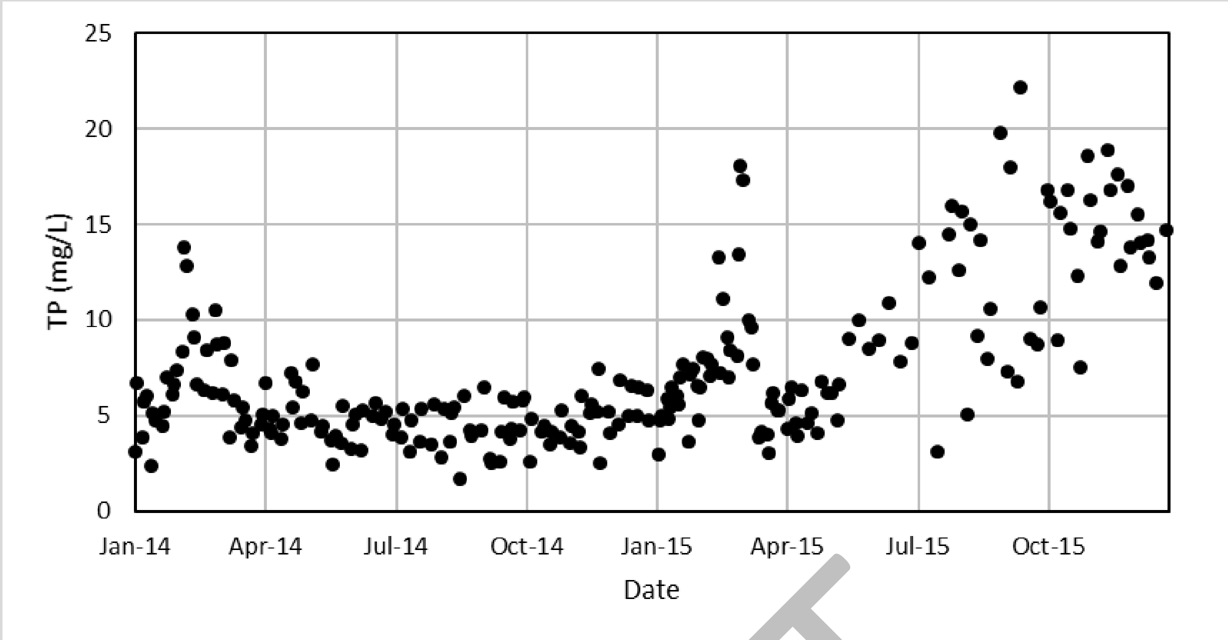

Figure 3-4. Pottersburg WWTP Raw Wastewater TP, 2014 and 2015

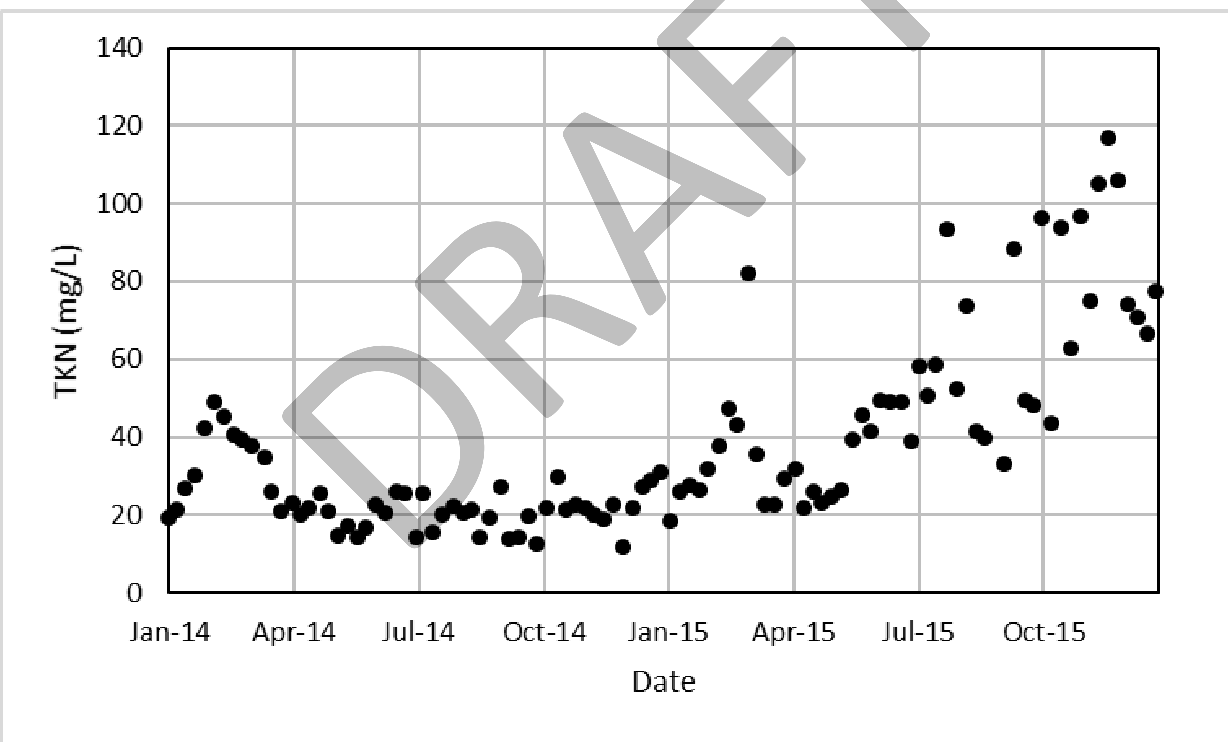

Figure 3-5. Pottersburg WWTP Raw Wastewater TKN, 2014 and 2015

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Treatment System Performance

Primary Clarification. CH2M notes that the SWD for the Sections 2 and 3 primary clarifiers is 2.5-m which is less than the typical design range of 3.0-m to 4.6-m. As summarized in Table 3-4, the primary clarifiers have been operating at ADF surface overflow rates (SORs) within the typical design guideline values, which are consistent with the SORs presented in the XCG Report. MDF SOR values are also within the typical design guideline values, except for Section 1. The large SOR at MDF for Section 1 is due to an unusually high total flow rate of 60,000 m^3/d into the Pottersburg WWTP with 27,000 m3/d going through Section 1 on June 28, 2015.

TSS removal across the primary clarifiers was similar to the values presented in the XCG Report, and within the typical design guideline for no upstream chemical addition. BOD_5 removal in Sections 2 and 3 was close to the typical design guideline values and greater than values presented in the XCG Report. The BOD_5 removal observed in Section 1 was much lower than the other removals observed in Sections 2 and 3, which is likely due to the higher SOR values observed in Section 1 at both the ADF and MDF.

Table 3-4. Pottersburg WWTP Primary Clarifier Average Operating Conditions

Parameter	Section 1	Section 2	Section 2 (XCG)	Section 3	Section 3 (XCG)	Typical Design Guideline Values[a]
SOR at ADF ($m^3/(m^2 \cdot d)$)	47.4	37.0	40.9	34.6	36.0	30-40
SOR at MDF ($m^3/(m^2 \cdot d)$)	118.6	69.5	60.3	55.1	53.2	60-80
Average TSS Removal (%)	63%	69%	65%	69%	66%	40-70
Average BOD5 Removal (%)	26%	33%	22%	37%	23%	35-45

[a] Design Guidelines for Sewage Works, MOECC, 2008.

Aerobic Treatment. Table 3-5 summarizes the operating data from 2012 through 2015, compared with the information presented in the XCG Report and typical design values.

Table 3-5. Pottersburg WWTP Bioreactor Average Operating Conditions

Parameter	Section 1	Section 2	Section 2 (XCG)	Section 3	Section 3 (XCG)	Typical Design Values
Plant Influent Flow (m^3/d)	10,804	14,345	15,945	10,148	10,683	N/A
BOD_5 Load (kg/d)	2,065	2,482	2,279	1,653	1,494	N/A
MLSS (mg/L)	2,343	2,210	2,013	2,003	1,913	3,000-5,000[a]
MLVSS (mg/L)	1,717	1,633	1,465	1,453	1,396	N/A
MLVSS:MLSS	0.73	0.74	0.73	0.73	0.73	N/A
HRT (hr)	8.0	7.0	6.3	8.1	7.7	>6[a], 4-8[b]
OLR (kg $BOD_5/(m^3 \cdot d)$)	0.57	0.59	0.55	0.48	0.44	0.31-0.72[a], 0.3-0.7[2]
F/Mv (d^{-1})	0.33	0.36	0.37	0.33	0.31	0.05-0.25[a], 0.2-0.4[2]
Estimated RAS:ADF Ratio (%)	103	95	74	123	110	50-200[a], 50-125[2]
RAS TSS (mg/L)	5,483	4,573	4,890	3,989	4,288	N/A
WAS Flow (m^3/d)	689	361	382	315	266	N/A
WAS Production (kg/d)	3,778	1,651	1,868	1,256	1,140	N/A
SRT (days)	2.2	5.6	4.5	5.5	5.9	>10[a], 3-15[b]
SVI (mL/g)	105	98	122	153	151	<100[b]

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Table 3-5. Pottersburg WWTP Bioreactor Average Operating Conditions

Parameter	Section 1	Section 2	Section 2 (XCG)	Section 3	Section 3 (XCG)	Typical Design Values

[a] Design Guidelines for Sewage Works, MOECC, 2008.

[b] Metcalf and Eddy (2003). Wastewater Engineering: Treatment and Reuse, 4th Ed.

F/Mv = food to microorganism ratio

HRT = hydraulic retention time

kg/d = kilograms per day

mL/g = millilitres per gram

MLSS = mixed liquor suspended solids

MLVSS = mixed liquor volatile suspended solids

OLR = organic loading rate

SRT = solids retention time

SVI = sludge volume index

TSS = total suspended solids

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CH2M's key findings from the bioreactor review are summarized as follows:

- The MLSS values are slightly larger than those presented in the XCG Report; however, they are still below the typical range for a nitrifying conventional activated sludge (CAS) plant.
- The RAS TSS for Section 1 was higher than the other sections, which is visually depicted in Figure 3-6.
- The WAS flow for Section 1 was much larger than the other sections, which is visually depicted in Figure 3-7. It is possible that a calibration issue exists on the WAS flow measurement instrument in Section 1, since the OLR, MLSS, and HRT in Section 1 are not very different from Sections 2 and 3.

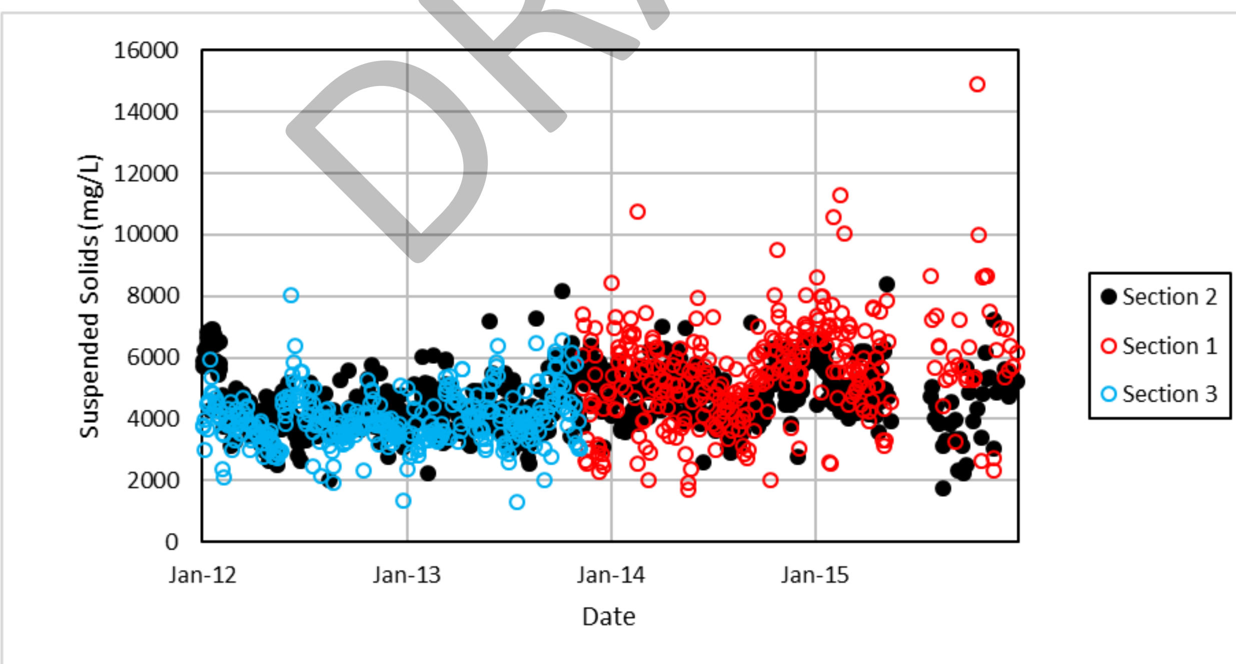

Figure 3-6. Pottersburg WWTP RAS Total Suspended Solids, 2012 through 2015

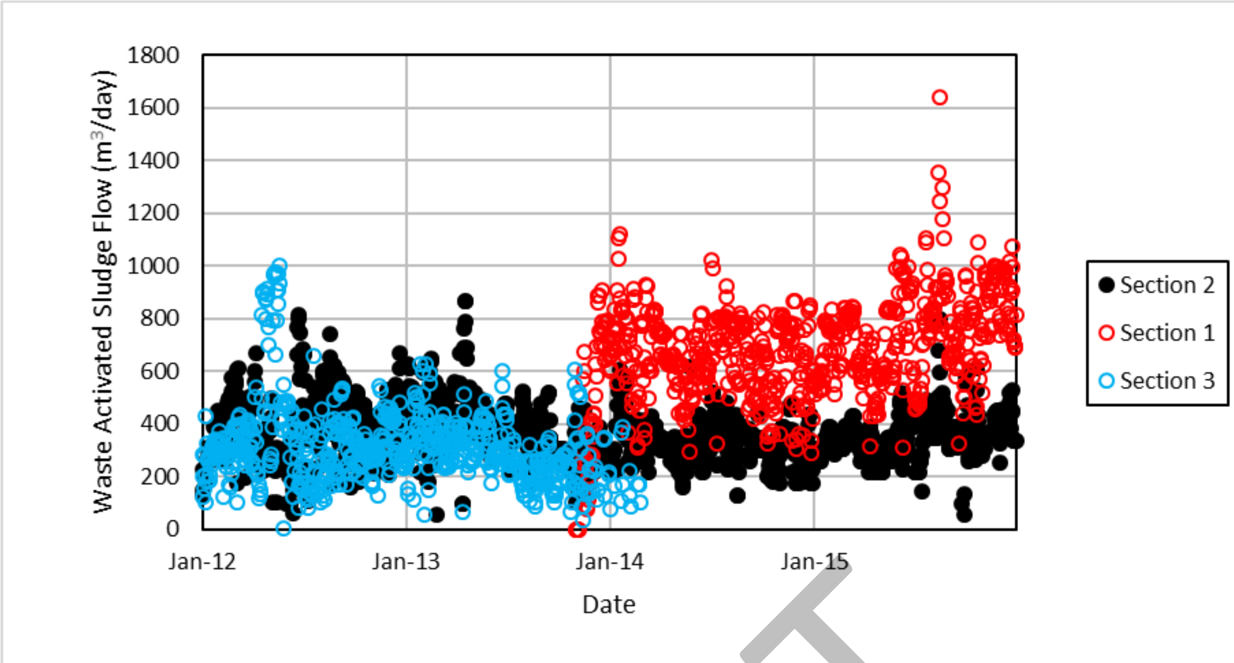

Figure 3-7. Pottersburg WWTP WAS Flow, 2012 through 2015

Secondary Clarification. Table 3-6 summarizes the operating data from 2012 through 2015, compared with the information presented in the XCG Report and typical design values. Note that the peak hour flow (PHF) was assumed to be equivalent to the PIF.

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Table 3-6. Pottersburg WWTP Secondary Clarifier Operating Conditions

Parameter	Section 1	Section 2	Section 2 (XCG)[a]	Section 3	Section 3 (XCG)[a]	Typical Design Guideline Values[b]
PHF (m^3/d)	67,150[c]	100,725[c]	45,049	49,801[d]	16,157[e]	N/A
MDF (m^3/d)	27,046	26,958	23,710	16,140	16,963	N/A
PHF SOR ($m^3/(m^2 \cdot d)$)	101.1	82.4	36.9	67.9	41.0	<37
MDF SLR ($kg/(m^2 \cdot d)$)	95.4	48.7	58.4	44.1	71.6	<170

[a] XCG calculations completed only for 2012

[b] Design Guidelines for Sewage Works, MOECC, 2008. Design peak hour values for an activated sludge process with coagulant addition to the mixed liquor for phosphorus removal

[c] Based on the 2015 PIF of 167,875 m3/d and assuming a Section 2: Section 1 flow split of 60:40

[d] Based on the 2013 PIF of 124,502 m3/d and assuming a Section 2: Section 3 flow split of 60:40

[e] Incorrectly reported in the XCG Report

Note:

SLR = solids loading rate

Based on the results presented in Table 3-6 the secondary clarifiers have operated at PHF SOR values greater than those presented in the XCG Report, which are also larger than the MOE Design Guidelines value. These large values are due to the Pottersburg PIF values in 2013 and 2015. The MDF SLR values were below the MOE Design Guideline value and similar to values presented in the XCG Report. Section 1 has a larger MDF SLR due to its higher MLSS and MDF than the other sections.

Final Effluent Quality. The effluent wastewater quality for the Pottersburg WWTP was found to be within compliance and very similar to the values presented in the XCG Report, which demonstrates that the system was able to adequately handle the increase in raw sewage quality noted in 2015. Table 3-7 presents a summary of the Pottersburg WWTP final effluent quality.

Table 3-7. Pottersburg WWTP Effluent Quality, 2012 through 2015

	BOD_5 (mg/L)	TSS (mg/L)	pH	TP (mg/L)	Ammonia (mg/L)	Dissolved Oxygen (mg/L)	TKN (mg/L)
2012	2.2	4.2	7.5	0.47	0.20	6.0	1.7
2013	2.5	5.6	7.5	0.45	0.36	5.9	1.6
2014	2.6	4.2	7.4	0.48	0.20	5.7	1.5
2015	2.3	6.0	7.3	0.44	0.45	4.8	2.2
Overall Average	2.4	5.0	7.4	0.46	0.30	5.6	1.8
XCG Report Overall Average	2.6	4.7	N/A	0.46	N/A	N/A	N/A
% Difference	-7%	6%	N/A	0	N/A	N/A	N/A
MOECC ECA Effluent Objective	5	8.5	N/A	0.5	5[a], 3[b]	4[c]	N/A
MOECC ECA Effluent Limit	10	10	6-9.5[d]	0.75	6[a], 4[b]	N/A	N/A

[a] December 1 – April 30

[b] May 1 – November 30

[c] MOECC ECA Effluent Objective Dissolved Oxygen is minimum level

[d] MOECC ECA Effluent Limit pH is range

3.1.1.3 Conclusions

CH2M's review of the Pottersburg WWTP current operations has concluded that plant operations have not differed substantially since XCG performed their assessment in 2013. A few notable exceptions were observed, particularly regarding the increase in raw sewage constituent concentrations recorded in 2015; however, the effluent results prove that the Pottersburg WWTP adequately handled the increase without compromising effluent quality.

Therefore, CH2M does not propose any changes to the conclusions drawn in the XCG Report with respect to the capacity assessment of the Pottersburg WWTP, or to the Stantec Pottersburg Report with respect to the results of the stress testing. As a result, CH2M has combined the unit capacity information presented in the XCG Report and the Stantec Pottersburg Report into summary Table 3-8.

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Table 3-8. Pottersburg WWTP Capacity Assessment Summary

Treatment Unit	Capacity Assessment		
	ADF (m^3/d)	**MDF (m^3/d)**	**PIF (m^3/d)**
Screens	N/A	N/A	60,0001
Grit Removal	N/A	N/A	60,000[a]
Primary Clarifiers	48,000[b]	59,050[a] 91,000[b]	N/A
Bioreactors	54,000[a,b]	N/A	N/A
Secondary Clarifiers	25,000[b]	63,620[a]	96,890[a] 95,000[b]
RAS Pumping	57,975[a]	N/A	N/A
Oxygenation	97,275[a]	N/A	N/A
Disinfection	N/A	N/A	60,000[a]
Sludge Thickening	66,540[a]	N/A	N/A
Overall Capacity	54,000[a] 25,000[b]	59,050[a]	60,000[a]

Per XCG Report

Per Stantec Pottersburg Report

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3.1.2 Vauxhall Wastewaster Treatment Plant

The Vauxhall WWTP was originally commissioned in the early 1950s with the construction of the existing Section 1. Subsequent expansions occurred as follows:

- Mid 1970s – addition of Section 2
- 1992 – addition of WAS thickening
- 2000 – Section 1 aeration upgrades
- 2002 – addition of UV disinfection
- Mid 2000s – Section 1 primary clarifier upgrades
- 2008 – electrical upgrades
- 2011 – Section 2 aeration upgrades
- 2012 – upgrading of RAS and WAS pumping, and the addition of a new WWTP headworks with mechanical screens, vortex grit removal, and chemically enhanced primary and secondary treatment, which brought the WWTP to its current rated capacity of 20,900 m3/d

The Vauxhall WWTP is located in an older part of the City where combined sewers and sanitary sewers with weeping tile connections are common. As a result, bypasses can occur during wet weather or during a spring melt.

CH2M visited the Vauxhall WWTP with City staff on June 13, 2017. The following subsections have been developed using information obtained during the site visit in addition to information contained within the XCG Report.

3.1.2.1 Overview of the Vauxhall WWTP

The Vauxhall WWTP is located at 54 Price Street in the City of London, and is operated under MOECC Amended Certificate of Approval (CofA) number 7972-86BHVK, issued on July 21, 2010. It provides secondary treatment for sewage generated within its sewershed at a rated ADF capacity of 20,900 m^3/d and peak flow of 34,640 m^3/d, and is comprised of two conventional activated sludge plants, referred to as Section 1 and Section 2. Final effluent produced by the Vauxhall WWTP is discharged into the Thames River.

During the site visit and through discussions with City staff, CH2M noted the following key observations and findings regarding the Vauxhall WWTP:

- Available land for potential future upgrades/expansion is not currently limited.
- Hauling thickened sludge to the Greenway WWTP to be incinerated involves sludge truck traffic through local neighbourhoods, which poses health and safety and environmental risks. Reducing or eliminating this practice is favoured by the City.
- Existing hydraulic bottleneck between the secondary clarifiers and the UV disinfection system. The City is considering an effluent PS to overcome this bottleneck.
- The City has planned for the construction of a stormwater berm capable of retaining a 250-year storm event.
- Final effluent TP objective is expected to reduce to 0.1 mg/L in the near future from the current level of 0.75 mg/L. The City is investigating Evoqua's Co-mag process.
- During wet weather events, some flows bypass the primary clarifiers, which are operated as chemically enhanced primary treatment (CEPT) units, and enter the aeration basin directly. The City is working with Stantec and Evoqua on potential expansion opportunities at Vauxhall WWTP, such as running CEPT at all times to increase downstream unit capacities.
- The City is interested in eventually having the Vauxhall WWTP rated for 60,000 m^3/d, if possible.

The following subsections present a summary of the Vauxhall WWTP and its current operation.

Inlet Works. Raw sewage is received by the Vauxhall WWTP via the Paardeburg and Chelsea Heights PSs, in addition to gravity sewers. Flows are combined and the overall flow rate is measured using an area-velocity meter upstream of the preliminary treatment units.

City staff noted that the Vauxhall WWTP experiences very high peak flows during wet weather events. During these events, flows can be bypassed and discharged directly into the Thames River, or into the aeration basins, depending on the event.

Vauxhall WWTP's preliminary treatment system consists of two mechanically cleaned fine screens with 6 mm screen size and a total peak flow capacity of 200,000 m^3/d. Screenings are collected and dewatered using a screw washer compactor and screw conveyer.

Following screening, wastewater flows are evenly distributed between two vortex-type aerated grit removal units, with a total peak flow capacity of 200,000 m^3/d. Each vortex grit removal unit is equipped with an air blower and an airlift pump to convey removed grit to a common grit classifier for dewatering. Grit removed from the system is hauled off-site for disposal.

Following grit removal, wastewater enters a splitter box for flow distribution to Section 1 and Section 2. Flows into each section are manually controlled based on gate settings at the splitter box.

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Section 1

Primary Clarification. Wastewater flows received by Section 1 are split between two rectangular primary clarifiers, each approximately 29.6-m by 9.14-m with 3.05-m SWD, which provide a total surface area of approximately 541-m^2. The Section 1 primary clarifiers are equipped with two primary sludge pumps (one duty, one standby). The primary sludge pumps transfer sludge collected by the primary clarifiers to the sludge storage tank.

Aerobic Treatment. Primary effluent is mixed with RAS from the secondary clarifiers in the re-aeration cell prior to entering an eleven-pass aerobic bioreactor. The re-aeration cell and bioreactor provide a total aeration volume of approximately 5,348-m^3. The bioreactor has the following approximate dimensions:

- 33.52 m by 4.27 m with 3.05 m SWD

Aeration is provided via three 170 cubic metre per minute (m^3/min) blowers (one duty, two standby) feeding fine bubble diffusion systems installed in each aerobic bioreactor.

Effluent from the aerobic bioreactor is dosed with ferric chloride prior to secondary clarification.

Secondary Clarification. Two circular secondary clarifiers receive effluent from the aerobic bioreactors. The secondary clarifiers are each approximately 30.5 m in diameter with 3.05 m SWD, which provide a total surface area of approximately 1,460 m^2.

The Section 1 secondary clarifiers are equipped with a total of three 10,204 m^3/d (two duty, one standby) RAS/WAS pumps that control the RAS and WAS flow rates. WAS from Section 1 is conveyed to the sludge storage tank.

Section 2

Primary Clarification. Wastewater flows received by Section 2 are split between two rectangular primary clarifiers, which provide a total surface area of approximately 220 m^2 and have the following approximate dimensions:

- 22.86 m by 4.8 m with 3.05 m SWD

The Section 2 primary clarifiers are equipped two primary sludge pumps (one duty, one standby). The primary sludge pumps transfer sludge collected by the primary clarifiers to the sludge storage tank.

Aerobic Treatment. Two two-pass aerobic bioreactors receive effluent from the primary clarifiers and RAS from the secondary clarifiers. The bioreactors provide a total aeration volume of approximately 2,870 m^3, with dimensions of each pass of approximately 22.86 m by 6.86 m with 4.58 m SWD.

Aeration is provided via three (one duty, two standby) 39 m^3/min blowers feeding fine bubble diffusion systems.

Effluent from the aerobic bioreactors is dosed with ferric chloride prior to secondary clarification.

Secondary Clarification. Two circular secondary clarifiers receive effluent from the aerobic bioreactors. The secondary clarifiers provide a total surface area of 616 m^2 and each have approximate dimensions of 19.8 m in diameter with 4.08 m SWD.

The Section 2 secondary clarifiers are equipped with a total of three 5,746 m^3/d (two duty, one standby) RAS/WAS pumps that control the RAS and WAS flow rates. WAS from Section 2 is conveyed to the sludge storage tank.

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Disinfection. Effluent from the Section 1 and Section 2 secondary clarifiers is combined and then disinfected via a UV disinfection system, with a total capacity of 34,640 m^3/d. The UV disinfection process is operated seasonally, from April 1 to September 30 of each year.

Final Effluent. Final effluent from the Vauxhall WWTP is discharged to the Thames River.

Chemical Addition. The Vauxhall WWTP operates a ferric chloride dosing system, an anionic polymer dosing system, and a cationic polymer dosing system, which allows the facility to operate chemically enhanced primary and secondary treatment, depending on the operating scenario. During wet weather events, the facility can process flows up to 150,250 m^3/d in the primary clarifiers using CEPT with ferric chloride and anionic polymer, prior to discharge to the Thames River. Additionally, flows of up to 49,750 m^3/d can be directed to the aerobic bioreactors for enhanced secondary treatment using ferric chloride and cationic polymer dosed upstream of the secondary clarifiers. Therefore, the total WWF treatment capacity of the Vauxhall WWTP, operating under both scenarios, is 200,000 m^3/d.

Ferric chloride for CEPT is stored on-site in a 30,000 L storage tank and dosed via three 2,700 L/hr metering pumps (two duty, one standby).

Ferric chloride for phosphorus removal is stored on-site in an 8 m^3 storage tank and dosed via two 100 L/hr chemical dosing pumps (one duty, one standby).

Liquid anionic polymer is stored neat on-site and made down to the appropriate concentration in a chemical aging tank. Neat polymer is pumped into the aging tank using one 1,800 millilitres per minute (mL/min) neat polymer metering pump. Made down polymer is dosed via three 4,500 mL/min metering pumps (two duty, one standby).

Liquid cationic polymer is stored neat on-site and made down to the appropriate concentration in a chemical aging tank. Neat polymer is pumped into the aging tank using one 1,800 mL/min neat polymer metering pump. Made down polymer is dosed via three 6,000 mL/min metering pumps (two duty, one standby).

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Sludge Management. Primary sludge and WAS from each of the two sections are separately pumped to the sludge storage tank and blended. The sludge storage tank has approximate dimensions of 11.5 m by 7.5 m with 4.3 m, SWD, for a total storage capacity of approximately 371 m^3. Stored sludge is transferred from the sludge storage tank via three 25 L/s variable speed sludge transfer pumps (one duty, one for truck loading, and one standby) to one 2 m wide gravity belt thickener, capable of processing 25 L/s of WAS. Polymer dosing is provided via two 25 L/hr polymer dosing pumps to enhance the operation of the gravity belt thickener.

Thickened sludge is stored in one thickened sludge storage tank with approximate dimensions of 11.5 m by 7.5 m with 4.3 m SWD, for a total storage volume of 371 m^3. Ultimate disposal of stored thickened sludge is through incineration at the Greenway WWTP.

3.1.2.2 Summary of Current Operations

CH2M received and reviewed the following information from the City:

- Monthly Plant Summaries (operating data) from 2012 through 2015
- The XCG Report
- A draft version of a report authored by Stantec, entitled Vauxhall WWTP Stress Testing – Summary Report, and dated February 14, 2017 (the Stantec Vauxhall Report)

The following subsections present a summary of the Vauxhall WWTP current operations. CH2M compared the operating data received (2012 through 2015) with the information presented in the XCG Report, which summarized operating data from 2008 through 2012. The purpose of the comparison was to identify if any substantial changes had occurred with respect to the influent characterization and/or treatment system performance since the XCG Report was completed that may impact the findings presented in either the XCG Report or the Stantec Vauxhall Report.

Raw Sewage Characteristics. The ADF through the Vauxhall WWTP between the years of 2012 through 2015 was 19.9 percent less than the ADF presented in the XCG Report. The decrease in influent flow to the plant may be attributed to a combination of low rainfall and a reduction in industrial dischargers (that is, shutdown of the Kellogg's plant). Since the ADF was less than that reported by XCG between 2008 to 2012, no substantial impact to plant performance is expected. Table 3-9 presents a summary of the flow information received from the City.

Table 3-9. Vauxhall WWTP Influent Flows, 2012 through 2015

Year	Average Day Flow (m^3/d)	Maximum Day Flow		Peak Instantaneous Flow		Minimum Day Flow (m^3/d)
		(m^3/d)	MDF Factor	(m^3/d)	PIF Factor	
2012	14,602	32,682	2.2	129,805	8.9	7,430
2013	15,770	41,061	2.6	123,960	7.9	7,430
2014	14,949	41,408	2.8	118,980	8.0	8,803
2015	13,438	40,995	3.1	124,980	9.3	9,477
Overall Average	14,690	39,037	2.7	124,431	8.5	N/A
XCG Average	18,337	42,070	2.3	97,767	5.3	N/A

MDFs were similar to those presented in the XCG Report, and PIFs were larger than those presented in the XCG Report.

CH2M reviewed the flow data reported for the entire plant, and that reported for Section 1 and Section 2, and observed issues related to the PIF reported values, as can be seen on Figures 3-8 and 3-9.

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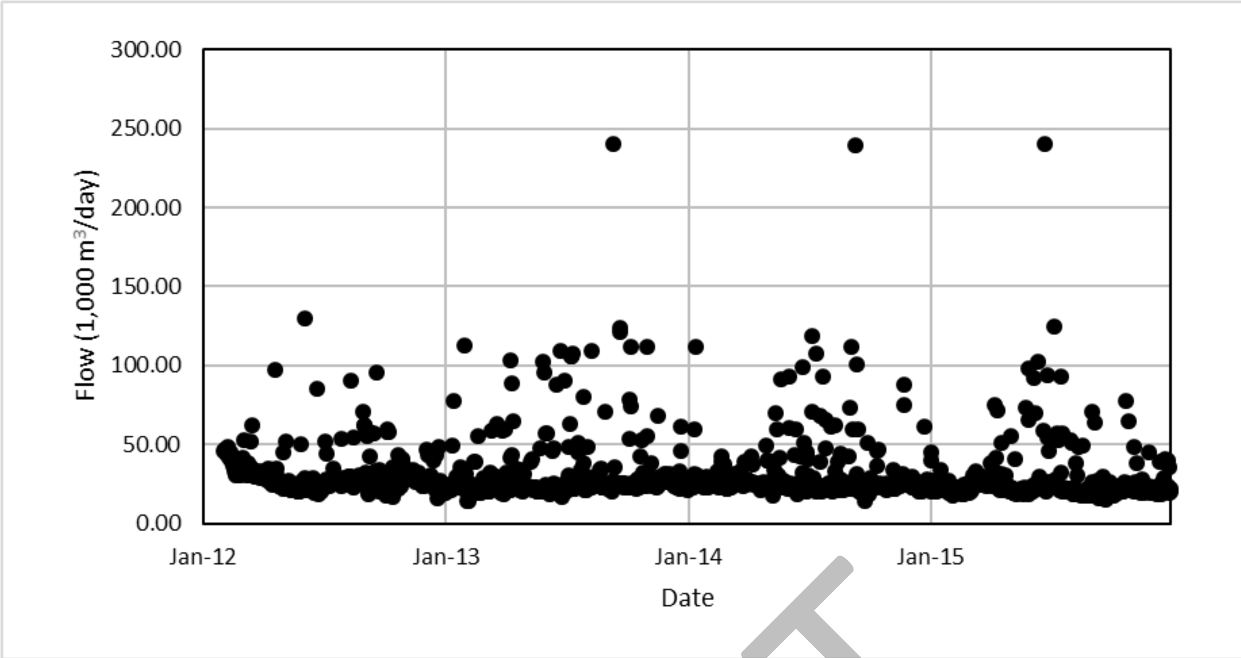

Figure 3-8. Vauxhall WWTP PIFs, 2012 through 2015

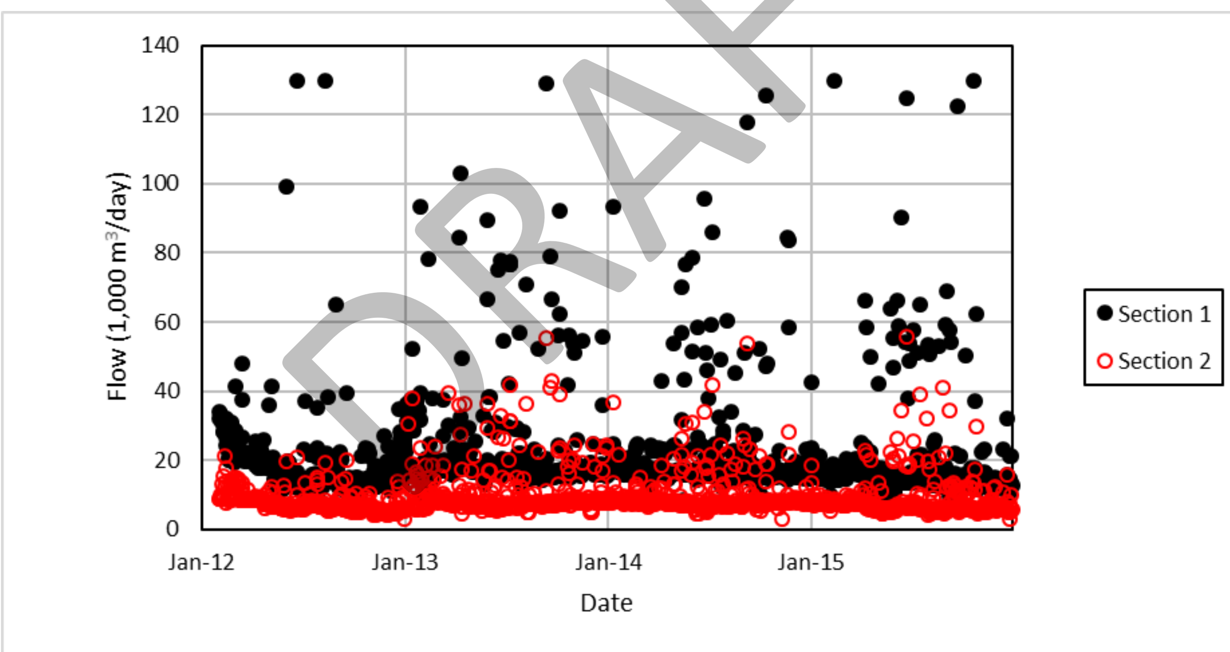

Figure 3-9. Vauxhall WWTP Section PIFs, 2012 through 2015

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As shown on Figure 3-8, it appears three outliers exist within the PIF dataset for the full plant. These significant outliers were omitted from CH2M's analysis. The individual section PIFs were also reviewed by CH2M and discrepancies were noted where values did not add up to the PIF of the plant on the same day, as summarized in Table 3-10.

Table 3-10. Vauxhall WWTP Summary of PIF Discrepancies

Date	Total Plant PIF (m^3/d)	Section 1 PIF (m^3/d)	Section 2 PIF (m^3/d)
June 21, 2012	85.5	129.9	20.74
August 10, 2012	90.54	129.87	19.27
September 11, 2013	239.88	128.89	55.37
September 10, 2014	238.99	117.63	53.87
October 13, 2014	36.66	125.42	13.66
February 13, 2015	19.44	129.77	8.9
June 23, 2015	239.88	124.88	55.55
September 24, 2015	15.42	122.46	10.96
October 23, 2015	22.74	129.74	13.46

Due to these issues, the PIF for individual sections was estimated by splitting the PIF of the plant between each section according to the average flow splits observed in the daily flow data provided. This method was not applied in the XCG Report. For the MDF of individual sections the recorded data was used rather than the flow split assumption. Please refer to Table 3-11 for a summary of the flow information for each section.

Table 3-11. Vauxhall WWTP Summary of Section Flows

Parameter	Section 1	Section 1 (XCG)	Section 2	Section 2 (XCG)
ADF (m^3/d)	9,896	12,916	4,637	5,370
Average Flow Split (%)	70	70	30	30
MDF (m^3/d)	29,066	41,534	13,678	22,210
PIF (m^3/d)[a]	90,864	99,180	38,942	39,094

[a] Based on the 2012 Peak Instantaneous Flow of 129,805 m^3/d and assuming the estimated flow split

Average raw wastewater quality values between the years of 2012 through 2015 were observed to be similar to those presented in the XCG Report, with the exception of TSS. CH2M noted that the average TSS recorded in 2013 is large compared with the other values presented in the Table 3-12. It is unclear why the raw sewage TSS recorded in 2013 differs from those recorded in 2008 to 2012, 2014, and 2015. One possible explanation is that changes occurred in the industrial loads discharged to the Vauxhall WWTP in 2013; however, confirmation from the City was not received.

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Table 3-12. Vauxhall WWTP Raw Wastewater Quality, 2012 through 2015

	BOD5 (mg/L)	TSS (mg/L)	pH	TP (mg/L)	TKN (mg/L)
2012	241	358	7.3	4.7	29.6
2013	281	426	7.3	5.2	30.7
2014	220	273	7.3	4.2	25.0
2015	190	279	7.4	5.4	32.7
Average	233	334	7.3	4.9	29.5
XCG Determined Average (2008-2012)	232	271		4.5	28.9
% Difference	0%	23%	N/A	8%	2%

Figure 3-10 illustrates the recorded TSS values in the raw sewage between 2012 and 2013. CH2M notes that the values appear to trend upward in 2013, and span a larger range.

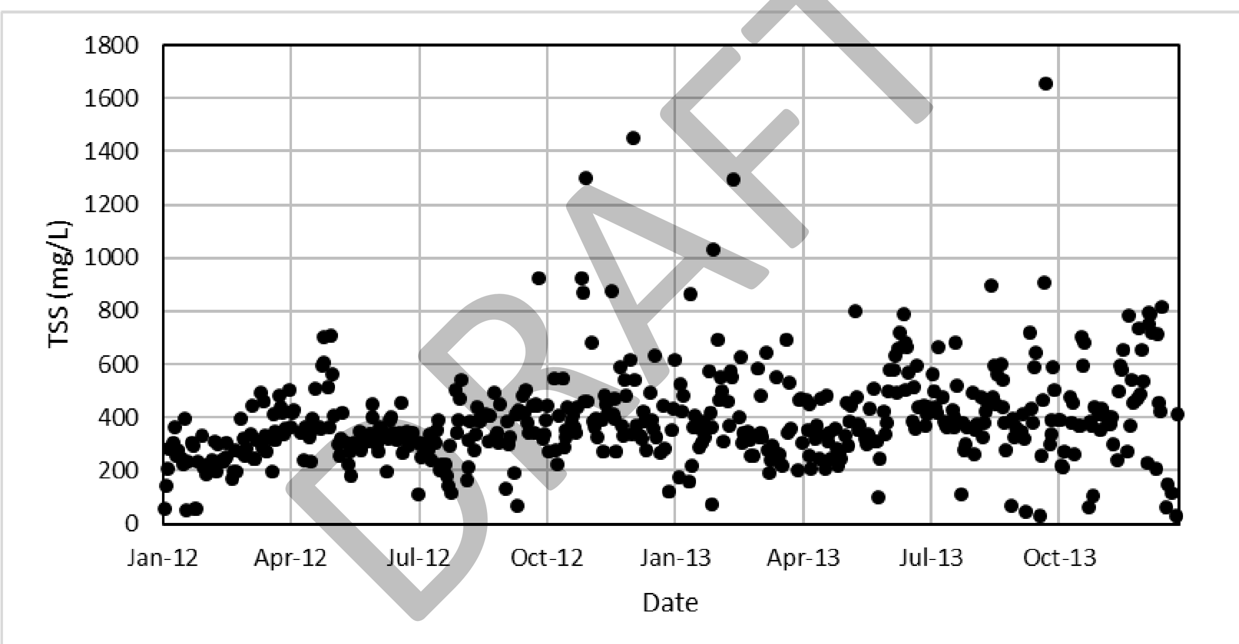

Figure 3-10. Vauxhall WWTP Raw Wastewater TSS, 2012 and 2013

Treatment System Performance

Primary Clarification. Based on the results presented in Table 3-13, the primary clarifiers have been operating at ADF SOR values slightly lower than those presented in the XCG Report and typical design guideline values. The calculated SOR at MDFs are also below these reference values.

Both TSS removal and BOD_5 removal across the primary clarifiers was larger than the removals presented in the XCG Report and typical design guideline values, with no chemical addition for phosphorus removal. This is likely due to the SOR values being lower than in the past, which provides less turbulence and a better environment for settling.

Table 3-13. Vauxhall WWTP Primary Clarifier Operating Conditions, 2012 through 2015

Parameter	Section 1	Section 1 (XCG)	Section 2	Section 2 (XCG)	Typical Design Guideline Values [a]
SOR at ADF ($m^3/(m^2 \cdot d)$)	18.3	23.9	21.1	24.4	30-40
SOR at MDF ($m^3/(m^2 \cdot d)$)	53.7	76.8	62.2	101.0	60-80
Average TSS Removal (%)	81	66	82	66	40-70
Average BOD Removal (%)	39	14	41	16	35-45

[a] Typical Design Guideline Values as taken from XCG Capacity Assessment

Aerobic Treatment. Table 3-14 summarizes the operating data from 2012 through 2015, compared with the information presented in the XCG Report and typical design values.

Table 3-14. Vauxhall WWTP Bioreactor Average Operating Conditions

Parameter	Section 1	Section 1 (XCG)	Section 2	Section 2 (XCG)	Typical Design Values
Plant Influent Flow (m^3/d)	9,896	12,916	4,637	5,370	n/a
BOD_5 Load (kg/d)	1,396	2,569	633	1,043	n/a
MLSS (mg/L)	2,148	2,059	1,948	1,765	3,000-5,000[a]
MLVSS (mg/L)	1,568	1,611	1,422	1,402	n/a
MLVSS:MLSS	0.73	0.78	0.73	0.79	n/a
HRT (hrs)	13.0	9.9	14.9	12.8	>6[a], 4-8[b]
OLR (kg $BOD_5/(m^3d)$)	0.26	0.48	0.22	0.36	0.31-0.72[a], 0.3-0.7[b]
F/Mv (d^{-1})	0.17	0.30	0.16	0.26	0.05-0.25[a], 0.2-0.4[b]
Estimated RAS:ADF Ratio (%)	150	76	157	77	50-200[a], 50-125[b]
RAS SS (mg/L)	3,465	4,340	3,022	3,536	n/a
WAS Flow (m^3/d)	276	372	474	304	n/a
WAS Production (kg/d)	956	1,613	1,432	776	n/a
SRT (days)	12.0	6.8	3.9	6.5	>10[a], 3-15[b]
SVI (mL/g)	69	86	127	140	<100[b]

[a] Design Guidelines for Sewage Works, MOECC, 2008.

[b] Metcalf and Eddy (2003). Wastewater Engineering: Treatment and Reuse, 4th Ed.

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CH2M's key findings from the bioreactor review are summarized as follows:

- The BOD_5 load for Section 1 is much larger than Section 2, which may be due to the larger influent flow to Section 1; however, these values are less than the historical values.
- Values of OLR and F/Mv are less than the historical and typical design values. This is likely because the BOD_5 load is less than in the past.
- RAS:ADF Ratio values are around twice the historical values however still near the typical guideline value. This large increase is likely due to lower average flows to the plant than in the past, while maintaining similar RAS flows to those used historically.
- WAS Flow in Section 1 was less than then Section 2, where this was not the case in the past. This change leads to the WAS Production of Section 1 being less than Section 2. Additionally, it leads to the SRT being higher in Section 1 than Section 2 as compared to the historically more balanced SRT values.

Figures 3-11 and 3-12 demonstrate the RAS SS and WAS Flow for all sections between 2012 and 2015.

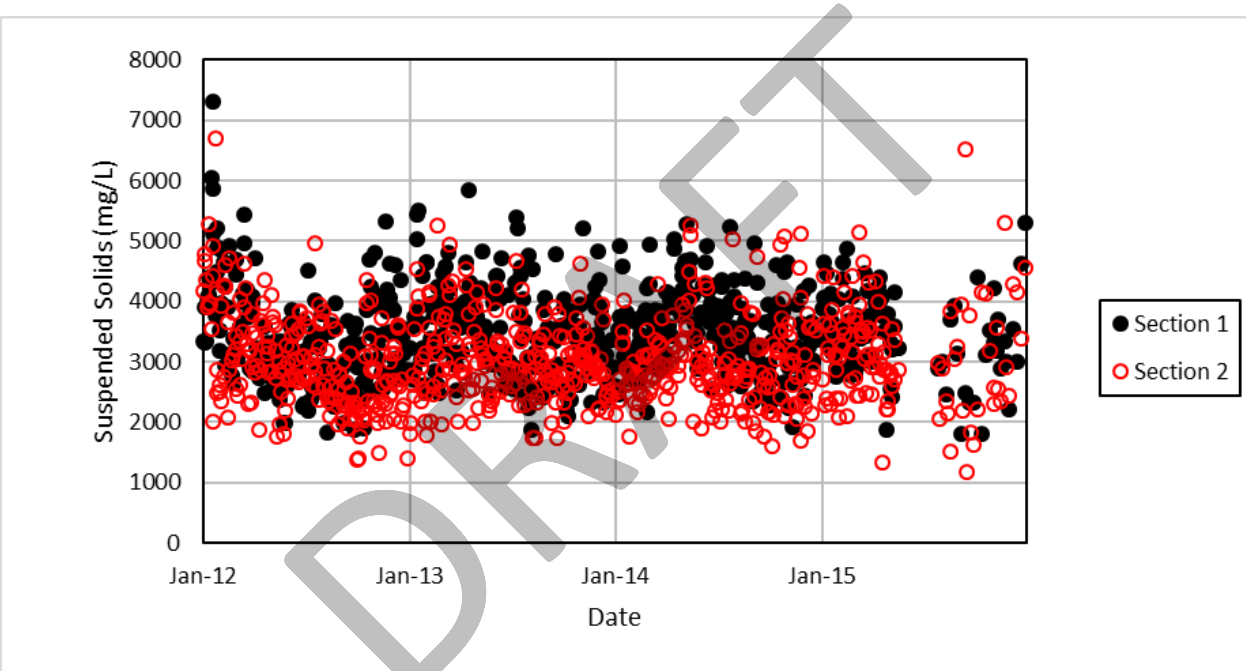

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Figure 3-11. Vauxhall WWTP RAS Total Suspended Solids, 2012 through 2015

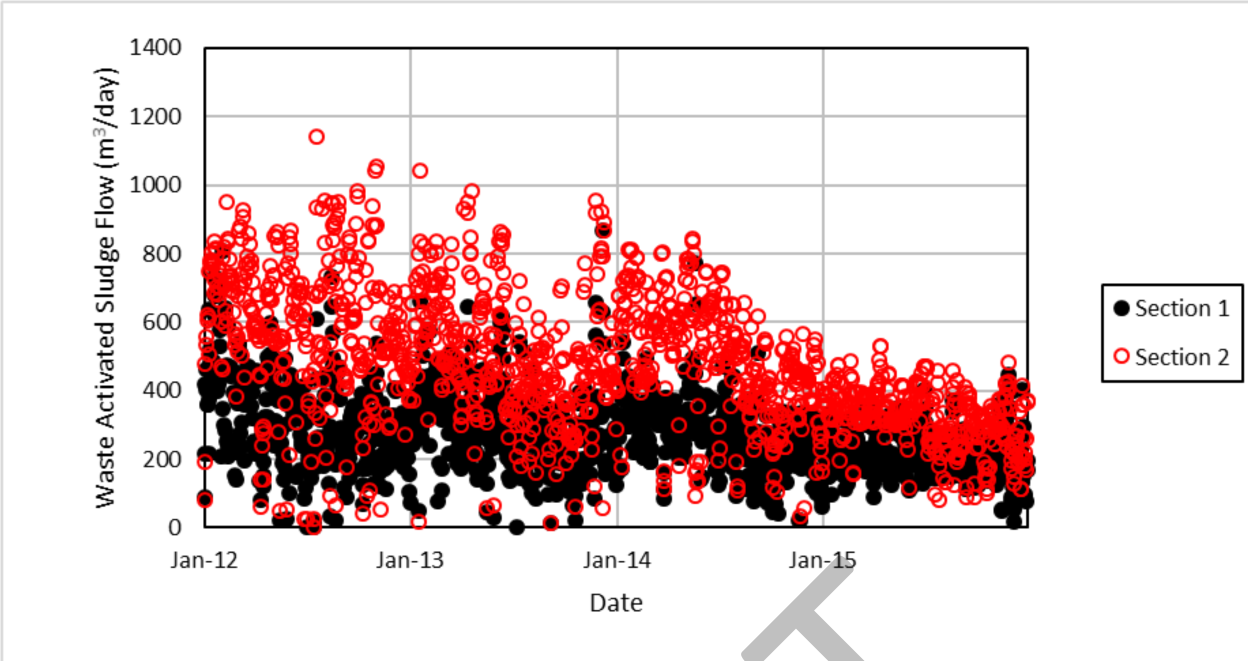

Figure 3-12. Vauxhall WWTP WAS Flow, 2012 through 2015

Secondary Clarification. Table 3-15 summarizes the operating data from 2012 through 2015, compared with the information presented in the XCG Report and typical design values. Note that the PHF was assumed to be equivalent to the PIF.

Table 3-15. Vauxhall WWTP Secondary Clarifier Operating Conditions

Parameter	Section 1	Section 1 (XCG)	Section 2	Section 2 (XCG)	Typical Design Guideline Values[a]
PHF (m^3/d)[b]	90,864	99,180	38,942	39,094	N/A
MDF (m^3/d)	29,066	41,534	13,678	22,210	N/A
PHF SOR ($m^3/(m^2 \cdot d)$)	62	68	63	63	<37
MDF SLR ($kg/(m^2 \cdot d)$)	43	73	43	76	<170

[a] Design Guidelines for Sewage Works, MOECC, 2008. Design peak hour values for an activated sludge process with coagulant addition to the mixed liquor for phosphorus removal

[b] Based on the 2012 Peak Instantaneous Flow of 129,805 m^3/d and assuming a Section 1: Section 2 flow split of 70:30

Based on the results presented in Table 3-15, the secondary clarifiers have operated at PHF SOR values similar to those presented in the XCG Report and larger than the MOE Design Guidelines value. The MDF SLR values were well below the MOE Design Guideline value and less than the values presented in the XCG Report.

Final Effluent Quality. The effluent wastewater quality values for the Vauxhall WWTP were generally less than the values presented in the XCG Report, which demonstrates that the system was performing as required. In the case of BOD5 and TP, the average value between the years of 2012 through 2015 was much less than that presented in the XCG Report. Table 3-16 presents a summary of the Vauxhall WWTP final effluent quality.

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Table 3-16. Vauxhall WWTP Effluent Wastewater Quality, 2012 through 2015

	BOD_5 (mg/L)	**TSS (mg/L)**	**pH**	**TP (mg/L)**	**NH_3 (mg/L)**	**DO (mg/L)**	**TKN (mg/L)**
2012	1.6	3.8	7.6	0.43	0.11	7.8	1.3
2013	1.7	5.8	7.7	0.36	0.11	7.9	1.3
2014	1.9	4.5	7.6	0.34	0.10	7.6	1.3
2015	1.4	4.4	7.5	0.28	0.14	8.5	1.2
Average	1.6	4.6	7.6	0.35	0.12	7.9	1.3
XCG Determined Average (2008-2012)	2.2	4.7	N/A	0.50	N/A	N/A	N/A
% Difference	-25	-2	N/A	-29	N/A	N/A	N/A
MOECC CofA Effluent Objective	15	15	N/A	0.75	5[a], 3[b]	N/A	N/A
MOECC CofA Effluent Limit	20	20	6-9.5[c]	1.0	6[a], 4[b]	N/A	N/A

[a] December 1 – April 30

[b] May 1 – November 30

[c] MOECC CofA Effluent Limit pH is range

Notes:

DO = dissolved oxygen
NH_3 = ammonia

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3.1.2.3 Conclusions

CH2M's review of the Vauxhall WWTP current operations has concluded that plant operations have not differed substantially since XCG performed their assessment in 2013. A few notable exceptions were observed, particularly regarding the increase in raw sewage TSS and the decrease in the ADF treated by the plant; however, the effluent results prove that the Vauxhall WWTP adequately handled these changes without compromising effluent quality.

Therefore, CH2M does not propose any changes to the conclusions drawn in the XCG Report with respect to the capacity assessment of the Vauxhall WWTP, or to the Stantec Vauxhall Report with respect to the results of the stress testing. As a result, CH2M has combined the unit capacity information presented in the XCG Report and the Stantec Vauxhall Report into summary Table 3-17.

Table 3-17. Vauxhall WWTP Capacity Assessment Summary

Treatment Unit	**Capacity Assessment**		
	ADF (m^3/d)	**MDF (m^3/d)**	**PIF (m^3/d)**
Screens	N/A	N/A	200,000[a]
Grit Removal	N/A	N/A	200,000[a]
Primary Clarifiers	50,000[2]	66,720[a] 115,000[b]	N/A

Table 3-17. Vauxhall WWTP Capacity Assessment Summary

Treatment Unit	Capacity Assessment		
	ADF (m^3/d)	MDF (m^3/d)	PIF (m^3/d)
Bioreactors (As-is)	30,000[a] 36,000[b]	N/A	N/A
Bioreactors (CEPT)	54,000[b]		
Secondary Clarifiers	32,000[b]	65,741[a]	76,812[a] 95,000[b]
RAS Pumping	31,900[a]	N/A	N/A
Oxygenation	49,262[a]	N/A	N/A
Disinfection	N/A	N/A	49,750[a]
Sludge Thickening	39,512[a]	N/A	N/A
Overall Capacity	30,000[a] 32,000[b]	66,741[a]	49,750[a]

[a] Per XCG Report

[b] Per Stantec Vauxhall Report

3.2 Collection Systems Background Information

3.2.1 Pottersburg Sewershed

The Pottersburg sewershed contains approximately 175 km of sanitary sewer and contains four PSs, as follows, that are illustrated on Figure A-9 of Appendix A:

- Clarke Road PS
- Trafalgar Street PS
- Gore Road PS
- East Park PS

The sewershed consists of three STSs conveying flows to the Pottersburg WWTP: the Jackson Road STS, the Feren Avenue STS, and the Pottersburg STS (Dillon, 1998). The Jackson Road STS conveys flows from the south end of the sewershed to the WWTP and includes a three-barrel siphon that conveys flows under the South Thames River. The Feren Avenue STS conveys flows from the west side of the sewershed to the WWTP. The Pottersburg STS acts as an overflow bypass to the Clarke Road PS. The portion of the trunk sewer between the Clarke Road PS and Dundas Street is in poor condition (Andrews Infrastructure, 2007) and is along easements through backyards and on private property. The Admiral Drive Sub-Trunk conveys pumped flows from the Clarke Road PS to the Trafalgar Street Sub-Trunk. The Trafalgar Street Sub-Trunk conveys flows from the Trafalgar Street PS and the Admiral Drive Sub-Trunk to the Pottersburg Trunk. The Gore Road Sub-Trunk conveys flows from the east end of Gore Road to the southern portion of the Pottersburg STS, and includes a two-barrel siphon to convey flows under the Pottersburg Creek. The Hamilton Road Sub-Trunk conveys flows from the East Park PS to the southern portion of the Pottersburg Trunk (Dillon, 1998).

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Previous studies have identified sewer surcharging along the Pottersburg STS during a 2-year design storm simulation (CH2M, 2011). The surcharging is in part due to the Pottersburg STS being in poor condition, enabling extraneous flows to enter the system. A previous study completed by Dillon (1998) indicates basement flooding occurrences between Trafalgar Street and Dundas Street along Vancouver Street, with some basement flooding at the Clarke Road PS as well as in the Culver Drive area.

The existing Pottersburg sewershed hydraulic model was constructed using Innovyze's InfoWorks CS product and was calibrated using monitored flow data at ten flow monitoring locations in sanitary sewers by CH2M in 2011 as part of the Pottersburg Sanitary Sewershed Improvements Study Update (2011). The model was later used in the Pottersburg Trunk Sanitary Sewer Realignment Study (2017) completed by CH2M, and was updated to Innovyze's InfoWorks Integrated Catchment Modeling software. During the Pottersburg Trunk Sanitary Sewer Realignment Study, a comparison was made between the available Clarke Road PS data and the modelled PS flow. Changes that were made to the Clark Road PS as a result of this comparison are as follows:

- Increased the 'R1' in the real time kinematic (RTK) parameters for the Clarke Road PS catchment area from 0.001 to 0.017 to increase the WWF to the Clarke Road PS
- Adjusted ON/OFF levels and flow rates of pumps based on monitored data
- Added 0.015 cubic metres per second trade flow to the parcel corresponding to Cargill Incorporated, based on monitored data
- Revised the base of the wet well from 5.11 m^2 to 2.77 m^2
- Decreased the 'R1' value in the FM07 catchment area from 0.02 to 0.00 based on monitored data

The modelled pump discharge rates and ON/OFF levels are summarized in Table 3-18.

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Table 3-18. Pumping Station Summary -Pottersburg

			Modelled Parameters		
	Reported Capacity (L/s)	**Speed Control**	**Discharge Rate (L/s)**	**Pump ON Level (m)**	**Pump OFF level (m)**
Clarke Road PS	378 [a]	Fixed Speed [a]			
Pump 1			50	259.7	259.2
Pump 2			50	259.7	259.2
Pump 3			60	260.1	259.2
East Park PS	105 [a]	VFD [a]			
Pump 1			105	236.5	234.5
Trafalgar Street PS	150 [a]	Fixed Speed [a]			
Pump 1			103	257.1	256.3
Pump 2			47	258	256.8
Gore Road PS	19 [a]	Fixed Speed [a]			
Pump 1			19	261.2	260.1

[a] From 2016 City of London Pumping Station Report

Note:

VFD = variable frequency drive

The modelled Clarke Road PS capacity, which was assigned based on monitored data, is less than half of the reported capacity. This is likely due to wear of the pumps, as indicated in the Pottersburg Trunk Sanitary Sewer Realignment Study (CH2M, 2017). Although the East Park PS is a VFD pump, it is modelled as a fixed pump for simplicity in the model.

The most recent hydraulic model from the Pottersburg Trunk Sanitary Sewer Realignment Study was used as a basis for the existing sanitary sewer capacity assessment for the Pottersburg sewershed in conjunction with previous studies.

3.2.2 Vauxhall Sewershed

The Vauxhall sewershed contains approximately 85-km of sanitary sewer and is divided by the Thames River into a north and south section. The flows in the north section of the Vauxhall sewershed generally flow west to the Vauxhall WWTP via the 1,500-mm-diameter Eleanor STS, also known as the East End Interceptor Combined Sewer (Dillon, 2017). Although the Eleanor STS is a combined sewer, much of the storm catchment areas have been separated since its construction in the 1930s (Dillon, 2017). The Eleanor STS also acts as a relief sewer for the Egerton Street Double Sewer (Dillon, 2017). The Egerton Street Double Sewer currently receives storm and sanitary flow from Burbrook Place (Dillon, 2013). A 2,100-mm diameter storm sewer runs south along Ashland Avenue and Highbury Avenue North.

Currently, there are two PSs in the Vauxhall sewershed including the Chelsea Heights PS and the Paardeberg PS. Flows from the south section of the sewershed drain to the Chelsea Heights PS, which pumps flow to the inlet of the Vauxhall WWTP. The Chelsea Heights PS has a rated capacity of 367 L/s (City of London, 2016) with one lead VFD pump and two lag VFD pumps. The Paardeberg PS pumps flows north of Oxford Street to the 450-mm-diameter sanitary sewer on Highbury Avenue. In the coming years, the Paardeburg PS flows are to be diverted to the Adelaide WWTP. The Paardeburg PS currently has a rated capacity of 21 L/s and two fixed speed pumps (City of London, 2016). These two PSs are currently not included in the existing Vauxhall sewershed hydraulic model.

Figure A-10 of Appendix A shows the location of the sanitary sewers, Chelsea Heights PS, Paardeburg PS, and Vauxhall WWTP within the Vauxhall sewershed.

The Draft Preliminary Design Report for Burbrook Place Reconstruction previously completed by Dillon summarized that the Burbrook Place sanitary sewer experiences frequent surcharging during wet weather events (Dillon, 2013). The Quebec Street and Oxford Street area has a relatively large frequency of basement flooding and a large response to rainfall events in the sanitary sewer. This could be due to upstream catch basin connections along Oxford Street, downspout connections, and surcharging in the Quebec Street Storm & Relief Sewer with the potential to cause reverse overflows to the sanitary sewer along Quebec Street (Dillon, 2013).

The Egerton Street Double Sewer is in poor condition and will be abandoned in the coming years with sanitary flow directed to the Eleanor STS and storm flows directed to the proposed Burbrook Trunk Storm Sewer.

Parts of the Vauxhall sewershed were previously modelled during the London PPCP Phase 2 project: Assignment 01 and Assignment 03. The purpose of this project was to calibrate the model and determine the sanitary sewer overflow (SSO) volume during the 7-month typical year. Dillon modelled Assignment 01, which was calibrated using flow data and rainfall data from 2015. The Assignment 01 model consists of the area east of approximately Ashland Avenue and Glenwood Avenue to the north of the Thames River, and east of Pond Mills Road to the south of the Thames River. Assignment 01 was calibrated to flow data at seven SSO locations.

Assignment 03 of the PPCP was completed by Stantec, and was calibrated using flow data and rainfall data from 2015. The Assignment 03 area consists of the area west of Pond Mills Road to the south of the Thames River, however only half of this area was calibrated. The Vauxhall portion of Assignment 03 was

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calibrated to flow data at one (1) SSO location. Approximately half of the 148 ha of parcels imported from the Assignment 03 model were downstream of the flow monitor, and it was assumed that the downstream parcels would have similar DWF and RTK parameters as the calibrated upstream parcels.

Figure A-11 in Appendix A illustrates the extent of the existing model, which does not include the Chelsea Heights PS or the Vauxhall WWTP. As shown in Figure A-11 in Appendix A, the Egerton Street Double Sewer is not included in the existing Vauxhall hydraulic model. Since there are several unknowns relating to the stormwater and wastewater contributions to the flow in the Egerton Street Double Sewer, extending the InfoWorks model to include the Egerton Street Double Sewer would provide unreliable results without flow monitoring data. Consequently, the existing Vauxhall hydraulic model will not be extended. Existing sewer capacity assessments will be completed using the calibrated portions of the model and previous studies, where possible.

3.3 Collection Systems Capacity Assessment

3.3.1 Pottersburg Sewershed

The hydraulic model was used to simulate the 5-year, 25-year, and 100-year design storm simulation. During these three design storm simulations, the model predicted surcharging along the Pottersburg STS, from the Clarke Road PS to the Pottersburg WWTP. The model also predicts surcharging in the Culver Drive and Culver Crescent area, and upstream of the Clarke Rd. PS during the 5-year to 100-year design storms. During the 25-year and 100-year design storm simulations, surcharging is also simulated in the Saskatoon Street and Wavel Street area. This surcharging can partly be attributed to capacity constraints along the Pottersburg STS. Hydraulic profiles showing the simulated level along the Pottersburg STS are in Figures A-12 to A-14 of Appendix A.

Surcharging is also simulated in the Trafalgar Street and Clarke Road area. This surcharging is in part due to the large volume of pumped flows from the Clarke Road PS entering the Trafalgar Street Sub-Trunk.

Table 3-19 summarizes the peak inflow to the PSs during the design storm simulations.

Table 3-19. Pottersburg PS Sewershed Capacity Comparison

		Maximum Simulated Inflow (L/s) [a]		
	Capacity (L/s)	**5-year**	**25-year**	**100-year**
Clarke Rd. PS	160 [b]	313	317	317
East Park PS	105	115	136	124
Trafalgar PS	150	149	172	183

[b] Based on monitored Data

[a] Based on modelled flow at downstream end of the PS influent pipe

The simulated results suggest that the peak inflows to the Clarke Rd. PS and the East Park PS during the 5-year design storm exceed the pumping capacity of the PS and upstream surcharging due to insufficient capacity at the Clarke Rd. PS is simulated during the 5-year design storm. The modelling results predict that the peak influent flows to the Clarke Rd. PS, East Park PS, and Trafalgar PS exceed the capacity of the PS during 25-year and 100-year design storm. Surcharging upstream of the Clarke Rd. PS, East Park PS (375 mm diameter influent pipe only), and the Trafalgar PS is simulated during the 25-year and 100-year design storm event, suggesting insufficient capacity at the PSs during extreme rainfall events.

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The simulation results suggest that there is a large response to wet weather in the Pottersburg sewershed and in general the Pottersburg sewershed does not have sufficient capacity, specifically at the Clarke Rd. PS and along the Pottersburg STS. The impact of inflow and infiltration (I&I) on the sewershed capacity will be further considered during the alternatives development in subsequent sections of this report.

3.3.2 Vauxhall Sewershed

The Assignment 01 model from the London PPCP project, that includes areas east of Ashland Avenue, was used to simulate the 5-year, 25-year, and 100-year design storms. During the 5-year, 25-year, and 100-year design storm simulation, surcharging was predicted along the west-flowing 675 mm diameter sanitary sewer upstream of the WWTP along Tommy Hunter Way. The predicted surcharging along the 675-mm-diameter sanitary sewer resulted in a freeboard less than 1.8-m, suggesting a risk for basement flooding, while the predicted surcharging during the 25-year and 100-year design storm events resulted in flooding to surface. Surcharging was also predicted along the Eleanor STS during the 25-year and 100-year design storm events. The simulated surcharging in the Eleanor STS during the 25-year design storm remain below basement flooding levels, while the simulated surcharging during the 100-year design storm resulted in flooding to surface. Hydraulic profiles showing the simulated level along the 1,500-mm-diameter Eleanor STS are in Figures A-15 to A-17 of Appendix A.

As previously mentioned, the Quebec Street and Oxford Street area has a relatively large frequency of basement flooding and the sanitary sewer has a large response to rainfall events. This is suspected to be the result of I&I into the sanitary sewer system. The Mornington Area Storm Drainage Servicing EA that is currently underway will consider mitigation measures to alleviate the strain on the sanitary sewer. The impact of I&I on the sewershed capacity will be further considered during the alternatives development in subsequent sections of this report.

The planned abandonment of the Egerton Street Double Sewer will reduce the volume of stormwater flows reaching the Vauxhall WWTP by diverting the storm flows to the proposed Burbrook Trunk Storm Sewer. However, this proposed abandonment of the Egerton Street Double Sewer will involve diverting sanitary flows to the Eleanor STS, which may result in additional flows to the trunk sewer. It is recommended that flow monitoring be conducted prior to diverting additional flows to the Eleanor STS.

In general, the Vauxhall sewershed appears to have sufficient capacity, except during extreme design storm events.

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SECTION 4

Development and Selection of Treatment System Alternatives

The Municipal Class EA process in Ontario defines the requirements for the development of a reasonable range of alternatives including a Do-Nothing option to provide a benchmark for the evaluation of alternatives. The development of potential alternatives should also consider the methods of implementation. This section outlines the process that was taken to identify a suite of alternatives for the Project.

4.1 Technical Objectives and Targets

The technical objectives and targets considered during the development of alternatives for wastewater treatment are as follows:

- Address short-term (that is, next 20 years) development within the Pottersburg sewershed.
- Address long-term (that is, next 50 years) development within the Pottersburg sewershed.
- Address aging infrastructure at the Vauxhall and Pottersburg WWTPs.
- Anticipate and address potential regulatory changes over the long term.

4.2 Opportunities and Constraints

The identified opportunities pertaining to wastewater treatment are outlined in Table 4-1.

Table 4-1. Wastewater Treatment Opportunities

Treatment Plant	Opportunity	Description
Vauxhall and Pottersburg	Vauxhall-Pottersburg Interconnection	Pipelines that will allow the transfer of sewage and solids between the two WWTPs to increase operational flexibility.
Vauxhall and Pottersburg	Peak Shaving	The City is investigating peak shaving opportunities within the two sewersheds to minimize bypass events at the two WWTPs during storm events.
Vauxhall	Available space	The Vauxhall WWTP is situated on a plot of land that has available space for additional infrastructure.

The identified constraints pertaining to wastewater treatment are outlined in Table 4-2.

Table 4-2. Wastewater Treatment Constraints

Treatment Plant	Constraint	Description
Pottersburg	No space	The Pottersburg WWTP is situated on a plot of land that does not have available space for additional infrastructure.
Pottersburg	Aging infrastructure	The Pottersburg WWTP was originally commissioned in 1955 and the infrastructure visually appears to be deteriorating.
Pottersburg	Secondary clarifiers	Average daily flow constraints observed during stress testing (per Stantec report: Pottersburg WWTP Stress Testing – Summary Report Draft).
Vauxhall	Thickened sludge disposal	Thickened sludge is trucked to the Greenway incinerator for disposal, which involves transportation through residential neighbourhoods.

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Table 4-2. Wastewater Treatment Constraints

Treatment Plant	Constraint	Description
Vauxhall	Aerobic bioreactors	Average daily flow constraints reported by XCG in their report: Capacity Assessment of the City of London's Wastewater Treatment Plants.
Vauxhall	Secondary clarifiers	Average daily flow constraints observed during stress testing (per Stantec report: Vauxhall WWTP Stress Testing – Summary Report Draft).

4.3 Selection of Alternatives

4.3.1 Long List of Alternatives

In consideration of the wastewater treatment opportunities and constrains identified above, a long list of potential management alternative components was created, and is provided below, categorized as either short-term (next 20 years) or long-term (next 50 years) integrated solutions. The long list of management alternative components will be used to generate a reasonable list of alternative solutions.

4.3.1.1 Short-term Integrated Alternative Solutions

The five short-term alternative solutions have been selected based on the EA guidelines for the development of a reasonable list of alternatives and the requirement to meet the study goals, objectives, and targets in the near term. With exception of the Do-Nothing alternative, each alternative solution contains key differentiating components and common alternative components from the long list that support the EA objectives. The following sections provide a detailed description of each short-term alternative.

Alternative 1 – Do-Nothing. The Do-Nothing option is a required baseline condition alternative that allows for the assessment of anticipated impacts if no remedial or mitigative measures are carried out to address the EA objectives.

Alternative 1 is not considered a realistic option for the City, as growth would be limited to the existing capacity limits at the existing WWTPs. Such a situation would put restrictions on the economic growth potential for the area.

Alternative 2 – Minor Capacity Increase at Vauxhall WWTP. The goal of the minor capacity increase at the Vauxhall WWTP is to accommodate future flows due to short-term growth within the Vauxhall sewershed. The minor capacity increase could be accomplished in a variety of ways, including, but not limited to, the following:

- Optimize chemical for CEPT.
- Conduct hydraulic analysis to identify and correct hydraulic limitations:
  - Focus on improvements to pass flows greater than current restrictions identified in the stress testing report (60 MLD due to secondary clarifier weir flooding and 55 MLD when Thames River is high).
- Peak flow shaving utilizing onsite tanks.
- Implement denitrification (if required in future) at the WWTP by converting part of the current bioreactor volume to anoxic.
- Upgrade existing oxygenation system (for example, VFDs on blowers, or automated blower control based on DO).

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A minor capacity increase at the Vauxhall WWTP is not considered a realistic option for the City, as growth potential within the Vauxhall sewershed is very limited, and this option does not provide adequate servicing to support planned growth in the Pottersburg sewershed. Similar to Alternative 1, such a situation would put restrictions on the economic growth potential for the area.

Alternative 3 – Major Capacity Increase at Vauxhall WWTP. The goal of the major capacity increase at the Vauxhall WWTP is to accommodate future flows due to short-term growth within the Vauxhall and Pottersburg sewersheds. The major capacity increase could be accomplished in a variety of ways, including, but not limited to, the following:

- Wet weather treatment:
  - Split flow treatment
  - Parallel auxiliary treatment:
    - Take WWF and put through a standby system (for example, high rate clarification)
    - Evaluate biologically enhanced high rate clarification
    - Evaluate intermittent step-feed or contact stabilization
- Denitrification implementation (if required in future) at the WWTP by constructing new anoxic tanks upstream of the existing bioreactors
- New treatment train consisting of new bioreactors and secondary clarification
- Retrofitting of primary clarifiers with Lamella plates to improve settling
- Retrofitting secondary clarifiers with energy dissipating inlets, centre wells, baffling to improve settling efficiency
- MLSS ballasting (for example, Evoqua's BioMag system) to permit higher secondary clarifier peak SOR
- New partial dewatering facility to handle solids

A major capacity increase at the Vauxhall WWTP is considered a realistic option for the City, as it can accommodate planned short-term growth potential within the Vauxhall and Pottersburg sewersheds. Transfer of sewage to the Vauxhall WWTP from the Pottersburg sewershed would be accomplished via the Vauxhall-Pottersburg Interconnection, which is currently planned for construction within the next five years. The Vauxhall WWTP would need to be re-rated to treat an ADF of 60 MLD under this option. Space exists at the Vauxhall WWTP site to accommodate a major upgrade.

Alternative 4 – Minor Capacity Increase at Pottersburg WWTP. The goal of the minor capacity increase at the Pottersburg WWTP is to accommodate future flows due to short-term growth within the Pottersburg sewershed. The minor capacity increase could be accomplished in a variety of ways, including, but not limited to, the following:

- Peak flow shaving utilizing onsite tanks
- Conducting hydraulic analysis to identify and correct hydraulic limitations:
  - Focus on improvements to pass flows greater than current restrictions identified in the stress testing report (20 MLD due to secondary clarifier flooding in Section 1, and 75 MLD due to Section 2 and 3 primary clarifier influent channel flooding)
- Denitrification implementation (if required in future) at the WWTP by converting part of the current bioreactor volume to anoxic

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A minor capacity increase at the Pottersburg WWTP is not considered a realistic option for the City, as the Pottersburg WWTP site does not have adequate space to accommodate a capacity increase, and the existing infrastructure will likely need to be replaced in the near-term.

Alternative 5 – Major Capacity Increase at Pottersburg WWTP. The goal of the major capacity increase at the Pottersburg WWTP is to accommodate future flows due to short-term growth within the Vauxhall and Pottersburg sewersheds. The major capacity increase could be accomplished in a variety of ways, including, but not limited to, the following:

- Wet weather treatment:
  - Implementation of CEPT and chemical enhancement of secondary treatment at Pottersburg
  - Split flow treatment
  - Parallel auxiliary treatment:
    - Take WWF and put through a standby system (for example, high rate clarification).
    - Evaluate biologically enhanced high rate clarification.
    - Evaluate intermittent step-feed or contact stabilization.
- Denitrification implementation (if required in future) at the WWTP by constructing new anoxic tanks upstream of the existing bioreactors
- New headworks, primary clarification, bioreactors, secondary clarification, and disinfection
- Additional secondary clarifier area to increase secondary clarification capacity
- MLSS ballasting (for example, Evoqua's BioMag system) to permit higher secondary clarifier peak SOR
- New partial dewatering facility to handle solids

Similar to Alternative 4, a major capacity increase at the Pottersburg WWTP is not considered a realistic option for the City, as the Pottersburg WWTP site does not have adequate space to accommodate a capacity increase, and the existing infrastructure will likely need to be replaced in the near-term.

4.3.1.2 Long-term Integrated Alternative Solutions

The nine long-term alternative solutions have been selected based on the EA guidelines for the development of a reasonable list of alternatives and the requirement to meet the study goals, objectives, and targets in the long term. With exception of the Do-Nothing alternative, each alternative solution contains key differentiating components and common alternative components from the long list that support the EA objectives. The following sections provide a detailed description of each long-term alternative.

Alternative 1 – Do Nothing. The Do-Nothing option is a required baseline condition alternative that allows for the assessment of anticipated impacts if no remedial or mitigative measures are carried out to address the EA objectives.

Alternative 1 is not considered a realistic option for the City, as growth would be limited to the existing capacity limits at the existing WWTPs. Such a situation would put restrictions on the economic growth potential for the area.

Alternative 2 – Replace Pottersburg WWTP with Advanced Treatment Facility. Replacing the Pottersburg WWTP with a new state-of-the-art treatment facility that will accommodate the treatment needs of the sewershed forecasted over the next 50 years. Demolition of the existing WWTP and construction of the new facility would occur after the short-term upgrades to the Vauxhall WWTP and

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the Vauxhall-Pottersburg Interconnection projects were complete so that sewage generated in the Pottersburg sewershed could be treated at the Vauxhall WWTP.

Alternative 2 will deal with the need to address aging infrastructure at the Pottersburg WWTP, but will not address aging infrastructure at the Vauxhall WWTP.

Alternative 3 – Replace Vauxhall WWTP with Advanced Treatment Facility. Replacing the Vauxhall WWTP with a new state-of-the-art treatment facility that will accommodate the treatment needs of the sewershed forecasted over the next 50 years. Demolition of the existing WWTP and construction of the new facility would occur after the short-term upgrades to the Vauxhall WWTP and the Vauxhall-Pottersburg Interconnection projects were complete so that sewage generated in the Vauxhall sewershed would be treated at the Pottersburg WWTP.

Alternative 3 will deal with the need to address aging infrastructure at the Vauxhall WWTP, but will not address aging infrastructure at the Pottersburg WWTP. Further, the Pottersburg WWTP would need to be upgraded to handle the additional capacity of receiving Vauxhall's sewage, plus the sewage generated in the Pottersburg sewershed during construction of the new Vauxhall WWTP.

Alternative 4 – Replace Vauxhall and Pottersburg WWTPs each with Advanced Treatment Facilities. Replacing both the Vauxhall and Pottersburg WWTPs each with new state-of-the-art treatment facilities that will accommodate the treatment needs forecasted over the next 50 years in both sewersheds. Demolition of the existing WWTP and construction of the new facility would occur after the short-term upgrades to the Vauxhall WWTP and the Vauxhall-Pottersburg Interconnection projects were complete so that sewage generated in either sewershed could be treated at the other facility, as needed, to accommodate construction. Based on the implementation of the preferred short-term alternative (that is, upgrades to the Vauxhall WWTP to handle flows from both sewersheds), the Pottersburg WWTP would need to be upgraded first, followed by the Vauxhall WWTP.

Alternative 4 will deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs. The City will need to continue to operate two separate treatment systems under this scenario.

Alternative 5 – Replace Vauxhall and Pottersburg WWTPs with one Advanced Treatment Facility. Replacing both the Vauxhall and Pottersburg WWTPs with one new state-of-the-art treatment facility that will accommodate the treatment needs forecasted over the next 50 years from both sewersheds (that is, 100 MLD). The new facility could potentially be located at the site of one of the existing facilities, or elsewhere in the Pottersburg or Vauxhall sewersheds. Once complete, the new facility would receive sewage from both sewersheds via pumping stations installed at the Vauxhall and Pottersburg WWTPs.

Alternative 5 will deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs, plus the City can reduce the number of operating plants.

Alternative 6 – Replace Vauxhall and Pottersburg WWTPs with one Advanced Treatment Facility with Capacity for Additional Flow from Other Sewershed. Replacing the Vauxhall and Pottersburg WWTPs with one new state-of-the-art treatment facility that will accommodate the treatment needs forecasted over the next 50-years from both sewersheds (that is, 100 MLD), plus an additional 40 MLD from an external sewershed. The new facility could potentially be located at the site of one of the existing facilities, or elsewhere in the Pottersburg or Vauxhall sewersheds. Once complete, the new facility would receive sewage from the sewersheds via pumping stations installed at the Vauxhall and Pottersburg WWTPs, and elsewhere to support growth and development in other sewersheds.

Alternative 6 will deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs, plus the City can reduce the number of operating plants. Alternative 6 provides the most flexibility for planning future growth and development since it allows for spare capacity to receive sewage from priority or strategic areas, as required.

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Alternative 7 – Convert Vauxhall or Pottersburg WWTP into Industrial Pre-treatment Facility. Converting either the Pottersburg or Vauxhall WWTPs into an industrial pre-treatment facility would provide some level of treatment for industrial wastewater prior to conventional treatment for domestic sewage.

Alternative 7 does not deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs. Additionally, the City has noted that the concept of pretreating industrial wastewater is against City policy and, therefore, not a realistic option for further consideration.

Alternative 8 – Concentrate Liquid Treatment at Pottersburg WTWP & Solids Treatment at Vauxhall WWTP. Concentrating liquids treatment at the Pottersburg WWTP and solids treatment at the Vauxhall WWTP would be accomplished via the Pottersburg-Vauxhall Interconnection. Raw sewage from the Vauxhall sewershed would be pumped to Pottersburg WWTP for treatment, while sludge generated at Pottersburg WWTP would be pumped to Vauxhall WWTP for treatment.

Alternative 8 will not ultimately deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs, plus the Pottersburg WWTP needs to be upgraded to handle the sewage capacity from both sewersheds.

Alternative 9 – Concentrate Liquid Treatment at Vauxhall WTWP & Solids Treatment at Pottersburg WWTP. Concentrating liquids treatment at the Vauxhall WWTP and solids treatment at the Pottersburg WWTP would be accomplished via the Pottersburg-Vauxhall Interconnection. Raw sewage from the Pottersburg sewershed would be pumped to the upgraded Vauxhall WWTP for treatment, while sludge generated at Vauxhall WWTP would be pumped to Pottersburg WWTP for treatment.

Alternative 9 will not ultimately deal with the need to address aging infrastructure at both the Vauxhall and Pottersburg WWTPs; however, this scenario would eliminate the need to truck sludge from the Vauxhall WWTP through the residential neighbourhoods to Greenway WWTP for incineration.

4.3.2 Screening of Alternatives Treatment Solutions

The initial screening of alternative treatment solutions (that is, a pass or fail) is provided in Table 4-3.

Table 4-3. Screening of Alternative Treatment Solutions

Alternative Number	Alternative	Description	Initial Screening
Short-term			
1	Do-Nothing	Do nothing; leave as is	✘
2	Minor capacity Increase at Vauxhall WWTP	Capacity increase to handle anticipated growth in the Vauxhall sewershed	✘
3	Major capacity Increase at Vauxhall WWTP	Capacity increase to handle anticipated growth in both sewersheds	✓
4	Minor capacity increase at Pottersburg WWTP	Capacity increase to handle anticipated growth in Pottersburg sewershed	✘
5	Major capacity increase at Pottersburg WWTP	Capacity increase to handle anticipated growth in both sewersheds	✘

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Table 4-3. Screening of Alternative Treatment Solutions

Alternative Number	Alternative	Description	Initial Screening
Long-Term			
1	Do-Nothing	Do nothing; leave as is	✗
2	Replace Pottersburg WWTP	Replacement with new facility capable of handling anticipated growth in the Pottersburg sewershed	✓
3	Replace Vauxhall WWTP	Replacement with new facility capable of handling anticipated growth in the Vauxhall sewershed	✓
4	Replace Pottersburg and Vauxhall WWTP with two new WWTPs	Replacement with new facilities capable of handling anticipated growth in their respective sewershed	✓
5	Replace Vauxhall and Pottersburg WWTPs with one new WWTP	Replacement with new facility capable of handling anticipated growth in both sewersheds	✓
6	Replace Vauxhall and Pottersburg WWTPs with one new WWTP with capacity for additional flow from other sewersheds	Replacement with new facility capable of handling anticipated growth in both sewersheds, plus flow from outside the sewershed	✓
7	Convert either Pottersburg or Vauxhall WWTPs to an Industrial Pre-treatment Facility	Focus industrial wastewater pre-treatment at one location while other location treats municipal wastewater and pre-treated industrial wastewater	✗
8	Concentrate liquids treatment at Pottersburg WWTP	Focus liquids treatment from both sewersheds at Pottersburg WWTP and solids treatment at Vauxhall WWTP	✓
9	Concentrate liquids treatment at Vauxhall WWTP	Focus liquid treatment from both sewersheds at /Vauxhall WWTP and solids treatment at Pottersburg WWTP	✓

✓ =alternative passes screening

✗ = alternative fails screening

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4.4 Evaluation of Treatment Alternatives

The evaluation of the integrated long-term alternative solutions follows the standard EA approach through the development of a comprehensive set of evaluation criteria. Evaluation of the integrated short-term alternative solutions was not carried forward since only one short-term alternative solution was identified as feasible by the project team. Evaluation criteria are grouped in the following four main objective categories:

1. Technical Criteria
2. Social and Cultural Criteria
3. Environmental Criteria
4. Economic Criteria

The purpose of this evaluation is to eliminate alternatives that do not meet the objectives put forward in the problem statement, and to identify a preferred alternative that best satisfies the objectives of the EA. The preferred alternative then undergoes further detailed analysis and development to confirm it can meet the objectives of the EA and to identify, at a concept level, the requirements for implementation.

A major capacity increase at Vauxhall WWTP (for example, a new treatment capacity of 60 MLD) was determined to be the only preferred short-term alternative; therefore, the evaluation criteria were not applied to this selected alternative.

4.4.1 Criteria Development

Table 4-4 lists the criteria developed for the evaluation for the identified long-term alternative solutions. Criteria were developed under each of four main objective categories and a performance scale was developed to provide an assigned level of performance for each alternative under each criterion. The scale provides a "10" for the highest level of performance, a "5" for a median level of performance, and a "0" for no recognized level of performance. This style of performance scale highlights the differences and similarities between alternatives.

A sensitivity analysis was performed to evaluate the effects of different weighting factors on the alternatives ranking. This was completed to assess the stability of the ranking exercise. The stability of the ranking exercise is deemed to be high if different weighting factors used in the sensitivity analysis do not substantially alter the outcome of the ranking. The two long-term alternatives that were tied with the best score scored the same (that is, remained tied for the best score), regardless of the different weighting factors applied to each of the four main categories. Therefore, category weighting has little influence on the evaluation outcome.

The evaluation of long-term screened treatment system alternatives is provided in Table 4-4.

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Table 4-4. Evaluation of Treatment System Screened Long-term Alternatives

Category	Criteria	Description
Technical	Performance	The ability of the alternative to satisfactorily perform its intended function. Reliable operation with O&M requirements comparable to existing systems. Ability to meet effluent objectives. Minimal impacts on existing operation requirements and performance.
	Public Health and Safety	The potential risk/liability or benefit to community health and safety.
	Operations Health and Safety	The potential risk/liability or benefit to occupational health and safety.
	Integration into Current Processes	The ability of the alternative system to be easily implemented on a technical, regulatory, and practical basis.
	Flexibility	The ability of the alternative to meet long-term requirements (that is, space available on-site; flexible with respect to implementation of other technologies; ability to expand beyond 50 years; and, the ability to meet future effluent requirements
	Sustainability	The ability for the alternative to balance economic, environmental and social considerations (Key Direction No. 8 of The London Plan).

Table 4-4. Evaluation of Treatment System Screened Long-term Alternatives

Category	Criteria	Description
Social and Cultural	Public Acceptability	The acceptability of the overall strategy by the public/users.
	Odour Impact	The potential effect the alternative may have on odour production.
	Noise Impact	The potential effect the alternative may have on noise production either during construction or operation.
	Impact on Surrounding Land Uses	The potential effect the alternative may have on the character of the area.
Environmental	Water Quality and Aquatic Systems	The potential effect the alternative may have receiving water quality and aquatic systems.
	Terrestrial Systems	The potential effect the alternative may have on terrestrial habitats or systems, including possible impacts on wildlife (including mammals, reptiles, birds) and terrestrial features/functions.
	Air Quality	Air Quality The potential effect the alternative may have on air emissions.
	Groundwater	The potential effect the alternative may have on groundwater resources.
Economic	Capital Cost	The estimated costs for capital works.
	O&M Cost	The estimated operating costs for staff resources, energy needs, and ongoing routine O&M activities.
	Lifecycle Cost	The total annual capital and operating/maintenance costs amortized over 50 years.

Note:

O&M = operations and maintenance

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4.4.2 Evaluation Results

The results of the evaluation scoring exercise indicate that Alternative 5 and Alternative 6 are tied with the highest score. These two alternatives remained tied with the highest score throughout the sensitivity testing described above.

Based on the evaluation, Alternative 1 is eliminated from further assessment. This alternative did not pass through this stage of the evaluation exercise, primarily because it did not effectively address the EA objectives and targets. Alternative 1 is the Do-Nothing alternative, and therefore does not address the future servicing needs and aging infrastructure issues within each sewershed. It serves as a benchmark for comparison with the other alternatives.

4.4.3 Scoring of Preferred Alternative

Alternatives 5 and 6 are similar, with the provision of 40 MLD of additional treatment capacity in Alternative 6 as the key difference. This section summarizes the scoring for each alternative.

4.4.3.1 Performance

All alternatives were assigned a score of 10, given that they would be designed to meet performance objectives.

4.4.3.2 Public Health and Safety

All alternatives were assigned a score of 5, since construction would be occurring at Pottersburg and/or Vauxhall WWTPs regardless of the alternative selected, and these two facilities are located within neighbourhoods and/or adjacent to public spaces.

4.4.3.3 Operations Health and Safety

All alternatives were assigned a score of 10, given that they would be designed to meet operational health and safety objectives.

4.4.3.4 Integration into Current Processes

All alternatives were assigned a score of 5, except for Alternative 5 and Alternative 6, which were assigned a score of 10 since they represent options that do not require any integration into existing processes.

4.4.3.5 Flexibility

All alternatives were assigned a score of 5, except for Alternative 5 and Alternative 6, which were assigned a score of 10 since they represent options that can allow for more flexibility given they are new designs, potentially on greenfield sites.

4.4.3.6 Sustainability

All alternatives were assigned a score of 5, except for Alternative 5 and Alternative 6, which were assigned a score of 10 since they represent new facilities that could be sustainably designed.

4.4.3.7 Public Acceptability

All alternatives were assigned a score of 5, since construction would occur at Pottersburg and/or Vauxhall WWTPs regardless of the alternative selected, and these two facilities are located within neighbourhoods and/or adjacent to public spaces.

4.4.3.8 Odour Impact

Alternatives involving new facility construction (i.e., Alternatives 2, 3, 4, 5, and 6) were assigned a score of 10, since new odour treatment systems, meeting current regulatory requirements and consisting of current industry best-practices could be incorporated into the design.

4.4.3.9 Noise Impact

All alternatives were assigned a score of 5, since construction would occur at Pottersburg and/or Vauxhall WWTPs regardless of the alternative selected, and these two facilities are located within neighbourhoods and/or adjacent to public spaces.

4.4.3.10 Impact on Surrounding Land Uses

Alternatives involving new facility construction (i.e., Alternatives 2, 3, 4, 5, and 6) were assigned a score of 10, since their design and construction can incorporate elements which would have the potential to enhance the visual aesthetic of the WWTP in question.

4.4.3.11 Water Quality and Aquatic Systems

Alternatives involving new facility construction (i.e., Alternatives 2, 3, 4, 5, and 6) were assigned a score of 10, since new, treatment processes using current industry best-practices, which would be capable of achieving stringent effluent quality could be incorporated into the design.

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4.4.3.12 Terrestrial Systems

All alternatives were assigned a score of 10, given that the type and extent of construction would be relatively similar. CH2M assumed that new facilities could be sited in areas that have less impact on surrounding land use and wildlife habitat.

4.4.3.13 Air Quality

All alternatives were assigned a score of 10, given that the type and extent of construction would be relatively similar, and the treatment processes would be relatively similar.

4.4.3.14 Groundwater

All alternatives were assigned a score of 10, given that the type and extent of construction would be relatively similar, and the treatment processes would be relatively similar.

4.4.3.15 Capital Cost

Alternatives 7, 8, and 9 received a score of 10, since they are expected to be least expensive relative to the other alternatives. A score of 5 was assigned to Alternatives 2 and 3, since they were assumed to be more expensive than Alternatives 7, 8, and 9, but less expensive than Alternatives 5 and 6. Note that CH2M has not yet completed any costing for the alternatives. These scores are qualitative only at this time.

4.4.3.16 Operation and Maintenance Cost

Alternatives 5 and 6 received a score of 10, since they represent new facilities with new equipment and processes for treatment. Note that CH2M has not yet completed any costing for the alternatives. These scores are qualitative only at this time.

4.4.3.17 Lifecycle Cost

Alternatives 5 and 6 received a score of 10, since they represent new facilities with new equipment and processes for treatment. Note that CH2M has not yet completed any costing for the alternatives. These scores are qualitative only at this time.

4.4.4 Identification of Preferred Treatment Alternative

4.4.4.1 Short-term

Alternative 3, a major capacity increase at Vauxhall WWTP to achieve a new treatment capacity of 60 MLD, was determined to be the only preferred short-term alternative for the following reasons:

- There is available space at Vauxhall WWTP whereas there is no space at Pottersburg WWTP.
- Vauxhall sewershed is established. Pottersburg sewershed is currently in growth-mode.
- Flow pumped from Pottersburg to Vauxhall via Interconnection to free-up capacity at Pottersburg WWTP to handle anticipated growth.
- Treatment of 60 MLD at Vauxhall matches the current combined capacity of Vauxhall and Pottersburg WWTPs. Portions of Pottersburg can be maintained based on anticipated growth in that sewershed and to optimize treatment between the Pottersburg and Vauxhall.

Upgrades at Vauxhall may include, but are not limited to, the following options:

- Implement Pottersburg-Vauxhall Interconnection, with consolidation of solids handling at Pottersburg WWTP.
- Increase capacity by making operational and/or process improvements.

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- Construct an effluent PS.

4.4.4.2 Long-term

As indicated in Table 4-5, Alternatives 5 (replacing both WWTPs with a new WWTP) and 6 (replacing both WWTPs with a new WWTP sized for additional flow) were tied for the top score. These two alternatives remained tied with the highest score throughout the sensitivity testing performed. Given the long-term nature of these alternatives, the project team decided to carry forward with further studies for both to determine which of the two is ultimately preferred. These studies would be undertaken during a future phase of work.

In the meantime, the City will carry forward with the short-term alternative to increase the treatment capacity at the Vauxhall WWTP.

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Table 4-5. Treatment Systems Detailed Evaluation Criteria

Dimension	Criterion	Description	Measure		
			10	5	0
Technical	Performance	The ability of the alternative to perform its intended function including O&M requirements comparable to existing systems, the ability to meet effluent objectives, and have minimal impacts on existing operation requirements and performance.	• Very reliable • Meets or exceeds effluent quality objectives	• Moderately reliable and meets effluent quality objectives.	• Not very reliable, high-levels of operation and maintenance required to meet effluent quality objectives
	Public Health and Safety	Potential risk/liability or benefit to community health and safety.	• Very reliable and effective • Results in very little potential risk to community health and safety compared to other strategies	• Moderately reliable and effective • Potential risks to community health and safety are moderate compared with other strategies	• Not very reliable and effective without substantial mitigation • Potential risks to community health and safety are high compared with other strategies
	Operations Health and Safety	Potential risk/liability or benefit to occupational health and safety.	• Very reliable and effective • Results in very little potential risk to operator health and safety compared to other strategies	• Moderately reliable and effective • Potential risks to operator health and safety are moderate compared with other strategies	• Not very reliable and effective without substantial mitigation • Potential risks to operator health and safety are high compared with other strategies
	Integration into Current Processes	The alternative system can be easily implemented on a technical, regulatory, and practical basis (land availability, operational aspects, etc.): • Ease of receiving regulatory approvals • Can be implemented based on current knowledge or if it requires pilot demonstrations for further study	• Very easy to implement with respect to approvals and construction	• Can be somewhat difficult to implement with respect to approvals with some constraints	• Presents many difficulties with respect to implementation
	Flexibility	The ability of the alternative to meet long-term requirements: • Space available on-site • Flexible with respect to implementation of other technologies • Ability to expand beyond 50 years • Ability to meet future effluent requirements	• Can easily be expanded in the future on-site	• Somewhat flexible to meet long-term needs (some constraints)	• Not very flexible • May be difficult to meet needs in long-term
	Sustainability	The ability for the alternative to balance economic, environmental and social considerations as outlined in Key Direction No. 8 of *The London Plan*.	• Best balance between economic, environmental and social considerations compared to other alternatives	• Moderate balance between economic, environmental and social considerations compared to other alternatives	• Poor balance between economic, environmental and social considerations compared to other alternatives
Social & Cultural	Public Acceptability	Public/user acceptability of overall strategy including acceptance to: • Short-term construction impacts • Possible noise/odour from control technologies	• Deemed most acceptable to public/user because it has least negative impacts.	• Deemed somewhat acceptable	• Deemed not very acceptable to public/user because it has several negative impacts
	Odour Impact	The potential of the alternative to produce odours.	• Little or no potential to produce odour.	• Moderate potential to produce odour	• High potential to produce odour • Substantial mitigation needed to control
	Noise Impact	The potential of the alternative to produce noise either during construction or operation.	• Little or no potential to produce noise	• Moderate potential to produce noise	• High potential to produce noise • Substantial mitigation needed to control
	Impact on Surrounding Land Uses	The potential of the alternative to impact the character of the area.	• Potential to enhance the visual character of the area	• Maintains the visual character of the area; some changes in aesthetics occur	• Detriment to the visual character of the area • Substantial changes to aesthetics

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Table 4-5. Treatment Systems Detailed Evaluation Criteria

Dimension	Criterion	Description	Measure		
			10	5	0
Environmental	Water Quality and Aquatic Systems	The potential of the alternative to adversely impact the receiving water quality and aquatic systems.	• Results in substantial improvements to water quality and does not adversely impact aquatic systems.	• Results in moderate improvements to water quality and aquatic systems.	• Results in little improvement to water quality beyond regulations • Substantial mitigation required to control impacts on aquatic systems
	Terrestrial Systems	The potential of the alternative to impact terrestrial habitats or systems, including possible impacts on wildlife (including mammals, reptiles, birds) and terrestrial features/functions.	• Minimal potential to negatively impact terrestrial systems and habitats.	• Moderate potential for negative impacts on terrestrial systems and habitats. Measures are available to mitigate impacts.	• High potential for negative impacts on terrestrial systems and habitats.
	Air Quality	The potential of the alternative to increase air emissions.	• Results in minimal air emissions	• Results in moderate amounts of air emissions, but does not negatively impact air quality	• Results in high amounts of air emissions • Substantial mitigation required to control air emissions to meet regulations
	Groundwater	The potential of the alternative to impact groundwater resources.	• No or minimal impact on groundwater resources	• Moderate impacts on groundwater resources	• High impacts on groundwater resources • Substantial mitigation needed to control.
Economic	Capital Cost	Estimated costs for capital works (including up-front capital investments).	• Low capital costs compared to other alternatives	• Moderate capital costs compared to other alternatives	• High capital costs compared to other alternatives
	O&M Cost	Estimated operating costs for staff resources, energy needs, and ongoing routine O&M activities.	• Low operating costs compared to other alternatives	• Moderate operating costs compared to other alternatives	• High operating costs compared to other alternatives
	Lifecycle Costs	Total annual capital and operating/maintenance costs amortized over 50 years: • Estimated costs for capital works (including up-front capital investments) • Estimated operating costs for staff resources, energy needs, and ongoing routine O&M activities	• Low lifecycle costs compared to other alternatives	• Moderate lifecycle costs compared to other alternatives	• High lifecycle costs compared to other alternatives

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Development and Selection of Collection System Alternatives

5.1 Technical Objectives and Targets

The technical objectives and targets considered during the development of alternatives for the collection system are as follows:

- Address existing and future capacity constraints within the Pottersburg and Vauxhall sewershed.
- Compliment the preferred WWTP short-term alternative.
- Compliment the preferred WWTP long-term alternative.

5.2 Opportunities and Constraints

The identified opportunities pertaining to the collection system are outlined in Table 5-1.

Table 5-1. Collection System Opportunities

Sewershed	Opportunity	Description
Pottersburg	Pottersburg STS Realignment	Proposed new route for the Pottersburg STS upstream of Dundas St. The proposed Pottersburg STS will have increased capacity compared to existing conditions and regulate the amount of flow to the southern portion of the Pottersburg STS.
Pottersburg	Upcoming infrastructure renewal projects	Planned Infrastructure projects/upgrades
Pottersburg	East Park Sewage Pumping Station Upgrades	Planned capacity upgrades at the East Park PS
Vauxhall	Removal of the Egerton Trunk	Sanitary flows will be diverted to Eleanor STS; storm flows will be diverted to Burbrook Place.
Vauxhall	Mornington Area Storm Drainage Servicing EA	To address storm and sanitary servicing, including addressing sanitary capacity constraints in the Mornington Ave area as well as the potential to address sewer separation and source control options in the area.
Vauxhall	Upcoming infrastructure renewal projects	Planned Infrastructure projects/upgrades
Pottersburg and Vauxhall	Pottersburg/Vauxhall Interconnection	Involves being able to transfer flow between the Vauxhall and Pottersburg WWTPs to utilize the available capacity at each.
Pottersburg and Vauxhall	Increased Capacity at Vauxhall	The proposed short-term WWTP alternative is to increase the capacity at the Vauxhall WWTP. This may allow for opportunity to divert more flows from Pottersburg sewershed to Vauxhall sewershed.
Pottersburg and Vauxhall	City's Basement Flooding Grant Program	To help fund weeping tile disconnection.
Pottersburg and Vauxhall	New Large WWTP	The proposed long-term WWTP alternative is to build a new large WWTP. This may allow the opportunity for flows in both sewersheds to more directly reach the WWTP and eliminate PSs.

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The identified constraints pertaining to the collection system are outlined in Table 5-2.

Table 5-2. Collection System Constraints

Sewershed	Constraint	Description
Pottersburg	Pottersburg STS	The Pottersburg STS has insufficient capacity (model predicts surcharging during a 2-year design storm)
Pottersburg	Population growth	Population growth is expected in the Pottersburg sewershed.
Pottersburg and Vauxhall	Infrastructure replacement to be on right-of-way	Infrastructure through private property will require easements.
Pottersburg and Vauxhall	Minimize infrastructure upgrades on high-traffic streets	Reduce traffic disruption
Pottersburg and Vauxhall	Minimize risk of basement flooding	Freeboard >1.8 m during 100-year design storm
Vauxhall	Minimize SSO overflows.	Reduce the overflow volume at SSOs in the Vauxhall sewershed.[a]

[a] Note that Pottersburg sewershed does not have any SSOs.

5.3 Selection of Alternatives

5.3.1 Long List of Alternatives

In consideration of the collection system opportunities and constrains identified above, a long list of potential management alternative components was developed. The purpose of a long list of collection system alternatives is to identify the full range of technologies and best practices available to mitigate the capacity constraints in the collection system and compliment the wastewater treatment preferred alternative. Alternatives were developed under existing, short-term, and long-term categories:

Alternative 1 – Do-Nothing. The Do-Nothing option is a required baseline condition alternative that allows for the assessment of anticipated impacts if no remedial or mitigative measures are carried out to address the EA objectives.

This is not considered a realistic option for the City, as growth would be limited to the existing capacity limits.

Existing alternatives are projects and programs that are currently underway to improve the capacity of the collection system.

Short-term alternatives may be implemented within the next 20 years to account for collection system capacity constraints that are in addition to the existing alternatives, to account for population growth, and to compliment the wastewater treatment short-term preferred alternative.

Long-term alternatives may be implemented after 20 years to compliment the wastewater treatment long-term preferred alternative.

5.3.1.1 Existing Alternatives

The purpose of identifying the existing alternatives (Table 5-3) is to understand the active planned capacity improvements to the Vauxhall and Pottersburg sewersheds. Existing alternatives will not be evaluated in this EA as these are currently active initiatives.

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Table 5-3. Existing Alternatives.

Alternative Number	Alternative	Description
1	Do-Nothing	Do nothing; leave as-is.
2	Disconnect Weeping Tiles	Applies to homes built between 1920 to 1985. Weeping tile connections to sanitary and combined sewers are a source of I&I. The City has a Basement Flooding Grant Program available to residential homeowners, condominium corporations and non-profit housing co-operatives to help pay for the costs of installing a sump pit and pump, and backwater valve, once weeping tiles are disconnected from the sanitary system.
3	Disconnect Downspouts	Downspout disconnection programs to educate and/or provide incentives and/or prohibit through municipal bylaw to home and building owners for disconnecting roof drains from the sanitary or combined sewers. Disconnection can reduce the volume of I&I to the sewer system. Downspout disconnection includes flat roof disconnection. The removal of these connections can be difficult to enforce.
4	Separate Sewers	This applies only to combined areas and involves separating combined sewers into separate storm and sanitary sewers.
5	Replace Pottersburg Trunk upstream of Dundas St.	The existing Pottersburg Trunk upstream of Dundas Street is in poor conditions and through easements. The existing Pottersburg Trunk Realignment Study (CH2M, 2017) was a study complete to evaluate realigning and replacing the Pottersburg Trunk upstream of Dundas Street.
6	Implement Pump Capacity Upgrades for East Park PS	A recent EA recommended increasing the capacity of the East Park PS at its existing site (R.V. Anderson Associates Limited, 2016).
7	Implement Pottersburg-Vauxhall Interconnection	This was a Municipal Class EA Master Plan completed by AECOM that involves being able to transfer flow between the Vauxhall and Pottersburg WWTPs to utilize the available capacity at each.

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It is estimated that there are approximately 4,950 homes in the Vauxhall sewershed and 5,930 homes in the Pottersburg sewershed have weeping tile connections, and therefore weeping tile disconnection has the potential to reduce I&I in these sewersheds by a substantial amount. Similarly, sewer separation in the Vauxhall sewershed has the potential to substantially reduce the I&I. Due to the previous success of the downspout disconnection program and bylaw enforcement within the City of London, it is unlikely that any further substantial I&I reduction from existing conditions can be achieved from downspout disconnections.

In addition to increasing the capacity, replacing the Pottersburg trunk upstream of Dundas St. may also help reduce I&I in the Pottersburg sewershed as this potion of the trunk sewer is currently in poor condition with the potential for water to infiltrate into the trunk through cracks.

Implementing pump capacity upgrades at the East Park PS and implementing the Pottersburg-Vauxhall interconnection has the potential to help reduce PS and WWTP bypasses and reduce end of pipe capacity constraints.

These existing alternatives align with the goal of improving the capacity of collection system. As these existing initiatives continue to be implemented, it is recommended that the collection system capacity is reassessed using updated flow monitoring and modeling. No further evaluation of the existing alternatives will be completed in this EA.

5.3.1.2 Short-Term Alternatives

The alternatives to address capacity constraints under this category were developed using source control measures, conveyance control measures, and end of pipe control measures, where applicable. Source control measures include municipal programs and policies that remove, capture or reduce the flow of stormwater and groundwater that may be directed to the sanitary or combined sewers. Conveyance control measures include methods of storing, slowing and/or staggering the flow in the sewer system during wet weather events, and increasing pipe capacities. End of pipe control measures occur at the end of a conveyance system or outfall.

Table 5-4 describes the short-term collection system alternatives and identifies the technical, economic, social, and environmental impacts for each alternative.

Table 5-4. Short Term Collection Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 1 – Do-Nothing				
Do nothing; leave as-is				
Alternative 2 – Inspect Sanitary Sewers for Cracks				
This applies to aging sanitary infrastructure in both sewersheds that may have cracks that allows infiltration into the sanitary sewers.	Potential to decrease the I&I entering the sanitary sewers. Could reduce the diameter of the sewer if sewer relining is implemented	Moderate to high capital costs	Sewer relining or new sewers could involve road closure Reducing I&I in the sewer system could reduce downstream bypasses Can reduce basement flooding risks	Reducing I&I in the sewer system could reduce downstream bypasses and sanitary sewer overflows Reducing cracks in the sewer system could improve the surrounding environment Construction should have limited impact on surrounding area
Alternative 3 – Conduct Study to Upsize Eleanor STS				
This involves upsizing the Eleanor STS in the Vauxhall sewershed.	Can be an effective means of reducing basement flooding and SSOs	High capital costs	Major disruptions to public including road closures Can reduce upstream basement flooding risks	Construction should have limited impact on surrounding area
Alternative 4 – Evaluate Available Capacity of Trunks in the Pottersburg Sewershed				
Model simulations in the Pottersburg Sewershed that account for population growth suggest that the Jackson Rd. Trunk, the Pottersburg Trunk (Downstream of Dundas Street), and the Hamilton Rd Trunk have some capacity constraints. This alternative is to verify and evaluate the capacity of these trunks further.	Can be an effective means of reducing basement flooding and SSOs	High capital costs	Major disruptions to public including road closures Can reduce upstream basement flooding risks	Construction should have limited impact on surrounding area

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Table 5-4. Short Term Collection Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 5 – Add Offline Storage along Pottersburg Trunk (downstream of Dundas St.)				
This alternative involves adding offline storage along the Pottersburg Trunk downstream of Dundas Street. Offline Storage combines a number of storage alternatives including offline storage (pipes or tanks), sewer replacement or twinning for additional storage capacity or storage tank or tunnel. Specific storage alternative to be used will need to be confirmed using site specific information at a future design stage.	Typically, most cost-effective means of controlling basement flooding related to WWF Lack of appropriate design standard for sizing Operational challenges to operate and maintain this type of infrastructure Moderate difficulty to implement depending on land availability and site conditions	High capital costs High O&M costs	Construction may significantly disrupt surrounding neighborhood If available open space is used, impact on private property would be minimized	Impact during construction would be confined to surrounding area
Alternative 6 – Implement Pump Capacity Upgrades for Clarke Rd. PS				
Bypassed flow from the Clarke Rd. PS enters the upstream end of the Pottersburg Trunk, and the large majority of the Pottersburg Trunk is simulated to be surcharged during a two-year design storm event. The Clarke Rd. PS currently pumps flows to the Admiral Drive Sub-Trunk, which feeds the Trafalgar Street Sub-Trunk that connects to the southern portion of the Pottersburg Trunk at Trafalgar Street. Increasing the capacity of the Clarke Rd. PS would increase the flows in the southern portion of the Pottersburg Trunk.	Will increase flows to downstream system and treatment facility Flexible pump operation	Moderate capital costs due to cost of mechanical equipment O&M costs similar to normal operation	Implemented using existing infrastructure, impact on residents should be minimal Increased risk of basement flooding downstream of pumping station	Construction should have limited impact on surrounding area

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Table 5-4. Short Term Collection Alternatives

Description	Technical Impacts	Economic Impacts	Social Impacts	Environmental Impacts
Alternative 7 – Conduct Study to redirect pumped flows from the Clarke Rd. PS				
This alternative is to conduct a study to evaluate redirecting the flows from the Clarke Rd. PS to the Adelaide WWTP. It would involve installing a forcemain that can convey flows north along Clarke road to the STS along Cheapside Street leading to the Adelaide WWTP.	Will increase flows to the downstream Adelaide system and treatment facility Will alleviate capacity constraints in the Pottersburg sewershed	High capital costs due to forcemain design and construction O&M costs similar to normal operation	Increased risk of basement flooding downstream of pumping station in the Adelaide sewershed Decreased risk of basement flooding in the Pottersburg sewershed Major disruptions to public including road closures	Construction should have limited impact on surrounding area
Alternative 8 – Conduct study to divert flow from Pottersburg Sewershed				
This alternative is to conduct a study to evaluate diverting flow from the Pottersburg Trunk at Dundas St. under the Pottersburg Creek to the Vauxhall sewershed. This alternative would require replacing approximately 750 m of the sanitary sewer along Dundas St. and Highbury Ave. in the Vauxhall sewershed to allow flow by gravity.	Will increase flows to the downstream Vauxhall system and treatment facility Will alleviate some capacity constraints along the Pottersburg Trunk	High capital costs due to bridge work and downstream sewer replacement Moderate O&M costs for potential required siphon	Increased risk of basement flooding downstream of pumping station in the Adelaide sewershed Decreased risk of basement flooding in the Pottersburg sewershed Would disrupt traffic on arterial road	Implementation could have little to moderate impact on surrounding environment

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5.3.1.3 Long-Term Alternatives

The long-term alternatives are described below in Table 5-5. Long-term alternatives will be screened but will not be evaluated in detail in this EA as these alternatives are dependent on the location of the proposed new WWTP.

Table 5-5. Long-Term Alternatives

Alternative Number	Alternative	Description
1	Do-Nothing	Do nothing; leave as-is
2	Conduct Study to Identify Collection System Efficiencies	This alternative depends on the location of the proposed new WWTP and is to consider efficiencies in conveying the wastewater to the WWTP.
3	Replace existing Vauxhall and Pottersburg WWTPs with PSs	This alternative depends on the location of the proposed new WWTP and involves adding PSs to the existing WWTP locations that can pump flow to the proposed new WWTP.

Table 5-5. Long-Term Alternatives

Alternative Number	Alternative	Description
4	Reroute Collection System	This alternative depends on the location of the proposed new WWTP and involves rerouting trunks and PSs in both sewersheds upstream of the proposed new WWTP.

5.3.2 Screening of Alternatives Collections

The long list of short-term and long-term alternatives was screened using a pass/fail evaluation which results in a short list of feasible alternatives. Table 5-6 shows the results of the screening exercise and indicates whether the alternative is a short-term or long-term alternative. The alternatives are numbered to simplify their reference in subsequence sections of this report. As mentioned in Section 5.3.1, existing alternatives were not evaluated in the EA as these are active initiatives.

Table 5-6. Collection System Screening of Alternatives

Alternative Number	Alternative	Description	Initial Screening
1	Do-Nothing	This applies to aging sanitary infrastructure in both sewersheds that may have cracks that allows infiltration into the sanitary sewers.	✗
Short-term			
2	Inspect Sanitary Sewers for Cracks	This applies to aging sanitary infrastructure in both sewersheds that may have cracks that allows infiltration into the sanitary sewers.	✓
3	Conduct Study to Upsize Eleanor STS	This involves upsizing the Eleanor STS in the Vauxhall sewershed.	✗
4	Evaluate Available Capacity of Trunks in the Pottersburg Sewershed	Model simulations in the Pottersburg Sewershed that account for population growth suggest that the Jackson Road Trunk, the Pottersburg Trunk (Downstream of Dundas Street), and the Hamilton Road Trunk have some capacity constraints. This alternative is to verify and evaluate the capacity of these trunks further.	✓
5	Add Offline Storage along Pottersburg Trunk	This alternative involves adding offline storage along the Pottersburg Trunk downstream of Dundas Street. Offline Storage combines a number of storage alternatives including offline storage (pipes or tanks), sewer replacement or twinning for additional storage capacity or storage tank or tunnel. Specific storage alternative to be used will need to be confirmed using site specific information at a future design stage.	✓
6	Implement Pump Capacity Upgrades for Clarke Road PS	Bypassed flow from the Clarke Road PS enters the upstream end of the Pottersburg Trunk, and the large majority of the Pottersburg Trunk is simulated to be surcharged during a two-year design storm event. The Clarke Road PS currently pumps flows to the Admiral Drive Sub-Trunk, which feeds the Trafalgar Street Sub-Trunk that connects to the southern portion of the Pottersburg Trunk at Trafalgar Street. Increasing the capacity of the Clarke Road PS would increase the flows in the southern portion of the Pottersburg Trunk.	✗
7	Conduct Study to redirect pumped flows from the Clarke Road PS	This alternative is to conduct a study to evaluate redirecting the flows from the Clarke Road PS to the Adelaide WWTP. It would involve installing a forcemain that can convey flows north along Clarke road to the STS along Cheapside Street leading to the Adelaide WWTP.	✓

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Table 5-6. Collection System Screening of Alternatives

Alternative Number	Alternative	Description	Initial Screening
8	Conduct study to divert flow from Pottersburg Sewershed	This alternative is to conduct a study to evaluate diverting flow from the Pottersburg Trunk at Dundas Street under the Pottersburg Creek to the Vauxhall sewershed. This alternative would require replacing approximately 750 m of the sanitary sewer along Dundas Street and Highbury Avenue in the Vauxhall sewershed to allow flow by gravity.	✓
Long-Term			
2	Conduct Study to Identify Collection System Efficiencies	This alternative depends on the location of the proposed new WWTP and is to consider efficiencies in conveying the wastewater to the WWTP.	✓
3	Replace existing Vauxhall and Pottersburg WWTPs with PSs	This alternative depends on the location of the proposed new WWTP and involves adding PSs to the existing WWTP locations that can pump flow to the proposed new WWTP.	✓
4	Reroute Collection System	This alternative depends on the location of the proposed new WWTP and involves rerouting trunks and PSs in both sewersheds upstream of the proposed new WWTP.	✗

✓ = alternative passes screening

✗ = alternative fails screening

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Alternative 1, Do-Nothing, did not pass the screening as it did not address the capacity constraints in the sewersheds or align with the wastewater treatment preferred alternative.

The short-term and long-term alternatives screening discussion follows.

5.3.2.1 Short-Term Alternatives

During the capacity assessment in Section 3, the Eleanor STS was identified as having sufficient capacity, except during extreme storm events. As a result, upsizing the Eleanor STS (short-term Alternative 3) would provide little benefit and this alternative will not be considered further in this EA.

As described in Section 3, bypassed flow from the Clarke Road PS enter the upstream end of the Pottersburg STS, and the majority of the Pottersburg STS is simulated to be surcharged during a two-year design storm event. The Clarke Road PS currently pumps flows to the Admiral Drive Sub-Trunk, which feeds the Trafalgar Street Sub-Trunk that connects to the southern portion of the Pottersburg STS. Increasing the capacity of the Clarke Road PS would help to reduce capacity issues in the upstream portion of the Pottersburg STS but would increase the surcharging downstream where the Trafalgar Street Sub-Trunk connects to the Pottersburg STS. Therefore, this short-term Alternative 6 was eliminated from further evaluation.

Short-term Alternatives 2, 4, 5, 7, and 8 passed the screening as they aligned with the goal of reducing capacity constrains and/or complying with the WWTP short term preferred alternative and were evaluated using the evaluation criteria, as discussed in Section 5.1.4.

5.3.2.2 Long-Term Alternatives

Although the location of the proposed new WWTP has not be confirmed, rerouting the collection system to eliminate the need for pumping stations at the existing PS locations would not be feasible, and therefore long-term Alternative 3 will not be evaluated further.

Long-term Alternative 2 and 3 passed the screening. These long-term screened alternatives are collection system alternatives that compliment the preferred long-term WWTP alternatives and are dependent on the location of the proposed new WWTP. Therefore, it is recommended that the two screened long-term alternatives are carried forward and are revaluated when the location for the new proposed WWTP is selected. No further evaluation will be completed on these preferred long-term alternatives in this EA.

5.4 Evaluation of Collection Alternatives

The short-term and long-term collection alternatives were evaluated using the same process described in Section 4.4.

5.4.1 Criteria Development

Table 5-7 lists the criteria developed for the evaluation of the short-term collection system alternative solutions. Criteria were developed under each of five categories. A performance scale was developed to provide an assigned level of performance for each alternative under each criterion. The scale provides a "10" for the highest level of performance, a "5" for a median level of performance, and a "0" for no recognized level of performance. This style of performance scale highlights the differences and similarities between alternatives.

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Table 5-7. Collection Systems Detailed Evaluation Criteria

Dimension	Criterion	Description	Measure		
			10	5	0
Technical	Constructability, Implementation, and Work Scope	The ability of the alternative to be implemented within the technical, regulatory, and practical constraints.	• Easy to implement and construct • Reasonable construction work scope	• Somewhat easy to implement and construct (some constraints) • Moderate scope of construction work	• Many challenges with respect to implementation and construction • High scope of construction work
	Operations and Maintenance	The ability of the alternative to be successfully operated and maintained by the City.	• Requires minimal operation and maintenance	• Provides a moderate level of operation and maintenance	• Provides considerable operation and maintenance
	Compatibility with Development and Growth	The compatibility of the alternative with development planning in the areas within the study area anticipated for development.	• Provides a substantial amount of flexibility for development planning	• Provides a moderate amount of flexibility for development planning	• Provides a minimal amount of flexibility for development planning
	Compatibility with Infrastructure Renewal Projects	The compatibility of the alternative with planned infrastructure renewal projects.	• Aligns with planned infrastructure replacement project(s)	• May align with future planned infrastructure replacement project(s)	• Does not align with any planned infrastructure replacement project(s)
	Peak Shaving	The ability of the alternative to reduce the peak flow to the WWTPs.	• Substantially reduces peak flow to the WWTPs	• Moderately reduces peak flow to the WWTPs	• Increases peak flow to the WWTPs
	Protection against Basement Flooding	The effectiveness of the alternative to reduce the risk for basement flooding.	• Substantially reduces the risk of basement flooding	• The alternative maintains the existing risk of basement flooding	• The alternative substantially increases the risk of basement flooding
Social & Cultural	Public Health and Safety	The potential of the alternative to reduce the risk to the health and safety of the community.	• Poses very little risk to community health and safety	• Poses moderate risk to community health and safety	• Poses high risk to community health and safety
	Occupational Health & Safety	The potential of the alternative to reduce the risk to the health and safety of City staff.	• Poses very little risk to occupational health and safety	• Poses moderate risk to occupational health and safety • Personal injury may be expected	• Poses high risk to occupational health and safety • Personal injury may be expected
	Recreation	The ability of the alternative to enhance recreation activities.	• Enhances recreational use of the area	• Maintains existing recreational use of the area	• Decreases recreational use of the area
	Aesthetics	The ability of the alternative to maintain or enhance visual character of the community.	• Enhances the visual character of the area	• Maintains the visual character of the area	• Decreased the visual character of the area
	Disruption	The potential for the alternative to disrupt local traffic and or use of the area by the public.	• No disruption to traffic	• Some disruption to traffic and use of the area by the public	• Substantial disruption to traffic and use of the area by the public
	Property Acquisitions	The relative impact that the alternative has on property acquisition requirements.	• Requires no property acquisition	• Requires some property acquisition	• Requires a high amount of property acquisition
Environmental	Water Quality	The potential effects the alternative has on the receiving body of water.	• Impact to the receiving stream is anticipated to be positive	• Impact to the receiving stream is unchanged	• Impact to the receiving stream is anticipated to be negative
	Terrestrial Systems	The potential effects the alternative has on local vegetation, trees and wildlife.	• Least impact to the terrestrial system	• Moderate impact to the terrestrial system	• Most impact to the terrestrial system
Economic	Capital Cost	The estimated capital cost of the alternative.	• Low capital costs compared to other alternatives	• Moderate capital costs compared to other alternatives	• High capital costs compared to other alternatives
	Operations and Maintenance Cost	Estimated ongoing operation and maintenance.	• Low operating costs compared to other alternatives	• Moderate operating costs compared to other alternatives	• High operating costs compared to other alternatives
	Lifecycle Cost	Total annual capital and O&M costs amortized over 20 years.	• Low lifecycle costs compared to other alternatives	• Moderate lifecycle costs compared to other alternatives	• High lifecycle costs compared to other alternatives

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5.4.2 Selection of Preferred Alternative

The screened short-term alternatives were evaluated using the evaluation criteria. The scoring results are summarized in Table 5-8.

Table 5-8. Evaluation of Short-Term Collection Alternatives

No.	Alternative Name	Technical	Social/Cultural	Environment	Economic	Total
2	Inspection of Sanitary Sewers for Cracks	30	45	15	15	105
4	Evaluation of Available Capacity of Trunks	35	45	10	15	105
5	Offline Storage along Pottersburg STS (downstream of Dundas Street)	25	25	5	5	60
7	Conduct study to pump flows from the Clarke Road PS to Adelaide sewershed	20	45	10	10	85
8	Conduct cost-benefit study to divert flow from Pottersburg sewershed	20	40	10	10	80

Short-term Alternatives 4, 7, and 8 are studies, and scores were given based on the assumption that the study results will suggest to proceed with the alternative. For instance, in the following three study alternatives, the outcome can either be do nothing or proceed with the alternative:

- **Alternative 4.** Evaluate the available capacity of the trunks in the Pottersburg sewershed: scores based on implementing design/construction of upsizing the trunks
- **Alternative 7.** Conduct study to pump flows from the Clarke Rd. PS to Adelaide sewershed: scores based on implementing design/construction of pumping flows from the Clarke Rd. PS to the Adelaide sewershed
- **Alternative 8.** Conduct cost-benefit study to divert flow from the Pottersburg sewershed: scores based on implementing design/construction of diverting some flows to the Vauxhall sewershed at Dundas Street

The scoring for short-term Alternative 2 was based on the potential of having to reline or repair a portion of the sewers. For this alternative, the assumption is that the number of sewers required to be relined is reasonable, and that the I&I reduction that can be achieved by repairing the sewers is also reasonable.

All screened short-term alternatives would provide a benefit to the collection system by either reducing capacity constraints or complimenting the wastewater treatment short-term preferred alternative. However, each alternative provides a solution or improvement to different locations and aspects within the collection system. As a result, the purpose of the scoring exercise is to attempt to quantify the magnitude of the benefits from each alternative and identify the most beneficial alternatives, and not necessarily recommend a single preferred solution.

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5.4.2.1 Technical

Under the technical criteria, the largest differentiator was the Operation and Maintenance criterion. Short-term Alternative 4 scored low as this alternative requires O&M for pumps and tank clean out. Short-term Alternative 7 would likely require the use of a siphon, which also resulted in a low score under the O&M criterion. Alternatives that required very little O&M scored high, and alternatives that required a moderate level of O&M or an equivalent level of O&M were scored moderately. Alternatives that involve a large scope of work, such as short-term Alternative 2, Alternative 4, and Alternative 7, were scored low under Constructability, Implementation, and Work Scope.

Under the Compatibility with Development and Growth criterion, alternatives that included I&I reduction, pipe capacity increases, or offline storage were scored high.

Alternative 5 scored low under Compatibility with Infrastructure Renewal Projects since an offline storage tank would likely would be in addition to any infrastructure renewal projects. Alternatives 2, 4, 7, and 8 were scored moderately under compatibility with infrastructure renewal projects.

Alternatives 4 and 5 have the potential to reduce the risk of basement flooding and were scored high under Protection against basement flooding. Alternative 2 was scored moderately under this criterion because although I&I reduction could be achieved from relining any aging pipes, relining also decreases the diameter of the sewer slightly, which reduces the pipe storage. Alternatives 7 and 8 were also scored moderately under this criterion since they reduce upstream surcharging levels but increase downstream surcharging levels.

5.4.2.2 Social & Cultural

All screened short-term alternatives had similar scores under the social and cultural criteria, except for Alternative 5. The reasoning is that an offline storage tank would require property acquisition and would decrease the recreational use and aesthetics in the area, resulting in low scores under Recreation, Aesthetics, and Property Acquisitions criteria.

5.4.2.3 Environmental

The scores under the environmental criteria were similar between each alternative. Short-term Alternative 2 scored high under Water Quality and Aquatic systems because it could prevent wastewater from seeping into the environment. Under terrestrial systems, short-term Alternative 5 scored low as it is expected that this would require a footprint.

5.4.2.4 Economic

Alternatives that involved large infrastructure upgrades were given a low score under the Capital Cost criterion. Alternative 5 was given a moderate score since although it was considered to be the least costly alternative, it is suspected to still be relatively costly.

Under the Operation and Maintenance criterion, Alternative 5 was considered to require the most additional maintenance costs compared to the other alternatives and was given a low score as a result.

5.4.3 Identification of Preferred Alternative

Collection system Alternative 2 and Alternative 4 are the two short-term alternatives that scored favourably during the evaluation. Alternative 2 will identify cracks in aging sewers and prioritize sewers to be relined. This alternative may help reduce the I&I in the collection system. Alternative 4 will assess the capacity of the Jackson Rd. Trunk, the Pottersburg Trunk (downstream of Dundas St.) and the Hamilton Rd. Sub-Trunk. This study should include flow monitoring, consider population projections, and consider the implementation of the existing alternatives.

The remaining alternatives, Alternative 5, Alternative 7, and Alternative 8, did not score favourably and are not recommended at this time.

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SECTION 6

Cost Analysis of Preferred Alternative

6.1 Treatment System Alternatives

6.1.1 Short-term Preferred Alternative

The cost to implement the preferred short-term alternative was developed to a preliminary level and includes cost proposals the City received to implement Evoqua's BioMag and CoMag systems to increase the capacity of secondary treatment stages at Vauxhall WWTP. The cost outlined in Table 6-1 was developed to the minus 30 percent to plus 50 percent level and provides an overall estimate range of $34.8 million to $74.5 million.

Table 6-1. Preferred Short-Term Treatment Costs

	Item Cost
Capital Costs	
Upgrades to Vauxhall WWTP	
Items	
Overall Hydraulic Improvements and Gate Replacements	$700,000
Evoqua BioMag System Components	$4,270,000
Evoqua CoMag System Components	$5,250,000
Additional Tankage for CoMag System	$1,080,000
Earthworks and Civil Upgrades	$150,000
Building to House Evoqua Equipment	$650,000
Magnetite and Dry Chemical Storage Building	$220,000
Chemical Feed and Delivery Systems	$300,000
Polymer Feed and Delivery Systems	$300,000
Upgrades to Aeration System	$300,000
RAS and WAS Pumping Upgrades	$200,000
Secondary Clarifier Mechanism Upgrades (2x 30.5 m dia, 2x 19.8 m dia)	$1,540,000
Final Effluent Pumping Station	$7,580,000
Sludge Handling Upgrades	$2,250,000
Odour Treatment Upgrades	$750,000
Vaux-Potts Interconnection	$7,350,000
Subtotal of New Equipment and Facility Improvements	**$32,890,000**
Indirect Costs	

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Table 6-1. Preferred Short-Term Treatment Costs

		Item Cost
Capital Costs		
Upgrades to Vauxhall WWTP		
12%	Engineering Fees	$3,950,000
4%	Project Management	$1,320,000
20%	Contingency	$6,580,000
15%	Contractor Overhead and Profit	$4,940,000
Subtotal Indirect Costs		**$16,790,000**
Total Capital Budget		**$49,680,000**

6.1.2 Long-term Preferred Alternatives

The cost to implement either long-term alternative was developed at a high level to provide an order-of-magnitude indication of the total project cost by implementing either Alternative 5 or 6. The costs are based on a dollar per L of treatment value ($3.3/L), as used by the City. Using this factor, the rough costs for implementing one of the two long-term alternatives are as follows:

- Alternative 5: $330 million for 100 MLD of treatment
- Alternative 6: $462 million for 140 MLD of treatment

Additional work is recommended that will impact the overall cost estimates outlined above, including:

- Study and assess the options for conveying flow from outside sewersheds.
- Determine possible siting locations for the new facility.
- Evaluate costs, benefits, and drawbacks associated with each alternative.

6.2 Collection System Alternatives

Since the collection system short-term preferred alternatives are studies, it is premature to develop capital and operating costs at this time. The studies' recommendations should be developed to such a degree so that they include cost analyses necessary to evaluate implementation of any capital works.

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SECTION 7

Preferred Short-term Alternative Conceptual Design Components and Recommendations

This section outlines the preferred short-term alternatives including conceptual design components, consideration and constraints, and construction planning matters.

7.1 Treatment System Preferred Alternative

7.1.1 Design Components

Upgrades to the Vauxhall WWTP to achieve the 60 MLD capacity target may include, but are not limited to, the following options:

- Implement the Vauxhall-Pottersburg Interconnection, with consolidation of solids handling at Pottersburg WWTP.
- Increase capacity by making operational or process improvements, or both.
- Construct an effluent pumping station at Vauxhall WWTP to overcome high water levels in the Thames River.

Recently, the City received cost proposals from Evoqua to implement the BioMag and CoMag systems at the Vauxhall WWTP in order to increase the facility's secondary treatment capacity up to 60 MLD. Incorporating these systems, or similar systems, to achieve the desired capacity increase is a key component in the design.

The feasibility of the short-term alternative depends on the successful implementation of the Vauxhall-Pottersburg Interconnection, which is scheduled to be constructed within the next five years.

7.1.2 Design Considerations and Constraints

7.1.2.1 Headworks

The Vauxhall WWTP headworks consist of two mechanically-cleaned fine screens with 6 mm screen size and a total peak flow capacity of 200 MLD. Following screening, wastewater flows are evenly distributed between two vortex-type aerated grit removal units, with a total peak flow capacity of 200 MLD. Given these existing capacities, the headworks are suitably sized to handle a facility expansion to 60 MLD.

7.1.2.2 Primary Clarification

The primary clarifiers at Vauxhall WWTP have an existing treatment capacity of 50 MLD; however, if they are operated under the CEPT scenario, they can process flows in excess of 60 MLD.

7.1.2.3 Bioreactors

The bioreactors at Vauxhall WWTP have an existing treatment capacity of approximately 30 MLD, and represent a potential bottleneck to re-rating the facility for a 60 MLD average daily flow. One of the options currently under investigation by the City is to implement Evoqua's BioMag system. The BioMag system adds a magnetite ballast to the biomass in the bioreactors so that it can settle out in the secondary clarifiers more easily and quickly. Improving the settleability of the MLSS in the bioreactors allows for the MLSS concentration in the bioreactors to increase, which results in a higher treatment potential. According to Evoqua's proposal, their BioMag system can allow the bioreactors to

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accommodate flows of up to 60 MLD. Further work is required to verify that the BioMag system will achieve the results advertised, and it is recommended that a technology review be conducted to evaluate alternative means of achieving the required bioreactor capacity increase prior to making a final selection. The technology review can include, but should be not limited to, the following options:

- Complete system modelling to determine a reasonable level of additional capacity (if any) that can be claimed through operational optimization/improvements (such as CEPT, increasing SRT, or fine-tuning blower operation via strict DO control).
- Build a new CAS section (or sections) to treat additional flows.
- Convert the existing CAS process to an attached growth process, such as a moving bed bioreactor.
- Upgrade the existing CAS process to operate as a membrane bioreactor (MBR) through the addition of a membrane separation process.

Ease of integration, feasibility of achieving the desired capacity increase, requirement for supporting systems, operability, and lifecycle costing all should be considered.

7.1.2.4 Secondary Clarifiers

The secondary clarifiers at Vauxhall WWTP have an existing treatment capacity of approximately 32 MLD, and represent a potential bottleneck to re-rating the facility for a 60 MLD average daily flow. As discussed above in Section 7.2.3, the City is currently investigating the feasibility of implementing Evoqua’s BioMag system, which would improve the settleability of the MLSS from the bioreactors and allow the existing secondary clarifiers to successfully operate at a higher SLR. The claims made by Evoqua need to be verified and, as discussed above, it is recommended that the City undertake a technology review and evaluation to complete their due diligence on determining the best path forward for increasing the capacity of the Vauxhall WWTP. The technology review can include, but should not be limited to, the following options:

- Complete computational fluid dynamics analysis on the existing secondary clarifiers to identify what means (if any) can be employed to upgrade their existing rated capacities (such as, energy dissipating inlets, baffling, inclined plate packs, etc.).
- Build a new conventional secondary clarifier (or clarifiers) to treat additional flows and solids loadings.
- Upgrade the solids separation process through the addition of a membrane system, to operate the CAS system as an MBR.
- Implement an alternative MLSS ballasting technology, such as Veolia Water Technology (Veolia)’s ACTIFLO process.

Ease of integration, feasibility of achieving the desired capacity increase, requirement for supporting systems, operability, and lifecycle costing all should be considered.

7.1.2.5 Supporting Systems

As part of conducting the technology review and evaluation to increase the treatment capacities of Vauxhall’s secondary treatment units (that is, bioreactors and secondary clarifiers), the supporting systems and equipment will need to be considered and updated as necessary. These systems include the sludge pumping systems (return and wasting), the oxygenation systems, potential bioreactor mixing systems to keep the heavier MLSS in suspension, chemical storage and dosing systems, and the sludge handling system. The feasibility of utilizing the Vauxhall-Pottersburg Interconnection to transfer raw sludge to Pottersburg WWTP for handling and processing can be evaluated to eliminate sludge trucking out of the Vauxhall WWTP to Greenway WWTP for incineration.

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7.1.3 Construction Considerations

Construction of the short-term alternative can occur in phases to add capacity to Vauxhall WWTP as required to keep up with development in the Pottersburg sewershed. The Vauxhall WWTP is located within an established neighbourhood with several nearby residents. The City will need to consider methods of keeping construction noise, dust, and odours to a minimum, while maintaining access to the adjacent roadways as much as possible. Residents will be adjusting to the other construction activities in the area, namely the construction of the Vauxhall-Pottersburg Interconnection. This project must be completed before Vauxhall WWTP can accept any flow from Pottersburg WWTP. In addition to the Vauxhall-Pottersburg Interconnection, the City has recently awarded a project to construct a new stormwater retention berm and final effluent pumping station at the Vauxhall WWTP. As such, the City is recommended to continue their proactive communications strategy to share with the residents the reasons for the construction at the Vauxhall WWTP and in the Vauxhall sewershed and its duration. These activities may help the public better adjust to construction activities at the site.

The Vauxhall WWTP is sited in an area with significant available space to accommodate construction equipment, materials laydown areas, temporary access ways, and future treatment stages, if needed. As a result, spatial limitations are not expected to create substantial issues.

7.2 Collection System Preferred Alternative

No design components were developed as part of this EA based on the preferred alternative for the collection system, since the preferred alternatives are studies whose goals will be to determine the design work required to improve the collection systems in the Vauxhall and Pottersburg sewersheds.

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SECTION 8

Future Work

8.1 Treatment System Alternatives

8.1.1 Short-term Alternatives Recommendations

The short-term alternative implementation plan requires several supporting studies and investigations as well as required permits and approval. This section discusses the schedule and recommended phasing of the required works and the integration of other projects.

8.1.1.1 Supporting Studies

Supporting studies or investigations, or both, that are recommended in the short-term are as follows:

- Technology review and evaluation to confirm the recommended approach for capacity upgrades at the Vauxhall WWTP. As indicated above, the technology review can include, but should not be limited to, the following:
  - Complete system modelling to determine a reasonable level of additional capacity (if any) that can be claimed through operational optimization/improvements (such as CEPT, increasing SRT, or fine-tuning blower operation via strict DO control).
  - Build a new CAS section (or sections) to treat additional flows.
  - Convert the existing CAS process to an attached growth process, such as a moving bed bioreactor.
  - Upgrade the existing CAS process to operate as a MBR through the addition of a membrane separation process.
  - Complete computational fluid dynamics analysis on the existing secondary clarifiers to identify what means (if any) can be employed to upgrade their existing rated capacities (such as, energy dissipating inlets, baffling, inclined plate packs, etc.).
  - Build a new conventional secondary clarifier (or clarifiers) to treat additional flows and solids loadings.
  - Upgrade the solids separation process through the addition of a membrane system, to operate the CAS system as an MBR.
  - Implement an alternative MLSS ballasting technology, such as Veolia Water Technology (Veolia)'s ACTIFLO process.
- Hydraulic study and debottlenecking to confirm that the flow paths within the Vauxhall WWTP can accommodate a re-rating
- Solids handling capability review at the Pottersburg WWTP and identification of recommended upgrades/improvements, as required. Consideration can be given to whether solids are dewatered at Pottersburg WWTP to reduce the number of trucks taking the solids for ultimate disposal at Greenway WWTP
- Condition assessment of the existing equipment at the Vauxhall WWTP to determine if anything requires immediate repair or replacement for continuing service until the long-term preferred alternative is ultimately identified and implemented

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8.1.1.2 Permits and Approvals

Re-rating the Vauxhall WWTP will require an ECA application to be submitted to the MOECC. Recent discussions with the MOECC have disclosed that they will commit to a one-year review and approval period for ECA applications. It is important to note, however, that this one-year timeframe only accounts for the time the MOECC is actively reviewing the ECA. The time it takes for an applicant to respond to MOECC questions or requests for additional information is not included in this one-year duration.

8.1.1.3 Schedule

According to growth forecasts for the Pottersburg sewershed, the Pottersburg WWTP may run out of available capacity by the year 2037. Therefore, at a minimum, the Vauxhall-Pottersburg Interconnection must be completed and operational, and some level of capacity increase must be completed at the Vauxhall WWTP to accommodate flow from Pottersburg. The City has indicated that lower capacity upgrades can be completed as early as 2021.

8.1.2 Long-term Alternatives Recommendations

As presented above, the long-term alternative evaluation resulted in a tie for the highest score between Alternative 5 and 6. Further work is recommended during a future project phase to identify an ultimate preferred alternative:

- Study and assess the options for conveying flow from other sewersheds, which will inform the feasibility of constructing Alternative 6 (140 MLD facility) over Alternative 5 (100 MLD facility). Considerations can include development potential of redirecting flow from outside sewershed(s) to a new, large facility (Alternative 6) and the costs associated with doing so.
- Determine possible siting locations for the new facility, and whether significant environmental impacts would need to be mitigated as a result.
- Complete the design of a pumping station at the Pottersburg WWTP to forward flow to the new facility. Flow from Vauxhall WWTP could be sent to Pottersburg WWTP via the Vauxhall-Pottersburg Interconnection. The design of a pumping station at the Vauxhall WWTP will need to be completed as well.
- Evaluate costs, benefits, and drawbacks associated with each alternative, based on the completion of additional work and studies.

Timing to implement the ultimate preferred long-term solution is over 20 years away, and will depend on the remaining life of the infrastructure at Pottersburg WWTP, the actual growth in Pottersburg sewershed, and/or the actual impacts of improvements to the collections systems (for example, a reduction of wet weather peak flows and I/I).

8.2 Collection System Alternatives

8.2.1 Existing Alternatives Recommendations

It is recommended that the existing alternatives to help increase the capacity of the collection system in the Pottersburg and Vauxhall sewersheds during wet weather events continue to be implemented.

It is also recommended that the collection system capacity within both sewersheds be continually monitored to determine the impact that these initiatives have on the sewershed and to refine capacity requirements. The sewershed models should also be updated as infrastructure projects are completed and new flow monitoring data is available.

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8.2.2 Short-term Recommendations

8.2.2.1 Supporting Studies

Supporting studies and/or investigations recommended in the short-term are as follows:

- Identify aging or damaged sanitary infrastructure that may need to be relined.
- Conduct further flow monitoring along the trunk Sewers in the Pottersburg sewershed to refine the future capacity assessment.
- Update the sewershed models as infrastructure projects are completed and as population growth occurs.

8.2.2.2 Permits and Approvals

The required permits and approvals are to be determined through work outside of this EA.

8.2.2.3 Schedule

The need for the recommended short-term alternatives partially depends on the success of implementing the existing alternatives. However, additional flow monitoring can and should begin immediately.

8.2.3 Long-term Recommendations

The preferred long-term collection system alternatives will align with the preferred treatment system long-term alternatives. Once the location and size of the proposed new WWTP is refined, it is recommended that a study to identify any efficiencies that can be achieved within the collection system be conducted. It is also recommended that replacing the Pottersburg and Vauxhall WWTPs with PSs be considered.

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Public and Agency Consultation

The EA process, particularly the development of alternative solutions, requires transparent stakeholder consultation to incorporate input from interested or impacted groups. This EA included an appropriate amount of consultation effort that consisted of two PICs in addition to one site visit and Project meetings with regulatory agencies. This section summarizes the stakeholder consultation activities that took place throughout the EA process. Detailed documentation of the consultation process, including mailing lists, PIC documentation, correspondence, and meeting summaries, is included in Appendix B.

9.1 Public Information Centres

To support the consultation process for this project, two PICs were held. The first PIC was held on June 21, 2017 from 5:30 PM to 7:30 PM and focused on providing the study background information and objectives. This also served as a platform for receiving public input on the study at the initiation phase and identifying additional stakeholders. City staff and Project team members from CH2M were present. The PIC was an “open-house” style, with 11 large panels displaying the study purpose and goals, Class EA process, overview of the Vauxhall and Pottersburg WWTPs, service area issues, previous studies, and project-specific activities. Attendees were encouraged to sign-in, view the panels, ask questions, and complete the Comment Sheet provided. An information brief summarizing the content of the display panels was also available for attendees to take home. Attendance was minimal with one participant.

The second PIC was held on January 31, 2018 from 6:00 PM to 8:00 PM and focused on the initial screening of alternatives, an outline of preferred alternatives, and an evaluation of screened alternatives. City staff and Project team members from CH2M were present. The PIC was again an “open-house” style with 14 large display panels. Attendees were encouraged to sign-in, view the panels, ask questions, and complete the Comment Sheet provided. An information brief summarizing the content of the display panels was also available for attendees to take home. Again, attendance was minimal with two participants.

9.2 Agency Consultation

Per EA requirements, numerous regulatory agencies (for example, Infrastructure Ontario, Ontario Ministry of Natural Resources and Forestry) and community stakeholders (for example, Hydro One) were included on the project mailing list and received the Notice of Commencement and Notices of PICs. Several regulatory agencies were consulted; however, no agencies aside from the ones listed below responded to the notifications.

9.3 First Nations Consultation

The City sent Project notifications to local First Nations throughout the study, including PIC information and study updates. To date, no responses were received.

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SECTION 10

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