**The Town of Petrolia**
**Waste Management of Canada**

# CLASS ENVIRONMENTAL ASSESSMENT FOR WASTEWATER TREATMENT AND LANDFILL LEACHATE MANAGEMENT

# ENVIRONMENTAL STUDY REPORT

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## REPORT PREPARATION AND REVIEW LOG

| Version | Date | Prepared By | QC Reviewer | Project Manager |
|---|---|---|---|---|
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# EXECUTIVE SUMMARY

## ES-1 BACKGROUND AND PURPOSE

### ES-1.1 BACKGROUND

The Town of Petrolia is situated within the County of Lambton, located in South Western Ontario.

Petrolia owns a wastewater treatment plant (WWTP) that services the properties within the Town. It is an extended aeration facility with tertiary filtration and ultraviolet disinfection, with a rated capacity of 3,800 $m^3$/d, discharging effluent to Bear Creek. The plant was originally constructed in 1975 and has undergone several improvements since that time. However, because most of the processes and structures are more than 35 years old, the plant requires major upgrades. Major tank processes do not provide adequate capacity to treat the Certificate of Approval rated flow and many of the plant processes continue to use equipment that is well past its useful life.

In addition to the major upgrades required, the Petrolia WWTP is operating at approximately 80% of its rated capacity, with flows in some months averaging between 85% and more than 100% . Recent growth and planning studies indicate that growth in the area within the next 25 years will require expansion of the plant capacity.

The Petrolia Landfill, also located within the Town, is owned and operated by Waste Management of Canada Corporation (WM). The site currently uses 26.02 hectares of land for disposal of municipal, industrial, commercial and institutional solid non-hazardous waste. Included in the Landfill are a gas management system for the collection of landfill gas and a leachate collection system. The leachate is currently hauled by truck to a number of alternative municipal treatment facilities. The landfill gas is utilized for electrical generation.

Since the Petrolia Landfill is located less than 1 km from the Petrolia wastewater collection system and approximately 2.5 km from the Petrolia WWTP, there is an opportunity to direct leachate through the wastewater collection system or a dedicated pipe from the landfill to the Petrolia WWTP for treatment. This would significantly reduce or eliminate the number of trucks, hauling distance and corresponding greenhouse gas emissions associated with the leachate disposal.

Currently the Petrolia WWTP does not have capacity or reliability to accept the additional loadings from the Petrolia Landfill leachate.

The Town of Petrolia and Waste Management of Canada are seeking the most environmentally sound and cost-effective solution to manage their wastewater and leachate and one solution that shows significant promise is to co-treat leachate with wastewater at the Petrolia WWTP. Completion of a Class Environmental Assessment (EA) study to plan for the management of wastewater and leachate will provide a sound, thorough approach evaluating a full range of solutions to identify preferred solutions for the Town and Waste Management, considering all potential environmental, community and cost impacts. This Schedule C Class EA was undertaken to plan for the expansion of the Petrolia WWTP to meet growth needs in the Town, and to plan for long term management of the Petrolia Landfill leachate.

## ES-1.2 STUDY OBJECTIVES

This Environmental Study Report (ESR) was completed in accordance with the Schedule C Class EA required by the MOE. It documents the study area and its historical and current condition, alternative solutions and design concepts considered for providing wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada, respectively. Rational for the preferred design concepts are discussed as well as impacts and mitigation measures. Finally the report includes public, agency and Aboriginal and First Nations consultation records and feedback.

A 30-day review period is available to members of the public, interest groups and review agencies, as required by the Class EA process. Any outstanding concerns regarding the project that cannot be resolved in discussion with the Town of Petrolia may request the Minister of the Environment to make an order for the project to comply with Part II of the Environmental Assessment Act, which addresses the individual environmental assessment, by submitting a written request to the Ministry of Environment at the following address:

The Honourable Jim Bradley
Minister of the Environment
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, ON M7A 2T5

If no Part II Order (bump-up) requests are received within the 30-day review period, the project will proceed through design and construction as outlined in the ESR. Information will be collected in accordance with the Freedom of Information & Protection of Privacy Act. With the exception of personal information, all comments will become part of public record.

# ES-2 CLASS ENVIRONMENTAL ASSESSMENT PROCESS

The Municipal Class Environmental Assessment (EA) outlines the procedures to be followed to satisfy requirements of the Environmental Assessment Act for water, wastewater and road projects. This process includes the following five phases:

- Phase 1 Define the Problem
- Phase 2 Identify and Evaluate Alternative Solutions to Determine a Preferred Solution
- Phase 3 Examine Alternative Methods of Implementation of the Preferred Solution
- Phase 4 Document the Planning, Design and Consultation Process
- Phase 5 Implementation and Monitoring

It is also very important to consult the public and agencies during the Class EA planning process.

Class EA projects are further distinguished by four possible 'schedules' depending on the level of impact expected. Schedule A projects represent minor operational and maintenance activities and are approved without the need of further assessment. Schedule A+ projects also represent minor activities and are pre-approved but require public notification prior to project implementation. Schedule B projects require screening of alternative solutions based on their environmental impacts. Phases 1 and 2 must be completed and are typically presented in a report with a Notice of Completion from the project proponent, followed by a 30-day public review period. If no significant impacts are identified and there are no requests for an Order by the Minister under Part II for an Individual EA, then the Schedule B projects are approved and may proceed to Phase 5. Any party may request the Minister of the Environment consider a Part II Order if any outstanding issues remain after the public review period.

Schedule C projects typically have greater potential to impact the environment and must complete all five phases of the Class EA planning process. In addition to Phases 1 and 2, Phase 3 involves the assessment of alternative solutions followed by a public consultation of the preferred design concept. Phase 4 typically entails the preparation of the Environmental Study Report (ESR) to be filed for public review. As long as no significant impacts are identified and no Part II Order is received from the Minister, then Schedule C projects are approved and proceed to Phase 5.

This document is the ESR for wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada, respectively, and is classified as a Schedule C Class EA project.

# ES-3 PHASES 1 AND 2 OVERVIEW

## ES-3.1 PROBLEM/OPPORTUNITY STATEMENT

The Petrolia WWTP is a 3,800 $m^3$/d extended aeration plant servicing the Town of Petrolia. Most components of the plant are more than 35 years old, and require major upgrading. In addition, a review of the capacity of the plant processes indicates that many processes do not provide adequate capacity to reliably treat the approved flow of 3,800 $m^3$/d to consistently achieve effluent objectives and effluent compliance. Projected growth for the Town, as well as the significant deficiencies at the plant, require that planning for expansion and upgrade of the plant be initiated through a Schedule C Class Environmental Assessment (EA).

The Petrolia Landfill, owned and operated by Waste Management of Canada Corporation (WM), is located within the Town of Petrolia. The Landfill is equipped with a leachate collection system to collect leachate. This leachate is currently trucked to a number of alternative municipal treatment facilities.

Since the Petrolia Landfill is located a short distance from the Petrolia WWTP, an opportunity exists to direct leachate to the Petrolia WWTP through the current wastewater collection system or a dedicated pipe. Currently the Petrolia WWTP does not have capacity or reliability to accept the additional loadings from leachate.

The Town of Petrolia and Waste Management are both seeking a cost-effective solution to manage their wastewater into the future. One solution that shows significant promise is to co-treat leachate with raw wastewater at the Petrolia WWTP. Planning for the management of wastewater and leachate through the Schedule C Class EA will provide a sound, thorough approach to evaluating a full range of solutions for the Town of Petrolia and Waste Management, considering all potential environmental, community and cost impacts.

# ES-4 STUDY AREA

## ES-4.1 STUDY AREA

The study area consists of the geographical area that could be affected by the servicing and treatment project alternatives. This area is focused on the urban boundaries of Petrolia and includes a few adjacent properties in the Township of Enniskillen, as shown in Figure ES-1. Petrolia lies within the Sydenham River watershed, and more specifically within two sub-watersheds; Bear Creek Headwaters and Lower Bear Creek.

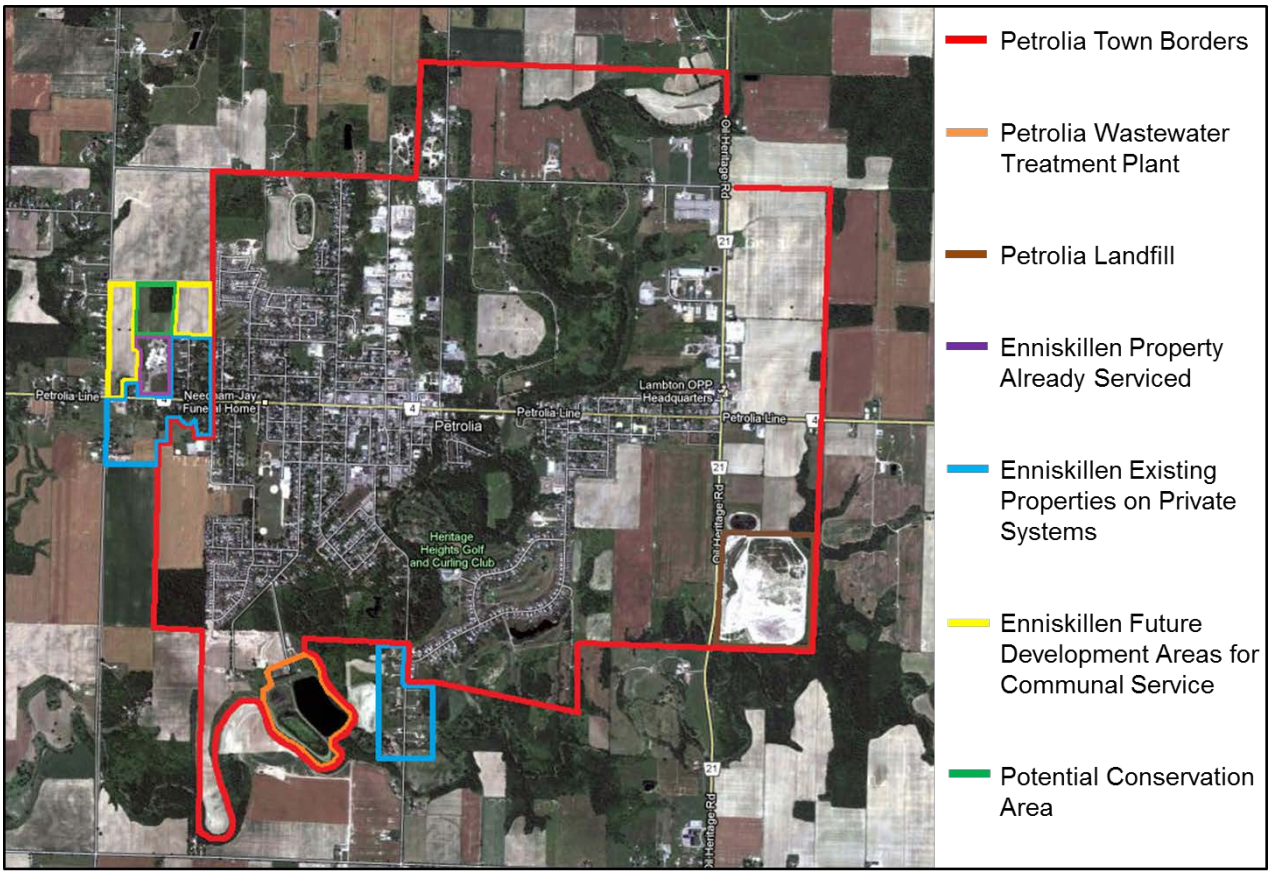


**Figure ES-1 Study Area Map**

# ES-5 DESIGN CRITERIA

The following sections present an overview of the design criteria used to develop the alternative solutions for wastewater treatment and leachate management for the Town of Petrolia and Waste Management, respectively.

## ES-5.1 WASTEWATER TREATMENT DESIGN CRITERIA

The average per capita flow in the Town of Petrolia is 556 L/cap.d. This was calculated from the 2008 to 2010 historic monthly average flow at the Petrolia WWTP of 3,028 $m^3$/d, and an average population in the Town of Petrolia of 5,450 between 2008 and 2010, extrapolated using the growth rate observed in the 2006 census.

From this average per capita flow of 556 L/cap.d and the maximum population projection of 9,216 for the year 2041, the design monthly average flow was determined to be 5,123 $m^3$/d. This flow is presented in Table ES-1 with the peak day, hourly and instantaneous flow factors.

**Table ES-1 2041 Wastewater Flows from the Petrolia Service Area and Peak Flow Factors**

| Parameters | Factors | Flows ($m^3$/d) |
|---|---|---|
| Monthly Average Flow | 1 | 5,123 |
| Peak Day Flow | 2.7[1] | 13,833 |
| Peak Hourly Flow | 3.2[2] | 16,394 |
| Peak Instantaneous Flow | 4.0[3] | 20,492 |

Notes:
1 Calculated from historic maximum day flow and monthly average flow at the Petrolia WWTP.
2 Based on the peak day flow plus 20% to allow for diurnal variation.
3 Typical peak instantaneous factor.

Historic concentration and flow data at the Petrolia WWTP from 2008 to 2010 were used to determine the 2041 design loadings based on the monthly average flow rate of 5,123 $m^3$/d. The data are presented in Table ES-2.

**Table ES-2 2041 Petrolia Wastewater Concentrations and Loadings**

| Parameters | Design Concentrations (mg/L) | 2041 Monthly Average Flow ($m^3$/d) | 2041 Design Loadings (kg/d) |
|---|---|---|---|
| 5-Day Biochemical Oxygen Demand ($BOD_5$) | 226 | 5,123 | 1,158 |
| Total Kjedhal Nitrogen (TKN) | 37.6 | | 193 |
| Total Suspended Solids (TSS) | 199 | | 1,020 |
| Total Phosphorous (TP) | 5.6 | | 28.7 |

## ES-5.2 LEACHATE MANAGEMENT DESIGN CRITERIA

Waste Management anticipates that the Petrolia Landfill will close in 2012 and the volume of leachate generated will begin to decrease from 20,000 $m^3$ to 5,000 $m^3$ in 2020, at which point it will continue to be generated at about 5,000 $m^3$ per year until the end of the planning period in 2041. The closure of the Petrolia Landfill has been delayed in the past, therefore in an effort to remain conservative a second scenario is proposed where the landfill closure is delayed by 3 years to 2015.

Historic leachate hauling volumes were provided by Waste Management. Due to the high variability in the leachate hauling volume data, a monthly average flow, maximum day flow and maximum week flow of leachate from the Petrolia Landfill are presented in Table ES-3.

**Table ES-3 Leachate Design Flows**

| Parameter | Volume of Leachate Shipped |
|---|---|
| Monthly Average Flow ($m^3/d$)[1] | 68 |
| Maximum Day Flow ($m^3/d$)[1] | 239 |
| Maximum Week Flow ($m^3/d$)[1] | 140 |

Notes:
1 Based on daily leachate shipping volumes from 2010 to October 2011, however leachate was not hauled every day.

It is anticipated that leachate quality will remain relatively unchanged during the site operating period and then begin to decrease in concentration after closure. A leachate sampling program was implemented on October 19, 2011 and will run for a minimum of 45 weeks. Traditional wastewater parameters are sampled weekly while metals are sampled once per month. To date, 26 samples have been collected, 7 including metals. Table ES-4 presents the leachate design loadings based on the monthly average, maximum day and maximum week flows.

**Table ES-4 Leachate Design Concentrations and Loadings**

| Parameters | Historic Average Concentrations (mg/L) | Design Average Loadings at a Flow of 68 $m^3/d$ (kg/d) | Design Maximum Day Loadings at a Flow of 239 $m^3/d$[1] (kg/d) | Design Maximum Week Loadings at a Flow of 140 $m^3/d$[1] (kg/d) |
|---|---|---|---|---|
| $BOD_5$ | 494 | 34 | 118 | 70 |
| TKN | 906 | 62 | 217 | 127 |
| TSS | 42 | 2.9 | 10.1 | 5.9 |
| TP | 2.8 | 0.19 | 1.18 | 0.40 |

Notes:
1 Based on daily leachate shipping volumes from 2010 to October 2011, however leachate was not hauled every day.

# ES-6 EVALUATION METHODOLOGY

For the evaluation of the alternative solutions, a Triple Bottom Line (TBL) evaluation methodology is proposed. This methodology is designed to select a preferred solution that balances the criteria of environmental protection, minimizing community impacts, and minimizing economic impacts (costs).

A weighting and ranking system is proposed in order for the evaluation to be systematic, rational and reproducible in comparing the alternatives and identifying the preferred solution. For this project, we are proposing that environmental and community goals are equally weighted at 40% as they each are defined by more indicator criteria, and the economic goal be weighted less at 20% as it is defined by fewer indicator criteria.

A preliminary set of indicator criteria grouped by the Triple Bottom Line categories, each with a short description, proposed to rank the alternative solutions, are listed in Table ES-5. Also shown in Table ES-5 is the value weighting of each criterion.

**Table ES-5 Evaluation Criteria Used in Evaluation**

| Indicator Criteria | Goal | Importance | Prorated Value Weight |
|---|---|---|---|
| **Protect Environment (40%)** | | | |
| Surface Water Protection | Maximize reliability in achieving effluent quality limits under all average and peak flows and loadings to the plant | High | 7.3% |
| Greenhouse Gasses | Minimize greenhouse gas generation or net energy use | High | 7.3% |
| Operating Complexity | Minimize risks to reliability and performance with a system that is simple | Medium | 3.6% |
| Chemical Use | Minimize use of chemical additives | Medium | 3.6% |
| Environmental Risk During Construction | Minimize risk of impacts to surface water, groundwater, land, terrestrial resources and aquatic habitats during construction | Medium | 3.6% |
| Treatment Plant Performance Risk During Construction | Minimize potential risk to performance and plant operations during construction | High | 7.3% |
| Spills | Minimize potential risks to surface water and land due to spills | High | 7.3% |
| **Minimize Community Impacts (40%)** | | | |
| Aesthetics | Maximize aesthetic appeal of the structures and area | High | 6.2% |
| Land Use | Maximize land use to preserve site area for any future requirements | Medium | 3.1% |
| Health and Safety | Maximize protection of public/operator health and safety from exposure to gaseous emissions, toxic organics or processing chemicals | High | 6.2% |
| Operations and maintenance staff | Minimize operations certification and training requirements | Medium | 3.1% |
| Odours | Minimize potential for odours affecting the community | High | 6.2% |
| Noise | Minimize potential for noise affecting the community | High | 6.2% |
| Traffic & Safety | Minimize truck traffic and during construction and operation and maximize community safety | High | 6.2% |
| Construction Duration | Provide the shortest possible construction schedule and operational impact to neighbouring areas and operators | Medium | 3.1% |
| **Minimize Economic Impacts (Costs) (20%)** | | | |
| Capital Costs | Minimize capital costs | High | 8.0% |
| Operations and Maintenance Costs | Minimize operations and maintenance costs | High | 8.0% |
| Operating Risks | Minimize operating cost risk due to dependence on electricity, fuels, chemicals or other on-going costs | Medium | 4.0% |

# ES-7 DEVELOPMENT AND SCREENING OF ALTERNATIVE SOLUTIONS

## ES-7.1 WASTEWATER TREATMENT

Four options were considered in determining the future of Petrolia's wastewater management and these options are outlined in Table ES-6.

**Table ES-6 List of Petrolia Wastewater Management Options**

| Option | Option | Description |
|---|---|---|
| 1 | Do Nothing[1] | • No change to the existing Petrolia WWTP |
| 2 | Limit Community Growth[1] | • Upgrade of the existing Petrolia WWTP<br>• No expansion of the existing Petrolia WWTP |
| 3 | Expansion and Upgrade of the Petrolia WWTP on the Existing Site | • Upgrade of the existing Petrolia WWTP<br>• Expansion of the existing Petrolia WWTP to provide capacity for growth in the Town |
| 4 | Construction of a New Wastewater Treatment Plant on a New Site | • Upgrade of the existing Petrolia WWTP<br>• Construction of a new wastewater treatment plant to provide capacity for growth in the Town |

Notes:
1 These solutions are required to be considered by the Municipal Class EA.

Based on the descriptions above, the only feasible solution for servicing existing and future growth over the planning period is the upgrade and expansion of the Petrolia WWTP on the existing site.

## ES-7.2 LEACHATE MANAGEMENT

Four options were considered for the future treatment of leachate from the Petrolia Landfill. These options are listed in Table ES-7. The following sections present a description of these options.

**Table ES-7 List of Leachate Management Options**

| Option | Option | Description |
|---|---|---|
| 1 | Do Nothing[1] | • Continue to haul leachate for treatment at various alternative wastewater treatment facilities |
| 2 | Haul Leachate to the Petrolia WWTP | • Haul leachate to the Petrolia WWTP for treatment |
| 3 | Discharge Leachate to the Petrolia Sewage Collection System | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill to the Petrolia sewage collection system |
| 4 | Discharge Leachate Directly to the Petrolia WWTP | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill directly to the Petrolia WWTP |

Notes:
1 This solution is required to be considered by the Municipal Class EA.

A comparative evaluation of leachate management options was completed using the criteria and ranking to score each option out of 100%. Option 3, connecting the Petrolia Landfill to the Petrolia collection system, and upgrading the Petrolia WWTP to accommodate leachate loadings, scored highest in both the community and economic categories, and had similar scores to other options in the environmental category.

# ES-8 DESIGN CONCEPT

The following section outlines the design concepts of the preferred solutions for wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada respectively.

## ES-8.1 DESIGN CRITERIA

The project will focus on combined design criteria for both wastewater from the Town of Petrolia and leachate from the Petrolia landfill. These combined concentrations and loadings are presented in Table ES-8.

**Table ES-8 Combined Wastewater and Leachate Design Concentrations and Loadings**

| Parameters | Petrolia Wastewater Average Concentration (mg/L) | Petrolia Landfill Leachate Peak Concentration (mg/L) | Combined Wastewater & Leachate Concentration (mg/L) [1,2] | Combined Wastewater & Leachate Loadings (kg/d)[3] |
|---|---|---|---|---|
| $BOD_5$ | 226 | 494 | 234 | 1,232 |
| TKN | 37.6 | 906 | 60.7 | 320 |
| TSS | 199 | 42 | 195 | 1,027 |
| TP | 5.6 | 2.8 | 5.6 | 29.5 |

Notes:
1 Petrolia wastewater design flow based on a 2041 monthly average flow of 5,123 $m^3$/d.
2 Petrolia landfill leachate design flow based on a weekly maximum of 140 $m^3$/d.
3 The combined wastewater and leachate design flows amounts to 5,263 $m^3$/d.

The design flows used to size specific unit processes is presented in Table ES-9. The design flows were calculated based on multiplying the monthly average flow (5,123 $m^3$/d) with the peak factor and adding 140 $m^3$/d to account for the peak leachate flow, which does not correspond to the wastewater peak factor.

**Table ES-9 Design Flows for each Unit Process**

| Unit Process | Monthly Average Flow ($m^3$/d) | Wastewater Peak Factor | Peak Leachate Flow ($m^3$/d) | Design Flow (m3/d)[1] |
|---|---|---|---|---|
| Headworks | 5,123 | 4[2] | 140 | 20,632 |
| Aeration Tanks | | 1 | | 5,263 |
| Oxygenation | | 1 | | 5,263 |
| Secondary Clarifiers | | 3.2[3] | | 16,534 |
| RAS Pumping | | 1 | | 5,263 |
| Tertiary Filtration | | 3.2[3] | | 16,534 |

Notes:
1 Calculated by multiplying the monthly average flow by the wastewater peak factor than adding the peak leachate flow.
2 Peak instantaneous flow.
3 Peak day flow plus 20% to allow for diurnal variation.

An Assimilative Capacity Study was completed in 2012 to present rationale for updating the effluent criteria of the upgraded and expanded Petrolia WWTP, and can be found in Appendix 2. The recommended effluent criteria are presented in Table ES-10. The plant will continue to have requirements for tertiary phosphorus removal, as well as year round nitrification.

**Table ES-10 Recommended Certificate of Approval Effluent Objectives and Limits for the Upgraded and Expanded Petrolia WWTP[1]**

| Parameters | Effluent Objectives | | Effluent Limits[2] | |
|---|---|---|---|---|
| | Concentration (mg/L) | Waste Loading (kg/d) | Average Concentration (mg/L) | Average Waste Loading (kg/d) |
| 5 Day Biochemical Oxygen Demand ($BOD_5$) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Ammonia Nitrogen | | | | |
| May 1 – Nov. 30 | 2.0 | 10.2 | 3.0 | 15.4 |
| Dec. 1 – Apr. 30 | 4.0 | 20.5 | 6.0 | 30.7 |
| Total Suspended Solids (TSS) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Phosphorous (TP) | 0.37 | 1.9 | 0.74 | 3.8 |
| E. Coli (Apr. 1 – Nov. 30) | 150 organisms / 100 ml | | 200 organisms / 100 ml | |
| pH (at all times) | 6.5 – 8.5 | | 6.0 – 9.5 | |

Notes:
1 Based on a monthly average flow of 5,123 $m^3$/d.
2 Monthly average concentrations and loadings shall not exceed the effluent limits.

## ES-8.2 UNIT PROCESS REQUIREMENTS

The following section provides more detail on the upgrades and expansion required at the Petrolia WWTP based on the design criteria. Table ES-11 summarizes the required upgrades.

**Table ES-11 Summary of the upgrade and expansion requirements for the Petrolia WWTP**

| Process | Existing | | Upgrade and Expansion |
|---|---|---|---|
| Headworks - Screens | | | |
| Type | Step Screen | Coarse Bar Rack | Replace existing with a new step screen |
| Number | 1 | 1 | 1 |
| Capacity | 6,000 $m^3$/d | 12,000 $m^3$/d | 20,632 $m^3$/d |
| Headworks - Grit Collection | | | |
| Type | Aerated grit tank | | Replace existing with a vortex grit collector |
| Number | 1 | | 1 |
| Capacity | | | 16,534 $m^3$/d |
| Aeration Tanks | | | |
| Number | 2 existing aeration tanks | | 2 additional aerations tanks |
| Dimensions | 24.7 m x 12.2 m x 3.96 m SWD | | 40.0 m x 8.0 m x 4.0 m SWD (preliminary) |
| Total Volume | 2,388 $m^3$ | | 2560 $m^3$ |
| Oxygenation | | | |
| Type | Mechanical surface aerator | Self-aspirating jet | Replace existing with a fine bubble aeration system |
| Number | 4 | 2 | 3 blowers (2 duty / 1 standby) |
| Total Capacity | 36 kg $O_2$/h | 52 kg $O_2$/h | 327 kg $O_2$/h |
| Phosphorous Removal | | | |
| Number of Pumps | 1 (duty) | | Replace existing with 2 (1 duty / 1 standby) |
| Containment | No | | Yes |
| Secondary Clarifiers | | | |
| Type | Square clarifiers with circular scrapers | | Upgrade existing<br>Add 2 new rectangular clarifiers |
| Dimensions | 12.2 m x 12.2 m x 3.0 m SWD | | 4 m x 18 m x 4 m SWD (preliminary) |
| Total Surface Area | 288 $m^2$ | | 288 $m^2$ |
| RAS Pumping | | | |
| Number | 2 (1 duty / 1 standby) | | Replace existing with 2 (1 duty / 1 standby) |
| Total Capacity | 3,273 $m^3$/d | | 5,123 $m^3$/d |
| Tertiary Filtration | | | |
| Type | Travelling bridge sand filter | | Replace existing with rotating disk filters |
| Number | 1 | | 2 |
| Total Surface Area | 31.8 $m^2$ | | 120 $m^2$ |
| UV Disinfection | | | |
| Type | Low pressure, low intensity | | No upgrades or expansions required |
| Number of Lamps | 40 lamps at 26 W per lamp | | |
| UV Output | 1040 W total | | |
| Biosolids Holding Tanks | | | |
| Number | 2 | | No expansion required |
| Dimensions | 22.25 m by 4.88 m by 3.05 m SWD | | |
| Total Volume | 312 $m^2$ | | |
| Aeration Type | Coarse bubble spargers | | Replace aeration equipment |

## ES-8.3 CAPITAL COSTS

The capital cost for the upgrade and expansion of the Petrolia WWTP to treat wastewater and leachate is between $23.4 and 24.1 million. Costs for the treatment of leachate at the Petrolia WWTP will be negotiated between the Town of Petrolia and Waste Management.

**Table ES-12 Total Capital Cost to Upgrade and Expand the Petrolia WWTP to Treat Wastewater and Leachate**

| Process | Estimated Capital Cost | |
|---|---|---|
| | Minimum | Maximum |
| Headworks | $ 3,100,000 | $ 3,100,000 |
| Aeration Tanks | $ 2,700,000 | $ 2,850,000 |
| Oxygenation | $ 2,700,000 | $ 2,900,000 |
| Secondary Clarifiers | $ 1,110,000 | $ 1,110,000 |
| Tertiary Filtration | $ 4,000,000 | $ 4,000,000 |
| Biosolids Handling Volume | $ 400,000 | $ 400,000 |
| Phosphorous Removal | $ 100,000 | $ 100,000 |
| Electrical & Controls | $ 1,000,000 | $ 1,000,000 |
| Miscellaneous | $ 300,000 | $ 300,000 |
| Leachate Forcemain & Pumping | $ 300,000 | $ 300,000 |
| **Subtotal** | **$ 15,710,000** | **$ 16,060,000** |
| Contingency 35% | $ 5,498,500 | $ 5,621,000 |
| Engineering 15% | $ 2,356,500 | $ 2,409,000 |
| **Total** | **$ 23,565,000** | **$ 24,090,000** |

## ES-3.4 IMPLEMENTATION PLAN

The implementation plan to provide wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada, respectively, is outlined below. The entire process is expected to take approximately 3.5 years.

- Stage 1 includes the design of the wastewater treatment plant upgrades and expansion, as well as the collection system to connect the Petrolia Landfill to the Petrolia collection system. The design stage is estimated at 1 year.
- Stage 2 consists of the construction of the wastewater treatment plant upgrades and expansion, as well as the collection system to connect the Petrolia Landfill to the Petrolia collection system. Construction will require two stages outlined below:
- Stage 2.1 will be the construction of a new plant at the Petrolia WWTP site and the connection of the Petrolia Landfill to the Petrolia collection system. This work will require approximately 1.5 years, and must be completed before the existing plant can be taken offline and upgraded.
- Stage 2.2 will be the retrofitting and upgrading the existing Petrolia WWTP and will require approximately 1 year.

## ES-8.4 IMPACTS AND MITIGATION MEASURES

Based on the results of the environmental assessment the project impact is considered small during construction and negligible during operation. Best construction practices will be implemented to ensure minimal disruption to the environment and residents during construction phases. The plant will institute the best available treatment technologies to treat Petrolia wastewater and landfill leachate.

A conceptual layout of the plant is presented in Figure ES-2. The existing site does not meet the 100 m minimum separation distance from existing properties and a future development area, but the design will ensure the expanded plant does not decrease the separation. Best design and construction practices will be implemented to ensure the most odorous processes (i.e. headworks) are located as far from existing or future residences as possible. In addition processes will be constructed with the necessary housing and odour control technologies to mitigate any potential odours.

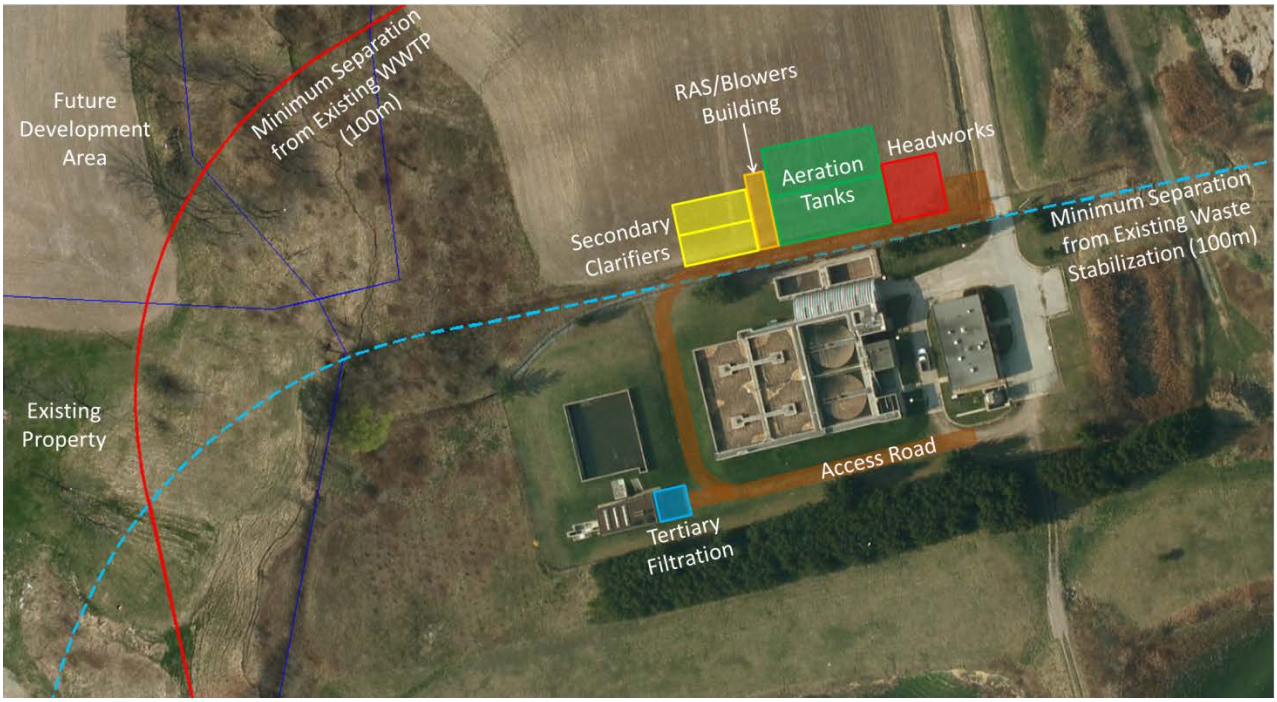


**Figure ES-2 Conceptual Layout of the Upgraded and Expanded Petrolia WWTP**

# ES-9 CONSULTATION

## ES-9.1 OVERVIEW

A summary of the public and Aboriginal and First Nations consultation activities undertaken as part of the Class EA process are presented in this section. The public consultation materials are included for reference in Appendix 3.

## ES-9.2 OBJECTIVES OF CONSULTATION ACTIVITIES

The objectives of the consultation activities for this project included:

- Inform the public, stakeholders and Aboriginal and First Nations of the project
- Offer educational information regarding the project
- Obtain input on project components at key decision-making points
- Meet or exceed the consultation requirements of the Class EA process.

## ES-9.3 DIRECT CONSULTATION ACTIVITIES

The following outlines the specific consultation activities undertaken to support the Class EA process for wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada.

- **Notice of Study Commencement:** A Notice of Study Commencement was placed in the local newspaper, Municipal webpage, Municipal notice board and sent to the project mailing list (Issued November 18, 2011).
- **Project Mailing List:** A contact list was developed for the project and continually upgraded as the project progressed. The list included residents, landowners, members of community groups and a number of review agencies, businesses and organizations. Also included were the Aboriginal and First Nations groups identified whose traditional rights may be impacted by the project.
- **Phone Calls:** Aboriginal and First Nations groups were contacted by phone to discuss their interest in the project.
- **Project Website:** Information on the project is posted on the Municipality's website (http://town.petrolia.on.ca/index.php?option=com_content&view=article&id=83), including notices, Technical Memorandums 1 and 2 and the poster boards presented at the Public Open House.
- **Public Open House:** One Public Open House was held on May 1, 2012 between 4 and 7 pm at the Town of Petrolia Municipal Office. The notice for the Public Open House was advertised in the local newspaper, posted on the Municipalities website and sent directly to the contacts on the project mailing list. The Public Open House provided displays for a walk through, comment sheets and handouts. Staff from the Town of Petrolia, Waste Management and CIMA were available to answer any questions.
- **Notice of Completion:** Included as first page of the ESR.

More detailed information on the Public Open House, the materials presented and feedback is included in Appendix 3.

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**APPENDIXES**

# 1. INTRODUCTION

## 1.1 BACKGROUND

The Town of Petrolia is situated within the County of Lambton, located in South Western Ontario.

Petrolia owns a wastewater treatment plant (WWTP) that services the properties within the Town. It is an extended aeration facility with tertiary filtration and ultraviolet disinfection, with a rated capacity of 3,800 $m^3$/d, discharging effluent to Bear Creek. The plant was originally constructed in 1975 and has undergone several improvements since that time. However, because most of the processes and structures are more than 35 years old, the plant requires major upgrades. Major tank processes do not provide adequate capacity to treat the Certificate of Approval rated flow and many of the plant processes continue to use equipment that is well past its useful life.

In addition to the major upgrades required, the Petrolia WWTP is operating at approximately 80% of its rated capacity, with flows in some months averaging between 85% and more than 100% . Recent growth and planning studies indicate that growth in the area within the next 25 years will require expansion of the plant capacity.

The Petrolia Landfill, also located within the Town, is owned and operated by Waste Management of Canada Corporation (WM). The site currently uses 26.02 hectares of land for disposal of municipal, industrial, commercial and institutional solid non-hazardous waste. Included in the Landfill are a gas management system for the collection of landfill gas and a leachate collection system. The leachate is currently hauled by truck to a number of alternative municipal treatment facilities. The landfill gas is utilized for electrical generation.

Since the Petrolia Landfill is located less than 1 km from the Petrolia wastewater collection system and approximately 2.5 km from the Petrolia WWTP, there is an opportunity to direct leachate through the wastewater collection system or a dedicated pipe from the landfill to the Petrolia WWTP for treatment. This would significantly reduce or eliminate the number of trucks, hauling distance and corresponding greenhouse gas emissions associated with the leachate disposal.

Currently the Petrolia WWTP does not have capacity or reliability to accept the additional loadings from the Petrolia Landfill leachate.

The Town of Petrolia and Waste Management of Canada are seeking the most environmentally sound and cost-effective solution to manage their wastewater and leachate and one solution that shows significant promise is to co-treat leachate with wastewater at the Petrolia WWTP. Completion of a Class Environmental Assessment (EA) study to plan for the management of wastewater and leachate will provide a sound, thorough approach evaluating a full range of solutions to identify preferred solutions for the Town and Waste Management, considering all potential environmental, community and cost impacts. This Schedule C Class EA was undertaken to plan for the expansion of the Petrolia WWTP to meet growth needs in the Town, and to plan for long term management of the Petrolia Landfill leachate.

## 1.2 STUDY OBJECTIVES

This Environmental Study Report (ESR) was completed in accordance with the Schedule C Class EA required by the MOE. It documents the study area and its historical and current condition, alternative solutions and design concepts considered for providing wastewater treatment and

leachate management for the Town of Petrolia and Waste Management of Canada, respectively. Rational for the preferred design concepts are discussed as well as impacts and mitigation measures. Finally the report includes public, agency and Aboriginal and First Nations consultation records and feedback.

A 30-day review period is available to members of the public, interest groups and review agencies, as required by the Class EA process. Any outstanding concerns regarding the project that cannot be resolved in discussion with the Town of Petrolia may request the Minister of the Environment to make an order for the project to comply with Part II of the Environmental Assessment Act, which addresses the individual environmental assessment, by submitting a written request to the Ministry of Environment at the following address:

The Honourable Jim Bradley
Minister of the Environment
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, ON M7A 2T5

If no Part II Order (bump-up) requests are received within the 30-day review period, the project will proceed through design and construction as outlined in the ESR. Information will be collected in accordance with the Freedom of Information & Protection of Privacy Act. With the exception of personal information, all comments will become part of public record.

# 2. CLASS ENVIRONMENTAL ASSESSMENT PROCESS

This section describes the Class Environmental Assessment process and its place in the overall legislation governing environmental assessments in Ontario.

## 2.1 ENVIRONMENTAL ASSESSMENT ACT

The Environmental Assessment Act (EA Act) in Ontario was passed in 1975 and proclaimed in 1976. This Act requires proponents to examine and document the environmental effects that may result from major projects or activities and their alternatives. Municipal undertakings became subject to the EA Act in 1981. The environment is described broadly in the Act as:

- Air, land or water
- Plant and animal life, including human life
- The 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.

The purpose of the EA Act is the betterment of people as a whole or any part of Ontario by providing for the protection, conservation and wise management in Ontario of the environment (R.S.O. 1990, Chapter E.18, Part I-Section 2).

As set out in Section 5(3) of the EA Act, an EA document must include the following:

1. A description of:
    - The purpose of the undertaking
    - The alternative methods of carrying out the undertaking
    - Alternatives to the undertaking

2. A description of:
    - The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly
    - The effects that will be caused or that might reasonably be expected to be caused to the environment
    - The actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate, or remedy the effects upon or the effects that might reasonably be expected upon the environment; by the undertaking, the alternative methods of carrying out the undertaking, and the alternatives to the undertaking
    - An evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking, and the alternatives to the undertaking (R.S.O. 1990, Chapter E.18, Part I-Section 2).

## 2.2 PRINCIPLES OF ENVIRONMENTAL PLANNING

The EA Act sets a framework for a systematic, rational and replicable environmental planning process that is based on five key principles, as follows:

1. Consultation with affected parties
2. Consideration of a reasonable range of alternatives
3. Identification an consideration of the effects of each alternative on all aspects of the environment
4. Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects
5. Documentation of the planning process in such a way that it may be repeated with similar results.

## 2.3 CLASS ENVIRONMENTAL ASSESSMENT

"Class" Environmental Assessments (Class EAs) were approved by the Minister of the Environment in 1987 for municipal projects having predictable and mitigable impacts. The municipal Class EAs were continually revised and updated. The Class EA approach streamlines the planning and approvals process for municipal projects that have the following characteristics:

- Recurring
- Similar in nature
- Usually limited in scale
- Predictable range of environmental impacts
- Responsive to mitigation

The Municipal Class EA, the Municipal Engineers Association (October 2000, as amended in 2007 and 2011), outlines the procedures to be followed to satisfy EA requirements for water, wastewater and road projects and includes five phases:

- Phase 1 Problem definition
- Phase 2 Identification and evaluation of alternative solutions for a preferred solution
- Phase 3 Examination of alternative methods of implementation of the preferred
- Phase 4 Documentation of the planning, design and consultation process
- Phase 5 Implementation and monitoring

Figure 1 depicts the Municipal Class EA process.

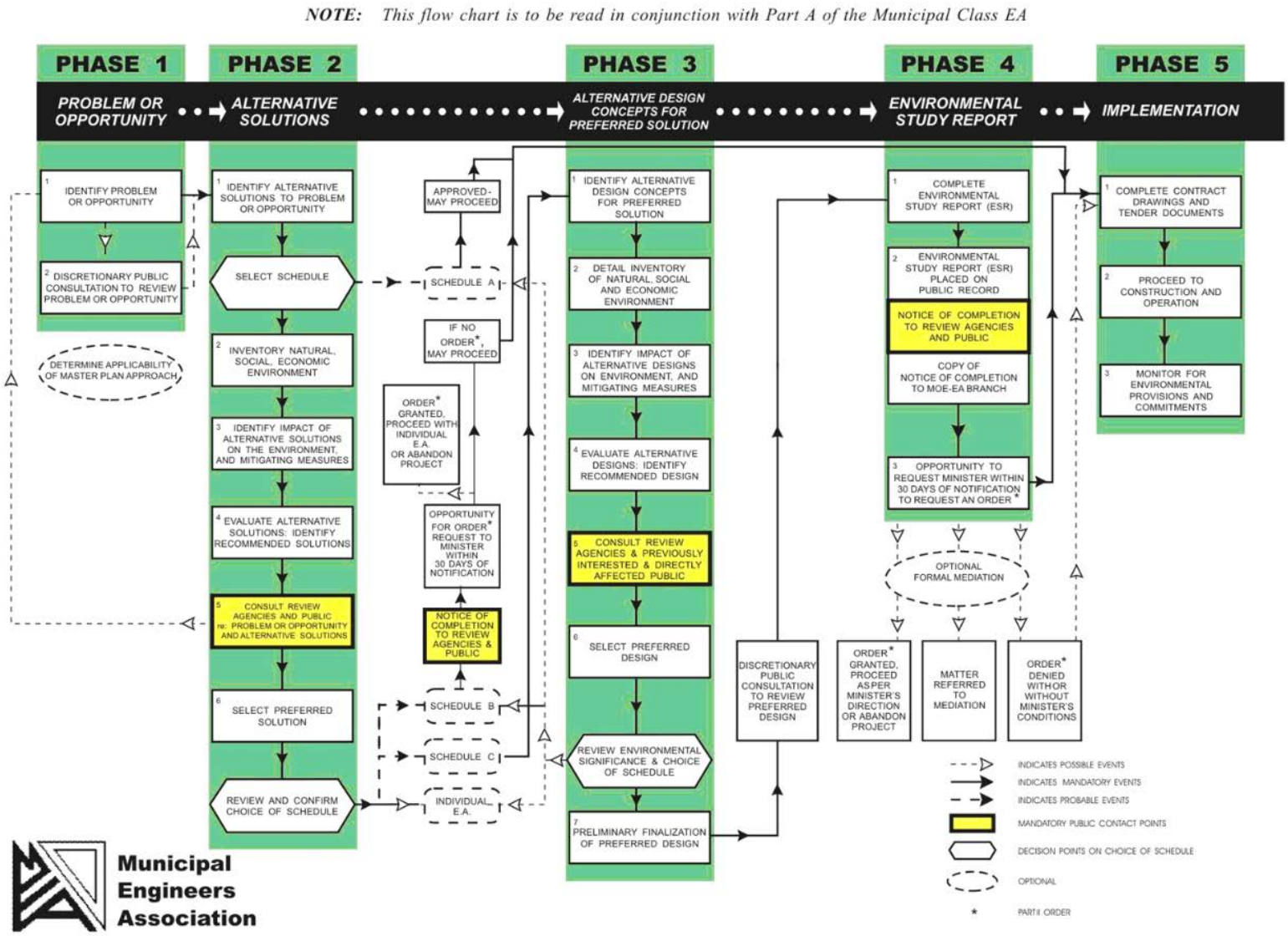


**Figure 1 Municipal Class EA Planning and Design Process**

## 2.4 PUBLIC AND AGENCY CONSULTATION

Public and agency consultation are a very important step in the Class EA planning process.

Class EA projects are further distinguished by four possible 'schedules' depending on the level of impact expected. Schedule A projects represent minor operational and maintenance activities and are approved without the need of further assessment. Schedule A+ projects also represent minor activities and are pre-approved but require public notification prior to project implementation. Schedule B projects require screening of alternative solutions based on their environmental impacts. Phases 1 and 2 must be completed and are typically presented in a report with a Notice of Completion from the project proponent, followed by a 30-day public review period. If no significant impacts are identified and there are no requests for an Order by the Minister under Part II for an Individual EA, then the Schedule B projects are approved and may proceed to Phase 5. Any party may request the Minister of the Environment consider a Part II Order if any outstanding issues remain after the public review period.

Schedule C projects typically have greater potential to impact the environment and must complete all five phases of the Class EA planning process. In addition to Phases 1 and 2, Phase 3 involves the assessment of alternative solutions followed by a public consultation of the preferred design concept. Phase 4 typically entails the preparation of the Environmental Study Report (ESR) to be filed for public review. As long as no significant impacts are identified and no Part II Order is received from the Minister, then Schedule C projects are approved and proceed to Phase 5.

This document is the ESR for wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada, respectively, and is classified as a Schedule C Class EA project.

# 3. STUDY AREA

The following section provides a general description of the study area in close proximity to Petrolia outlining the existing natural, socio-economic and features within this defined area.

## 3.1 STUDY AREA

The study area consists of the geographical area that could be affected by the servicing and treatment project alternatives. This area is focused on the urban boundaries of Petrolia and includes a few adjacent properties in the Township of Enniskillen, as shown in Figure 2. Petrolia lies within the Sydenham River watershed, and more specifically within two sub-watersheds; Bear Creek Headwaters and Lower Bear Creek.

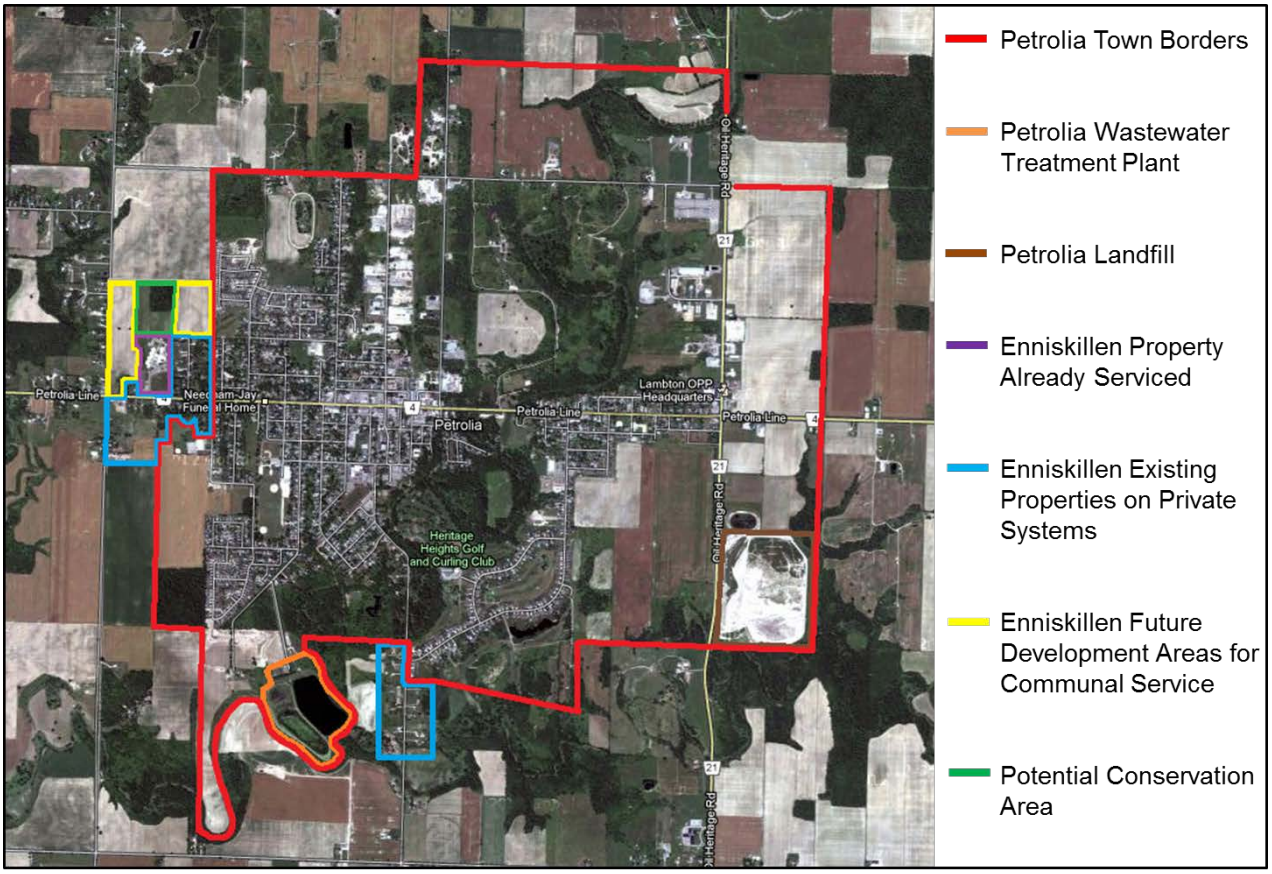


**Figure 2 Map of Study Area**

## 3.2 NATURAL ENVIRONMENT

### 3.2.1 Climate

There is no Environment Canada weather monitoring station within Petrolia, however one is located about 10 km away on Rokeby Line, between Wanstead Road and Oakdale Road. This station was used to determine the climate conditions in Petrolia. Data are presented in Table 1.

**Table 1 Climate Conditions in Petrolia (Environment Canada, 2006-2010)**

| Parameter | Value |
|---|---|
| Average Annual Precipitation (mm) | 929.2 |
| Snowfall (%) | 13 |
| Rainfall (%) | 87 |
| Driest Month | February |
| Wettest Month | August |
| Daily Average Temperature ($^{o}$C)[1] | 9 |
| Highest Recorded Temperature on Record ($^{o}$C)[2] | 36 |

Notes:
1. Daily temperature ranges from a high of 21.4 $^{o}$C in July to a low of -4.9 $^{o}$C in February.
2. Recorded in July 2007 & 2010.

The climate of Petrolia as part of Lambton County is moderated by the Great Lakes, specifically Lake Huron and Lake Erie. The addition of moisture from the Lakes increases precipitation amounts in autumn and winter, while the Lake heat leads to milder winters. Conversely in the summer, the cooler lake waters temper the tropical air from the south. The combination of these factors makes Lambton County's climate one of the most suitable in Canada for both agriculture and settlement.

### 3.2.2 Physiography, Geology and Soils

Figure 3 shows the aggregate resources of Lambton County and the current sand and gravel pit locations. These are primarily located in the east and northeast and there are no licensed aggregate operations in the Petrolia study area.

Petrolia lies within the Lambton Clay Plain which is mainly flat consisting mostly of clay and silt soils on top of bedrock. This is the result of fine-grained materials deposited at the bottom of ancient glacial lakes. The soil map presented in Figure 3 was developed from detailed county soil surveys.

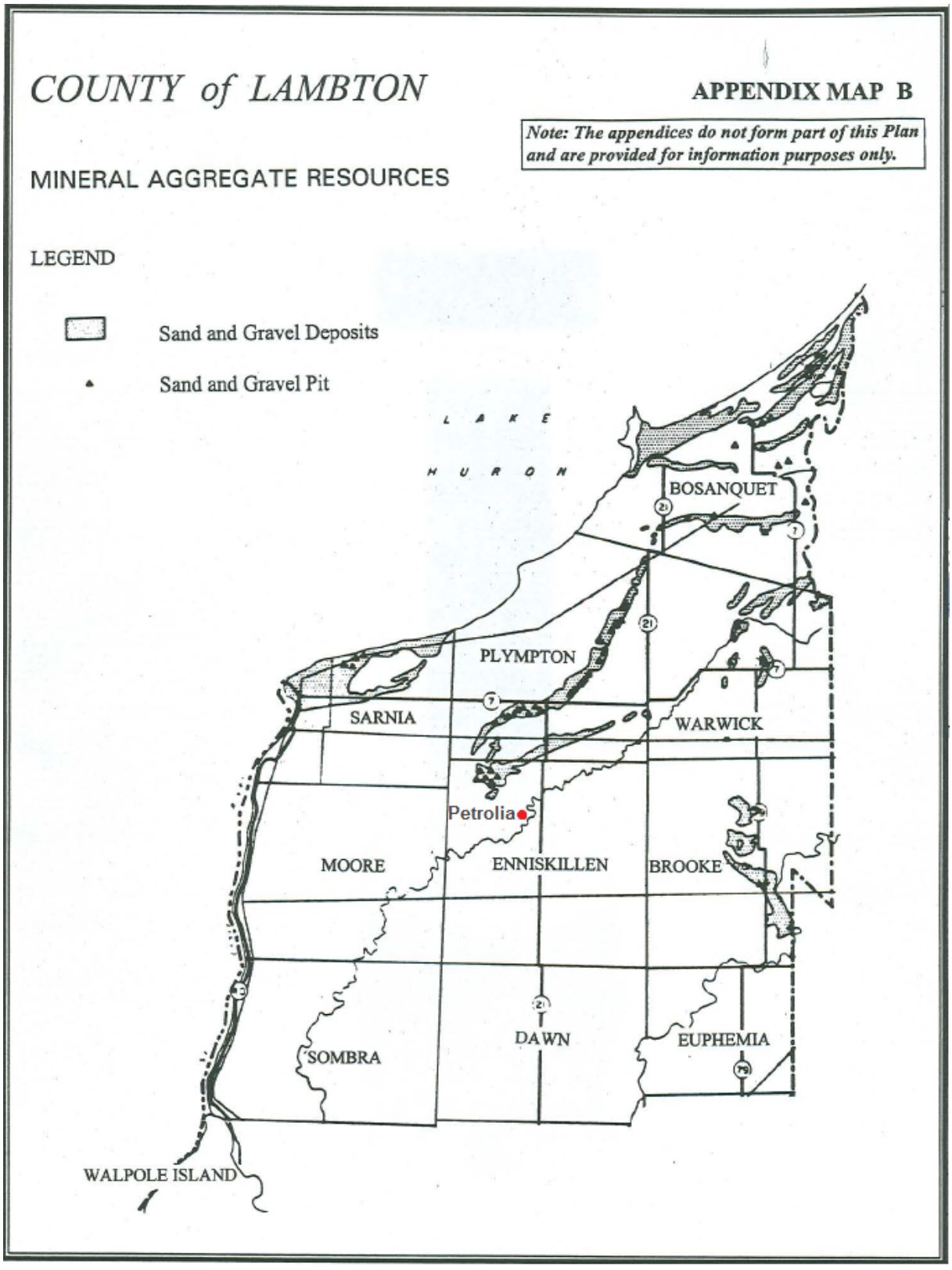


**Figure 3 Aggregate Resources of Lambton County (County of Lambton, 2009)**

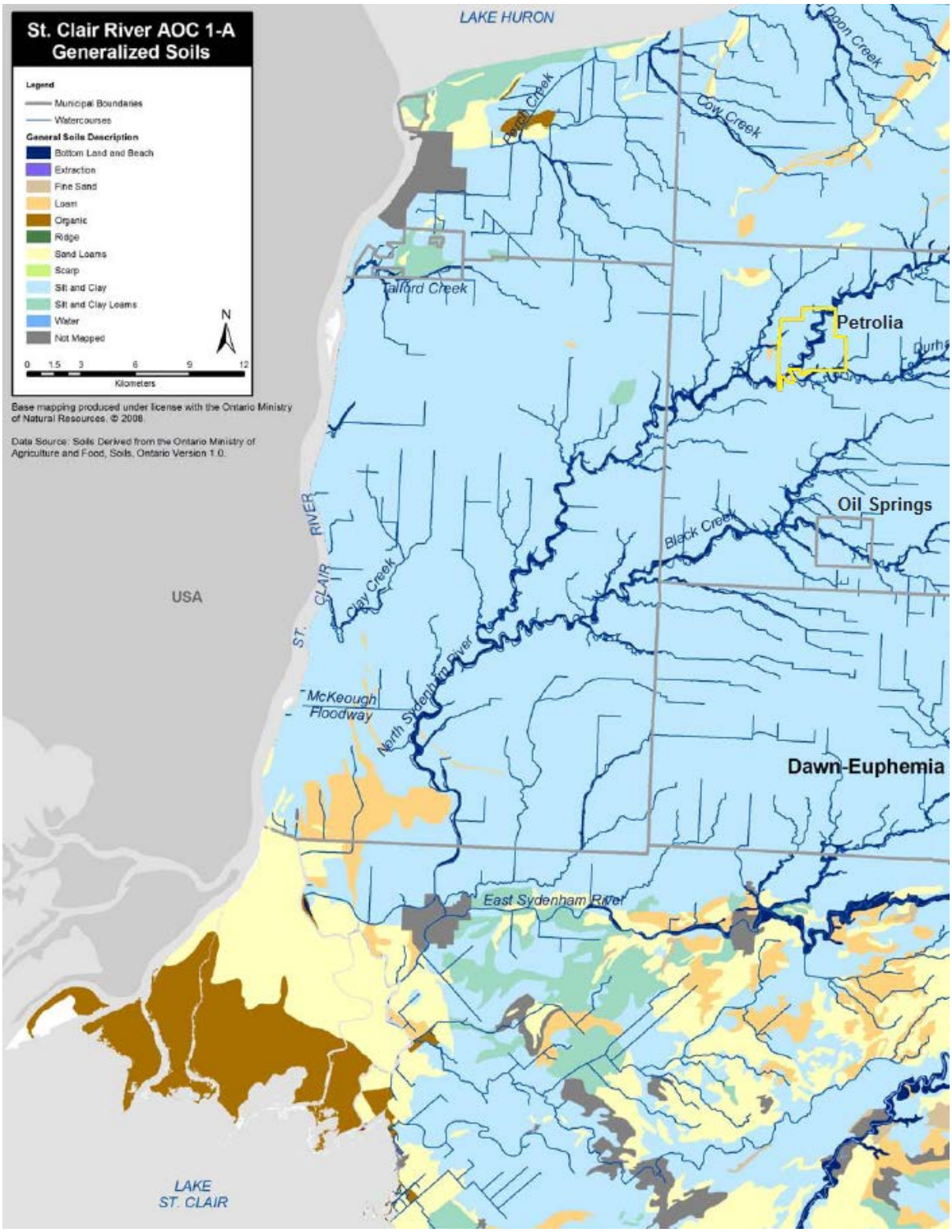


**Figure 4 Soil Map (SCRCA, 2009)**

### 3.2.3 Water Resources and Aquatic Ecology

#### 3.2.3.1 Surface Water

Petrolia is located within the Sydenham watershed, specifically the sub-watersheds of Bear Creek Headwaters and Lower Bear Creek. Bear Creek is the primary water course flowing through Petrolia, and flows southwesterly through the centre of the Town and just south of the Petrolia WWTP, which discharges to this Creek. Durham Creek (listed as Little Bear Creek on some maps) is a westerly flowing stream falling just south of the Petrolia boundaries and the Petrolia Landfill, connecting with Bear Creek just before the Petrolia WWTP. At this confluence, the Bear Creek Headwaters sub-watershed ends and the Lower Bear Creek sub-watershed begins. The watercourse continues in a south-westerly direction as Bear Creek before emptying into the North Sydenham River and eventually discharging into Lake St. Clair. The main watercourses of the area can be seen in Figure 5.

The SCRCA Watershed Report Card, 2008, gave the surface water quality an overall grade of C, on a scale of A to F, for both the Bear Creek Headwaters and Lower Bear Creek sub-watersheds. This general assessment of surface water quality is based on three key indicators, benthic score, phosphorous and E. coli bacteria. This system for grading surface water quality was developed in 2003 by Ontario's Conservation Authorities.

#### 3.2.3.2 Benthic Community

Benthic invertebrates are aquatic organisms that live in stream sediments and are used as indicators of water quality and stream health, as they are sensitive to pollution. A stream is scored based on the Family Biotic Index (FBI) and ranges from 1 (healthy) to 10 (degraded).

The Bear Creek Headwaters and Lower Bear Creek sub-watersheds were sampled approximately 15 km northeast and southwest of the Town of Petrolia. A FBI score of 5.7 and 5.5 was determined respectively, indicating Fair water quality in both sub-watersheds.

#### 3.2.3.3 Groundwater

Petrolia residents and businesses are connected to a municipal water supply system which draws from Lake Huron. There is one aquifer within the study area, known as the Fresh Water Aquifer, and it lies between the overburden and bedrock layers. This aquifer is limited in quantity and contains high sodium and chloride. Insufficient data were collected at the time of the SCRCA Watershed Report Card, 2008, thus, grades were not applied to the groundwater quality within the specific watersheds.

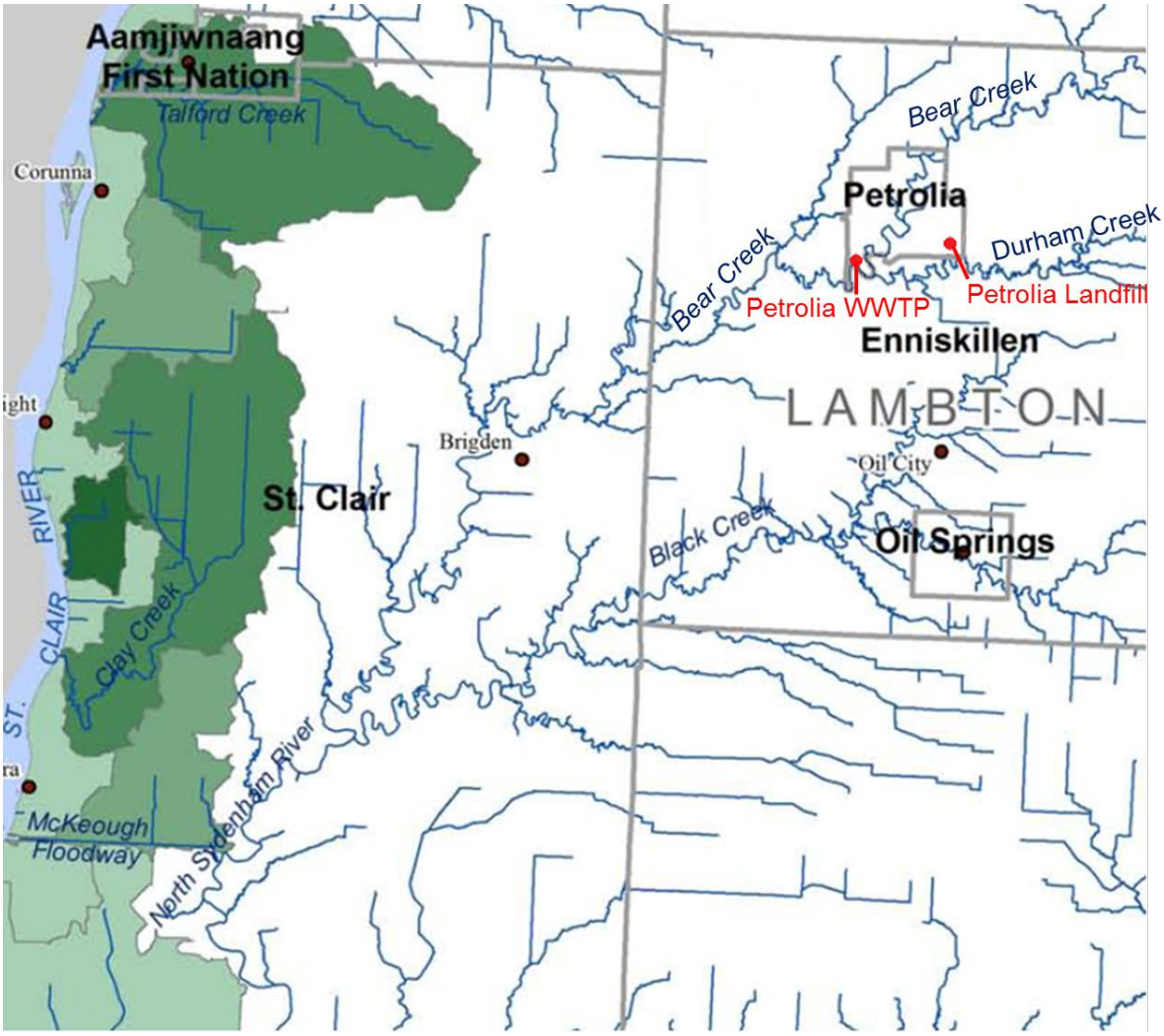


**Figure 5 Major Watercourses Near the Study Area (SCRCA, 2009)**

3.2.3.4 Fisheries & Species at Risk

Within the Bear Creek Headwaters and Lower Bear Creek sub-watershed regions there is a warm water fish community consisting of 46 species, including northern pike, largemouth, smallmouth and rock bass, walleye and sunfish.

Additionally, there are a number of fish, plants, birds, reptiles, mussels and mammals at risk within the sub-watersheds. Table 2 lists the species considered at risk by the Community on the Status of Endangered Wildlife in Canada (COSEWIC), a group that assesses species for their consideration for legal protection and recovery under the Species at Risk Act (SARA). The Round Pigtoe and Mudpuppy Mussel are considered S1 (extremely rare) according to a provincial rank from the Species at Risk in Ontario (SARO) List.

**Table 2 Species at Risk in the Bear Creek Headwaters and Lower Bear Creek Sub-Watersheds (SCRCA, 2008)**

| Species Common Name | Species Scientific Name | COSEWIC |
|---|---|---|
| **Fish** | | |
| Blackstripe Topminnow | *Fundulus notatus* | Special Concern |
| Spotted Sucker | *Minytrema melanops* | Special Concern |
| Brindled Madtom | *Noturus miuris* | Not at Risk |
| Bigmouth Buffalo | *Ictiobus cyprnellus* | Special Concern |
| **Plants** | | |
| Green Dragon | *Arisaema dracontium* | Special Concern |
| Kentucky Coffeee-tree | *Gymnocladus dioicus* | Threatened |
| Butternut | *Juglans cinerea* | Endangered |
| Blue Ash | *Fraxinus quadrangulata* | Special Concern |
| Shumard Oak | *Quercus shumardii* | Special Concern |
| **Birds** | | |
| Loggerhead Shrike | *Lanius ludovicianus* | Endangered |
| **Reptiles** | | |
| Spiny Softshell Turtle | *Apalone spinifera* | Threatened |
| Butler's Gartersnake | *Thamnophis butlerii* | Threatened |
| **Mussels** | | |
| Round Pigtoe | *Pleurobema sintoxia* | Endangered |
| Mudpuppy Mussel | *Simpsonaias ambigua* | Endangered |
| **Mammals** | | |
| Gray Fox | *Urocyon cinereoargenteus* | Threatened |

### 3.2.4 Terrestrial Ecology

#### 3.2.4.1 Riparian Vegetation and Habitat

Healthy forests help to maintain good air and water quality as well as provide habitat for the diverse plant and wildlife in the area. Conservation Ontario uses two factors that provide strong indications of a forests health and are easily measured using aerial photography. They are forest cover and forest interior percentage. Forest cover refers to the total percentage of the watershed covered in forests, and the forest interior is defined as the percentage of forest more than 100 m from the forest edge. Forest interior is necessary for some bird species to nest successfully. Goals set by Environment Canada (2004) recommend a forest cover of 30% and forest interior of 10%. Bear Creek Headwaters and Lower Bear Creek were given grades of D and C, respectively, and are considered too low for sustainability (SCRCA, 2008).

#### 3.2.4.2 Significant Natural Areas

Of specific interest within Petrolia's municipal boundaries are the Bridgeview Conservation Area, a locally significant wetland, and the environmentally protected primary corridor located along Bear Creek, as shown in Figure 2. According to the Town's Official Plan, these areas will be protected from development.

There may be other natural features located outside the designated areas and the Town will work with residents and service groups to identify and protect these natural features. These may include rare trees, tree rows, cemetery landscaping and vegetated areas. The Town will also work to reduce the amount of contaminants, such as pesticides, herbicides and salts, entering receiving watercourses.

Also of note is the Lorne C. Henderson Conservation Area, another locally significant wetland, located just west of Petrolia's boundaries.

## 3.3 SOCIO-ECONOMIC ENVIRONMENT

### 3.3.1 Existing Population

Petrolia is one of eleven municipalities making up Lambton County in Southern Ontario, and one of four that has experienced growth in recent years. The most up to date data available were from the 2006 Census, and according to the results, Petrolia's population increased 7.5% from 4,849 people in 2001 to 5,215 people in 2006, for a growth rate of 1.5% per year. Table 3 shows the population change from 2001 to 2006 for all the municipalities of Lambton County.

**Table 3 Population Growth for the Municipalities of Lambton County (2001 to 2006)**

| Municipality | 2001 Population | 2006 Population | Percent Growth 2001 to 2006 |
|---|---|---|---|
| Brooke-Alvinston | 2,785 | 2,665 | - 4.3% |
| Dawn-Euphemia | 2,369 | 2,200 | - 7.7% |
| Enniskillen | 3,259 | 3,120 | - 4.3% |
| Lambton Shores | 10,571 | 11,150 | 5.2% |
| Oil Springs | 758 | 715 | - 5.7% |
| Petrolia | 4,849 | 5,215 | 7.5% |
| Plympton-Wyoming | 7,359 | 7,506 | 2.0% |
| Point Edward | 2,101 | 2,020 | - 3.9% |
| Sarnia | 70,876 | 71,420 | 0.8% |
| St. Clair | 14,659 | 14,640 | - 0.1% |
| Warwick | 4,025 | 3,945 | - 2.0% |

### 3.3.2 Land Use and Zoning

Figure 6 shows the land use plan for Petrolia from the Town's Official Plan adopted in 1999. There are a variety of specific land use designations including residential, rural, general and highway commercial, general and light industrial, major open space and hazard & environmentally protected areas. Also visible in the figure are the Petrolia Landfill, Petrolia WWTP and a locally significant wetland, known as the Bridgeview Conservation Area.

Hazard and environmentally protected areas may be subject to flooding and instability due to erosion and excessive slopes and/or they may contain significant natural features such as wetlands and woodlands. Development within these areas is prohibited or restricted, as it could result in the loss of life, property damage, or destruction of significant natural features. However, special uses of this land can include conservation, forestry, parks, golf courses or other passive outdoor recreational uses.

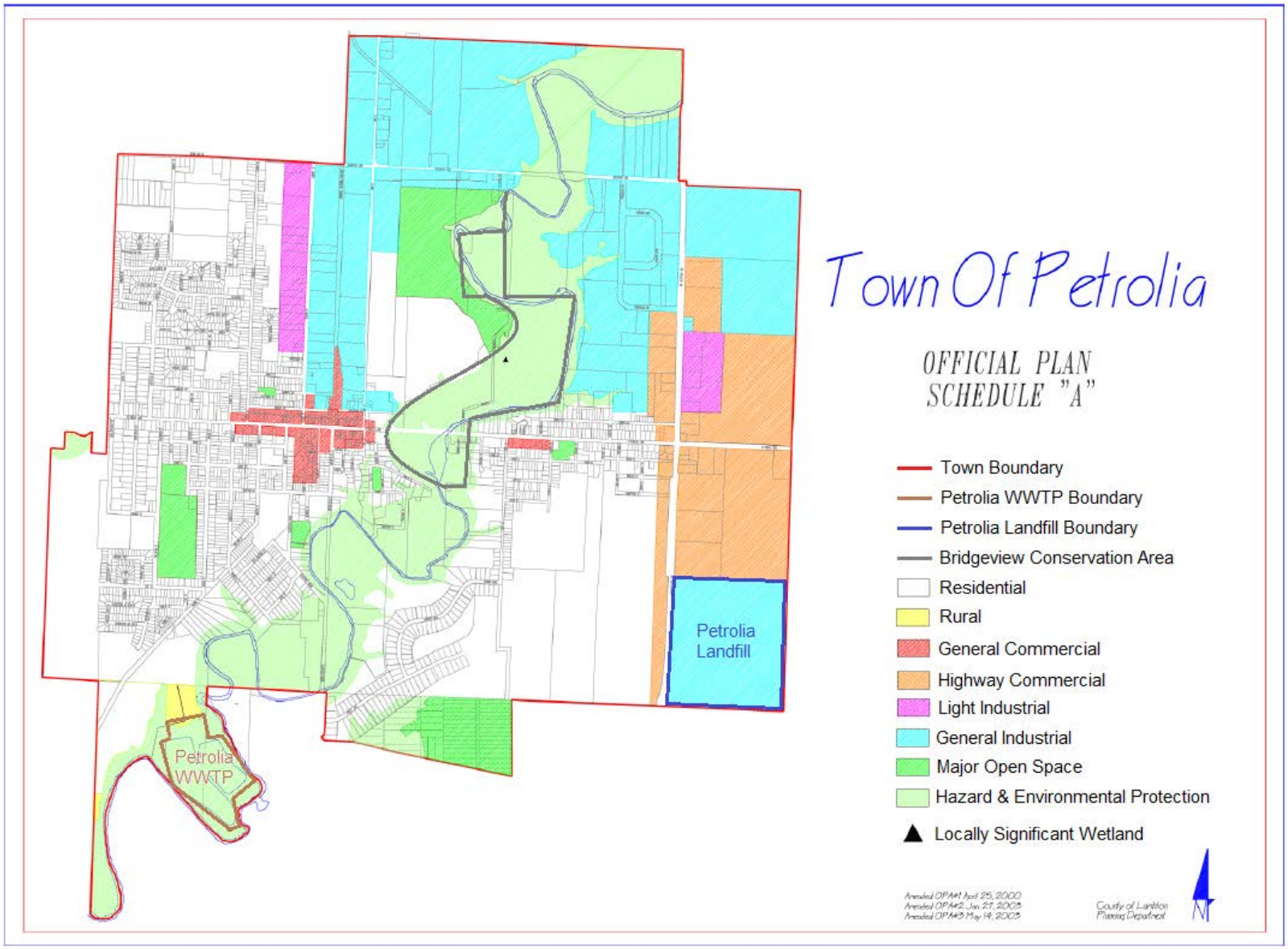


**Figure 6 Land Use Plan for the Town of Petrolia (Town of Petrolia, 1999)**

### 3.3.3 Municipal Infrastructure

Within Petrolia the following major infrastructure exists:

- Municipal water supply system and elevated water storage tank
- Petrolia Wastewater Treatment Plant (WWTP)
- Petrolia Landfill owned and operated by Waste Management of Canada
- Charlotte Eleanor Englehart Hospital of Bluewater Health
- Lambton Central Collegiate and Vocational Institute.

All of Petrolia is serviced by municipal water piped from the Water Treatment Plant (WTP), with a rated capacity of 12,000 $m^3$/d, located in Sarnia at Bright's Grove, about 20 km north of the Town. This WTP services a number of other municipalities, with a total serviceable population of 9,639.

Water drawn from Lake Huron is treated using membrane filtration, fluoridation and chlorination.

### 3.3.4 Heritage Resources

Petrolia is known as 'Canada's Victorian Oil Town' as it was a focal point of the oil industry back in the mid-to-late 1800's and early-to-mid 1900's. With this came the development of institutional, commercial and residential buildings of very high quality. Figure 7 (Wendy Shearer et al., 2009) shows the concentrations of pre-1946 buildings in downtown Petrolia that may be designated as heritage resources as well as those properties already designated Heritage Resources under part IV of the Ontario Heritage Act.

Any redevelopment or public works must be sensitive to these heritage resources. These properties are all located more than 800 m north of the Petrolia WWTP, and even further from the Petrolia Landfill, which lies to the east.

### 3.3.5 Recreation

According to the Town's Official Plan, major open spaces as well as some portions of the lands listed as hazards and environmental protection areas, shown in Figure 2, are to be used for recreation, such as parks or other specific recreational facilities, to meet the needs and wants of the residents.

For the most part, the environmentally protected area around Bear Creek and the Bridgeview Conservation Area contain trails and parks that are used by the residents. These trails are interconnected throughout the Town.

Recreation facilities exist to the southwest of central Petrolia and include the Greenwood Recreation Centre, soccer fields and baseball diamonds. This is also the location of the Petrolia and Enniskillen Fall Fair, which takes place every year during the first weekend after Labour Day. Additionally, there is a track and field facility located at the Lambton Central Collegiate and Vocational Institute towards the centre of the Town, and the Heritage Heights Golf and Curling Club located to the southwest. All of these facilities are more than 800 m from the Petrolia WWTP and Petrolia Landfill.

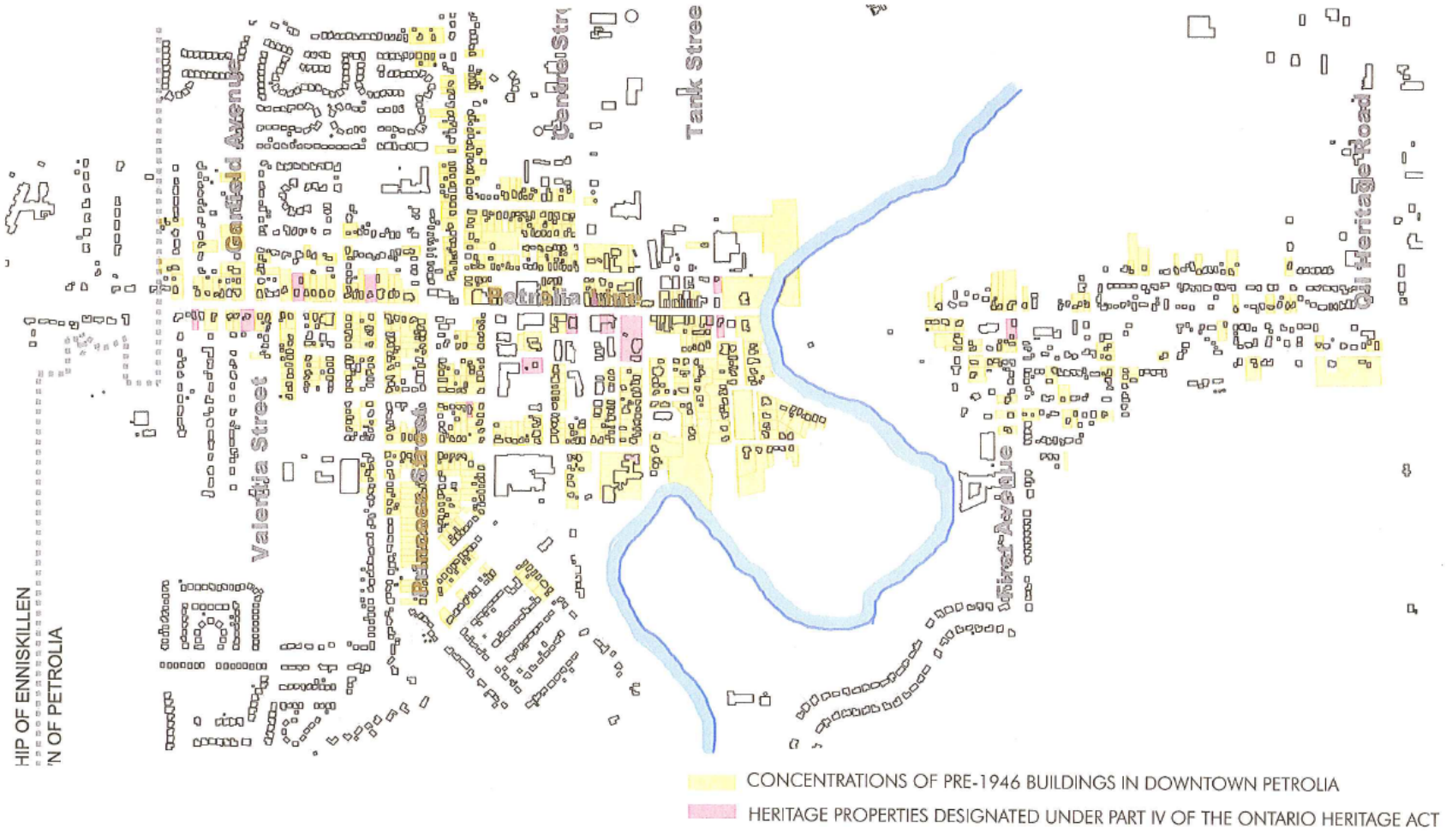


**Figure 7 Location of Heritage Resources Within Petrolia (Wendy Shearer et al., 2009)**

# 4. STATUS OF THE EXISTING FACILITIES

## 4.1 PETROLIA WASTEWATER TREATMENT PLANT

### 4.1.1 Serviceable Population of Petrolia WWTP

The Town of Petrolia has a municipal wastewater collection, treatment and disposal system, and it is anticipated that in the long term, all lands or new development within the municipal boundaries will be serviced by this system. The Town's Official Plan recognizes that some areas of the municipality may not be feasibly serviced, and individual septic systems may be permitted for certain, limited development. Additionally, some industrial areas within the service area may be permitted to develop their own systems where specialized treatment is required. This will be allowed at the discretion of the Municipality in consultation with the Province. For the purposes of this study, the entire population of Petrolia is considered to be serviced by the municipal sewage treatment system.

### 4.1.2 Description of Existing Facilities

An aerial view of the Petrolia WWTP is presented in Figure 8.


**Figure 8 Aerial View of the Petrolia WWTP**

Raw wastewater to the Petrolia WWTP is pumped to the headworks from an off-site pumping station and forcemain. The headworks facility consists of a single automatically-cleaned step-screen and an aerated grit tank. A manually raked coarse bar rack is available when the automatic screen is off-line for maintenance.

Flow from the grit removal process is directed to two parallel aeration tanks in an extended aeration process. Each aeration tank is equipped with two mechanical surface aerators, as well as one self-aspirating jet aerator, which was installed more recently to supplement air to the tanks.

Alum is added to mixed liquor from the aeration tanks for phosphorous precipitation before flowing to two square secondary clarifiers, each equipped with a circular scraper mechanism. Return activated sludge from each clarifier flows to a common sump for pumping activated sludge back to the aeration inlet channel. Waste activated sludge is intermittently wasted from the forcemain to aerobic sludge holding tanks.

Secondary effluent flows by gravity to a surge tank to equalize flows upstream of a single travelling bridge sand filter and the ultraviolet disinfection system. Disinfection is run year round at the request of the MOE, even though it is not required by the Certificate of Approval. Final effluent is discharged continuously through an outfall to Bear Creek.

Two aerobic sludge holding tanks are available to partially stabilize waste sludge before discharge to the east lagoon (88,220 $m^3$) for stabilization and long-term storage. Additionally a west lagoon (126,540 $m^3$) is available for emergency storage and treatment of raw wastewater. These lagoons are approved for seasonal discharge between April 1 and May 31 and between October 1 and November 30. The lagoon discharge flow rates must be regulated so the loadings to Bear Creek do not exceed Certificate of Approval limits.

Figure 9 shows the treatment train for the existing Petrolia WWTP.

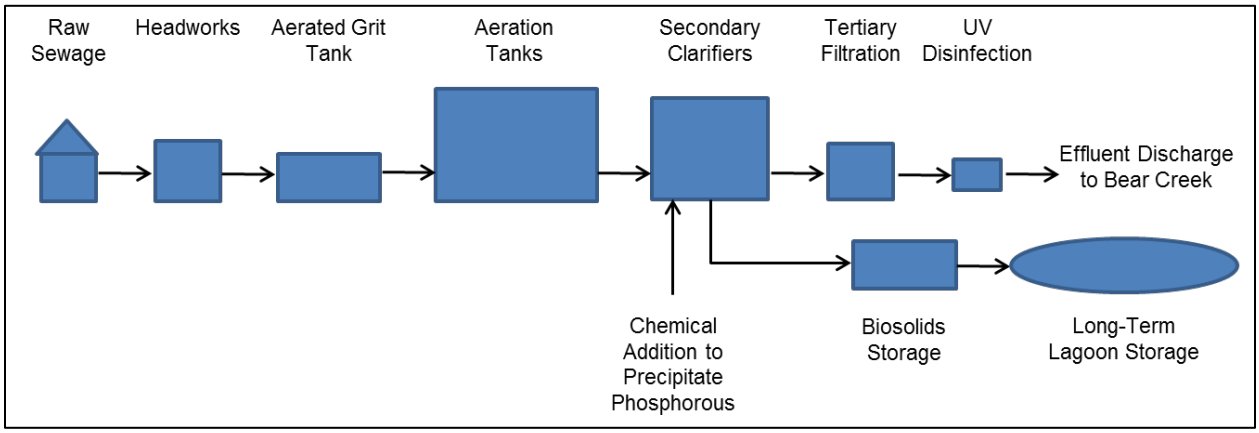


**Figure 9 Treatment Train of the Existing Petrolia WWTP**

### 4.1.3 Physical Condition and Capacity Assessment

A physical condition and capacity assessment of the Petrolia WWTP was completed by CIMA in August 2011. That report is provided in Appendix 1. Based on that review, the following deficiencies pose a risk to the plant achieving reliable operation and performance based on the existing Certificate of Approval rated capacity, or pose a health and safety risk:

- Structural condition: Deficiencies include cracks in aeration tanks, administration building leaks and other safety features.
- Capacity: Capacity is not adequate for Certificate of Approval rated flows in screen/grit removal, aeration, oxygenation and tertiary filtration processes.
- Equipment condition: Most major equipment is operating well beyond its normal service life, resulting in significant risk of failure and long periods of major process shut-down for repair, due to the difficulty in finding replacement parts.
- Electrical system: The motor control centre is over 30 years old and requires dangerous access to reset equipment. There is no stand-by power for critical processes.
- Flows in numerous months over the past 3 years have exceeded 100% of the plant's rated capacity. MOE policy requires the initiation of planning for plant expansion once 85% of the rated capacity is reached.

### 4.1.4 Raw Wastewater Flows

Historic flow data were summarized from the 2008, 2009 and 2010 Annual Reports (CH2M HILL, 2009, 2010, 2011).

**Figure 10 charts the historic monthly average and maximum day flows to the Petrolia WWTP. Additional data are presented in**

Table 4. Raw wastewater flow was measured using a Parshall flume.

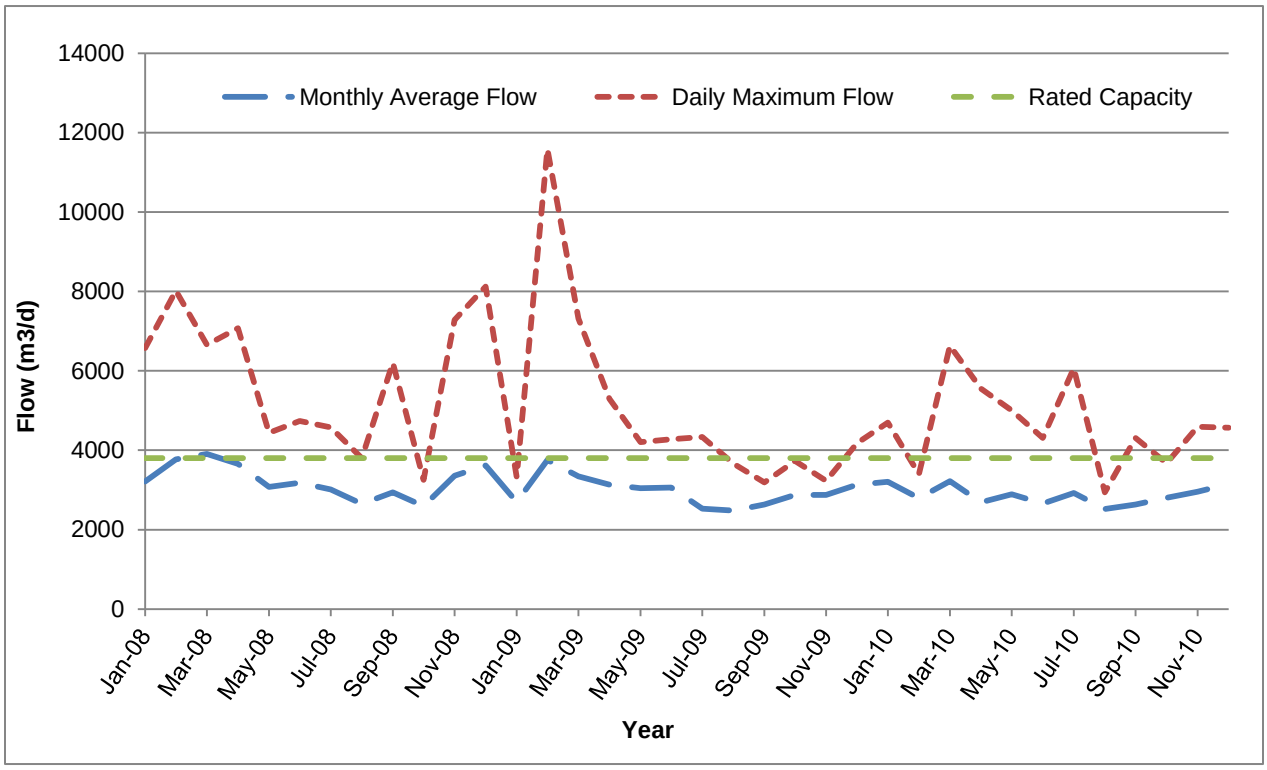


**Figure 10 Historic Monthly Average and Maximum Day Flows to the Petrolia WWTP**

**Table 4 Historic Flows to Petrolia WWTP (2008 – 2010)**

| Parameters | Flows (% of Rated Capacity) |
|---|---|
| Monthly Average Flow ($m^3$/d) | 3,028 (80%) |
| Average Per Capita Flow (L/cap.d) | 556[1] |
| Maximum Month Flow ($m^3$/d) | 3,909 (103%) |
| Maximum Day Flow ($m^3$/d)[2,3] | 8,126 (201%) |

Notes:
1 Based on an average projected population for 2008 to 2010 of 5,450 using the 2001 to 2006 growth rate of 1.5% per year presented in Table 3.
2 Based on the maximum day flow reported for each month.
3 One of the 36 maximum day flows did not fall below this value but appeared to be an anomaly.

The monthly average flow from 2008 to 2010 was 3,028 $m^3$/d, which represents 80% of the rated plant capacity of 3,800 $m^3$/d. Average flows in 3 months met or exceeded the plant rated capacity.

The average per capita flow was 556 L/cap.d, which is within a typical range, allowing for some level of infiltration and inflow in an older system, as well as daytime residents from local rural areas for schools, employment and other urban activities.

The maximum day flow was calculated from the maximum day flow reported for each of the 36 months, from 2008 to 2010. All but one value fell below 8,126 $m^3$/d during the three year monitoring period. The highest maximum day flow value was 11,590 $m^3$/d reported in February 2009. Peak instantaneous flow data are not available for the Petrolia WWTP.

### 4.1.5 Raw Wastewater Quality

Historic concentration data were gathered from the 2008, 2009 and 2010 Annual Report of Operations for the Petrolia WWTP (CH2M HILL, 2009, 2010, 2011). Table 5 presents the average concentrations and raw wastewater loadings to the plant between 2008 and 2010.

**Table 5 Historic Raw Wastewater Average Concentrations and Loadings to Petrolia WWTP (2008 to 2010)**

| Parameters | Historic Average Concentrations (mg/L) | Historic Monthly Average Flow ($m^3$/d) | Historic Average Loadings (kg/d) |
|---|---|---|---|
| 5-Day Biochemical Oxygen Demand ($BOD_5$) | 226 | 3,028 | 679 |
| Total Kjeldhal Nitrogen (TKN) | 37.6 | | 113 |
| Total Suspended Solids (TSS) | 199 | | 595 |
| Total Phosphorous (TP) | 5.6 | | 17.0 |

Table 6 provides a comparison of the historical per capita loadings to typical per capita loadings (Metcalf & Eddy 2003).

**Table 6 Comparison of Historic and Typical Per Capita Loadings (2008 to 2010)**

| Parameters | Historical Per Capita Loadings Based on a Population of 5,450[2] (g/cap.d) | Typical Per Capita Loadings (g/cap.d)[1] |
|---|---|---|
| $BOD_5$ | 125 | 80 |
| TKN | 21 | 13 |
| TSS | 109 | 90 |
| TP | 3.1 | 3.2 |

Notes:
1 From Metcalf & Eddy Fourth Edition, 2003, Table 3-12 page 182.
2 Estimated population in 2009.

From Table 6, it can be seen that the historical per capita loadings are higher than typical per capita loadings for both $BOD_5$, TKN and TSS. As stated above, Petrolia is a central town and experiences incoming rural population during the day; this is a likely cause for the higher than typical results.

### 4.1.6 Effluent Quality Standards and Performance

Effluent data for the period of 2008 to 2010 are presented in Table 7 (CH2M HILL, 2009, 2010, 2011). The Petrolia WWTP has consistently produced excellent effluent quality, with concentrations well below the effluent compliance requirements. During the monitoring period the plant slightly exceeded the effluent objectives for $BOD_5$ twice and the TSS and TP once, but not the effluent limits.

**Table 7 Historic Effluent Quality (2008 to 2010)**

| Parameters | Average (mg/L) | Peak Month (mg/L) | Effluent Objective (mg/L) | Effluent Compliance (mg/L) |
|---|---|---|---|---|
| $BOD_5$ | 1.8 | 6.8[1] | 5 | 10 |
| $NH_3$-N | | | | |
| May 1 – Nov. 30 | 0.2 | 0.41 | 2 | 3 |
| Dec. 1 – Apr. 30 | 0.37 | 1.58 | 5 | 7 |
| TSS | 1.0 | 8.9[2] | 5 | 10 |
| TP | 0.48 | 0.63[3] | 0.5 | 1.0 |
| pH (at all times) | 7.38 | 8.01 | 6.5 – 8.5 | 6.5 – 9.5 |
| E. Coli (Apr 1 – Nov 30) | 3 organisms / 100 ml | 5 organisms / 100 ml | 150 organisms / 100 ml | 200 organisms / 100 ml |

Notes:
1 Peak month exceeded effluent objective in March and April 2009.
2 Peak month exceeded effluent objective in March 2009.
3 Peak month exceeded effluent objective in Aug 2009.

The Petrolia WWTP is also allowed to discharge from the east and west lagoons during April 1st to May 31st and October 1st to November 31st of each year. In 2008, the west lagoon was discharged for 4 days during May, and for 22 days in March of 2009, both the east and west lagoons were discharged according to a Provincial Officer's Order (POO), 0348-7PMJPG. The west lagoon was also discharged for 12 days during May 2010, but the sampling results were unavailable and thus not included in this section.

The effluent objectives and compliance limits for lagoon discharge are the same as those for discharge from the plant. Table 8 summarizes the average plant effluent concentrations, while Table 9 summarizes the lagoon effluent concentrations during these months. During March 2009 the plant exceeded effluent objectives for $BOD_5$ and TSS but not compliance limits, as shown in Table 8. Discharge from the lagoons also resulted in effluent objectives not being met for TSS in 2008 and $BOD_5$, TSS and E. Coli in 2009, while TSS and E. Coli also exceeded the compliance limits in 2009 as shown in Table 9.

In discharging from the lagoons, the Petrolia WWTP is required to meet the waste loading compliance limits, which included the total monthly loading from the plant and the lagoons. The limits as well as the loading results are summarized in Table 10.

The effluent during May of 2008 met both the waste loading objectives and compliance limits. However, during March of 2009 both TP and $NH_3$-N met the compliance limit but did not meet the objective limit and $BOD_5$, TSS and E. Coli did not meet the compliance limits.

**Table 8 Plant Average Effluent Concentration during 2008 and 2009 Lagoon Discharge Periods**

| Parameters | May 2008 | March 2009 | Effluent Objective | Effluent Compliance |
|---|---|---|---|---|
| $BOD_5$ (mg/L) | 1.2 | 6.1 | 5 | 10 |
| $NH_3$-N (mg/L) | | | | |
| May 1 – Nov. 30 | 0.1 | NA | 2 | 3 |
| Dec. 1 – Apr. 30 | NA | 1.6 | 5 | 7 |
| TSS (mg/L) | 0.6 | 8.9 | 5 | 10 |
| TP (mg/L) | 0.62 | 0.3 | 0.5 | 1.0 |
| pH (at all times) | 7.18 | 7.37 | 6.5 – 8.5 | 6.5 – 9.5 |
| E. Coli (Apr 1 – Nov 30) (organisms per 100 ml) | 3 | 25 | 150 | 200 |

## Table 9 Lagoon Average Effluent Concentration during 2008 and 2009 Lagoon Discharge Periods

| Parameters | May[1] 2008 | March[2] 2009 | Effluent Objective | Effluent Compliance |
|---|---|---|---|---|
| $BOD_5$ (mg/L) | 2.8 | 7.2 | 5 | 10 |
| $NH_3$-N (mg/L) | | | | |
| May 1 – Nov. 30 | 1.4 | NA | 2 | 3 |
| Dec. 1 – Apr. 30 | NA | 2.4 | 5 | 7 |
| TSS (mg/L) | 9.2 | 13 | 5 | 10 |
| TP (mg/L) | 0.33 | 0.33 | 0.5 | 1.0 |
| pH (at all times) | 7.26 | 7.34 | 6.5 – 8.5 | 6.5 – 9.5 |
| E. Coli (Apr 1 – Nov 30) (organisms per 100 ml) | 49 | 934 | 150 | 200 |

Notes:
1 Discharge occurred from May 23rd to May 26th.
2 Discharge occurred from February 27th to March 20th.

## Table 10 Total Loading during Lagoon Discharge from 2008 to 2009

| | Average Day Lagoon Loading | | Average Day Plant Loading | | Approximate Total Loading During Lagoon Discharge | | Waste Loading Objective | Waste Loading Compliance |
|---|---|---|---|---|---|---|---|---|
| **Parameters** | **2008** | **2009** | **2008** | **2009** | **2008** | **2009** | | |
| Discharge Date | May[1] | March[2] | May[1] | March[2] | May[1] | March[2] | | |
| Discharge Volume ($m^3$) | 15,817 | 197,483 | 95,347 | 103,663 | 111,164 | 301,146 | | |
| $BOD_5$ (kg/d) | 1.4 | 45.9 | 3.7 | 20.4 | 5.1 | 66.3 | 19 | 38 |
| $NH_3$-N (kg/d) | | | | | | | | |
| May 1 – Nov. 30 | 0.7 | NA | 0.3 | NA | 1.0 | NA | 7.2 | 11.4 |
| Dec. 1 – Apr. 30 | NA | 15.2 | NA | 5.4 | NA | 20.6 | 19 | 26.6 |
| TSS (kg/d) | 4.7 | 82.8 | 1.9 | 29.8 | 6.6 | 112. 6 | 19 | 38 |
| TP (kg/d) | 0.17 | 2.1 | 1.9 | 1.0 | 2.07 | 3.1 | 1.9 | 3.8 |
| E. Coli (Apr 1 – Nov 30) (organisms per 100 ml) | 49 | 934 | 3 | 25 | 9.5 | 621 | 150 | 200 |

Notes:
1 Discharge occurred from May 23rd to May 26th.
2 Discharge occurred from February 27th to March 20th.

## 4.2 PETROLIA LANDFILL

### 4.2.1 Serviceable Population of the Petrolia Landfill

The Petrolia Landfill currently accepts solid non-hazardous municipal, industrial, commercial and institutional solid waste from within the Province of Ontario.

### 4.2.2 Description of Existing Facilities

The Petrolia Landfill is owned and operated by Waste Management Corporation of Canada (WM) and is a solid non-hazardous waste landfill located at 4052 Oil Heritage Road in Petrolia, as was previously shown in Figure 2. The site is approximately 41.23 ha, with 26.02 ha licensed for waste disposal.

Incoming waste is deposited into excavated cells below grade in the local clayey soil. Leachate is currently collected by underdrains and toedrains that are connected to a pumping station. From there leachate is transported by truck to a number of alternative municipal treatment facilities. A gas management system is installed for the collection and use of landfill gas for energy generation.

Figure 11 shows the layout of the Petrolia Landfill.

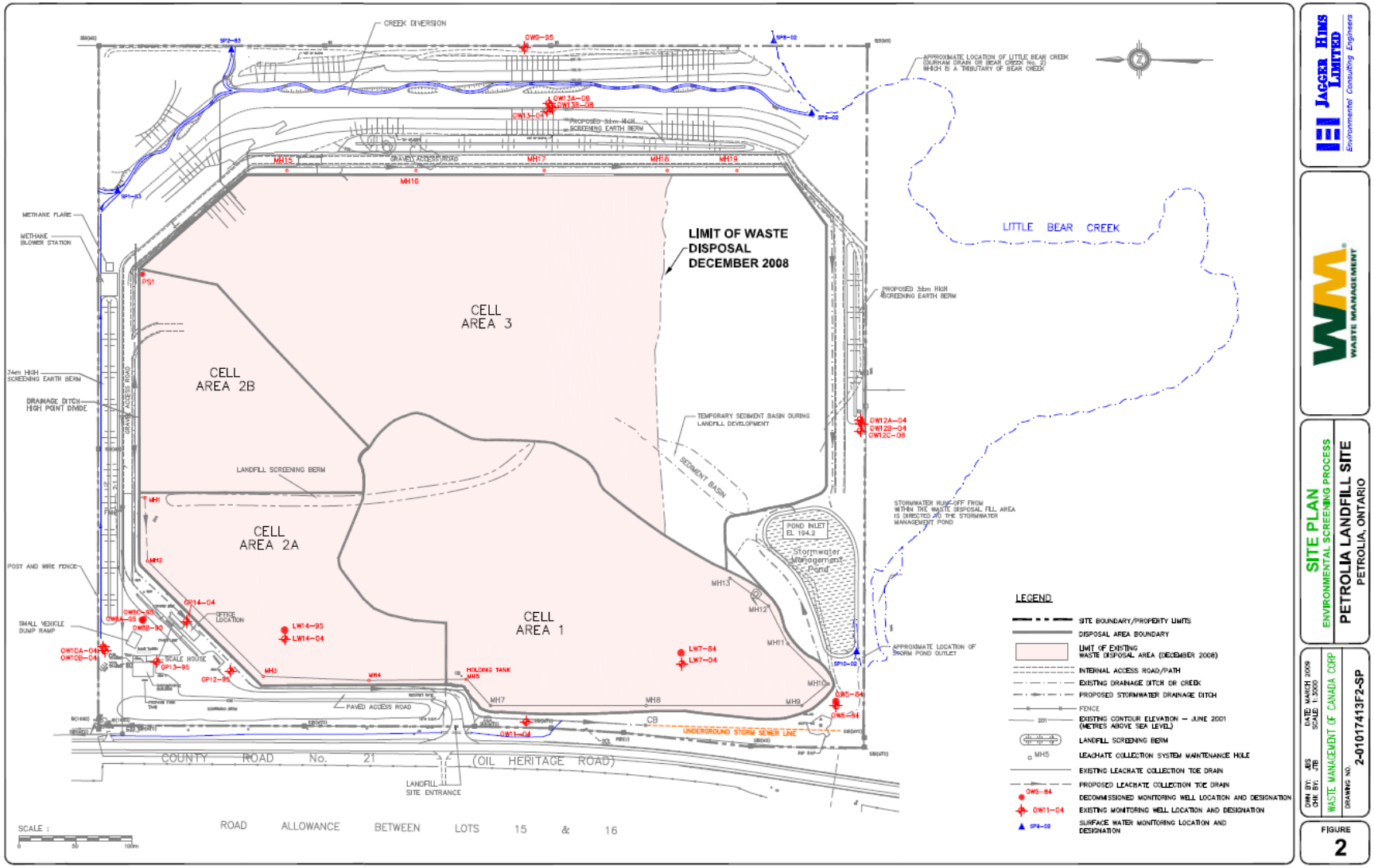


**Figure 11 Petrolia Landfill Site (Jagger Hims Ltd. 2009)**

### 4.2.3 Incoming Waste

The Petrolia Landfill is currently approved to receive 365,000 tonnes per year of solid non-hazardous municipal, industrial, commercial and institutional waste. The site has a daily maximum of 2,000 tonnes and cannot exceed an annual average of 1,000 tonnes per day over a 365 day period. The site is also approved for the storage of 1,200 $m^3$ of whole tires and tire shred for use as a supplemental drainage layer for the leachate collection system.

### 4.2.4 Leachate Flows and Cost

Leachate is defined as any liquid that extracts solids as it passes through matter. Landfill leachate helps promote decomposition and is generated by precipitation falling on and flowing through the waste material while gaining dissolved and suspended contaminants along the way. In order to prevent the leachate from contaminating groundwater or surface water, an impermeable liner or membrane must be used to contain the leachate. This leachate can then be collected and treated.

Leachate collected at the Petrolia Landfill is hauled away for treatment, at an average cost of 2.43¢ per litre. Flows are calculated based on the volume of leachate shipped. Daily volumes were provided by WM for 2010 and 2011, while monthly volumes were provided for 2008 and 2009. Leachate volumes are presented in Figure 12 and Table 11.

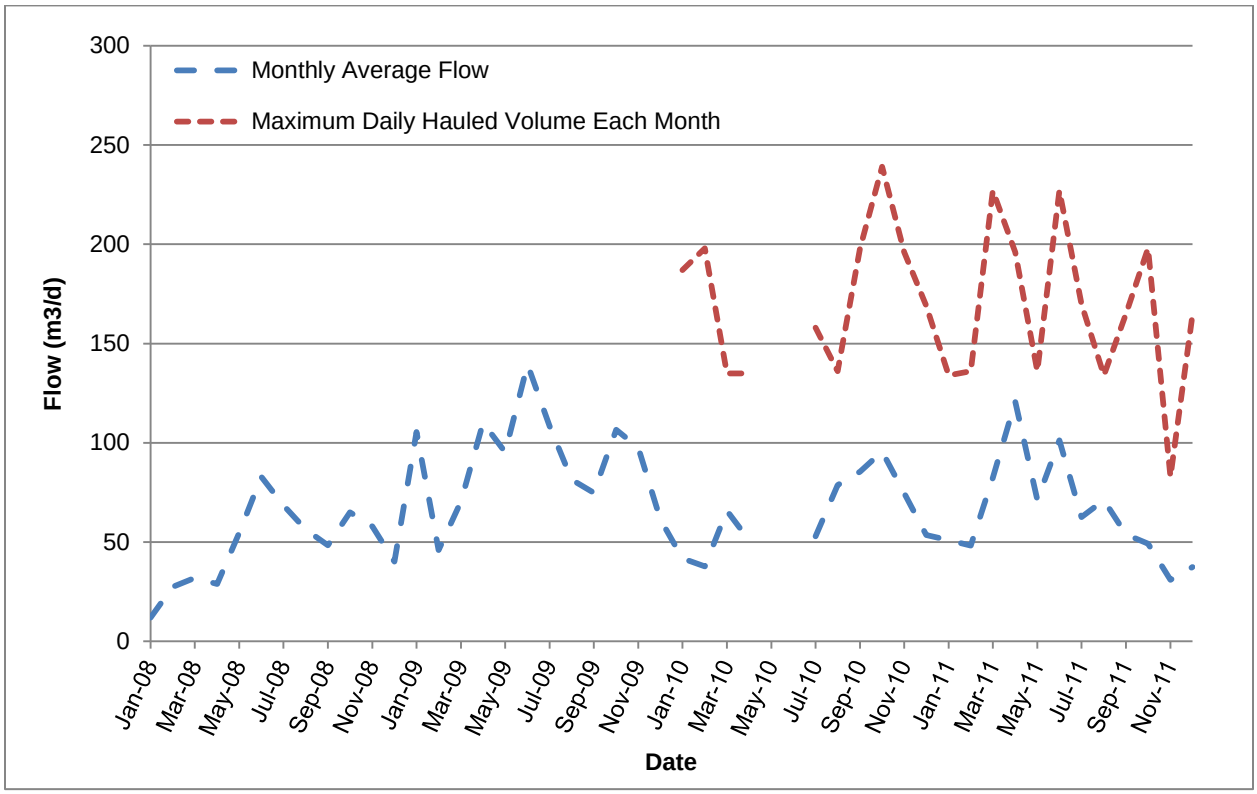


**Figure 12 Historic Monthly Average and Maximum Day Leachate Flows from the Petrolia Landfill (Jan 2008 to Oct 2011)**

**Table 11 Historic Leachate Flows**

| Parameter | Volume of Leachate Shipped |
|---|---|
| Monthly Average Flow ($m^3/d$)[1,2] | 68 |
| Maximum Day Flow ($m^3/d$)[1,2] | 239 |
| Average Total Month ($m^3$)[3] | 2,012 |
| Average Total Year ($m^3$)[4] | 23,140 |

Notes:

1 Based on daily leachate shipping volumes from 2010 to October 2011, however leachate was not hauled every day.
2 May and June 2010 were excluded as outliers.
3 Based on monthly leachate hauling volumes from 2008 up to and including October 2011.
4 Based on monthly leachate hauling volumes from 2008 to 2010.
5 Current average haulage and disposal rate of 2.43¢ per L.

During this historic period leachate was typically not hauled on weekends or holidays, and there were many other days throughout 2010 and 2011 when leachate was not hauled. In order to determine a useful monthly average flow, the value of 68 $m^3/d$ was calculated based on leachate being collected and hauled every day. The maximum day flow of 239 $m^3/d$ was based upon the actual maximum hauled volume recorded for a single day.

A review of the historical monthly volume indicates that the warmer, wetter, months from March to October produced a higher volume of leachate, while less was generated during colder, dryer, months from November to February. June had the highest average day flow of 108 $m^3/d$ (excluding June 2010 where no leachate was hauled), which was anticipated as historically June is among the wettest months. February produced the lowest average day flow of 40 $m^3/d$, which was expected as February has historically been the driest month.

It should be noted that these variations may be due to an inability to haul leachate during the colder months, as leachate was only hauled on average 14 days per month from November to February versus 19 days per month from March to October, based on data from 2010 and 2011.

### 4.2.5 Leachate Quality

The leachate sampling program at the Petrolia Landfill began on October 19th, 2011 and will run for a minimum of 45 weeks. $BOD_5$, COD, $NH_3$-N, TKN, TSS and TP are sampled every week and metals are sampled once per month. To date, 26 samples have been collected, 7 including metals. Results are summarized in Table 12. Comparing these values to those of the raw wastewater presented in Table 5, it can be seen that the Petrolia Landfill leachate is greater in strength for $BOD_5$ and TKN, while it has lower concentrations of TP and TSS.

**Table 12 Leachate Quality[1]**

| Parameters | Minimum Concentrations (mg/L) | Maximum Concentrations (mg/L) | Average Concentrations (mg/L) |
|---|---|---|---|
| $BOD_5$ | 164 | 954 | 494 |
| COD | 460 | 2,800 | 1643 |
| $NH_3$-N | 559 | 1,150 | 837 |
| TKN | 621 | 1,920 | 906 |
| TSS | 12 | 150 | 42 |
| TP | 0.18 | 6.04 | 2.8 |

Notes:
1 Based on 26 samples collected weekly between October 19, 2011 and April 11, 2012 from the leachate pumping station wet well.

# 5. DESIGN CRITERIA

## 5.1 POPULATION

In October of 2010, a study was completed by the County of Lambton to project the population to the year 2031 (Lambton County, 2010). Projections suggested for planning purposes were based on a weighted growth scenario. The weighted growth scenario takes into account the past three census periods of the individual municipality with more emphasis placed on the most recent census. A maximum growth scenario is also presented, based on the best growth rates of the last three census periods being achieved consistently.

Population data for Petrolia are presented in Table 13, showing extrapolated projections to the year 2041 for the purposes of this Class EA study.

**Table 13 Weighted Population Growth for the Town of Petrolia Projected to 2041**

| Growth Scenario | 2006 Population | 2031 Projected Population | Percent Growth 2006 to 2031 | 2041 Extrapolated Population | Percent Growth 2006-2041 |
|---|---|---|---|---|---|
| Weighted | 5,215 | 6,204 | 19.0% | 6,602 | 26.6% |
| Maximum | 5,215 | 8,071 | 54.8% | 9,216 | 76.7% |

Both scenarios project growth for the Town of Petrolia into the year 2041. The weighted scenario projects growth of 26.6% from 5,215 people in 2006 to 6,602 people in 2041, or an annual growth rate of 0.67% per year. The maximum growth scenario projects a population increase from 5,215 people in 2006 to 9,216 people in 2041 for a total growth of 76.7%, or an average growth rate of 1.6% per year. These trends are plotted in Figure 11.

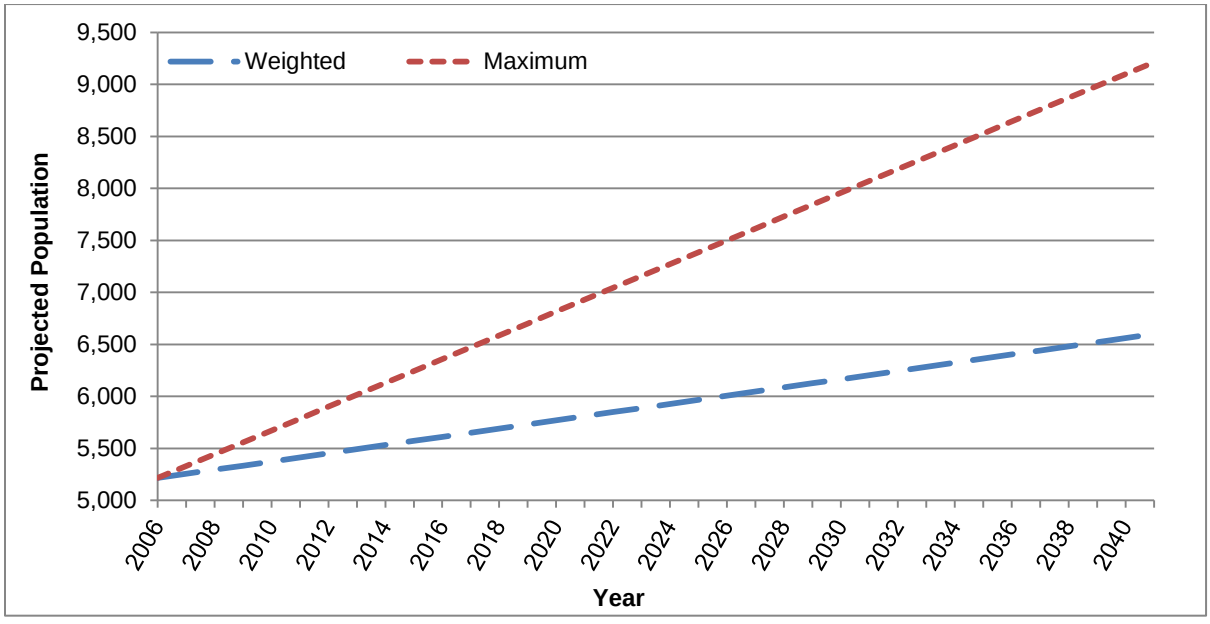


**Figure 13 Predicted Population Based on a Weighted and Maximum Growth Scenario to 2041**

For the purposes of planning municipal infrastructure facilities, a conservative approach should be taken in determining capacity needs. This will ensure capacity is available for a reasonable planning period (20 to 30 years), and will avoid the need for several construction phases.

## 5.2 PETROLIA WASTEWATER TREATMENT PLANT

### 5.2.1 Projected Wastewater Flows

Population data for the Town of Petrolia are not available for 2007 to present. For the purposes of developing alternative solutions for the Class EA, projected flows will be based on the maximum growth scenario to ensure a conservative approach. In later phases, the actual design flow for the preferred solution may be refined to reflect more up-to-date population data.

The average per capita flow of 556 $m^3$/cap.d previously presented in Table 4 was used to calculate projected wastewater flows. This value was based on the 2008 to 2010 monthly average flow data and the projected maximum population from 2008 to 2010.

The projected monthly average flow to the Petrolia WWTP for the weighted and maximum growth scenarios are presented in Figure 14.

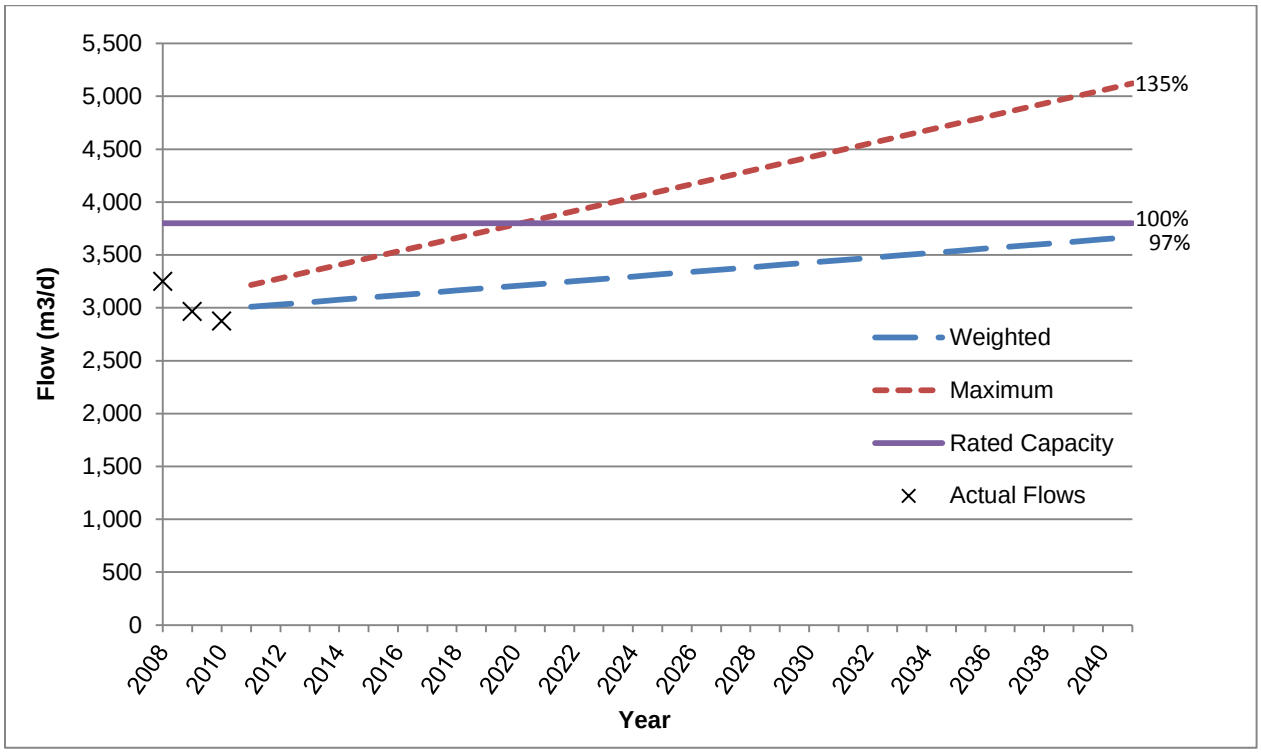


**Figure 14 Monthly Average Flows to the Petrolia WWTP Based on a Weighted, Maximum and Average Growth Scenario to 2041**

It is expected that the monthly average flow of wastewater to the Petrolia WWTP will increase to between 3,669 and 5,123 $m^3$/d by 2041, which would correspond to 97 to 135 % of the current rated plant capacity of 3,800 $m^3$/d. The conservative flows to be used for the purpose of evaluating alternative solutions in this Class EA are presented in Table 14.

**Table 14 2041 Wastewater Flows from Petrolia Service Area and Peak Flow Factors**

| Parameters | Factors | Flows ($m^3/d$) |
|---|---|---|
| Monthly Average Flow | 1 | 5,123 |
| Peak Day Flow | 2.7[1] | 13,833 |
| Peak Hourly Flow | 3.2[2] | 16,394 |
| Peak Instantaneous Flow | 4.0[3] | 20,492 |

Notes:

**Calculated from the maximum day flow and monthly average flow presented in**

1 Table 4.
2 Peak hourly flow based on historical peak day flow factor plus 50% of average day flow to allow for diurnal peaks.
3 Typical peak instantaneous factor.

### 5.2.2 Design Wastewater Quality

Historic concentration and flow data from 2008 to 2010 were used to determine the 2041 design average loadings based on the monthly average flow rate of 5,123 $m^3/d$. The data are presented in Table 15. This historic information is from Table 5.

**Table 15 2041 Petrolia Wastewater Concentrations and Loadings**

| Parameters | Design Concentrations (mg/L) | 2041 Monthly Average Flow ($m^3/d$) | 2041 Design Average Loadings (kg/d) |
|---|---|---|---|
| $BOD_5$ | 226 | 5,123 | 1,158 |
| TKN | 37.6 | | 193 |
| TSS | 199 | | 1,020 |
| TP | 5.6 | | 28.7 |

## 5.3 PETROLIA LANDFILL

### 5.3.1 Leachate Flows and Cost

Waste Management anticipates that the Landfill will close in 2012 and the volume of leachate generated will begin to decrease from 20,000 $m^3$ to 5,000 $m^3$ in 2020, at which point it will continue to be generated at about 5,000 $m^3$ per year up to the end of the planning period in 2041. The closure of the Petrolia Landfill has been delayed in the past, therefore in an effort to remain conservative a second scenario is proposed where the landfill closure is delayed by 3 years to 2015.

Figure 15 shows the decrease in the yearly generated leachate volumes for the estimated closure date of 2012 (minimum scenario) and the conservative closure date of 2015 (maximum scenario).

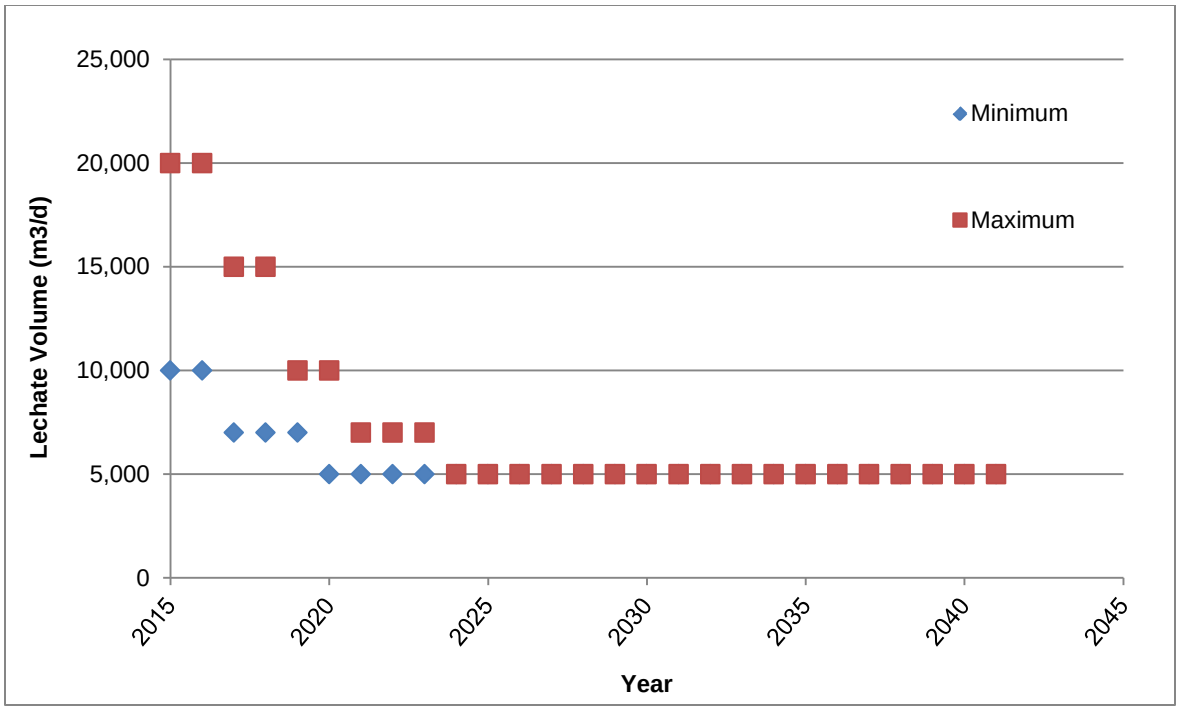


**Figure 15 Projected Yearly Leachate Volume Generated at the Petrolia Landfill from 2012 to 2041**

Due to the high variability in the leachate hauling volume data, a monthly average flow, maximum day flow and maximum week flow of leachate from the Petrolia Landfill are presented in Table 16 for the purposes of this Class EA. This info is from historic data in Table 11.

**Table 16 Leachate Design Flows**

| Parameter | Volume of Leachate Shipped |
|---|---|
| Monthly Average Flow ($m^3/d$)[1,2] | 68 |
| Maximum Day Flow ($m^3/d$)[1,2] | 239 |
| Maximum Week Flow ($m^3/d$)[1,2] | 140 |

Notes:
1 Based on daily leachate shipping volumes from 2010 to October 2011, however leachate was not shipped every day.

### 5.3.2 Leachate Quality

It is anticipated that leachate quality will remain relatively unchanged during the site operating period and then begin to decrease in concentration. To remain conservative, historic and current concentrations are used. Available data were used to develop leachate quality for the purposes of developing alternatives for the Class EA, as presented earlier in Table 12. Leachate design loadings were calculated based on the flow for average day, maximum day and maximum week presented in Table 16, and are summarized and presented in Table 17. As additional sampling results are obtained, these values will be refined.

## Table 17 Leachate Design Concentrations and Loadings

| Parameters | Historic Average Concentrations (mg/L) | Design Average Loadings at a Flow of 68 $m^3/d$ (kg/d) | Design Maximum Day Loadings at a Flow of 239 $m^3/d$[1] (kg/d) | Design Maximum Week Loadings at a Flow of 140 $m^3/d$[1] (kg/d) |
|---|---|---|---|---|
| $BOD_5$ | 494 | 34 | 118 | 70 |
| TKN | 906 | 62 | 217 | 127 |
| TSS | 42 | 2.9 | 10.1 | 5.9 |
| TP | 2.8 | 0.19 | 1.18 | 0.40 |

Notes:

1 Based on daily leachate shipping volumes from 2010 to October 2011, however leachate was not shipped every day.

# 6. PROBLEM/OPPORTUNITY STATEMENT

The Petrolia WWTP is a 3,800 $m^3$/d extended aeration plant servicing the Town of Petrolia. Most components of the plant are more than 35 years old, and require major upgrading. In addition, a review of the capacity of the plant processes indicates that many processes do not provide adequate capacity to reliably treat the approved flow of 3,800 $m^3$/d to consistently achieve effluent objectives and effluent compliance. Projected growth for the Town, as well as the significant deficiencies at the plant, require that planning for expansion and upgrade of the plant be initiated through a Schedule C Class Environmental Assessment (EA).

The Petrolia Landfill, owned and operated by Waste Management of Canada Corporation (WM), is located within the Town of Petrolia. The Landfill is equipped with a leachate collection system to collect leachate. This leachate is currently trucked to a number of alternative municipal treatment facilities.

Since the Petrolia Landfill is located a short distance from the Petrolia WWTP, an opportunity exists to direct leachate to the Petrolia WWTP through the current wastewater collection system or a dedicated pipe. Currently the Petrolia WWTP does not have capacity or reliability to accept the additional loadings from leachate.

The Town of Petrolia and Waste Management are both seeking a cost-effective solution to manage their wastewater into the future. One solution that shows significant promise is to co-treat leachate with raw wastewater at the Petrolia WWTP. Planning for the management of wastewater and leachate through the Schedule C Class EA will provide a sound, thorough approach to evaluating a full range of solutions for the Town of Petrolia and Waste Management, considering all potential environmental, community and cost impacts.

# 7. EVALUATION METHODOLOGY

## 7.1 EVALUATION APPROACH

For the evaluation of the alternative solutions, a Triple Bottom Line (TBL) evaluation methodology is proposed. This methodology is designed to select a preferred solution that balances the criteria of environmental protection, minimizing community impacts, and minimizing economic impacts (costs).

A weighting and ranking system is proposed in order for the evaluation to be systematic, rational and reproducible in comparing the alternatives and identifying the preferred solution. For this project, we are proposing that environmental and community goals are equally weighted at 40% as they each are defined by more indicator criteria, and the economic goal be weighted less at 20% as it is defined by fewer indicator criteria.

The methodology proposed is described as follows:

1. A series of indicator criteria are defined for each of the three criteria, which reflect how well an alternative would meet that goal. For example, an indicator of environmental protection is greenhouse gas generation.
2. The importance of each indicator criterion relative to the other indicators is given a value weight, which reflects the priorities and goals of the Town and WM. An indicator criterion with a higher value weight will have more significant impact to the overall evaluation scoring.
3. Each alternative will be scored based on how well it meets each indicator criterion, based on its relative impacts and/or risks and potential mitigation of risks. Proposed scoring is based on a scale of one to five, with '1' being the least able to meet the criterion and having the highest or most severe impact compared to other alternatives, and '5' being best able to meet the criterion and having no impact and/or providing an overall benefit, compared to other alternatives. The scoring will be evaluated using the following guidelines:

    - Score of 5: Alternative meets indicator criterion with negligible impacts and/or risks requiring no mitigation, or alternative results in a net benefit.
    - Score of 4: Alternative does not meet indicator criterion, but causes only minor impacts and/or risks requiring little mitigation.
    - Score of 3: Alternative does not meet indicator criterion, causing moderate impacts and/or risks requiring some mitigation.
    - Score of 2: Alternative does not meet indicator criterion, causing major impacts and/or risks requiring significant mitigation.
    - Score of 1: Alternative does not meet indicator criterion, causing sever impacts and/or risks requiring extensive mitigation.

    For qualitative criterion, such as costs, the highest cost would receive a score of 1, the lowest cost a score a 5, and other costs would be prorated to receive a score between 1 and 5.

4. The final score for each alternative is determined as the sum of: the score of each indicator criterion multiplied by the value weight assigned to that criterion.
5. Scores for wastewater treatment solutions for the Town will be compared, and the highest scoring solution will be recommended as preferred. Likewise, the waste management solution with the highest score will be recommended as preferred.

## 7.2 EVALUATION CRITERIA

A preliminary set of indicator criteria grouped by the Triple Bottom Line category, each with a short description, proposed to be used to rank the alternative solutions, are listed in Table 18. Also shown in Table 18 is the value weighting of each criterion. The value weight was determined based on the following:

- Low value has a relative weight of 1
- Medium value has a relative weight of 2
- High value has a relative weight of 4

The actual % value weight was based on the above relative weighting, and prorated for the number of indicator criteria and the % value of the goal (i.e., 40% for environmental and community, 20% for economics).

## Table 18 Evaluation Criteria Used in Evaluation

| Indicator Criteria | Goal | Importance | Prorated Value Weight |
|---|---|---|---|
| **Protect Environment (40%)** | | | |
| Surface Water Protection | Maximize reliability in achieving effluent quality limits under all average and peak flows and loadings to the plant | High | 7.3% |
| Greenhouse Gases | Minimize greenhouse gas generation or net energy use | High | 7.3% |
| Operating Complexity | Minimize risks to reliability and performance with a system that is simple | Medium | 3.6% |
| Chemical Use | Minimize use of chemical additives | Medium | 3.6% |
| Environmental Risk During Construction | Minimize risk of impacts to surface water, groundwater, land, terrestrial resources and aquatic habitats during construction | Medium | 3.6% |
| Treatment Plant Performance Risk During Construction | Minimize potential risk to performance and plant operations during construction | High | 7.3% |
| Spills | Minimize potential risks to surface water and land due to spills | High | 7.3% |
| **Minimize Community Impacts (40%)** | | | |
| Aesthetics | Maximize aesthetic appeal of the structures and area | High | 6.2% |
| Land Use | Maximize land use to preserve site area for any future requirements | Medium | 3.1% |
| Health and Safety | Maximize protection of public and operator health and safety from exposure to gaseous emissions, toxic organics or processing chemicals | High | 6.2% |
| Operations and maintenance staff | Minimize operations certification and training requirements | Medium | 3.1% |
| Odours | Minimize potential for odours affecting the community | High | 6.2% |
| Noise | Minimize potential for noise affecting the community | High | 6.2% |
| Traffic & Safety | Minimize truck traffic and during construction and operation and maximize community safety | High | 6.2% |
| Construction Duration | Provide the shortest possible construction schedule and operational impact to neighbouring areas and operators | Medium | 3.1% |
| **Minimize Economic Impacts (Costs) (20%)** | | | |
| Capital Costs | Minimize capital costs | High | 8.0% |
| Operations and Maintenance Costs | Minimize operations and maintenance costs | High | 8.0% |
| Operating Risks | Minimize operating cost risk due to dependence on electricity, fuels, chemicals or other on-going costs | Medium | 4.0% |

## 7.3 CALCULATION BASIS

Table 19 presents the basis for calculations used to assess design requirements, cost and other environmental impacts associated with each alternative solution.

**Table 19 Basis of Calculations to Develop Alternative Solutions**

| Item | Factor | Basis/Source |
|---|---|---|
| Petrolia WWTP Design Requirements | Process capacity sizes for plant processes | • MOE Design Guidelines for Sewage Works (2008)<br>• Historical flow and loading data to plant |
| Capital Cost | Capital costs for treatment processes, pumping and linear infrastructure (general) | • Based on typical costs for recently tendered similar projects<br>• Allows contingency at design concept phase – cost estimates will be refined during Phase 3 of the Class EA |
| | Capital cost for treatment of leachate at Petrolia WWTP | • Based on prorated capital cost (taking into account an economy of scale) of expanding key processes (aeration tank, aeration system, biosolids management) due to incremental loading from leachate |
| Net Present Value Operating Costs | Net present value (NPV) operating costs (general) | • Based on 27 year life-cycle from 2015 to 2041<br>• Based on annual rates of inflation at 2% and interest at 4% |
| Operating Costs | Leachate flows | • Data provided by Waste Management<br>• Minimum scenario based on landfill closure in 2012<br>• Maximum scenario based on landfill closure in 2015 |
| | Leachate haulage to alternate wastewater treatment plants outside of Petrolia | • Based on 33,000 liters of leachate per truckload estimated from daily leachate hauling data<br>• Based on $0.0119 per L for haulage<br>• Estimated average round trip of 180 km<br>• Based on additional $0.0124 per L for treatment<br>• Data provided by Waste Management |
| | Leachate haulage (to Petrolia WWTP) | • Using existing costs, above, and based on 20% of existing cost ($0.0024) being a fixed cost for loading/unloading, and 80% being a per kilometer cost ($1.74 per km)<br>• Estimated round trip to Petrolia WWTP of 12 km |
| | Leachate treatment at Petrolia WWTP | • Based on cost of wastewater treatment from Town's agreement with OMI, prorated from a $ per L cost to a $ per unit of oxygen demand (because leachate is low volume but concentrated), including a 10% allowance (refer to text below)<br>• Estimated cost is $0.00504 per L[1] |
| Greenhouse Gas Emissions | For leachate haulage | • Calculated using Urban Transportation Emissions Calculator, or UTEC, version 3.0 (2011) from Transport Canada to determine carbon dioxide equivalents ($CO_2e$).<br>• Conversion factor of approximately 0.87 kg $CO_2e$/km for heavy-duty commercial vehicles was used for haulage |

Note:

1. Capital and operating costs for Waste Management to utilize the Petrolia WWTP and collection system are estimated for the purposes of evaluating options. Actual costs will be negotiated between the Town of Petrolia and Waste Management.

The estimated cost for treating leachate at the Petrolia WWTP was based on the oxygen demand required to treat $BOD_5$ and TKN, because although the leachate has a low flow, it has high $BOD_5$ and TKN concentrations resulting in high loadings, as shown in Table 17. In calculating treatment costs at the Petrolia WWTP, the Agreement for Operations, Maintenance and Management Services for the Petrolia WWTP (2009) between the Town and CH2M Hill - OMI was used as a baseline annual cost to the Town of Petrolia for wastewater treatment, totalling $371,271 per year for 2009. From this, a cost of $121.57 kg $O_2$/d was calculated using historic plant data (2008 to 2010) for $BOD_5$ and TKN loadings of 679 and 113 kg/d respectively. Using this treatment rate per kg $O_2$/d and a 10% markup, a treatment cost for leachate at the Petrolia WWTP was calculated.

# 8. DEVELOPMENT AND SCREENING OF ALTERNATIVE SOLUTIONS FOR WASTEWATER TREATMENT

Four options were considered in determining the future of Petrolia's wastewater management. These options are listed in Table 20 and the following sections discuss each option and their potential.

**Table 20 List of Petrolia Wastewater Management Options**

| Option | Option | Description |
|---|---|---|
| 1 | Do Nothing[1] | • No change to the existing Petrolia WWTP |
| 2 | Limit Community Growth[1] | • Upgrade of the existing Petrolia WWTP<br>• No expansion of the existing Petrolia WWTP |
| 3 | Expansion and Upgrade of the Petrolia WWTP on the Existing Site | • Upgrade of the existing Petrolia WWTP<br>• Expansion of the existing Petrolia WWTP to provide capacity for growth in the Town |
| 4 | Construction of a New Wastewater Treatment Plant on a New Site | • Upgrade of the existing Petrolia WWTP<br>• Construction of a new wastewater treatment plant to provide capacity for growth in the Town |

Notes:
2 These solutions are required to be considered by the Municipal Class EA.

## 8.1 DO NOTHING

Option 1 for the Petrolia WWTP is to do nothing. For this option, the Petrolia WWTP would continue to operate in its current state. A physical condition and capacity assessment of the Petrolia WWTP completed by CIMA in August 2011(included in TM1) showed that there are many deficiencies that pose a risk to reliable plant operation and performance, and operator health and safety. The plant is operating at about 80% of its rated capacity, with flow in some months exceeding 100% of the rated capacity. Some of the individual plant processes do not have adequate capacity to maintain reliable performance at current flow or the rated design capacity.

With the expected growth of the Town, the result of doing nothing would be non-compliance due to growth and an increased risk of process failure. Option 1 is not a feasible alternative and was not considered further.

## 8.2 LIMIT GROWTH

Option 2 for the Petrolia WWTP is to limit the growth in the Town and maintain the current wastewater flows by preventing any population increase. Upgrades to various plant processes and equipment would still be required in order to improve plant performance and reliability, but there would be no need for expansion.

Since the existing plant does not provide adequate reliable capacity for rated flows and the County of Lambton's Official Plan for growth is projecting a population increase, this option would not meet performance and capacity requirements, and was not considered further.

## 8.3 EXPANSION AND UPGRADE OF THE PETROLIA WASTEWATER TREATMENT PLANT

Option 3 for the Petrolia WWTP is to complete upgrades to address deficiencies and expand the plant to provide for planned growth. For this alternative, the Town would complete the necessary upgrades to existing structures, equipment and processes and construct the additional process works required to increase the plant capacity. Land is available for expansion within the existing Town-owned plant site.

The result of the upgrades and expansion would be a more reliable plant capable of servicing the Town of Petrolia and its expected growth to the year 2041 and beyond. This solution was carried forward as feasible within Phase 2 of the Class EA.

## 8.4 CONSTRUCTION OF A NEW WASTEWATER TREATMENT PLANT

Option 4 for the Petrolia WWTP would be to construct a new wastewater treatment plant to treat some or all of the existing and planned flow from the service area. This option would require identification of a new site through an extensive Class EA process, and acquisition of land for the new plant. New collection and pumping infrastructure would be required to direct flow to a new site.

The potential delays for the Class EA and land acquisition, as well as the cost for a new plant, pumping and collection system make the construction of a new wastewater treatment plant an infeasible solution for the Town and was not considered further.

## 8.5 RATIONALE FOR SELECTION OF PREFERRED SOLUTION

Based on the descriptions above, the only feasible solution available for servicing existing and future growth from the Petrolia WWTP service area for the planning period is the upgrade and expansion of the current facilities. Rationale for this recommendation is highlighted as follows:

- This alternative would address existing deficiencies at the plant, which contribute to risks to performance, compliance and operator health and safety, while also providing capacity to accommodate growth.
- There is room for upgrade and expansion of the plant on the existing site.
- The ‘do nothing’ alternative would not address existing deficiencies.
- The ‘limit growth’ alternative would not provide capacity for growth projected in the County Official Plan.
- The ‘new plant’ alternative would have significantly higher capital cost and an extended planning and implementation period than the preferred alternative, and because the existing site has capacity for expansion, it does not make sense to pursue this solution.

## 8.6 DESCRIPTION OF PREFERRED SOLUTION

### 8.6.1 Effluent Criteria

CIMA completed an Assimilative Capacity Study (2012) to present rationale for the effluent criteria of the upgraded and expanded Petrolia WWTP and to assess the impacts of these discharges on the receiving water, Bear Creek. This study can be found in Appendix 2. Table 21 presents recommended effluent criteria for the expanded plant.

**Table 21 Recommended Certificate of Approval Effluent Objectives and Limits for the Upgraded and Expanded Petrolia WWTP[1]**

| Parameters | Effluent Objectives | | Effluent Limits[2] | |
|---|---|---|---|---|
| | Concentration (mg/L) | Waste Loading (kg/d) | Average Concentration (mg/L) | Average Waste Loading (kg/d) |
| 5 Day Biochemical Oxygen Demand ($CBOD_5$) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Ammonia Nitrogen | | | | |
| May 1 – Nov. 30 | 2.0 | 10.2 | 3.0 | 15.4 |
| Dec. 1 – Apr. 30 | 4.0 | 20.5 | 6.0 | 30.7 |
| Total Suspended Solids (TSS) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Phosphorous (TP) | 0.37 | 1.9 | 0.74 | 3.8 |
| E. Coli (Apr. 1 – Nov. 30) | 150 organisms / 100 ml | | 200 organisms / 100 ml | |
| pH (at all times) | 6.5 – 8.5 | | 6.0 – 9.5 | |

Notes:
1 Based on a monthly average flow of 5,123 $m^3$/d.
2 Monthly average concentrations and loadings shall not exceed the effluent limits.

The plant will continue to have requirements for tertiary phosphorus removal, as well as year round nitrification.

### 8.6.2 Headworks

The existing headworks facility consists of a manually cleaned coarse bar rack and a mechanically cleaned step-screen with a peak rated capacity of 6,000 $m^3$/d which is less than current peak flows at the plant. The headworks is hydraulically limited and bypassed on a regular basis.

The existing aerated grit chamber has a volume of 25.5 $m^3$ with a detention time of 2.4 minutes, the low end of the MOE Design Guidelines for Sewage Works (2008) of 2 to 5 minutes. The current design is poor, and in consideration of the inadequate screen capacity and poor overall condition, it is recommended that the entire headworks facility be replaced.

The new headworks facility will have a peak rated capacity of 20,492 $m^3$/d with coarse and fine screens, and a new grit removal system with screenings and grit conveyance.

### 8.6.3 Aeration Tanks

The existing aeration tanks have a total volume of 2,388 $m^3$, providing a solids retention time (SRT) of 12 days at current average flow and 9 days at the rated plant capacity, compared to a minimum of 15 days in the MOE Design Guidelines for Sewage Works (2008). Historically, the 12 day SRT has provided sufficient year round nitrification; however, as the flows increase the retention time will shorten, and additional aeration capacity will be required.

Using the MOE Design Guideline for Sewage Works (2008) for a SRT of 15 days, a volume of approximately 5,000 $m^3$ will be required to achieve sufficient year round nitrification in the year 2041. This will require an additional volume of approximately 2,600 $m^3$.

### 8.6.4 Oxygenation

Oxygenation is currently supplied by mechanical aerators and self-aspirating jet aerators. The mechanical aerators are approaching 35 years old and operating beyond their normal service life. The current oxygenation capacity does not meet the requirements of historic peak oxygen demands. It is recommended that a new aeration system replace all existing oxygenation equipment.

### 8.6.5 Secondary Clarifiers

Two square secondary clarifiers currently provide a settling surface area of 288 $m^2$, which is sufficient for the current plant design flow. Square clarifiers typically do not perform as well as circular or rectangular clarifiers. The sludge collection mechanisms are in poor condition and the scum collectors are not functional. Existing RAS piping is approaching 35 years and buried piping is corroding and with increasing flows, additional capacity will be required to treat 5,123 $m^3$/d.

The MOE Design Guidelines for Sewage Works (2008) requires a solid overflow rate of 40 $m^3/m^2d$, thus a surface area of 512 $m^2$ would be required for future flows into the year 2041. This will require an additional surface area of approximately 220 $m^2$.

### 8.6.6 Tertiary Filtration

Tertiary filtration is currently achieved using a traveling bridge sand filter and mechanism which is beyond its normal service life and is almost 35 years old. The existing filter area is 31.8 $m^2$ and the current hydraulic loading rate exceeds the MOE Design Guidelines for Sewage Works (2008). It was determined that a filtration area of approximately 113 $m^2$ is required for 2041 flows.

Use of a smaller surface area will be evaluated in phase 3 of the Class EA when developing the conceptual design, since an equalization tank is available to buffer flow prior to filtration and disinfection.

### 8.6.7 UV Disinfection

The existing UV disinfection system was installed in 1995 and is in good overall condition. In combination with the existing equalization tank, this system has adequate capacity to disinfect the peak design flow to the Petrolia WWTP.

### 8.6.8 Biosolids Handling

Existing sludge holding tanks use coarse bubble spargers fed by two blowers, but much of the system is broken, corroded or seized and needs to be replaced.

### 8.6.9 Phosphorous Removal

The current phosphorous removal system consists of an outdoor chemical storage tank surrounded by a concrete secondary containment area and a chemical feed pump in a dedicated room within the administration building. A secondary containment area is required in the pumping room to meet Code and upgrades to the pumping system are required.

### 8.6.10 Electrical & Controls

A single MCC currently provides power to all unit processes, but it is almost 35 years old. There is no stand-by power, SCADA or automation available for critical processes and key equipment. Thus the MCC replacement and a new standby power facility are required. SCADA and automation for key equipment are also proposed to provide better monitoring and control of all plant unit processes.

### 8.6.11 Miscellaneous

Many miscellaneous repairs are required to address a number of structural and architectural deficiencies such as tank leaks, spalling, etc.

### 8.6.12 Capital Cost

The estimated capital cost to upgrade and expand the Petrolia WWTP to address deficiencies is $22.5 million allowing for 35% contingency and 15% engineering. The estimated costs associated with the upgrades required to each major plant process are outlined in Table 22.

**Table 22 Upgrade and Expansion Costs for the Petrolia WWTP**

| Process | Estimated Capital Cost |
|---|---|
| Headworks | $ 3,100,000 |
| Aeration Tanks | $ 2,600,000 |
| Oxygenation | $ 2,400,000 |
| Secondary Clarifiers | $ 1,100,000 |
| Tertiary Filtration | $ 4,000,000 |
| Biosolids Handling Volume | $ 400,000 |
| Phosphorous Removal | $ 100,000 |
| Electrical & Controls | $ 1,000,000 |
| Miscellaneous | $ 300,000 |
| **Subtotal** | **$ 15,000,000** |
| Contingency 35% | $ 5,250,000 |
| Engineering 15% | $ 2,250,000 |
| **Total** | **$22,500,000** |

# 9. DEVELOPMENT AND SCREENING OF ALTERNATIVE SOLUTIONS FOR LEACHATE MANAGEMENT

## 9.1 DEVELOPMENT OF SOLUTIONS FOR LEACHATE MANAGEMENT

Four options were considered for future treatment of leachate from the Petrolia Landfill. These options are listed in Table 23. The following sections present a description of these options.

**Table 23 List of Leachate Management Options**

| Option | Option | Description |
|---|---|---|
| 1 | Do Nothing[1] | • Continue to haul leachate for treatment at various alternative wastewater treatment facilities |
| 2 | Haul Leachate to the Petrolia WWTP | • Haul leachate to the Petrolia WWTP for treatment |
| 3 | Discharge Leachate to the Petrolia Sewage Collection System | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill to the Petrolia sewage collection system |
| 4 | Discharge Leachate Directly to the Petrolia WWTP | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill directly to the Petrolia WWTP |

Notes:
1 This solution is required to be considered by the Municipal Class EA.

## 9.2 OPTION 1: DO NOTHING

### 9.2.1 Description

Option 1 for the management of leachate from the Petrolia Landfill is to do nothing. For this alternative, leachate would continue to be hauled by truck from the Petrolia Landfill to various alternate wastewater treatment facilities.

### 9.2.2 Infrastructure Required

No infrastructure is required for Option 1.

### 9.2.3 Environmental Impacts and/or Risks

#### 9.2.3.1 Greenhouse Gases

The primary environmental impact associated with Option 1 is greenhouse gas emissions associated with hauling the leachate to alternative wastewater treatment facilities. Based on the average distance to the sites in and around London, Ontario, a round trip would average 180 km. Greenhouse gas emissions for Option 1 are presented in Table 24.

**Table 24 Greenhouse Gas Emissions for Leachate Management Option 1: Haul Leachate to Alternative Wastewater Treatment Facilities**

| Parameter | 2011 Value |
|---|---|
| Round Trip (km) | 180 |
| Yearly Loads Hauled (#) | 723[1] |
| Yearly Kilometers (km) | 130,140 |
| Yearly Greenhouse Gas Emissions (t $CO_2e$) | 113.4[2] |

Notes:
1 Based on 23,851,492 liters of leachate for 2011 provided by Waste Management.
2 Based on 0.87 kg $CO_2e$/km derived from the Transport Canada UTEC version 3 (2011).

#### 9.2.3.2 Surface Water Protection

The primary risk to surface water and land is a leachate spill during transport. Other risks are minimal based on sufficient capacity being available for treatment of the Petrolia Landfill leachate at the alternative wastewater treatment destinations.

#### 9.2.3.3 Construction

There are no construction activities required for Option 1.

### 9.2.4 Community Impacts

#### 9.2.4.1 Truck Traffic

An average of 2 truckloads of leachate would be hauled per day. The truck route is along the outskirts of Petrolia, and on Highway 402, and therefore, would not have a significant impact on the community of Petrolia. Trucks may need to travel through residential communities and businesses to reach the destination treatment facilities.

It is anticipated that leachate volumes will decrease in the future requiring less than 1 truck per day to haul leachate by 2041.

#### 9.2.4.2 Construction

There are no construction activities required for Option 1.

#### 9.2.4.3 Odour

Odour is not expected to be a concern to the Petrolia community, as the truck loading will continue to be at the Petrolia Landfill and the unloading at the destination wastewater treatment facilities.

### 9.2.5 Costs

#### 9.2.5.1 Capital Cost

There is no capital cost associated with Option 1.

### 9.2.5.2 Operating Cost

The primary operating costs for Option 1 are hauling and treating the leachate at alternative wastewater treatment facilities. The current and estimated 2041 operating costs for Option 1 are outlined in Table 25.

**Table 25 Annual Operating Costs for Leachate Management Option 1: Haul Leachate to Alternative Wastewater Treatment Facilities**

| Item | Cost in 2011 (in 2012 $) | Cost in 2041 (in 2012 $) |
|---|---|---|
| Total Leachate (L) | 23,851,492[1] | 5,000,000[1] |
| Loads Hauled | 723 | 152 |
| Distance Hauled (km)[2] | 130,140 | 27,360 |
| Haulage Cost | $ 283,833 | $ 59,500 |
| Treatment Cost | $ 295,759 | $ 62,000 |
| **Total Cost[3]** | **$ 600,000** | **$ 100,000** |

Notes:
1 Based on data provided by Waste Management.
2 Based on a 180 km round trip.
3 Costs rounded to the nearest $100,000.

Waste Management anticipates that the volume of leachate produced at the Petrolia Landfill will decline in the future as shown in Figure 15. The 27-year NPV operating cost for hauling and treating leachate is estimated between $2.9 and $4.1 million in 2012 dollars. These costs are presented in Table 12.

**Table 26 NPV Operating Costs of Lechate Management Option 1: Haul Leachate to Alternative Wastewater Treatment Facilities**

| Cost Item | 27 Year Net Present Value (in 2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | $ 1,400,000 | $ 2,000,000 |
| Treatment | $ 1,500,000 | $ 2,100,000 |
| **Total[1]** | **$ 2,900,000** | **$ 4,100,000** |

Notes:
1 Costs rounded to the nearest $100,000.

### 9.2.5.3 NPV Cost

Since there is no capital cost associated with Option 1, the 27-year NPV cost for Waste Management is estimated between $2.9 and $4.1 million in 2012 dollars, to continue hauling leachate to alternative wastewater treatment facilities.

## 9.3 OPTION 2: HAUL LEACHATE TO THE PETROLIA WWTP

### 9.3.1 Description

Option 2 for the management of leachate from the Petrolia Landfill is to haul the leachate by truck to the Petrolia WWTP. Trucks are required to travel through residential communities in order to reach the plant located on Maude Street.

The leachate has high concentrations of $BOD_5$ and TKN therefore loadings to the Petrolia WWTP would be significant, as was presented previously in **Error! Reference source not found.**, thus additional capacity would be required to accommodate leachate, including an equalization tank and pumping on site to allow a controlled leachate feed to the plant.

### 9.3.2 Infrastructure Required

Additional aeration, oxygenation and secondary clarifier capacity at the Petrolia WWTP is required to treat the leachate $BOD_5$ and TKN loadings. At the plant, a holding tank will be required for the trucks to unload into. This tank will also serve to buffer leachate flow to the process, since the leachate will need to be equalized and bled into the plant, to minimize impacts of the high strength loadings.

### 9.3.3 Environmental Impacts and/or Risks

#### 9.3.3.1 Greenhouse Gases

For Option 2 the traveling distance would be approximately 6 km from the Petrolia Landfill to the Petrolia WWTP, resulting in a round trip of 12 km. Greenhouse gas emissions are estimated at 7.6 t $CO_2e$ in 2012, decreasing to 2041, as presented in Table 13.

**Table 27 Greenhouse Gas Emissions for Leachate Management Option 2: Haul Leachate to the Petrolia WWTP**

| Parameter | Value |
|---|---|
| Round Trip (km) | 12 |
| Yearly Loads Hauled (#) | 723 |
| Yearly Kilometers (km) | 8,676 |
| Yearly Greenhouse Gas Emissions (t $CO_2e$) | 7.6[2] |

Notes:
1 Based on 23,851,492 liters of leachate for 2011 provided by Waste Management.
2 Based on 0.87 kg $CO_2e$/km derived from the Transport Canada UTEC version 3 (2011).

#### 9.3.3.2 Surface Water Protection

The Petrolia WWTP would need to be expanded and upgraded to accommodate the Landfill leachate. The leachate would be stored on site in an equalization tank so that the leachate could be bled in on a continuous basis or flow could be stopped if there was ever an upset in plant operation. There would be minimal addition to effluent loads or impact on effluent quality because the leachate flow is small and capacity would be provided to treat the leachate.

There is a risk of leachate spill during transport or unloading. Impacts would be mitigated through normal safety procedures.

#### 9.3.3.3 Construction

Construction required at the Petrolia WWTP for leachate treatment would be a small component of the overall Petrolia WWTP upgrades and expansion process. Environmental risk during construction for the plant and leachate works would be mitigated through good construction practices.

### 9.3.4 Community Impacts

#### 9.3.4.1 Truck Traffic

The main community impact associated with hauling leachate to the Petrolia WWTP is truck traffic, with the truck load requirements described in Option 1. The blue route is approximately 6 km, the red route is approximately 8 km and the yellow route is approximately 11 km. Even though the trucks have a short travel distance, these vehicles would need to travel through residential areas of Petrolia to reach the plant, as shown in Figure 16.


**Figure 16 Potential Routes for Hauling Leachate to the Petrolia WWTP**

Regardless of the route selected, the truck traffic through the centre of Petrolia WWTP would increase community health and safety risks and may result in noise and odour concerns to affected residents and businesses.

#### 9.3.4.2 Construction

The additional construction requirements for leachate treatment, relative to the overall Petrolia WWTP upgrade and expansion projects, are not anticipated to be significant. During construction, procedures for noise and dust control, working hours for construction, and other normal procedures, will be implemented to minimize impacts to the community during construction.

#### 9.3.4.3 Odours

In addition to the odours related to hauling through the community, there may be a risk of odour release during unloading of the leachate at the Petrolia WWTP. Unloading facilities will be design to minimize the exposure of leachate odours to the environment.

### 9.3.5 Costs

#### 9.3.5.1 Capital Cost

The additional Petrolia WWTP upgrade and expansion requirements and costs to accommodate leachate are presented in Table 28. The total capital cost is estimated between $0.9 and $1.4 million.

**Table 28 Petrolia WWTP Upgrade and Expansion Requirements and Cost for Leachate Management Option 2: Haul Leachate to the Petrolia WWTP**

| Process | Estimated Capital Cost | |
|---|---|---|
| | Minimum | Maximum |
| Aeration Tanks Volume | $ 100,000 | $ 250,000 |
| Oxygenation | $ 300,000 | $ 500,000 |
| Secondary Clarifiers | $ 10,000 | $ 10,000 |
| Leachate Equalization Tank & Pumping | $ 170,000 | $ 170,000 |
| **Subtotal** | **$ 580,000** | **$ 930,000** |
| Contingency 35% | $ 203,000 | $ 325,500 |
| Engineering 15% | $ 87,000 | $ 139,500 |
| **Total[1]** | **$ 900,000** | **$ 1,400,000** |

Notes:
1 Costs rounded to the nearest $100,000.

#### 9.3.5.2 Operating Cost

Operating costs associated with Option 2 include leachate transportation and treatment costs at the Petrolia WWTP. The current and estimated 2041 costs are presented in Table 15.

**Table 29 Annual Operating Costs for Leachate Management Option 2: Haul Leachate to the Petrolia WWTP**

| Haulage | 2011 (in 2012 $) | 2041 (in 2012 $) |
|---|---|---|
| Total Leachate (L) | 23,851,492[1] | 5,000,000[1] |
| Loads Hauled | 723 | 152 |
| Distance Hauled (km)[2] | 8,676 | 1,824 |
| Haulage Cost | $ 62,738 | $ 15,072 |
| Treatment Cost[3] | $ 100,720 | $ 25,180 |
| **Total Cost[4]** | **$ 150,000** | **$ 40,000** |

Notes:
1 Based on data provided by Waste Management.
2 Based on a 12 km round trip.
3 Based on flow data from Figure 15 and concentration data from **Error! Reference source not found.**.
4 Total costs are rounded to the nearest $10,000.

The 27-year NPV operating cost for transportation and treatment at the Petrolia WWTP is estimated between $0.9 and $1.2 million in 2012 dollars, as showing in Table 16.

**Table 30 NPV Operating Costs of Leachate Management Option 2: Haul Leachate to the Petrolia WWTP**

| Cost Item | 27 Year NPV (in 2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | $ 350,000 | $ 450,000 |
| Treatment | $ 550,000 | $ 750,000 |
| **Total[1]** | **$ 900,000** | **$ 1,200,000** |

Notes:
1 Costs are rounded to the nearest $50,000.

### 9.3.5.3 NPV Cost

The estimated 27-year NPV of hauling leachate to the Petrolia WWTP for treatment is between $1.8 and $2.6 million in 2012 dollars, and includes the capital cost required to upgrade the plant to accommodate the leachate and the 27-year NPV operating costs. These costs are presented in Table 31.

**Table 31 NPV-Cost of Leachate Management Option 2: Haul Leachate to the Petrolia WWTP**

| Cost Item | 27 Year NPV (in 2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Capital | $ 900,000 | $ 1,400,000 |
| 27 Year NPV Operating | $ 900,000 | $ 1,200,000 |
| **Total** | **$ 1,800,000** | **$ 2,600,000** |

## 9.4 OPTION 3: DISCHARGE LEACHATE TO THE PETROLIA COLLECTION SYSTEM

### 9.4.1 Description

Option 3 for the management of leachate from the Petrolia Landfill is to provide a connection to Petrolia's municipal sewage collection system. This would require the construction of a new pumping station at the Petrolia Landfill as well as a sanitary forcemain. Similarly to Option 2, additional capacity would be required for several processes at the Petrolia WWTP to accommodate the leachate.

### 9.4.2 Infrastructure Required

Option 3 requires the installation of a forcemain and a pumping station to connect the leachate tank at the Petrolia Landfill to the municipal sewage collection system. The existing leachate tank at the Landfill would continue to be used to store and equalize leachate, so that pumping into the system could be on a continuous or off-peak basis to avoid sudden high loads at the plant. The same upgrades are required to the Petrolia WWTP processes as described for Option 2.

The existing sewer line capacity has been reviewed and adequate capacity is available for leachate flows from the Petrolia Landfill.

There are two options for the location of the forcemain and they are outlined in the following sections.

#### 9.4.2.1 Route Option 3A

For Option 3A, the forcemain would be constructed along Oil Heritage Road with connection to the existing 300 mm sanitary sewer approximately 800 m north at Petrolia Line. From there the sewers flow to the East End Pumping Station at Petrolia Line and Barett's Lane and continue through the Town's trunk sewer system to the Petrolia WWTP on Maude Street. The route for Option 3A is shown in Figure 3.

#### 9.4.2.2 Route Option 3B

For Option 3B, the forcemain would be routed west through future development lands located between Oil Heritage Road and 1st Avenue, connecting to the existing 350 mm gravity sewer at 1st Avenue and Garden Crescent. From there the sewers would flow to the East End Pumping Station at Petrolia Line and Barett's Lane and continue to the Petrolia WWTP on Maude Street. The route for Option 3B is shown in Figure 4.

The development area has been identified for future residential land use in the Town`s Official Plan; however, a detailed road pattern has not yet been established through any Planning Act approvals. A preliminary road pattern has been identified in the AECOM Development Study (April 2009) but alignments have not been confirmed. To implement Option 3B, utility easements would be required from all affected land-owners and these utility easements would need to be coordinated with future road patterns.

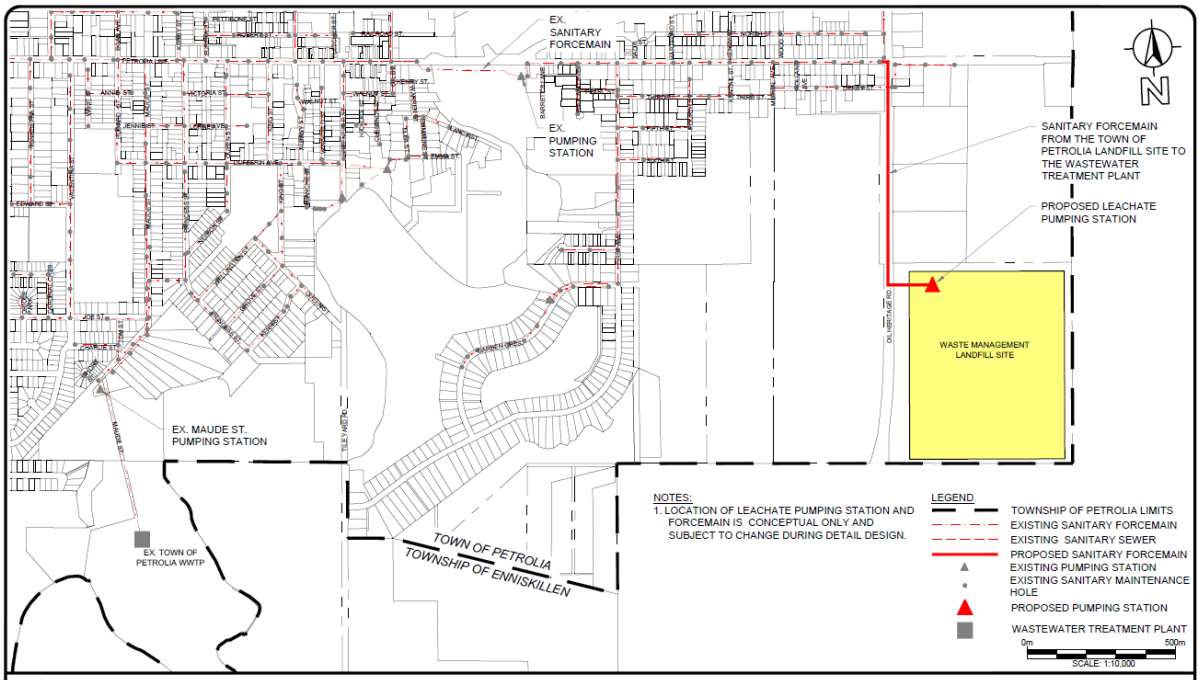


**Figure 17 Route Option 3A: Discharge Leachate to the Petrolia Sewage Collection System**

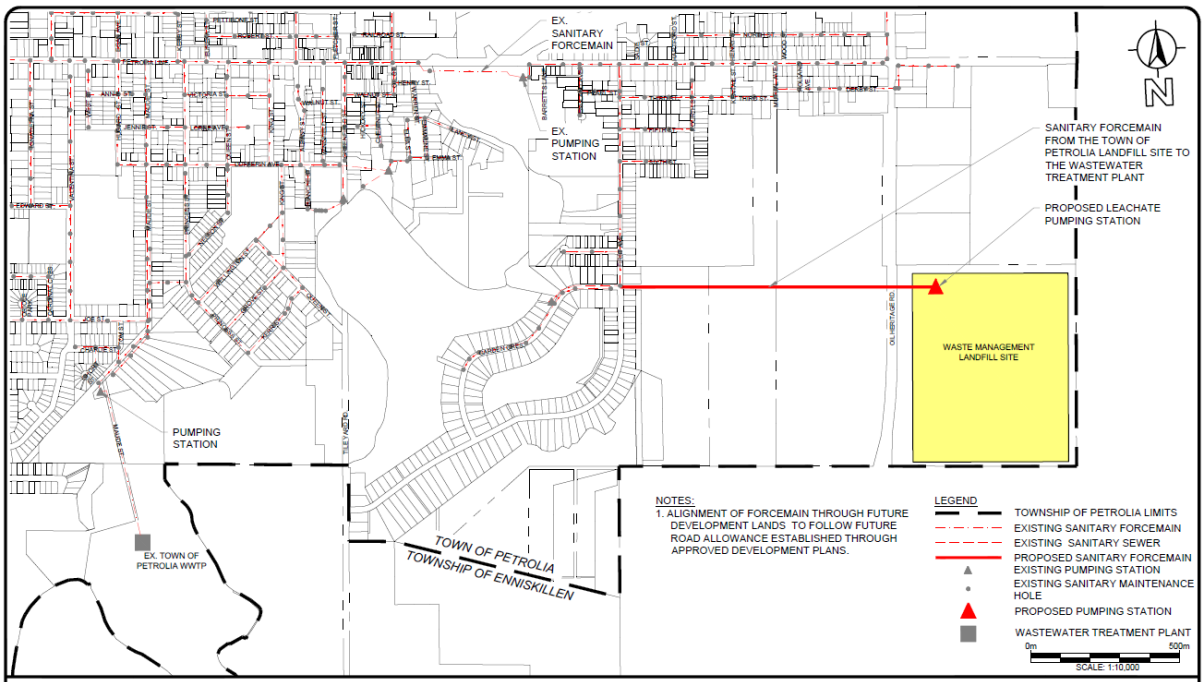


**Figure 18 Route Option 3B: Discharge Leachate to the Petrolia Sewage Connection System**

### 9.4.3 Environmental Impacts and/or Risks

#### 9.4.3.1 Greenhouse Gases

No leachate transportation is required therefore only minimal greenhouse gas emissions will be associated with a nominal amount of pumping energy required to direct the small leachate volume through the municipal sewage collection system.

#### 9.4.3.2 Surface Water Protection

In Options 3A and 3B, leachate will be pumped directly into the Petrolia sewage collection system from the equalization tank constructed at the Petrolia Landfill. The leachate will be fed into the collection system during off-peak hours, but the ability to control when the leachate arrives at the Petrolia WWTP is limited. There is a risk that the leachate may arrive during periods of high flows and it may have an impact on the effluent quality objectives and limits. This could be mitigated by giving the Town overall remote control over the leachate pumping operation.

#### 9.4.3.3 Construction Risks

The construction activities required for Options 3A and 3B will be completed using good construction practices to mitigate risk. These activities include the forcemain, pumping station and the additional capacity required at the Petrolia WWTP to accommodate the leachate.

### 9.4.4 Community Impacts

#### 9.4.4.1 Truck Traffic

There will be no truck traffic with Option 3A or 3B.

#### 9.4.4.2 Construction

The construction required for the Petrolia WWTP upgrade and expansion in order to accommodate the leachate are the same as those presented for Option 2. Good construction practices will be implemented and these activities are not expected to adversely affect the residents of Petrolia, nor is the construction of a pumping station at the Petrolia Landfill.

Option 3A requires construction of a forcemain along Oil Heritage Road within the existing road allowance. Good construction practices will be implemented to mitigate impacts to traffic and the residents located along Oil Heritage Road between the landfill and Petrolia Line during construction.

Option 3B requires construction of a forcemain through future development land which is not currently occupied. Good construction practices will be implemented to mitigate impacts to traffic and residents during construction activities across Oil Heritage Road and while connecting to the existing sewers at 1$^{st}$ Avenue and Garden Crescent. Construction through the future development land would be required to follow the not yet developed road pattern.

#### 9.4.4.3 Odours

There is the potential for odours while the leachate is pumped through the Petrolia sanitary sewage collection system; however, the volumes are not anticipated to be large and it is expected that mixing with the residential sewage will dilute it and mitigate odours caused by the leachate alone.

### 9.4.5 Costs

#### 9.4.5.1 Capital Cost

Capital costs for the Petrolia WWTP upgrades and expansion to accommodate leachate for Options 3A and 3B are presented in Table 18. The capital costs in 2012 dollars for Options 3A and 3B are estimated between $1.05 and $1.6 million and $1.15 and $1.65 million, respectively.

**Table 32 Capital Cost for Leachate Management Options 3A and 3B: Discharge Leachate to Petrolia Sewage Collection System**

| Process | Estimated Capital Cost | | | |
|---|---|---|---|---|
| | Option 3A | | Option 3B | |
| | Minimum | Maximum | Minimum | Maximum |
| Aeration Tanks Volume | $ 100,000 | $ 250,000 | $ 100,000 | $ 250,000 |
| Oxygenation | $ 300,000 | $ 500,000 | $ 300,000 | $ 500,000 |
| Secondary Clarifiers | $ 10,000 | $ 10,000 | $ 10,000 | $ 10,000 |
| Leachate Forcemain & Pumping | $ 300,000 | $ 300,000 | $ 350,000 | $ 350,000 |
| **Subtotal** | **$ 710,000** | **$ 1,060,000** | **$ 760,000** | **$ 1,100,000** |
| Contingency 35% | $ 248,500 | $ 371,000 | $ 266,000 | $ 388,500 |
| Engineering 15% | $ 106,500 | $ 159,000 | $ 114,000 | $ 165,000 |
| **Total[1]** | **$ 1,050,000** | **$ 1,600,000** | **$ 1,150,000** | **$ 1,650,000** |

Notes:
1 Costs rounded to the nearest $50,000.

#### 9.4.5.2 Operating Cost

The estimated annual operating cost associated with Options 3A and 3B include only leachate treatment costs at the Petrolia WWTP and is the same as that presented for Option 2 in Table 15.

The 27-year NPV operating cost for treating leachate at the Petrolia WWTP for Options 3A and 3B is also the same as that presented for Option 2 in Table 30, totaling between $550,000 and $750,000 in 2012 dollars.

#### 9.4.5.3 NPV Cost

The 27-year NPV cost for the management of leachate at the Petrolia WWTP by discharging to the Petrolia sewage collection system is estimated between $1.6 and $2.35 million for Option 3A and between $1.7 and $2.4 million for Option 3B, both in 2012 dollars. These costs are presented in Table 33.

**Table 33 NPV Cost of Leachate Management Options 3A and 3B: Discharge Leachate to the Petrolia Sewage Collection System**

| Cost Item | 27 Year NPV (in 2012 $) | | | |
|---|---|---|---|---|
| | Option 3A | | Option 3B | |
| | Minimum | Maximum | Minimum | Maximum |
| Capital | $ 1,050,000 | $ 1,600,000 | $ 1,150,000 | $ 1,650,000 |
| 27 Year NPV Operating | $ 550,000 | $ 750,000 | $ 550,000 | $ 750,000 |
| **Total** | **$ 1,600,000** | **$ 2,350,000** | **$ 1,700,000** | **$ 2,400,000** |

## 9.5 OPTION 4: DISCHARGE LEACHATE DIRECTY TO THE PETROLIA WWTP

### 9.5.1 Description

Option 4 for the management of leachate from the Petrolia Landfill would be to provide a direct connection to the Petrolia WWTP. This would require the construction of a new pumping station at the Petrolia Landfill and a sanitary forcemain connecting the pumping station to the Petrolia WWTP inlet works. Similarly to Options 2 and 3, additional capacity would be required at the Petrolia WWTP in order to accommodate the leachate.

### 9.5.2 Infrastructure Required

Option 4 requires the installation of a pumping station at the Petrolia Landfill and a forcemain. The most direct route from the Landfill to the plant is a forcemain running west through the future development lands to 1st Avenue and Garden Crescent. The forcemain would then run south along 1st Avenue to Tile Yard Road, across private properties located in Enniskillen Township and across Bear Creek to the Petrolia WWTP. Figure 19 depicts the proposed forcemain route.

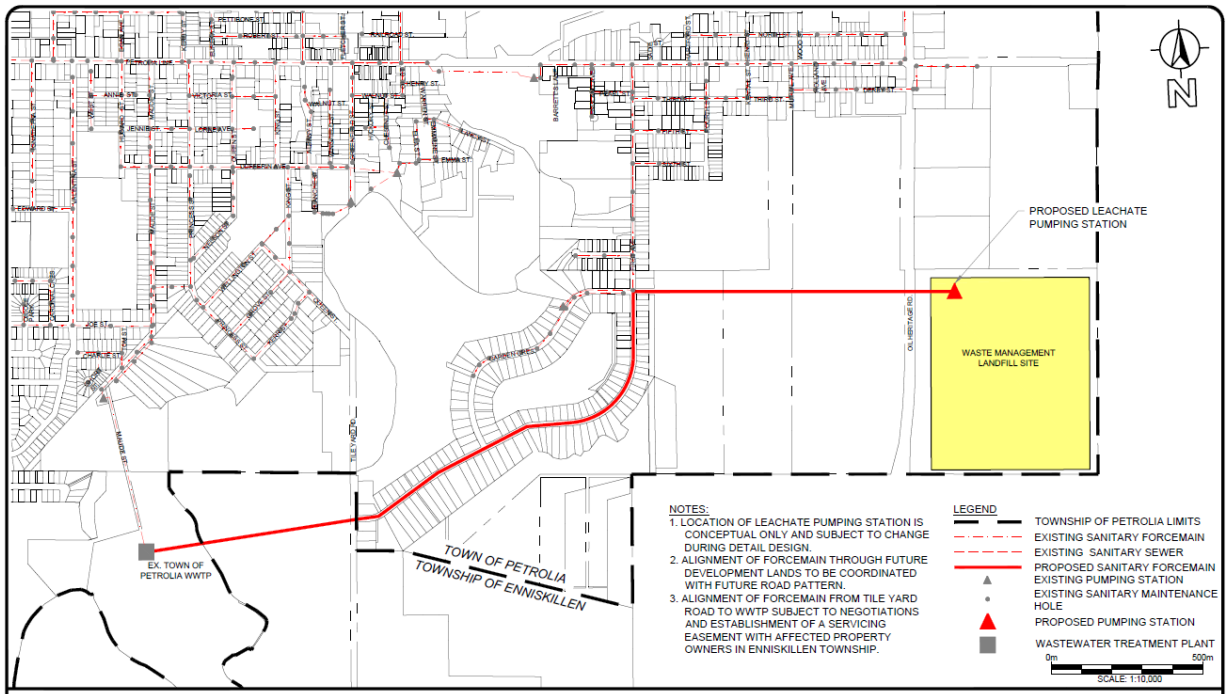


**Figure 19 Route Option 4: Discharge Leachate Directly to the Petrolia WWTP**

Installing the forcemain through the future development area, identified for residential use, should follow road alignments once they are established, as discussed for Option 3B. Installation along 1st Avenue to Tile Yard Road requires construction within an existing developed road allowance, significantly increasing construction costs. Continuing the forcemain through Enniskillen Township will require easements from affected property owners to permit the construction and maintenance required for the forcemain. The forcemain is also required to cross designated hazard lands associated with Bear Creek and this construction would need to be completed using trenchless installation methods, such as horizontal directional drilling, minimizing disturbances to the natural areas.

### 9.5.3 Environmental Impacts and/or Risks

#### 9.5.3.1 Greenhouse Gases

No leachate transportation is required therefore there are no greenhouse gas emissions, except for a nominal amount of pumping energy to direct the leachate to the Petrolia WWTP.

#### 9.5.3.2 Surface Water Protection

The Petrolia WWTP would need to be expanded and upgraded to accommodate the Landfill leachate. The leachate would be stored in an equalization tank at the Petrolia Landfill and could be controlled if there was ever an upset in plant operation. The small volume of leachate fed into the process would have an insignificant increase in effluent loads. Impacts to the treatment performance would be mitigated by controlling leachate flow based on continuous or off-peak pumping.

#### 9.5.3.3 Construction Risks

Construction activities required for Option 4 pose some risk to the environment because the forcemain will be installed across a designated hazard zone surrounding Bear Creek. Great care and good construction practices will be implemented to mitigate risks. The pumping station to be installed at the Petrolia Landfill is not anticipated to pose significant risk to the environment.

### 9.5.4 Community Impacts

#### 9.5.4.1 Truck Traffic

There will be no truck traffic with Option 4.

#### 9.5.4.2 Construction

The primary community impact for Option 4 is the construction associated with the installation of the forcemain, specifically along 1st Avenue to Tile Yard Road and through the private properties of Enniskillen Township. Good construction practices will be implemented to avoid adversely affecting the residents of these areas. The construction of a pumping station at the Petrolia Landfill is not expected to adversely affect residents.

#### 9.5.4.3 Odours

There is the potential for odours while the leachate is pumped to the Petrolia WWTP, however they are expected to be minor to non-existent and will not adversely affect residents.

### 9.5.5 Costs

#### 9.5.5.1 Capital Cost

Capital costs for Option 4 are similar to Options 2 and 3, except a longer forcemain is required. The total capital costs in 2012 dollars for discharging leachate directly to the Petrolia WWTP are estimated between $2.0 and $2.5 million and are presented in Table 20.

**Table 34 Capital Cost for Leachate Management Option 4: Discharge Leachate Directly to the Petrolia WWTP**

| Process | Option 4 Estimated Capital Cost | |
|---|---|---|
| | Minimum | Maximum |
| Aeration Tanks Volume | $ 100,000 | $ 250,000 |
| Oxygenation | $ 300,000 | $ 500,000 |
| Secondary Clarifiers | $ 10,000 | $ 10,000 |
| Leachate Forcemain & Pumping | $ 900,000 | $ 900,000 |
| **Subtotal** | **$ 1,310,000** | **$ 1,660,000** |
| Contingency 35% | $ 458,500 | $ 581,000 |
| Engineering 15% | $ 196,500 | $ 249,000 |
| **Total[1]** | **$ 2,000,000** | **$ 2,500,000** |
| Notes:<br>1 Costs rounded to the nearest $100,000 | | |

#### 9.5.5.2 Operating Cost

The operating cost for Option 4 includes only the treatment of leachate at the Petrolia WWTP, as presented in Table 15 for Option 2. The 27 year NPV Operating cost for Option 4, discharging the leachate directly to the Petrolia WWTP, is estimated between $550,000 and $750,000 in 2012 dollars, the same as presented in Table 16 for Option 2.

#### 9.5.5.3 NPV Cost

The 27 year NPV cost to manage leachate by discharging directly to the Petrolia WWTP in 2012 dollars is estimated between $2.55 and $3.25 million, and is presented in Table 35.

**Table 35 NPV Cost of Leachate Management Option 4: Discharge Leachate Directly to the Petrolia WWTP**

| Cost Item | 27 Year NPV (in 2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Capital | $ 2,000,000 | $ 2,500,000 |
| 27 Year NPV Operating | $ 550,000 | $ 750,000 |
| **Total** | **$ 2,550,000** | **$ 3,250,000** |

## 9.6 COMPARISON OF FEASIBLE OPTIONS

A comparative evaluation of the Landfill leachate options was completed, using the criteria and ranking system provided in Chapter 6, and presented in Table 22 as well as the rationale for scoring each option.

Each option for the management of Landfill leachate was scored out of 5 points, and weighed according to its importance. Weighted scores were summed to result in a total score out of 100%. Table 23 summarizes the score in each relevant area.

**Table 36 Summary of Scoring Results for Landfill Leachate Options**

| Criteria Group | Possible Score | Option 1 Do Nothing | Option 2 Haul to Petrolia WWTP | Option 3 Direct Connection to the Petrolia Sewage Collection System | Option 4 Direct Connection to the Petrolia WWTP |
|---|---|---|---|---|---|
| Environmental | 40 | 32.7 | 32.7 | 33.5 | 34.2 |
| Community | 40 | 33.8 | 33.2 | 36.3 | 34.5 |
| Economic | 20 | 12.0 | 14.0 | 15.2 | 13.6 |
| **Total Score** | **100** | **78.6** | **79.9** | **85.0** | **82.2** |

Option 3, involving construction of a pumping station and forcemain to connect the leachate storage tank at the Petrolia Landfill to the Petrolia collection system, and upgrades to the Petrolia WWTP for the leachate loading, scored highest in both community and economic category, and had similar scores to other options in the environmental category. Advantages of Option 3 relative to other options are:

- Greenhouse gases: Greenhouse gas generation due to truck traffic will be eliminated because flow would be pumped directly to the collection system. This compares to Option 1, where greenhouse gas generation results from approximately 720 trucks per year on round trips of 180 km.
- Traffic: Relative to Options 1 and 2, there would be no community safety or noise impacts due to truck traffic.
- Minimized Cost Risk: The cost of leachate management could be established through a long term agreement with the Town, relative to Option 1, where Waste Management would need to re-negotiate contract costs with other wastewater treatment facilities and haulers, with a risk of higher costs in the future. It can also be noted that if the leachate volumes do not decline in the future, as predicted by Waste Management, there is significantly less cost risk with Option 3, since the per volume cost is considerably less for treatment at Petrolia WWTP than for hauling to and treating at more remote facilities.
- Net Present Value Costs: The total estimated NPV capital and operating cost for the 27-year period is estimated between $1.7 and $2.4 million, including capital and operating costs. This is much less than the estimated NPV cost for hauling and treating at alternative treatment facilities (not taking into account cost risk) for Option 1, and similar to than the NPV cost for Option 2.

## Table 37 Comparative Evaluation Matrix for Leachate Management Options

| Criteria | Weight | Option 1<br>Do nothing - Continue to Haul Leachate to Alternative Treatment Facilities | Score | Weighted Score | Option 2<br>Haul Leachate to the Petrolia WWTP | Score | Weighted Score | Option 3<br>Direct Connection to the Petrolia Sewage Collection System | Score | Weighted Score | Option 4<br>Direct Connection to the Petrolia WWTP | Score | Weighted Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Environmental Impact** | | | | | | | | | | | | | |
| **Surface Water Protection**<br>Maximize reliability in achieving effluent quality | 7.3% | Negligible risks based alternative wastewater treatment facilities being able to accommodate leachate treatment | 5 | 7.3% | Minor risks. Petrolia WWTP would be upgraded and expanded to accommodate leachate. Leachate storage at the Petrolia WWTP would enable operations staff to control leachate flow to add leachate continuously or off-peaks, to minimize risk to effluent quality. | 4 | 5.8% | Moderate risks. Leachate is discharged to the Petrolia sewage collection system during off-peak hours, but less control as to when leachate would arrive at Petrolia WWTP. Leachate during plant upset events could impact treatment performance and effluent quality. | 3 | 4.4% | Minor risks. Petrolia WWTP would be upgraded and expanded to accommodate leachate. Leachate storage at the Petrol Landfill would enable operations staff to control leachate flow to add leachate continuously or off-peaks, to minimize risk to effluent quality. | 4 | 5.8% |
| **Greenhouse Gases**<br>Minimize generation or net energy use | 7.3% | Highest greenouse gas emissions compared to other alternatives, resulting from hauling leachate approximately 90 km from Petrolia Landfill to alternative wastewater treatment facilities. | 2 | 2.9% | Minor impacts from greenhouse gas emissions to haul leachate from Petrolia Ladnfill to the Petrolia WWTP | 4 | 5.8% | Negligible greenhouse gas emissions resulting from nominal energy requirements to pump leachate. | 5 | 7.3% | Negligible greenhouse gas emissions resulting from nominal energy requirements to pump leachate. | 5 | 7.3% |
| **Operating Complexity**<br>Minimize risks to reliability and performance | 3.6% | Negligible impact to operting complexity based on alternative wastewater treatment facilities currently accomodating leachate. | 5 | 3.6% | Minor impact on operating complexity required to manage the feed of leachate into the Petrolia WWTP. | 4 | 2.9% | Minor impact on operating complexity required to manage the feed of leachate into the Petrolia WWTP. | 4 | 2.9% | Minor impact on operating complexity required to manage the feed of leachate into the Petrolia WWTP. | 4 | 2.9% |
| **Chemical Use**<br>Minimize use of additives | 3.6% | Negligible impact based on alternative wastewater treatment facilities currently able to accomodate leachate. | 5 | 3.6% | Negligible impact based on a nominal amount of alum required to treat additional leachate flows. | 5 | 3.6% | Negligible impact based on a nominal amount of alum required to treat additional leachate flows. | 5 | 3.6% | Negligible impact based on a nominal amount of alum required to treat additional leachate flows. | 5 | 3.6% |
| **Environmental Risk During Construction**<br>Minimize impacts to environment | 3.6% | No construction activities required for Option 1. | 5 | 3.6% | Minor risks as leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional risk. | 4 | 2.9% | Moderate risks to the environment during construction due to forcemain installation. Leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional risk. | 3 | 2.2% | Major risks to the environment during construction due to the forcemain installation through an environmental hazard area surrounding Bear Creek. Leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional risk. | 2 | 1.5% |
| **Treatment Plant Performace During Construction**<br>Minimize performance risks | 7.3% | No construction activities required for Option 1 and alternative treatment facilities are currently able to accommodate leachate. | 5 | 7.3% | Minor risk to plant performance during construction to accommodate leachate as these activities represent a small component of the overall project presenting minor additional risk. | 4 | 5.8% | Minor risk to plant performance during construction to accommodate leachate as these activities represent a small component of the overall project presenting minor additional risk. | 4 | 5.8% | Minor risk to plant performance during construction to accommodate leachate as these activities represent a small component of the overall project presenting minor additional risk. | 4 | 5.8% |
| **Spills**<br>Minimize environmental risks to surface water and land due to spills | 7.3% | Moderate risks during loading, unloading and transporting leachate approximately 90 km to alternative wastewater treatment facilities. | 3 | 4.4% | Minor risks during loading, unloading and transporting approximately 6 km to the Petrolia WWTP. | 4 | 5.8% | Negligible risks of spills during leachate pumping. | 5 | 7.3% | Negligible risks of spills during leachate pumping. | 5 | 7.3% |
| **Total Environmental Weighting** | 40% | | | 32.7% | | | 32.7% | | | 33.5% | | | 34.2% |
| **Community Impact** | | | | | | | | | | | | | |
| **Aesthetics**<br>Maximize aesthetic appeal | 6.2% | Negligible impacts based on existing alternative wastewater treatment facilities able to accommodate leachate. | 5 | 6.2% | Negligible impact as construction will occur at remote Petrolia WWTP site. | 5 | 6.2% | Negligible impact as construction will occur at remote Petrolia Landfill and Petrolia WWTP sites. | 5 | 6.2% | Negligible impact as construction will occur at remote Petrolia Landfill and Petrolia WWTP sites. | 5 | 6.2% |
| **Land Use**<br>Maximize use of land | 3.1% | Negligible impacts based on existing alternative wastewater treatment facilities able to accommodate leachate. | 5 | 3.1% | Minor impact required to accommodate leachate as construction activities and footprint is minor compared to those already required at the Petrolia WWTP. | 4 | 2.5% | Minor impact required to accommodate leachate as construction activities and footprint is minor compared to those already required at the Petrolia WWTP. | 4 | 2.5% | Minor impact required to accommodate leachate as construction activities and footprint is minor compared to those already required at the Petrolia WWTP. | 4 | 2.5% |
| **Health and Safety**<br>Maximize protection to public and operators | 6.2% | Negligible impacts to public and operators based on existing alternative wastewater treatment facilities able to accommodate leachate. | 5 | 6.2% | Negligible impacts to public and operatiors based on the Petrolia WWTP upgrades and expansion to accommodate the leachate. | 5 | 6.2% | Negligible impacts to public and operatiors based on the Petrolia WWTP upgrades and expansion to accommodate the leachate. | 5 | 6.2% | Negligible impacts to public and operatiors based on the Petrolia WWTP upgrades and expansion to accommodate the leachate. | 5 | 6.2% |
| **Operations and Maintenance Staff**<br>Minimize certification/training requirements | 3.1% | Negligible impacts based on existing alternative wastewater treatment facilities able to accommodate leachate. | 5 | 3.1% | Minor certifiaction and/or training requiremed in order to accommodate leachate at the Petrolia WWTP. | 4 | 2.5% | Minor certifiaction and/or training requiremed in order to accommodate leachate at the Petrolia WWTP. | 4 | 2.5% | Minor certifiaction and/or training requiremed in order to accommodate leachate at the Petrolia WWTP. | 4 | 2.5% |
| **Odours**<br>Minimize odour | 6.2% | Minor odour risks based on leachate being loaded and unloaded at the remote Petrolia Landfill and alternative wastewater treatment facilities. | 4 | 4.9% | Minor ordour risks based on leachate being loaded and unloaded at the remote Petrolia Landfill and Petrolia WWTP. | 4 | 4.9% | Minor ordour risks based on leachate being discharged to the Petrolia sewage collection system and eventually being diluted by municipal sewage. | 4 | 4.9% | Moderate ordour risks based on leachate being discharged directly to the Petrolia WWTP. | 3 | 3.7% |
| **Noise**<br>Minimize noise | 6.2% | Moderate noise impacts from approximately 2 trucks per day transporting leachate 90 km from the Petrolia Landfill to alternative wastewater treatment facilities, requiring travel through some residential and business areas. | 3 | 3.7% | Minor noise impacts from approximately 2 trucks per day transporting leachate 6 km from the Petrolia Landfill to the Petrolia WWTP, requiring travel through some residential and business areas. | 4 | 4.9% | Negligible noise impacts at the Petrolia Landfill to pump leachate to the Petrolia sewage collection system. | 5 | 6.2% | Negligible noise impacts at the Petrolia Landfill to pump leachate directly to the Petrolia WWTP. | 5 | 6.2% |
| **Traffic & Safety**<br>Minimize traffic and maximize community safety | 6.2% | Moderate risks from approximately 2 trucks per day transporting leachate 90 km from the Petrolia Landfill to alternative wastewater treatment facilities, requiring travel through some residenstil and business areas. | 3 | 3.7% | Moderate risk from approximately 2 trucks per day transporting leachate 6 km from the Petrolia Landfill to the Petrolia WWTP, requiring travel through some residential and business areas. | 3 | 3.7% | No traffic or safety risks to pump leachate from the Petrolia Landfill to the Petrolia sewage collection system. | 5 | 6.2% | No traffic or safety risks to pump leachate from the Petrolia Landfill directly to the Petrolia WWTP. | 5 | 6.2% |
| **Construction Duration**<br>Minimize construction duration | 3.1% | Negligible construction impacts based on existing alternative wastewater facilities able to accommodate leachate. | 5 | 3.1% | Minor impacts as leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional work. | 4 | 2.5% | Moderate impacts during construction for forcemain installation that may disrupt a small number of residents. Leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional work. | 3 | 1.8% | Major impacts during construction for forcemain installation that may disrupt a moderate number of residents. Leachate construction activities at the Petrolia WWTP represent a small portion of the overall project and present minor additional risk. | 2 | 1.2% |
| **Total Community Weighting** | 40% | | | 33.8% | | | 33.2% | | | 36.3% | | | 34.5% |
| **Economic Impact** | | | | | | | | | | | | | |
| **Minimize Capital Cost (2012 dollars)** | 8.0% | Negligible capital costs based on existing alternative wastewater treatment facilities able to accommodate leachate. | 5 | 8.0% | Capital cost estimate is between $0.9 and $1.4 million. | 2.33 | 3.7% | Capital cost estimate is between $1.7 and $2.4 million. | 2.03 | 3.2% | Capital cost estimate is between $2.0 and $2.5 million in 2012 dollars. | 1 | 1.6% |
| **Minimize 27 Year Net Present Value Operating Cost (2012 dollars)** | 8.0% | Net present value operating cost is between $2.9 and $4.1 million. | 1 | 1.6% | Net present value operating cost is between $0.9 and $1.2 million. | 4.4 | 7.0% | Net present value operating cost is between $0.55 and $0.75 million. | 5 | 8.0% | Net present value operating cost is between $0.55 and $0.75 million. | 5 | 8.0% |
| **Minimize Operating Cost Risks** | 4.0% | Moderate operating risks based on unknown potential increases in fuel costs to haul leachate 90 km and treatment costs at alternative wastewater treatment facilities. | 3 | 2.4% | Minor operating risks based on fuel costs to haul leachate 6 km and treatment costs at the Petrolia WWTP. | 4 | 3.2% | Negligible operating risks based on treatment at the Petrolia WWTP, based on establishing long term agreement with Town. | 5 | 4.0% | Negligible operating risks based on treatment at the Petrolia WWTP, based on establishing long term agreement with Town. | 5 | 4.0% |
| **Total Economic Weighting** | 20% | | | 12.0% | | | 14.0% | | | 15.2% | | | 13.6% |
| **Total Weighting** | 100% | | | 78.6% | | | 79.9% | | | 85.0% | | | 82.2% |

# 10. DESIGN CONCEPT

## 10.1 OVERVIEW

The preferred solution for wastewater treatment in the Town of Petrolia for the planning period is the upgrade and expansion of the existing Petrolia WWTP, which will address the current plant deficiencies while also providing capacity to accommodate growth into the future.

For management of leachate from the Petrolia landfill the preferred solution is to pump the leachate from an existing landfill storage tank through a new forcemain to the Petrolia collection system, and to upgrade the Petrolia WWTP during the expansion to provide capacity to also treat the leachate.

## 10.2 PETROLIA WWTP

### 10.2.1 Overview

The upgrades and expansion of the Petrolia WWTP will be designed to provide capacity for a wastewater flow of 5,123 $m^3$/d based on servicing in 2041, and the capacity to treat a leachate flow of 140 $m^3$/d. The design will provide:

- Full treatment of peak flows resulting from extraneous flow (infiltration and inflow) in the system
- Removal of grit and screenings that have the potential to affect downstream processes
- Removal of total suspended solids to achieve the anticipated effluent criteria for this parameter
- Removal of biochemical oxygen demand or BOD (organics) to achieve the anticipated effluent criteria for this parameter
- Removal of ammonia to achieve a non-acutely lethal effluent and meet the anticipated effluent criteria for this parameter
- Removal of phosphorous to meet the anticipated effluent criteria for this parameter
- UV disinfection to eliminate virtually all pathogens in the effluent
- Stabilization of the resulting residual sludge to reduce pathogens and vector attraction and generate biosolids that can be disposed of in accordance with Ontario regulations.

### 10.2.2 Design Criteria

The study area consists of the Town of Petrolia and a few adjacent properties from the Township of Enniskillen. The adjacent properties include an existing retirement home already serviced by the Petrolia WWTP, existing properties on private systems and a future development area for communal service.

The expanded Petrolia WWTP will be designed to treat wastewater from the Town of Petrolia and adjacent properties for the 2041 planning period, as well as leachate from the Petrolia landfill. The design wastewater (with leachate) concentrations and loadings are presented in Table 38.

**Table 38 Combined Wastewater and Leachate Design Concentrations and Loadings**

| Parameters | Petrolia Wastewater Average Concentration (mg/L) | Petrolia Landfill Leachate Peak Concentration (mg/L) | Combined Wastewater & Leachate Concentration (mg/L) [1,2] | Combined Wastewater & Leachate Loadings (kg/d)[3] |
|---|---|---|---|---|
| $BOD_5$ | 226 | 494 | 234 | 1,232 |
| TKN | 37.6 | 906 | 60.7 | 320 |
| TSS | 199 | 42 | 195 | 1,027 |
| TP | 5.6 | 2.8 | 5.6 | 29.5 |

Notes:
1 Petrolia wastewater design flow based on a 2041 monthly average flow of 5,123 $m^3$/d.
2 Petrolia landfill leachate design flow based on a weekly maximum of 140 $m^3$/d.
3 The combined wastewater and leachate design flow amounts to 5,263 $m^3$/d.

The design flows used to size specific unit processes are presented in Table 39. The design flows were calculated by multiplying the monthly average flow (5,123 $m^3$/d) with the appropriate wastewater peak factor and then adding the peak leachate flow of 140 $m^3$/d.

**Table 39 Petrolia WWTP Wastewater Design Flows for each Unit Process**

| Unit Process | Monthly Average Flow ($m^3$/d) | Wastewater Peak Factor | Peak Leachate Flow ($m^3$/d) | Design Flow ($m^3$/d)[1] |
|---|---|---|---|---|
| Headworks | 5,123 | 4[2] | 140 | 20,632 |
| Aeration Tanks | | 1 | | 5,263 |
| Oxygenation | | 1 | | 5,263 |
| Secondary Clarifiers | | 3.2[3] | | 16,534 |
| RAS Pumping | | 1 | | 5,263 |
| Tertiary Filtration | | 3.2[3] | | 16,534 |

Notes:
1 Calculated by multiplying the monthly average flow by the wastewater peak factor then adding the peak leachate flow.
2 Peak instantaneous flow based on estimated historical peak factors.
3 Peak hourly flow based on historical peak day flow factor plus 50% of average day flow to allow for diurnal peaks.

The recommended Certificate of Approval effluent criteria were developed and presented in an Assimilative Capacity Study for the receiving water Bear Creek, included in Appendix 2. The criteria were based on a wastewater flow of 5,123 $m^3$/d to the Petrolia WWTP and are presented in Table 40.

**Table 40 Recommended Certificate of Approval Effluent Objectives and Limits for the Upgraded and Expanded Petrolia WWTP[1]**

| Parameters | Effluent Objectives | | Effluent Limits[2] | |
|---|---|---|---|---|
| | Concentration (mg/L) | Waste Loading (kg/d) | Average Concentration (mg/L) | Average Waste Loading (kg/d) |
| 5 Day Biochemical Oxygen Demand ($CBOD_5$) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Ammonia Nitrogen | | | | |
| May 1 – Nov. 30 | 2.0 | 10.2 | 3.0 | 15.4 |
| Dec. 1 – Apr. 30 | 4.0 | 20.5 | 6.0 | 30.7 |
| Total Suspended Solids (TSS) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Phosphorous (TP) | 0.37 | 1.9 | 0.74 | 3.8 |
| E. Coli (Apr. 1 – Nov. 30) | 150 organisms / 100 ml | | 200 organisms / 100 ml | |
| pH (at all times) | 6.5 – 8.5 | | 6.0 – 9.5 | |

Notes:
1 Based on a monthly average flow of 5,123 $m^3$/d.
2 Monthly average concentrations and loadings shall not exceed the effluent limits.

## 10.3 COLLECTION SYSTEM DESIGN CONCEPT

Two forcemain alternative solutions were presented to direct leachate from the Petrolia Landfill to the Petrolia collection system. The first was based on a forcemain installed along Oil Heritage Road, and the second was based on a forcemain installed through future development lands.

For the purposes of refining the concept in Phase 3 of the Class EA, the Old Heritage Road location is recommended. Figure 20 presents the preferred foremain design concept for discharging leachate to the Petrolia collection system. The main reasons for choosing this route is that it is shorter, slightly less expensive and there has not yet been a road map developed for the future development area that would be used.

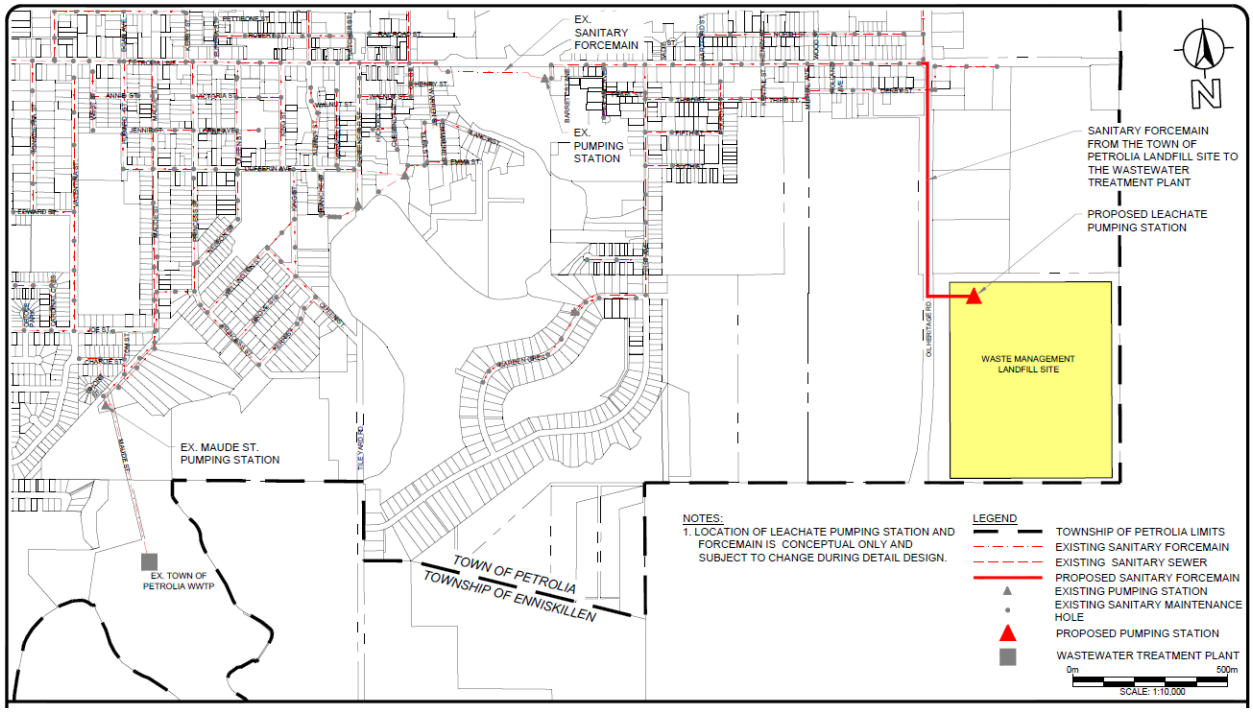


**Figure 20 Preferred Forcemain Design Concept for Discharging Leachate to the Petrolia Sewage Collection System**

## 10.4 PETROLIA WWTP PROCESS UPGRADES

The following section provides more detail on the upgrades and expansion required at the Petrolia WWTP calculated based on the design flows for each unit process outlined in Table 39. Table 41 summarizes the required upgrades and each section provides more detail for the specific process or system.

**Table 41 Design Concept of Process Upgrade and Expansion at the Petrolia WWTP**

| Process | Existing | | Upgrade and Expansion |
|---|---|---|---|
| Headworks - Screens | | | |
| Type | Step Screen | Coarse Bar Rack | Replace existing with a new step screen |
| Number | 1 | 1 | 1 |
| Capacity | 6,000 $m^3/d$ | 12,000 $m^3/d$ | 20,632 $m^3/d$ |
| Headworks - Grit Collection | | | |
| Type | Aerated grit tank | | Replace existing with a vortex grit collector |
| Number | 1 | | 1 |
| Capacity | | | 16,534 $m^3/d$ |
| Aeration Tanks | | | |
| Number | 2 existing aeration tanks | | 2 additional aerations tanks |
| Dimensions | 24.7 m x 12.2 m x 3.96 m SWD | | 40.0 m x 8.0 m x 4.0 m SWD (preliminary) |
| Total Volume | 2,388 $m^3$ | | 2560 $m^3$ |
| Oxygenation | | | |
| Type | Mechanical surface aerator | Self-aspirating jet | Replace existing with a fine bubble aeration system |
| Number | 4 | 2 | 3 blowers (2 duty / 1 standby) |
| Total Capacity | 36 kg $O_2/h$ | 52 kg $O_2/h$ | 327 kg $O_2/h$ |
| Phosphorous Removal | | | |
| Number of Pumps | 1 (duty) | | Replace existing with 2 (1 duty / 1 standby) |
| Containment | No | | Yes |
| Secondary Clarifiers | | | |
| Type | Square clarifiers with circular scrapers | | Upgrade existing<br>Add 2 new rectangular clarifiers |
| Dimensions | 12.2 m x 12.2 m x 3.0 m SWD | | 4 m x 18 m x 4 m SWD (preliminary) |
| Total Surface Area | 288 $m^2$ | | 288 $m^2$ |
| RAS Pumping | | | |
| Number | 2 (1 duty / 1 standby) | | Replace existing with 2 (1 duty / 1 standby) |
| Total Capacity | 3,273 $m^3/d$ | | 5,123 $m^3/d$ |
| Tertiary Filtration | | | |
| Type | Travelling bridge sand filter | | Replace existing with rotating disk filters |
| Number | 1 | | 2 |
| Total Surface Area | 31.8 $m^2$ | | 120 $m^2$ |
| UV Disinfection | | | |
| Type | Low pressure, low intensity | | No upgrades or expansions required |
| Number of Lamps | 40 lamps at 26 W per lamp | | |
| UV Output | 1040 W total | | |
| Biosolids Holding Tanks | | | |
| Number | 2 | | No expansion required |
| Dimensions | 22.25 m by 4.88 m by 3.05 m SWD | | |
| Total Volume | 312 $m^2$ | | |
| Aeration Type | Coarse bubble spargers | | Replace aeration equipment |

### 10.4.1 Headworks

The existing headworks facility consists of a manually cleaned coarse bar rack with a capacity of about 12,000 $m^3$/d and a mechanically cleaned step-screen with a peak rated capacity of 6,000 $m^3$/d which is less than current peak flow at the plant. The headworks is hydraulically limited and bypassed on a regular basis.

The existing aerated grit tank has a volume of 25.5 $m^3$ with a detention time of 2.4 minutes, the low end of the MOE Design Guidelines for Sewage Works (2008) of 2 to 5 minutes. The current design is poor, and combined with the inadequate screen capacity and poor overall condition, it is recommended that the entire headworks facility be replaced.

A headworks facility that operates effectively is essential to improve downstream equipment reliability and minimize maintenance. Upgrades to the existing system would not be able to provide an appropriate level of treatment, thus a new headworks facility is required. Screening will require a peak hydraulic capacity of 20,632 $m^3$/d and one 6 to 9 mm opening mechanically cleaned step screen is recommended. A vortex grit collection system is recommended for the same hydraulic capacity as it provides the most effective grit removal of the available technologies while also helping to prevent odour and have low head loss in a small space.

### 10.4.2 Aeration Tanks

The existing extended aeration tanks have a total volume of 2,388 $m^3$, providing a solids retention time (SRT) of 12 days at current average flow and 9 days at the rated plant capacity, compared to a minimum of 15 days in the MOE Design Guidelines for Sewage Works (2008). Historically, the 12 day SRT has provided sufficient year round nitrification; however, as the flows increase the retention time will shorten, and additional aeration capacity will be required.

For an extended aeration facility the MOE Design Guideline for Sewage Works (2008) requires a minimum solids retention time (SRT) of 15 days and a hydraulic retention time (HRT) of 15 hours based on the design monthly average flow of 5,123 $m^3$/d. SRT is the limiting requirement, and will require an aeration tank volume of approximately 5,000 $m^3$, which also provides a HRT of 23.5 hours, for sufficient aeration and year round nitrification in the year 2041.

To achieve this, it is recommended that two new aeration tanks be constructed each with a volume of 1,280 $m^3$, for a total of 2,560 $m^3$. This will provide a total capacity of approximately 5,000 $m^3$/d with existing and new tanks to meet the 2041 requirements.

### 10.4.3 Oxygenation

Oxygenation is currently supplied by mechanical aerators and supplemented by self-aspirating jet aerators. The mechanical aerators are approaching 35 years old and operating beyond their normal service life. The current oxygenation capacity does not meet the requirements of historic peak oxygen demands.

It is recommended that the existing aeration systems be replaced by fine bubble diffusers. Oxygenation is the most energy intensive process in a wastewater treatment plant, accounting for approximately 50% of a plant's total energy consumption, and fine bubble diffusers provide the best energy efficiency. They are only marginally more expensive than other oxygenation systems, and the energy cost savings from lower energy consumption make up the difference in a short period.

In the MOE Design Guidelines for Sewage Works (2008), an extended aeration facility is designed to provide 1.5 kg of oxygen per kg of $BOD_5$ and 4.6 kg of oxygen per kg of TKN, with a typical peak factor of 2 to accommodate diurnal and daily loading fluctuations. This results in a requirement of 273 kg of oxygen per hour for treating both wastewater and leachate. Based on an oxygen transfer efficiency of 9.6%, the new blowers will be required to deliver oxygen at a rate of 11,700 $m^3$/h. It is recommended that three blowers capable of delivering 4,500 $m^3$/h each, be installed, two duty and one standby.

### 10.4.4 Secondary Clarifiers

Two square secondary clarifiers with circular collection equipment currently provide a settling surface area of 288 $m^2$, which is sufficient for the current plant design flow. Square clarifiers typically do not perform as well as circular or rectangular clarifiers, as the circular collection equipment can allow sludge to buildup in the corners of the tanks. The sludge collection mechanisms are in poor condition and the scum collectors are not functional. Existing RAS piping is approaching 35 years and buried piping is corroding and with increasing flows, additional capacity will be required to treat the 2041 flow of 5,263 $m^3$/d.

The MOE Design Guidelines for Sewage Works (2008) recommends a surface overflow rate at peak hour flow of 40 $m^3/m^2$d. Based on an estimated hourly peaking factor of 3.2, a total surface area of 414 $m^2$ would be required for the 2041 flows. The collection equipment of the existing secondary clarifier tanks will be completely replaced, and benching will be installed in the corners to prevent sludge buildup and increase their efficiency. In order to serve the new aeration tanks, the new secondary clarifiers must be sized for approximately half of the flow, therefore two new rectangular clarifiers, each with an area of 144 $m^2$, are proposed.

### 10.4.5 Tertiary Filtration

Tertiary filtration is currently achieved using a traveling bridge sand filter and mechanism which is beyond its normal service life and is almost 35 years old. There is also a surge tank upstream of the filter to help buffer peak flows. The existing filter area is 31.8 $m^2$ and the historic hydraulic loading rate with the surge tank is 2.8 $L/m^2 \cdot s$, exceeding the MOE Design Guidelines for Sewage Works (2008) of 2.1 $L/m^2 \cdot s$ for shallow-bed travelling bridge filters.

It was determined that a filtration area of approximately 92 $m^2$ is required for 2041 flows, but the actual area will depend on the filtration capacity of the selected filter equipment. It is recommended that the existing tertiary filtration system is replaced by two rotating disk units to provide a total filtration area of approximately 120 $m^2$. These units are relatively simple, easily maintained and provide low head loss, while incurring a small footprint.

### 10.4.6 UV Disinfection

The existing UV disinfection system was installed in 1995 and is in good overall condition. In combination with the existing equalization tank, this system has adequate capacity to disinfect the peak design flow to the Petrolia WWTP.

### 10.4.7 Biosolids Handling

Existing sludge holding tanks have a total volume of 312 $m^2$ and use coarse bubble spargers fed by two blowers. Much of the aeration system is broken, corroded or seized and needs to be replaced. Replacement of this system in included in the Petrolia WWTP design concept.

### 10.4.8 Phosphorous Removal

The existing phosphorous removal system consists of an outdoor chemical storage tank surrounded by a concrete secondary containment area and a chemical feed pump in a dedicated room within the administration building. A secondary containment area is required in the pumping room to meet Code and upgrades to the pumping system are required. The design concept includes upgrades to chemical storage and containments and an additional contingency feed pump.

### 10.4.9 Electrical & Controls

A single MCC currently provides power to all unit processes, but it is almost 35 years old. There is no stand-by power, SCADA or automation available for critical processes and key equipment. Thus the MCC replacement and a new standby power facility are required. SCADA and automation for key equipment are also proposed to provide better monitoring and control of all plant unit processes.

### 10.4.10 Miscellaneous

Many unit processes require a number of miscellaneous upgrades and repairs to address structural deficiencies, such as leaks and spalling. Many of the handrails and stairs used throughout the existing plant require replacement in order to maintain safety standards. The administration building also requires a number of miscellaneous upgrades including numerous leaks.

Figure 21 presents the treatment train for the upgraded and expanded Petrolia WWTP.

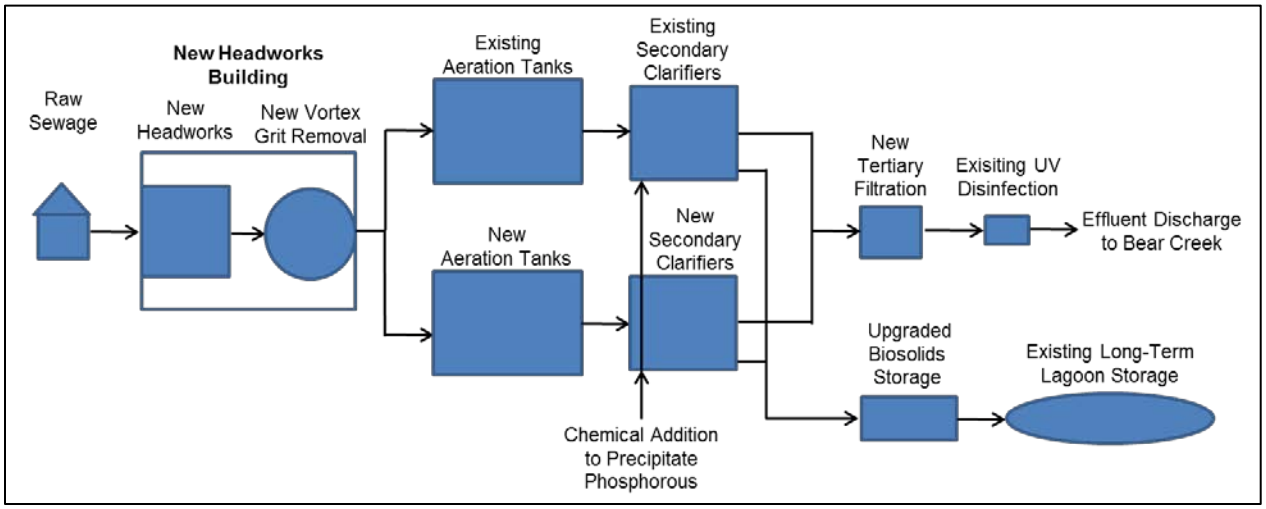


**Figure 21 Treatment Train of the Upgraded and Expanded Petrolia WWTP**

## 10.5 PROPOSED PLANT LAYOUT

The proposed layout for the recommended upgrades and expansion at the Petrolia WWTP are presented in Figure 22. The influent will enter into the new headworks building and be split, half to the old plant and half to the new plant. The influent to the old plant will flow to the existing channels and continue throughout the plant as it does currently. Flow to the new plant will travel

through the new aeration tanks and secondary clarifiers to tertiary filtration and disinfection. The new RAS/blowers building will house equipment for both the new and old plant. This layout will allow the old plant to remain in operation while the new plant is built, followed by operation of the new plant while the old plant is taken off-line to be upgraded.

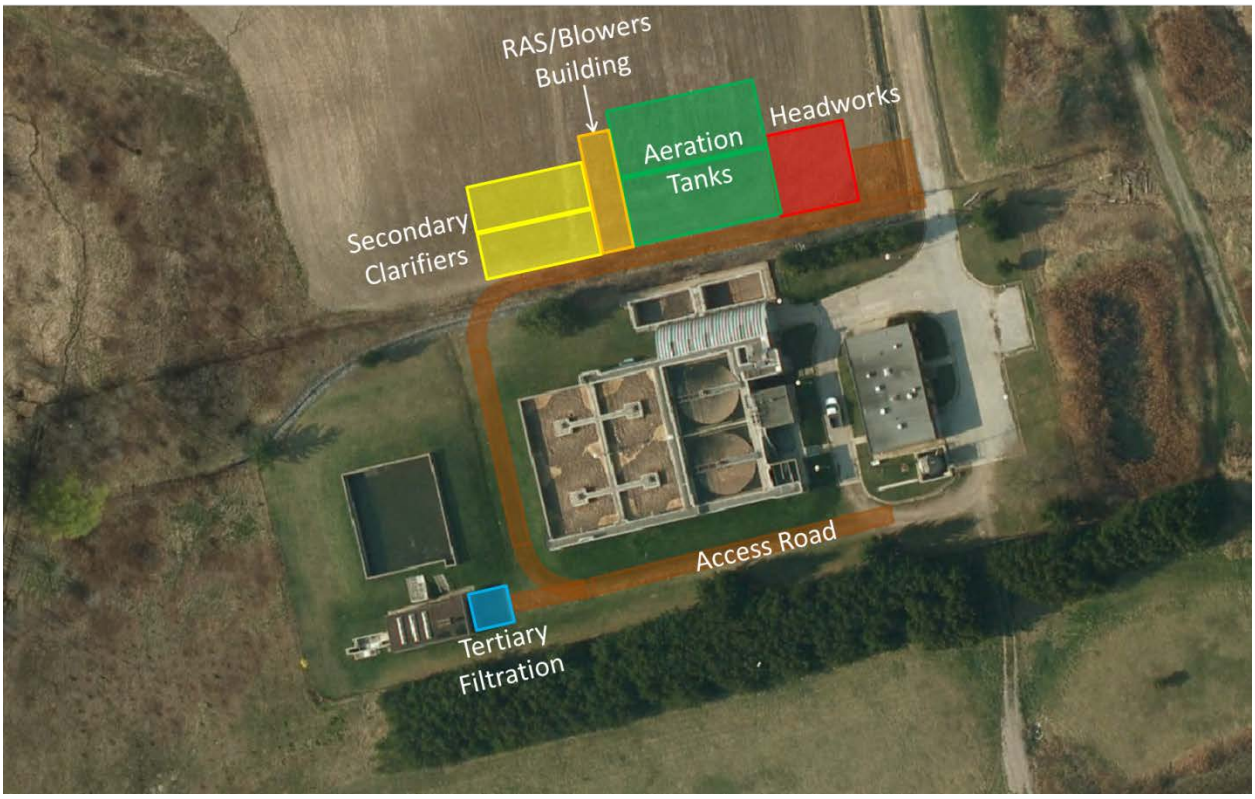


**Figure 22 Proposed Plant Layout on the Existing Petrolia WWTP site**

## 10.6 COST

A range of capital costs are presented in this section due to uncertainty in regards to closing the Petrolia Landfill, as closures have been delayed in the past. It is anticipated that leachate will be generated at a rate of 20,000 $m^3$ per year until closure, at which point it will decrease to 5,000 $m^3$ per year over an 18 year period and continue to generate 5,000 $m^3$ per year until the end of the planning period in 2041. The minimum scenario is based on the planned Landfill closure in 2012, while the maximum scenario is based on a 3 year delay and closure in the year 2015.

The total capital cost for the upgrade and expansion of the Petrolia WWTP to treat both wastewater and leachate is between $23.6 and $24.1 million, including the connection of the Petrolia Landfill to the Petrolia collection system. These costs are presented in Table 42.

**Table 42 Total Capital Cost for the Upgrade and Expansion of the Petrolia WWTP to Treat Wastewater and Leachate**

| Process | Estimated Capital Cost | |
|---|---|---|
| | Minimum | Maximum |
| Headworks | $ 3,100,000 | $ 3,100,000 |
| Aeration Tanks | $ 2,700,000 | $ 2,850,000 |
| Oxygenation | $ 2,700,000 | $ 2,900,000 |
| Secondary Clarifiers | $ 1,110,000 | $ 1,110,000 |
| Tertiary Filtration | $ 4,000,000 | $ 4,000,000 |
| Biosolids Handling Volume | $ 400,000 | $ 400,000 |
| Phosphorous Removal | $ 100,000 | $ 100,000 |
| Electrical & Controls | $ 1,000,000 | $ 1,000,000 |
| Miscellaneous | $ 300,000 | $ 300,000 |
| Leachate Forcemain & Pumping | $ 300,000 | $ 300,000 |
| **Subtotal** | **$ 15,710,000** | **$ 16,060,000** |
| Contingency 35% | $ 5,498,500 | $ 5,621,000 |
| Engineering 15% | $ 2,356,500 | $ 2,409,000 |
| **Total** | **$ 23,565,000** | **$ 24,090,000** |

## 10.7 PROPOSED IMPLEMENTATION

The implementation plan to provide wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada, respectively, is as follows:

- Design: The design of the wastewater treatment plant upgrades and expansion, as well as the collection system connecting the Petrolia Landfill to the Petrolia collection system will take an estimated 1 year followed by a 3 month tender period.
- Construction: The construction will consist of two phases as follows:
    - Construction of a new plant at the Petrolia WWTP site and the connection of the Petrolia Landfill to the Petrolia collection system. This work will require approximately 1.5 years, and must be completed before the existing plant can be taken offline and upgraded.
    - Retrofitting and upgrading the existing Petrolia WWTP will require approximately 1 year.

The entire process is expected to take approximately 3.75 years as outlined in Figure 23.

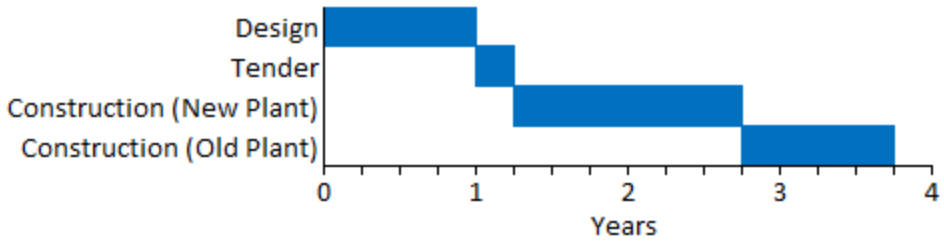


**Figure 23 Implementation Timeline for the Upgrade and Expansion of the Petrolia WWTP**

## 10.8 IMPACTS AND MITIGATION MEASURES

This section addresses the impacts of the proposed design concept for the upgrade and expansion of the Petrolia WWTP and the mitigation measures.

### 10.8.1 Receiving Water Quality

An assimilative capacity study was completed to assess the impact of the Petrolia WWTP upgrades and expansion on the quality of the receiving water, Bear Creek, and can be found in Appendix 2. From this, a new set of effluent criteria was developed to ensure the plant has the least possible impact on the Creek.

The Petrolia WWTP will use the best available treatment technology to minimize loadings to Bear Creek. The proposed effluent criteria maintain the existing concentration objectives and limits for $BOD_5$, TSS, TP, E. Coli and pH, while decreasing them for TP and ammonia so as not to increase their loadings from the current Certificate of Approval. These criteria were discussed with and reviewed by the MOE.

A new Certificate of Approval, now called an Environmental Certificate of Approval, will be needed and will require on-going monitoring and annual reporting. The Petrolia WWTP will be able to achieve these effluent concentration objectives and limits with and without the treatment of leachate from the Petrolia Landfill.

### 10.8.2 Site Traffic

The Petrolia WWTP is accessed by travelling along Maude Street, and requires travel through residential areas and the centre of the Town. All traffic will continue to occur during normal working hours, 5 days per week.

During normal operation, vehicles accessing the site will include Municipality staff and operator vehicles as well as trucks for chemical and other deliveries, and for disposal of screenings.

During construction, vehicles accessing the site will include vehicles required for normal operation, as the existing plant will continue to treat the Town's wastewater, as well as vehicles required for construction of the new processes. Measures will be put in place to minimize impacts from mud and dust on affected streets.

### 10.8.3 Construction & Commissioning

An Environmental Management Plan (EMP) will be developed during the design phases for all construction and commissioning activities associated with this project. The EMP will:

- Establish roles and responsibilities for the engineering team, contractors, and the construction program
- Plan for the management of plant flow or process interruptions that may be necessary during construction
- Establish procedures for management of environmental issues such as waste, water, air quality and spill prevention, containment and control, as well as control and management of materials, vehicles and equipment, noise, traffic and pests
- Establish a monitoring program for environmental compliance and construction impacts (health and safety, odour, noise, dust, traffic, environmental) through regular inspections.

### 10.8.4 Ecosystem Protection

The following mitigation measures for protection of the ecosystem will be implemented during construction and operation of the upgraded and expanded Petrolia WWTP:

- All construction activities will occur within the property boundaries with the exception of the forcemain construction to connect the Petrolia Landfill to the Petrolia collection system
- Spill prevention, control and containment measures will be implemented wherever required.

### 10.8.5 Waste Management

All waste materials from operation of the new plant will be disposed of in accordance with applicable legislation and guidelines, including the Ontario Waste Management Act. Wastes include screenings and grit, which will be appropriately disposed of off-site, and biosolids, which will be appropriately treated and stored in the long-term sludge storage and stabilization lagoon.

### 10.8.6 Energy Efficiency

The upgrades and expansion of the Petrolia WWTP will include some of the most energy efficient technologies available, including:

- Process design and equipment selection
- Building design and insulation
- Heating, ventilation, air conditioning (HVAC) systems.

Specifically, a fine bubble aeration system will be installed, which is the most energy efficient technology available for oxygenation, which typically accounts for 50% of a wastewater treatment plants energy consumption.

### 10.8.7 Dust and Mud

There are no anticipated concerns regarding dust and mud during normal plant operation. During construction, appropriate mitigation measures, such as dust curtains, will be implemented to minimize any impacts.

### 10.8.8 Social-Economic Impacts

The Petrolia WWTP requires major upgrades and expansion in order to adequately service the existing population of Petrolia, as well as to provide adequate service into the year 2041 based on growth projection outlined in the County of Lambton's Official Plan. The project is not expected to have significant negative socio-economic impacts on the surrounding community and businesses. A service rate increase in order to finance the required upgrades and expansion of the Petrolia WWTP is necessary and a Water and Wastewater Rate Study was completed by Watson and Associates in February 2012. This document can be found on the Petrolia website at http://town.petrolia.on.ca/.

### 10.8.9 Land Use

All of the construction required at the Petrolia WWTP will occur within the property boundaries of the existing site. The MOE recommends a minimum 100 m buffer distance between any wastewater treatment plant and existing residences. There is a proposed residential development that lies within 100 m of the existing plant; however, the proposed upgrades and expansion will not cause any additional residences to fall within 100 m of the plant. This can be seen in Figure 24.

### 10.8.10 Odour and Noise Control

In recent history, there have been no reported odour or noise complaints related to the Petrolia WWTP. In order to ensure odour and noise do not become issues for the future residential development within the 100 m buffer distance, the proposed upgrades and expansion will select technologies with low odour and noise generation.

The most odorous processes (i.e. Headworks) will be located furthest from the future residential developments, as seen in Figure 24, and where necessary, housed within buildings equipped with odour control equipment.

Noise will be controlled by locating all equipment and machines indoors in buildings appropriately designed for noise attenuation.

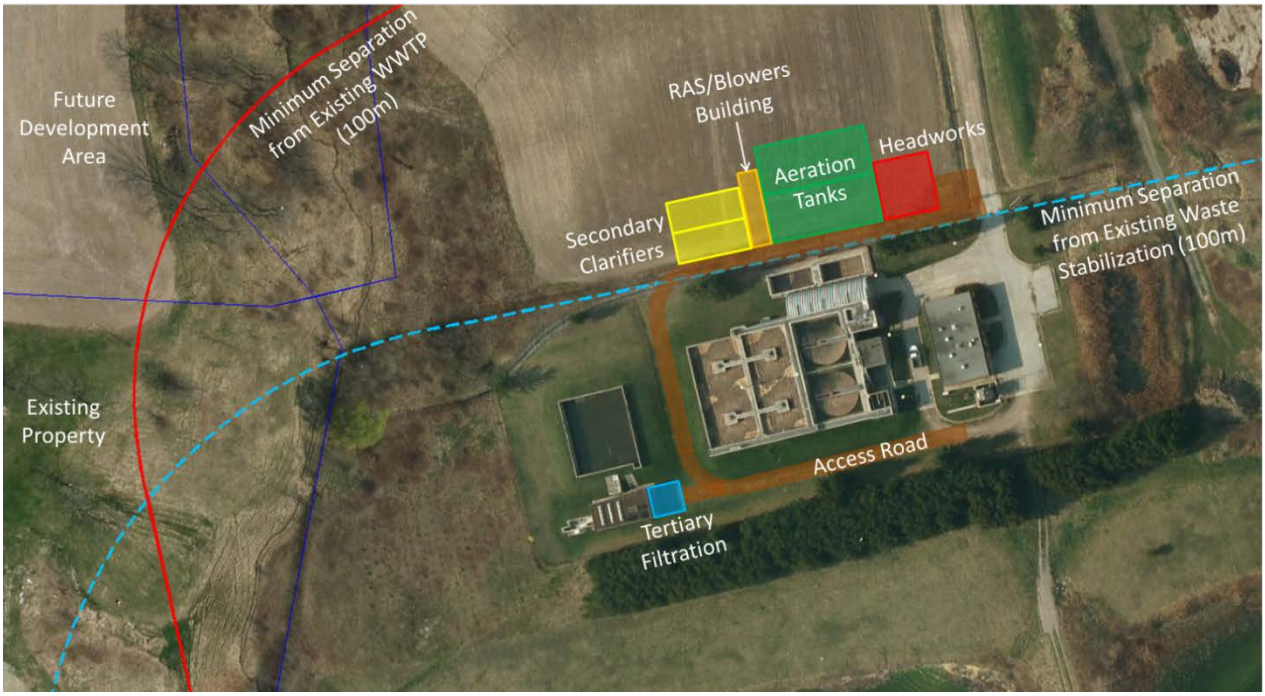


**Figure 24 Proposed Plant Layout on the Existing Petrolia WWTP site with MOE Recommended Minimum Separation Distances**

# 11. CONSULTATION

## 11.1 OVERVIEW

A summary of the public and Aboriginal and First Nations consultation activities undertaken as part of the Class EA process are presented in this section. The public consultation materials are included for reference in Appendix 3.

## 11.2 OBJECTIVES OF CONSULTATION ACTIVITIES

The objectives of the consultation activities for this project included:

- Inform the public, stakeholders and Aboriginal and First Nations of the project
- Offer educational information regarding the project
- Obtain input on project components at key decision-making points
- Meet or exceed the consultation requirements of the Class EA process.

## 11.3 DIRECT CONSULTATION PROGRAM

The following outlines the specific consultation activities undertaken to support the Class EA process for wastewater treatment and leachate management for the Town of Petrolia and Waste Management of Canada.

- **Notice of Study Commencement:** A Notice of Study Commencement was placed in the local newspaper, Municipal webpage, Municipal notice board and sent to the project mailing list (Issued November 18, 2011).
- **Project Mailing List:** A contact list was developed for the project and continually upgraded as the project progressed. The list included residents, landowners, members of community groups and a number of review agencies, businesses and organizations. Also included were the Aboriginal and First Nations groups identified whose traditional rights may be impacted by the project.
- **Phone Calls:** Aboriginal and First Nations groups were contacted by phone to discuss their interest in the project.
- **Project Website:** Information on the project is posted on the Municipality's website (http://town.petrolia.on.ca/index.php?option=com_content&view=article&id=83), including notices, Technical Memorandums 1 and 2 and the poster boards presented at the Public Open House.
- **Public Open House:** One Public Open House was held on May 1, 2012 between 4 and 7 pm at the Town of Petrolia Municipal Office. The notice for the Public Open House was advertised in the local newspaper, posted on the Municipalities website and sent directly to the contacts on the project mailing list. The Public Open House provided displays for a walk through, comment sheets and handouts. Staff from the Town of Petrolia, Waste Management and CIMA were available to answer any questions.
- **Notice of Completion:** Included as first page of the ESR.

More detailed information on the Public Open House, the materials presented and feedback is included in Appendix 3.

## 11.4 COMMENTS AND FEEDBACK

No comments or feedback were received over the course of the project via Public Information Centre, letters, emails and other media.

There has been a request for an additional Open House from the Aamjiwnaang First Nations. The request was received late due to a mailing mix-up, thus the Open House will occur during the 30-day public review period. If comments arise from this consultation, the review period would be extended so that every effort could be made to resolve any outstanding issues.

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# APPENDIX 1
# CONDITION AND ASSESSMENT REPORT

**The Town of Petrolia**

# PETROLIA WASTEWATER TREATMENT PLANT
# CONDITION ASSESSMENT

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Report Preparation and Review Log

| Version | Date | Prepared by | QC Reviewer |
|---|---|---|---|
| 1.0 | August 16, 2011 | Troy Briggs | Deborah Ross |
| | | | |
| | | | |
| | | | |

# EXECUTIVE SUMMARY

The Petrolia Wastewater Treatment Plant (WWTP) is an extended aeration facility with tertiary treatment and seasonal ultraviolet disinfection. Final effluent is discharged through an outfall to Bear Creek. The plant includes two lagoons, for emergency treatment of wastewater and sludge stabilization and storage, respectively.

The Petrolia WWTP was originally constructed in 1977 with a rated capacity of 3,180 $m^3$/d, and was subsequently rerated to 3,800 $m^3$/d in 2002. Average flow to the plant represents 80% of its re-rated capacity of 3,800 $m^3$/d, although flows in some months have exceeded 85%.

The Town recognizes that many of the plant components are deteriorating and operating well beyond their service life. Major upgrade is required to for the Petrolia WWTP to continue to perform reliably, and to minimize risk of non-compliance and to operator health and safety.

Due to planned growth in the Town, a Schedule C Class Environmental Assessment to plan for the expansion needs for the Petrolia WWTP will be initiated in fall 2011. Due to the age, condition and reliability concerns of the existing plant, the expansion project will need to incorporate and be compatible with upgrades to address existing deficiencies.

The purpose of this evaluation was to assess the existing Petrolia WWTP, to identify factors that pose a risk to the plant achieving reliable operation and performance, or pose a health and safety risk. Based on this evaluation, a preliminary capital cost estimate was developed for upgrades to provide long-term reliability to achieve performance and comply with current standards and regulations.

Based on a physical condition assessment and process capacity review, the following deficiencies were identified at the existing Petrolia WWTP:

- Structural condition: Deficiencies include cracks in aeration tanks, administration building leaks and other safety features.
- Capacity: Capacity is not adequate for Certificate of Approval flows in screen, grit removal, aeration, oxygenation and tertiary filtration processes.
- Equipment condition: Most major equipment is operating well beyond its normal service life, resulting in significant risk of failure and long periods of major process shut-down for repair, due to the difficulty in finding replacement parts.
- Electrical system: The MCC is over 30 years old and requires dangerous access to reset equipment. There is no stand-by power for critical systems processes.

For the purposes of developing a capital cost that reflects the investment required into the existing infrastructure to reliably achieve performance and comply with current standards, a program of plant upgrading needs was developed based on upgrading the plant at the existing Certificate of Approval rated capacity. The total estimate cost to upgrade the plant to address deficiencies is $12.8 million, including a 35% allowance for engineering and contingencies.

The Petrolia WWTP upgrading project will be developed in consideration of the plant capacity needs, to be determined though the planned Schedule C Class EA study.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

The Petrolia Wastewater Treatment Plant (WWTP) is an extended aeration plant with tertiary filtration and seasonal ultraviolet disinfection. Final effluent is discharged through an outfall to Bear Creek. Two lagoons are available: the east lagoon (126,540 $m^3$) is used for emergency treatment of wastewater, and the west lagoon (88,200 $m^3$) is used for biosolids stabilization and storage. The lagoons are approved to discharge seasonally between April 1 and May 31 and between October 1 to November 30.

The Petrolia WWTP was originally constructed in 1977 with a rated capacity of 3,180 $m^3$/d, and was subsequently rerated to 3,800 $m^3$/d in 2002. The plant is currently operating at 80% of it re-rated capacity of 3,800 $m^3$/d, although flows in some months have exceeded 85%.

The Town recognizes that many of the plant components are deteriorating and operating well beyond their service life. Major upgrade is required to ensure consistent reliable operation, and minimize risk of non-compliance and risk to operator health and safety. As a recent example, in August 2011, the return sludge pipe deteriorated to cause a spill, resulting in shut-down and bypass of the treatment process for several days.

Due to planned growth in the Town, a Schedule C Class Environmental Assessment will be initiated in fall 2011 to plan for the expansion needs for the Petrolia WWTP. Because of the age, condition and reliability concerns of the existing facility, the expansion project will need to incorporate and be compatible with upgrades to address existing deficiencies.

## 1.2 PURPOSE OF REPORT

The purpose of this evaluation was to assess the existing Petrolia WWTP to identify factors that pose a risk to the plant achieving reliable operation and performance, or pose a health and safety risk. Based on this evaluation, a preliminary capital cost estimate is provided for upgrades to provide long-term reliability to achieve performance and comply with current standards and regulations.

# 2. PLANT DESCRIPTION

## 2.1 DESCRIPTION

Raw wastewater to the Petrolia WWTP is pumped to the headworks from an off-site pumping station and forcemain. The headworks consist of a single automatically-cleaned step-screen and an aerated grit tank. A manually raked coarse bar rack is available when the automatic screen is off-line for maintenance.

Flow from the grit removal process is directed to two parallel aeration tanks in an extended aeration process. Each aeration tank is equipped with two mechanical surface aerators, as well as one self-aspirating jet aerator, which was installed more recently to supplement air to the tanks. Mixed liquor from the aeration tanks flows to two square secondary clarifiers, each equipped with a circular scraper mechanism. Return activated sludge (RAS) from each clarifier flows through a telescopic valve to a common RAS sump for pumping activated sludge back to the aeration inlet channel. Waste activated sludge is intermittently wasted from the RAS forcemain to aerobic sludge holding tanks.

Alum is added to the mixed liquor upstream of the secondary clarifiers for phosphorus precipitation and removal in the clarifiers.

Secondary effluent flows by gravity to a surge tank to equalize flows upstream of a single travelling bridge sand filter and UV disinfection system. Final effluent is discharged continuously to Bear Creek.

Two (2) aerobic sludge holding tanks are available to partially stabilize waste sludge before discharge to the east lagoon for further stabilization and storage. Supernatant from the lagoon is discharged seasonally. The west lagoon is available for emergency storage and treatment of raw wastewater to the Petrolia WWTP.

The Certificate of Approval only allows for seasonal discharge from the lagoons, from April 1 to May 31 and October 1 to November 30. In addition, the lagoon discharge flow rates needs to be regulated, so that total loadings to Bear Creek do not exceed Certificate of Approval limits.

Figure 1 shows an aerial view of the Petrolia WWTP. Table 1 presents unit process design criteria for major processes.


**Figure 1 Aerial View of Petrolia WWTP**

## Table 1 Unit Process Design Criteria

| Process | Description | |
|---|---|---|
| Screen | | |
| Type | 6 mm Step Screen | Manually cleaned coarse bar rack |
| Number | 1 | 1 |
| Capacity | 6,000 $m^3$/d | >12,000 $m^3$/d |
| Grit Removal | | |
| Type | Aerated grit tank | |
| Number | 1 | |
| Dimensions | 3.05 m by 2.74 m by 3.05 m SWD | |
| Volume | 25.5 $m^3$ | |
| Aeration Tanks | | |
| Number | 2 | |
| Dimensions | 24.7 m by 12.2 m x 3.96 m SWD | |
| Total Volume | 2,388 $m^3$ | |
| Oxygenation | | |
| Type | Mechanical Surface Aerator | Self-aspirating jet type |
| Number | 4 | 2 |
| Size | 7.5 kW each | 22 kW |
| Phosphorus Removal | | |
| Storage Tank | 1 – 27.3 $m^3$ storage tank | |
| Chemical Pumps | 1 – 0.2 kW chemical feed pump | |
| Secondary Clarifiers | | |
| Type | Square with circular scraper | |
| Dimensions | 12.2 m x 12.2 m x 3.0 m SWD | |
| Total Surface Area | 288 $m^2$ | |
| RAS Pumping | | |
| Number | 2 (1 duty/1 standby) | |
| Capacity | 3,273 $m^3$/d @ 7.6 m TDH | |
| Equalization/Surge Tank | | |
| Number | 1 | |
| Dimensions | 18.3 m by 15.2 m by 1.83 m deep | |
| Volume | 510 $m^3$ | |
| Tertiary Filtration | | |
| Type | Travelling Bridge Sand Filter | |
| Number | 1 | |
| Dimensions | 11.58 m x 2.74 m | |
| Surface Area | 31.8 $m^2$ | |
| UV Disinfection | | |
| Type | Low pressure, low intensity | |
| Number of Lamps | 40 | |
| UV Output | 26 W per lamp (1040 W total) | |
| Sludge Holding Tanks | | |
| Number | 2 | |
| Dimensions | 22.25 m by 4.88 m by 3.05 m SWD | |
| Total Volume | 312 $m^3$ | |
| Aeration Type | Coarse bubble sparger | |
| Blower Size | Two (2) 15 kW blowers rated at 9.46 L/s each | |
| Emergency Storage Lagoon (East) | 126,540 $m^3$ | |
| Sludge Stabilization Lagoon (West) | 88,200 $m^3$ | |

## 2.2 RAW WASTEWATER FLOWS AND LOADINGS

The recent average raw wastewater flow data for the Petrolia WWTP for the period from 2008 to 2010 are presented in Table 2. The 3 year average flow was 3,028 $m^3$/d or 80% of the Certificate of Approval rated capacity. Higher monthly flows have been experience, for example, in 2010, average flow in 3 months exceeded 84% of the rated capacity.

**Table 2 Historic Plant Flow (2008 to 2010)**

| Parameter | Value |
|---|---|
| Average | 3,027 $m^3$/d |
| Peak Day | 11,590 $m^3$/d |

The peak day flow of 11,590 $m^3$/d was extreme and occurred on only one occasion. For the purpose of assessing the capacity of the Petrolia WWTP for this report, a typical peak day flow factor of 2.5 was used. Peak instantaneous flow data are not recorded at the plant and therefore, this assessment was based on a typical peak instantaneous flow factor of 4.0.

Raw wastewater concentrations for 2009 are summarized in Table 3. Concentrations are typical of a medium strength domestic wastewater.

**Table 3 Historic Average Raw Wastewater Concentrations and Loadings (2009)**

| Parameter | Concentration (mg/L) | Loading (kg/d) |
|---|---|---|
| $BOD_5$ | 237 | 702 |
| TSS | 209 | 619 |
| TKN | 38.3 | 114 |
| TP | 6.0 | 18 |

## 2.3 EFFLUENT QUALITY

Effluent quality data for the period of 2009 to 2010 are presented in Table 4. The Petrolia WWTP has consistently produced excellent effluent quality; well below effluent compliance requirements. During one single month, the plant slightly exceeded the effluent objective for $BOD_5$ and TP.

**Table 4 Historic Effluent Quality (2009-2010)**

| Parameter | Average | Peak Month | Effluent Objective | Effluent Compliance |
|---|---|---|---|---|
| BOD5 | 1.9 mg/L | 6.8 mg/L | 5 mg/L | 10 mg/L |
| TSS | 0.7 mg/L | 1.3 mg/L | 5 mg/L | 10 mg/L |
| NH3-N | | | | |
| May 1 – Nov. 30 | 0.19 mg/L | 0.41 mg/L | 2 mg/L | 3 mg/L |
| Dec. 1 – Apr. 30 | 0.30 mg/L | 1.15 mg/L | 5 mg/L | 7 mg/L |
| TP | 0.49 mg/L | 0.63 mg/L | 0.5 mg/L | 1.0 mg/L |

# 3. STRUCTURAL/ARCHITECTURAL CONDITION ASSESSMENT

A visual structural inspection of the Petrolia WWTP was undertaken on April 26, 2011. The following points outline structural and architectural deficiencies noted, and rehabilitation requirements:

- The concrete sewage tankage structure that sits at least partially above grade at the rear of the facility is in fair condition. The concrete material itself appears in fair to good condition and should last many more years if maintained. Due to its above grade exposure to the sun, wind and cold during the winter months, the tank has experienced expected thermal expansion and contraction cracks; some of which are visibly leaking. These cracks require repair through polyurethane injection, epoxy injection or routed and sealed with a flexible caulking.

**Aeration Tank Cracks and Leaking**

- The caulking in all of the expansion and control joints in the tankage has failed and requires replacement.
- The stairs from the top level of the tank exiting to grade at the rear of the tankage do not meet minimum code requirements for width or load resistance, and require replacement.
- The aluminum handrails at the front stairs to the aeration tanks should be modified to meet minimum building code requirements for access.

**Non-code Compliant RearAccess Stairs**

- The galvanized steel garage shed fixed to the side of the tanks requires localized cleaning and touch-ups in spots where it is beginning to rust, especially around the door frame. Also, along the side of the garage, sludge has built up along the base, which could damage the steel and accelerate the aging of the structure.
- The top steel riser on the manhole towards the front of the sewage tanks is not secured and poses a safety risk.
- Water is entering the wall cavity around the perimeter of the administration building, and bleeding through to the exterior around many doors and windows. This has caused localized spalling of the exposed split face concrete block during freeze thaw cycles during the winter and spring. The source of this water issue needs to be located and repaired to avoid further damage to the exterior block work. Localized repair to the block, as attempted previously, will not stop the issue from reoccurring. It is possible that a failed roof membrane has caused this issue, and the building may require a roofing replacement.

**Leaking and Brick Spalling in Administration Building**

# 4. PROCESS CONDITION ASSESSMENT AND PROCESS CAPACITY EVALUATION

## 4.1 INTRODUCTION

A visual inspection of process equipment was undertaken on August 11, 2011. During the inspection, CIMA staff discussed unit process operation with plant operating staff. Representative plant operating data for 2008 to 2010 were collected during the site visit to assist in the unit process evaluation.

## 4.2 HEADWORKS

The existing mechanically cleaned step-screen is located outdoors within a plywood enclosure to help protect against the elements and freezing. Screenings are manually removed from an elevated platform by plant staff. The screen has a rated peak capacity of 6,000 $m^3$/d, which is less than peak flows experienced at the plant. As a result, the screen is regularly hydraulically limited and bypassed. This has resulted in a significant accumulation of screenings downstream processes, that have resulted in plugging and maintenance issues.

The aerated grit tank is 25.5 $m^3$ in volume, providing a detention time of 2.4 minutes at peak design flow. This is at the low end of the Design Guideline (MOE, 2008) range of 2 to 5 minutes for aerated grit tanks. The grit tank also has a very low length to width ratio of 1.1 and does not have any inlet or outlet baffling. These factors together cause short-circuiting and poor grit collection. In addition, the existing air lift mechanism for grit removal from the bottom of the tank is broken and not functioning. Plant staff noted significant downstream grit accumulation in the aeration tanks.

A properly functioning headworks facility is essential to improve downstream equipment reliability and minimize maintenance. Due to the screening capacity limitations and poor grit tank design, upgrades to headworks would not be considered to provide a reliable solution, and therefore, a new headworks facility the recommended upgrade approach for the Petrolia WWTP. This facility would incorporate screening and grit removal capacity for the full range of flows encountered at the facility, and would include screenings and grit handling systems.

## 4.3 SECONDARY TREATMENT

### 4.3.1 Overview

A capacity assessment of the extended aeration process components is presented in this section, as well as a physical condition assessment of the process equipment, including oxygenation equipment, return sludge pumping system and clarifier equipment.

### 4.3.2 Aeration

The capacity of the aeration tanks was assessed to confirm that it can operate effectively to achieve removal of BOD and provide full nitrification on a year round basis, to meet ammonia objectives in the Certificate of Approval.

Table 5 presents aeration tank operating parameters compared to MOE Design Guidelines.

**Table 5 Aeration Tank Operating Parameters**

| Parameter | Historic (2008-2010) | Rated Capacity | MOE Design Guideline (2008) |
|---|---|---|---|
| HRT (h) | 18.9 | 15 | 15 |
| $BOD_5$ VLR ($kg/m^3.d$) | 0.30 | 0.38 | 0.17-0.24 |
| MLSS (mg/L)[1] | 3,500 | 3,500 | 3,000-5,000 |
| F:M (gBOD/gVSS.d)[2] | 0.13 | 0.17 | 0.05-0.15 |
| SRT (days)[3] | 11.7 | 9.3 | >15 days |

Note:
1. Upper end of typical operating range of 2,500 to 3,500 mg/L reported by plant operator.
2. Based on a typical MLVSS/MLSS ratio of 0.65 in an extended aeration facility.
3. Based on a sludge yield of 1 gTSS per $gBOD_5$ with chemical addition for phosphorus removal.

Using a mixed liquor concentration at the high end of the normal operating range, a solids retention time (SRT) of 12 days would be provided at current average flows and 9 days would be provided at the design capacity. These values compare to a minimum of 15 days recommended by the MOE Design Guidelines.

As demonstrated through historical plant performance, a 12 day SRT is sufficient to achieve a high level of year-round nitrification. However, as the plant flows increase, or during high flow periods, the operating SRT will shorten, increasing the risk non-compliance with respect to ammonia during the winter months.

Estimation of the upgrade costs for the Petrolia WWTP to reliably achieve effluent ammonia limits at design flow was based on the construction of one additional aeration tank, similar in size to the existing tanks.

### 4.3.3 Oxygenation

Oxygen is supplied to the aeration tanks using a combination of mechanical aerators and self-aspirating jet aerators, the latter which were added to supplement air to the tanks to meet demand that could not be provided by the mechanical aerators alone. The mechanical aerators are almost 35 years old and are operating beyond their normal service life. Due to the age of this equipment, it is difficult to obtain repair parts and there is a risk of long out-of-service periods if repair is required. During these periods, there would not be adequate oxygenation capacity to achieve nitrification requirements.

**Existing Mechanical Aerators**

Table 6 presents the oxygen demand and oxygenation capacity of the Petrolia WWTP. Oxygenation capacity is slightly less than required to meet historic peak oxygen demands. As the plant approaches design flow, there is a risk that there will not be sufficient oxygen to provide complete nitrification during peak loading periods, resulting in ammonia breakthrough and a risk of exceeded effluent ammonia concentration objectives.

**Table 6 Oxygenation Capacity**

| Parameter | Historic (2008-2010) | Rated Capacity | Oxygenation Capacity[3] |
|---|---|---|---|
| Oxygen Demand | | | |
| Average[1] | 67 kg/h | 84 kg/h | |
| Peak[2] | 100 kg/h | 125 kg/h | 88 kg/h |

Note:
1. Based on 1.5 times influent BOD load plus 4.5 times influent TKN load.
2. Based on typical peak factor of 1.5 times the average load to accommodate diurnal and daily loading fluctuations.
3. Based on a typical field transfer efficiency of 1.2 kg $O_2$/kWh for mechanical aerators and self-aspirating jet aerators.

In consideration of the age and capacity limitations of the mechanical aerators, for the purposes of estimating the cost up upgrading requirements for the Petrolia WWTP, a new fine bubble diffused aeration system would be recommended to replace the oxygenation equipment.

### 4.3.4 Secondary Clarification

Mixed liquor from the aeration tanks is settled in two (2) square secondary clarifiers. The existing clarifier sludge collection mechanisms are in poor condition and the scum collectors have completely corroded and are not functional.

**Corroded Clarifier Mechanism**

The existing RAS pumps are almost 35 years old and buried RAS piping is corroded. The Town recently had to complete emergency repairs to stop a leak in the buried RAS piping, which resulted in bypass of the treatment process for several days.

**Corroded RAS Piping**

Plant staff have observed carryover of solids from the secondary clarifier and biosolids accumulation in the downstream surge tank. In addition, under peak flow conditions the level in the aeration tanks can raise significantly due to a hydraulic bottleneck in the influent to the secondary clarifiers.

Table 7 summarizes secondary clarifier process operating parameters. The existing clarifiers provide adequate surface area for the plant design flow. Typically square clarifiers do not perform as well as circular or rectangular units, and therefore, additional clarifier capacity may be required to reliably achieve good secondary effluent quality to avoid impacts on downstream filters

**Table 7 Secondary Clarifier Operating Parameters**

| Parameter | Historic (2008-2010) | Rated Capacity | MOE Design Guideline (2008) |
|---|---|---|---|
| Peak SOR ($m^3/m^2.d$)[1] | 36 | 45 | 40 |
| Peak SLR ($kg/m^2.d$)[2] | 125 | 162 | 170 |
| RAS Rate (% average flow) | 108% | 100% | 50-200% |

Note:
1. Based on peak instantaneous flow factor of 4.0.
2. Based on peak day flow factor of 2.5 with RAS rate equivalent to 100% of average flow and 3,500 mg/L mixed liquor concentration.

For the purposes of developing costs for upgrading the existing plant, a new secondary clarifier is recommended to address performance limitations and hydraulic bottlenecks. Replacement of the existing sludge and scum collection mechanisms is also included, as well as replacement of the existing RAS pumps and piping system.

## 4.4 TERTIARY FILTRATION

The existing single travelling bridge sand filter and mechanism is almost 35 years old and operating beyond its normal service life.

Secondary effluent flows to a 510 $m^3$ surge tank upstream of the filter. The discharge pipe from the surge tank is sized to help to buffer peak flow to the filter. An evaluation of filter capacity was based on the surge tank buffering peak hourly flows, so that the peak flow to the filter would not exceed the peak day flow.

Tertiary filter process operating parameters are presented in Table 8, based on a secondary effluent TSS concentration of 15 mg/L. As shown, the hydraulic loading rate at existing and rated capacity exceeds the MOE Design Guideline.

**Table 8 Tertiary Filter Operating Parameters**

| Parameter | Historic (2008-2010) | Rated Capacity | MOE Design Guideline (2008) |
|---|---|---|---|
| Peak Hydraulic Loading Rate ($L/m^2.s$) | 2.8 | 3.5 | 2.1 |
| Peak Solids Loading Rate ($mg/m^2.s$) | 41 | 52 | 51 |

Due to the high hydraulic loading rate to the filter, and the age and risk to service due to maintenance, the upgrade needs are based on replacement the existing filter with a larger unit. There is potential to retrofit the existing filter with a newer cloth media type filter within the existing filter tank and building, which could provide up to double the filtration area in the same footprint. This lower cost alternative would be investigated during a later pre-design phase of the upgrades..

## 4.5 UV DISINFECTION

The existing UV disinfection system was installed in 1995 and is in good overall condition. This system has adequate capacity to disinfection peak design flow to the Petrolia WWTP.

## 4.6 SLUDGE HANDLING

There are two sludge holding tanks used to aerate and partially stabilize sludge before it is transferred to the stabilization and storage lagoon. These tanks are equipped with aeration systems consisting of coarse bubble spargers fed by two blowers. A large portion of the aeration system is either broken, corroded or seized and requires replacement.

## 4.7 PHOSPHORUS REMOVAL

The phosphorus removal system consists of an outdoor chemical storage tank feeding a single chemical feed pump. The storage tank is surrounded by a concrete secondary containment area.

The chemical pump is located in a dedicated room within the administration building.

To provide adequate pump capacity over the full range of plant flows, and to provide standby capacity, upgrade costs to the Petrolia WWTP were based on replacing the existing pump with two (2) new pumps (duty/stand-by) with a larger operating range and turn-down capacity. In addition, to bring the room up to current standards, upgrades including provision of a secondary containment area to capture any chemical spills from chemical panel leaks or a broken pump suction or discharge line.

## 4.8 ELECTRICAL AND CONTROL SYSTEMS

Power supply to all unit processes is from a single MCC located in the administration building. The MCC is almost 35 years old and a number of the operating buttons (reset, etc.) on the front of the MCC no longer function, requiring staff to remove protective covers and manually reset equipment adjacent to live 600 V power.

There is no provision for stand-by power at the Petrolia WWTP. Stand-by power should be provided for critical unit processes such as the headworks and UV disinfection to ensure hydraulic capacity and disinfection is provided during any power outage.

To address safety concerns and ensure long-term reliability of the electrical distribution equipment, upgrade costs were based on a new MCC and a new standby power facility.

Most equipment is manually controlled at the Petrolia WWTP with auto-dialer call-out of critical alarms. A new automation and SCADA system is included with the estimate of upgrade costs to allow staff to better monitor and control all unit processes within the plant.

# 5. ESTIMATED COST TO UPGRADE PETROLIA WWTP

Overall, the Petrolia WWTP is in fair condition, considering the age of most equipment in the facility. However, a number of components are operating beyond the end of their service life and some processes do not have adequate process capacity for the design flow, introducing a risk to performance during peak flow periods. In addition, there it will be difficult to find replacement parts for many of the major process components due to their age, so equipment failure could result in long out-of-service periods that would reduce the treatment effectiveness, potentially significantly.

The Petrolia WWTP upgrading project will be developed in consideration of the plant capacity needs, to be determined though a Schedule C Class EA study that will be initiated in fall 2011. However, for the purposes of developing a capital cost that reflects the investment required into the existing infrastructure to reliably achieve performance and comply with current standards, a program of plant upgrading needs was developed based on upgrading the plant at the existing Certificate of Approval rated capacity.

Table 9 presents a list of the major deficiencies, upgrade requirements and estimated capacity capital costs for upgrading the existing Petrolia WWTP. The total estimate cost to upgrade the plant to address deficiencies is $12.8 million.

**Table 9 Estimated Capacity Cost to Address Deficiencies at Petrolia WWTP**

| Item | Deficiency | Upgrade Basis | Estimated Capital Cost |
|---|---|---|---|
| Structural Refurbishment | • Aeration tank stair do not meet code<br>• Minor leaks/spalling in concrete | • Replace aeration tank stairs<br>• Repair concrete spalling, leaks, handrails | $250,000 |
| Headworks | • Inadequate capacity<br>• Significant rag accumulation in downstream processes<br>• Ineffective grit removal and grit accumulation in aeration tanks | • New headworks with screening and grit removal sized for peak design flow | $2,700,000 |
| Aeration | • Insufficient volume for ammonia removal at design flow | • One (1) new aeration tank | $1,500,000 |
| Oxygenation | • Mechanical aerators operating beyond normal life<br>• Insufficient capacity<br>• Technology is not energy efficient | • New energy efficient fine bubble aeration system | $1,800,000 |
| Secondary Clarifier | • Existing equipment is broken and corroded<br>• RAS pumps and piping are over 30 years old<br>• There is a hydraulic bottleneck | • One (1) new secondary clarifier<br>• New clarifier mechanisms in existing clarifiers<br>• New RAS system | $1,125,000 |
| Tertiary Filtration | • Insufficient capacity for peak flow<br>• Filters are operating beyond normal life | • Replace and expand to provide for rate capacity | $3,975,000 |
| Biosolids Handling | • Diffusers broken and valves seized<br>• Blowers over 30 years old | • Replace blowers, diffusers, valves and piping | $375,000 |
| Phosphorus Removal | • Only one chemical metering pump<br>• No secondary containment in metering pump room | • New chemical pump panel and containment | $100,000 |
| Electrical and Controls | • MCC over 30 years old and requires dangerous access to reset equipment<br>• No stand-by power for critical systems<br>• No automation or SCADA controls | • Replace existing MCC<br>• Provide stand-by power for critical systems<br>• Automation and SCADA system for process control of key equipment | $975,000 |
| **Total** | | | **$12,800,000** |

**Note:**
1. All capital costs include a 35% contingency and 15% for engineering.

# APPENDIX 2
# ASSIMILATIVE CAPACITY STUDY

# THE TOWN OF PETROLIA
# WASTE MANAGEMENT OF CANADA

# CLASS ENVIRONMENTAL ASSESSMENT FOR WASTEWATER TREATMENT AND LANDFILL LEACHATE MANAGEMENT

# ASSIMILATIVE CAPACITY STUDY TO EVALUATE EFFLUENT REQUIREMENTS FOR EXPANSION OF THE PETROLIA WWTP
# -DRAFT-


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**April 9, 2011**

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# 1. INTRODUCTION

## 1.1 BACKGROUND

The Town of Petrolia is situated within the County of Lambton, located in South Western Ontario.

Petrolia owns The Petrolia Wastewater Treatment Plant (WWTP), which services the properties within the Town. It is an extended aeration facility with tertiary filtration and ultraviolet disinfection, with a rated capacity of 3,800 $m^3$/d, discharging effluent to Bear Creek. There are two lagoons at the plant; one provides long term sludge storage, while the other serves as an overflow lagoon, which receives raw wastewater in excess of plant capacity during peak flow events or maintenance shut-down periods.

The plant was originally constructed in 1975 and has undergone several improvements since that time. However, because most of the processes and structures are more than 35 years old, the plant requires major upgrades. Major tank processes do not provide adequate capacity to treat the Certificate of Approval rated flow and many of the plant processes continue to use equipment that is well past its useful life.

In addition to the major upgrades required, the Petrolia WWTP is operating at approximately 80% of its rated capacity. Recent growth and planning studies indicate that growth in the service area within the next 25 years will require expansion of the plant capacity.

The Petrolia Landfill, also located within the Town, is owned and operated by Waste Management of Canada Corporation (WM). The site currently uses 26.02 hectares of land for disposal of municipal, industrial, commercial and institutional non-hazardous solid waste. The Landfill includes a gas management system for the collection of landfill gas, and a leachate collection system. The leachate is currently hauled by truck to a number of different municipal wastewater treatment facilities. The landfill gas is utilized for electricity generation.

Since the Petrolia Landfill is located less than 1 km from the Petrolia wastewater collection system and approximately 2.5 km from the Petrolia WWTP, there is an opportunity to direct leachate through the wastewater collection system or a dedicated pipe from the landfill to the Petrolia WWTP for treatment. This would significantly reduce or eliminate the number of trucks, hauling distance and corresponding greenhouse gas emissions associated with the leachate disposal.

Currently the Petrolia WWTP does not have capacity or reliability to accept the additional loadings from the Petrolia Landfill leachate.

The Town of Petrolia and Waste Management of Canada are seeking the most environmentally sound and cost-effective solution to manage their wastewater and leachate, respectively, and one solution that shows significant promise is to co-treat leachate with wastewater at the Petrolia WWTP. Completion of a Class Environmental Assessment (EA) study to plan for the management of wastewater and leachate will provide a sound, thorough approach, evaluating a full range of solutions, to identify preferred solutions for the Town and Waste Management, considering all potential environmental, community and cost impacts. This Schedule C Class EA is being undertaken to plan for the expansion of the Petrolia WWTP to meet growth needs in the Town, and to plan for long term management of the Petrolia Landfill leachate.

## 1.2 PURPOSE OF REPORT

Expansion of the Petrolia WWTP will increase allowable effluent flow to Bear Creek. To evaluate the impacts to Bear Creek of the proposed expansion, an assimilative capacity study was completed. This report presents background on the Petrolia WWTP and Bear Creek, and presents the results of the assimilative study and rationale for proposed effluent criteria for the expanded plant.

The assessment presented in this report is based on a rated capacity of 5,123 $m^3$/d. This is the projected average day flow for 2041 at the end of the planning period.

# 2. PETROLIA WASTEWATER TREATMENT PLANT

## 2.1 SERVICEABLE POPULATION OF THE PETROLIA WWTP

The Town of Petrolia has a population of approximately 5,500 people. It is anticipated that in the long term, all lands or new developments within the municipal boundaries will be serviced by the Town's municipal wastewater collection, treatment and disposal system. The Town's Official Plan (Town of Petrolia, 1999) recognizes that some areas of the municipality may not be feasibly serviced, and individual septic systems may be permitted for certain, limited development. Additionally, some industrial areas within the service area may be permitted to develop their own systems where specialized treatment is required. This will be allowed at the discretion of the Municipality in consultation with the Province. For the purposes of this study, the entire population of Petrolia is considered to be serviced by the municipal sewage treatment system.

## 2.2 DESCRIPTION OF EXISTING FACILITIES

An aerial view of the Petrolia WWTP is presented in Figure 1.


**Figure 1 Aerial View of the Petrolia WWTP**

The Petrolia WWTP is an extended aeration facility with tertiary filtration and ultraviolet disinfection, with a rated average day flow capacity of 3,800 $m^3$/d and a peak flow capacity of 10,640 $m^3$/d.

Two lagoons are also located at the Petrolia WWTP; an east lagoon (88,220 $m^3$) used for sludge stabilization and long-term storage and a west lagoon (126,540 $m^3$) used for emergency storage and treatment of wastewater. These lagoons are approved for seasonal discharge between April 1 and May 31 and between October 1 and November 30. The lagoon discharge flow rates must be regulated such that the combined plant and lagoon effluent concentration and loadings to Bear Creek do not exceed the Certificate of Approval effluent limits presented in Table 1.

**Table 1 Certificate of Approval Effluent Objectives and Limits for the Petrolia WWTP**

| Parameters | Effluent Objectives | | Effluent Limits[1] | |
|---|---|---|---|---|
| | Concentration (mg/L) | Waste Loading (kg/d) | Average Concentration (mg/L) | Average Waste Loading (kg/d) |
| 5 Day Biochemical Oxygen Demand ($BOD_5$) | 5.0 | 19.0 | 10.0 | 38.0 |
| Total Ammonia Nitrogen | | | | |
| May 1 – Nov. 30 | 2.0 | 7.2 | 3.0 | 11.4 |
| Dec. 1 – Apr. 30 | 5.0 | 19.0 | 7.0 | 26.6 |
| Total Suspended Solids (TSS) | 5.0 | 19.0 | 10.0 | 38.0 |
| Total Phosphorous (TP) | 0.5 | 1.9 | 1.0 | 3.8 |
| E. Coli (Apr. 1 – Nov. 30) | 150 organisms / 100 ml | | 200 organisms / 100 ml | |
| pH (at all times) | 6.5 – 8.5 | | 6.0 – 9.5 | |

Notes:
1 Monthly average concentrations and loadings shall not exceed the effluent limits.

## 2.3 PHYSICAL CONDITION AND CAPACITY ASSESSMENT

A physical condition and capacity assessment of the Petrolia WWTP was completed by CIMA in August 2011. Based on that review, the following deficiencies pose a risk to the plant achieving reliable operation and performance based on the existing Certificate of Approval rated capacity, or pose a health and safety risk:

- Structural condition: Deficiencies include cracks in aeration tanks, administration building leaks and other safety features.
- Capacity: Capacity is not adequate for Certificate of Approval rated flows in screen, grit removal, aeration, oxygenation and tertiary filtration processes.
- Equipment condition: Most major equipment is operating well beyond its normal service life, resulting in significant risk of failure and long periods of major process shut-down for repair, due to the difficulty in finding replacement parts.
- Electrical system: The motor control centre is over 30 years old and requires dangerous access to reset equipment. There is no stand-by power for critical processes.
- Flows in numerous months over the past 3 years have exceeded 100% of the plant's rated capacity. MOE policy requires the initiation of planning for plant expansion once 85% of the rated capacity is reached.

There have also been a number of occurrences where the Petrolia WWTP has been required to divert flow to the emergency treatment (west) lagoon bypassing the treatment process. The most significant events from the past three years are outlined in Table 2 starting with the most recent events.

**Table 2 Events Requiring Significant Bypass of the Treatment Process to the Emergency Lagoon at the Petrolia WWTP**

| Date | Volume to Lagoon ($m^3$) | Reason |
|---|---|---|
| 2011, Nov. 28 – 30 | 20,502 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 3 days. |
| 2011, July 10 – 11 | 5,060 | Cleaning of the aeration tanks required bypass of the treatment process for 2 days. |
| 2011, July 6 – 9 | 7,498 | A buried RAS pipe began leaking due to corrosion and the treatment process was bypassed for 4 days while emergency repairs were conducted. |
| 2010, Aug. 12 - 17 | 5,273 | Filter process was bypassed for 6 days for repairs. |
| 2010, Jul. 12 | 2,189 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 1 day. |
| 2009, Dec. 20 – 21 | 1,085 | The filter train was not working and required bypass of the filtration process for 2 days. |
| 2009, Apr. 28 – May 9 | 25,437 | A shaft broke on the NW aerator requiring the aerations tanks to be emptied and treatment process bypassed for 12 days while emergency repairs were conducted. |
| 2009, Apr. 26 – 27 | 8,049 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 2 days. |
| 2009, Mar. 8 – 12 | 9,581 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 5 days. |
| 2009, Feb. 11 – 13 | 20,178 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 3 days. |
| 2008, Dec. 27 – 29 | 7,209 | Rainfall and snowmelt resulted in high flows and required bypass of the treatment process for 3 days. |
| 2008, Nov. 14 – 15 | 4,782 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 2 days. |
| 2008, Sep. 13 – 15 | 5,584 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 3 days. |
| 2008, Feb. 17 – 18 | 5,693 | Heavy rainfall resulted in high flows and required bypass of the treatment process for 2 days. |

# 3. WATER RESOURCES AND AQUATIC ECOLOGY

## 3.1 DESCRIPTION OF WATERSHED

Petrolia is located within the Sydenham watershed of the St. Clair Region Conservation Authority (SCRCA), specifically the sub-watersheds of Bear Creek Headwaters and Lower Bear Creek. Bear Creek is Petrolia's primary water course flowing south-westerly through the centre of the Town and just south of the Petrolia WWTP, which discharges to this Creek. The drainage area of Bear Creek at the point of Petrolia WWTP effluent discharge is approximately 342 $km^2$. Durham Creek (listed as Little Bear Creek on some maps) is a westerly flowing stream falling just south of the Petrolia boundaries and the Petrolia Landfill, connecting with Bear Creek just before the Petrolia WWTP. At this confluence, the Bear Creek Headwaters sub-watershed ends and the Lower Bear Creek sub-watershed begins. The watercourse continues in a south-westerly direction as Bear Creek before emptying into the North Sydenham River and eventually discharging into Lake St. Clair. The main watercourses of the area can be seen in Figure 2.

The SCRCA Watershed Report Card, 2008, gave the surface water quality an overall grade of C, on a scale of A to F, for both the Bear Creek Headwaters and Lower Bear Creek sub-watersheds. This general assessment of surface water quality is based on three key indicators, benthic score, phosphorous and E. coli bacteria. This system for grading surface water quality was developed in 2003 by Ontario's Conservation Authorities.

## 3.2 BENTHIC COMMUNITY

Benthic invertebrates are aquatic organisms that live in stream sediments and are used as indicators of water quality and stream health, as they are sensitive to pollution. A stream is scored based on the Family Biotic Index (FBI) and ranges from 1 (healthy) to 10 (degraded).

The Bear Creek Headwaters and Lower Bear Creek sub-watersheds were sampled approximately 15 km northeast and southwest of the Town of Petrolia. A FBI score of 5.7 and 5.5 was determined respectively, indicating Fair water quality in both sub-watersheds.

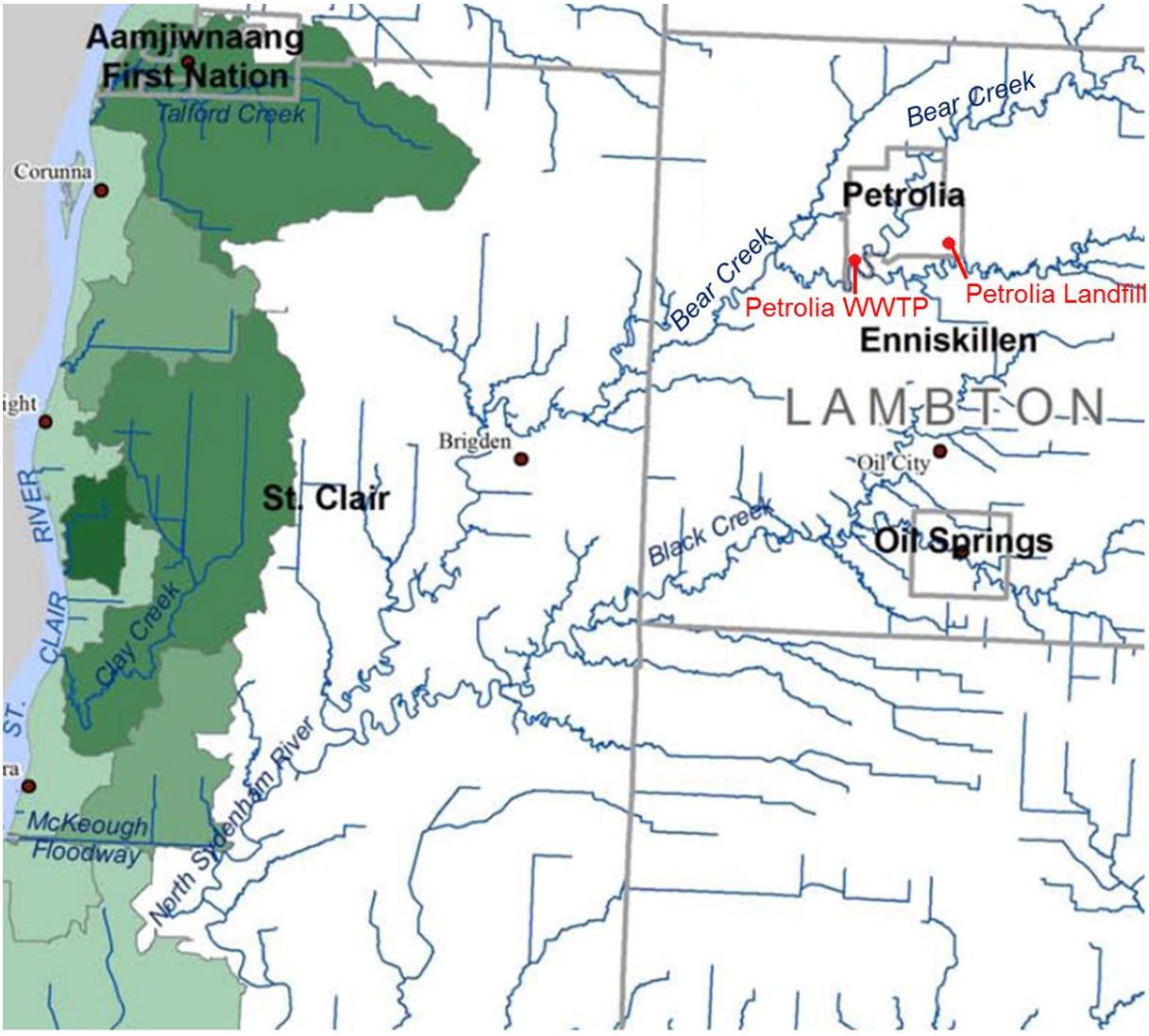


**Figure 2 Major Watercourses near the Study Area (SCRCA, 2009)**

## 3.3 FISHERIES & SPECIES AT RISK

Within the Bear Creek Headwaters and Lower Bear Creek sub-watershed regions there is a warm water fish community consisting of 46 species, including northern pike, largemouth, smallmouth and rock bass, walleye and sunfish.

Additionally, there are a number of fish, plants, birds, reptiles, mussels and mammals at risk within the sub-watersheds. Table 3 lists the species considered at risk by the Community on the Status of Endangered Wildlife in Canada (COSEWIC), a group that assesses species for their consideration for legal protection and recovery under the Species at Risk Act (SARA). The Round Pigtoe and Mudpuppy Mussel are considered S1 (extremely rare) according to a provincial rank from the Species at Risk in Ontario (SARO) List.

**Table 3 Species at Risk in the Bear Creek Headwaters and Lower Bear Creek Sub-Watersheds (SCRCA, 2008)**

| Species Common Name | Species Scientific Name | COSEWIC |
|---|---|---|
| **Fish** | | |
| Blackstripe Topminnow | *Fundulus notatus* | Special Concern |
| Spotted Sucker | *Minytrema melanops* | Special Concern |
| Brindled Madtom | *Noturus miuris* | Not at Risk |
| Bigmouth Buffalo | *Ictiobus cyprnellus* | Special Concern |
| **Plants** | | |
| Green Dragon | *Arisaema dracontium* | Special Concern |
| Kentucky Coffee-tree | *Gymnocladus dioicus* | Threatened |
| Butternut | *Juglan cinerea* | Endangered |
| Blue Ash | *Fraxinus quadrangulata* | Special Concern |
| Shumard Oak | *Quercus shumardii* | Special Concern |
| **Birds** | | |
| Loggerhead Shrike | *Lanius ludovicianus* | Endangered |
| **Reptiles** | | |
| Spiny Softshell Turtle | *Apalone spinifera* | Threatened |
| Butler's Gartersnake | *Thamnophis butlerii* | Threatened |
| **Mussels** | | |
| Round Pigtoe | *Pleurobema sintoxia* | Endangered |
| Mudpuppy Mussel | *Simpsonaias ambigua* | Endangered |
| **Mammals** | | |
| Gray Fox | *Urocyon cinereoargenteus* | Threatened |

## 3.4 GROUNDWATER

Petrolia residents and businesses are connected to a municipal water supply system that draws from Lake Huron. There is one aquifer within the study area, known as the Fresh Water Aquifer, and it lies between the overburden and bedrock layers. This aquifer is limited in quantity and contains high sodium and chloride. Insufficient data were collected at the time of the SCRCA Watershed Report Card, 2008, thus, grades were not applied to the groundwater quality within the specific watersheds.

## 3.5 SIGNIFICANT NATURAL AREAS

Of specific interest within Petrolia's municipal boundaries are the Bridgeview Conservation Area, a locally significant wetland upstream of the Petrolia WWTP, and the environmentally protected primary corridor located along Bear Creek. According to the Town's Official Plan, these areas will be protected from development. Also of note is the Lorne C. Henderson Conservation Area, another locally significant wetland, located just west of Petrolia's boundaries and downstream of the WWTP.

# 4. RECEIVING WATER FLOWS AND BACKGROUND QUALITY

## 4.1 BEAR CREEK FLOWS

Bear Creek daily flow data reflecting the current creek conditions were collected for 20 years between 1991 and 2010 from Environment Canada Water Survey of Canada, flow monitoring station 02GG006. This flow monitoring station is located approximately 5.5 km northeast of the Petrolia WWTP, just east of Oil Heritage Road on Lasalle Line.

In evaluating the impacts of the Petrolia WWTP on Bear Creek, the 7Q20 low flow was used. The 7Q20 low flow is determined by calculating the 7-day average flow from each month over the past 20 years and then determining the 5$^{th}$ percentile of these values for each month. These data is presented in Table 4.

The highest 7Q20 low flows occur between March and May, as well as December. The lowest 7Q20 low flows occur between July and November, specifically between August and October where there are some periods having zero flow. Historic level measurements indicate there is at least 3.5 m of water within the Creek at all times, and therefore, during these periods the Creek seems to act as a stagnant pool.

**Table 4 Estimated Monthly 7Q20 Flows for Bear Creek Upstream of the Petrolia WWTP Discharge Location**

| Month | Average Flows ($m^3/s$)[1] | 7Q20 Flows ($m^3/s$)[2] |
|---|---|---|
| January | 3.4 | 0.078 |
| February | 5.1 | 0.139 |
| March | 6.1 | 0.681 |
| April | 3.7 | 0.639 |
| May | 2.5 | 0.241 |
| June | 1.5 | 0.075 |
| July | 0.5 | 0.018 |
| August | 0.3 | 0.004 |
| September | 1.1 | 0 |
| October | 1.4 | 0.003 |
| November | 2.5 | 0.038 |
| December | 3.4 | 0.293 |

Notes
1 Water quantity data from Environment Canada monitoring station 02GG006 from 1991 to 2010.
2 Calculated as the 5$^{th}$ percentile value of the past 20 years minimum 7-day average values for each month.

## 4.2 DILUTION

Table 5 presents the dilution that is available for the Petrolia WWTP effluent at the projected design capacity of 5,123 $m^3$/d. During the lowest flow months (July to November) the Petrolia WWTP effluent contributes most of the flow of Bear Creek.

**Table 5 Dilution Available at Bear Creek Based on Monthly 7Q20 Flows**

| Month | 7Q20 Flows ($m^3/s$) | Dilution for the Petrolia WWTP discharge as % of 7Q20 Flow At Capacity (0.059 $m^3/s$) |
|---|---|---|
| January | 0.078 | 76 |
| February | 0.139 | 42 |
| March | 0.681 | 9 |
| April | 0.639 | 9 |
| May | 0.241 | 24 |
| June | 0.075 | 79 |
| July | 0.018 | 328 |
| August | 0.004 | 1475 |
| September | 0.000 | NA |
| October | 0.003 | 1967 |
| November | 0.038 | 155 |
| December | 0.293 | 20 |

The average total annual flow in Bear Creek over the 20 year monitoring period was 974 $m^3$, and Figure 3 shows the total annual flows for the Creek from 1991 to 2010. The minimum flow was approximately 570 $m^3$ in 2002 and the maximum flow was approximately 1942 $m^3$ in 2008.

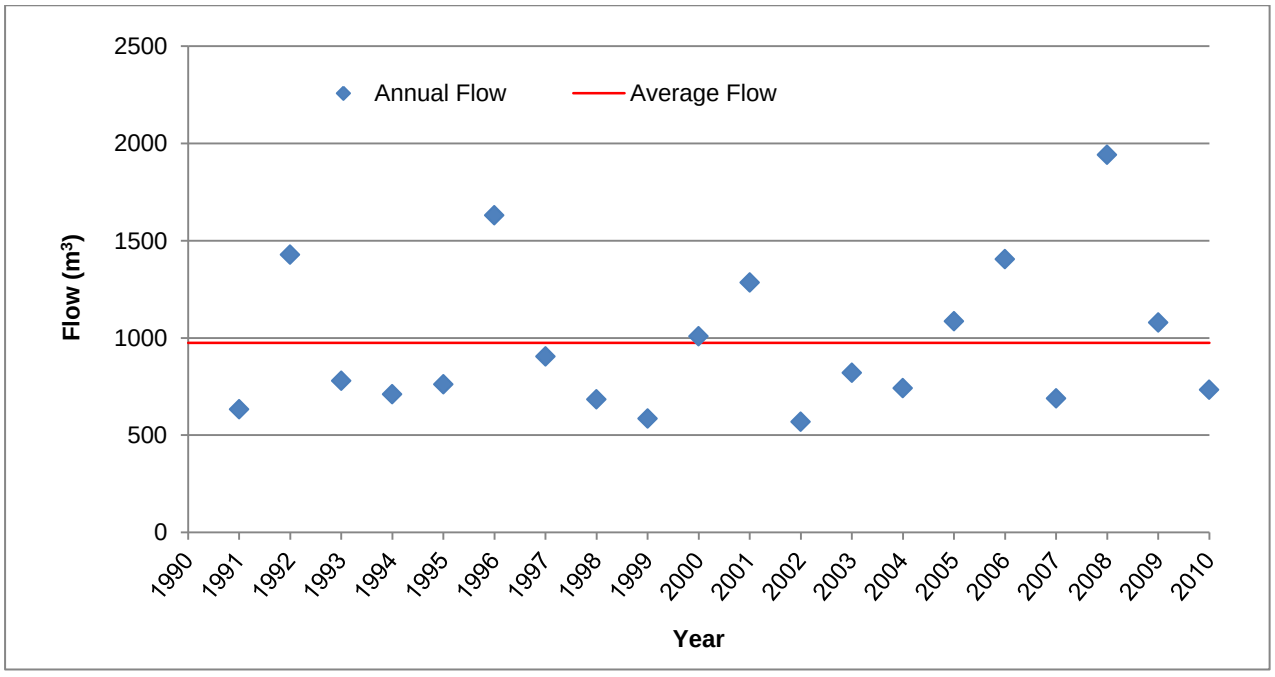


**Figure 3 Total Annual Flows in Bear Creek from 1991 to 2010**

## 4.3 BEAR CREEK WATER QUALITY

Bear Creek water quality data were obtained from the Ontario Ministry of the Environment and Energy (MOEE), monitoring station 04002701402, located at the same location as the flow monitoring station described above. The available data are from the years 1984 to 1996 and 2002 to 2011 and presented in Table 6 along with the Provincial Water Quality Objectives (PWQO) (MOEE 1994b) and the Canadian Water Quality Guidelines (CWQG). The CWQO were developed by Environment Canada in cooperation with the Canadian Council of Ministers of the Environment (CCME).

The un-ionized ammonia concentration was calculated as a function of stream temperature and pH using the equations and table found in Appendix B.

**Table 6 Historical Water Quality Data for Bear Creek Upstream of the Petrolia WWTP**

| Parameters | Number of Samples | Average[1] | 75th Percentile | Provincial Water Quality Objective | Canadian Water Quality Guidelines |
|---|---|---|---|---|---|
| $BOD_5$ (mg/L) | 125 | 3.25 | 3.94 | - | 25 |
| Ammonia-N (mg/L) / un-ionized ammonia-N (mg/L)[2] | 193 | 0.110/0.003 | 0.120/0.003 | 0.02 (un-ionized) | 0.19 (un-ionized) |
| TSS (mg/L) | 198 | 56.8 | 74.3 | - | 25 |
| TP (mg/L) | 201 | 0.420 | 0.236 | 0.03 | - |
| Alkalinity (mg/L) | 204 | 3.25 | 3.94 | - | - |
| Chlorine (mg/L) | 205 | 108 | 80 | - | 120[5] |
| Nitrate (mg $NO_3^-$N/L) | 193 | 5.30 | 7.15 | - | 13 |
| E. Coli (counts)[3] | 13 | 375 | 520 | 100 counts / 100 ml | 200 counts / 100 ml |
| Fecal Coliforms (counts)[4] | 103 | 514 | 590 | 100 counts / 100 ml | 200 counts / 100 ml |
| pH | 205 | 8.02 | 8.18 | 6.5 – 8.5 | - |

Notes:
1 Water quality data from the MOE monitoring station 04002701402 from 1984 to 1996 and 2002 to 2011.
2 Un-ionized ammonia-N[2] values were calculated based on the equations and table provided in Appendix B.
3 E. Coli results from June 1994 to December 1995.
4 Fecal Coliform results from January 1984 to October 1994.
5 CWQG for freshwater long-term exposure.

The background water quality of the receiving watercourse, Bear Creek, has low un-ionized ammonia (0.003 mg/L) with a low $BOD_5$ (3.94 mg/L). Chlorine (80 mg/L) and nitrate (7.15) values are also below the CWQG of 120 and 13 mg/L respectively, and the Creek's pH value consistent lies within the PWQO limits of 6.5 to 8.5.

The Creek does exhibit high TSS (74.3 mg/L) compared to the CWQG of 25 mg/L, as well as high E. Coli and Fecal Coliform counts at 520 and 590 organisms per 100 ml respectively compared to the PWQO of 100 organisms per 100 ml. Phosphorous (0.236 mg/L) is also high compared to the PWQO of 0.03, and thus Bear Creek is considered Policy 2 with respect to phosphorous. Policy 2 states, "*Water quality which presently does not meet the PWQO shall not be degraded further and all practical measures shall be taken to upgrade the water quality of the Objectives".*

# 5. RECOMMENDED OBJECTIVES AND CRITERIA FOR EXPANDED PETROLIA WWTP

## 5.1 EFFLUENT OBJECTIVES AND CRITERIA

Table 7 presents proposed effluent objectives and criteria for the expanded Petrolia WWTP. When compared to existing Certificate of Approval limits, presented in Table 1, lower cold weather ammonia limits and lower phosphorus limits are proposed to minimize impacts from the expanded discharge capacity.

**Table 7 Recommended Certificate of Approval Effluent Objectives and Limits for the Upgraded and Expanded Petrolia WWTP[1]**

| Parameters | Effluent Objectives | | Effluent Limits[2] | |
|---|---|---|---|---|
| | Concentration (mg/L) | Waste Loading (kg/d) | Average Concentration (mg/L) | Average Waste Loading (kg/d) |
| 5 Day Biochemical Oxygen Demand ($CBOD_5$) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Ammonia Nitrogen | | | | |
| May 1 – Nov. 30 | 2.0 | 10.2 | 3.0 | 15.4 |
| Dec. 1 – Apr. 30 | 4.0 | 20.5 | 6.0 | 30.7 |
| Total Suspended Solids (TSS) | 5.0 | 25.6 | 10.0 | 51.2 |
| Total Phosphorous (TP) | 0.37 | 1.9 | 0.74 | 3.8 |
| E. Coli (Apr. 1 – Nov. 30) | 150 organisms / 100 ml | | 200 organisms / 100 ml | |
| pH (at all times) | 6.5 – 8.5 | | 6.0 – 9.5 | |

Notes:
1 Based on an average daily flow of 5,123 $m^3/d$
2 Monthly average concentrations and loadings shall not exceed the effluent limits.

Table 8 outlines the current and proposed effluent objectives, as well as the benefits and rationale for the proposed new objective criteria.

## 5.2 LAGOON DISCHARGES

The two lagoons at the Petrolia WWTP are currently allowed to discharge during the months of April, May, October and November. These months correspond to the highest non-frozen flows in Bear Creek, and it is suggested that they continue to be allowed to discharge during these periods. During periods of lagoon discharge, the Petrolia WWTP is required to ensure a combined monthly average effluent loading and concentrations from both the WWTP and lagoon within the average waste loading and concentration limits presented in Table 7.

With the increased reliability and plant capacity after upgrades and expansion, it is expected that there will be far fewer events requiring bypass of the treatment process to the west lagoon. Discharge from both lagoons can continue during periods of low flow and at a rate low enough to keep the total effluent concentrations and loadings below the design objectives.

## Table 8 Rationale for Proposed Objectives

| Parameter | Current Objective (mg/L) | Proposed Objective (mg/L) | Benefit / Rationale |
|---|---|---|---|
| $BOD_5$ | 10.0 | 10.0 | • Extended aeration process is currently in use and will continue to be used |
| Total Ammonia Nitrogen<br>May 1 – Nov. 30<br>Dec. 1 – Apr. 30 | <br>3.0<br>7.0 | <br>3.0<br>6.0 | • Year round nitrification through extended aeration process is currently in use and will continue to be used<br>• Effluent objective will be reduced to ensure it remains below the known MOE accepted limit of 0.1 mg/L for non-toxic effluent for un-ionized ammonia[1] |
| TSS | 10.0 | 10.0 | • Tertiary filtration is currently in use and will continue to be used<br>• Background 75$^{th}$ percentile concentration for TSS in Bear Creek (74.3 mg/L) is above the CWQG of 25 mg/L<br>• Every effort will be made not to degrade the water quality of Bear Creek further |
| TP | 0.5 | 0.37 | • Tertiary filtration is currently in use and will continue to be used<br>• Background 75$^{th}$ percentile concentration of phosphorous in Bear Creek (0.236 mg/L) is above the PWQO therefore effluent will be treated according to Policy 2<br>• Effluent limit will be lowered so as not to increase allowable loadings to Bear Creek |
| E. Coli<br>(Apr. 1 – Nov. 30) | 200 organisms / 100 ml | 200 organisms / 100 ml | • UV disinfection is currently in use and will continue to be used<br>• Background 75$^{th}$ percentile E. Coli counts in Bear Creek is above the PWQO of 100 organisms / 100 ml<br>• Every effort will be made not to degrade the water quality of Bear Creek further |
| pH (at all times) | 6.5 – 8.5 | 6.5 – 8.5 | • Effluent pH within PWQO of 6.5 – 8.5 at all times |
| Chlorine | No requirement | No requirement | • Non-toxic UV disinfection system currently in operation year round therefore chlorine is not an issue for the effluent |

Notes:
1 Based on a summer effluent temperature of 20$^{o}$C and a pH of 7.6 (75$^{th}$ percentile value).

# 6. REFERENCES

CCME, Canadian Water Quality Guidelines, 2004

MOEE, Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters, 1994a

MOEE, Provincial Water Quality Objectives, 1994b

SCRCA, St. Clair River Watershed Plan, AOC Area 1-A, 2009

SCRCA, Watershed Report Card, 2008

Town of Petrolia, Official Plan, 1999

# APPENDIX 3
# CONSULTATION MATERIAL

# Notice of Study Commencement

## Town of Petrolia
## Class Environmental Assessment to Plan for Wastewater Treatment in the Town of Petrolia

The Town of Petrolia operates the Petrolia wastewater collection system, which collects and delivers wastewater to the Petrolia Wastewater Treatment Plant (WWTP). The plant provides a high level of treatment, and ultimately discharges treated and disinfected effluent to Bear Creek.

The Petrolia WWTP is operating at near 80% of its approved capacity of 3,800 cubic metres per day ($m^3/d$), and with anticipated growth for the 30-year planning period to 2041, additional capacity will be required. In addition, most components of the facility are more than 35 years old, equipment is outdated and at risk of failure, which could lead to environmental and health and safety impacts. The Town has diligently worked to address maintenance problems on a case by case basis; however, a major capital upgrade of the facility is required in the near future so that the plant can provide reliable operation and achieve performance criteria.

The Town has initiated a study to identify the best solution, design concept and implementation plan for provision of reliable and effective wastewater treatment capacity for the existing service area and planned population growth. This project is being planned under **Schedule C** of the **Municipal Class Environmental Assessment** (Municipal Engineers Association, October 2000, as amended in 2007).

In planning wastewater treatment for the Town, treatment of landfill leachate, representing a small volume of high strength wastewater, at the Petrolia WWTP, is also being considered. The leachate is currently hauled by truck to a number of alternative municipal wastewater facilities for treatment. Waste Management, who owns and operates the Petrolia Landfill, has partnered with the Town for this project. The project could reduce the environmental impact of hauling leachate and could also reduce leachate disposal costs.

Public input and comment are invited, for incorporation into the planning and design of this project. A Public Information Centre is planned for spring 2012. In the meantime, if you would like to be included on the mailing list, or have specific comments, please contact either of the following:


Ms. Dianne Caryn, CAO
The Corporation of the Town of Petrolia
411 Greenfield Street, Box 1270
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Ms. Deborah Ross, Project Manager
CIMA
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Phone: (905) 695-1005
Fax: (905) 695-0525


This notice issued November 18, 2011.

# Notice of Public Information Centre
# and
# Completion of Phases 1 and 2 of the
## Class Environmental Assessment to Plan for Wastewater Treatment and Landfill Leachate Management in the Town of Petrolia

The Town of Petrolia operates the Petrolia wastewater collection system, which collects and delivers wastewater to the Petrolia Wastewater Treatment Plant (WWTP). The plant provides a high level of treatment, and ultimately discharges treated and disinfected effluent to Bear Creek.

The Petrolia WWTP is operating at near 80% of its approved capacity of 3,800 cubic metres per day ($m^3/d$), and with anticipated growth for the 30-year planning period to 2041, additional capacity will be required. In addition, a major capital upgrade of the facility is required in the near future so that the plant can provide reliable operation and achieve performance criteria.

In fall of 2011, the Town initiated a study to identify the best solution, design concept and implementation plan for provision of reliable and effective wastewater treatment capacity for the existing service area and planned population growth. This project is being planned under **Schedule C** of the **Municipal Class Environmental Assessment** (Municipal Engineers Association, October 2000, as amended in 2007 and 2011).

In planning wastewater treatment for the Town, treatment of landfill leachate, representing a small volume of high strength wastewater, at the Petrolia WWTP, is also being considered. Waste Management, who owns and operates the Petrolia Landfill, has partnered with the Town for this project.

Phases 1 and 2 of the Class Environmental Assessment have now been completed. During these phases, alternative solutions for treatment of wastewater to 2041 and management of leachate were evaluated, considering environmental, community and social impacts. The preferred solution identified through the evaluation is to upgrade and expand the Petrolia WWTP on the existing site, and to provide adequate capacity for treatment of the landfill leachate. The solution includes construction of a new pumping station at the Petrolia Landfill, and forcemain from the pumping station to connect to the Petrolia wastewater collection system.

Phases 1 and 2 reports are available electronically for review upon request to the contacts below, and public input and comment are invited.


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Phase 3 of the project is underway, to develop a design concept and implementation strategy for the preferred solutions. A **Public Open House**, will provide information on Phases 1, 2 and 3 of the Class Environmental Assessment. At that time, you will have opportunity to meet with the project team, ask questions and provide input on the project, which will be considered in finalizing the preferred solution, concept and implementation plan. The **Public Open House** will be held:

**Between 4 pm and 7 pm**
**Tuesday May 1, 2012**
**Town of Petrolia Office - Victoria Hall**
**411 Greenfield St**
**Petrolia, ON N0N 1R0**

This notice issued April 25, 2012.



# Public Open House

## Class Environmental Assessment to Plan for Wastewater Treatment and Leachate Management in the Town of Petrolia

***Welcome!***

TOWN OF PETROLIA
INCORPORATED 1874

WASTE MANAGEMENT

CIMA+
Partners in excellence

# Outline

- Introduction and Background
  - Purpose of this Public Open House
  - Background of the Petrolia WWTP and Petrolia Landfill
  - Municipal Class EA Process and Opportunity Statement
- Decision Making Process
  - Description of the ‘Triple Bottom Line’ Approach
  - List of Indicator Criteria and Goals
- Petrolia Wastewater Treatment Plant Evaluation and Recommendations
- Leachate Management Evaluation and Recommendations
- Next Steps

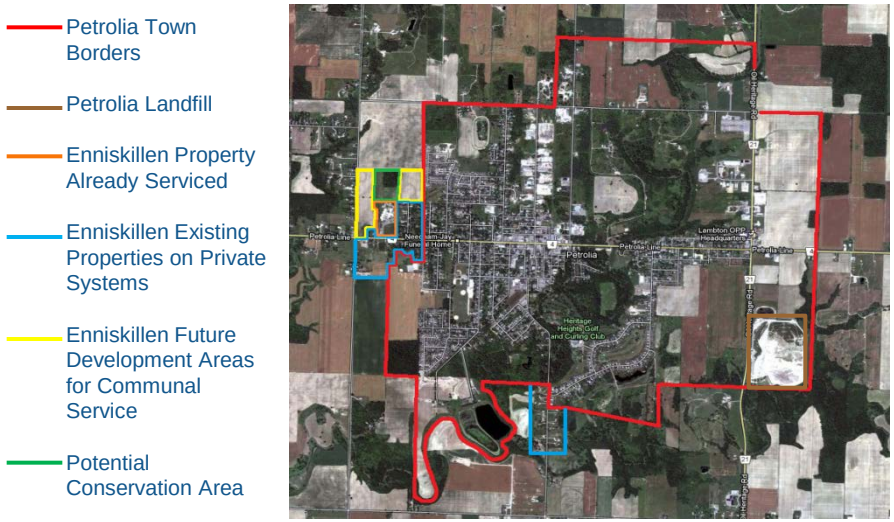
# Purpose of this Public Information Session and the Study Area

## Purpose of this Public Information Session

- The Town of Petrolia is currently completing a Schedule C Class Environmental Assessment (EA) to plan for the upgrade and expansion of the Petrolia Wastewater Treatment Plant (WWTP)
- This Public Open House allows the public the opportunity to provide feedback and formally participate in the EA process
- The Public Open House promotes the constructive exchange of ideas and information between project proponents, the affected public and other interested parties
- Please walk through the displays and complete a comment sheet after your review
- Staff from the Town of Petrolia, Waste Management and CIMA are available to answer any questions you may have

## Study Area

- The study area consists of all properties currently serviced by the Petrolia WWTP and all future developments within the Town of Petrolia as well as the Petrolia Landfill.
- Some existing properties on private systems as well as future development areas within the Township of Enniskillen are also included in the study area, to be considered for future wastewater servicing.



# Background Information: Petrolia WWTP

- The Town of Petrolia owns and operates a wastewater treatment plant servicing properties within the Town
- The plant was originally constructed in 1975 and has undergone several improvements since that time
- The Petrolia wastewater treatment plant is an extended aeration facility with tertiary filtration and ultraviolet disinfection discharging effluent to Bear Creek

**2041 Wastewater Design Flows for the Petrolia Service Area**

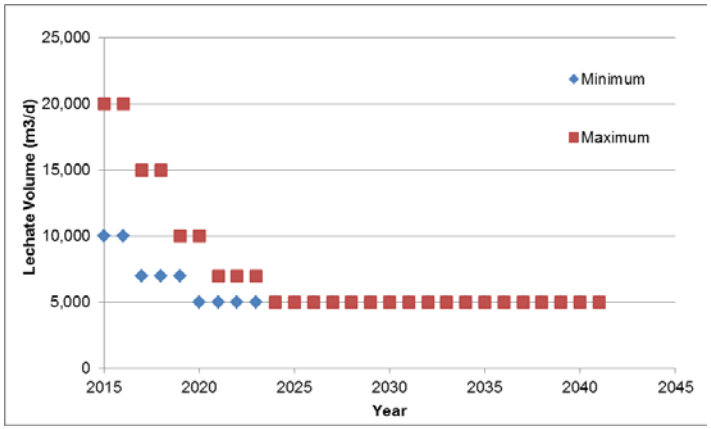
| Flow Parameter | Flows ($m^3/d$) |
|---|---|
| Monthly Average | 5,123 |
| Peak Day | 13,833 |
| Peak Instantaneous | 20,492 |

**Wastewater Design Concentrations and Loadings for 2041**

| Parameter | Design Concentrations (mg/L) | 2041 Average Monthly Flow ($m^3/d$) | 2041 Design Loadings (kg/d) |
|---|---|---|---|
| Biochemical oxygen demand ($BOD_5$) | 226 | 5,123 | 1,158 |
| Total Kjedahl nitrogen (TKN) | 37.6 | | 193 |
| Total Suspended Solids (TSS) | 199 | | 1,020 |
| Total Phosphorous (TP) | 5.6 | | 28.67 |

# Background Information: Petrolia Landfill

- The Petrolia Landfill is owned and operated by Waste Management Canada Corporation (WM)
- The site uses 26.02 hectares of land for the disposal of municipal, industrial and commercial solid wastes
- The Landfill collects contaminated runoff from rains and moisture, known as leachate, and hauls it to alternative municipal treatment facilities
- After the landfill is closed, leachate production is expected to decrease
  - The Minimum scenario shows leachate production for a 2012 landfill closure
  - The Maximum scenario shows leachate production for a 2015 landfill closure (Petrolia Landfill closures have been delayed in the past)

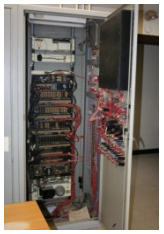

**Projected Yearly Leachate Volume Generated at the Petrolia Landfill**

**Leachate Design Concentrations and Loadings**

| Parameter | Average Concentration (mg/L) | Design Flow ($m^3/d$) | Design Loadings (kg/d) |
|---|---|---|---|
| $BOD_5$ | 590 | 140 | 83 |
| Ammonia-Nitrogen | 947 | | 133 |
| TKN | 1,034 | | 145 |
| TP | 1.21 | | 0.17 |
| TSS | 33.8 | | 4.7 |

# Why is an Environmental Assessment Required?

- The Ministry of the Environment (MOE) requires the commencement of an EA whenever a wastewater treatment plant reaches or exceeds 85% of its rated capacity flow in order to plan for expansion
- The Petrolia WWTP regularly experiences flows above 85% and sometimes above 100% of its rated capacity
- The population of Petrolia is expected to continue to grow as outlined in the County of Lambton's Official Plan
- A condition assessment of the Petrolia WWTP was completed and it was determined that many of the processes require major upgrades
  - Headworks provides insufficient capacity and there is significant rag and grit accumulation downstream
  - Aeration tanks do not provide adequate capacity for nitrification
  - Oxygenation equipment is old and unreliable
  - Secondary clarifier tanks do not provide sufficient capacity
  - Sludge collection equipment is broken and unreliable
  - Tertiary filtration equipment is old and unreliable





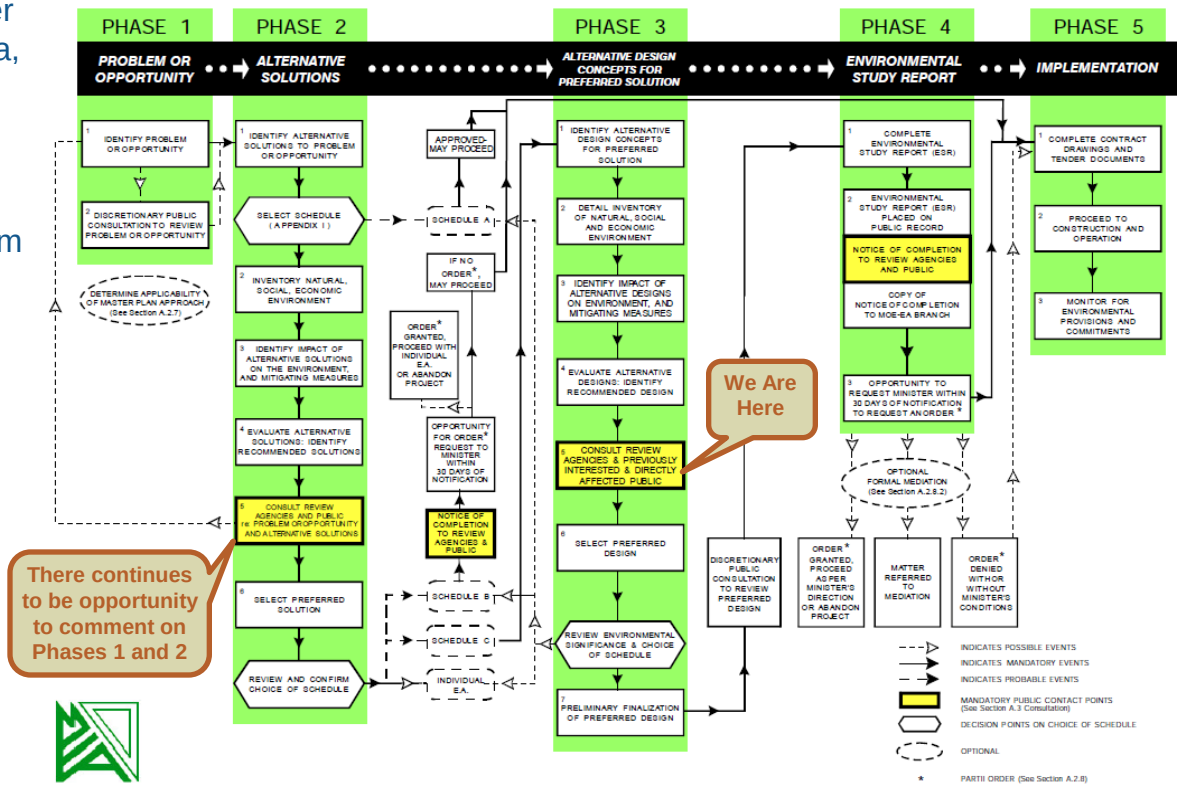




# Opportunity Statement and the Municipal Class Environmental Assessment Process

## Problem/Opportunity Statement

- In addition to planning to provide wastewater treatment for the expected growth in Petrolia, the opportunity exists to treat leachate from the Petrolia Landfill at the Petrolia wastewater treatment plant
- The Petrolia Landfill is located less than 1 km from the Petrolia sewage collection system and approximately 6 km by truck from the Petrolia WWTP
- Co-treatment of leachate with Petrolia wastewater would significantly reduce truck hauling distances and the subsequent greenhouse gas emissions

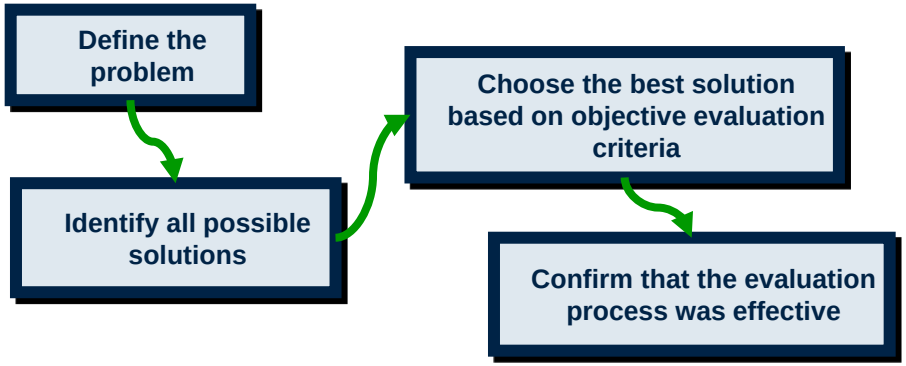



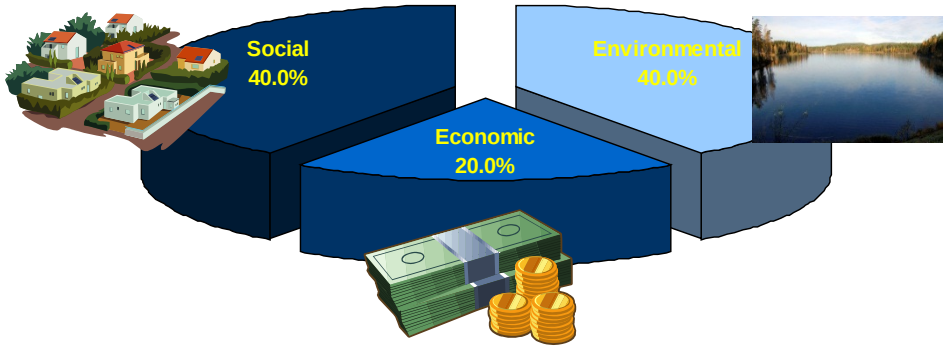
# How Were Decisions Made Regarding the Preferred Solutions?

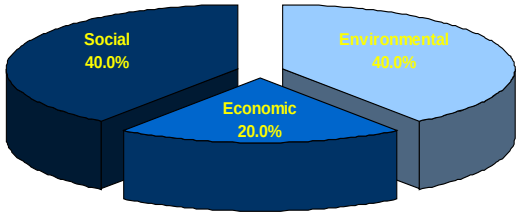
- In planning for wastewater treatment and leachate management in the Town of Petrolia, the following important principals were followed:
  - Follow internationally recognized principles of good governance
  - Provide sustainability by meeting present needs and ensuring viability well into the future
- The 'Triple Bottom Line' (TBL) is an approach to decision-making that considers economic, social and environmental issues in a comprehensive, systematic and integrated way

- A list of criteria and weights were developed with input from the Town of Petrolia and Waste Management Corporation of Canada
- The criteria developed were grouped into the following three indices:
  - Minimize ***environmental*** impacts
  - Minimize ***social*** impacts
  - Minimize ***economic*** impacts
- The percentage value shown is the total weight assigned to each index, and reflects its importance in the evaluation

**4 Main Steps in Making Decisions:**






# Indicator Criteria, Goals and Importance

| | Indicator Criteria | Goal | Importance |
|---|---|---|---|
| Environmental | Surface Water Protection | • Maximize the reliability in achieving effluent quality limits under all average and peak flows and loadings to the plant | High |
| | Greenhouse Gases | • Minimize greenhouse gas generation or net energy use | High |
| | Operating Complexity | • Minimize risks to reliability and performance with a system that is simple | Medium |
| | Chemical Use | • Minimize use of chemical additives | Medium |
| | Environmental Risk During Construction | • Minimize risk of impacts to surface water, groundwater, land, terrestrial resources and aquatic habitats during construction | Medium |
| | Treatment Plant Performance Risk During Construction | • Minimize potential risk to performance and plant operations during construction | High |
| | Spills | • Minimize potential risks to surface water and land due to spills | High |
| Social | Aesthetics | • Maximize aesthetic appeal of the structures and area | High |
| | Land Use | • Maximize land use to preserve site area for any future requirements | Medium |
| | Health and Safety | • Maximize protection of public and operator health and safety from exposure to gaseous emissions, toxic organics or processing chemicals | High |
| | Operations and Maintenance Staff | • Minimize operations certification and training requirements | Medium |
| | Odours | • Minimize the potential for odours to affect the community | High |
| | Noise | • Minimize the potential for noise to affect the community | High |
| | Traffic and Safety | • Minimize truck traffic and during construction and operation maximize community safety | High |
| | Construction Duration | • Provide the shortest possible construction schedule and operational impact to neighbouring areas and operators | Medium |
| Economic | Capital Costs | • Minimize capital costs | High |
| | Operations and Maintenance Costs | • Minimize operations and maintenance costs | High |
| | Operating Risks | • Minimize operating cost risk due to dependence on electricity, fuels, chemicals or other on-going costs | Medium |

# Alternative Solutions for Wastewater Treatment

- Four options were considered in determining the future of Petrolia's wastewater management

| Option | | Description | Result | |
|---|---|---|---|---|
| 1 | Do Nothing[1] | • No change to the existing Petrolia WWTP | X | • Does not address WWTP deficiencies |
| 2 | Limit Community Growth[1] | • Upgrade of the existing Petrolia WWTP<br>• No expansion of the existing Petrolia WWTP | X | • Does not provide capacity for growth projected in the Lambton County Official Plan |
| 3 | Upgrade and Expansion of the Petrolia WWTP on the Existing Site | • Upgrade of the existing Petrolia WWTP<br>• Expansion of the existing Petrolia WWTP to provide capacity for growth in the Town | Y | • Addresses WWTP deficiencies<br>• Room is available for upgrade and expansion at the existing site |
| 4 | Construction of a New Wastewater Treatment Plant on a New Site | • Upgrade of the existing Petrolia WWTP<br>• Construction of a new wastewater treatment plant to provide capacity for growth in the Town | X | • Significantly higher capital cost<br>• Extended planning and implementation period<br>• Room already exists at the current site |

*Notes:*
*1 These solutions are required to be considered by the Municipal Class EA process.*

- Option 3, the upgrade and expansion of the Petrolia WWTP, is the only feasible solution available for servicing existing and future growth for the service area identified at a total cost of $12.8 million

# Alternative Solutions for Leachate Management (LM)

- Four options were considered in determining the management of leachate from the Petrolia Landfill

| Option | | Description |
|---|---|---|
| 1 | Do Nothing[1] | • Continue to haul leachate for treatment at various alternative wastewater treatment facilities |
| 2 | Haul Leachate to the Petrolia WWTP | • Haul leachate to the Petrolia WWTP for treatment |
| 3 | Discharge Leachate to the Petrolia Sewage Collection System | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill to the Petrolia sewage collection system |
| 4 | Discharge Leachate Directly to the Petrolia WWTP | • Build a pumping station at the Petrolia Landfill<br>• Install a forcemain to connect the Petrolia Landfill directly to the Petrolia WWTP |

*Notes:*
*1 This solution is required to be considered by the Municipal Class EA process.*

- The Petrolia Landfill is expected to close in 2012 followed by decreasing leachate volumes; however, closures have been delayed in the past, thus two scenarios were included for costing purposes
  - The Minimum scenario is based on the Petrolia Landfill closing in 2012
  - The Maximum scenario is based on the Petrolia Landfill closing in 2015

# LM Option 1: Continue to Haul Leachate to Alternative Treatment Facilities

## Advantages

- No capital cost
- No construction activities

## Disadvantages

- Long transportation distances
  - Community safety and traffic
  - Higher risk of spills
- High greenhouse gas emissions
  - (114 $tCO_2e$ in 2011)
- High leachate transportation and treatment costs
  - Cost uncertainty

| Cost Item | 27 Year Net Present Value (2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | $ 1,400,000 | $ 2,000,000 |
| Treatment | $ 1,500,000 | $ 2,100,000 |
| Capital | 0 | 0 |
| **Total** | **$ 2,900,000** | **$ 4,100,000** |

# LM Option 2: Haul Leachate to the Petrolia WWTP

## Advantages

- Reduced transportation distance and greenhouse gas emissions
  - Lower risk of spills
  - (7.6 $tCO_2e$ in 2011)
- Reduced leachate transportation and treatment costs
  - Improved cost certainty
- Additional construction requirements are minor
  - Additional construction required is small and localized at the Petrolia WWTP

## Disadvantages

- Truck traffic in Petrolia
  - Community safety and traffic
- Capital costs for treatment at the Petrolia WWTP
  - Treatment process capacity
  - Leachate equalization tank and pumping at the Petrolia WWTP

| Cost Item | 27 Year Net Present Value (2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | $ 350,000 | $ 450,000 |
| Treatment | $ 550,000 | $ 750,000 |
| Capital | $ 900,000 | $ 1,400,000 |
| **Total** | **$ 1,800,000** | **$ 2,600,000** |

# LM Option 3: Discharge to the Petrolia Sewage Collection System

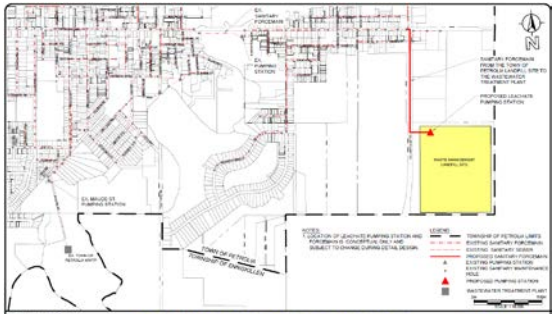
## Advantages

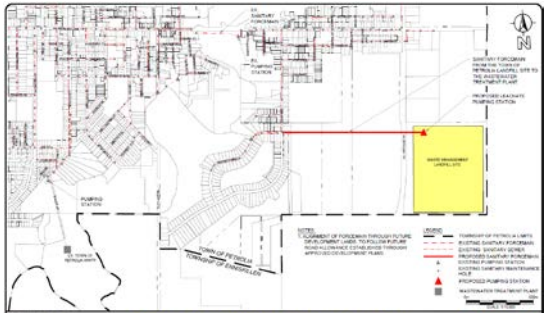
- No greenhouse gas emissions
- No truck traffic
  - Improved community safety
  - No leachate haulage costs
  - No risk of spills
- Reduced leachate treatment costs at the Petrolia WWTP

## Disadvantages

- Capital costs for treatment at the Petrolia WWTP
  - Treatment process capacity
- Capital costs for connection to the Petrolia collection system
  - Construction of a pumping station and forcemain
- Additional construction required to install forcemain
  - May affect community traffic
  - Two connection options are presented in the figures below

| Cost Item | 27 Year Net Present Value (2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | 0 | 0 |
| Treatment | $ 550,000 | $ 750,000 |
| Capital | $ 1,150,000 | $ 1,650,000 |
| **Total** | **$ 1,700,000** | **$ 2,400,000** |





# LM Option 4: Discharge Directly to the Petrolia WWTP

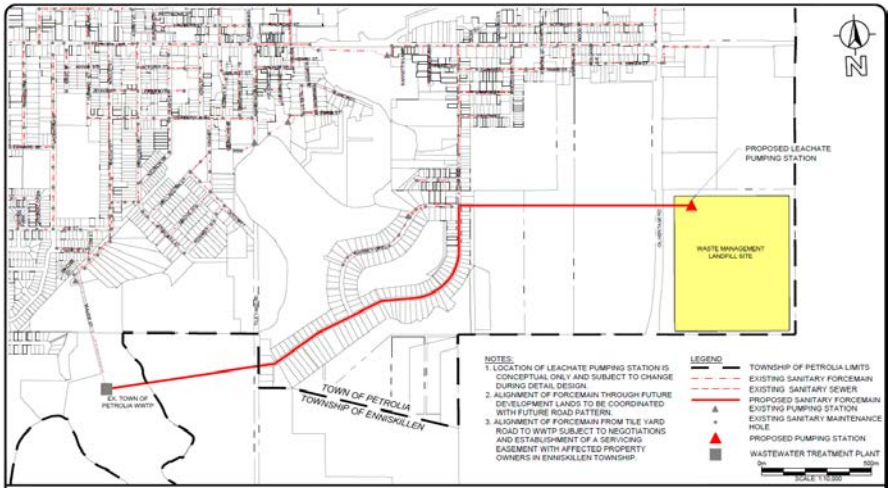
## Advantages

- No greenhouse gas emissions
- No truck traffic
  - Improved community safety
  - No leachate haulage costs
  - No risk of spills
- Reduced leachate treatment costs at the Petrolia WWTP

## Disadvantages

- Capital costs for treatment at the Petrolia WWTP
  - Treatment process capacity
- Capital costs for connection to the Petrolia collection system
  - Construction of a pumping station and forcemain
- Additional construction required to install forcemain
  - Will affect community traffic
  - Forcemain location presents additional risk to environmentally sensitive areas

| Cost Item | 27 Year Net Present Value (2012 $) | |
|---|---|---|
| | Minimum | Maximum |
| Haulage | 0 | 0 |
| Treatment | $ 550,000 | $ 750,000 |
| Capital | $ 2,000,000 | $ 2,500,000 |
| **Total** | **$ 2,550,000** | **$ 3,250,000** |



# Summary of Leachate Management Scoring Results and Preferred Solution

| Criteria Group | Possible Score | Option 1 Do Nothing | Option 2 Haul to Petrolia WWTP | Option 3 Discharge to the Petrolia Sewage Collection System | Option 4 Direct Connection to the Petrolia WWTP |
|---|---|---|---|---|---|
| Environmental | 40 | 32.7 | 32.7 | 33.5 | 34.2 |
| Social | 40 | 33.8 | 33.2 | 36.3 | 24.5 |
| Economic (Net Present Value Cost ($ million)) | 20 | 12.0 ($2.9 - $4.1) | 14.0 ($1.8 - $2.6) | 15.2 ($1.7 - $2.4) | 13.6 ($2.6 - $3.3) |
| **Total** | **100** | **78.6** | **79.9** | **85.0** | **82.2** |

- Using the TBL approach, option 3 was identified as the preferred Leachate Management solution
  - Greenhouse gas emissions, traffic and spill risks are eliminated, improving environmental and community safety
  - Cost risk can be minimized through a long term agreement with the Town of Petrolia
  - Net present value costs for the planning period are the lowest of all options

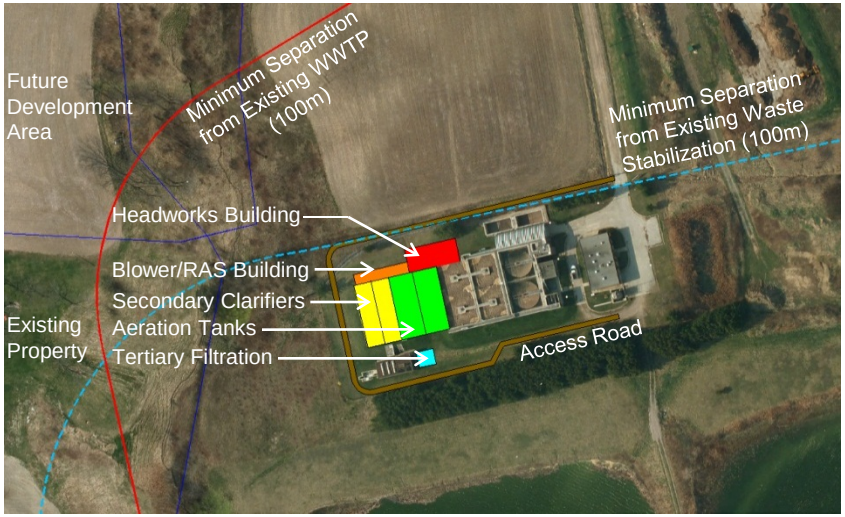
# Preferred Design Concept for Wastewater Treatment and Leachate Management

- Preferred Design Concepts
  - For the treatment of wastewater in the Town of Petrolia it is recommended that the Petrolia wastewater treatment plant is upgraded and expanded on the existing site
  - For the management of leachate from the Petrolia Landfill, it is recommended that a direct connection to the Petrolia sewage collection system is provided for treatment at the Petrolia wastewater treatment plant

**Conceptual Connections to the Petrolia Sewage Collection System**

## Major upgrades required at the Petrolia WWTP

| Process | Deficiencies | Upgrade Needs |
|---|---|---|
| Headworks | Insufficient capacity and unreliable equipment | Provide new headworks |
| Aeration Tanks | Insufficient volume | Two new aeration tanks |
| Oxygenation | Insufficient capacity and unreliable equipment | New energy efficient equipment |
| Secondary Clarifiers | Insufficient capacity and broken equipment | Two new clarifier tanks and replace equipment |
| Tertiary Filtration | Insufficient capacity and unreliable equipment | Provide new tertiary filtration system |
| Miscellaneous | Various older systems and electrical equipment | Upgrade old systems and replace electrical equipment |




**Conceptual Plant Layout**

# What Happens Next?

- After today, the project team will:
  - Respond to comments and questions received
  - Compile information received from you to finalize the recommended wastewater treatment and leachate management options for the Town of Petrolia
  - Continue to complete Phases 3 and 4 of the Municipal Class EA considering your comments
  - Prepare Environmental Study Report and submit for a 30-day public review period before the end of June 2012

**Thank you for your input!**

Please complete a comment sheet and leave it here today, or
return to the Town by Tuesday May 15, 2012