DESIGN AND OPERATIONS REPORT

WOOLWICH BIO-EN
ANAEROBIC DIGESTION FACILITY
ELMIRA, ONTARIO

Prepared For:
Woolwich Bio-En Inc.

FEBRUARY 2010
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1.0 INTRODUCTION

This Design and Operations (D&O) Report was prepared by Conestoga-Rovers & Associates (CRA), on behalf of Woolwich Bio-En Inc. (Bio-En), in support of an Application for a Renewable Energy Approval, for the proposed Anaerobic Digestion (AD) facility ("Proposed Facility"). This D&O Report was prepared in accordance with Ontario Regulation (O.Reg.) 359/09. The Proposed Facility is an AD operation that will receive and process organics into biogas, a liquid soil amendment, and a solid soil amendment.

The biogas will be used for combustion in a co-generation system to generate 2,850 kilowatts (kW_{el}) of electricity and 3,360 kW_{therm} of heat. The electricity will be sold to the Ontario Power Authority (OPA) under the OPA's Feed In Tariff (FiT) Program. The thermal energy produced will be sold to neighbouring industrial users and used in the AD process. The digestate will be temporarily stored at the Proposed Facility before it is collected and transported by one or more of the contracted third-party haulers to be applied to agricultural fields as a soil amendment or to be used as a fertilizer in the agricultural industry.

The Proposed Facility is intended to receive and process organics, manage the resulting digestate and emissions, and manage the environmental impacts of processing operations.

The Proposed Facility is designed specifically to help Ontario achieve its renewable energy supply targets and also to provide sufficient volume for organics processing capacity in Ontario in response to requirements for diversion of materials from landfills.

Articles of Incorporation for Bio-En are included in Appendix A of this document.

1.1 SITE BACKGROUND

The property on which the Proposed Facility will be located (the Site) is currently owned by Marbro Capital and has historically been used for agricultural crop production. The area of the Site not developed for the Proposed Facility will continue to be used for agricultural crop production until Marbro Capital further develops the area. An existing metal garage and shed will be demolished to make room for the 26 metre (m) right-of-way to the Site. Bio-En will lease the Site from Marbro Capital. An agreement for the lease of the Site from Marbro Capital for the Proposed Facility has been executed. The preliminary terms of the agreement yield control of the land to Bio-En for a 20-year

term (with an option to renew for an additional 6 years), which includes consent to submit this Application. This agreement is attached in Appendix B.

1.2 OBJECTIVE OF D&O REPORT

The objective of this D&O Report is to describe the design of the Proposed Facility and the operational plan. The design and operations for the Proposed Facility will meet the requirements of the following documents, including, but not limited to:

- Ontario Regulation 359/09 - Renewable Energy Approvals
- Fire Code - O.Reg. 213/07
- Digester Gas Code CAN/CGA-B105 M93
- Fertilizer Regulations (C.R.C., c.666)

In addition to the D&O Report, the following reports are being prepared in support of the Application for Renewable Energy Approval (REA):

- Construction Plan Report
- Consultation Report
- Decommissioning Plan Report
- Effluent Management Report
- Emissions Summary and Air Dispersion Modelling (ESDM) Report
- Hydrogeological Assessment Report
- Noise Study Report
- Odour Study Report
- Project Description Report
- Surface Water Assessment Report – including a water body report
- Archeological Report
- Heritage Report
- Environmental Impact Study Report

An initial public consultation was held in February 2009 regarding this project. An additional public consultation meeting will occur 60 days following the publication of the Draft reports as outlined in O.Reg. 359/09.

1.3 ORGANIZATION OF D&O REPORT

This D&O Report is organized into the following sections:

- Section 1.0 Introduction
- Section 2.0 Site Location
- Section 3.0 Design Considerations
- Section 4.0 Process Description
- Section 5.0 Site Design and Facilities
- Section 6.0 Site Operations
- Section 7.0 Potential Environmental Effects and Monitoring Programs
- Section 8.0 Exhaust Management System
- Section 9.0 Surface Water Management
- Section 10.0 Site Monitoring Programs
- Section 11.0 Contingency Planning

2.0 SITE LOCATION

2.1 GENERAL

The Proposed Facility will be located in the Town of Elmira on an undeveloped property at 40 Martin's Lane. The legal address of the Proposed Facility is Part Lot 18 of Registrar's Compiled Plan 1301, more specifically, Part 9 of Registered Plan of Survey 58R-14363. The regional Site location is shown on Figure 1. An aerial plan of the Site, including roads, buildings, structures and main arteries situated within 300 m of the Proposed Facility, is presented on Figure 2A. Figure 2B demonstrates the easement, right-of-way information available from the Municipality within 300 m of the proposed Facility. Figure 2C demonstrates the locations of the utilities within 300 m of the proposed Facility as provided by the Local Distribution Company, Waterloo North Hydro. Figure 2D demonstrates the services information available from the Municipality within 300 m of the proposed Facility. A detailed Site Layout Plan for the Proposed Facility is presented on Figure 3.

The Site has a total area of approximately 1.55 hectares (ha). The entire Site will be used for the biogas generation, storage, and utilization facilities as well as the supporting infrastructure.

The locations of the Operations Building, Process Building, and Digester Tanks are shown on Figures 3 and 9. The buildings and tanks will have a final building footprint of approximately 0.33 ha and the service area, including storm water management (SWM) pond, roads and parking, will cover an additional 0.56 ha. Access to the Site will be achieved by extending Martin's Lane.

2.2 ZONING OF SITE AND SURROUNDING AREAS

The present zoning of the Site is designated as General Industrial – Dry (M-1) and areas surrounding the Site are zoned M-1, Agricultural (A), and Institutional (P), as noted on the zoning map provided on Figure 4.

The nearest residence to the Site is located approximately 167 m north west of the Facility. An industrial development is located immediately east of the Site. Property zoned as Institutional is located approximately 270 m to the south of the Site. The nearest watercourse to the Site is a creek approximately 240 m northeast of the Site, which flows into Canagagigue Creek.

3.0 DESIGN CONSIDERATIONS

3.1 DESIGN CONCEPT

The Proposed Facility will utilize a two-stage AD process to produce biogas, which in turn is converted into electrical and thermal energy. The biological processes present in AD systems can be divided into three main steps: hydrolysis, acetogenesis, and methanogenesis. Hydrolysis and acetogenesis convert biodegradable feedstocks into simple sugars and volatile fatty acids, followed by conversion into a variety of fatty acids required for methanogenesis. Methanogenesis converts the products of hydrolysis and acetogenesis into methane and carbon dioxide (biogas). The optimum conditions, particularly pH and temperature, for hydrolysis and acetogenesis differ from those for methanogenesis. Separating the hydrolysis and acetogenesis from the methanogenesis into two separate fermenters reduces the overall hydraulic retention time (HRT), increases the organic loading rate, and increases the biogas yield. The two-stage AD process that will be employed at the Proposed Facility is described in detail in Section 4.1.

Potential air emissions from the Site will result from the combustion exhaust from the cogeneration system, emissions from the back-up flare and volatile organic compounds and odours from the proposed Process Building. The Process Building will be maintained at a slight negative pressure and all air from the building will pass through a biofilter to remove odour. The concentrations of contaminants resulting from the emissions from this Facility are all below applicable Ontario Ministry of Environment (MOE) health based criteria as applicable. Further detail regarding the emissions of air contaminants from this Facility is provided in the ESDM report. Figure 5 shows the locations of equipment that have the potential to emit contaminants to the air. The locations of the closest odour and noise receptors are provided in Figure 6. Odour and the planned mitigation measures at the Proposed Facility are discussed in detail in Section 7.3. Details on the biofilter are provided in Section 8.1.2.

3.2 DESIGN CAPACITY

The ultimate design capacity of the Proposed Facility is 70,000 tonnes/year of organic material, as listed in Section 3.3. An additional 12,600 tonnes, or 12,600 cubic metres (m^3) per year, of water is required to achieve the consistency necessary for the AD process. The water will be collected from storm water runoff (3,600 m^3), or purchased from the municipality or off-Site suppliers or recycled process water (9,000 m^3) as required. All required infrastructure for the Proposed Facility will be in place prior to

commencement of operations. The following provides a summary of the components that will be constructed for the Proposed Facility:

- Weigh-scale or bridge
- Operations Building (including cogeneration equipment, the electrical room including monitoring and other electrical equipment, control room and a multipurpose room [lunch room])
- Process Building (including liquid and solid material receiving areas, material storage areas, pre-processing and mixing equipment, pumps, controllers, solids separator, and digestate solids storage bin)
- Three Pretreatment Tanks
- Two Main Digestion Tanks
- Secondary Digestion and Repository (Digestate Storage Tank)
- Process Water Tank
- Transformer
- Biofilter
- Biogas flare
- Storm water management (SWM) pond

An overall mass balance for the system is shown on Figure 7.

3.3 INCOMING MATERIALS AND SERVICE AREA

Organics to be processed at the Proposed Facility include, but are not limited to:

- Organics from food processing facilities, grocery stores, food distribution companies, and milling facilities (0 to 40,000 tonnes/year)
- Livestock manure (0 to 13,000 tonnes/year)
- Glycerol (0 to 3,000 tonnes/year)
- Kitchen waste (0 to 40,000 tonnes/year)
- Fats, oil, and grease (FOG) (0 to 20,000 tonnes/year)
- Renewable energy crops (i.e., corn silage) (0 to 12,000 tonnes/year)
- Organic solids skimmed from a dissolved air flotation (DAF) tank (0 to 20,000 tonnes/year)

The AD technology to be implemented for the Proposed Facility is able to achieve a high level of pathogen reduction as a result of the pasteurization effect in the Pre-treatment Tanks, resulting in a stable organic product that can be readily used as an agricultural soil amendment with no additional processing steps.

It is estimated that the maximum storage time for the organic material at the Facility is three days. It is anticipated, that on average, the organic feedstocks would be processed within one to two days. The Facility will pre-treat one batch every two days, therefore, waste will be stored one to two days prior to being pumped into the pretreatment tank. The material will be pumped from the pretreatment tank (after the pretreatment process is complete) to the digester at a rate of approximately 6-12 m^3/hour depending on the calorific value of the pretreated material.

It is anticipated that the Proposed Facility will service an area that is Ontario-wide, but will primarily focus on southwestern Ontario, however, the Facility may service other jurisdictions.

3.4 DISPOSAL RATE ESTIMATE AND RESIDUAL WASTE PRODUCTION

Ultimately, the design capacity of the Proposed Facility will be 70,000 tonnes/year of organic materials. The Proposed Facility will operate 7 days per week but will only accept waste 6 days per week, 52 weeks per year. The supply of organic materials to the Proposed Facility at the design capacity is expected to average 245 tonnes/day, with a maximum of 750 tonnes/day.

Residual waste (contraries) will be screened out of the incoming kitchen and food processing wastes in a grinding unit. It is expected that the kitchen waste and food processing waste constitute approximately 20 to 40 percent, by weight, of the total incoming organics. It is anticipated that approximately 20 percent of the kitchen waste and food processing waste will be screened out as residual to be landfilled. Residual waste produced at the Proposed Facility will be approximately 20 tonnes/day and will be stored in the Process Building in dedicated containers. The maximum amount of residual waste to be stored on Site will be 40 tonnes. Residual waste will be removed from the Site when storage capacity is reached.

The solids separated from the digestate will have a dry matter content of approximately 27 percent and will accumulate at a rate of approximately 25 tonnes/day. A bin will be provided to provide approximately 40 tonnes of storage and will be transported off Site

to be land applied, sold as a fertilizer or stored at another MOE-approved site as required.

The maximum amount of digestate liquid to be stored on Site is 4,310 m^3. The digestate liquid will be stored in a Secondary Digester and Repository Tank that will provide approximately 30 days of storage. Bio-En will contract one or more third-party haulers to transport the digestate off Site to be directly land applied or stored at another storage facility until it can be land applied.

Both the solid and liquid portions of the digestate will be managed as a soil amendment or as a fertilizer material as defined under the Fertilizers Act. Bio-En is working with the Canadian Food Inspection Agency (CFIA) to develop a sampling and operations plan to ensure material satisfies the requirements of the Fertilizer Act and can be safely land applied to agricultural fields.

4.0 PROCESS DESCRIPTION

4.1 PROCESS OVERVIEW

A description of the AD process for the Proposed Facility is provided in the following sections. An overall process schematic is included on Figure 8 and a conceptual facility layout is included on Figure 9.

The AD process to be employed at the Proposed Facility can be summarized as follows:

- Incoming renewable energy crops and other solid wastes are unloaded onto the floor in the Solids Receiving area in the Process Building.
- Liquid or slurry manure is unloaded from tankers into the first pretreatment tank or into one of the liquid storage tanks.
- Incoming dissolved air flotation solids (DAF) and fats, oils, and greases (FOG) materials are unloaded into 175 m^3 storage tanks outside of the Process Building. The DAF and FOG materials are pumped to a Liquid Organics Mixing Unit in the Process Building. The incoming feedstock storage tanks are contained by a concrete barrier wall for secondary containment.
- Incoming glycerine is unloaded into a 20 m^3 storage container and fed into the Liquid Organics Mixing Unit to be combined with the other feedstock materials.
- Incoming kitchen waste and food processing organic materials are processed in the Solid Organics Pre-processing and Mixing Unit and are mixed with the other organic materials and recycled process water so they can be pumped to a storage tank or pretreatment tank. Materials are pumped from the storage tank, Solid Organics Pre-processing and Mixing Unit to the Pretreatment Tanks.
- Residual material that is not suitable for AD is sorted from incoming kitchen and food processing waste and is stored in the Process Building in a dedicated area and are transported off Site when the 40 m^3 bin has reached capacity.
- Surface runoff water collected in the SWM pond or fresh municipal or off-Site water is used to supplement the recycled process water as required to balance water losses in the AD process.
- The organic materials are pumped from the Mixing Units to a Pretreatment Tank equipped with two mixers to further homogenize the materials and increase the temperature of the organics to approximately 50-60°C.
- The mixed organic materials are then pumped to one of the two other Pretreatment Tanks, equipped with only one mixer each, for a hydraulic retention time (HRT) of approximately 20 hours. The Pre-treatment Tanks are operated in batches. While

the material in one of the tanks is undergoing pretreatment, the other tank is being emptied and filled with new material.

- After pretreatment, the organic material is periodically pumped to one of two Digestion Tanks to complete the AD process and generate the desired biogas. Unlike the Pre-treatment Tanks, the Digestion Tanks are operated under continuous mix and the material from the Pretreatment Tanks is intermittently dosed in to the Digestion Tanks. The digesters are insulated and heated to maintain a temperature of approximately 35 - 45°C and have an HRT of approximately 15 to 25 days. During the AD process, the fermenter conditions and resulting biogas is continuously monitored as part of an overall control process to optimize biogas yields and energy production.
- The methane-poor gas from the Pretreatment Tanks is injected into the Digestion Tanks through the floor to facilitate vertical mixing and maximize methane collection efficiency of the entire AD process.
- The biogas from the Main Digester Tanks and the Secondary Digester and Repository Tank is collected in biogas storage membranes and is piped to a Combined Heat and Power (CHP) cogeneration unit, or to a flare if the CHP unit is not operational and the biogas storage is full.
- Electrical and thermal energy are generated in the CHP units that are specifically designed for the combustion of biogas. Thermal energy is recovered from the CHP unit using a heat exchanger.
- The digestate is pumped from the Digestion Tanks through a solids separator to remove the solids (approximately 4 percent dry matter) for recycle water or directly to the Secondary Digester and Repository Tank to await off-Site transport and eventual land application on agricultural fields. The liquid portion of the digestate is either recirculated back to the Mixing Unit as an inoculant for the AD process or pumped to the Secondary Digester and Repository Tank. Secondary Digester and Repository Tank will have approximately 30 days storage capacity.
- The solid portion of the digestate (approximately 27 percent dry matter) is stored in a bin in the Process Building and transported off Site when the bin reaches capacity. The digestate solids are land applied as a nutrient source and soil conditioning agent (fertilizer), similar to the digestate liquids.

4.2 PROCESS MONITORING AND CONTROL

By controlling the environment in the Pretreatment and Digestion Tanks, the AD process can be directed and accelerated, resulting in shorter retention times, increased

organic loading rates, and increased biogas yields. The process control system allows for an efficient and economical operation of the Proposed Facility while maintaining the quality of the final biogas product.

The server for the process monitoring system communicates directly with the system controllers, which provide the visualization displays, data storage, and alarm handling. The process visualization contains control windows, alarm windows, and several trending screens. These trending screens provide a graphical overview of the historical data. Control of the overall process is accomplished from the control room in the Operations Building. From this location, the operator is able to change setpoints and control the selected components in manual mode or set the system to an automatic run status. All alarms generated by the control system are registered in the monitoring room and a list of historical alarms is maintained for process tracking.

As AD is a biological process that requires anaerobic microorganisms to decompose organic materials under controlled conditions, a successful system must ensure that the correct parameters are controlled. In a two-stage AD system, the robust hydrolysis bacteria require different environmental conditions than the methane bacteria, which are also more sensitive to any environmental disturbance. Key parameters that are important to the process include temperature, pH, dry matter content, and flow in the Pretreatment and Digestion Tanks; and methane, oxygen, and hydrogen sulfide concentrations in the biogas. The following presents a discussion of these key monitoring parameters:

- Temperature: Temperature is automatically monitored and controlled to maintain appropriate environmental conditions in each of the tanks. In the first Pretreatment Tank (two paddle mixers) the substrate is heated to approximately 50-60°C and then pumped to a second Pretreatment Tank where the temperature is maintained above 50°C for approximately 20 hours to achieve pasteurization and complete the pretreatment. In the Digestion Tanks a constant temperature is maintained between 35 and 45°C as methane bacteria are sensitive to temperature change.
- pH: pH is automatically monitored and controlled (via dosing schedule) to maintain appropriate environmental conditions in each tank. The pH in the Pretreatment Tanks is maintained at an acidic level as low as 4 or 5. The desired pH in the Digestion Tanks is between 7 and 8 (neutral). To minimize disturbance on the sensitive methane bacteria in the digesters, small quantities of the substrate are dosed periodically into the digester from the Pretreatment Tank.
- Dry Matter: Through the liquefaction of the biomass substrate in the Mixing unit, the Pretreatment and Digestion Tanks can be fed using pumps and pipes. This

enables precise metering of added quantities. The dry matter content of the substrate is maintained at approximately 12 percent.

- Flow: Flows are continuously monitored and controlled to ensure the desired HRT is achieved in each tank. The approximate HRT in the series of two Pretreatment Tanks is 20 hours to achieve pasteurization and complete the pretreatment. The desired HRT in the Digestion Tanks is approximately 20 days to maximize biogas generation and recovery.
- Biogas Composition: The analysis of the composition of the biogas in the different tanks of the Proposed Facility is the basis for the optimal operation of the biogas plant, and also for an efficient desulphurization process. The target methane content of the biogas is between 40 and 70 percent by volume. The hydrogen sulfide concentration must be reduced to less than 200 parts per million (ppm) using a chemical-physical process involving air injection and the addition of iron oxide or other suitable chemical as needed before being fed into the internal combustion engine to minimize damage to the engine. The oxygen content is maintained between 0 and 25 percent by volume. Excess moisture in the biogas is also damaging to the engines. A condenser is used to minimize moisture content; however, moisture content will not be monitored or controlled.

The following summarizes the process parameters monitored at the Facility:

- Biogas CH_4 content
- Biogas hydrogen sulphide content
- Biogas O_2 content
- Liquid level in each tank
- Weight or volume of incoming substrate
- Substrate temperature
- Substrate pH
- Flows
- Mixer output (Hz)
- Electricity metered

4.3 TRAFFIC FLOW

The primary streams of truck traffic that are expected at the Site include:

- Incoming loads of organic materials
- Outgoing loads containing liquid digestate
- Outgoing loads containing separated solids
- Outgoing residual waste

A general Site Layout Plan for the Proposed Facility, indicating the flow of incoming and outgoing truck traffic, is presented on Figures 10a and 10b, respectively, including the location of the Site and truck queuing areas. Truck queuing will occur within the property boundaries.

All traffic containing incoming organics and outgoing digestate will utilize a common weigh scale as shown on Figures 10a and 10b. At design capacity, the maximum number of trucks transporting organic materials to and digestate from the Proposed Facility is expected to be no more than 80 trucks per day. On average, it is expected that no more than 15 trucks per day will deliver organics to the Site and 15 trucks will transport liquid digestate or solids from the Site, however, there may be periods of time that require more truck traffic on-Site. The bulk of this truck traffic will be limited to the hours of 7:00 a.m. to 7:00 p.m. with few trucks on-Site outside of those hours.

Should any organic material or debris be on the exterior of trucks, it will be removed using a high-pressure hose before leaving the Site. This cleaning will occur within the Process Building where the wash water will be collected and drained to the Process Water Tank for use in the AD process.

4.4 MATERIAL HANDLING

Prior to entering the Process Building, all hauling vehicles will pass the weigh scale for proper weighing and tracking of the incoming organics and outgoing digestate. After being weighed, the vehicle will travel to the Process Building and will enter into the receiving areas where the incoming organics are unloaded. Vehicles will then pass the weigh scale again upon departure.

The Process Building will be equipped with overhead doors with automated access control. The overhead doors will remain closed during regular operation except to

admit ingoing and outgoing trucks. The tipping floors in the Processing Building will be sloped to allow for the collection of liquid wastes that may originate from the materials handled in the unloading area and from wash waters that are generated during truck cleaning.

Renewable energy crops will be delivered and unloaded onto the floor of the solids receiving area in the Process Building. This material will be pre-processed in the Solid Organic Pre-processing and Mixing Unit and will be mixed with water as needed to achieve a material consistency with approximately 12 percent dry matter, which is pumpable and more suitable for the AD process. A pump in the Mixing Unit delivers material to the first Pretreatment Tank or to storage tanks.

After being weighed, the tanker trucks transporting the incoming DAF and FOG substrates will back up into the Liquid Receiving Area of the Process Building and pump into respective storage tanks located outside of the Process Building or the first Pretreatment Tank. All incoming organic substrates, including food processing and kitchen wastes, will be delivered to the Site in containers or live-bottom trailers and unloaded inside the Process Building for odour control purposes. These organic materials will be processed through a Solid Organic Pre-processing and Mixing Unit to screen out residual inorganic wastes and to shred the material to achieve a particle size of approximately 12 millimetres. The Mixing Unit will also convert this solid organic material into a pumpable substrate. The shredded organic waste is stored in a tank outside the Process Building. The glycerine is also unloaded into a 20 m^3 storage tank located outside the Process Building.

Four pumps will be used to manage all of the material at the Proposed Facility. One rotary piston pump [4 bar, 70 cubic metres per hour (m^3/h)] will be dedicated to dosing organic material into the Digestion Tanks from the Pretreatment Tank. Another rotary piston pump (4 bar, 70 m^3/h) will be dedicated to pumping digestate from the Digestion Tanks to the separator and also pumping the liquid portion from the separator directly to the Process Water Tank or the Secondary Digester and Repository Tank. A third rotary piston pump (4 bar, 110 m^3/h), with a bio-cut system to chop up substrate as it passes through the pump, will be used as part of a central pumping station to manage the movement of all other materials at the Proposed Facility, particularly the substrate management to and between the three Pretreatment Tanks. These three pumps and corresponding pneumatic valves are controlled automatically by the process control system. A fourth dedicated submersible pump (180 m^3/h) will be used to pump material from the Secondary Digester and Repository Tank to tanker trucks to be transported off Site. All of the tanks can be emptied if required through the central pumping station into the Secondary Digester and Repository Tank.

4.5 ANAEROBIC DIGESTION

The pumpable input materials are pumped into the first Pretreatment Tank. The solid input materials such as the energy crops are first mixed with liquid input materials or recycled process water in Mixing Unit and then pumped into the first Pretreatment Tank. Materials are fed into the first Pretreatment Tank until a maximum level is reached at which time the control system stops the feeding system.

Pretreatment is the most critical component of the fermentation process. Acidifying bacteria and the acetic acid and methane forming bacteria have different environmental requirements such as temperature and pH values. This is why the pretreatment is separated from the fermenter and carried out in separate tanks. This allows the pretreatment to be controlled and optimized. The completed pretreatment then allows the biomass in the digester tanks to be better utilized by the methane-forming bacteria.

The three Pretreatment Tanks have inside dimensions of 9 m in diameter and 8 m in height for a total available volume of 430 m^3. The floor, wall, and cover of each tank will be constructed from 0.3 m thick reinforced concrete with external thermal insulation and a thixotropic and pre-accelerated bisphenol-A epoxy based vinyl ester resin internal coating to protect the concrete from the acidic materials in the tanks. The tank floors will be 1.0 m below grade with a sump installed for cleanouts. Stainless steel heating coils will be installed approximately 1.0 m above the floor of the tanks to heat the contents of the Pretreatment Tanks. The pretreatment tanks have been designed with a live load factor of 1.5.

The incoming organic materials are mixed thoroughly in the first Pretreatment Tank with two vertical mixing units. The two slow turning propeller agitators force the fermented substrate to the bottom, thereby preventing a floating layer. The mixers have an output of 15 kW and are mounted through the concrete cover.

In this first Pretreatment Tank the material is heated to approximately 50 to 60°C over a period of approximately 12 hours. The first Pretreatment Tank is operated in batches to permit a high organic loading rate over a short period to achieve the desired low pH values. The material is then pumped to one of the other two Pretreatment Tanks where it has approximately 20 hours of HRT. The temperature in the two secondary Pretreatment Tanks ranges from approximately 50 to 60°C. From the secondary Pretreatment Tank, the full Digestion Tanks are periodically dosed in small quantities with pretreated material so as not to upset the temperature and pH.

The pretreated material is further fermented in an anaerobic atmosphere in one of two heated, insulated, and airtight Digestion Tanks at a temperature between approximately 35 and 45°C. In the Digestion Tanks, the carbohydrates, fats, and proteins in the pretreated material are broken down and ultimately converted to methane and carbon dioxide by methane producing bacteria.

The two Digestion Tanks have inside dimensions of 24 m in diameter and 8 m in height for a total available volume of 3,170 m^3. The floor and wall of each tank will be constructed from 0.3 m thick reinforced concrete with external thermal insulation and an internal coating 1.5 m from the top to protect the concrete from the biogas and ensure gas leak-tightness. A 60 cm diameter center column will be installed in the Digestion Tanks to support the double membrane biogas storage dome. The tank floors will be 1.0 m below grade with a sump installed for cleanouts. Stainless steel heating coils will be installed approximately 1.0 m above the floor of the Digestion Tanks to maintain a desired temperature. The digester and digestate storage tanks have been designed with a live load factor of 1.5.

Four agitators will be installed on an angle in the concrete wall of each of the Digestion Tanks. Two of the agitators are electrically driven, double propeller, low revolution mixers. One of the agitators is an electrically driven, single propeller, high revolution mixer. These three agitators are spaced approximately equidistant around the perimeter of the Digestion Tanks. As a result of their pumping action, a turning movement, as well as vertical circulation, is achieved. This guarantees optimal mixing in the Digestion Tanks. The fourth agitator is a power take-off, single propeller mixer that can be powered by a tractor in emergencies. Mixing in the Secondary Digester and Repository Tank is similar to the Digestion Tanks with one additional double propeller, low revolution agitator.

A biogas is produced during the pretreatment process that is low in methane (3 to 15 percent) and high in carbon dioxide (80 to 90 percent). That gas is used as gas agitation in the center of the Digestion Tanks to supplement the mixing from the mechanical agitators located around the perimeter. The pretreatment gas is injected through the bottom of the Digestion Tanks using a blower. The bubbling of the gas up through the digester tanks produces a vertical mixing effect.

The biogas is captured and stored in the double membrane biogas storage domes on top of the Digestion and Secondary Digester and Repository Tanks. This membrane is designed to exceed the permeability guideline of 500 $cm^3/m^2/day/bar$ as outlined in O.Reg. 359/09. The membrane material is also resistant to aggressive vapours. The

flexible inner membrane completely encapsulates the biogas and separates it from the liquid surface and the outer membrane. The outer membrane is the weather protection membrane. Each Digestion Tank will have 1,620 m^3 of biogas storage. The Secondary Digester and Repository Tank will have 2,960 m^3 of biogas storage, using a similar double membrane storage system, for a total biogas storage of 6,200 m^3. Each biogas storage is equipped with a pressure safety valve and vacuum safety valve. A blower fan supplies air to the inter-space between the inner and outer membranes to maintain the shape of the outer membrane regardless of the amount of biogas in the biogas storage.

4.6 BIOGAS UTILIZATION

The biogas generated during the pretreatment phase is injected into the Digestion Tanks and the gas generated in the Digestion Tanks is captured and stored in the double membrane biogas storage domes on top of the Digestion and Secondary Digester and Repository Tanks before being conditioned and converted into electricity and heat.

The biogas is expected to contain approximately 59 percent (40 to 70 percent) methane, depending on the nature of the feedstocks available to the Proposed Facility. The biogas also contains small quantities of hydrogen sulphide. The biogas conditioning is carried out to reduce the concentration of hydrogen sulphide to less than 200 ppm using a chemical-physical process involving air injection and the addition of iron oxide or other suitable chemical as needed. The biogas also contains a certain amount of moisture (0 to 5 percent by volume) that can damage the generator during combustion. To remove the moisture, the gas is cooled through a condenser. The condensate water will be collected and transferred to the Process Water Tank. The biogas has 95 to 100 percent relative moisture and a temperature of approximately 40°C. By cooling the gas down, the absolute humidity of the biogas is reduced. The condensed water is separated from the biogas. The biogas is injected into the motor via a blower, which increases the pressure of the biogas and therefore also its temperature, decreasing the relative humidity of the biogas.

The biogas will be used in a CHP unit to convert the biogas to electrical and thermal energy. As previously stated, it is expected that the Proposed Facility will generate 2,850 kW_{el} and 3,360 kW_{therm} of energy available for sale. Two Jenbacher Type 420 GS – BL co-generation units will be used to convert the biogas to energy. The electrical energy produced will be sold to the OPA under a contract as part of the OPA FiT Program. All electricity generated by the Proposed Facility will be sold to the OPA and all electricity used by the Proposed Facility will be purchased separately from the local

Utility (i.e., not net-metered). The thermal energy produced will be sold to neighbouring industrial users and used in the AD process.

Excess biogas that can not be combusted in the CHP unit will be burned through a gas flare. The gas flare operates with an exhaust temperature of 1,000 to 1,200°C with concealed combustion. The capacity of the flare is 1,400 m^3/h and it will be made of stainless steel.

4.7 INTENDED FINAL USE OF DIGESTATE

As pretreated substrate is dosed into the Digestion Tanks an equal volume of digested substrate, or digestate overflows to the Secondary Digester and Repository Tank. The digestate will be pumped from the Digestion Tanks through a solids separator. The liquid portion of the digestate (approximately 4 percent dry matter) from the solids separator will either be recirculated back into the AD process through the Process Water Tank as an inoculant or be pumped to the Secondary Digester and Repository Tank to await off-Site transport by a third-party hauler, and eventual land application. It is anticipated that the Secondary Digester and Repository Tank will have approximately 30 days storage capacity. The solid portion of the digestate (approximately 27 percent dry matter) from the solids separator will be stored in a bin in the Process Building and transported off Site by a third-party hauler and land applied as a nutrient source and soil conditioning agent, or sold as a fertilizer, similar to the digestate liquids. The third-party hauler will assume all liability for the final use and disposal of the digestate material as part of its contract with Bio-En and provide additional off-Site storage as required.

The digestate will be evaluated and monitored regularly in accordance with the sampling program designed by a third-party hauler in cooperation with the CFIA. The monitoring program will ensure that the digestate is acceptable for land application as a fertilizer material.

At a later date, the Facility may implement a water treatment system to treat the liquid digestate for discharge to the Municipal sewer system. At that time, Bio-En will inform the MOE and will provide a discharge agreement between Bio-En and the Township.

4.8 OVERALL MASS BALANCE

An overall mass balance for the system is provided on Figure 7.

5.0 SITE DESIGN AND FACILITIES

5.1 PROPOSED BUILDINGS PLAN

A conceptual facility layout for the Proposed Facility is provided on Figure 9. As shown on Figure 9, the primary areas and building structures at the Site will consist of the following:

- Weigh-scale or bridge attended remotely
- Operations Building (including cogeneration equipment, the electrical and control rooms including monitoring and other mechanical equipment, office space and a multipurpose room [lunch room])
- Process Building (including liquid and solid material receiving areas, material storage areas, pre-processing and mixing equipment, pumps, controllers, solids separator, and digestate solids storage bin)
- Biofilter (discussed in Section 8.1.2)
- Three Pretreatment Tanks (discussed in Section 4.5)
- Two Main Digestion Tanks (discussed in Section 4.5)
- Secondary Digester and Repository (Digestate Storage) Tank (discussed in Section 4.5)
- Process Water Tank

Each building will be equipped with gas sensors to detect carbon monoxide and methane. Also discussed below are the supporting infrastructure planned for the Proposed Facility.

5.1.1 WEIGH SCALE BRIDGE

A single weigh scale bridge will be utilized to monitor both incoming and outgoing transport vehicles. The weigh scale will be located north of the Process Building as shown on Figure 9. Truck access to the weigh scale is described on Figures 10a and 10b. The weigh scale will be attended remotely by Site operating staff located in the control room. The location of the control room is shown on Figure 9. All incoming and outgoing delivery vehicles are required to cross the weigh scale except liquid digestate which may also be shipped by volume.

5.1.2 OPERATIONS BUILDING

The 318 m^2 Operations Building will consist of the following:

- CHP unit room
- Electrical room
- Operator's Control Room/Office (control room)
- Multipurpose(Lunch) room

The control room will be located in the Operations Building northeast of the digesters, as shown on Figure 9. The control room will house administrative functions of the Proposed Facility, including remote monitoring of weigh scale operations and washroom/locker facilities. The process monitoring system central computer will also be located in the control room. The control room will be fully equipped with electrical and phone utilities, potable water, and sanitary facilities.

All Site records, log books, copies of the annual progress reports, Operations Manual, maintenance and preventative maintenance procedures, inspection program, and Contingency Plan will be contained in the control room. Additionally, a full copy of the Renewable Energy Approval will be contained in the control room.

5.1.3 PROCESS BUILDING

The 935 m^2 Process Building will consist of the following:

- Solid and Liquid Organics Receiving Areas
- Solid Organics Pre-Processing and Mixing Unit
- Liquid Organics Mixing Unit
- Central pumping station and two other rotary piston pumps
- Residual Waste Storage
- Solids separator to remove water from digestate
- Digestate solids storage/transport bin

5.1.4 PROCESS WATER TANK

The Process Water Tank will be located adjacent to the first Pretreatment Tank and the Process Building. It has an inside diameter of 9 m and a height of 3 m with a total usable volume of 130 m^3. The floor and wall of the water tank will be constructed reinforced concrete with external thermal insulation. The Process Water Tank acts as an equilibrium tank for the process recycle water and surface runoff water prior to being fed to the Mixing Units unit. To mix the recycled process water and surface runoff water, a slow running propeller mixer is used.

5.2 ACCESS ROADS

Access to the Site will be via Martin's Lane leading east from Arthur Street. Incoming traffic will travel east along this road to the Proposed Facility, as shown on Figure 10a, and enter via the access gates located on the southwest side of the Site. Outbound traffic will exit via the same entrance and travel west along Martin's Lane from the Proposed Facility.

It is noted that this road provides access to the Proposed Facility and does not receive general traffic flow.

5.3 SITE FENCING

The Site will be fully enclosed by fencing as shown on Figure 9, with a lockable gate at the access point to the Site. The fencing will encompass all facilities on Site, including the weigh scale bridge, Operations Building, Pretreatment Tanks, Digestion Tanks, Secondary Digester and Repository Tank, and SWM pond. Access to the Site will be regulated at all times and only authorized personnel will be permitted onto the Site property.

5.4 PAVED AREAS

All surfaces on which hauling vehicles and processing equipment will operate will be paved to limit potential for dust generation and allow for more effective surface water management. All paved areas will be sloped to facilitate surface water collection.

The paved areas of the Site are shown on Figure 9, with the incoming and outgoing traffic flows shown on Figures 10a and 10b.

5.5 SANITARY SERVICE

The Proposed Facility will be serviced by the Town of Elmira's sanitary services. The sanitary services need to be extended with the extension of Martin's Lane. The only discharge to the sanitary service will be from the toilet, shower and sink in the Operations Building.

5.6 ELECTRICAL SERVICE

Electrical service to the Site will be provided via a new connection to the existing electrical line on Martin's Lane. All electricity generated on Site will be sold to Ontario Power Authority and all electricity used on Site will be purchased separately from the local utility. In the event of a power outage, a backup generator will be used to operate the biofilter and flare if necessary. This generator would be exempt from the Renewable Energy Approval as provided in S.7 of O Reg. 359/09. In the event of a power outage, the Main Digester Tanks and Secondary Digester and Repository (Digestate Storage) Tank can be mixed manually using the generator or with a tractor power take-off to maintain biogas generation until power to the Site can be restored.

5.7 WATER SERVICE

A new water service will be installed for the Site. The Facility has estimated its annual water requirement to be approximately 10,825 m^3/year (approximately 9000 m^3/year for process use and 1,825 m^3/year for biofilter operation). The Facility will require approximately 5 m^3/day (1,825 m^3/year) of water for operation of the biofilter, this water taking will be on an as needed basis to make up for evaporation and purging losses from the biofilter. The additional Facility water will be required to wash down trucks on Site and to provide make up water to the process. The washing water will be taken periodically during the day, and will be collected and reused at the Facility. The process make up water will be taken intermittently as required by the process. The timing of these water takings are very difficult to predict until the Facility is operational and the digestion recipe is refined, but will always be subject to change. Bio-En anticipates that the majority of water required for process operations will be taken during the hours of 8:00 a.m. to 6:00 p.m.. Bio-En was in discussion with the local

municipality (Township of Woolwich [Township]) regarding the availability of water at the Site. During this discussion, the Township indicated to Bio-En through correspondence that the water requirements for the Facility would not be an issue.

5.8 SEWAGE GENERATED AT THE FACILITY

As mentioned throughout the report, minimal sewage will be generated by the operation of this Facility. The only discharge to the sanitary sewer system will result from the on-site toilet, shower and sink.

Storm water collected in the Storm Water Management Pond will be pumped to the Process Water Tank to be used as process water. Storm water that is not used as process water will be treated as outlined in the Stormwater Management Plan Report prior to discharge. As previously mentioned, the liquid digestate that is not used in the process will be shipped off-Site for land application or sold as a fertilizer. The Facility may install a water treatment facility and discharge treated digestate to the sewer in the future, in this event, Bio-En will notify the MOE and provide an agreement to discharge with the Township.

6.0 SITE OPERATIONS

6.1 SITE ACCESS, SUPERVISION, AND SECURITY

Trained personnel will be on Site and will supervise all activities occurring during the hours of operation of the Proposed Facility. The Site will be secured by a fence and lockable gates at the entrance to allow only authorized personnel onto the Site.

Signage will be posted at the entrance to the Site identifying:

- Facility name
- Renewable Energy Approval Number
- Hours of operation
- Emergency numbers for contacting Site personnel

6.2 HOURS OF OPERATION AND OPERATING SCHEDULE

The Proposed Facility will generate electrical and thermal energy 24 hours per day, 7 days per week.

The receiving of organics will occur from 6:00 a.m. to 11:00 p.m., Monday through Saturday. Trained personnel will be available on Site at all times when organics are being received at the Proposed Facility.

7.0 POTENTIAL ENVIRONMENTAL EFFECTS AND CONTROL PROGRAMS

7.1 LITTER CONTROL

Since material receiving and unloading will occur solely indoors, there is not a significant primary source of litter at the Site. In cases where delivery of material is not via tanker truck, in order to minimize the amount of litter potentially created at the Site, all hauling trucks will be required to remain tarped until the material is unloaded inside the Process Building unloading areas. Housekeeping procedures for the Site will include regular monitoring for litter surrounding the perimeter of the buildings, which will be picked up by Site personnel as required to prevent accumulation. The overall litter control program for the Site will be specified in the Operations Plan and communicated to all Site personnel.

7.2 NOISE CONTROL

The primary sources of noise which are expected at the Site include the following:

- CHP unit
- Radiators located on the ground to the North of the Operations Building
- Agitators
- Truck Traffic

Trucks will be on Site for a minimum amount of time where possible, and with a minimum of truck idling outside the buildings. Additionally, there is expected to be little truck queuing outside of the buildings.

The majority of the mechanical equipment contained at the Site is enclosed within the structure of the buildings, and is not expected to generate significant noise outside the Proposed Facility. The doors to the Operations and Process Buildings will remain closed except to admit vehicles or on-Site personnel. The CHP unit will be located in a separate room in the Operations Building that will be equipped with acoustical lining.

7.3 ODOUR CONTROL

The Digestion and Secondary Digester and Repository Tanks are all sealed with double membrane covers that are designed to exceed the permeability guideline of 500 $cm^3/m^2/day/bar$ as outlined in O.Reg. 359/09. All of the biogas from the AD

process is combusted in two cogeneration units or a back-up flare if required. If either or both of the cogeneration units are incapacitated for any reason or more biogas is generated than can be consumed by the cogeneration units the automated backup flare, which is sized to handle 100 percent of the biogas generated at the Proposed Facility, will combust the biogas. Combustion of the biogas eliminates all potential odours from the methane, hydrogen sulfide, and low concentrations of organic sulfides and volatile organic compounds in the biogas. Thus no odours will be emitted from the Proposed Facility during the actual AD process.

Odours are potentially generated from the incoming organic material, depending on the type of material, as it is unloaded, pre-processed, and stored before it is pumped into the sealed AD process tanks. Odours may potentially also be generated during the separation, storage, and loading of digestate solids in the Process Building. The Proposed Facility will be designed and operated to manage all potential odours generated as part of the pre- and post-processing steps of the AD process.

The Process Building remains under a slight negative pressure under static conditions to ensure that uncontrolled emissions are not released from the building. Additionally, the main doors of the Process Buildings will remain closed except to admit hauling trucks and processing equipment on an as-needed basis. The main doors will be quick closing in the Solid and Liquid Organics Receiving and the Solids Removal Areas of the Process Building where the potential for odour release is the greatest. All other doors of the Proposed Facility will be closed at all times except to admit personnel on an as-needed basis. All air drawn from the Process Building is directed to the exhaust management system comprised of the biofilter for final emission via the stack. Below is a summary of the key odour management features planned for the Proposed Facility.

1. Minimize time feedstock material is stored prior to addition to AD process as fresher material has less potential for odour and greater biogas potential
2. Covered trailers or tanker trucks
3. Unloading of all trucks done indoors in negative pressure halls with two air exchanges per hour
4. Pre-processing and storage of incoming organics, and digestate solids separation and storage done indoors directly under exhaust hoods that create localized negative pressure zones with five air exchanges per hour
5. Quick closing overhead doors
6. Sealed storage tanks for DAF and FOG material that are vented directly to biofilter system

7. Automated modular inorganic media biofilters sized and configured to provide redundancy to allow maintenance and servicing on one module while still providing treatment capacity with remaining module
8. Stack after biofilter to provide dispersion of air emissions from biofilter
9. Ducting configured to allow Process Building air to be used as make up air in the cogeneration units in the unlikely event of a total biofilter failure

The biofilter planned for the Proposed Facility is discussed in detail in Section 8.1.2.

7.4 DUST CONTROL

Dust is not anticipated to be a significant concern at the Proposed Facility. All Site roads and parking areas will be paved with asphalt to minimize dust generation outside of the buildings. Incoming material is not dry and no dust is created as part of the AD process.

7.5 VECTOR AND VERMIN CONTROL

The design of the Proposed Facility and the implementation of good housekeeping procedures will eliminate sources of attraction for vector and vermin. Immediate and appropriate action will be taken if at any time pests are found at the Site. As needed, a qualified licensed pest control professional will be hired for pest control.

Cleanliness, while important for the whole plant, is essential for the unloading area. One staff member at the Proposed Facility will be responsible for cleanliness and general assistance to the operator.

7.6 EMPLOYEE TRAINING PROGRAMS

Overall, Bio-En will maintain high standards in the field of safety, health, and the environment. Based on these standards and all pertinent regulations, the Proposed Facility will comply with all workplace safety, worker protection, safety policies, and ergonomics, as required.

Regular inspections at the workspace will be carried out by the facility manager to ensure consistent compliance among employees with safety and health regulations. Additionally, the effectiveness and efficiency of the Proposed Facility's policies on

safety, health, and the environment will be reviewed periodically and revised as necessary.

An Employee Training Program will be provided for all employees who are actively involved in day-to-day operations. Detailed Health and Safety and Emergency Response Plans will be developed for the Proposed Facility and will form part of the Site Operations Plan.

7.7 MAINTENANCE AND PREVENTATIVE MAINTENANCE SCHEDULES

Preventative maintenance is a critical aspect for the effective and efficient operation of the Proposed Facility equipment. Equipment includes, but is not limited to the CHP unit and mechanical equipment such as pumps, agitators, Solid Organics Pre-processing and Mixing Unit and the Liquid Organics Mixing Unit.

A detailed maintenance and preventative maintenance program will be developed and implemented and will remain on Site to be available for inspection at any time. Site supervisory duties will include ensuring that maintenance schedules and procedures are observed. The maintenance program will be periodically reviewed and revised as necessary.

8.0 EXHAUST MANAGEMENT SYSTEM

8.1 SYSTEM COMPONENTS

The Proposed Facility is designed to handle and treat all air flows and potential odours arising from material handling in the Process Building. The Process Building remains under a slight negative pressure to ensure that no uncontrolled emissions are released.

The proposed exhaust management system is comprised of the following:

- Main duct, allowing air to be drawn in from the Process Building
- Process equipment (blowers and variable frequency drive)

8.1.1 DUCTING

Process air from the Process Buildings will be transferred to a central duct which directs the air to the biofilter. The process air exhausted from the Process Building is collected in the main exhaust duct. Air dampers will automatically adjust the volume of air taken from the Process Building based on the operating condition of the building. In order to optimize heat demand and odour control, all exhausts are interconnected by ductwork allowing the exhaust from the Process Building.

The Process Building is operated under negative pressure under static conditions. Consequently, potential odour and dust emissions from the Process Building are prevented. The net exhaust discharged from the Process Building is passed through the biofilter before discharge through the stack.

8.1.2 BIOFILTER

An inorganic media biofilter has been selected for the Proposed Facility. Inorganic biofilters have been used in waste processing applications and are being utilized more often as regulations impose more rigid standards on odour emission. In general, inorganic systems are more expensive capitally than organic systems, are less maintenance intensive, and demonstrate lower operating costs.

The inorganic media biofilters planned for the Proposed Facility will have the following key features:

- 85 percent odour removal efficiency (manufacturer performance rating)
- Sized and configured to provide redundancy to allow maintenance and servicing on one module while still providing treatment capacity on remaining modules by maintaining an inventory of parts, altering the flow rate to the biofilter, or by using the air as combustion intake air for the engines
- Inorganic filter media depth of 1.83 m
- Temperature and humidity of incoming air controlled for optimum biofilter performance
- Permanent inorganic filter material with ten year warranty to reduce media replacement downtime
- Down flow design results in the top layers of the filter media, which can be easily accessed without having to remove all of the filter media
- Operator friendly automated controls compatible with Proposed Facility SCADA system

8.2 ESTIMATED RATE OF EXHAUST

Approximately 20,000 m^3/h of ventilation air is delivered to the exhaust management system. The resulting negative air flow in the unloading area will result in a net ingress of air through open overhead doors and other entry points.

8.3 EXHAUST MANAGEMENT SYSTEM PERFORMANCE

A monitoring program for the exhaust management system will ensure proper maintenance and operation of the biofilter at the required efficiency levels. Parameters measured in the monitoring program include:

- Pressure drop across the biofilter
- Moisture content of biofilter bed media
- Temperature of biofilter
- Temperature of influent air
- Relative humidity of influent air

9.0 SURFACE WATER MANAGEMENT

A complete Surface Water Assessment Report is being prepared under a separate cover. A summary of that report will be included in the final version of the Design and Operations Report submitted to the MOE.

10.0 SITE MONITORING PROGRAMS

10.1 SITE INSPECTION PROGRAM

A Site inspection program will be developed for the Proposed Facility which will include all aspects of the Proposed Facility's operations to ensure conformity with the Site REA. Required inspections will be recorded in a log book. Records will include:

- Name and signature of inspector
- Date and time of inspection
- Deficiencies found
- Recommended actions
- Date and description of actions taken

Site inspections will be performed by trained personnel. Recommendations from the Site inspection program will be incorporated into the revised Operations Manual as required, and modifications will be communicated to Site personnel.

10.2 INCOMING ORGANICS VOLUME MONITORING

Various streams of incoming organics will be accepted at the Proposed Facility. Any incoming loads not meeting the applicable criteria will be rejected and appropriate measures will be taken to remove the materials from the Site for disposal. A full record will be kept in the daily logs of all rejected loads and the destination of the rejected materials. Rejected loads will be removed within 72 hours of receipt at the Proposed Facility and will be stored, as required, inside the Proposed Facility in a designated and separate area.

It is noted that the Proposed Facility will be sufficiently robust to easily accommodate changing characteristics in the incoming organics ratios.

10.3 DIGESTATE QUALITY MONITORING

Quality control monitoring of digestate being produced will meet O.Reg. 267/03 (as amended) requirements for NASM and Guidelines for the Utilization of Biosolids and Other Wastes on Agricultural Land (March 1996) or CFIA fertilizer requirements. Digestate quality monitoring will be completed by Bio-En or a third-party hauler. Metal

content, non-biodegradable particulate matter, nutrients, and pathogens are parameters which will be tested for under the regulatory requirements.

Written records will be maintained and will include:

- Quantity, by weight and volume, of digestate produced and removed from the Proposed Facility
- Analysis and laboratory reports
- Sample collection locations and volume
- Day and time of collection
- Sample handling procedures
- Name of laboratory facility conducting the testing

10.4 SURFACE WATER MONITORING

All surface water from the Site not used in the AD process will be directed to the SWM pond for storage and final discharge into the ditch located north of the future Martin's Lane. A visual inspection of the SWM pond will be performed on a regular basis to ensure that SWM pond is operating correctly. A Surface Water Report has been prepared in support of the Application for REA and is available under separate cover.

10.5 NOISE, LITTER, AND DUST MONITORING

Litter will be monitored on a daily basis. The collection of litter on Site will be done on an as-needed basis, with prevention measures taken if specific areas become litter concerns. A general procedure for complaints relating to litter, noise, or dust will be developed.

10.6 OPERATIONS MANUAL

An Operations Manual will be developed for the Proposed Facility, which outlines:

- Responsibilities of Site personnel
- Employee training program and training protocols
- Material receiving and handling procedures

- Contingency procedures
- Records management
- Complaint response procedure

All Site personnel will be trained according to the procedures described in the Operations Manual upon commencement of their employment and existing employees will be retrained on any revisions made. A copy of the Operations Manual will be available for reference at the Proposed Facility at all times. The Operations Manual will be periodically updated and revised as required.

10.7 RECORDS MANAGEMENT

On-Site records will be maintained of material received, stored, digested, and transferred. In the form of a daily log, measurements of the following parameters will be recorded:

- Date, quantity, source, and type of material received on Site
- Date, quantity, type, and destination of material transferred off Site
- Descriptions of out-of-service durations of any control, treatment, disposal, or monitoring processes
- Inspection reports

All records related to Site operations will be retained at the Site and made available to the MOE upon request.

10.8 ANNUAL REPORT

An annual progress report for the Proposed Facility will be prepared and submitted to the MOE on an annual basis. The progress report will contain the following:

- A monthly and annual mass balances of incoming and outgoing materials
- An annual summary of non-compliance items or significant process disruptions occurring at the Site
- A written description of any emergencies occurring at the Site, remedial measures undertaken, and mitigative measures enacted to prevent reoccurrence

- A summary of Site operations negatively impacting the local environment, remedial measures undertaken, and mitigative measures enacted to prevent reoccurrence
- A summary of rejected loads, reason for rejection, and final destination of the rejected materials

Copies of the annual progress report will be kept at the Site at all times.

10.9 COMPLAINTS RESPONSE

Bio-En's design and operating procedures have been developed with the intention of minimizing negative impacts to the surrounding community. However, in the event that complaints regarding the operation of the Site are received, Bio-En will handle the complaints as follows:

- Establish a complaint log which includes information such as the following:
  - Weather conditions (wind strength, wind direction, temperature, precipitation)
  - Contact information of the complaint
  - Details of the nature and severity of the complaint
  - Location, time, and date where the problem occurred and any other person to witness or be involved with the event
  - Time, date and name of Bio-En/Township/Regional employee who received complaint
  - Any unusual events or activities that were occurring on-Site that may have attributed or caused the event which resulted in the complaint
  - Any other information pertinent to the specific complaint
- Coordinate complaint response with MOE staff where there is an exceedance of the MOE legislation limits or a term or condition of the Renewable Energy Approval.
- Cooperate with the MOE on voluntary or mandatory compliance instruments and record actions taken in this regard.
- Provide complainant with feedback about the problem and how it was rectified, within seven days of the complaint. If the issue cannot be rectified within seven days, Bio-En will continue to provide the complainant with weekly updates of mitigative actions being taken until such time as the issue is resolved.

11.0 CONTINGENCY PLANNING

11.1 SITE CONTINGENCY PLAN

A Contingency Plan for the Site will be updated prior to the commissioning of the Proposed Facility and will include the following:

- A list of persons responsible for the Site, including contact information
- A list of emergency phone numbers for applicable emergency bodies
- A description of fire protection, control systems, and emergency procedures
- A description of safety devices and maintenance procedures
- Training of Site personnel
- A Site Layout Plan including location of all emergency equipment
- Spill Response Plans

The Contingency Plan will be kept in a central location on Site at all times. Training will be provided for Site personnel in all contingency procedures.

11.2 ODOUR ISSUES

The Site will be inspected on a daily basis to ensure that odours are not a problem. If odours are detected, the following steps will be put in place progressively until the odour is mitigated:

- Confirm all odour mitigation procedures and best practices are followed
- Ensure that the Process Building is maintained under negative pressure
- Inspect outdoor facilities for spills or standing water
- Inspect all piping, pumps, tanks, and other exposed equipment for cracks, leaks, etc.

As outlined in Section 8.1.2, the biofilter has many redundancy features incorporated into its design. The Facility will maintain spare parts on-Site so that in the case of malfunction or maintenance, the repairs can be completed in a timely manner.

11.3 FEEDSTOCK SHORTAGES

The flexibility of the Bio-En feedstocks and operations will provide for simple adaptation in the event of feedstock shortages. Process monitoring equipment is designed to function in a consistent manner to ensure that the digester tanks remain full at all times. During feedstock shortages, the HRT of the digester tanks will be adjusted to ensure that the volume in the digesters remains consistent.

11.4 MARKET DISRUPTIONS

Bio-En will have an agreement with one or more third-party haulers, to remove the Facility's end products from the Site (solid and liquid digestate) for use as a soil amendment and fertilizer. If the third-party hauler does not have a location to apply this material, or can not sell it as fertilizer, the third-party hauler will be responsible for removing the material from the Site and storing it off-Site or disposing of it at an approved waste disposal site.

11.5 LABOUR DISRUPTIONS

At present, it is not anticipated that any unionized labour will be utilized on-Site. However, in the event of a labour disruption, management staff will be able to oversee the process control and operate the facility to ensure that any material that is currently on-Site will be processed.

11.6 EQUIPMENT MALFUNCTION

The waste storage tanks have all been designed with a storage capacity of at least two days, which will provide support while equipment is being repaired or replaced. In the event that a problem occurs with any one of the pretreatment or digester tanks, there will still be at least one of each tank operational at all times. As the digesters will be cross-linked, flow can be delivered to any of the tanks, as required. This system redundancy will allow for the continuous processing of waste at a reduced capacity, while repairs are undertaken. If the utilization area is down for any reason, all biogas will then be delivered to the on-Site flare, which is sized to handle 100 percent of the total expected biogas volume.

11.7 POWER FAILURES

In the event of a power failure, a back-up power generator will ensure that the Process Building airflow systems remain functional. Power take-off agitators will be installed in each Main Digestion Tank and in the Secondary Digester and Repository Tank to maintain biogas production and keep solids in suspension. These take-off agitators can be powered by a generator, or using a tractor. Biogas will be accumulated in the Digestion Tanks and Secondary Digester and Repository Tank until such time as the co-generation units are operational again or until they are full and the biogas is flared.

11.8 FIRES, SPILLS AND OTHER EMERGENCIES

11.8.1 FIRE

In the event that a fire is identified on the Site, fire fighting assistance should be requested from the Woolwich Fire Department. The Site supervisor or designated representative should then meet the fire department at the main gate and direct/lead the fire department to the location of the fire. All available resources should be made available to assist the fire department as requested by the fire department officials.

The Woolwich Fire Department will either be paged to respond through a Site monitoring system, or will be called by the Operator by dialing: 911.

The Woolwich Fire Department will be provided with a copy of the Facility layout and will be advised on the operation of the Facility and emergency protocols.

11.8.2 ACCIDENTS

First aid kits should be maintained, regularly inspected and re-supplied as required in the following locations:

i) Operations Building

ii) Process Building

For reference, the following emergency numbers have been provided:

Ambulance:	911
Fire Department:	911
Police:	911

The telephone numbers should be verified on an annual basis, and posted by all Site telephones.

11.8.3 SPILLS

Spills of fuel or any liquid wastes inadvertently brought to the Site are to be contained as quickly as possible by the construction of temporary berms and/or the application of absorbent materials. Every reasonable effort should be made to minimize the area affected by the spill. The effected area will be cordoned off to prevent access. The spill is to then be reported immediately to the MOE District Office or the Spills Action Centre (800-268-6060). Documentation of the spill, the remediation and the impact to the environment is to be maintained with the Site records for a period of five years and reported in the annual report.

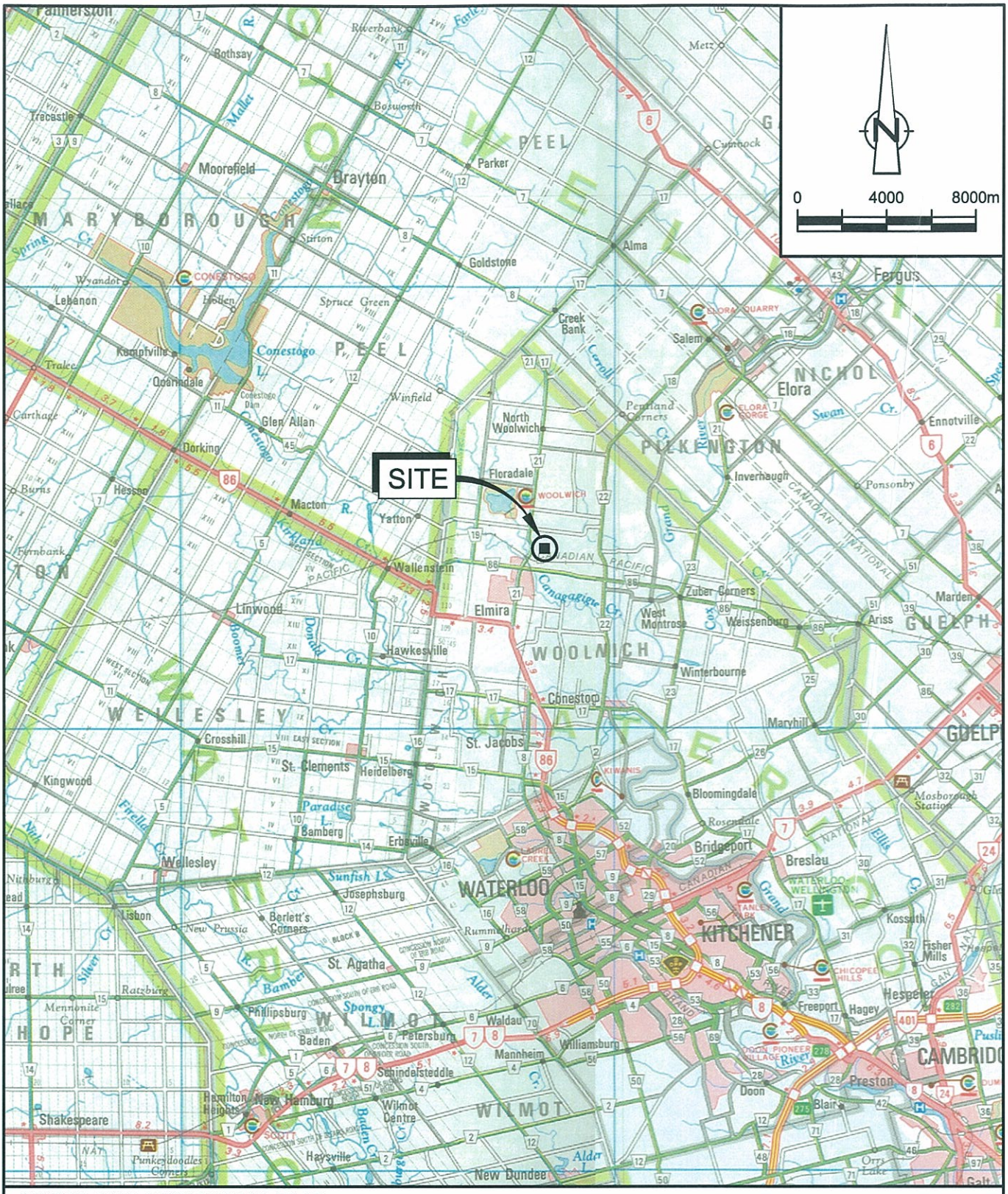
Spill kits will be kept on-Site at all times, in a secure, easily accessible location. One kit will be kept in the processing building and the second will be kept in the operations building. These kits should contain the following materials:

i) Tyvek coveralls
ii) Protective rubber gloves
iii) Goggles
iv) Yellow "CAUTION" tape
v) Pylons
vi) Disposal bags
vii) Absorbent materials
viii) Shovel
ix) List of emergency contact telephone numbers
x) Spill response pocket guide

11.8.4 EMERGENCY CONTACTS

Emergency contact numbers should be posted on the main entrance gate:

- Operations Manager Emergency Contact Number
- Operator contact and pager number
- Emergency services (i.e., fire, police, ambulance, etc.)
- Site security service contacts



SOURCE: RAND MCNALLY ROAD ATLAS

figure 1

REGIONAL SITE LOCATION
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

46254-07(002)GN-WA001 JAN 06/2010

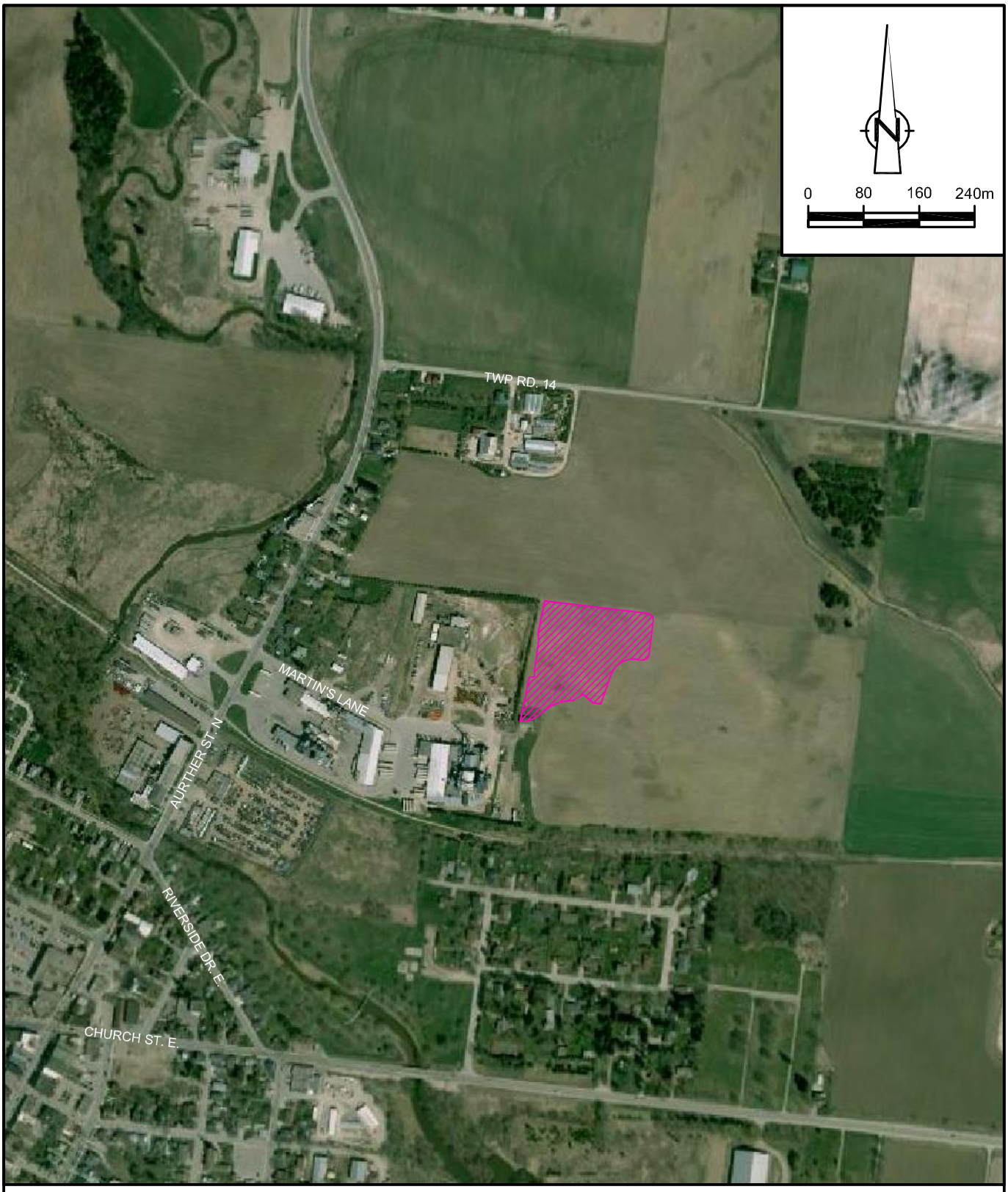


figure 2A

AREA PLAN
DESIGN AND OPERATIONS REPORT
ELMIRA BIO-EN FACILITY
Elmira, Ontario

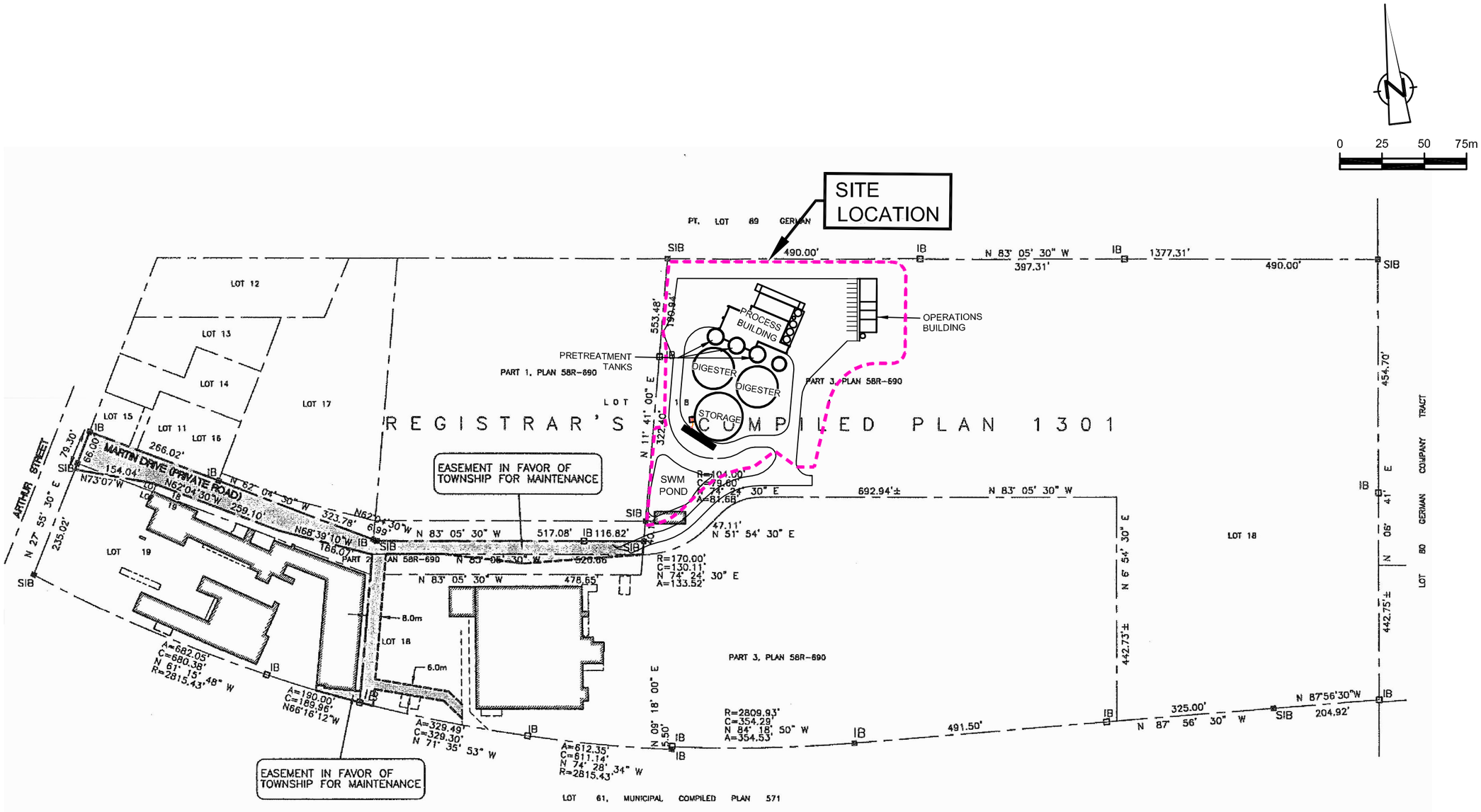


figure 2B

AREA PLAN - EASEMENTS AND RIGHTS OF WAY
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

SOURCE: THE WALTER FEDY PARTNERSHIP,
EASEMENT CONCEPT PLAN, JANUARY 27, 1998.

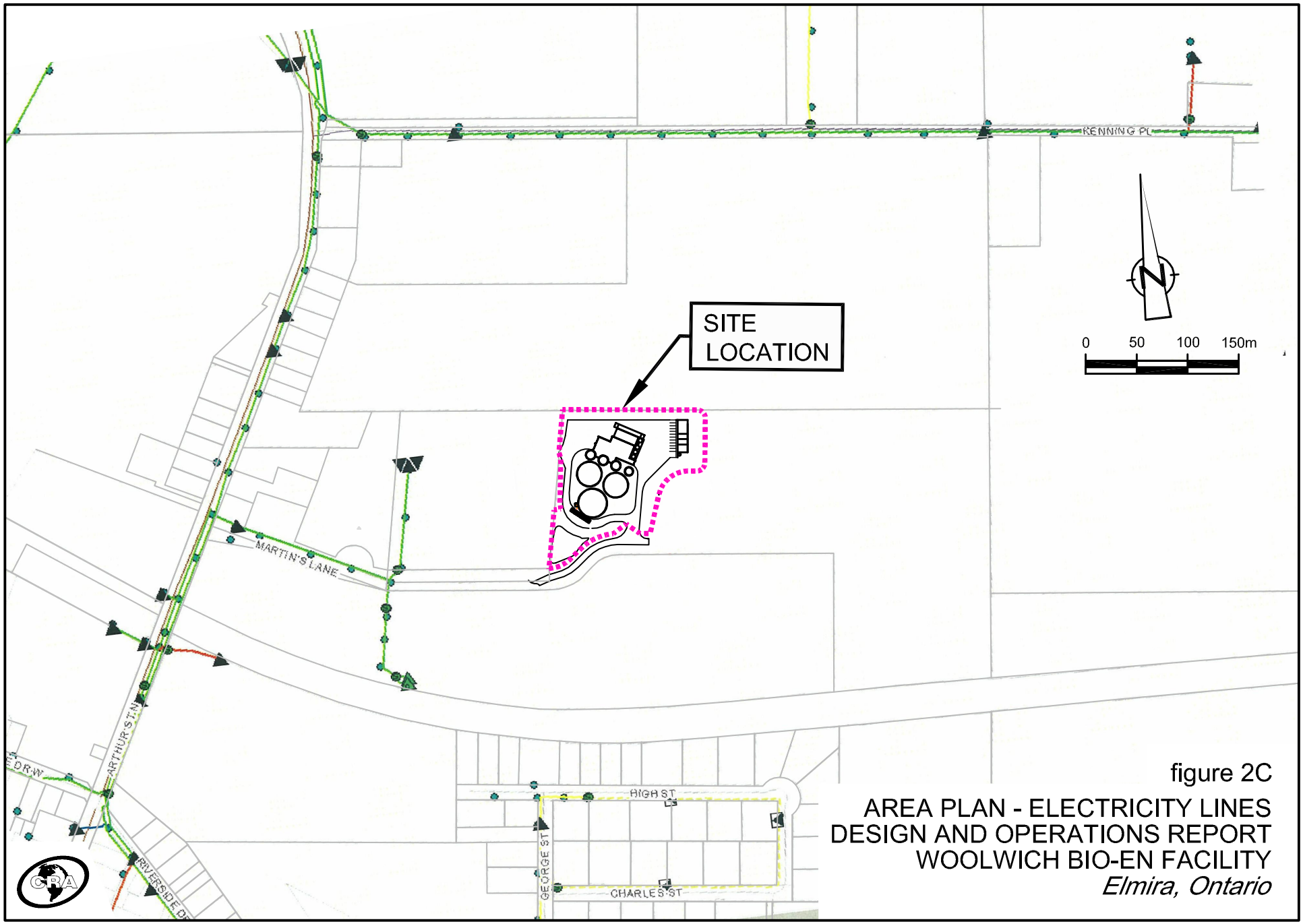


figure 2C

AREA PLAN - ELECTRICITY LINES
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

46254-07(002)GN-WA013 JAN 12/2010

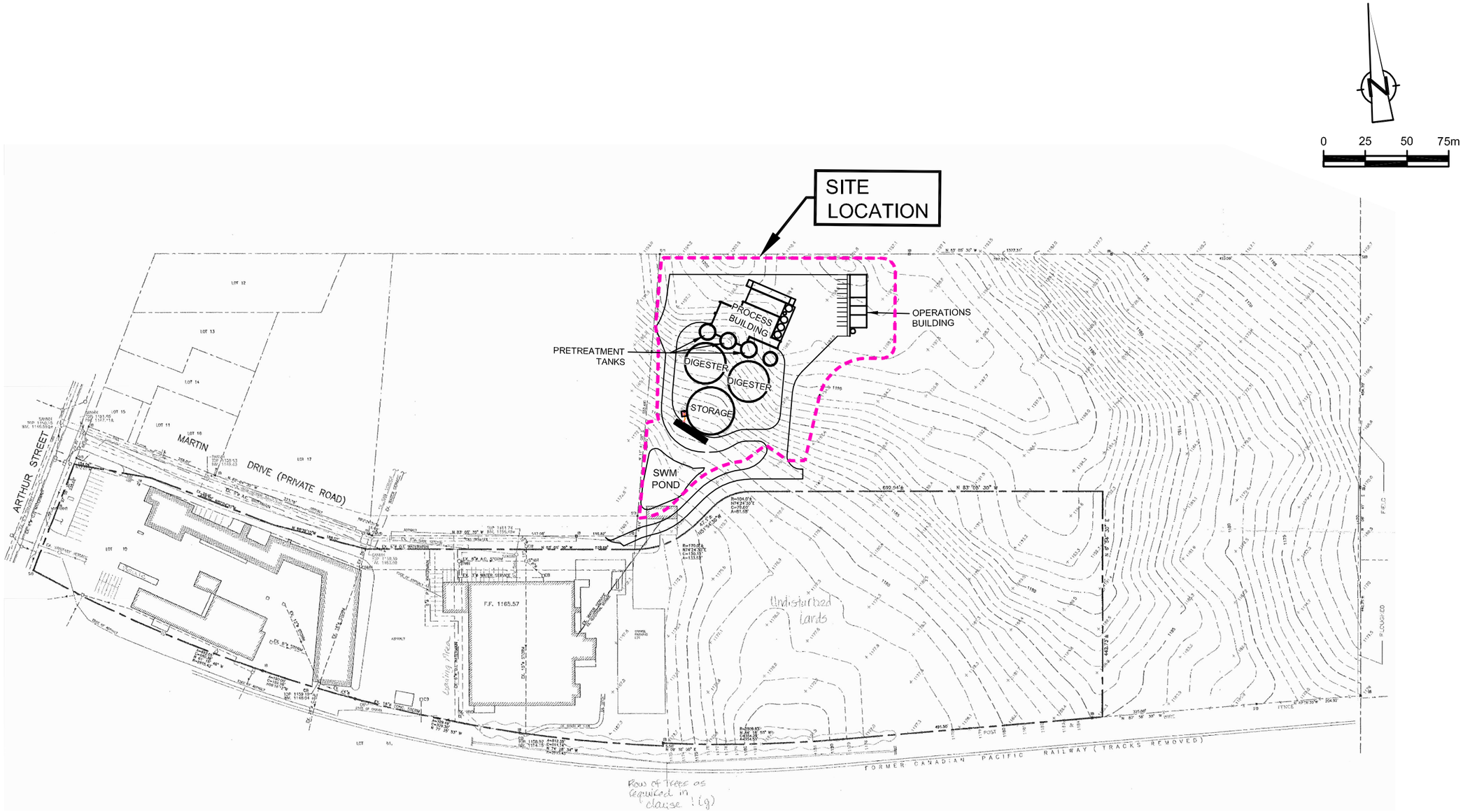


figure 2D

AREA PLAN - SERVICES
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

SOURCE: THE WALTER FEDY PARTNERSHIP,
SITE PLAN, DECEMBER 9, 2005.

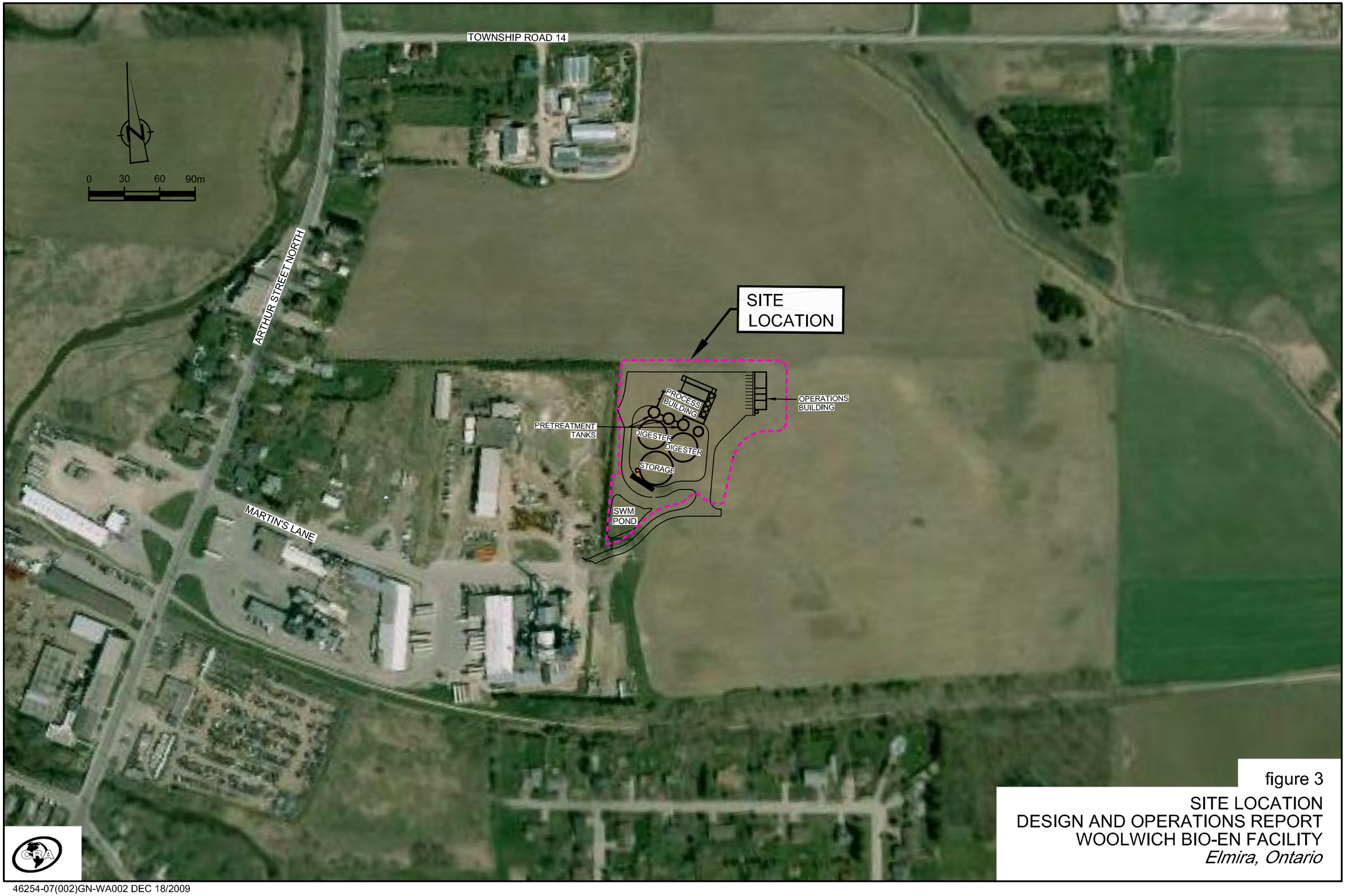


figure 3

SITE LOCATION
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

46254-07(002)GN-WA002 DEC 18/2009

MAP SYMBOL	CLASSIFICATION
A	AGRICULTURAL
R-1	RESIDENTIAL - SETTLEMENT
R-4	RESIDENTIAL - MIXED MEDIUM DENSITY
R-6	RESIDENTIAL - COMMERCIAL
C-1	CORE COMMERCIAL - URBAN
M-1	GENERAL INDUSTRIAL - DRY
O-1	OPEN SPACE
P	INSTITUTIONAL

0 40 30 120m

ARTHUR STREET

A
M-1
M-1(F)
R-4(F)
R-4
R-6
P
C-1
O-1
R-1

figure 4

ZONING PLAN
DESIGN AND OPERATIONS REPORT
ELMIRA BIO-EN FACILITY
Elmira, Ontario

46254-07(002)GN-WA003 DEC 10/2009

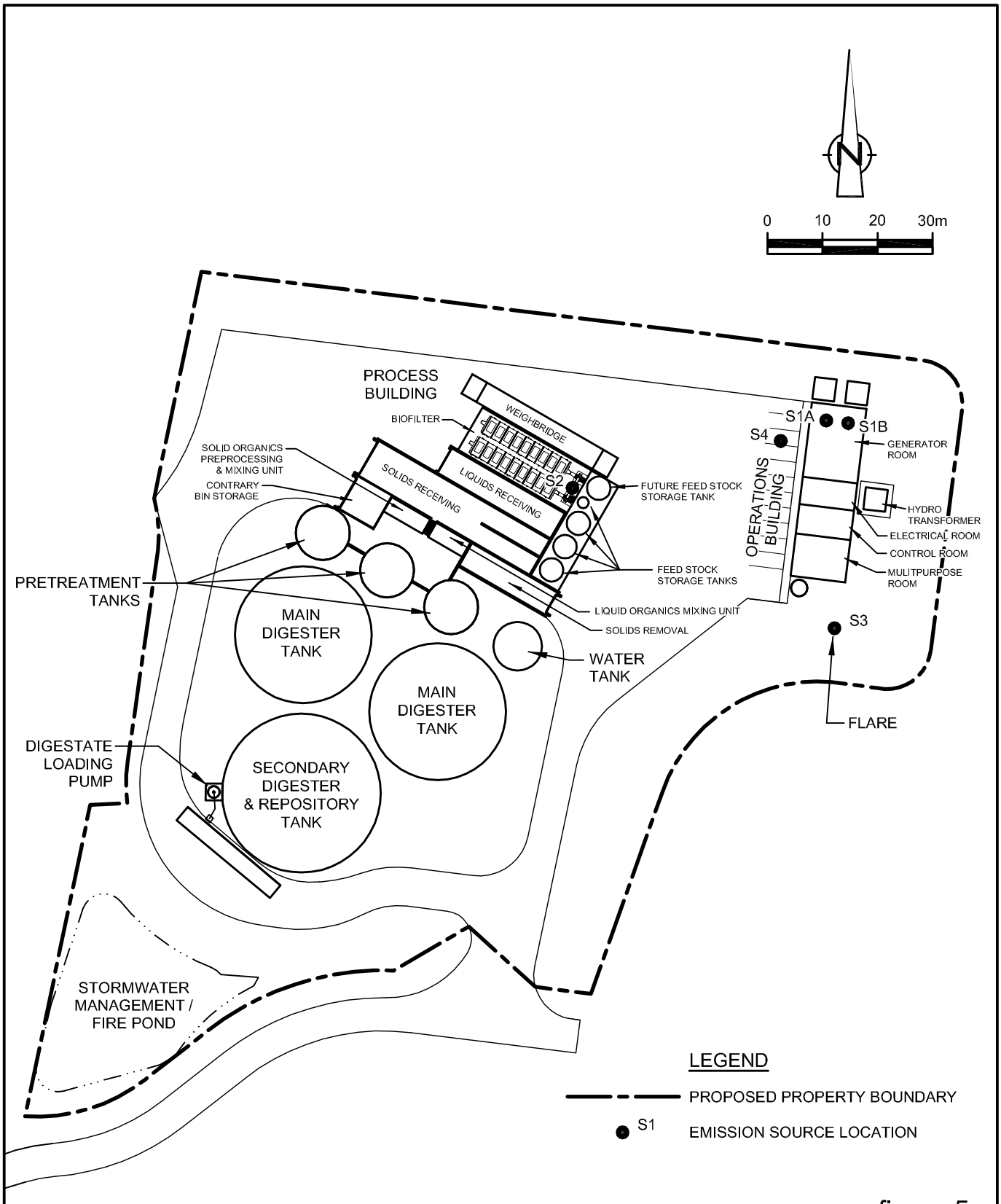


figure 5

EMISSION SOURCE LOCATIONS
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

MAP SYMBOL	CLASSIFICATION
A	AGRICULTURAL
R-1	RESIDENTIAL - SETTLEMENT
R-4	RESIDENTIAL - MIXED MEDIUM DENSITY
R-6	RESIDENTIAL - COMMERCIAL
C-1	CORE COMMERCIAL - URBAN
M-1	GENERAL INDUSTRIAL - DRY
O-1	OPEN SPACE
P	INSTITUTIONAL

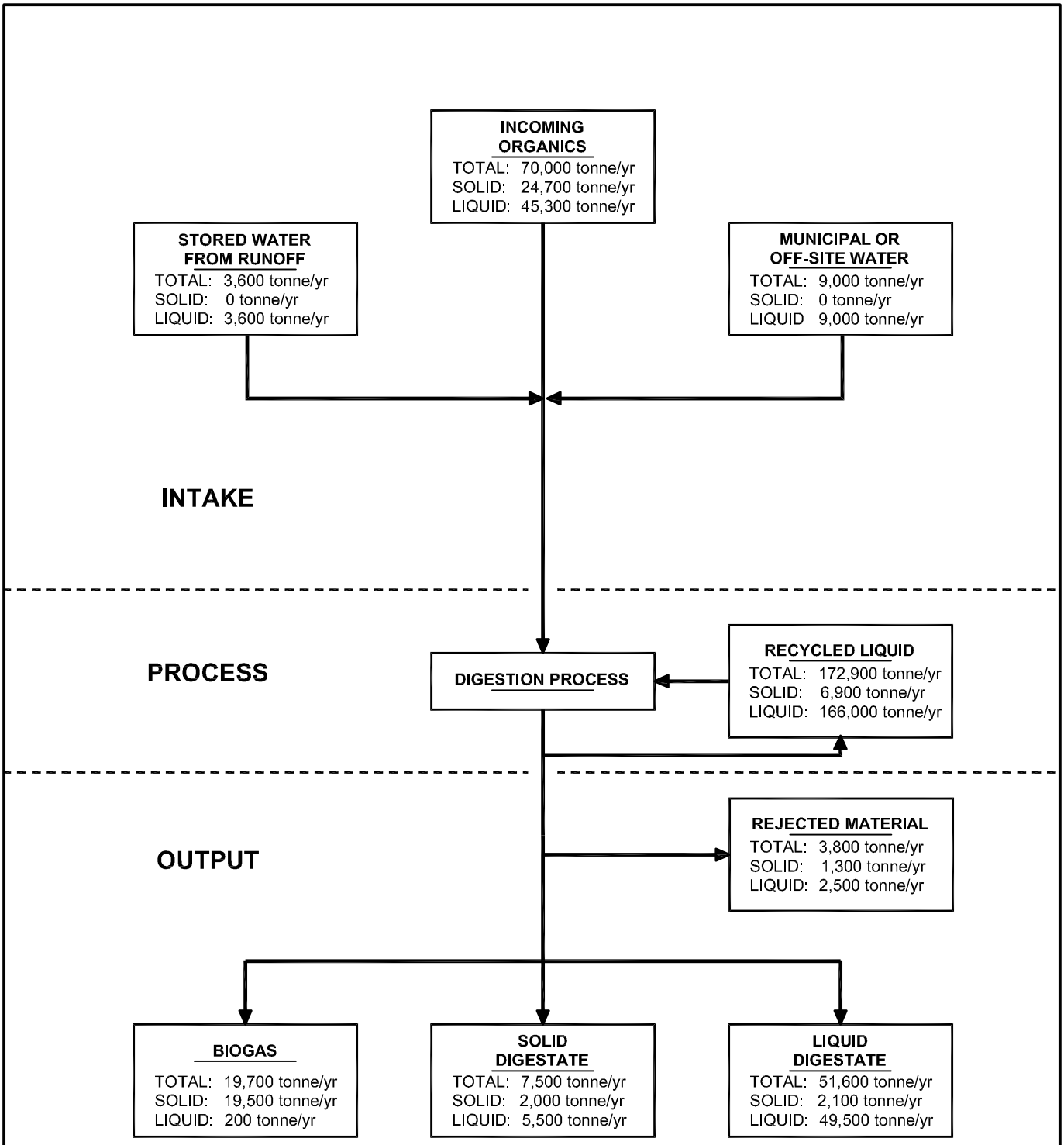
LEGEND

POR1 POINT OF RECEPTION

figure 6

ODOUR AND NOISE POINTS OF RECEPTION
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

46254-07(002)GN-WA005 DEC 18/2009



NOTES:

1. RECYCLE RATE BASED ON THE SCALING OF ANOTHER BIOGAS FACILITY DESIGNED BY AGRINZ.
2. THE LIQUID AND SOLID PRODUCT OUTPUTS LISTED ARE BASED ON CONSUMPTION OF INPUT MATERIALS DURING THE PROCESS TO CREATE BIOGAS AND SOLID/ LIQUID COMPOSITIONS OF DIGESTATE OUTPUT BY ANOTHER BIOGAS FACILITY DESIGNED BY AGRINZ.

figure 7

OVERALL MASS BALANCE
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

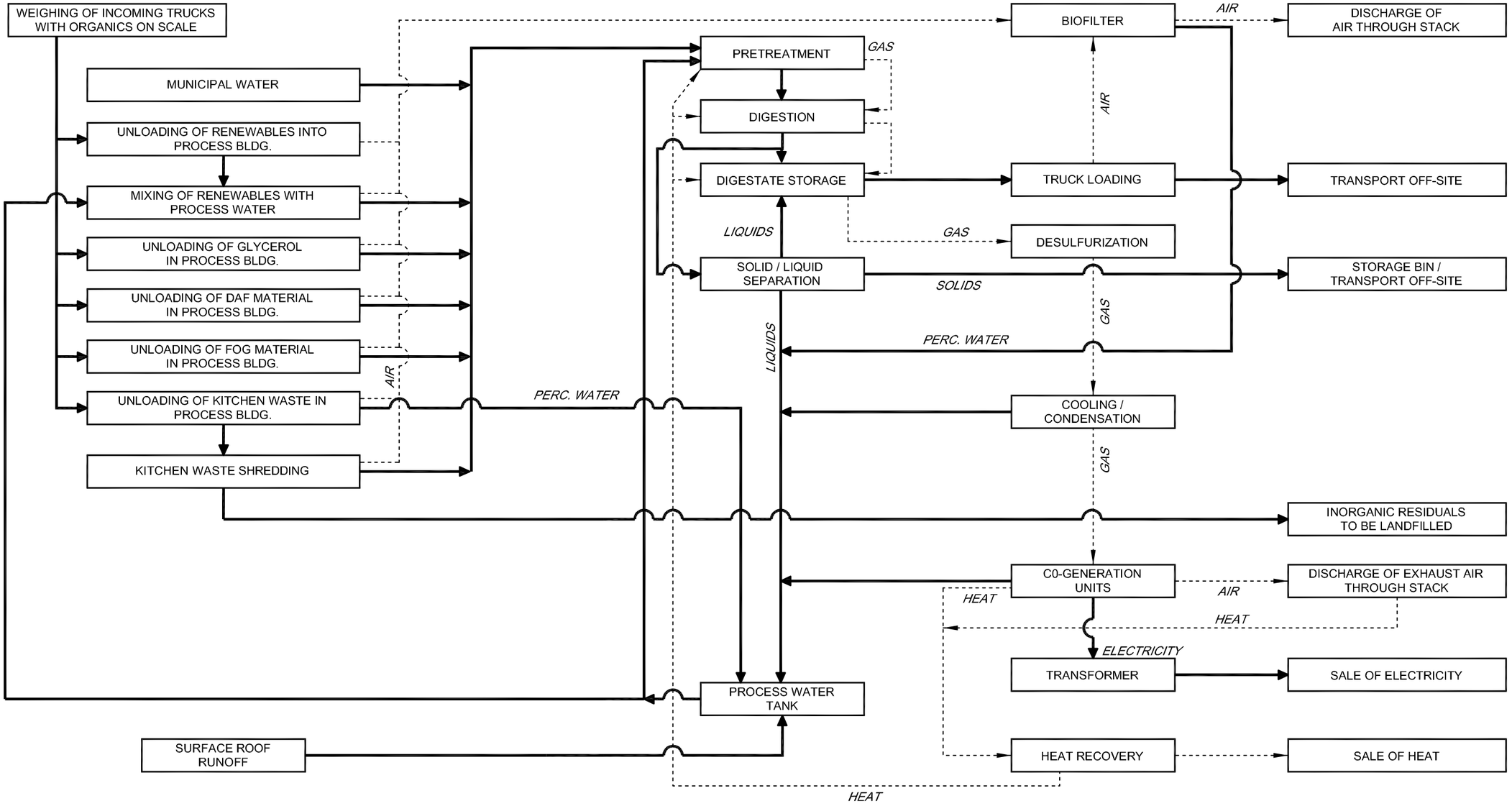
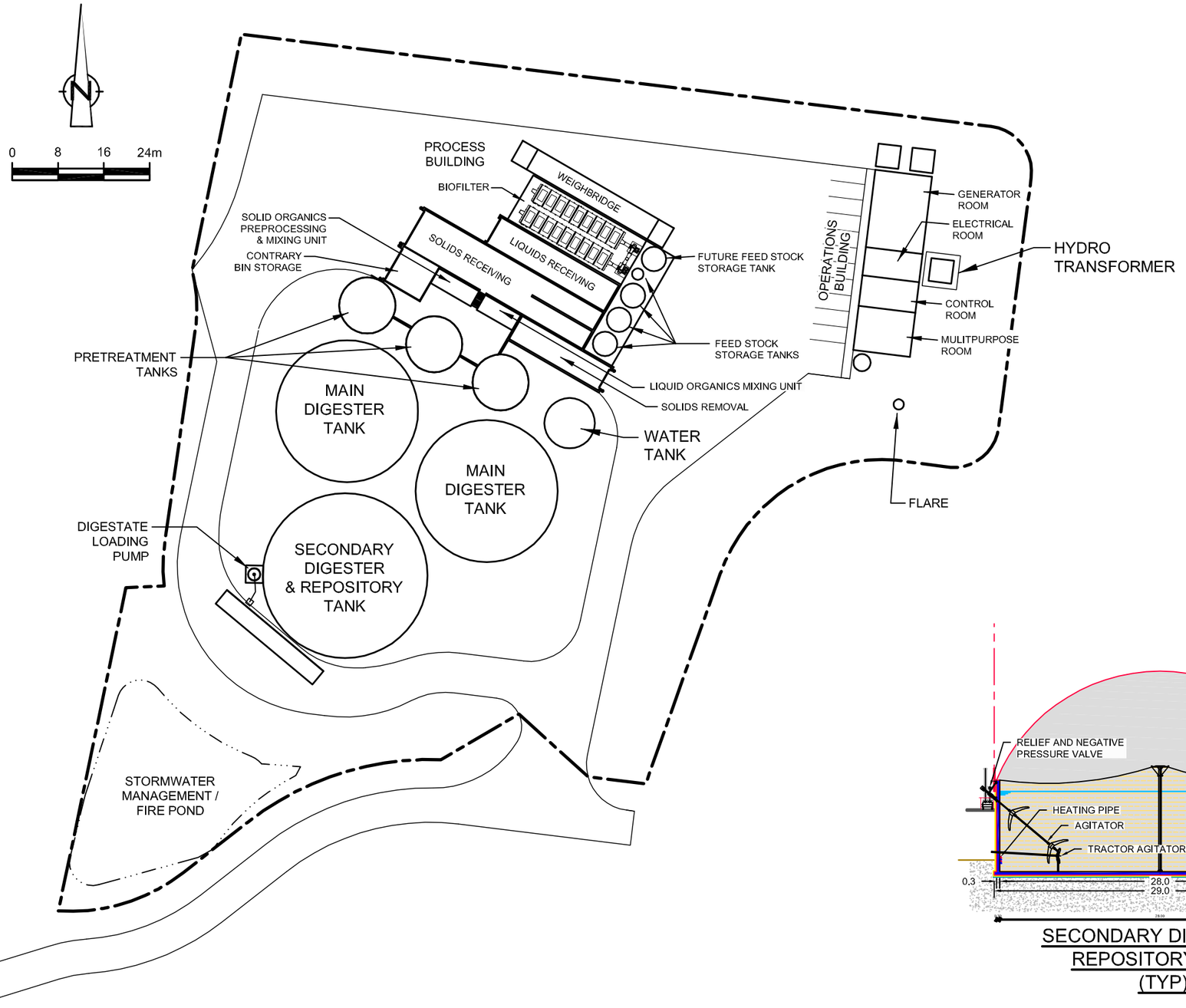
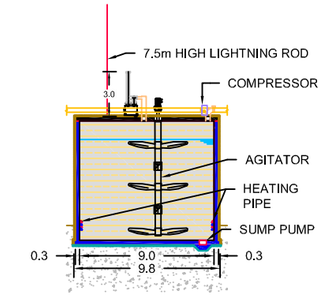


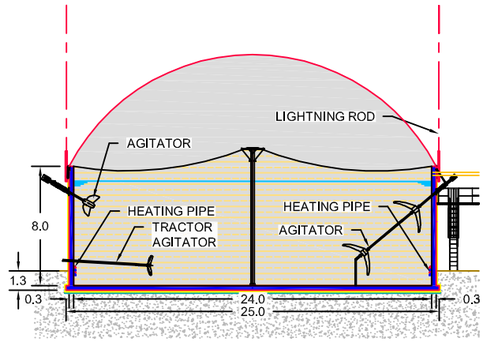
figure 8

PROCESS SCHEMATIC
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario





PRETREATMENT TANK (TYP)



MAIN DIGESTER TANK (TYP)

SECONDARY DIGESTER & REPOSITORY TANK (TYP)

figure 9

CONCEPTUAL FACILITY LAYOUT
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

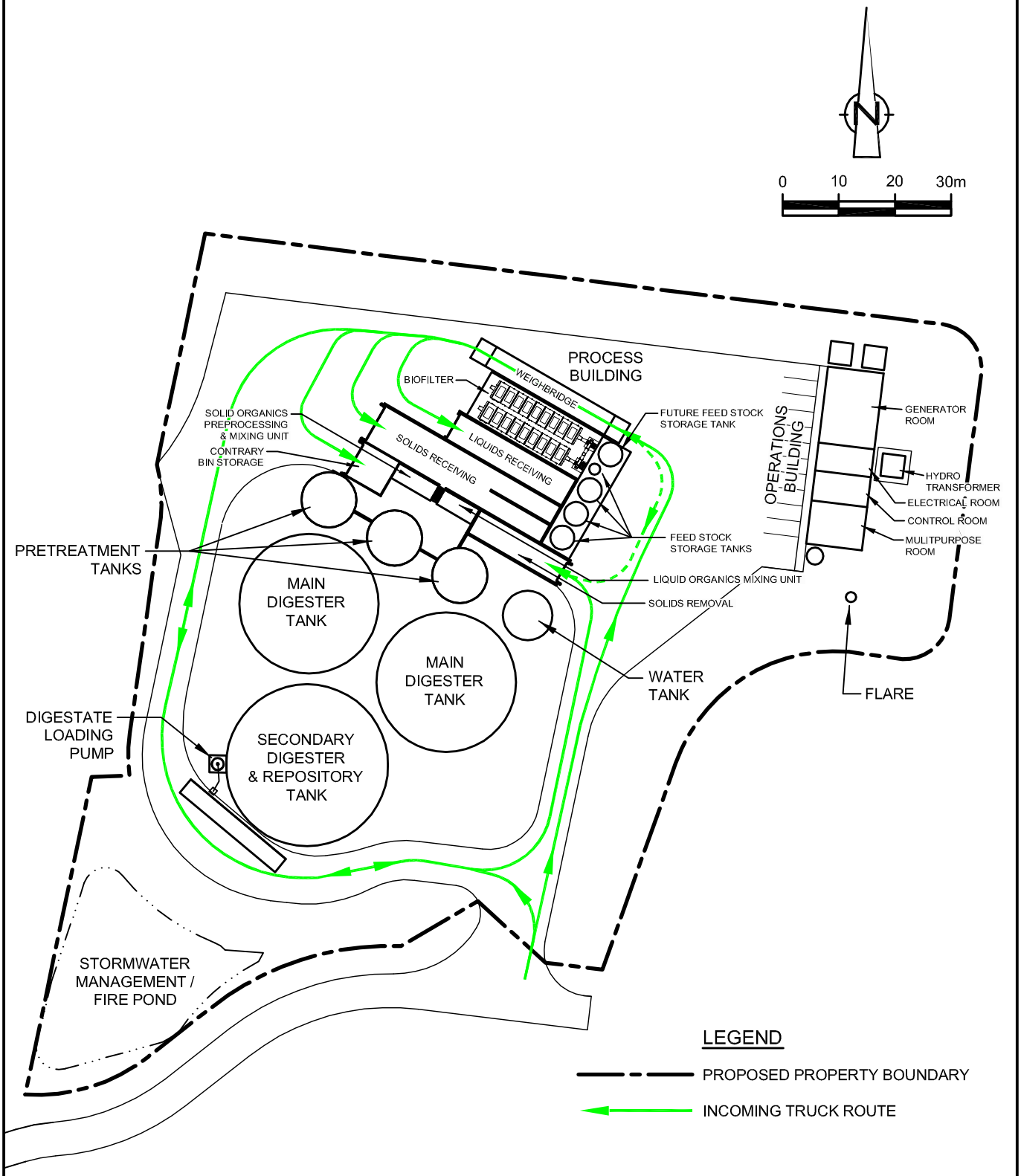


figure 10A

INCOMING TRAFFIC FLOW
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

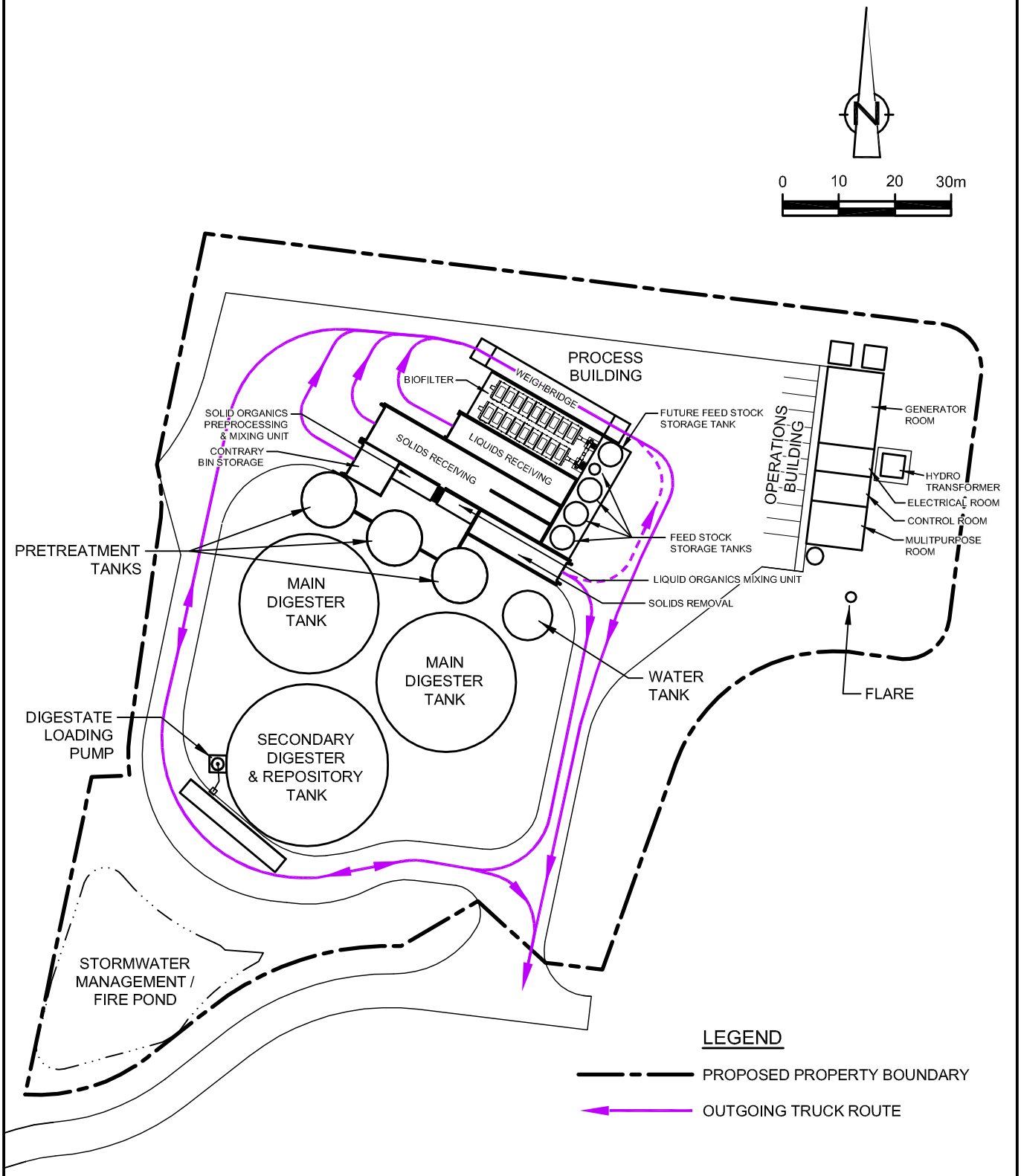


figure 10B

OUTGOING TRAFFIC FLOW
DESIGN AND OPERATIONS REPORT
WOOLWICH BIO-EN FACILITY
Elmira, Ontario

APPENDIX A

WOOLWICH BIO-EN ARTICLES OF INCORPORATION

Request ID: 008997916
Demande n°:
Transaction ID: 031787095
Transaction n°:
Category ID: CT
Catégorie:

Province of Ontario
Province de l'Ontario
Ministry of Consumer and Business Services
Ministère des Services aux consommateurs et aux entreprises
Companies and Personal Property Security Branch
Direction des compagnies et des sûretés mobilières

Date Report Produced: 2007/03/20
Document produit le:
Time Report Produced: 16:49:08
Imprimé à:

Certificate of Incorporation
Certificat de constitution

This is to certify that

Ceci certifie que

WOOLWICH BIO-EN INC.

Ontario Corporation No.

Numéro matricule de la personne morale en Ontario

002130868

is a corporation incorporated, under the laws of the Province of Ontario.

est une société constituée aux termes des lois de la province de l'Ontario.

These articles of incorporation are effective on

Les présents statuts constitutifs entrent en vigueur le

MARCH 20 MARS, 2007

Director/Directrice
Business Corporations Act/Loi sur les sociétés par actions

APPENDIX B

LEASE AGREEMENT WITH MARBRO CAPITAL