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Petawawa Net Zero Facility

Effluent Management Report

August 02, 2022

Contents

1 Introduction

The Town of Petawawa is proposing to develop, construct, and operate the Town of Petawawa Net-Zero Facility (the Project) in the Town of Petawawa. The project will produce electricity and heat for use by the Net-Zero Facility through a Combined Heat and Power Plant (CHP Plant) using biogas generated on-site, and renewable natural gas for export. The development of the project will help show how smaller wastewater treatment plants can get to Net Zero Energy operating conditions and provide an alternative avenue to organics waste treatment, in turn freeing up capacity in municipal landfills. The project is subject to Ontario Regulation 359/09 – Renewable Energy Approvals under Part V.0.1 of the Environmental Protection Act (O. Reg. 359/09).

The proposed Town of Petawawa Net-Zero Facility has the key advantage of being located at the existing Petawawa Water Pollution Control Plan (WPCP). ***The effluent generated by the Net-Zero Facility will not be directly discharged to a receiving water body. All of the effluent will be treated by the WPCP and discharged in compliance with the WPCP Environmental Compliance Approval.***

This report is arranged into six sections, including this introduction. Section 2 provides background information on the General Project Area and a high level description of the net zero facility that will be associated with the project. Section 3 provides a description of effluent (sewage). Section 4 describes the impacts of the project on the WPCP. Section 5 provides the conclusions of the report.

2 Background

2.1 General Project Area Description

The boundaries of the General Project Area are contained within the Town of Petawawa, Renfrew County, with the Ottawa River located approximately 400 m from the west side of the site. The project area is contained by the 560 Abbie Lane Property Line.

2.2 High Level Description of Net Zero Facility

The Petawawa Net Zero project (Project) will transform the Petawawa Water Pollution Control Plant (WPCP) into a Resource Recovery Facility by upgrading its anaerobic digesters to divert waste from landfill and significantly increase biogas production for use as electricity, making the plant energy neutral or positive, and reducing GHG emissions. This will involve the generation and utilization of biogas on-site in Combined Heat and Power (CHP) Units and further into the future, a Biogas Upgrading System.

The location of the project site is situated within the Petawawa WPCP (Water Pollution Control Plant) located at 560 Abbie Lane, Petawawa, County of Renfrew, K8H 2X2 (Site).

The Project will be built in phases, primarily Phase 0 and Phase 1-2. The first is Phase 0, which include addition of CHP, upgrades to digesters and organics receiving. Phase 1-2 involves the addition of a waste reception building, sludge thickening, biosolids dewatering and the capability of producing Renewable Natural Gas with a biogas upgrading unit, along with an increase in the amount of organics received at the facility. Phase 0 will be implemented in the near term, with future phases following on the lessons learned in Phase 0. Details on project phases can be found in the Design and Operations report, which is submitted under a separate cover.

2.3 Process Description

The Petawawa Net Zero Facility will take food waste slurry and co-digest it with biosolids from the WPCP (refer to Appendix A for a block flow diagram of the process). The three main sources of effluent are:

1. Decant from biosolids storage (Phase 0)
2. Filtrate from the sludge thickening (Phase 1-2)
3. Filtrate from the sludge dewatering (Phase 1-2)

Operations staff decant liquid from the biosolids storage tanks to reduce the volume of biosolids removed from the plant. The decant stream is composed of water that has separated from the biosolids in storage and is returned to the WPCP headworks. The pre-thickening system at the Facility will pre-thicken the combined Primary Sludge (PS) and Thickened Waste Activated Sludge (TWAS) from approximately 2% Total Solids (TS) to 10%TS. The thickened sludge will go to the anaerobic digesters and the filtrate will be returned to the WPCP headworks. Similarly, the dewatering system will increase the Total Solids content of the digestate from approximately 4-5%TS to 25%TS, producing a filtrate that will be returned to WPCP headworks for treatment. The filtrate streams are composed of the water content that has been removed from the incoming feed, dilution water associated with the polymer dosing, and wash water for the equipment. These filtrate streams are collected in a sump pit in their respective buildings prior to transportation to the headworks.

All other sources of effluent at the Facility have negligible and intermittent flows, as shown in Appendix B. These sources, including wash water and condensate, are all collected within sumps at the Facility and sent to headworks for treatment.

3 Description of Sewage Collection, Treatment, and Disposal

Sewage Collection from the Net Zero Facility to the WCPC will occur at three points. The thickener building, dewatering building, and the combined drains of the biogas conditioning, CHP, and biogas upgrade skids. The decant stream current exists at the WPCP and will not be modified as part of the Project.

Both the thickener and dewatering buildings will have a sump pit, when added in Phase 1-2. Two sump pumps, operating in duty/standby, will convey the wastewater to the existing return line to the WCPC headworks.

The drain line for the biogas conditioning, CHP, and biogas upgrade skids, will be collected in a small pre-fabricated sump pit located just off the foundation pad. Two sump pumps, operating in duty/standby, will convey the drain water to a small insulted and heat-traced line to be utilized for wastewater returns to the WPCP headworks return.

4 Petawawa Water Pollution Control Plant Impacts

The Petawawa WPCP is owned by the Town of Petawawa and operated by the Ontario Clean Water Agency (OCWA). The plant treats domestic sewage from the Town of Petawawa and Garrison Petawawa, a Canadian Forces base.

The Petawawa WPCP is a Xylem ICEASTM Sequencing Batch Reactor (SBR) activated sludge facility with four SBRs in parallel. Each SBR basin features a pre-react zone located upstream of the main SBR tank, as well as a fine pore aeration system. Each basin is aerated using one positive displacement blower. Effluent from the SBR basins is disinfected by a UV system before being discharged into the Ottawa River. The Petawawa WPCP has a nominal design flow of 8,730 m^3/d and a peak design flow of 17,460 m^3/d.

Additional loading to the plant from processing organic waste will come from sludge storage decant, filtrate from sludge thickening, and filtrate from sludge dewatering. In Phase 0, additional loading will only come from biosolids storage as sludge thickening and sludge dewatering are part of Phase 1-2. Table 1 sets out the additional loading from these streams.

	Current Raw Sewage		With Phase 0			With Phase 1-2*		
	mg/L	kg/d	mg/L	kg/d	% increase	mg/L	kg/d	% increase
TSS	308	1643	366	1953	19%	368	1965	20%
BOD_5	121	645	132	704	9%	135	721	12%
TKN	35	188	48	255	35%	66	351	86%
TP	5	25	9	48	87%	11	60	135%

*Return stream from dewatering is included in Phase 1-2 loading. No decanting is assumed in Phase 1-2 because the solids concentration in storage will be sufficiently high that decanting will not provide any thickening benefits.

The impacts on the WPCP treatment processes were evaluated by rating the capacity of the treatment processes that would be impacted by the return streams: SBR reactors (BOD_5 loading and oxygen availability); anaerobic digesters and sludge storage. The capacities of these unit processes are shown in Figures 1, 2 and 3 for current operation, Phase 0 and Phase 1-2, respectively.

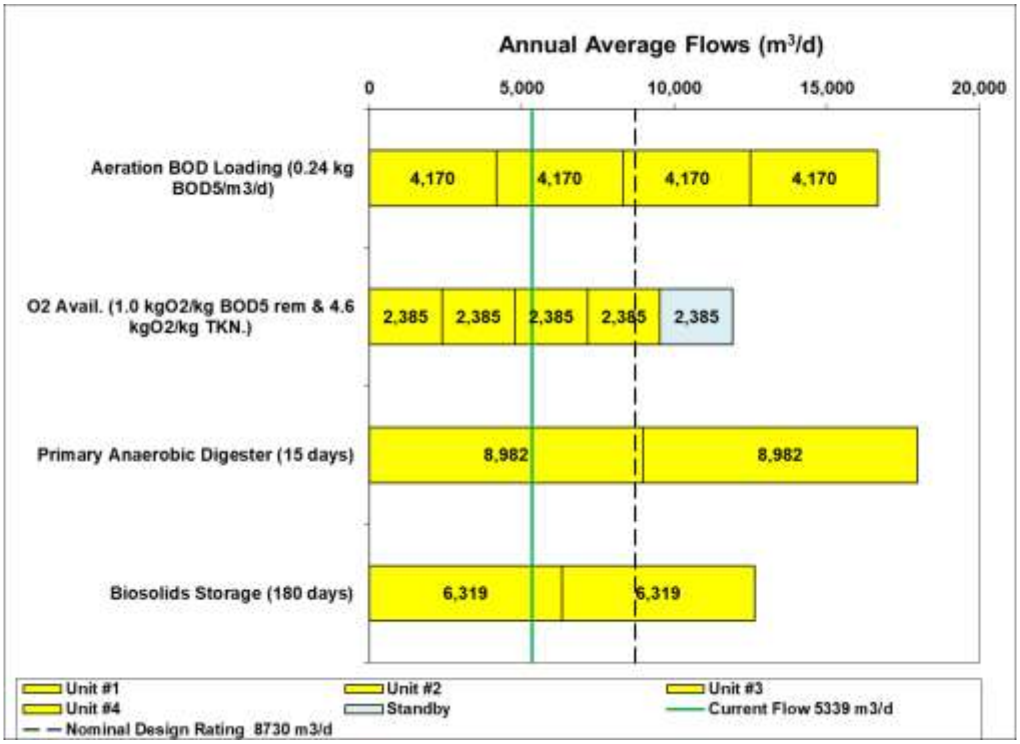

Figure 1: Current process capacities of unit process that would be impacted by return streams by the net-zero project.

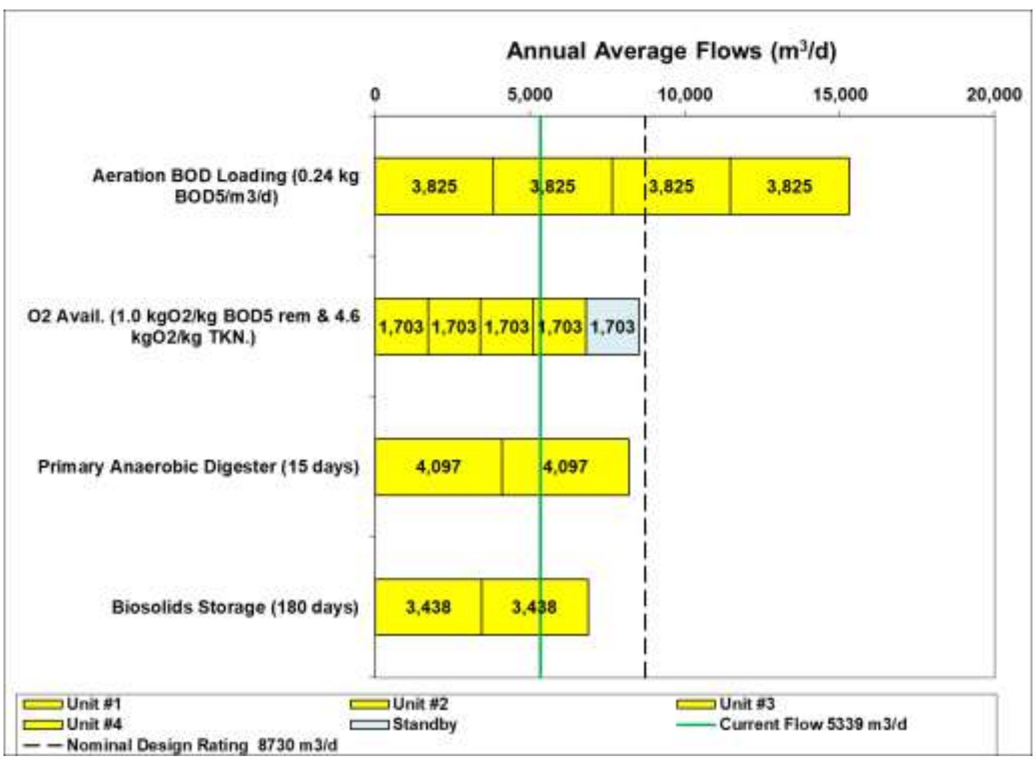

Figure 2: Phase 0 unit process capacities of process impacted by return streams from organic waste processing.

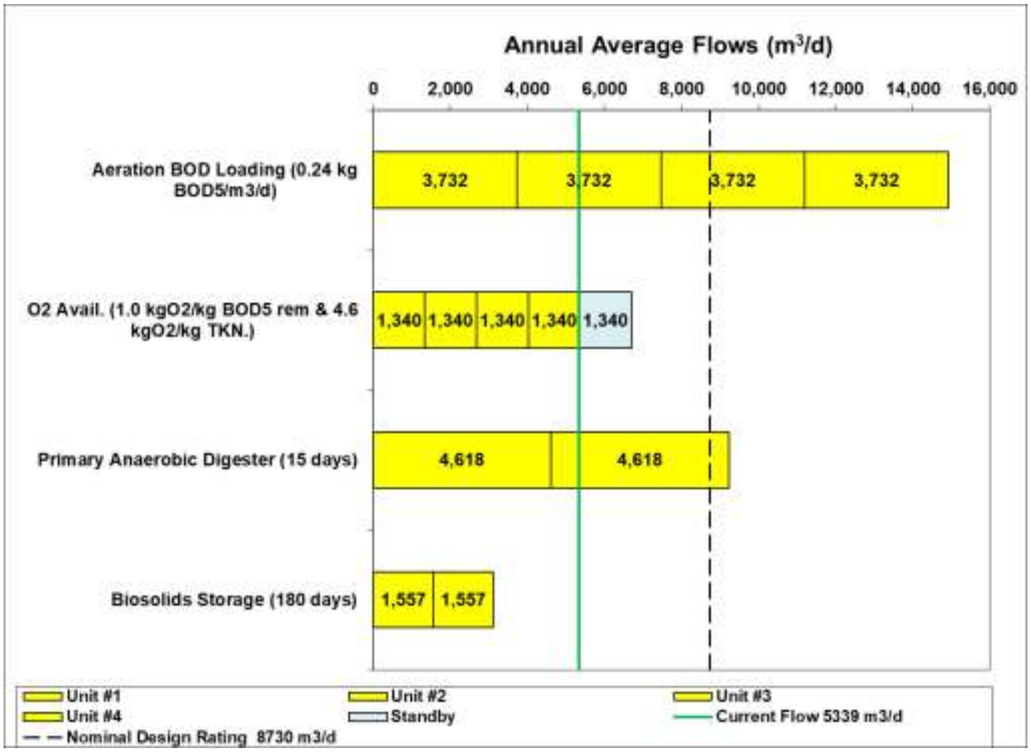

Figure 3: Phase 1-2 unit process capacities of process impacted by return streams from organic waste processing. Note that Phase 0 digester capacity was marginal whereas digester capacity in Phase 1-2 is capable at the rated capacity of the WPCP because of sludge thickening added in Phase 1-2.

Figure 1 shows aeration BOD loading, oxygen availability, primary anaerobic digestion and biosolids storage are capable at current raw sewage flows and at the design capacity of the WPCP (i.e. bars extend to, or to the right of the current sewage flow and the rated capacity).

Figure 2 shows unit process capacities are capable for Phase 0 at current sewage flow rates (i.e. bars extend to the right of the current sewage flow rate of 5,339 m^3/d). However, at the WPCP rated capacity of 8,730 m^3/d, oxygen availability and biosolids storage are not capable (bars do not extend to the rated capacity), and anaerobic digester capacity is marginal (bar is within 80% of the rated capacity). Adequate digester capacity at flow rates approaching the rated WPCP capacity will be achieved operationally by reducing the flow of organic waste fed to the digesters as wastewater flows approach the WPCP design capacity. Aeration capacity at higher flow rates approaching the rated WPCP capacity will be achieved operationally by limiting decanting from storage since the decant stream has a high oxygen demand that reduces the capacity to treat sewage. An operational solution to biosolids storage is to haul and store biosolids off-site when land application sites are not available (e.g. winter months).

Operations staff will closely monitor the impacts of decanting on the treatment process and adjust decanting so the WPCP effluent is in compliance with effluent limits and objectives. Should decant be found to negatively affect the treatment process, operators will cease decanting.

Unit process capacities are capable in Phase 1-2 at current sewage flow rates except for biosolids storage. The deficiency in biosolids storage capacity can be mitigated by hauling and storing biosolids off-site. At higher flow rates approaching the rated WPCP capacity, aeration and biosolids storage are not capable. The operational approach to managing return streams would be to limit unit process operations that return liquid back to the headworks of the WPCP to a level that does not negatively impact the WPCP treatment processes, and limit organic waste reception to minimize the strength and amount of return streams if it is found that the return streams cannot be treated by the WPCP processes. Note that Phase 1-2 is a future phase to be developed based on the lessons learned in Phase 0. At the time of Phase 1-2 development, the WPCP may also undergo expansion and upgrade, which could include treatment processes for return streams to minimize their impacts.

5 Summary and Conclusion

The effluent generated by the Net-Zero Facility will not be directly discharged to a receiving water body. All of the effluent will be treated by the WPCP under compliance of the WPCP Certificate of Authorization. The WPCP is capable of treating the return streams provided operational practices are implemented to mitigate impacts of the return streams on the WPCP treatment processes.

Appendix A: Block Flow Diagrams

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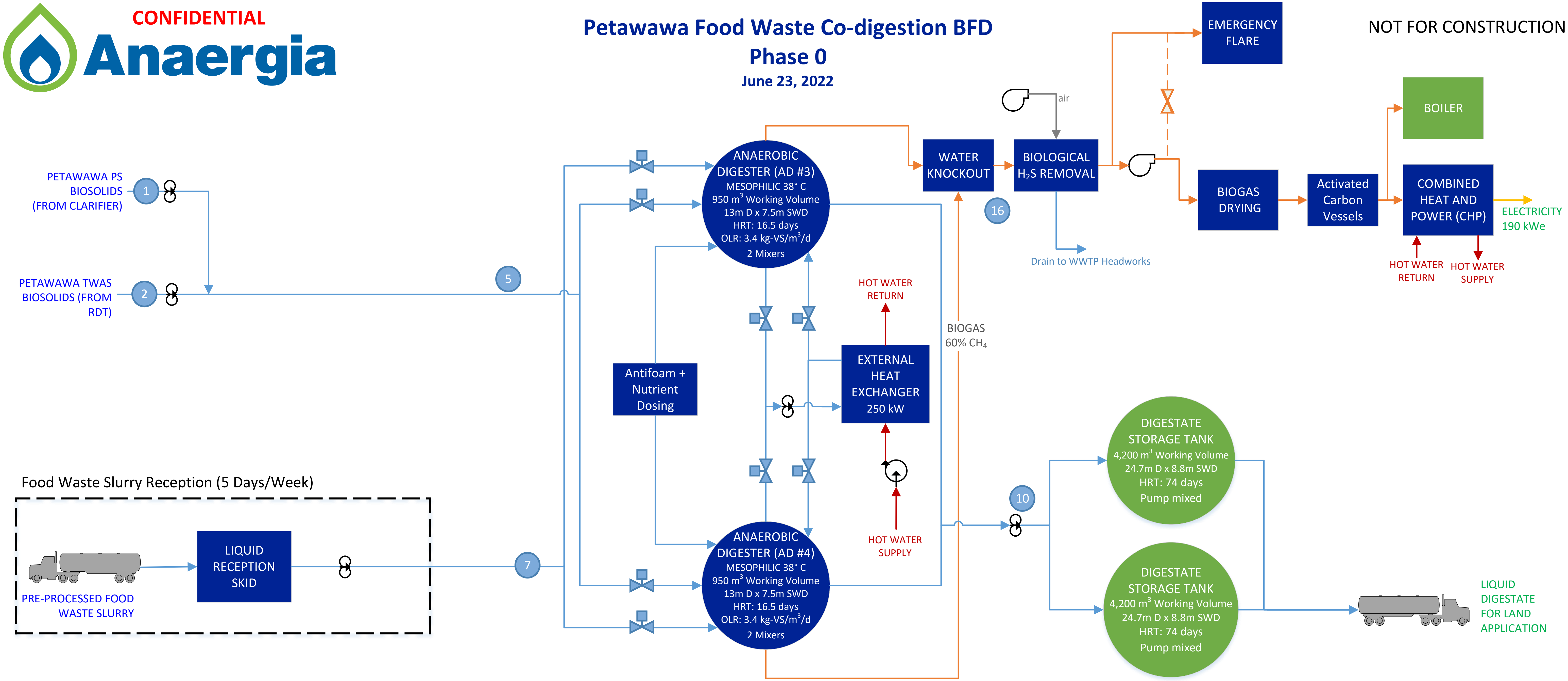
Petawawa Food Waste Co-digestion BFD
Phase 0
June 23, 2022

NOT FOR CONSTRUCTION



Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Stream	PS Feed	WAS Feed	SST Feed	SST dil polymer	AD Sludge Feed	SST Filt to Headworks	Food reception	Food to AD	Sludge and Food to AD	Digestae out of AD	Digestate to SSD	SSD dilute polymer	Cake solids	SSD Filtrate	Liquid dig to land	Biogas (Nm3/day)	Biogas to BUP
Operation days/wk	7	7	NA	NA	7	NA	5	7	7	7	NA	NA	NA	NA	NA	7	NA
Flow (T/day)	29.8	49.0	NA	NA	78.8	NA	41.1	41.1	119.8	113.7	NA	NA	NA	NA	NA	4936	NA
TS	3.0%	2.0%	NA	NA	2.4%	NA	15.0%	15.0%	6.7%	2.2%	NA	NA	NA	NA	NA		
VS:TS	73%	85%					85%	85%	84%								

Comments:

1. Operation is on a 365 days/year, 7 days/week, and 24 hours per day basis unless otherwise specified.
2. Flows are expressed in metric tonnes.
3. External feedstock reception is expected to operate 250 days/year, 5 days/week.

Preliminary Design – For Approval, not for construction

SST 225
Hydraulic Capacity: 35m3/h
Solids Loading Capacity: 700 kg/h

LEGEND

ANAERGIA SCOPE	NOT IN ANAERGIA SCOPE	Optional

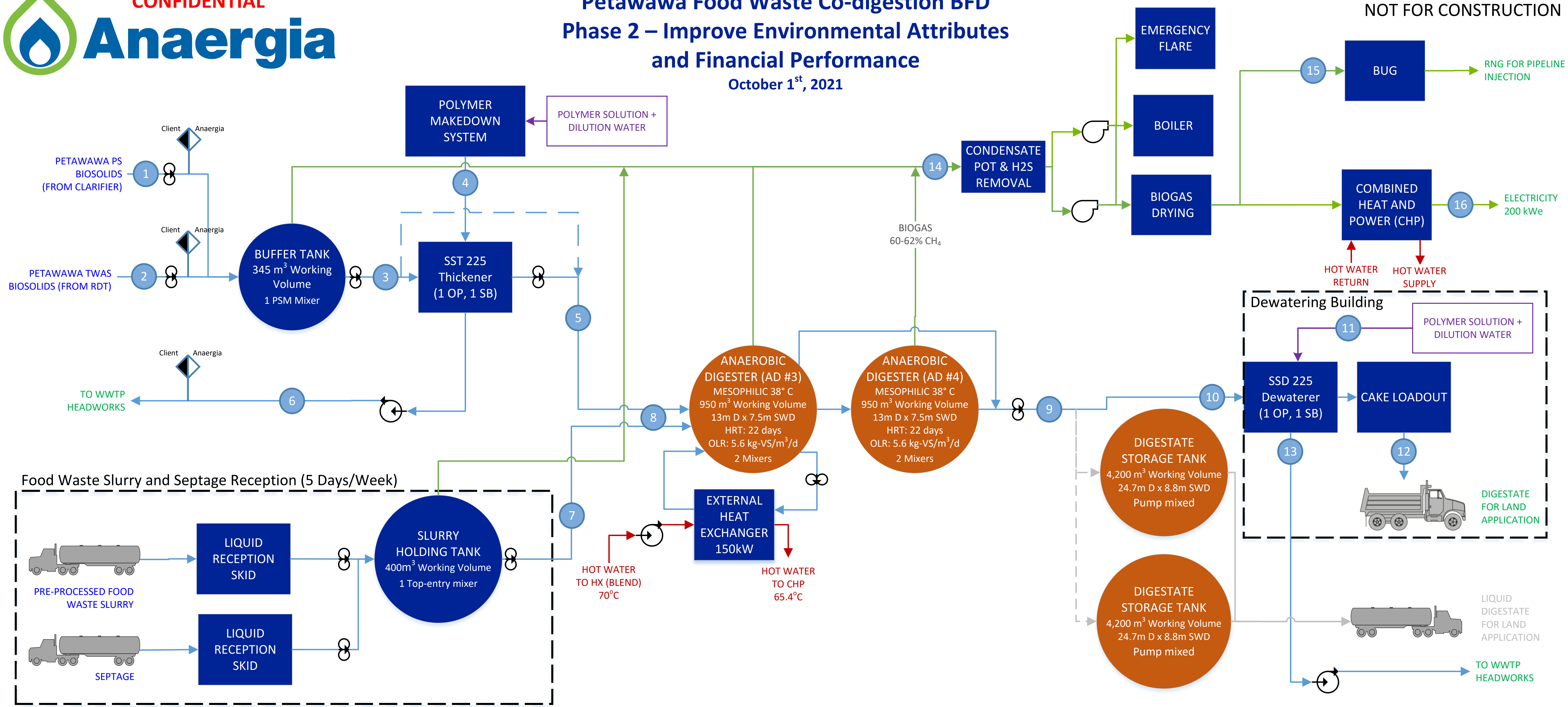
Rev.	Date	Edit.	Check.	Appr.	
03	2021.10.01	JG	RG		
02	2021.06.30	JG	RG		
01	2020.09.14	IK	AK		
04	2022.06.13	ML	AK		
Rev.	**Date**	**Edit.**	**Check.**	**Appr.**	**Drawing No.:**

Drawing Name: Block Flow Diagram
Project: Petawawa Phase 0
Project-No:
Street: 560 Abbie Lane
City: Petawawa, ON
Country: Canada
Customer: Petawawa

CONFIDENTIAL

Petawawa Food Waste Co-digestion BFD
Phase 2 – Improve Environmental Attributes and Financial Performance
October 1st, 2021

NOT FOR CONSTRUCTION



Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Stream	PS Feed	WAS Feed	SST Feed	SST dil polymer	AD Sludge Feed	SST Filt to Headworks	Food to AD	Sludge and Food to AD	Digestate out of AD	Digestate to SSD	SSD dilute polymer	Cake solids	SSD Filtrate	Total Biogas (Nm3/d)	Biogas to BUG (Nm3/d)	Power (kWe)
Operation (days/wk)	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Flow (MT/day)	29.8	49.0	78.8	3.3	14.0	68.0	76.7	90.8	80.0	80.0	6.4	13.2	67.0	8,545	6,669	200
TS	3.0%	2.0%	2.4%	0.2%	12.0%	<1.0%	15.0%	14.5%	4.6%	4.6%	0.2%	25.0%	<1.0%			

Comments:

1. Operation is on a 365 days/year, 7 days/week, and 24 hours per day basis unless otherwise specified.
2. Flows are expressed in metric tonnes.
3. External feedstock reception is expected to operate 250 days/year, 5 days/week.

Preliminary Design – For Approval, not for construction

SST 225
Hydraulic Capacity: 35m3/h
Solids Loading Capacity: 700 kg/h
SSD 225
Hydraulic Capacity: 16m3/h
Solids Loading Capacity: 325 kg/h

LEGEND

NEW BY ANAERGIA	EXISTING MODIFIED BY ANAERGIA	AVAILABLE – ON STANDBY	NOT APPLICABLE

Rev.	Date	Edit.	Check.	Appr.
03	2021.10.01	JG	RG	AK
02	2021.06.30	JG	RG	
01	2020.09.14	IK	AK	
00	2020.09.09	IK	AK	

Drawing No.:

Drawing Name: Block Flow Diagram
Project: Petawawa 30% Design Basis
Project-No:
Street: 560 Abbie Lane
City: Petawawa, ON
Country: Canada
Customer: Petawawa

Appendix B: Effluent Flows from Net Zero Facility to Petawawa WPCP

Source	Average Flow (m3/h)	Peak Flow (m3/h)	Active Hours Per Day	Days Per Year	TSS (mg/L)	TAN (mg/L)	BOD_5 (mg/L	TP (mg/L)	Comments
Sludge storage decant (Phase 0)	1.8	-	-	As Needed	7000	1510	1315	500	Decanting from storage only in Phase 0
Thickening Filtrate (Phases 1-2)	5.7	7.1	12	365	2,750	35	500	35	Filtrate goes to thickening building sump pit prior to transportation to WPCP headworks
Dewatering Filtrate (Phase 1-2)	3.7	4.6	18	365	2,000	2,400	624	500	Filtrate goes to dewatering building sump pit prior to transportation to WPCP headworks
Slurry/Septage Reception - cleaning	Negligible	Negligible	As Needed	250	N/A	N/A	N/A	N/A	Drain from slurry/septage reception area goes to WPCP headworks
Thickening Building - cleaning	Negligible	Negligible	As Needed	365	N/A	N/A	N/A	N/A	Water used for cleaning equipment and any liquid from the trucks in the loadout area goes to a sump, then transported to headworks
Dewatering Building - cleaning	Negligible	Negligible	As Needed	365	N/A	N/A	N/A	N/A	Water used for cleaning equipment in dewatering building goes to sump, then transported to headworks
Biogas Condensate Trap	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
H2S Removal System	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
Conditioning Skid (CHP)	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
Conditioning Skid (Biogas Upgrading)	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
CHP - condensation	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
Biogas Upgrading	Negligible	Negligible	24	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks
Boiler Blowdown	Negligible	Negligible	As Needed	365	N/A	N/A	N/A	N/A	Collected in drain, transported to headworks