Feasibility Study for Wastewater Servicing, Kawartha Downs

October 14, 2021

Prepared for:
RIC (Moore Drive) Inc. & RIC (Highway 28) Inc.

Cambium Reference: 12579-001

CAMBIUM INC.

866.217.7900

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1.0 Introduction

RIC (Moore Drive) Inc. and RIC (Highway 28) Inc. (Client) retained Cambium Inc. (Cambium) to carry out a wastewater feasibility study for a proposed multi-use residential and recreational facility in the community of Fraserville, County of Peterborough, Ontario (Site). The Site consists of three parcels of land comprising 40.9 ha (101 acres) at 1683 Moore Drive, 18.2 ha (45 acres) at 1490 County Road 28, and 48.59 ha (120 acres) at 1382 County Road 28.

The total area of the subject property is approximately 108.15 ha in size. It is understood that 588 residential lots are proposed for the northern portion of the Site, in addition to wastewater servicing for a multi-use recreational complex at the existing Kawartha Downs property. There are no municipal services for water or wastewater currently near the property; therefore, it is understood that any proposed development at the Site would be privately serviced.

This report is to assess the feasibility of wastewater servicing on the Site and includes an assessment of wastewater Packaged Treatment Plant options, their suitable locations and their budgetary estimates in regards to the wastewater servicing within the property.

As part of the scope of work, Cambium was also retained to complete a Geotechnical Investigation (Cambium, 2021a), a Phase I and Phase II Environmental Site Assessment (ESA) (Cambium, 2021b; Cambium, 2021c; Cambium, 2021d), a Preliminary Natural Features Assessment & Ecological Constraints (Cambium, 2021e), a Water Supply Assessment (Cambium, 2021f), and an Environmental Impact Study (EIS) (Cambium, 2021g); each of these reports will be presented under a different cover.

1.1 Site Description

The Site is 108 ha (267 acres) and is L-shaped. The lands at 1683 Moore Drive and 1490 Country Road 28 are currently used for agricultural purposes with some forested and wetland areas present and a residential dwelling on each parcel, while the parcel at 1382 County Road 28 is the existing Kawartha Downs and Speedway property.

The northern portion of the Site is currently vacant field; it is zoned Agricultural (A) as per 'Map D-4' per the Township of Cavan-Monaghan Zoning By-Law 2015-58 Schedule. The southern portion of the Site is developed with a commercial building, paved parking, paved driveways, and a 3/8-mile paved oval racetrack; it is zoned Commercial District 4 (C4) as per plate 'D-4' per the Township of Cavan-Monaghan Zoning By-Law 2015-58 Schedule.

The Site is bordered by natural core, rural residential, and agricultural to the west, hamlet residential and agricultural to the south, County Road 28 to the east, and Moore Drive to the North.

2.0 Physiographic and Geologic Setting

The Site is situated within a Sand Plain area within the Peterborough Drumlin Field Physiographic Region. The Peterborough Drumlin Field is characterized as a rolling glacial till plain with numerous drumlins and drumlinoid hills. The rock underlying this area is limestone of the Lindsay and Verulam Formations. Cambium completed a geotechnical investigation to confirm the existing soils on the Site which were predominately silty sand overburden deposits (see Cambium 2021a).

2.1 Existing Wastewater System - Kawartha Downs and Speedway

Cambium staff visited the Site on August 11, 2021 to conduct an inspection of the existing wastewater system at the Site in order to document, assess layout and complete a condition assessment. Historically, all wastewater was treated by an Advanced Treatment System (ATS) located north of the existing Kawartha Downs building. The ATS consisted of two 10,000 USgal (37,854 L) concrete raw sewage tanks in series, an above ground advanced treatment system (FAST trailer mounted treatment plant), a 5,000 USgal (18,927 L) pump tank and a subsurface disposal bed. It was reported by maintenance staff that this ATS has not been in use for more than five years at the time of inspection. The two 10,000 USgal (37,854 L) concrete raw sewage tanks are now isolated from the remaining wastewater treatment system and are being used as holding tanks. The holding tanks are being regularly pumped every Monday, Wednesday, and Friday of each week. As such, further intrusive inspection was not completed on the existing wastewater system.

It should be noted that the Race Office, containing a single water closet but is a separate building from the Kawartha Downs building, is also serviced by the sewage system described above. Also, much further north of the Kawartha Downs building but on the same large parcel of land, are two farmhouses currently being rented as single-family dwellings. Each were reported to be serviced by their own septic system but not intrusively inspected.

Considing the historical operation issues of the existing large subsurface sewage treatment system servicing the Karwartha Downs property, this system would not be suitable to incorporate into any future redevelopment plans for the Site.

3.0 Sewage Flow Design

Design sewage flows were calculated using the 2008 Sewage Design Guidelines from the Ministry of Environment, Conservation and Parks (MECP) (Ministry of Environment, 2008). The extent of the development of the commercial/entertainment lands is unknown at this time but has been estimated to be upwards of 100,000 L/day as a conservative estimate.

				L/day	
Residential Development	588 Units	*2.4	275	**388,080**	*Assumed 2.4 people per housing unit as per standard practice for subdivision in Ontario
Single Detached	123 units				
Semi-Detached	272 units				
Townhouses	193 units				
Entertainment Centre			100,000	**100,000**	Estimated - extent of development is unknown at this time
				488,080	
Total Site Average Design Flow			**488,080**	**L/Day**	
Total Site Average Design Flow			**488**	**m^3/d**	
The minimum permissible peaking factor			**2**		As per MECP 2008 Guidelines
Peak Design Flow			**976**	**m^3/d**	

3.1 Domestic Sewage Characteristics

The typical characteristics of domestic strength sewage for the proposed development, as per Section 8.2, Table 8-1, Note 1, MECP Guidelines are presented as follows (Ministry of Environment, 2008):

BOD_5 -	150 to 200	mg/L
TSS -	150 to 200	mg/L
TKN -	30 to 40	mg/L
TAN -	20 to 25	mg/L
TP -	6 to 8	mg/L

4.0 Conceptual Wastewater Servicing

A total of 588 residential lots are proposed for the northern portion of the Site while it is proposed to redevelop the southern portion into a multi-use recreational complex which may include sport fields, hotel, resturants and enterntainment venues; however the extent of the redevelopment is unknown at this time. Considering the density of the proposed residential development, servicing the lots with individual on-site sewage (septic) systems would not be deemed feasible. Furthermore, a communal large subsurface disposal system would require a large land area for the disposal field, with approximately 9,760 m^2 required for a Type A Area Bed plus the addition tank area for an Advanced Treatment system. As such, considering the proposed development area, there is inadequate land area for a communal on-site subsurface disposal system.

A wastewater Packaged Treatment Plant may be feasible for the treatment and disposal of wastewater from the Site. It is understood that this development would also be an opportunity for additional growth to the area with potential surrounding dwellings connecting to the wastewater treatment system as well.

5.0 Packaged Treatment Plant Options

There are multiple modular Packaged Treatment Plants (PTP) technologies which would be feasible for servicing the Site, such as:

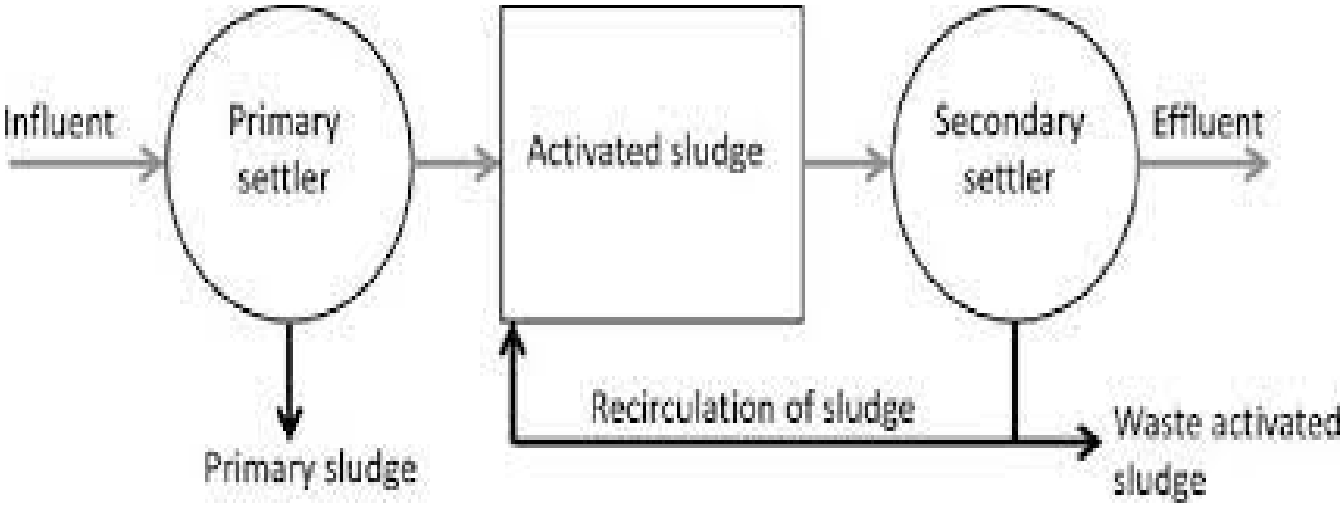
- Conventional Activated Sludge (CAS) system
- Sequential Batch Reactor (SBR) system
- Extended Aeration (EA) system
- Membrane Bio-Reactor (MBR) system based aerobic treatment technology

These technologies have routinely been installed and operating province wide.

Standard treatment system will generally comprise of a screening or grit chamber, primary clarification or sedimentation, an aeration tank where aerobic microorganisms will be biologically active, a secondary clarification unit and a tertiary treatment unit such as a ultraviolet (UV) disinfection unit.

5.1 Option 1: Conventional Activated Sludge System

A Conventional Activated Sludge (CAS) system commonly includes a primary clarifier, an aeration tank, which is used for biological degradation, and a secondary clarifier (sedimentation tank), where the sludge in separated from the treated wastewater (refer to process flow diagram). The first step in the CAS system is a screening chamber followed by a primary clarification and the second step is aeration. The aeration tank or basin will be followed by a secondary clarifier or a final settling tank. A part of the micro-organisms are fed back into the aeration tank from the secondary clarifier in order to keep load of micro-organisms at a sufficient level for the biological degrading process to be continued. This shall be controlled based on required F/M ratio and MLSS in the aeration tank. Finally, effluent from secondary clarifier is transported to a disinfection unit such as Ultraviolet Disinfection Unit or any other tertiary treatment process prior to discharging into the receiving water body.



Apart from treatment train within the plant, a sludge holding tank is also reaquired as a standard practice. The location of this unit depends on the manufacturer of the package plant; it could be attached to the CAS Plant Pad or installed separately, but in close proximity to the main plant.

5.1.1 CAS PTP Effluent Characteristics

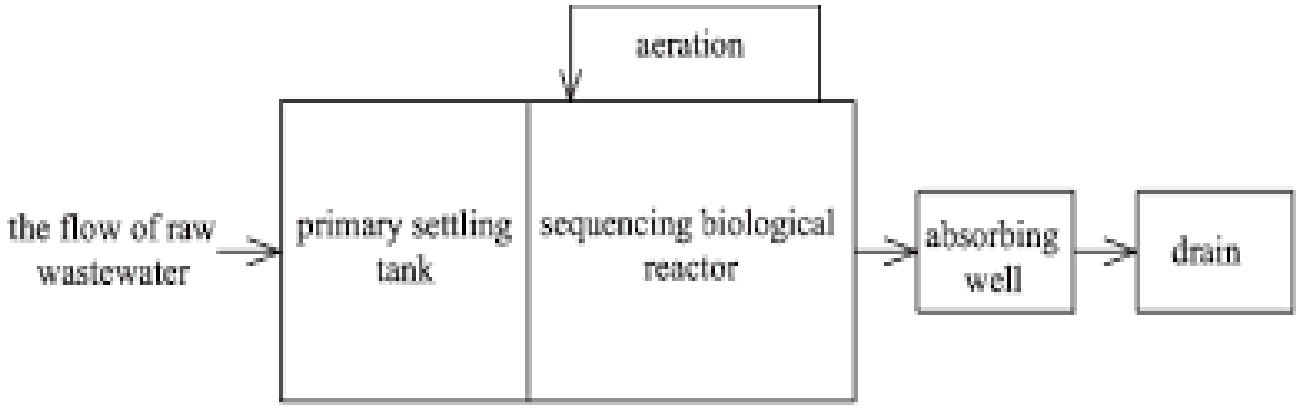
CAS Packaged Plants can achieve the required biological degradation, nitrification and phosphorus removal. The typical effluent quality from treatment from a CAS system is outlined in Section 8.2, Table 8-1 of the MECP Guidelines and is presented as follows:

BOD_5 -	15	mg/L
TSS -	15	mg/L
TAN -	3	mg/L
TP -	<1.0	mg/L

5.2 Option 2: Sequencing Batch Reactor System

The Sequencing Batch Reactor System (SBR) is one of the common biological systems used to treat domestic wastewater due to its functionality and simplicity. The SBR process utilizes a fill-and-draw reactor with complete mixing during the batch reaction step (after filling the reactor) where the subsequent steps of aeration and clarification occur in the same tank. All SBR systems have a few steps in common, which carried out in sequence, such as fill and settle, react (aeration), final settle (sedimentation/ clarification) and sludge draw (decant). All

actions in the reactor occur at a separate sequence of time period. Finally, a disinfection system such as Ultraviolet (UV) Disinfection System will be attached to the SBR packaged treatment system to remove total coliforms and fecal coliforms as required by MECP's prescribed limit for discharge.



5.2.1 SBR CAS PTP Effluent Characteristics

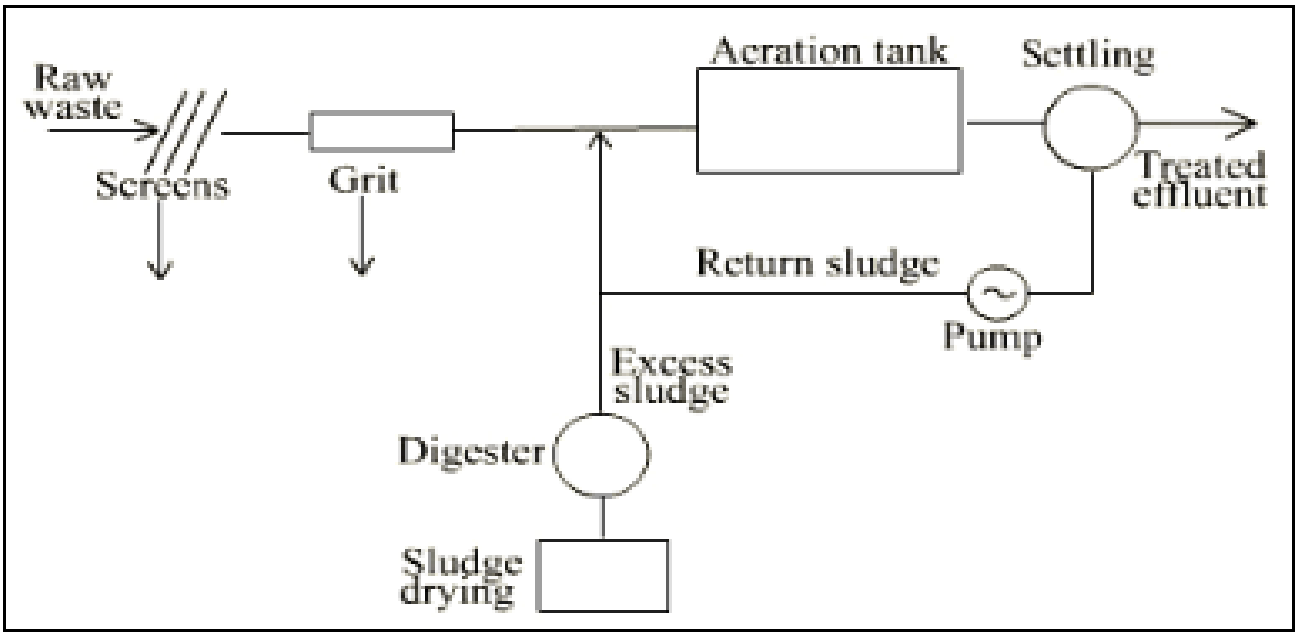
A SBR Packaged Treatment System will achieve the similar performance with that of a CAS Packaged Treatment System. It shouldbe noted that a SBR system is another form of a CAS system and its performance level is as per Section 8.2, Table 8-1 for CAS Systems, MECP 2008 Guidelines and is presented as follows:

BOD_5 -	15	mg/L
TSS -	15	mg/L
TAN -	3	mg/L
TP -	<1.0	mg/L

5.3 Option 3: Extended Aeration System

The Extended Aeration (EA) Process, a modification of the Conventional Activated Sludge (CAS) Process, effectively treats wastewater. The standard basis of design includes an aeration system, providing a 24-hour detention time and a final settling tank, with an effective 4-hour detention time for biological activities. Diffused air is introduced into the aeration tank

which provides the proper environment for the development of aerobic bacteria, which in turn process the nutrients and organic material in the wastewater. The prolonged period of aeration also oxidizes a portion of the solids in the system. Oxygenation by diffused aeration provides operating flexibility and standby reserve to meet the demanding requirements of varied package plant applications. Separation of the solids from the mixed liquor developed in the aeration tank takes place in the settling compartment. The clarified effluent is withdrawn for reuse or discharged into a receiving stream from the top of the settling tank. The settled solids are rapidly pumped from the bottom of the settling tank back to the aeration system. Extended Aeration Plants provide excellent Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) removal efficiency, with only minimal routine maintenance and operational tasks required of the plant operator. An Ultraviolet (UV) Disinfection System shall be normally attached to this system for removal of e-coli, other harmful bacteria and viruses.



5.3.1 CAS PTP Effluent Characteristics

The typical effluent quality from treatment from a EA system is outlined in Section 8.2, Table 8-1 of the MECP Guidelines and is presented as follows:

BOD_5 (C) -	15	mg/L	As per Section 8.2 Table 8.1 EA (with P-removal) MECP 2008 Guidelines
TSS -	15	mg/L	- Same -
TAN -	3	mg/L	- Same -
TP -	<1.0	mg/L	- Same -

5.4 Option 4: Membraine Bio-Reactor Treatment System

The Membrane Bio-Reactor (MBR) based treatment systems are also a viable option to treat domestic sewage and municipal sewage. However, the larger footprint requirements and the capital cost of such treatment systems are higher compared to the other options, as is the cost of replacing the membranes. Furthermore, the operation & maintenance costs as compared to other options are also cost prohibitive. Therefore, the MBR systems will not be feasible for a medium sized development such as proposed.

5.5 Tertiary Disinfection System

The wastewater treatment system will require tertiary treatment for the disinfection of bacteria, prior to discharge. The fecal coliform count in the untreated raw sewage in Ontario is approximately in the range of 10^4 - 10^6 per 100 mL. The MECP has prescribed a limit of 200 per 100 mL for fecal coliforms in the treated effluent.

An Ultraviolet (UV) disinfection system can achieve removal of fecal coliforms from 10^4 - 10^6 to less than 200 per 100 mL as is documented by the MECP for ECA-approved Packaged Treatment Plants.

5.6 Location of PTP and Surface Water Receivers

The most feasilble location for the PTP is on the eastern portion of the Site, between the proposed residential development on the northern portion of the Site, and the recreation lands to the south, as shown on Figure 2. For this Option, it is assumed that up to two (2) pumping stations may be required to move wastewater from the western portion of the proposed residential development to the PTP location. This location was deemed suitable based on the existing contours, extent of the proposed developmetn and the constraints proscribed by the locations of the provincially significant wetlands and their required setback.

Discharge would be via a dry ditch to the seasonal watercourse towards the east, which flows into the Otonabee River, although this would require a conveyance across Peterborough County Road 28. Alternatively, discharge could be into the Cavan Wetland complex located on the central portion of the Site and directly west of the PTP location, which flows to the west thgrough a seasonal watercourse off the property, into Cavan Creek to the north and ultimately flowing into the Otonabee River.

The wastewater treatment plant will require an Environmental Compliance Approval (ECA) from the Ministry of the Environment, Conservation and Parks (MECP). It is presumed that the Ministry may require stringent treatment for discharging into a dry ditch such as tertiary treatment disinfection, phosporus removal and filtration. Additional consultation with the Ministry will be required to determine which surface water receiver is suitable; additional natural heritage studies may also be required to assess the aquatic environment of the surface water receiver as well.

5.7 Estimated Budgetary Costs

The estimated costs for the three PTP options are presented in Table 1 below. The estimates include the cost of the equipment, concrete, installation, exaction, permitting, enginneering, etc.

Embedded Table 1 Budgetary Cost Comparisons for PTP Options

System	Overall Footprint	Estimated Cost
Sequencing Batch Reactor (SBR)	20 x 13 m	$ 2,500,000
Extended Aeration System (EA)	35 x 15 m	$2,627,000
Conventional Activated Sludge System (CAS)	40 x 14 m	$2,988,000

Overall, the cost of the SBR PTP is the lowest due to the smaller footprint size as this relates to the amount of concrete and excavation required. Assuming that the SBR technology is selected as the preferred treatment option, an overall estimate of the wastewater treatment system is presented in Table 2.

Embedded Table 2 Estimated Cost of Wastewater Treatment System

Item	System Equipment	Estimated Cost
1	SBR PTP	$2,500,000
2	Tertiary Filtration (if required)	$ 150,000
3	Chemical Feed System (if required)	$ 25,000
4	UV System	$ 50,000
5	2 Pumping Stations	$ 620,000
6	Discharge & Outfall	$ 100,000
	Total Estimated Cost	**$3,270,000 to $ 3,445,000**

6.0 Closing

A Package Treatment Plant incorporating SBR, CAS or EA technology is feasible to service the proposed development; which includes both the residential development of 588 houses and the proposed redevelopment of the recreation lands on the Kawartha Downs lands. The daily sewage flow is calculated to be approximately 488 m^3 with peak usage up to 976 m^3.

The PTP will require adequate Ultraviolet (UV) disinfection system and possibly additional phosphorus treatment and filtration for dry ditch discharge. The discharge would be directed either to the west through an unnamed seasonal water course located on the east side of Peterbourgh County Road 28, which flows into the Otonabee River, or alternatively, to the west into the Cavan Wetland Complex located on the property; the Cavan Wetland Complex is the headwater area which drains into the Cavan Creek to the north, which ultimately flows into the Otonabee River.

An Environmental Compliance Approval will be required from the Ministry of the Environment, Conservation and Parks for the PTP and the location of the sewage outfall, and will require additional studies to assess a suitable surface water receiver.

Respectfully submitted,

Cambium Inc.

Jim Bailey, P.Eng.
Vice President

Kevin Warner, M.Sc., P.Geo., BCIN
Group Manager – Water & Wastewater

KDW/kdw

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7.0 References

Cambium. (2021a). *Geotechnical Investigation Report - 1683 Moore Drive and 1490 County Road 28, Fraserville, Ontario.* Cambium Inc.

Cambium. (2021b). *Phase I Environmental Site Assessment - 1382 County Road 28, Fraserville, Ontario.*

Cambium. (2021c). *Phase I Environmental Site Assessment - 1683 Moore Drive and 1490 County Road 28, Fraserville, Ontario.*

Cambium. (2021d). *Phase II Environmental Site Assessment - 1683 Moore Drive and 1490 County Road 28, Fraserville, Ontario.*

Cambium. (2021e). *Preliminary Natural Features Assessment & Ecological Constraints Analysis at Kawartha Downs & Speedway, Fraserville, Ontario.*

Cambium. (2021f). *Water Supply Summary, Kawartha Downs, Fraserville.*

Cambium. (2021g). *Environmental Impact Study - 1490 County Road 28 and 1683 Moore Drive, Fraserville, Cavan-Monaghan, County of Peterborough, Ontario.*

Ministry of Environment. (2008). *Design Guidelines for Sewage Works.*

8.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

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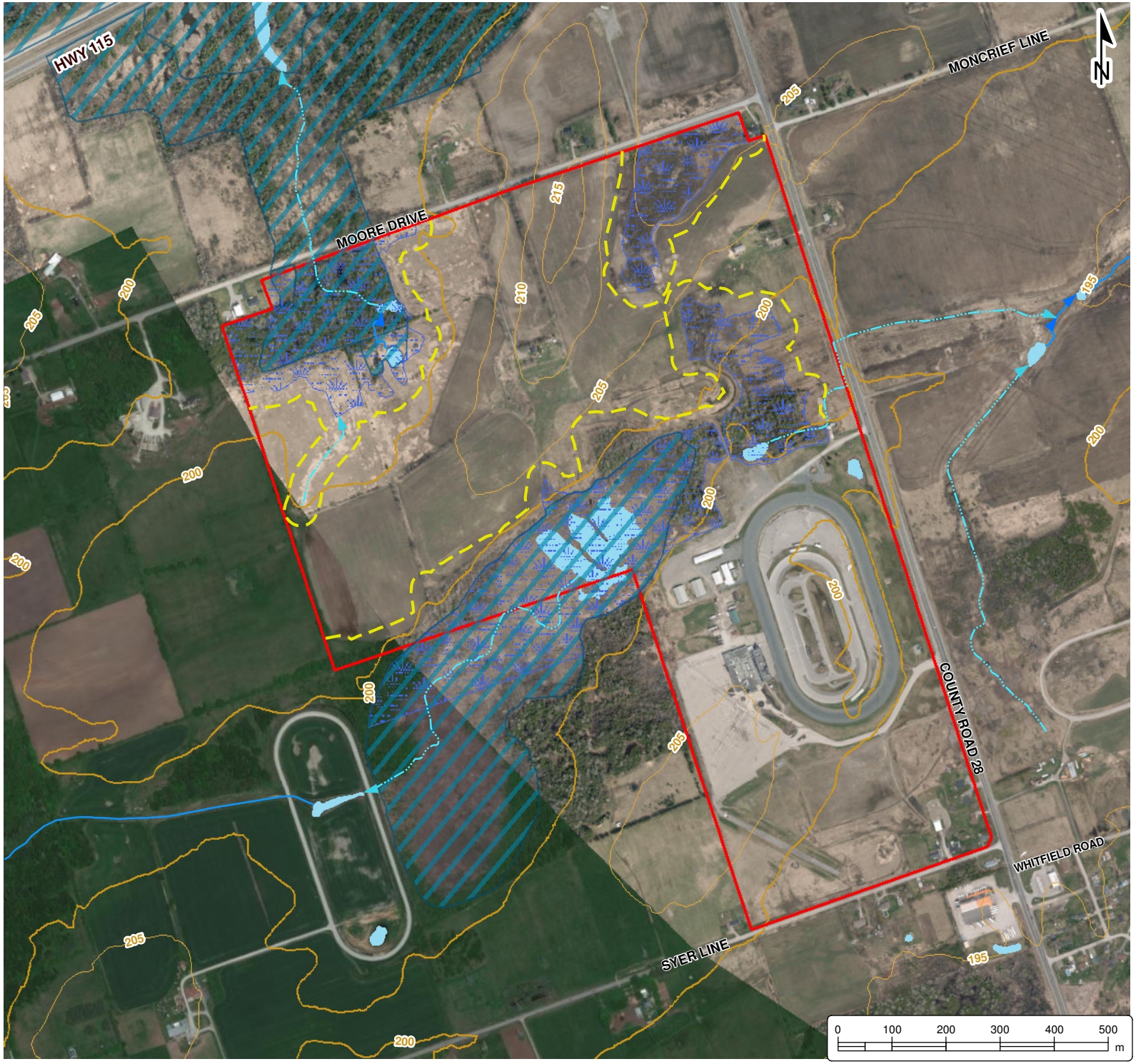
The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

Appended Figures



FEASIBILITY STUDY FOR WASTEWATER SERVICING

ROMSPEN INVESTMENT CORPORATION

Kawartha Downs and Speedway
Fraserville, Ontario

LEGEND

- 30m Development Wetland Setback
- Watercourse, Intermittent
- Watercourse, Permanent
- Contour 5m Interval (Major)
- Contour 5m Interval (Minor)
- Water Area
- Wetland Community
- Provincially Significant Wetland
- Subject Property (111.03 ha) (approximate)

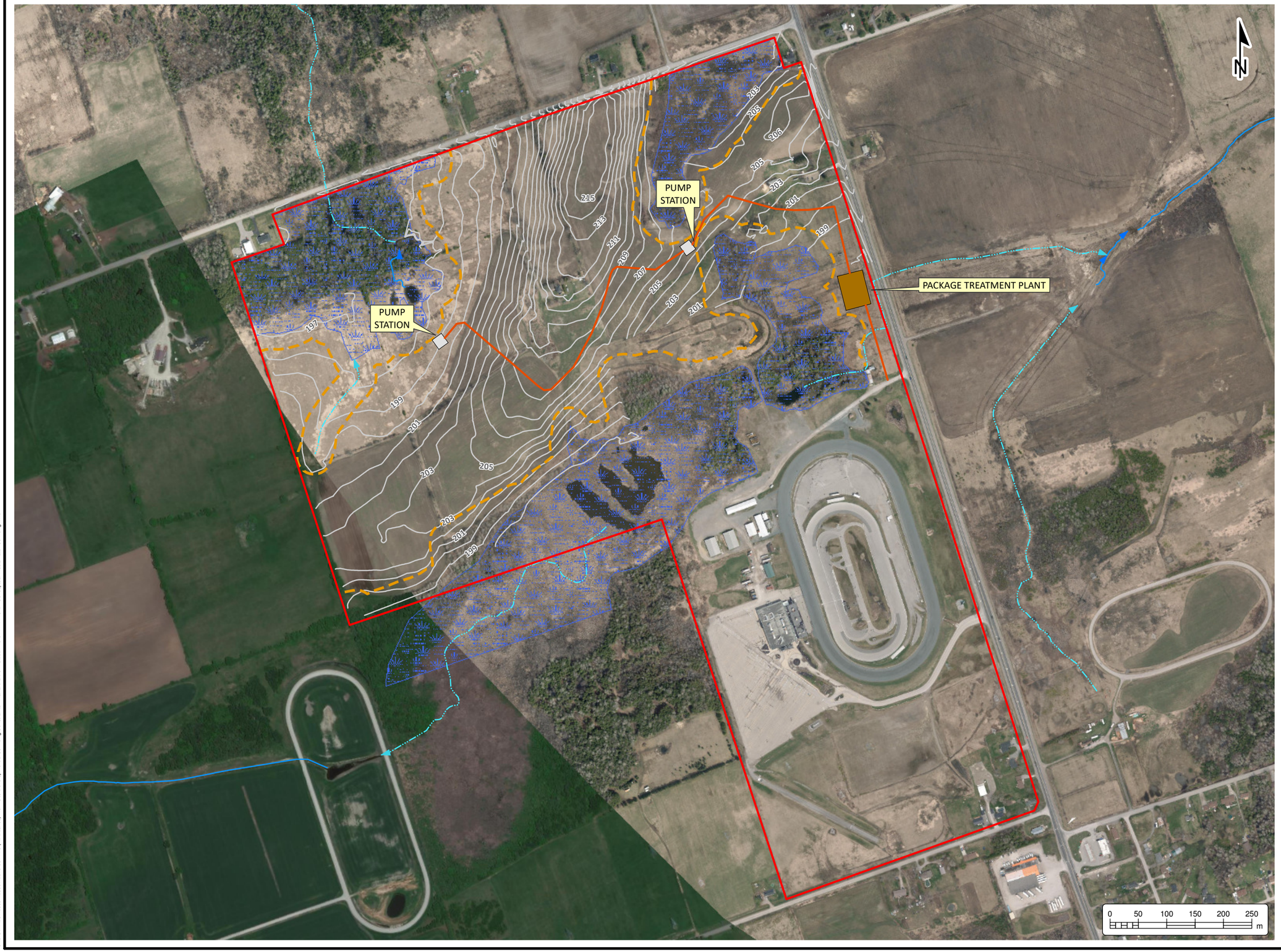
Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE PLAN

Project No.: 12579-001		Date: October 2021	Rev.:
Scale: 1:10,000		Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: KW	Figure: 1	

O:\GIS\MXDs\12500-12999\12579-001 RIC (KDL Lands) Inc. - Site Development & Servicing Constraints - Kawartha Downs\2021-10-14 WW FIG 1 - Site Plan.mxd



WASTEWATER FEASIBILITY ASSESSMENT

ROMSPEN INVESTMENT CORPORATION

Kawartha Downs and Speedway, Fraserville, Ontario

LEGEND

- 30m Significant Feature Setback
- Contour (1m intervals)
- Watercourse, Intermittent
- Watercourse, Permanent
- Forcemain
- Wetland
- Pump Station
- Package Treatment Plant
- Site (approximate)

Notes:

- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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CAMBIUM

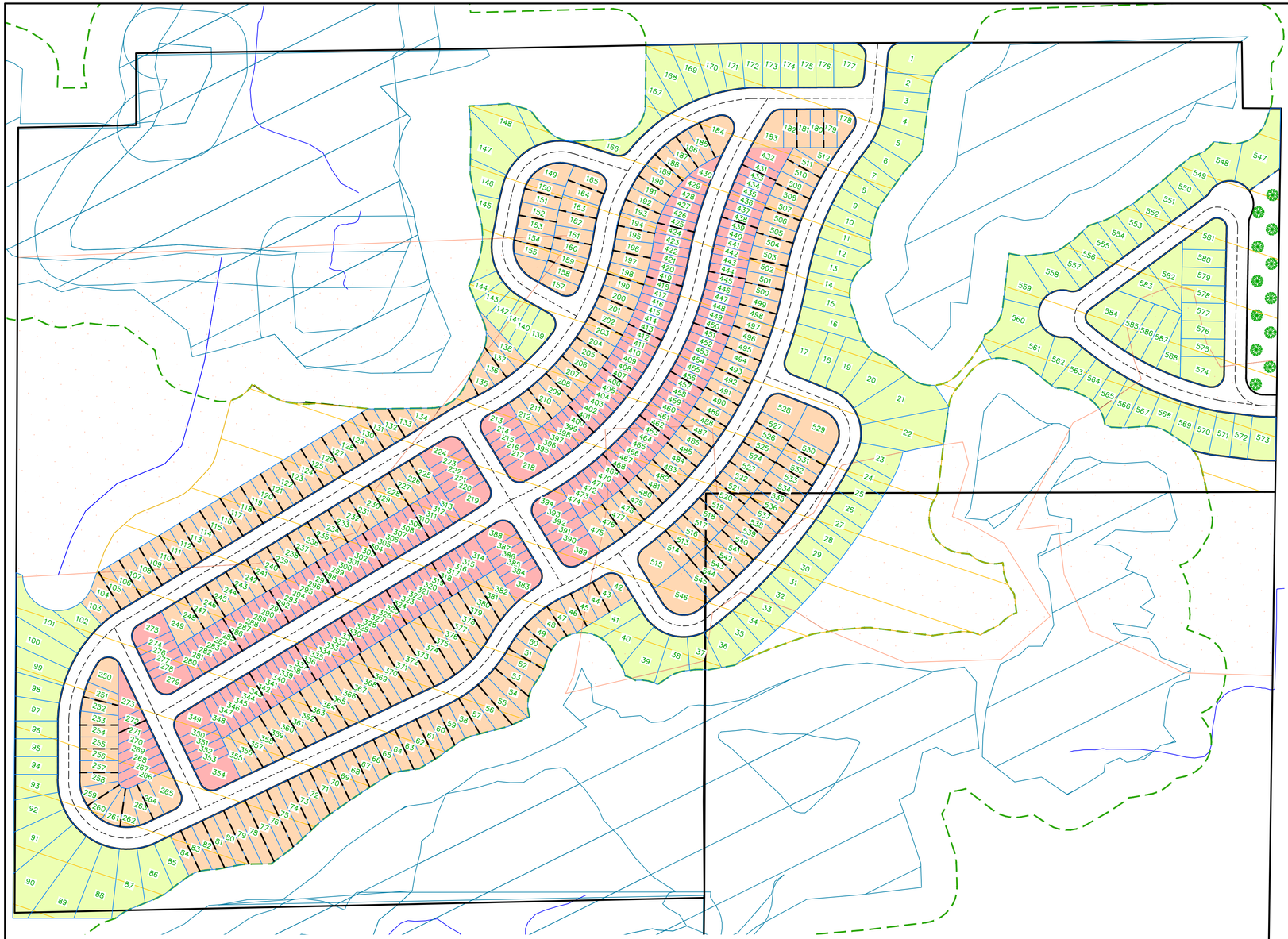
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

CONCEPTUAL WASTEWATER SERVICING

Project No.: 12579-001	Date: October 2021	
Scale: 1:6,500	Projection: NAD 1983 UTM Zone 17N	
Created by: MAT	Checked by: KW	Figure: 2

O:\GIS\MXDs\12500-12599\12579-001 RIC (KDL Lands) Inc. - Site Development & Servicing Constraints - Kawartha Downs\2021-10-01 WW FIG 2 - Conceptual Wastewater Servicing.mxd

Appendix A
Conceptual Site Plan



MUNICIPAL SERVICES

123 LOTS

URBAN RESIDENTIAL ONE ZONE:
SINGLE DETACHED DWELLING
MIN. LOT AREA: 555 SQ.M.
MIN. LOT FRONTAGE: 15 M. AND 18 M. FOR CORNER LOT

272 LOTS

URBAN RESIDENTIAL TWO ZONE:
SEMI-DETACHED AND SEMI DETACHED LINKED
MIN. LOT AREA: 325 SQ.M.
MIN. LOT FRONTAGE: 10 M. AND 15 M. FOR CORNER LOT

193 LOTS

URBAN RESIDENTIAL THREE ZONE:
TOWNHOUSE
MIN. LOT AREA: 800 SQ.M. AND 240 SQ. M. PER TOWNHOUSE UNIT
MIN. LOT FRONTAGE: 20 M. AND 7.5 M. PER TOWNHOUSE UNIT

RIGHT OF WAY

CITY OF PETERBOROUGH STANDARD CROSS SECTION
URBAN CROSS SECTION
FULLY SERVICED
SIDEWALK ON BOTH SIDES

8.5m ROAD WIDTH (GUTTER TO GUTTER)
18.5m ROW
MIN. CURB RADIUS 10.7m

PROBABLY BREEDING GRASSLANDS (DEVELOPED GRASSLANDS 6.13ha)

DEVELOPMENT AREA

WETLAND

Parcel #	Area	Parcel #	Area	Parcel #	Area	Parcel #	Area	Parcel #	Area	Parcel #	Area
1	1419.75m	99	828.28m	197	351.68m	295	248.74m	393	279.23m	491	325.00m
2	581.60m	100	1031.48m	198	351.85m	296	248.94m	394	386.34m	492	325.00m
3	585.73m	101	1332.19m	199	351.94m	297	249.13m	395	240.50m	493	325.00m
4	719.40m	102	555.00m	200	351.95m	298	249.33m	396	240.50m	494	325.00m
5	770.21m	103	325.00m	201	351.88m	299	249.53m	397	240.50m	495	325.00m
6	634.75m	104	394.79m	202	351.73m	300	249.73m	398	240.50m	496	325.00m
7	555.00m	105	370.34m	203	351.50m	301	249.93m	399	240.50m	497	325.00m
8	555.00m	106	370.81m	204	351.18m	302	250.12m	400	240.50m	498	325.00m
9	555.00m	107	371.29m	205	350.79m	303	250.32m	401	240.50m	499	325.00m
10	557.72m	108	370.91m	206	350.32m	304	250.52m	402	240.50m	500	325.00m
11	601.96m	109	371.59m	207	349.78m	305	250.72m	403	240.50m	501	325.00m
12	632.34m	110	371.52m	208	349.15m	306	250.91m	404	240.50m	502	342.86m
13	555.00m	111	371.45m	209	348.46m	307	251.11m	405	240.50m	503	344.70m
14	555.00m	112	371.37m	210	347.69m	308	251.31m	406	240.50m	504	344.70m
15	671.82m	113	371.30m	211	346.85m	309	251.51m	407	240.50m	505	344.70m
16	849.74m	114	371.23m	212	359.44m	310	251.71m	408	240.50m	506	344.70m
17	1113.78m	115	371.16m	213	414.62m	311	251.90m	409	240.50m	507	344.70m
18	682.91m	116	371.09m	214	257.28m	312	250.39m	410	240.50m	508	344.70m
19	970.94m	117	371.01m	215	257.28m	313	250.30m	411	240.50m	509	344.70m
20	1198.00m	118	370.94m	216	257.28m	314	391.03m	412	240.50m	510	344.70m
21	1819.03m	119	370.87m	217	257.28m	315	261.05m	413	240.50m	511	344.68m
22	1872.70m	120	370.80m	218	589.20m	316	246.24m	414	240.50m	512	325.00m
23	763.81m	121	370.73m	219	570.01m	317	247.06m	415	240.50m	513	339.46m
24	577.66m	122	370.65m	220	289.43m	318	247.88m	416	240.50m	514	339.46m
25	577.66m	123	370.58m	221	290.85m	319	248.70m	417	240.50m	515	845.94m
26	577.66m	124	370.51m	222	292.27m	320	249.52m	418	240.50m	516	339.46m
27	577.66m	125	370.44m	223	293.68m	321	250.33m	419	240.50m	517	339.46m
28	577.66m	126	370.37m	224	515.11m	322	251.15m	420	240.50m	518	339.46m
29	577.66m	127	370.29m	225	337.04m	323	251.97m	421	240.50m	519	339.46m
30	577.66m	128	370.22m	226	325.00m	324	252.79m	422	249.80m	520	339.46m
31	577.66m	129	370.15m	227	325.00m	325	253.61m	423	251.24m	521	339.46m
32	577.66m	130	370.08m	228	325.00m	326	254.43m	424	251.47m	522	339.46m
33	577.66m	131	364.37m	229	325.00m	327	255.24m	425	247.10m	523	339.46m
34	577.66m	132	325.00m	230	325.00m	328	256.06m	426	240.54m	524	339.46m
35	577.66m	133	325.00m	231	325.00m	329	256.88m	427	240.54m	525	339.46m
36	686.60m	134	604.75m	232	325.00m	330	257.70m	428	240.54m	526	339.46m
37	629.17m	135	325.00m	233	325.00m	331	258.52m	429	240.54m	527	339.46m
38	727.77m	136	325.00m	234	325.00m	332	259.33m	430	284.42m	528	684.19m
39	1065.91m	137	352.38m	235	325.00m	333	260.15m	431	241.77m	529	1020.12m
40	876.79m	138	465.22m	236	325.00m	334	260.97m	432	508.27m	530	354.25m
41	709.93m	139	687.47m	237	325.00m	335	261.79m	433	241.77m	531	354.25m
42	323.32m	140	394.44m	238	325.00m	336	262.61m	434	241.77m	532	354.25m
43	325.00m	141	380.35m	239	325.00m	337	263.42m	435	241.77m	533	354.25m
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52	399.90m	150	326.47m	248	325.00m	346	270.79m	444	255.56m	542	354.25m
53	411.34m	151	354.89m	249	471.53m	347	271.60m	445	255.96m	543	354.25m
54	508.23m	152	351.51m	250	544.16m	348	338.08m	446	256.34m	544	354.25m
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56	494.40m	154	357.61m	252	325.00m	350	243.75m	448	257.07m	546	1107.96m
57	426.86m	155	336.28m	253	325.00m	351	243.75m	449	257.41m	547	1595.16m
58	378.84m	156	360.78m	254	325.00m	352	243.75m	450	257.74m	548	856.25m
59	335.60m	157	364.30m	255	325.00m	353	243.75m	451	258.04m	549	555.00m
60	347.40m	158	358.61m	256	325.00m	354	716.57m	452	258.34m	550	555.00m
61	365.96m	159	358.61m	257	325.00m	355	338.21m	453	258.61m	551	555.00m
62	377.60m	160	358.61m	258	325.00m	356	379.85m	454	258.87m	552	555.00m
63	384.17m	161	358.61m	259	325.00m	357	391.09m	455	259.11m	553	555.00m
64	359.22m	162	392.44m	260	325.00m	358	402.34m	456	259.34m	554	555.00m
65	332.92m	163	392.44m	261	325.00m	359	413.58m	457	259.54m	555	570.53m
66	331.86m	164	392.44m	262	325.00m	360	424.83m	458	259.73m	556	559.18m
67	344.79m	165	440.20m	263	325.00m	361	436.07m	459	259.91m	557	558.41m
68	358.32m	166	1320.23m	264	325.00m	362	447.32m	460	260.06m	558	853.56m
69	372.57m	167	663.80m	265	636.07m	363	458.57m	461	260.20m	559	1123.78m
70	388.88m	168	1009.44m	266	317.95m	364	469.81m	462	260.32m	560	1188.92m
71	405.33m	169	847.88m	267	318.99m	365	481.06m	463	260.42m	561	1121.81m
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73	451.81m	171	664.06m	269	265.71m	367	503.55m	465	260.57m	563	604.33m
74	483.74m	172	627.87m	270	240.00m	368	514.79m	466	260.61m	564	555.00m
75	515.67m	173	561.56m	271	240.00m	369	526.04m	467	260.64m	565	561.75m
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77	563.25m	175	561.05m	273	473.74m	371	548.53m	469	260.64m	567	555.00m
78	567.41m	176	560.80m	274	243.75m	372	559.14m	470	260.62m	568	555.00m
79	524.49m	177	938.81m	275	537.74m	373	572.82m	471	260.57m	569	555.00m
80	482.50m	178	367.39m	276	243.75m	374	578.60m	472	260.51m	570	589.48m
81	454.48m	179	367.39m	277	243.75m	375	568.96m	473	260.43m	571	608.43m
82	427.44m	180	367.39m	278	243.75m	376	544.36m	474	270.27m	572	555.00m
83	392.58m	181	367.39m	279	527.19m	377	505.96m	475	450.26m	573	813.90m
84	373.76m	182	367.39m	280	245.72m	378	455.58m	476	325.00m	574	841.05m
85	613.44m	183	605.42m	281	245.97m	379	403.75m	477	325.00m	575	555.00m
86	903.38m	184	647.29m	282	246.17m	380	374.44m	478	325.00m	576	555.00m
87	1129.58m	185	325.00m	283	246.36m	381	352.95m	479	325.00m	577	556.83m
88	1428.74m	186	325.00m	284	246.56m	382	327.73m	480	325.00m	578	555.00m
89	1846.97m	187	325.00m	285	246.76m	383	473.37m	481	325.00m	579	555.00m
90	2068.21m	188	325.00m	286	246.96m	384	262.43m	482	325.00m	580	555.00m
91	1228.87m	189	325.00m	287	247.16m	385	263.14m	483	325.00m	581	727.01m
92	859.28m	190	325.00m	288	247.35m	386	263.84m	484	325.00m	582	853.93m
93	682.33m	191	325.00m	289	247.55m	387	264.55m	485	325.00m	583	853.93m
94	555.00m	192	325.00m	290	247.75m	388	527.09m	486	325.00m	584	1064.34m
95	555.00m	193	325.00m	291	247.95m	389	566.91m	487	325.00m	585	620.42m
96	555.00m	194	325.00m	292	248.14m	390	279.23m	488	325.00m	586	651.89m
97	664.77m	195	325.00m	293	248.34m	391	279.23m	489	325.00m	587	673.45m
98	706.00m	196	368.37m	294	248.54m	392	279.23m	490	325.00m	588	555.00m

BENCH MARK 1

BENCH MARK 2

TRUE NORTH

KEY PLAN

REVISIONS

No.	Description	Date
1	DRAFT	-/06/21

METRIC — Dimensions are in METRES and/or MILLIMETRES unless otherwise shown

NOT FOR CONSTRUCTION

WILLS

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.748.9944
E. wills@dmwills.com

Project Name/Location

KAWARTHA DOWNS REDEVELOPMENT

FRASERVILLE, ON

Drawing Title

Drawn By:	LC	SCALE: Horz.	Vert.
Designed By:	LC	Plot Date:	10/09/2021
Checked By:	—	Project No.:	21-85152
Engineer:	—	Dwg File No.:	Sht. No.:

Appendix B

Documentation for SBR Packaged Treatment Plant

ISAM™

INTEGRATED SURGE ANOXIC MIX

Proven Technology

FLUIDYNE'S ISAM™ IS A TOTAL TREATMENT SYSTEM

incorporating BOD, TSS and nitrogen removal along with sludge reduction in an integrated system. Raw (crude) sewage enters a covered anaerobic reactor for pretreatment, sludge thickening and sludge destruction. Complex organic solids undergo hydrolysis to simpler soluble organics which pass to the surge anoxic mix (SAM™) tank.

FLUIDYNE

THE EXPERIENCED LEADER IN WASTEWATER TREATMENT TECHNOLOGY

fluidynecorp.com

H2FLOW EQUIPMENT INC.

1-(888) 575-8642 www.h2flow.com

A TOTALLY NEW CONCEPT IN SBR DESIGN

FLUIDYNE ISAM™

In operation, all influent flow enters the anaerobic basin where influent solids are allowed to settle much like a primary clarifier. Elimination of primary solids in the anaerobic basin allows for much smaller SBR basins at equivalent SRT than conventional SBRs. The anaerobic selector also creates soluble carbon as a food source for biological nutrient removal through anaerobic conversion of settleable BOD to soluble BOD. The influent then flows to the SAM™ surge basin, or influent equalization basin. The surge basin provides flow and nutrient equalization to optimize treatment at the full range of flows and loadings.

100% ON-LINE STANDBY EQUIPMENT

Fluidyne's prepackaged ISAM SBRs are furnished with spare mixing/fill pump and aerator assembly installed for 100% redundancy.

REDUCES WASTE SLUDGE BY 75%

The Fluidyne ISAM™ Sequencing Batch Reactor incorporates an anaerobic selector chamber with the SAM™ SBR. The anaerobic selector not only provides consistent phosphorous removal by subjecting the recirculated biomass to anaerobic conditions, forcing the release of phosphorous, but also creates soluble carbon as a food source for phosphorous removal through anaerobic conversion of settleable BOD to soluble BOD. Additionally, anaerobic sludge digestion occurs in the anaerobic selector chamber, reducing waste solids production by up to 75% for the entire secondary process.

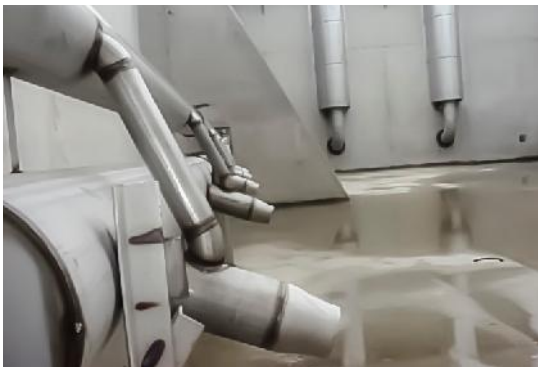
SEVERAL UNIQUE FEATURES

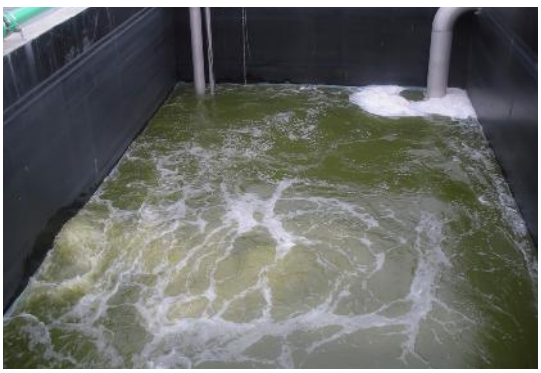
Several unique feature of the Fluidyne ISAM™ SBR include odor control and scum skimming. Mixed liquor is maintained in the SAM™ tank to immediately react with incoming flow from the anaerobic chamber to suppress odors and initiate and accelerate carbon and nitrogen reactions. Mixed liquor is recycled from the top of the SBR tank effectively removing scum by use of proprietary flow and scum control system. In addition, nitrates are recycled to the SAM™ tank for effective and rapid denitrification. Denitrification reactions are accelerated in the presence of the unreacted carbon from the raw sewage entering the SAM™ tank. Aeration and energy requirements are reduced as nitrates are fully reduced to nitrogen gas in the SAM™ tank.

EXPERIENCED LEADER IN SEQUENCING BATCH REACTOR TECHNOLOGY

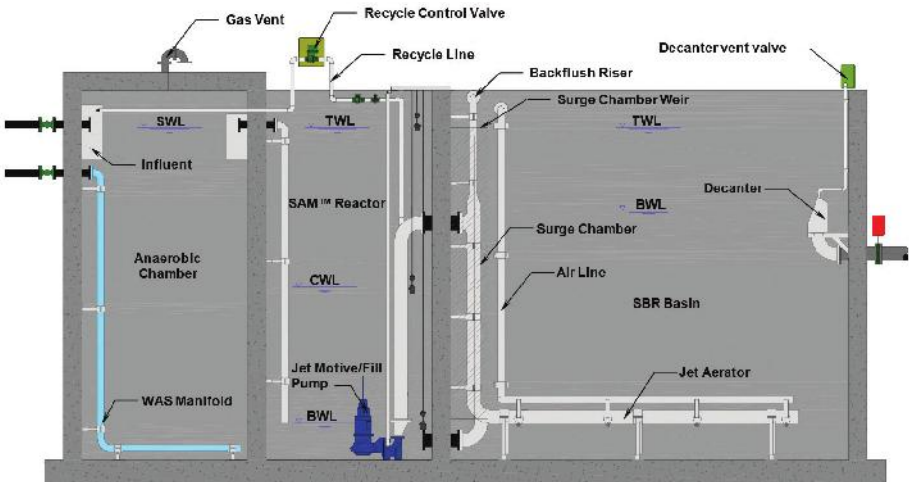
BENEFITS:

- Easy to operate and maintain
- Reduced operation and maintenance cost
- SBR basin has no moving parts that require maintenance.
- Power usage is controlled through the Fluidyne control panel
- Covered anaerobic selector chamber for odor control
- More flexible than continuous flow plants
- ISAM performs consistently regardless of influent flow changes
- Ability to handle highly variable flows and loading. Built in flow equalization is provided in the SAM™ reactor to handle peak hourly flows
- Built in sludge reduction system
- Aeration and mixing can automatically be adjusted to optimize power and prohibit filamentous growth
- Process utilizes quiescent settle and decant periods
- Small footprint with no digesters, secondary clarifiers,RAS piping and pumping
- Produces the highest quality effluent (Typical Fluidyne ISAM™ facilities are achieving less than 10 mg/L BOD5 and TSS, less than 1 mg/L NH3-N, less than 7 mg/L total N, and less than 2 mg/L phosphorus)
- Automatic scum skimming prior to effluent discharge provides highest quality effluent
- Easily expandable by adding additional flow trains



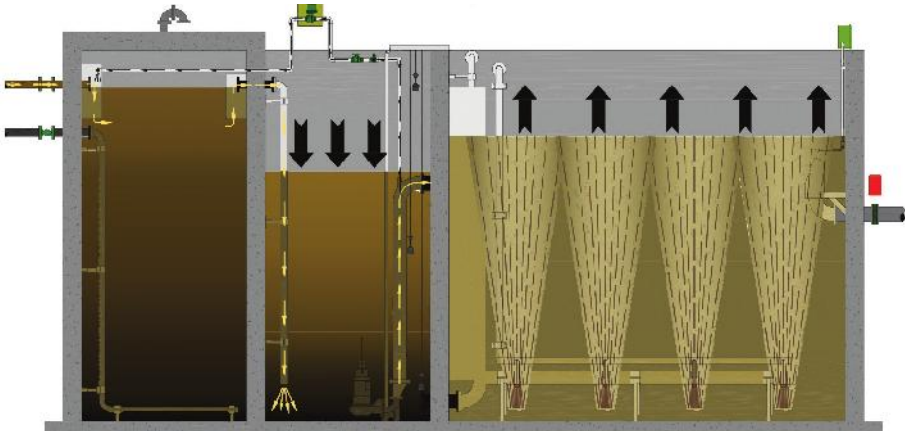


System Components:



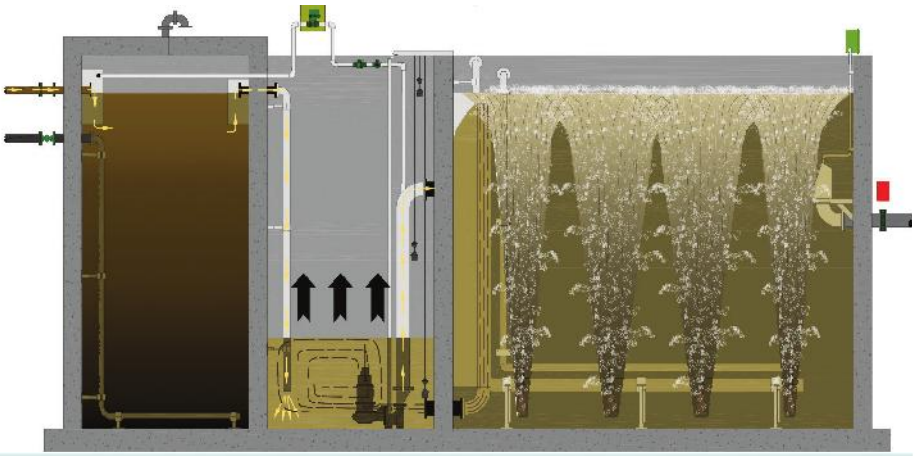
Influent continuously enters the anaerobic chamber where solids settle. Settleable BOD is converted to soluble BOD. BOD is reduced by 30% and solids are reduced by 60%. The influent then flows to the SAM™ reactor. Mixed liquor is maintained in the SAM™ reactor to suppress orders and initiate and accelerate carbon and nitrogen reduction.

Fill Phase:

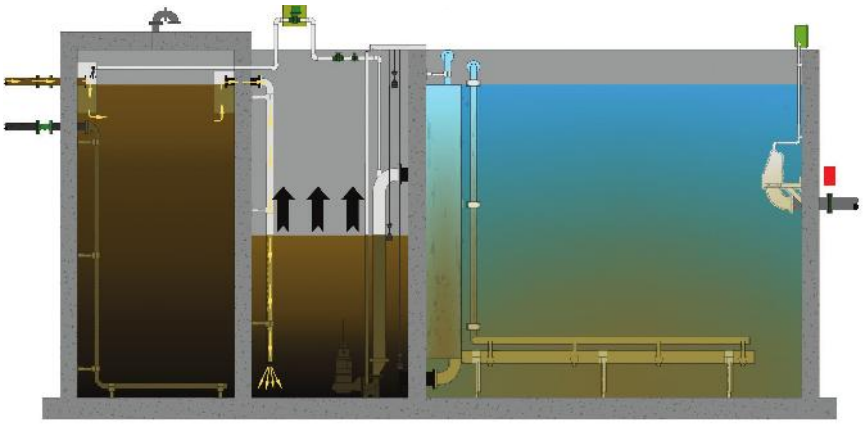


When the level in the SAM™ reactor reaches a predetermined "control level" the motive liquid pump is started. The SBR basin is filled and mixed. A percentage of the pumped flow is returned to the anaerobic chamber where biological solid settle. Settled solids in the anaerobic chamber are digested.

Interact Phase:

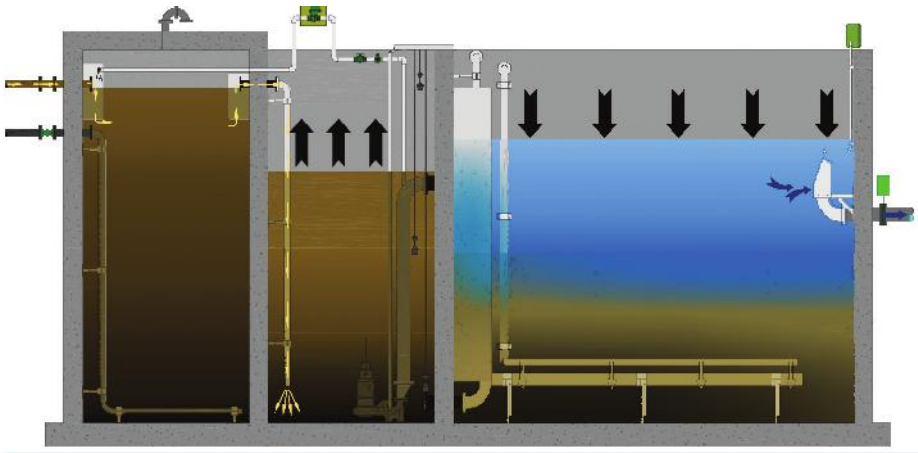


When the level in the SBR reaches TWL, nitrified mixed liquor overflows the surge chamber weir and is returned to the SAM™ chamber to mix and react with the raw influent. Aeration is cycled on and off to provide the required oxygen. Denitrification is reliable and complete. Scum is also removed from the SBR basin.



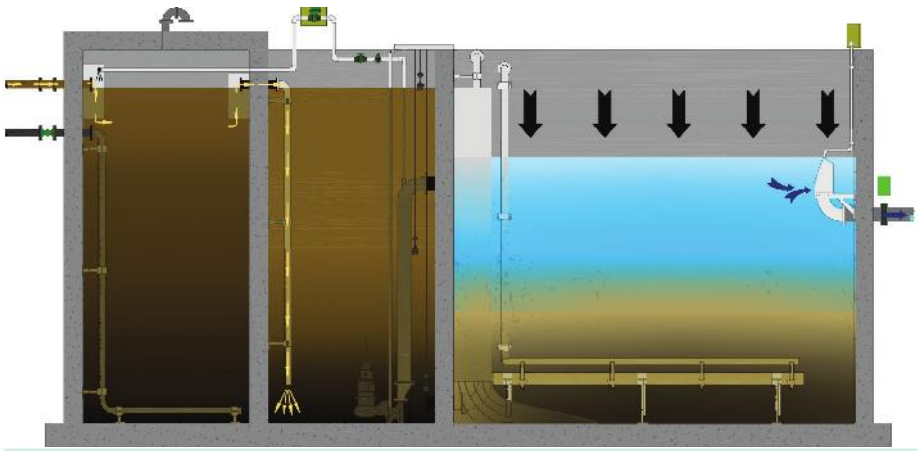
Settle Phase:

When the level in the SAM™ reactor again reaches “control level” aeration is discontinued and the SBR basin settles under perfect quiescent conditions.



Decant Phase:

When the settle timer expires, the decant valve is open and treated effluent is withdrawn from the upper portion of the SBR basin by means of a fixed solids excluding decanter.



Filled Decant Phase:

If, during peak flow events, the SAM™ reactor reaches TWL before the decant phase ends, influent flows in a reverse direction through the surge return line and overflows the surge chamber secondary weir and is diffused into the settled sludge at very low velocity as the decant phase continues.

FLUIDYNE

THE EXPERIENCED LEADER IN WASTEWATER TREATMENT TECHNOLOGY

THE EXPERIENCED LEADER IN WASTEWATER TREATMENT TECHOLOGY

FLUIDYNE CORPORATION

5436 Nordic Drive, Suite D
Cedar Falls, IA 50613

FLUIDYNECORP.COM

H2FLOW EQUIPMENT INC.

Merrickville WWTP
Ontario, CA

Wastewater Treatment Facility

Case Study Details

DESIGN CRITERIA	INFLUENT	EFFLUENT
Total Average Dry Weather	800 m3/day	-
Total Peak Wet Weather	3,800 m3/day	-
BOD_5	255 mg/l	10
Suspended Solids	361 mg/l	10
Total Phosphorous	9 mg/l	1
TKN in, Ammonia out	45 mg/l	3.5 / 7 (Summer/Winter)

This project was implemented to treat the municipal wastewater for the Town of Merrickville, located in Eastern Ontario. The wastewater treatment system comprised of Grinder/Screen, biological treatment ISAM and UV disinfection. The treated effluent was to be discharged to a sensitive river in the vicinity of the site.

H2FLOW EQUIPMENT INC. supplied Franklin Miller Grinder/Screen, a FLUIDYNE ISAM SBR system including PD air blowers and alum feed system and TROJAN ultraviolet disinfection unit,. It was delivered to be operated by Ontario Clean Water Agency (OCWA). H2FLOW EQUIPMENT INC also provided an aerobic digester and a Fluidyne jet mixing system with a Hayword Gordon Sludge Mixing pump and a Permastore GFS sludge holding tank as well as controls for all H2Flow supplied equipment.

The system has been operating effectively and satisfying the strict discharge limits to the receiving environment. There are many inherent benefits of the ISAM system among which the integral sludge digestion, small foot print and effective nutrient removal are the most prominent.

Engineering Consultant: AECOM
Installation Contractor: Black & MacDonald
Start-Up: December 2011

580 Oster Lane, Vaughan, Ontario, L4K 2C1, Canada TEL (905) 660-9775 / FAX (905) 660-9744
info@h2flow.com www.h2flow.com