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**APPENDIX E**

# Preliminary Design Report



# RM OF MACDONALD - OAK BLUFF FORCEMAIN & LAGOON STUDY PRELIMINARY DESIGN REPORT

**Project No. 221-01415-00**

**March 22, 2023**

**Original Prepared for [Manitoba Water Services Board](#)**

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RM OF MACDONALD -  
OAK BLUFF  
FORCEMAIN &  
LAGOON STUDY  
PRELIMINARY DESIGN  
REPORT  
MANITOBA WATER SERVICES BOARD

FOR FINAL SUBMISSION (REVISION 3)  
ORIGINAL

PROJECT NO.: 221-01415-00  
DATE: MARCH 22, 2023

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March 22, 2023

Manitoba Water Services Board  
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**Attention:** Mr. Nathan Wittmeier, M.T.S., P.Eng.

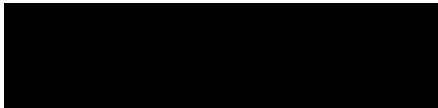
**Subject: RM of Macdonald – Oak Bluff Forcemain & Lagoon Study Preliminary Design Final Report**

Dear Mr. Wittmeier,

WSP Canada Inc. is pleased to submit the Final Preliminary Design Report for the RM of Macdonald Oak Bluff Forcemain & Lagoon Study. The remaining deliverable on this project is the preparation and submission of an Environmental Act Proposal, which will be submitted in the coming weeks.

We appreciate the opportunity to continue to work with the MWSB and the RM of Macdonald. Should you have any questions or would like to discuss this submission in further detail, please do not hesitate to contact us.

Kind Regards,



Dana Bredin, P.Eng., PMP  
Project Manager

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3	Issued as Final	Brianna Landrie, EIT Dana Bredin, P.Eng.	Jason Bunn, P.Eng.	Dana Bredin, P.Eng.	March 23, 2023



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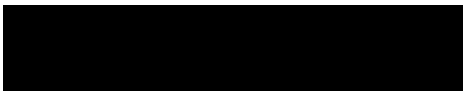
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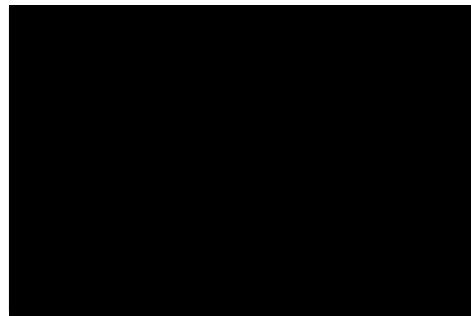
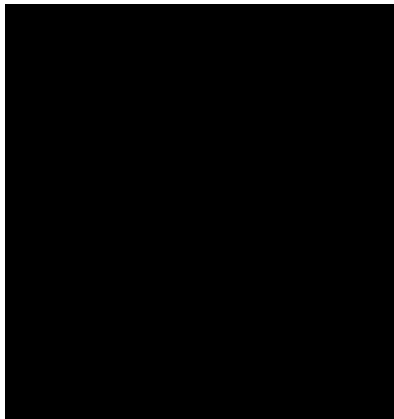
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## EXECUTIVE SUMMARY

The Manitoba Water Services Board (MWSB) and the Rural Municipality of Macdonald (RM) retained WSP Canada Inc. (WSP) to complete a Preliminary Design Report for the upgrade of the wastewater infrastructure for the community of Oak Bluff and the McGillivray Commercial District (MCD). The specific objectives of this report were to complete a needs assessment in order to project organic and hydraulic loadings over a 25-year design period for Oak Bluff and the MCD, conceptualize three lagoon expansion options for the existing Oak Bluff Lagoon and provide a recommendation. The two lift stations and forcemains that contribute to the existing Oak Bluff Lagoon were also reviewed in terms of capacity, with timelines for upgrades provided.

The community of Oak Bluff is located at the intersection of the Perimeter Highway (PTH #100), PTH #2, and PTH #3, and the MCD is located along McGillivray Boulevard (PTH #3) between Brady Road and extending to 800 m west of Loudon Road. Oak Bluff has seen significant growth in the past decade with the development of the Oak Bluff West neighbourhood, while the MCD has also seen significant commercial development in the past decade. There are currently two lagoons in use to service Oak Bluff and the MCD. The original Oak Bluff Lagoon is a small two-cell facultative lagoon and services the existing low-pressure sewers (LPS) within Oak Bluff, including the original residential development Oak Bluff Estates, the school, and the existing commercial and industrial developments. The existing Oak Bluff Lagoon is also a two-cell facultative lagoon, and services the development of Oak Bluff West and the MCD, both via their own lift stations and forcemains. The report focuses on the expansion to the existing Oak Bluff Lagoon, as the original Oak Bluff Lagoon will remain unchanged.

WSP completed a geotechnical site investigation, lift station drawdown testing, and wastewater sampling, and reviewed data provided by the RM in order to determine both current and future organic and hydraulic loadings. Based on our analysis of the collected data, the estimated current organic and hydraulic loadings to the existing Oak Bluff Lagoon are 211.3 kg-BOD<sub>5</sub>/d and 78,480 m<sup>3</sup> (230-day storage period) respectively. Accordingly, the existing Oak Bluff Lagoon currently utilizes 46% of its organic capacity and 44% of its hydraulic capacity. The projected future 25-year design loadings are 863.9 kg-BOD<sub>5</sub>/d and 505,840 m<sup>3</sup> and the existing Oak Bluff Lagoon is projected to reach its organic capacity in the design year 2032 and reach its hydraulic capacity in the design year 2028.

From the projected future 25-year design loadings, WSP conceptualized three lagoon expansion options, Option 1 – Facultative Lagoon Expansion, Option 2 – Aerated Lagoon Expansion, and Option 3 – Aerated Lagoon Expansion with SAGR. Of the three options reviewed, Option 2 is recommended based on the efficient use of available land, the flexibility for future expansion both in treatment and hydraulic capacity, and its ability to consistently meet current wastewater effluent limits. Furthermore, while the capital and operational costs are greater than Option 1, the benefits to convert the current lagoon system from facultative to aerated, outweigh the increased costs. The estimated cost for construction for Option 2 is [REDACTED] including engineering, contingency and administration costs.

Finally, both lift stations and forcemains that convey wastewater to the existing Oak Bluff Lagoon were reviewed in terms of capacity and timelines for potential upgrades. It is determined that the Oak Bluff West forcemain should be twinned between design years 2024 and 2026 depending on pump capacity, and the lift station pumps should be upgraded in the design year 2037 in order to accommodate the full build-out of Oak Bluff West. The MCD lift station will reach its capacity when there are approximately 100 commercial serviced lots connected to the lift station (currently 48 serviced lots) estimated to occur by 2025. Recommended upgrades at or prior to this time are to twin the existing forcemain to the lagoon. This will provide sufficient capacity until further development will require upgrading of the pumps in the lift station.



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E	PRELIMINARY DESIGN DRAWINGS
F	NEXOM PROPOSALS
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# 1 INTRODUCTION

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## 1.1 BACKGROUND

The RM of Macdonald is one of Manitoba's largest municipalities, covering an area of 1,106 square kilometers. It is located immediately southwest of Winnipeg and is part of the Capital Region Partnership, see **Figure 1-1**. The RM extends from the Winnipeg in the northeast, over the Perimeter Highway, and to several communities, such as Oak Bluff, La Salle, and Sanford. The 2021 Census from Statistics Canada found that the RM has a population of 8,120 and is one of the fastest-growing areas in Manitoba.

This report focuses on the community of Oak Bluff and the MCD. The community of Oak Bluff is located at the intersection of the Perimeter Highway (PTH #100), PTH #2 and PTH #3, and the MCD is located along McGillivray Boulevard (PTH #3) between Brady Road and extending 800 metres to the west of Loudon Road. Both areas are ideally located for residents and businesses seeking a location outside of Winnipeg but still connected to a major transportation network for quick access to Winnipeg and surrounding areas.

Oak Bluff has seen significant growth in the past decade with the development of Oak Bluff West, a Qualico development, in addition to the existing residential neighbourhood Oak Bluff Estates, which was constructed in the 1990s. Oak Bluff is serviced by a K-6 school (Oak Bluff Community School) as well as a commercial development along Highway #3, which includes two large gas bars with parking space for semi-trucks, a Tim Horton's drive-thru, two restaurants, a large farm equipment dealership, a community centre and arena, and several smaller businesses. On the north side of the community, Oak Bluff also has an industrial park consisting of several transportation and logistics companies, timber manufacturing and storage yards, a concrete batch plant, agricultural industries, and other smaller commercial and industrial businesses.

The MCD has also seen a surge in commercial and light industrial development in the past five years with the completion of two large developments, South Landing Business Park and McGillivray Business Park, as well as the planning of several other large commercial developments along Loudon Road and McCreary Road, and south of McGillivray Boulevard. Currently, the MCD includes transportation and logistics companies, car and heavy equipment dealerships, storage and warehousing facilities, construction and landscaping companies, manufacturing (Malach Metal & Machining and Polywest), a hockey school and arena, and several smaller commercial businesses. With the lack of available commercial and industrial zoned space inside Winnipeg, it is anticipated that areas such as the MCD will continue to see sustained growth in the near term.

Wastewater collection in Oak Bluff and the MCD mainly consists of low-pressure sewers (LPS) except for Oak Bluff West which has its own gravity sewer system. There are currently two lagoons in use to service Oak Bluff and the MCD. The original Oak Bluff Lagoon is a small two-cell facultative lagoon and services the existing LPS within Oak Bluff, including Oak Bluff Estates, the school, and the existing commercial developments and industrial developments south of Agri Park Road. The existing Oak Bluff Lagoon is also a two-cell facultative lagoon, however, much larger in both treatment and storage capacity. The new lagoon services the development of Oak Bluff West, existing industrial development north of Agri Park Road and the MCD. Wastewater from Oak Bluff West is collected via gravity sewer and conveyed to the



lagoon via a centrally located lift station and forcemain. Wastewater from the existing industrial development and the MCD is conveyed to the lagoon via a lift station and forcemain located south of McGillivray Blvd on the east side of Road 7E. The new lagoon also accepts all truck hauled wastewater from the rural residents in the RM, as well as the annual LPS pump-outs in Oak Bluff and the MCD.

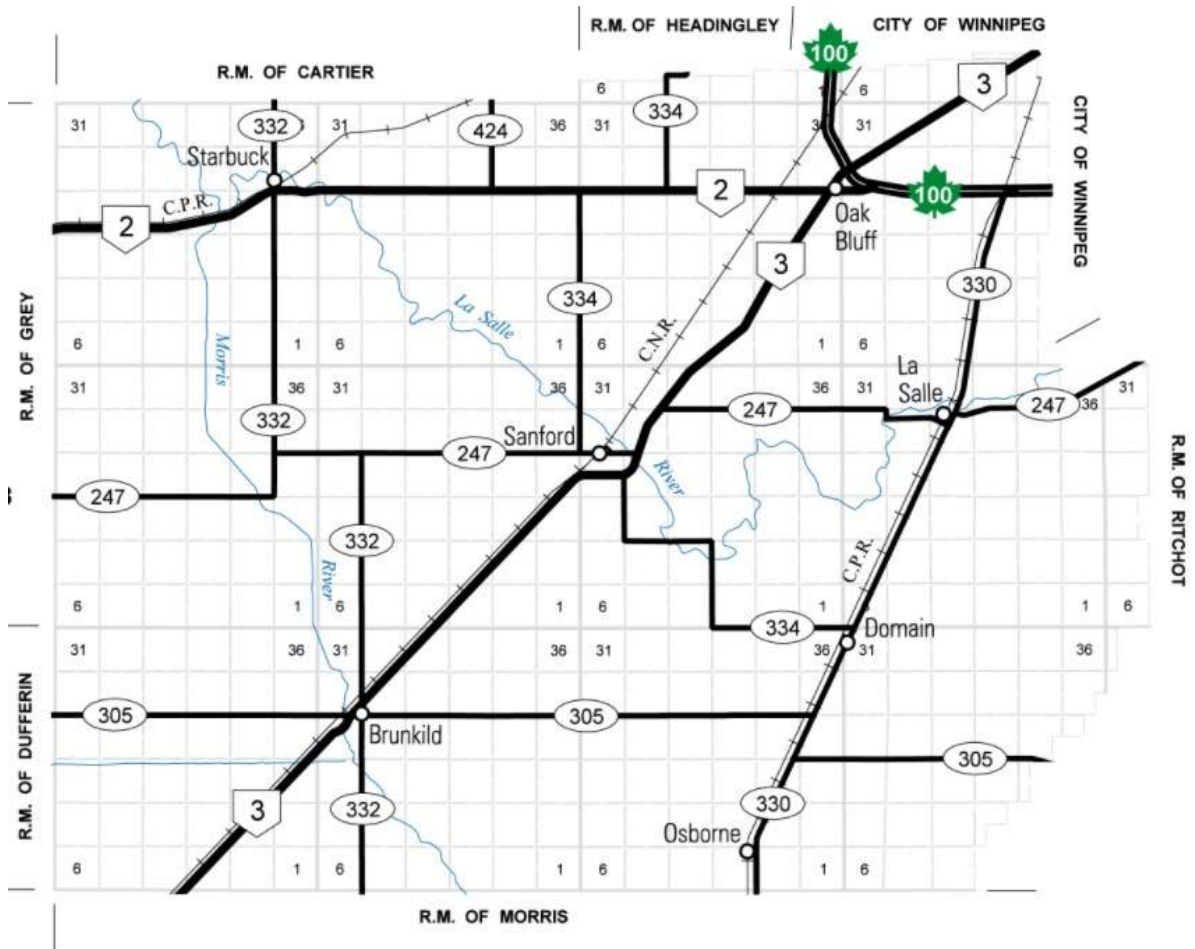


Figure 1-1: Map of RM of Macdonald

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## 1.2 PROJECT SCOPE

The RM of Macdonald and the MWSB have engaged WSP to complete a preliminary design study regarding the Oak Bluff lagoon and forcemain. The main objectives of this study are to:

- Review data, reports, documentation, records, plans, and regulatory requirements related to the project (Section 1.3);
- Conduct drawdown tests of both lift stations to confirm hydraulic loading (Section 2.3);
- Complete a topographical survey of the proposed lagoon site (Section 2.2);
- Complete a geotechnical investigation including permeability tests (Section 2.1);
- Project population and commercial/industrial wastewater demand over a 25-year design period, or a design year of 2047 (Section 3);
- Complete a needs assessment for the existing lift stations and forcemains conveying wastewater to the lagoon and evaluate required upgrades, sizing, and alignments to meet the design period (Section 3.6);
- Determine organic and hydraulic loading for current and design periods (Section 3.5);
- Conceptualize and evaluate lagoon treatment options for expansion to meet loading requirements to comply with current environmental standards over the design period (Section 4);
- Provide capital costs for the lagoon expansion options (Section 5);
- Prepare and submit a draft preliminary design report to discuss the findings and provide recommendations for a lagoon expansion and upgrades for the forcemain and lift station, including cost estimates;
- Present the draft report to MWSB and RM staff at the municipal office; and,
- Incorporate MWSB and RM comments and submit electronic and four hard copies of the final report to MWSB for distribution.

---

## 1.3 BACKGROUND DOCUMENTS

The following reports and studies were reviewed as part of the preliminary design and needs assessment:

- Oak Bluff-McGillivray Infrastructure Review – Water & Sewer Capacity and Upgrading Study, prepared by WSP Canada Inc., February 2019.
- Oak Bluff Lagoon Assessment – Technical Memorandum, prepared by GENIVAR, November 2008.
- Macdonald-Ritchot Planning Development Plan (Draft), prepared by WSP Canada Inc., February 2022.

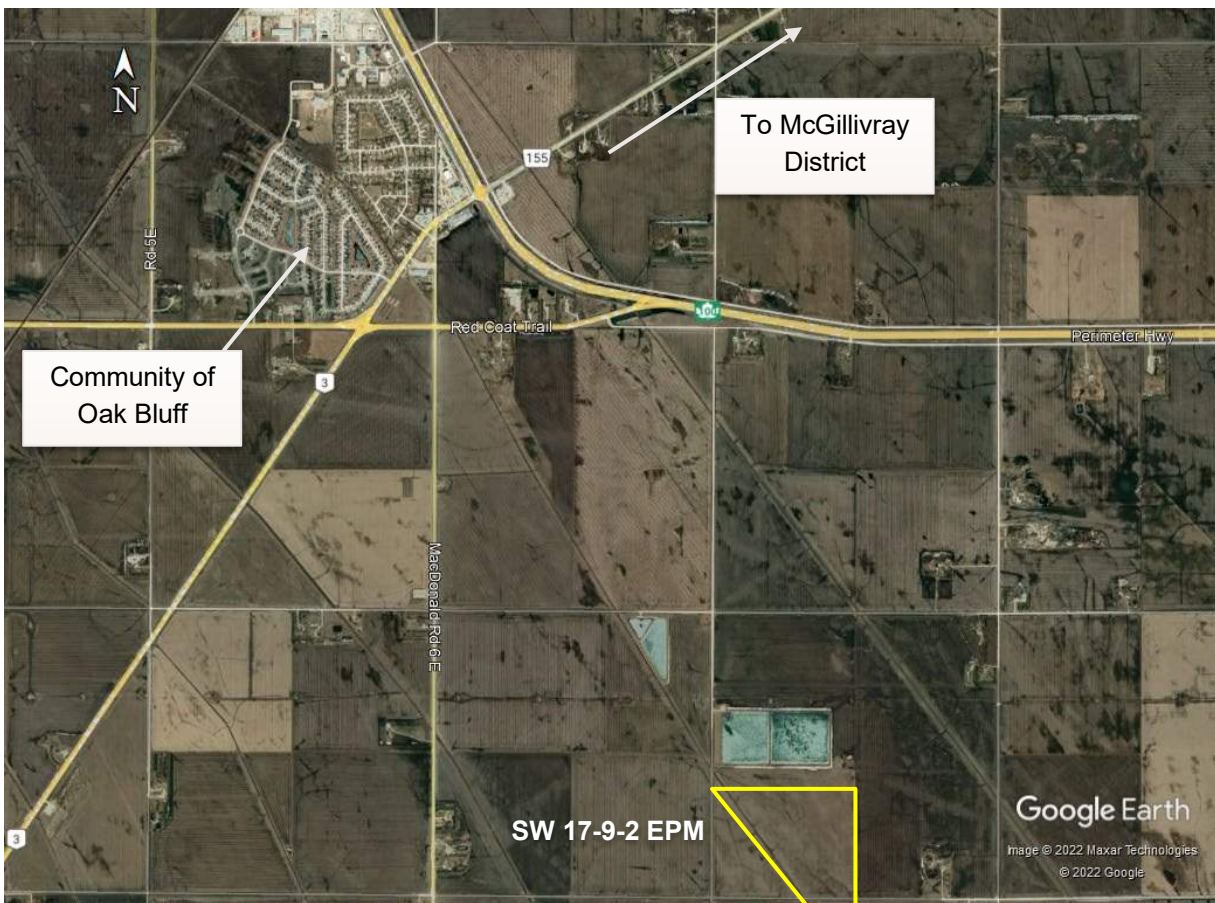
The following data was provided by the RM of Macdonald and reviewed in order to project the wastewater generation and 20-year design loadings:

- Lift station pumping hours and MultiSmart data from January 1, 2021 to June 20, 2022.

- Water consumption data from 2019 to 2021.
- Septic truck hauling data from 2019 to 2021.
- Current number of water service connections (residential and commercial) in Oak Bluff and the MCD.
- Development plans for the MCD.
- 2021 census population data for Oak Bluff and the RM of Macdonald.

## 1.4 PROPOSED DEVELOPMENT LOCATION

Based on previous studies, the new lagoon has been proposed to be constructed south of the existing lagoon, in SW 17-9-2 EPM, as shown in **Figure 1-2**.



**Figure 1-2: Location map of the proposed development**



## 2 FIELD INVESTIGATIONS

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### 2.1 GEOTECHNICAL SITE INVESTIGATION

A geotechnical investigation was completed at the proposed lagoon site on April 4, 2022. Three (3) testholes (TH22-01, 05 and 06) were drilled between 5.1 m and 6.7 m below grade using a track-mounted solid stem auger operated by Paddock Drilling Ltd. The three testholes were completed on the cultivated land south of the lagoon. The general soil profile of the testholes consisted of a 250 mm to 300 mm layer of topsoil underlain by a clay layer which extended to the depths explored. The clay was observed as brown to dark grey, moist, high plasticity, and contained some silt, and trace of sand. The frost depth encountered on site was approximately 1.83 m below grade, and the clay was stiff to firm below the frost. No seepage or caving conditions were noted at the time of drilling.

One hydraulic conductivity test was completed on the in-situ clay material found throughout the site. A Shelby tube sample was taken from TH22-01 at a depth of 0.9 m to 1.5 m, and the hydraulic conductivity was found to be  $6.0 \times 10^{-9}$  cm/s. Accordingly, WSP's recommendation is for a clay cut-off wall to be constructed around the perimeter berms of the proposed lagoon.

The full geotechnical report can be found in **Appendix A**.

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### 2.2 TOPOGRAPHIC SURVEY

WSP previously completed a topographic survey of the project site for the new lagoon construction in June 2010. The area surveyed was the land now occupied by the existing Oak Bluff Lagoon as well as the expansion land to the south, parts of NW and SW 17-19-2 E, as shown in the Existing Site Plan found in **Appendix E**. Ground features such as Road 7E and the Atchison Drain were surveyed, including the culverts along the discharge route. Additional as-built survey data was collected upon the completion of the new lagoon in fall 2010, including the top of berm, exterior toe, perimeter ditching, perimeter fencing, and piping and valves.

From a review of the survey information, the natural topography of the site gently slopes northeast to southwest with the high-point situated at the northeast corner of SW 17-9-2 E. The change in elevation across the site is less than 1.5 m, from the high-point to the Atchison Drain.

---

### 2.3 LIFT STATION DRAWDOWN TESTING

WSP visited the Oak Bluff and McGillivray lift stations on March 16, 2022, to conduct drawdown testing. The purpose of the testing is to calculate the pumping rates and validate the collected MultiSmart data. This information is then used to determine the pumped volumes from pump hour logs.

During the drawdown tests, the cycles are timed while the lift station fills and the pumps are turned off, and during the drawdown period while the lead pump is turned on. The cycle time is then compared against the known measured volume of the wet well to determine the pumped flow rates for each pump at the lift station, as well as the wastewater inflow rate at that point in time.



According to records, the Oak Bluff lift station is a duplex setup with Flygt model NP-3202.180 HT, 45 hp, 600V, 3-phase electrical, submersible pumps operating with a 468 impeller. The interior diameter of the concrete barrel is 3,024 mm. The McGillivray lift station is a duplex setup with Flygt model NP-3102.181 LT, 5 hp, 600V, 3-phase electrical, submersible pumps. The interior diameter of the concrete barrel is 2,438 mm.

The results of the drawdown testing for each lift station are summarized in **Table 2.1**. Full details of the lift station drawdown testing are provided in **Appendix B**.

**Table 2.1: Drawdown Test Results**

LIFT STATION	PUMP 1	PUMP 2
Oak Bluff West Lift Station	30.62 L/s	35.90 L/s
McGillivray Lift Station	15.21 L/s	15.15 L/s

It is noted that both pumps for the Oak Bluff West Lift Station should theoretically operate at approximately 41.0 L/s, and the lift station drawdown test indicates that these pumps are operating below their pump curve. This is further discussed in Section 4.4.1.

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## 2.4 WASTEWATER CHARACTERIZATION

During the lift station drawdown testing, two wastewater samples were retrieved for third party lab testing from the McGillivray Lift Station. The depth of the Oak Bluff West Lift Station prevented samples from being safely retrieved. The wastewater characteristics of the McGillivray Lift Station are summarized in the tables below. Full results are found in **Appendix C**.

**Table 2.2: McGillivray Lift Station Sample #1 Results**

PARAMETERS	RESULT
Ammonia, Total (as N)	69.1 mg/L
BOD Carbonaceous	181 mg/L
Phosphorus (P) -Total	7.39 mg/L
Total Kjeldahl Nitrogen	69.7 mg/L
Total Suspended Solids	275 mg/L
pH	7.66

**Table 2.3: McGillivray Lift Station Sample #2 Results**

PARAMETERS	RESULT
Ammonia, Total (as N)	66.6 mg/L
BOD Carbonaceous	164 mg/L
Phosphorus (P) -Total	7.67 mg/L
Total Kjeldahl Nitrogen	76.2 mg/L
Total Suspended Solids	220 mg/L
pH	7.72



Both total ammonia and TKN are higher than what is expected for untreated domestic wastewater, especially as BOD, TSS, and total phosphorus are inline with what is expected. As only one data point was collected as part of this study, more sampling of the raw influent wastewater would be required to further characterize the wastewater contributing to the lagoon.

## 3 NEEDS ASSESSMENT

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### 3.1 EXISTING WASTEWATER INFRASTRUCTURE

There are currently two lagoons in use to serve the community of Oak Bluff and the MCD. The original Oak Bluff Lagoon is a two-cell facultative lagoon built in 1989 and is located within NE 18-9-2E. The existing Oak Bluff Lagoon was built in 2010 and is also a two-cell facultative located within the northern half of section 17-9-2E. Both lagoons operate under Environment Act Licence (EAL) no. 2898, dated September 15, 2009.

The original Oak Bluff Lagoon receives wastewater via LPS from Oak Bluff Estates (original residential development), the commercial businesses along PTH #3 at the Perimeter, and the southern half of the industrial park north of Oak Bluff. Based upon information provided by the RM, this lagoon discharges once a year in the fall after an application of aluminum sulfate (alum) for phosphorus reduction. This lagoon only receives the liquid portion of the wastewater from the existing Oak Bluff LPS. The solids portion of the wastewater is hauled to the existing Oak Bluff lagoon through the RM's ongoing program where all septic tanks connected to the LPS are annually emptied.

Oak Bluff West and the McGillivray District are currently serviced by the existing Oak Bluff Lagoon. Wastewater from Oak Bluff West is collected via gravity sewer and conveyed to the lagoon via a centrally located lift station and forcemain. The lift station is designed to accommodate the full build-out of Oak Bluff West and is connected to 250Ø and 300Ø forcemains. However, currently wastewater is conveyed via a single forcemain (250Ø) to the lagoon, with the second forcemain (300Ø) installed through the neighbourhood and terminates at PTH #3. Wastewater from the MCD is conveyed to a lift station via an existing 250Ø low-pressure sewermain. As well, 9 commercial lots from the northern half of the Oak Bluff industrial park are conveyed to the lift station via a 100Ø low-pressure sewermain. The lift station is located south of McGillivray Blvd on the east side of Road 7E. This lift station conveys wastewater to the lagoon via a single 250Ø forcemain.

Based on the information provided by the RM, the existing Oak Bluff Lagoon typically discharges once a year in the fall. The lagoon is discharged to the Atchison Drain which flows southeast to the La Salle River. Alum is used for phosphorus reduction and is delivered via a truck to a single point for application in the secondary cell. Typically, only one application has been needed to meet effluent requirements.

The existing Oak Bluff Lagoon also receives all the truck hauled wastewater from the rural residences in the RM that are not connected to a municipal sewer system. Furthermore, all LPS pump-outs from Oak Bluff are hauled and dumped at the existing Oak Bluff Lagoon.

A site plan detailing the location of the lagoons, lift stations, and forcemains is shown in **Figure 3-1**.

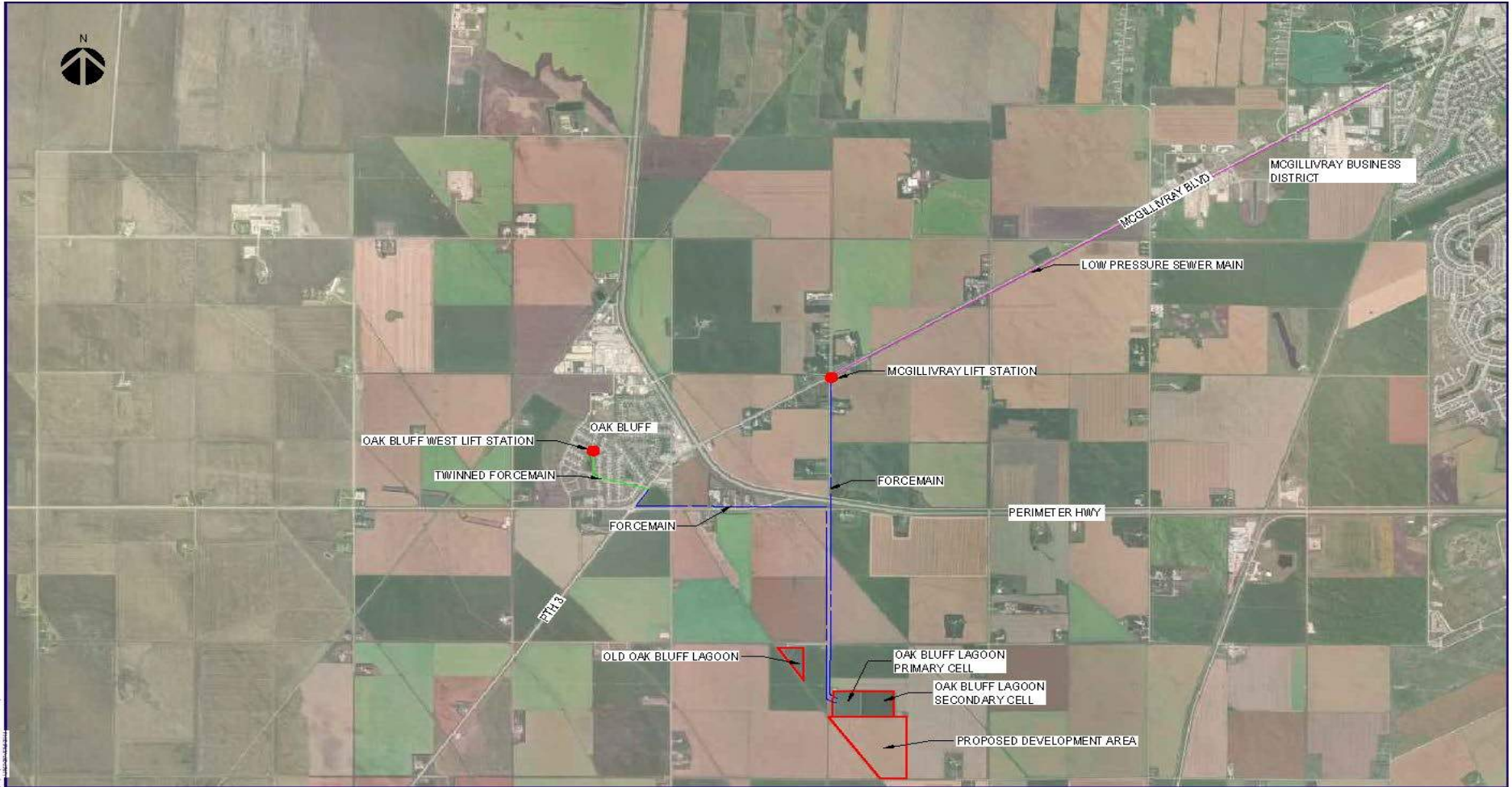


Figure 3-1: Overall Site Map



The original Oak Bluff Lagoon has a treatment capacity of 58.2 kg-BOD<sub>5</sub>/day and a storage capacity of 62,200 m<sup>3</sup>. The existing Oak Bluff Lagoon has a treatment capacity of 460.3 kg-BOD<sub>5</sub>/day and a storage capacity of 176,800 m<sup>3</sup>. The original and new lagoons' as-built specifications are summarized in the following tables.

**Table 3.1: Original and Existing Oak Bluff Lagoons As-Built Specifications**

PARAMETERS	ORIGINAL OAK BLUFF LAGOON		EXISTING OAK BLUFF LAGOON	
	PRIMARY CELL	SECONDARY CELL	PRIMARY CELL	SECONDARY CELL
Bottom Cell Dimensions	Irregular	Irregular	262.0 m x 288.0 m	325.0 m x 288.0 m
Interior Side Slopes (Horizontal:Vertical)	4H:1V	4H:1V	4H:1V	4H:1V
Operating Depth	1.5 m	2.1 m	1.5 m	1.5 m
Freeboard	1.0 m	1.0 m	1.0 m	1.0 m
Surface Area at Operating Depth	0.58 ha	62,900 m <sup>3</sup>	8.22 ha	10.11 ha
Total Volume	14,800 m <sup>3</sup>	8,100 m <sup>3</sup>	118,200 m <sup>3</sup>	146,000 m <sup>3</sup>
Storage Volume	7,400 m <sup>3</sup>	54,800 m <sup>3</sup>	59,100 m <sup>3</sup>	117,700 m <sup>3</sup>

**Table 3.2: Original and Existing Oak Bluff Lagoon Organic and Storage Capacities**

PARAMETERS	ORIGINAL OAK BLUFF LAGOON	EXISTING OAK BLUFF LAGOON
Organic Treatment Capacity	58.2 kg-BOD <sub>5</sub> /day	460.3 kg-BOD <sub>5</sub> /day
Storage Capacity	62,200 m <sup>3</sup>	176,800 m <sup>3</sup>

## 3.2 ENVIRONMENT ACT LICENCE

The original and existing Oak Bluff lagoons both operate under EAL no. 2898, dated September 15, 2009. Both lagoon primary cells must not exceed 56 kg-BOD<sub>5</sub>/ha/day and not exceed an operating depth of 1.5 m. However, the original Oak Bluff Lagoon secondary cell can operate to a maximum depth of 2.1 m, while the existing Oak Bluff Lagoon secondary cell must not exceed an operating depth of 1.5 m. Both lagoons can only discharge between June 15<sup>th</sup> and October 31<sup>st</sup>. The current discharge effluent parameters that the RM is required to meet prior to discharge are as follows:

- BOD<sub>5</sub> must not exceed 25 mg/L;
- Fecal coliforms must not exceed 200 per 100 mL of sample;



- Total coliforms must not exceed 1,500 per 100 mL of sample; and,
- Total phosphorus must not exceed 1 mg/L.

A copy of EAL no. 2898 can be found in **Appendix D**.

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## 3.3 EXISTING WASTEWATER LOADINGS

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### 3.3.1 CURRENT EQUIVALENT POPULATION

The RM of Macdonald provided the number of existing residential and commercial water and sewer connections for Oak Bluff and the MCD, as shown in the table below. The number of residential connections for Oak Bluff was divided into the old development (Oak Bluff Estates) and the new development (Oak Bluff West). Based upon the 2008 Technical Memo, Oak Bluff Estates is known to have 186 residential service connections, which has not changed since the full build-out of the development in the 1990s.

**Table 3.3: Number of Water and Sewer Connections for Oak Bluff and MCD**

AREA		NO. OF WATER CONNECTIONS	NO. OF SEWER CONNECTIONS
Oak Bluff	Residential Oak Bluff Estates	186	186
	Residential Oak Bluff West	331	331
	Commercial	36	28
McGillivray Commercial District	Residential	56	40
	Commercial	52	48

From the 2019 WSP Infrastructure Study, an equivalent resident unit (ERU) was used to link both the community Oak Bluff and the MCD in order to project future demand for the area. One residential connection was considered one ERU and one commercial connection was considered three ERUs. Furthermore, it can be considered that one ERU is equivalent to three persons. This is based on the Census data that shows that the persons per occupied dwelling is approximately 3.0 persons per dwelling for both Oak Bluff and the RM Macdonald as a whole.

In Section 3.3.5, a review of the lift station pump hours as well as the water consumption demand for the MCD establishes the criteria that one commercial connection is equivalent to three ERUs.

The existing equivalent population for both Oak Bluff and the MCD is presented in the following tables, and is based on the current number of sewer connections provided by the RM.



**Table 3.4: Existing Oak Bluff Equivalent Population**

AREA		NO. OF SEWER CONNECTIONS	ERU	EQUIVALENT POPULATION
Oak Bluff	Residential Oak Bluff Estates	186	186	558
	Residential Oak Bluff West	331	331	993
	Commercial	28	84	252
<b>TOTAL</b>		<b>545</b>	<b>601</b>	<b>1,803</b>

**Table 3.5: Existing MCD Equivalent Population**

AREA		NO. OF SEWER CONNECTIONS	ERU	EQUIVALENT POPULATION
McGillivray Commercial District	Residential	40	40	120
	Commercial	48	144	432
<b>TOTAL</b>		<b>88</b>	<b>184</b>	<b>552</b>

### 3.3.2 TRUCK HAULED WASTEWATER

The RM of Macdonald receives trucked wastewater from rural customers in the municipality from both holding tanks and septic tanks. Rural residents make up a large portion of the organic loading contributors to the existing Oak Bluff Lagoon. Based upon information provided in the 2019 WSP Infrastructure Study and confirmed by the RM, there are 660 rural residences that have septic or holding tanks. **Table 3.6** summarizes the volume of septic and holding wastewater hauled to the Oak Bluff Lagoon from 2019-2021.

It is not known why the sudden increase of holding tank wastewater was hauled to the Oak Bluff Lagoon in 2021, however, holding tank wastewater is much lower in strength (BOD5) than septic tank wastewater, thus it does not significantly affect the lagoon's loadings.

**Table 3.6: Volume of Truck Hauled Wastewater 2019-2021**

YEAR	WASTEWATER VOLUME IN LITRES	
	HOLDING TANK	SEPTIC TANK
<b>2019</b>	558,050	688,730
<b>2020</b>	554,180	717,850
<b>2021</b>	1,519,420	753,510

Additionally, the RM administers an annual tank emptying programs for all customers connected to the LPS. This program generally occurs during the summer months. The following **Table 3.7** summarizes the number of pump outs for the Oak Bluff LPS and McGillivray LPS customers from 2019-2021.



**Table 3.7: Number of Pumpouts for LPS Customers 2019-2021**

YEAR	NO. OF PUMPOUTS FOR LPS CUSTOMERS	
	OAK BLUFF & RURAL RESIDENTS	MCGILLIVRAY
2019	281	71
2020	284	89
2021	285	116

### 3.3.3 ORIGINAL OAK BLUFF LAGOON LOADINGS

The original Oak Bluff Lagoon only accepts the liquid portion of the LPS wastewater from Oak Bluff Estates and the commercial and industrial development in Oak Bluff. All other wastewater sources are directed to the existing Oak Bluff Lagoon. There are currently 214 LPS sewer connections (186 residential and 28 commercial) that contribute to this lagoon, and it is sufficiently sized to accommodate this wastewater source, as this lagoon is only required to be discharged once per year. It is assumed that this lagoon will continue to function in this capacity and therefore, the hydraulic loading contribution of these LPS connections will not be included for the analysis and preliminary design of the existing Oak Bluff Lagoon expansion.

### 3.3.4 EXISTING ORGANIC LOADING

The ability of a lagoon to treat the incoming wastewater is a measure of organic loading capacity. Organic loading refers to the quantity of organic material present in the incoming wastewater and is measured as the five-day Biochemical Oxygen Demand (BOD<sub>5</sub>). The organic loading becomes the total mass of BOD<sub>5</sub> in kg/d in the wastewater discharged to the lagoon. The wastewater from a piped collection system is generally consistent on a year-round basis, whereas truck-hauled wastewater from septic systems are seasonally variable.

On the basis of accepted practice, the existing Oak Bluff Lagoon's daily organic loading for domestic wastewater collected via a piped system is estimated at 0.077 kg-BOD<sub>5</sub> per person. The daily BOD<sub>5</sub> production for the MCD LPS system is still considered to be 0.077 kg per person, as the RM administers a tank emptying program where the solids portion of the wastewater from each septic tank connected to the LPS is emptied and hauled to the lagoon annually. Thus, both the liquid and collected solids of this wastewater source end up at the lagoon. However, for the original Oak Bluff LPS system, only the solids portion of the wastewater is emptied into the existing Oak Bluff Lagoon. The liquid portion of the wastewater conveyed through the LPS system is assumed to contain approximately 30% to 50% of average values of BOD for domestic wastewater, with the solids portion of the wastewater containing the remaining fraction. Note that the typical septic tank BOD removal, when properly installed, is 50% (EPA, 2002).

Regarding truck hauled wastewater, the Oak Bluff Lagoon EAL stipulates that wastewater from septic tanks can only be emptied into the lagoon during the summer period (June 1 to October 15). As a result, it is typical that approximately 55% of the truck hauled septic tank wastewater is emptied into the lagoon during a 45-day period during summer and early fall. This narrow period of time is when the lagoon will usually see the maximum organic loading from truck hauled wastewater. Holding tank wastewater is typically dumped year-round at the lagoon, usually distributed evenly across all months of the year.



However, for the purposes of the report, it can conservatively be assumed that the peak loading of the holding tank wastewater occurs during the same 45-day period.

When calculating the organic loading of the lagoon, the following criteria were used:

- Average daily BOD<sub>5</sub> per person = 0.077 kg
- Solids portion of the LPS wastewater = 60% of the average daily BOD<sub>5</sub> per person
  - Wastewater strength of septic tanks = 5000 mg/L This wastewater strength was selected based upon a WSP study completed in 2016 to determine the strength of truck hauled septage for the RM of Ste. Anne. Seven samples were taken of the septage, and the average BOD was found to be slightly less than 5,000 mg/L
- Wastewater strength of holding tanks = 500 mg/L
  - This wastewater strength was also selected based upon the same WSP study completed in 2016 for the RM of Ste. Anne. Nine samples were taken of the holding tank wastewater, and the average BOD was found to be slightly less than 380 mg/L. For the purposes of this report, a BOD value of 500 mg/L was selected. Holding tank wastewater is generally of higher strength than piped wastewater as holding tank customers use less water to avoid more frequent pump outs.

Using the above criteria, the current organic loading is calculated as follows:

- *Oak Bluff West* = 331 ERU \* 3 persons/ERU \* 0.077 kg-BOD<sub>5</sub>/person = 76.5 kg-BOD<sub>5</sub>/day
- *MCD* = 184 ERU \* 3 persons/ERU \* 0.077 kg-BOD<sub>5</sub>/person = 42.5 kg-BOD<sub>5</sub>/day
- *Oak Bluff LPS* = 270 ERU \* 3 persons/ERU \* 0.077 kg-BOD<sub>5</sub>/person \* 60% = 37.5 kg-BOD<sub>5</sub>/day
- *Septic tank wastewater* = 753.5 m<sup>3</sup> \* 5 kg-BOD<sub>5</sub>/m<sup>3</sup> \* 55% ÷ 45 days = 46.0 kg-BOD<sub>5</sub>/day (at peak time)
- *Holding tank wastewater* = 1,519 m<sup>3</sup> \* 0.5 kg-BOD<sub>5</sub>/m<sup>3</sup> \* 55% ÷ 45 days = 9.3 kg-BOD<sub>5</sub>/day (at peak time)
- **Total current organic loading = 211.8 kg-BOD<sub>5</sub>/day**

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### 3.3.5 EXISTING HYDRAULIC LOADING

In terms of hydraulic load, the majority of wastewater comes from the two lift stations, Oak Bluff West and McGillivray. Both of these lift stations have the MultiSmart management systems from Xylem, which electronically measure and record pumping hours and track liquid levels in each lift station. Daily pump hour data and total daily wastewater volumes from each lift station were obtained for 2021 and the first half of 2022. Data prior to 2021 was not used, as the RM had each lift station MultiSmart recalibrated in 2020 due to errors in the data collection.

The daily recorded volume data from both lift stations were reviewed, however it was determined that the volumes were not being calculated properly, particularly in the McGillivray lift station. The daily pumped wastewater volumes were not in agreement with the metered water consumption data, nor was the MultiSmart generating a valid per capita wastewater generation rate. Xylem was contacted to investigate the issues with both lift station MultiSmart systems; however, no solution was offered.



WSP completed drawdown testing at both lift stations and as an alternative to the MultiSmart data used the estimated pumping rates and recorded pump hours for each pump to generate an estimated wastewater volume. When reviewing the daily pump hours for the McGillivray lift station, it was clear that prior to June 1, 2021, both pumps operated twice as much per day (on average) than after June 1, 2021. It is not known what caused this issue, however, due to this discrepancy in pumping hours, only data after June 1 was used to determine the hydraulic loading and the wastewater generation per equivalent person.

Finally, in order to balance that the collected data from 2021 was during one of the drier years on record, data from the first half of 2022 was used. The second quarter of 2022 was the second wettest spring (March 1 to June 1, 2022) on record as measured at the Winnipeg Airport weather station. Furthermore, winter 2021-22 (October 1<sup>st</sup>, 2021 to May 31<sup>st</sup>, 2022) was the 3<sup>rd</sup> snowiest year on record.

### 3.3.5.1 OAK BLUFF WEST

The 2021 and 2022 pump hours were provided by the RM for the Oak Bluff West lift station. Based on the results of the lift station drawdown test, pumping rates for each pump (**Table 2.1**) were used to calculate the total volume of wastewater pumped per quarter and is summarized in **Table 3.8**.

**Table 3.8: 2021-22 Pump Hours and Calculated Wastewater Volume for Oak Bluff West**

		PUMP 1		PUMP 2		
		Hours	Volume (L)	Hours	Volume (L)	Total Volume (L) (Pump 1 + Pump 2)
2021	Quarter 1	58.62	6,461,249	39.84	5,148,315	11,609,564
	Quarter 2	69.61	7,673,467	49.53	6,401,089	14,074,556
	Quarter 3	68.46	7,546,933	48.72	6,296,433	13,843,366
	Quarter 4	64.19	7,076,095	52.78	6,821,804	13,897,899
2022	Quarter 1	63.19	6,965,946	51.17	6,613,189	13,579,135
	Quarter 2	169.74	18,711,172	108.61	14,037,467	32,748,639
<b>Total</b>		<b>493.81</b>	<b>54,434,862</b>	<b>350.65</b>	<b>45,318,297</b>	<b>99,753,159</b>

In order to validate the wastewater volume calculated from the pump hours, it was compared with the 2021 water consumption data obtained from the RM. The RM provided residential and commercial consumption data. Based on the number of water connections (**Table 3.3**), the residential water consumption data was broken out into Oak Bluff West and old Oak Bluff, as summarized in **Table 3.9**. Approximately 65% of residential water consumption was allocated for Oak Bluff West, which is based upon the ratio of residential sewer connections in Oak Bluff.



**Table 3.9: 2021 Water Consumption in Oak Bluff**

2021	WATER CONSUMPTION IN LITRES		
	Oak Bluff West	Oak Bluff Estates	Commercial
Quarter 1	12,061,855	6,494,845	6,230,000
Quarter 2	18,609,370	10,020,430	8,806,400
Quarter 3	24,460,215	13,170,885	5,787,900
Quarter 4	14,043,315	7,561,785	8,192,400
<b>Total</b>	<b>69,174,755</b>	<b>37,247,945</b>	<b>29,016,700</b>

It is noticeable that a large amount of water is used during summer to water lawns and gardens, and fill swimming pools, as water consumption doubled when comparing Quarter 1 and Quarter 3. Snow melt and surface water runoff which results in infiltration into the wastewater collection systems in the spring and summer months also can increase the amount of wastewater pumped through the lift station. Thus, fall and winter (Quarters 1 & 4) are best used when comparing the water consumption data with the wastewater volume. In both cases, the water consumption data from Oak Bluff West tracks very closely (within 1.0% and 3.9% agreement) with the pumped wastewater volume, as shown in **Table 3.10**. This agreement in data provides confidence that the estimated wastewater volumes can be used to determine an accurate litre per capita generation rate for Oak Bluff West.

**Table 3.10: Oak Bluff West Water Consumption vs. Pumped Wastewater Comparison**

2021	OAK BLUFF WEST	
	Water Consumption (L)	Pumped Wastewater (L)
Quarter 1	12,061,855	11,609,563
Quarter 2	18,609,370	14,074,555
Quarter 3	24,460,215	13,843,365
Quarter 4	14,043,315	13,897,899
<b>TOTAL</b>	<b>69,174,755</b>	<b>53,425,382</b>

The following criteria was used to establish a wastewater generation rate per capita for Oak Bluff West:

- Equivalent population = 331 ERU \* 3 persons/ERU = 993 persons
- Total volume of pumped wastewater = 99,753,159 Litres

Using the above criteria, the wastewater generation per capita is calculated as follows:

- Wastewater generation per capita = 99,753,159 litres ÷ 546 days ÷ 993 persons = **184.0 litres per capita per day (l/c/d)**



The above calculated wastewater generation rate is not unexpected as this development benefits from modern installation standards, including sump pumps for homes that typically do not discharge to the sewer system and low-flow and low-flush fixtures. Furthermore, Oak Bluff is situated adjacent to Winnipeg, and as a satellite community a significant portion of the population leave the neighbourhood during the day, further reducing wastewater generation.

The RM of Macdonald design standards for sizing municipal sewer use 275 l/c/d for wastewater. This value is likely too conservative when sizing a lagoon. Moreover, a lagoon has more flexibility to accommodate fluctuations in the wastewater flows than a municipal sewer system, so it is recommended to select a wastewater generation rate that strikes a balance between both the calculated wastewater generation and the RM design standards. A wastewater generation rate of **200 l/c/d** is selected for both estimating current hydraulic loadings and lagoon design purposes for Oak Bluff.

### 3.3.5.2 MCGILLIVRAY COMMERCIAL DISTRICT

The 2021 pump hours were provided by the RM for the McGillivray lift station. As previously discussed, only pump hours after June 1, 2021, were used to determine the total pumped volume. Based on the results of the lift station drawdown test, pumping rates for each pump (**Table 2.1**) were used to calculate the total volume of wastewater pumped per quarter and is summarized in **Table 3.11**.

**Table 3.11: 2021 Pump Hours and Calculated Wastewater Volume for the MCD**

		PUMP 1		PUMP 2		
		Hours	Volume (L)	Hours	Volume (L)	Total Volume (L) (Pump 1 + Pump 2)
2021	Quarter 2 <sup>1</sup>	25.59	1,182,188	21.75	1,186,422	2,368,610
	Quarter 3	81.69	4,472,978	82.10	4,477,689	8,950,667
	Quarter 4	83.59	4,577,223	84.23	4,593,909	9,171,132
2022	Quarter 1	89.91	4,923,352	91.22	4,975,192	9,898,544
	Quarter 2	126.06	6,902,669	127.20	6,937,586	13,840,255
<b>Total</b>		<b>402.84</b>	<b>22,058,410</b>	<b>406.50</b>	<b>22,170,798</b>	<b>44,229,208</b>

<sup>1</sup> Pump hours start at June 1, 2021

In order to validate the wastewater volume, it was compared with the 2021 water consumption data obtained from the RM. The comparison between the 2021 water consumption calculated for the MCD and the pumped wastewater is summarized in **Table 3.12**. Using the Quarter 4 data, water consumption tracks closely (within 2.3% agreement) with the pump wastewater from the McGillivray lift station. This agreement in data provides confidence that the estimated wastewater volumes can be used to determine an accurate litre per capita generation rate for the MCD.



**Table 3.12: 2021 Water Consumption vs. Pumped Wastewater Comparison for the MCD**

2021	MCGILLIVRAY COMMERCIAL DISTRICT	
	Water Consumption (L)	Pumped Wastewater (L)
Quarter 1	6,232,100	n/a
Quarter 2	8,423,300	2,368,610 <sup>1</sup>
Quarter 3	12,220,900	8,950,667
Quarter 4	8,965,800	9,171,132
<b>Total</b>	<b>35,842,100</b>	<b>20,490,409</b>

<sup>1</sup> Pump hours start at June 1, 2021

To determine the equivalent population for the commercial users in the MCD, the number of water connections and consumption data was used. In 2021, there were 52 commercial water connections in the MCD, and water consumption in the MCD in 2021 was 35,842,100 L (Table 3.12). Consequently, the water consumption per commercial connection is approximately 1,890 L/d, which is approximately 3.35 times the residential water consumption per residential connection in Oak Bluff in 2021.

Historically, the RM has considered each commercial connection to be equivalent to three ERU. For the purposes of this report, one commercial connection will be equivalent to three ERU rather than 1 connection to 3.35 ERU (as measured in 2021) as the difference is accounted for in the wastewater generated per capita, as discussed below.

The following criteria was used to establish a wastewater generation rate per capita for the MCD:

- Equivalent population = 188 ERU \* 3 persons/ERU = 552 equivalent persons
- Total volume of pumped wastewater = 44,229,208 Litres
- No. of days = 395 days (June 1, 2021 – June 30, 2022)

Using the above criteria, the wastewater generation per capita is calculated as follows:

- Wastewater generation per capita = 44,229,208 Litres ÷ 395 days ÷ 552 persons = **202.8 litres per capita per day (l/c/d)**

Similar to Oak Bluff, the calculated wastewater generation rate for the MCD is less than the RM design standard of 275 l/c/d. Again, this is not unexpected as the businesses in the MCD are generally only open during work hours and there are few businesses that produce a significant quantity of wastewater as of June 2022. However, there is certainly a distinct possibility of the MCD needing to accommodate for users that will have higher wastewater loadings, whether it is a future industry (i.e., food processing) or heavy commercial users (i.e., hotel, arena, etc.). Thus, a wastewater generation rate of **250 l/c/d** for the MCD is selected for both estimating current hydraulic loadings and lagoon design purposes. This selected wastewater generation rate is 25% greater than the selected wastewater generation rate for Oak Bluff, which offsets both the potential of high demand users and the difference between the calculated ERU per commercial connection (3.35 ERU per commercial connection in 2021) and the selected ERU per commercial connection (3 ERU per commercial connection).



### 3.3.5.3 HYDRAULIC LOADING SUMMARY

The ability of a lagoon to store the incoming wastewater is a measure of its hydraulic loading capacity. Hydraulic loading refers to the volume of wastewater flowing to the lagoon. The Oak Bluff Lagoon is presently designed for a 230-day storage period beginning November 1st and ending June 15th of the following year. Typically, hydraulic loading is calculated over a 230-day storage period, which provides a small amount of flexibility at the beginning of the discharge period.

Regarding truck hauled wastewater, there are three separate sources: holding tank, septic tank and LPS pump outs. Holding tank wastewater is typically dumped year-round at the lagoon, usually distributed evenly across all months of the year. Based on a 230-day storage period, approximately 65% of the total holding tank wastewater will contribute to the hydraulic loading of the lagoon.

Septic tanks can only be emptied at the lagoon from June 1 until October 15, thus there is only 15-days where the wastewater volume of the septic tanks contribute to the overall hydraulic loading. As a result, approximately 10% (15 of 137 days available for septic tank wastewater disposal) of the septic tank wastewater will contribute to the hydraulic loading of the lagoon.

Finally, the LPS pump outs are completed by the RM usually during the summer months for the Oak Bluff LPS and the MCD LPS, thus do not contribute to the hydraulic loading of the lagoon.

When calculating the hydraulic loading of the lagoon, the following criteria were used:

- Average per capita demand for Oak Bluff = 200 L/c/d
- Average per capita demand for the MCD = 250 L/c/d
- Equivalent population for Oak Bluff = 331 ERU \* 3 persons/ERU = 993 persons
- Equivalent population for the MCD = 188 ERU \* 3 persons/ERU = 552 persons
- Storage period = 230 days
- 65% of holding tank wastewater is contributed to the lagoon during the storage period.
- 10% of septic tank wastewater is contributed to the lagoon during the storage period.

Using the above criteria, the current hydraulic loading is calculated as follows:

- Oak Bluff West hydraulic loading = 993 persons × 200 L/c/d × 230 days = 45,678 m<sup>3</sup>
- MCD hydraulic loading = 552 persons × 250 L/c/d × 230 days = 31,740 m<sup>3</sup>
- Holding tank hydraulic loading = 1,519 m<sup>3</sup> × 65% = 987 m<sup>3</sup>
- Septic tank hydraulic loading = 754 m<sup>3</sup> × 10% = 75 m<sup>3</sup>
- Total current hydraulic loading = **78,480 m<sup>3</sup>**

## 3.4 POPULATION PROJECTION

### 3.4.1 CENSUS DATA

The information shown in the Table below is based on the Census Profile available from Statistics Canada for the census years 1996-2021 specific to the RM of Macdonald.

**Table 3.13: Census Data for the RM of Macdonald (1996-2021)**

YEAR	RM OF MACDONALD POPULATION	5-YEAR GROWTH	ANNUALIZED AVERAGE GROWTH	NO. OF OCCUPIED PRIVATE DWELLINGS	PEOPLE PER OCCUPIED PRIVATE DWELLING
1996	4,900	n/a	n/a	1,530	3.20
2001	5,320	8.57%	1.71%	1,665	3.19
2006	5,653	6.26%	1.25%	1,813	3.11
2011	6,280	11.09%	2.22%	2,050	3.06
2016	7,162	14.04%	2.81%	2,382	3.01
2021	8,120	13.38%	2.68%	2,743	2.96

The following Table documents the population information for the community of Oak Bluff. Statistics Canada data for Oak Bluff only became available in 2011.

**Table 3.14: Census Data for the Community of Oak Bluff (2011-2021)**

YEAR	OAK BLUFF POPULATION	5-YR GROWTH [%]	ANNUALIZED AVERAGE GROWTH [%]	NO. OF OCCUPIED PRIVATE DWELLINGS	PEOPLE PER OCCUPIED PRIVATE DWELLING
2011	581	n/a	n/a	n/a	n/a
2016	1,051	80.90%	16.18%	325	3.23
2021	1,442	37.20%	7.44%	475	3.03

Of note, Statistics Canada provides data on *Total private dwellings* within the population bases as well as *Private dwellings occupied by usual residents*. We have elected to tabulate only the latter as it provides the most representative and conservative data for the purposes of this study. *People per Occupied Private Dwelling* was calculated by dividing the population by the number of private occupied dwellings.

### 3.4.2 DESIGN EQUIVALENT POPULATION

The RM of Macdonald and Oak Bluff have both seen considerable growth in the past decade. The RM has been steadily growing at over 2.5% per year, with Oak Bluff and La Salle being the primary communities responsible for the population growth. In fact, the population of Oak Bluff has almost tripled in the past decade, mostly all driven by the Oak Bluff West development. The MCD also has substantial



growth potential due to the amount of available land zoned for commercial and industrial development, which cannot be captured by population counts and growth rates. This high growth in the RM and the potential in the MCD makes it difficult to select an annual growth rate in order to project a 25-year design population for this region of the RM. Thus, in order to establish an equivalent design population that capture both the growth in Oak Bluff and the MCD, a detailed analysis has been completed to determine the future number of residential units in Oak Bluff West and surrounding areas and the future number of lots available in the MCD. Information provided by both the RM and Qualico have been used to complete this analysis.

### 3.4.2.1 OAK BLUFF WEST AND SURROUNDING AREAS

The Qualico development of Oak Bluff West has seen tremendous growth in the past decade. The existing Phases 1 through 3 have been fully constructed, with the majority of the lots with homes constructed and occupied (331 of 363 available lots). Phases 4 and 5 are in the process of being completed with homes beginning to be constructed on lots in Phase 4. There is one known future multi-family site in Phase 5, and is estimated to have 9 residential units.

From information provided by Qualico, there is an additional 525 lots available beyond Phase 5, which includes all Qualico owned land as well as the three private farm sites surrounding the development. It is assumed that these private farm sites will be developed into residential homes during the 25-year design horizon. Furthermore, Qualico has stated that the number of housing starts have averaged between 35 and 40 per year since the start of the development. It is also assumed that this number housing starts per year will continue until the development has reached its capacity, which is anticipated to be in approximately 17 to 20 years. After the Qualico development is completed in the design year of 2042, it is assumed that residential development will continue at 40 housing starts per year in other areas currently available for development until the design-year of 2047.

Beyond Oak Bluff West, the RM has identified that the land to the south of the arena is anticipated for development in the near future. From the discussions with the RM, this area is anticipated to be developed as multi-family units, and full development is anticipated to be 100 ERU.

Additionally, based upon the most recent draft of the Macdonald-Ritchot Planning Study, the RM has allocated approximately 53.3 hectares (131.7 acres) of land north of the existing Oak Bluff industrial park as developable commercial land. It is projected that 67% of this available land will be developed during the 25-year design, or approximately 88 acres. Further, it is estimated that there will be one commercial sewer connection for every 2 acres of available land, and that one commercial connection is equivalent to three ERU.

Figure 3-2 details the planned Oak Bluff developments and remaining available lands. The following **Table 3.15** summarizes the projected ERUs and equivalent population in Oak Bluff and surrounding areas for the 25-year design period.



**Table 3.15: Projected 25-year Design Period ERUs and Equivalent Population for Oak Bluff**

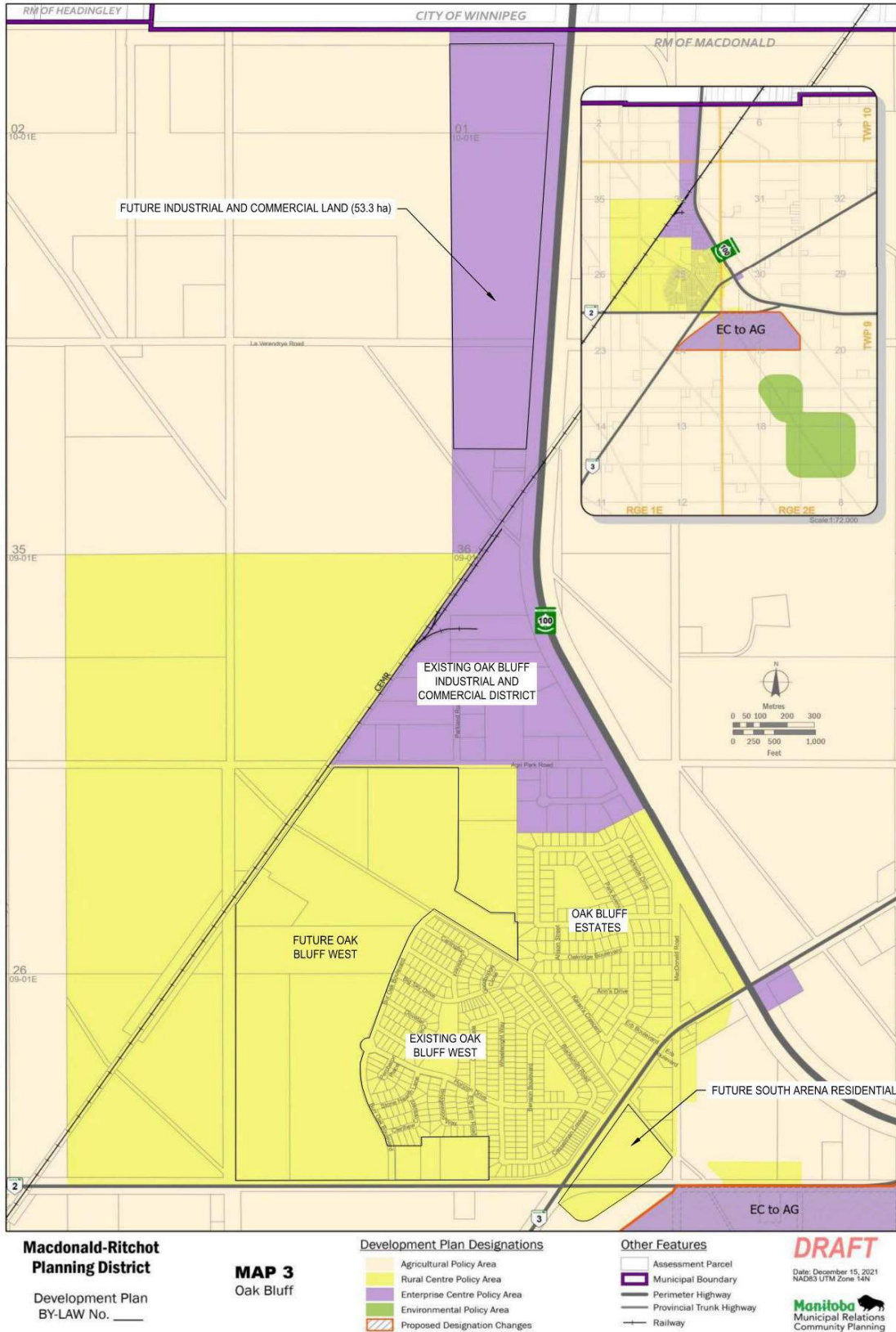
<b>AREAS</b>	<b>ERU</b>	<b>EQUIVALENT POPULATION</b>
Existing Oak Bluff West	331	993
Future Oak Bluff West Phase 1 – 3 (Existing) <sup>1</sup>	32	96
Future Oak Bluff West Phase 4 & 5 (Under Construction)	118	354
Future Oak Bluff West Future Lots <sup>2</sup>	525	1,575
Future Oak Bluff West Future Multi-Family	9	27
<b>SUBTOTAL – OAK BLUFF WEST</b>	<b>1,015</b>	<b>3,045</b>
Future Arena South Multi-Family	100	300
Future residential development <sup>3</sup>	200	600
Future Commercial Development	132	396
<b>TOTAL – OAK BLUFF</b>	<b>1,447</b>	<b>4,341</b>

<sup>1</sup> Based on the number of existing sewer connections, it is considered that 331 of the 363 of the residential units are occupied.

<sup>2</sup> This includes all remaining Qualico owned land and private farm sites.

<sup>3</sup> The future residential development is based on a continuation of 40 lots per year from the design year of 2042 to 2047.

It's important to note that total projected equivalent population in the above table does not include the existing equivalent population (186 residential sewer connections and 28 commercial sewer connections) that contribute to the Old Oak Bluff Lagoon. Including this equivalent population (810) will increase the total projected equivalent population of Oak Bluff to 5,151.



**Figure 3-2: Oak Bluff Development Plan with Future Developments**



### 3.4.2.2 MCGILLIVRAY COMMERCIAL DISTRICT

Based upon the current draft Macdonald-Ritchot Planning Development Report, the MCD is bounded by Wyper Road to the north, Brady Road to the east, Road 54 N to the south, and extends approximately 800 m (½ mile) west of Loudon Road. The MCD has seen significant development in the past decade, particularly with the new commercial developments of South Landing and McGillivray Business Park being completed and with commercial buildings being constructed and occupied within these developments. Two other commercial developments are currently under construction, Prairie Business Park and McCreary Developments, which will add even more available commercial space to the MCD in the near term.

The RM has provided preliminary development plans for several plots of land within the MCD, and the number of available lots were tallied. Where preliminary development plans were not available, an estimated acreage was calculated and a number of lots was assigned to each area based on an average lot size of 2 acres. This includes the former site of Paramount Pallet, Lakes of Fort Whyte (behind Auto Show Sales & Finance), the empty lot east of the Lakes of Fort Whyte, several plots of land that the landowners have expressed interest in developing, as well as a portion of the remaining land within the MCD that was not identified in the documents provided by the RM (known as Areas A to F), as well as unallocated empty land west of Loudon Road. Furthermore, using recent aerial imagery, available lots within existing developments have also been identified in the South Landing development and the Samborski development.

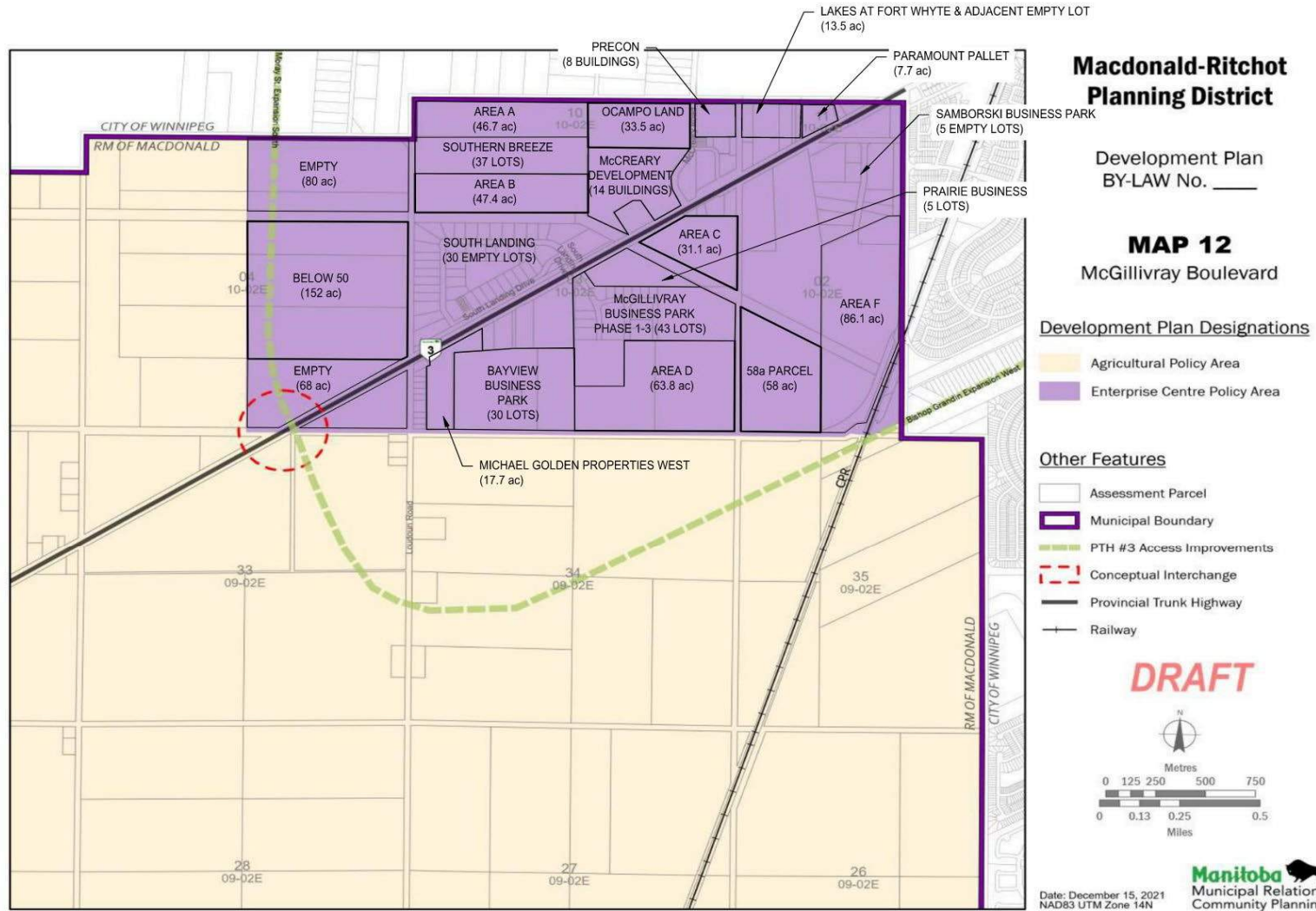
**Figure 3-3** details the breakdown of the planned MCD developments and remaining available lands and **Table 3.16** below summarizes the projected future lots within the MCD for the 25-year design period.



**Table 3.16: Projected 25-year Design Period ERUs and Equivalent Population for MCD**

DEVELOPMENT	AREA (ACRES) <sup>1</sup>	NO. OF LOTS	ERU	EQUIVALENT POPULATION
South Landing (Available Lots)	---	30	90	270
Samborski (Available Lots)	---	5	15	45
Precon	---	8	24	72
Prairie Business Park	---	5	15	45
McGillivray Business Park (Phase 1 – 3)	---	43	129	387
Southern Breeze Holdings	---	37	111	333
McCreary Developments	---	14	42	126
Bayview Business Park (Phase 1 & 2)	---	20	60	180
Paramount Pallet (redevelopment)	7.7	4	12	36
Lakes at Fort Whyte & Adjacent Empty Lot	13.3	7	21	63
Ocampo Land	33.5	17	51	153
Michael Golden Properties (East and West)	37.6	19	57	171
58a Parcel	58	29	87	261
Below 50	152	76	228	684
Area A	46.7	24	72	216
Area B	47.4	24	72	216
Area C	31.1	16	48	144
Area D	63.8	32	96	288
Area F	76	38	114	342
Unallocated empty land (west of Loudon Road)	140	70	210	630
<b>SUBTOTAL FUTURE</b>	---	<b>518</b>	<b>1,554</b>	<b>4,662</b>
<b>SUBTOTAL EXISTING</b> (Table 3.5)	---	---	<b>184</b>	<b>552</b>
<b>TOTAL – MCD</b>	---	---	<b>1,738</b>	<b>5,214</b>

<sup>1</sup> Area was used to estimate the number of lots based on an assumption of one lot per two acres.



**Figure 3-3: McGillivray Commercial District Development Plan with Future Development**

### 3.4.3 SUMMARY

The following information was used to project the 25-year design equivalent population for Oak Bluff:

- There are on average 40 housing starts per year.
- An additional 684 ERU is projected for the full development of Oak Bluff West (for a total of 1,015 ERU), another 100 ERU are considered for the lands south of the arena, and another 200 ERU to be allocated for future residential development beyond Oak Bluff West and lands south of the arena.
- With a total of 984 ERU allocated and with a projected 40 housing starts per year, it will take approximately 25 years to develop.
- An additional 132 ERU are allocated for the commercial development north of Oak Bluff, which is approximately 67% of the available commercial land.
- As there are no current development plans for the available commercial land north of Oak Bluff, the allocated 132 ERU will only be applied to the last 15 years of the 25-year design period.

The following information was used to project the 25-year design equivalent population for the MCD:

- There are an estimated 518 available future lots, and each is assumed to have one commercial sewer connection.
- Three ERU are equivalent to one commercial lot or sewer connection.
- All identified 518 lots will be developed in the 25-year design period, which equates to approximately 21 lots developed per year.
- No increase to the residential sewer connections is anticipated.

**Table 3.17** below summarizes the existing ERU and 25-year design ERU for both Oak Bluff and the MCD.

**Table 3.17: Summary of Existing and Projected ERU for Oak Bluff and the MCD**

AREA	EXISTING ERU (2022)	PROJECTED ERU (2047)	PROJECTED EQUIVALENT POPULATION (2047)
Oak Bluff West Residential	331	1,015	3,045
Oak Bluff Future Residential	0	300	900
Oak Bluff Future Commercial	0	132	396
MCD Residential	40	40	120
MCD Commercial	144	1,698	5,094
<b>TOTAL – OAK BLUFF LAGOON</b>	<b>785</b>	<b>3,185</b>	<b>9,555</b>
Old Oak Bluff Residential	186	186	558
Old Oak Bluff Commercial	84	84	252
<b>TOTAL – OLD OAK BLUFF LAGOON</b>	<b>270</b>	<b>270</b>	<b>810</b>

## 3.5 WASTEWATER LOADING PROJECTIONS

The following considerations have been applied in order to estimate the future organic and hydraulic loadings:

- The future ERU from **Table 3.17** will be used to project wastewater loadings.
- The hydraulic portion of the existing residential and commercial LPS connections from old Oak Bluff will continue to flow to the original Oak Bluff Lagoon, only the solids portion will be considered, and this will not increase over the 25-year design period.
- New commercial development in Oak Bluff will new connected to the new lagoon.
- The number of residential ERU within the MCD will not increase during the 25-year design.
- Rural truck hauling will increase at a 2% rate, starting from the existing truck haul loadings as outlined in **Section 3.3.2**.

When calculating the projected organic loading of the lagoon, the following criteria is applied:

- Average daily BOD<sub>5</sub> per person = 0.077 kg
- Solid's portion of the LPS wastewater = 60% of the total BOD<sub>5</sub>
- Truck hauled wastewater increases by 2% per year

When calculating the projected hydraulic loading of the lagoon, the following criteria were used:

- Average per capita demand for Oak Bluff residential ERU = 200 L/c/d
- Average per capita demand for the MCD ERU and Oak Bluff future commercial ERU = 250 L/c/d
- Storage period = 230 days
  - A 180-day storage period is provided in **Table 3.20**, which is used to size the Aerated Lagoon with SAGR option. A shorter storage period (120 to 150 days) was reviewed, however, as the lagoon discharges into a drain that does not flow year-round it would be challenging to seek regulatory approval for an early spring or late fall discharge where freezing conditions would generally prevail.
- Truck hauled wastewater increases by 2% per year

The projected wastewater organic and hydraulic loading for the current year, and 10-year design and 25-year design periods are presented in the tables below.

**Table 3.18: Organic Loading Projections**

AREA	ORGANIC LOADING FOR DESIGN YEAR (KG-BOD <sub>5</sub> /D)		
	2022	2032	2047
Old Oak Bluff <sup>1</sup>	37.4	37.4	37.4
Oak Bluff West & Future Residential	76.5	167.4	303.8
Oak Bluff New Commercial	0	0	30.5
MCD Residential	9.2	9.2	9.2
MCD Commercial	33.3	176.9	392.2
Truck Hauled WW	55.3	67.5	90.8
<b>TOTAL</b>	<b>211.7</b>	<b>458.4</b>	<b>863.9</b>

<sup>1</sup> Solids portion to be hauled to the lagoon annually

**Table 3.19: Hydraulic Loading Projections**

AREA	HYDRAULIC LOADING FOR DESIGN YEAR (M <sup>3</sup> )		
	2022	2032	2047
Old Oak Bluff <sup>1</sup>	0	0	0
Oak Bluff West Residential	45,678	99,995	181,470
Oak Bluff New Commercial	0	0	22,770
MCD Residential	6,900	6,900	6,900
MCD Commercial	24,840	132,066	292,905
Truck Hauled WW	1,063	1,334	1,795
<b>TOTAL</b>	<b>78,481</b>	<b>240,295</b>	<b>505,840</b>

<sup>1</sup> No hydraulic loading from Old Oak Bluff, as wastewater is conveyed to the original Oak Bluff Lagoon

The Oak Bluff Lagoon is currently sized to accommodate an organic loading of 460.3 kg-BOD<sub>5</sub>/d and has a storage capacity of 180,000 m<sup>3</sup>. Based upon the stated design loadings, the existing lagoon is projected to reach its organic capacity in the design year 2032 and reach its hydraulic capacity in design year 2028. The following table summarized the current lagoon capacity and the 10 and 25-year design loadings.

**Table 3.20: Summary of Wastewater Loading Projections**

	OAK BLUFF LAGOON CAPACITY	PRESENT DAY (2022)	10-YEAR DESIGN (2032)	25-YEAR DESIGN (2047)
Organic Loading	460.3 kg-BOD/d	211.8 kg-BOD/d	458.4 kg-BOD/d	863.9 kg-BOD/d
Hydraulic Loading (230-days)	180,000 m <sup>3</sup>	78,480 m <sup>3</sup>	240,295 m <sup>3</sup>	505,840 m <sup>3</sup>
Hydraulic Loading (180-days)	180,000 m <sup>3</sup>	---	188,060 m <sup>3</sup>	395,875 m <sup>3</sup>

## 3.6 WASTEWATER CONVEYANCE DEMAND

The wastewater from the development of Oak Bluff West and the MCD are conveyed to the Oak Bluff Lagoon via separate lift stations and forcemains, as previously discussed. The existing and future wastewater conveyance demand for Oak Bluff West and the MCD is discussed in the following sections.

### 3.6.1 OAK BLUFF WEST

The wastewater generated from the homes in the Oak Bluff West subdivision is directed to its own lift station located within the development, then pumped to the existing Oak Bluff lagoon via a single 250Ø forcemain. Its twin forcemain (300Ø) has been installed to the boundary of the development, and will be connected to the lagoon in the future. The criteria used to calculate the existing, 10-year and 25-year design wastewater volumes for the lift station and FM are outlined in **Table 3.21**.

**Table 3.21: Criteria for Oak Bluff West Wastewater Conveyance Volume Calculations**

CRITERIA	VALUE
Average per capita demand <sup>1</sup>	275 L/c/d
Average number of persons per ERU	3 persons/ERU
Existing ERU in Oak Bluff West	331 ERU
Future 10-year Design ERU in Oak Bluff West	684 ERU
Future 25-year Design ERU in Oak Bluff West	1,015 ERU
Peak day peaking factor	2.5
Peak hour peaking factor (for sewage conveyance)	4.0
Extraneous flows	2,200 L/ha/d
Infiltration	20,800 L/ha/d
Current Oak Bluff West land area	63.8 ha
Total Oak Bluff West land area	160.8 ha

<sup>1</sup>The average wastewater flow was found to be lower than 275 L/d, but this figure is the amount indicated in the RM's Servicing Standards for sewage infrastructure design and was therefore used in these calculations.

Based on the criteria above, the total Oak Bluff West wastewater contribution was found for the existing ERU, 10-year design ERU, and the 25-year ERU. These contributions are summarized in **Table 3.22**.



**Table 3.22: Total Oak Bluff West Wastewater Contribution to the Lagoon.**

DESIGN YEAR	PEAK HOUR WASTEWATER DEMAND [L/S]	INFILTRATION [L/S]	TOTAL PEAK HOUR CONTRIBUTION [L/S]
Existing	12.6	17.0	29.6
10-year design	26.4	30.6	57.0
25-year design	38.8	42.8	81.6

A sample calculation for the existing design year is shown below.

*Demand per person*

$$\begin{aligned}
 &= (\text{Average per capita demand}) * (\text{Design ERU}) * (\text{Number of persons per ERU}) \\
 &* (\text{Peak hour peaking factor}) = 275 \frac{\text{L}}{\text{person} * \text{day}} * 331 \text{ERU} * 3 \frac{\text{person}}{\text{ERU}} * 4.0 \\
 &= 1,092,300 \text{ L/d} = \mathbf{12.6 \text{ L/s}}
 \end{aligned}$$

The Oak Bluff West area was measured to be 63.8 hectares. Using the above criteria, the contribution from the infiltration and extraneous flows is estimated at 17.0 L/s, as shown in the calculations below.

*Total infiltration and extraneous flows = (Extraneous flows + Infiltration) \* Area*

$$= (2,200 + 20,800) \frac{\text{L}}{\text{ha} * \text{day}} * 63.8 \text{ ha} \div 86,400 \frac{\text{s}}{\text{day}} = \mathbf{17.0 \text{ L/s}}$$

Therefore, the total existing peak hour contribution from Oak Bluff West is 29.6 L/s.

### 3.6.2 MCGILLIVRAY COMMERCIAL DISTRICT

The wastewater generated from within the MCD is directed to its own lift station, then pumped to the Oak Bluff Lagoon via a single 250Ø forcemain. There are also 9 commercial lots (27 ERU) that contribute to the McGillivray lift station from Oak Bluff, and is not anticipated to change during the design period. The criteria used to calculate the existing, 10-year and 25-year design wastewater volumes for the lift station and FM are outlined in **Table 3.23**.

**Table 3.23: Criteria for the MCD Wastewater Conveyance Volume Calculations**

CRITERIA	VALUE
Average per capita demand <sup>1</sup>	275 L/c/d
Average number of persons per ERU	3 persons/ERU
Existing ERU in MCD & Oak Bluff Commercial	211
Future 10-year Design ERU in MCD	832
Future 25-year Design ERU in MCD	1,765
Peak Day peaking factor	2.5
Peak Hour peaking factor	4.0
Infiltration through septic tank risers	0.01 L/tank/s

<sup>1</sup>The average wastewater flow was found to be lower than 275 L/d, but this figure is the amount indicated in the RM's Servicing Standards for sewage infrastructure design and was therefore used in these calculations.

Based on the criteria above, the total MCD wastewater contribution was found for the existing ERU, 10-year design ERU, and the 25-year ERU. These contributions are summarized in **Table 3.24**.

**Table 3.24: Total MCD Wastewater Contribution to the Lagoon**

DESIGN YEAR	PEAK HOUR WASTEWATER DEMAND [L/S]	INFILTRATION [L/S]	TOTAL PEAK HOUR CONTRIBUTION [L/S]
Existing	8.1	1.0	9.0
10-year design	31.8	3.0	34.8
25-year design	67.4	6.2	73.6

A sample calculation for the existing design year is shown below.

*Demand per person*

$$\begin{aligned}
 &= (\text{Average per capita demand}) * (\text{Design ERU}) * (\text{Number of persons per ERU}) \\
 &\quad * (\text{Peak hour peaking factor}) \\
 &= 275 \frac{\text{L}}{\text{person} * \text{day}} * 211 \text{ ERU} * 3 \frac{\text{person}}{\text{ERU}} * 4.0 \div 86,400 \frac{\text{s}}{\text{day}} = \mathbf{8.1 \text{ L/s}}
 \end{aligned}$$

To find the contribution from infiltration into the septic tanks, the number of tanks need to be determined using the ERU values. It is assumed that each wastewater connection, residential or commercial, will have one septic tank. The MCD currently has 40 existing residential wastewater connections, which is anticipated to remain unchanged over the 25-year design period. These 40 residential connections are also equivalent in ERU. To convert the remaining ERU into commercial connections, the 40 residential connections were subtracted from the ERU design values found in **Table 3.23**, then converted to number of commercial connections by dividing by three. The 40 residential connections were then added again to complete the conversion. A sample calculation for the current number of lots is shown below.

$$\text{Number of wastewater connections} = \frac{211 - 40}{3} + 40 = 97 \text{ connections} = 97 \text{ tanks}$$



Based on the current number of connections, the contribution from infiltration into the septic tanks is estimated at 0.9 L/s, as shown in the calculations below.

$$\begin{aligned} \text{Infiltration into septic tank covers} &= (\text{Infiltration through septic tank}) * (\text{Serviced lots}) \\ &= 0.01 \frac{\text{L}}{\text{tank} * \text{s}} * 97 \text{ tanks} = \mathbf{1.0 \text{ L/s}} \end{aligned}$$

Therefore, the total existing peak hour wastewater contribution to the McGillivray lift station is 9.0 L/s.

## 4 PRELIMINARY DESIGN

### 4.1 EFFLUENT QUALITY OBJECTIVES

The applicable wastewater treated effluent quality guidelines are as follows:

- Federal Wastewater Systems Effluent Regulations (WSER)
- Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG)

As categorized by WSER, the existing lagoon operates as an *intermittent discharging wastewater system with annual average daily wastewater volume of 100 to ≤17,500 m<sup>3</sup>*. The federal WSER limits are shown in **Table 4.1**.

**Table 4.1: WSER Treated Effluent Limits**

PARAMETER	LIMIT
cBOD	Annual average of ≤ 25 mg/L
TSS	Annual average of ≤ 25 mg/L
Unionized Ammonia (NH <sub>3</sub> )	Maximum concentration in the year < 1.25 mg/L as Nitrogen (N) at 15°C ± 1°C
Total Residual Chlorine	Annual average ≤ 0.02 mg/L

Under the provincial requirements, Tier 1 MWQSOG apply, including a total phosphorus limit. **Table 4.2** lists the applicable provincial effluent limits based on a design equivalent population of 9,555.

**Table 4.2: Provincial Treated Effluent Limits**

PARAMETER (mg/L)	LIMIT
BOD	25 mg/L
TSS	25 mg/L
Fecal Coliforms	200 per 100 mL
Total Phosphorus	1 mg/L
Total Ammonia <sup>1</sup>	Site specific
<sup>1</sup> Total Ammonia limit would be required for an early discharge (May 1 <sup>st</sup> ), and is based on specific site characterization as determined by the Province of Manitoba.	

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## 4.2 NUTRIENT REDUCTION CONSIDERATIONS

Lagoons are relatively low cost, simple to operate and provide effective wastewater treatment in terms of organic carbon (BOD) and pathogen removal. However, phosphorus removal in these lagoons is often low, generally only between 15% and 50% [1]. Because of this, there is increasing pressure from provincial regulators to upgrade these facilities to prevent the eutrophication of receiving water bodies. MECP requires the total phosphorus concentration to be  $\leq 1.0$  mg/L in the treated wastewater effluent. However, MECP does offer some leniency in the type of phosphorus reduction implemented for facilities discharging less than 820 kg/year of total phosphorus which is equivalent to a population under 2,000. The existing (and projected) population serviced by the Oak Bluff lagoon is above 2,000 equivalent people.

Four main options were reviewed for phosphorus reduction at the proposed Oak Bluff Lagoon expansion:

- Chemical addition;
- Irrigation; and,
- Constructed wetland.

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### 4.2.1 CHEMICAL ADDITION

Both Oak Bluff lagoons currently operate with a total phosphorus limit of 1 mg/L. The RM currently broadcasts alum on the surface of the secondary cells prior to discharge. In brief, surface application commences with taking water samples from the isolated secondary cell for the purpose of jar testing, which is conducted to determine the amount of chemical that will be required to lower the total phosphorus level below 1.0 mg/L. After the chemical is ordered and delivered to site, it is applied to the lagoon from the shore. As the various cations (of which phosphorus is one of) precipitate out of the wastewater, they settle out to the bottom of a lagoon cell as a chemical sludge. Confirmatory testing is performed after the application to confirm the lowered phosphorus level meets the licence requirement. With the many uncontrolled inputs into a lagoon's functioning, it is possible that more than one round of chemical dosing is required to lower the phosphorus levels sufficiently, especially if overdosing is to be avoided. Once it has been confirmed that the phosphorus level in the secondary cell to be discharged is below the regulated limit, the cell is able to be discharged if it has successfully met the other discharge testing requirements as well.

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### 4.2.2 IRRIGATION

Irrigation is considered a nutrient reduction option, not because it reduces the level of phosphorus in the wastewater, but because it applies the wastewater to agricultural land and keeps the phosphorus out of any watercourses and therefore the phosphorus is put to beneficial use for plant growth. There are several factors to consider when determining whether irrigation is suitable, including:

- Land suitability in the local area (i.e., soil conditions, availability of agricultural land);
- Groundwater contamination risks; and
- Quality of the wastewater.



Typically, a detailed irrigation report would need to be completed in order to determine the suitability of the municipal wastewater for irrigation. However, for the purposes of this report, a high-level review was completed. To summarize, the land situated around Oak Bluff and the proposed lagoon site is mostly all cultivated and is classified for agricultural use. The soil conditions are similar throughout the area and generally consist of Red River clays. There is no information available on groundwater levels at the lagoon site as the geotechnical investigation did not encounter groundwater during drilling and sampling, though groundwater is known to be confined to the limestone bedrock beneath the thick layer of Red River clay. Municipal wastewater typically has elevated levels of nutrients (nitrogen and phosphorus), salinity, electrical conductivity, chloride and boron, and this will impact what type of crop that can be grown where the irrigation is to take place.

Some additional factors that need to be considered include:

- MECP regulatory requirements.
- No engagement with landowners or cooperating farm producers has taken place.
- No engagement with residents of the RM or within the local study area has taken place.
- Study area specifics such as soil characteristics, crop agronomy, infrastructure requirements and available land are not all known.
- Effluent water quality is somewhat known as the RM keeps discharge records for the BOD, fecal coliforms and total phosphorus.
- Emerging Substances of Concern (ESOC) including pharmaceuticals, antibiotics, endocrine disrupting chemicals, hormones and personal care products are found in very low concentrations in municipal wastewater, generally not identified as an environmental or health risk, but are being studied and monitored.

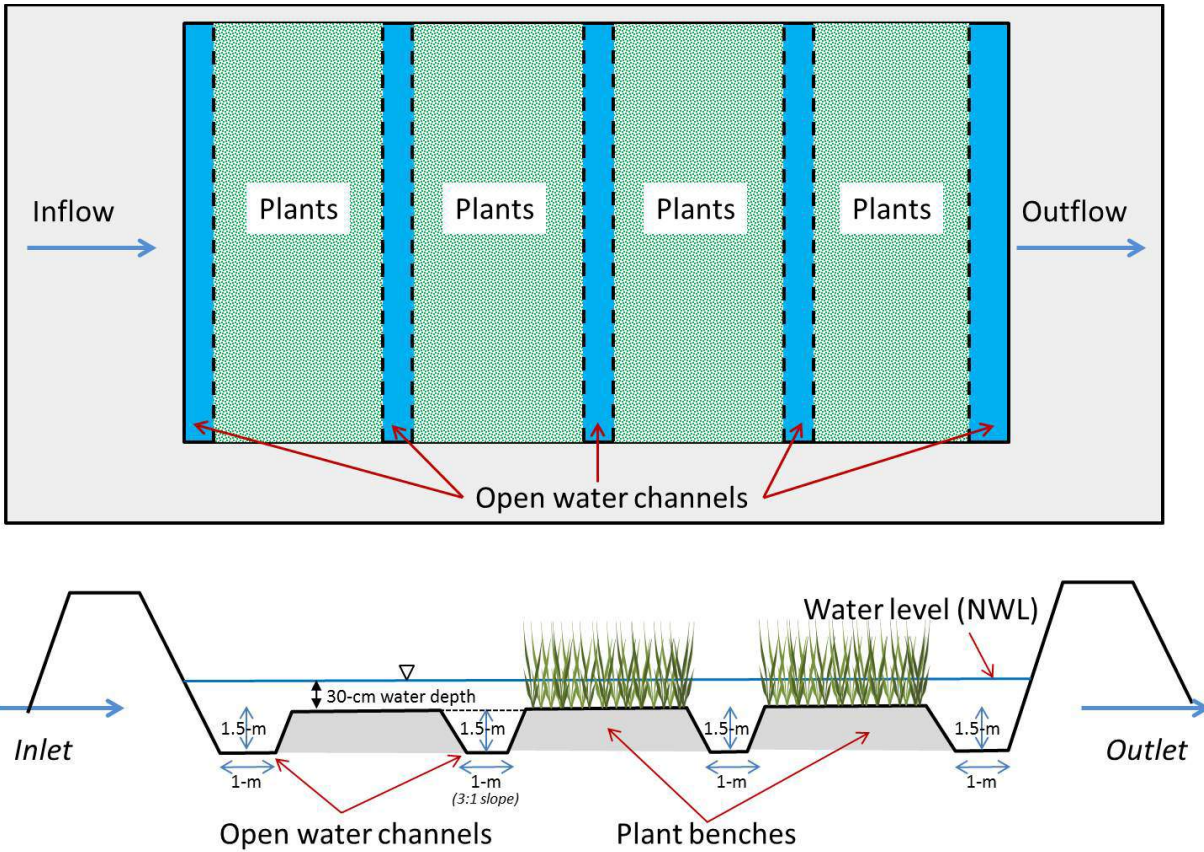
At this time, a separate study regarding the suitability of irrigation would need to be completed, including public consultation, to determine whether this option is feasible. However, based upon the size of the lagoon and there being limited need for irrigation for the types of crops grown in the area, WSP does not recommend pursuing this option further.

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### **4.2.3 CONSTRUCTED WETLAND**

WSP has been working with Native Plant Solutions (NPS) for several years on wetland projects for the reduction of phosphorus from wastewater in several communities, including St-Pierre-Jolys, La Broquerie, Shoal Lake and the RM of Ste. Anne. Constructed wetlands have been gaining attention as an option to reduce phosphorus within a lagoon type system. Constructed wetlands have an advantage over the use of chemicals because there is no resultant chemical sludge to manage. However, a surface flow wetland system does require a relatively large land base.

Wetlands operate on the convention that plants have the ability to feed off of the nutrients in wastewater. Typically, cattail are employed for this purpose. A typical constructed wetland is shown in Figure 4-1. The treated wastewater enters one end of the wetland and moves to the other end where a weir type control structure controls the water level in the wetland and allows water to be discharged. It also serves to control the water level during the winter storage period when the wetland is no longer operating.



**Figure 4-1: Typical design of a constructed wetland cell**

Using an influent phosphorus loading of 6 mg/L and an *annual* hydraulic loading of over 675,000 m<sup>3</sup>, a phosphorus loading of 4,050 kg/year is projected. Based on an estimated phosphorus removal of 1 kg/day/hectare of functional wetland area and 123 discharge days per year (June 15 – October 15), a wetland cell would require a functional wetland area of approximately 33 ha. To account for the open water channel areas, which occupy approximately 10% of the wetland area, an overall bottom area of 3.3 ha would be required. Wetland cells are typically constructed with 4:1 side slopes and 1.5 metres high berms, which allows for a maximum water depth of 0.5 m and a freeboard of 1.0 m. The area for berms around the perimeter of the wetland cell requires an additional 20% of land, which brings the total land required for a wetland cell to 44 ha (108 ac), which would require more land than is available for the lagoon expansion. Furthermore, future expansion to accommodate La Salle will rely on the remaining available land. Thus, a constructed wetland cell would not be a feasible solution for phosphorus removal for the lagoon expansion.

#### 4.2.4 NUTRIENT REMOVAL SUMMARY

Overall, the best option available to the RM would be to continue with chemical addition (alum) for nutrient reduction, as irrigation and a wetland cell are not feasible for the Oak Bluff Lagoon. The



preliminary design options presented below will include chemical addition for nutrient reduction, either via broadcasting (facultative lagoon option) or an automated system (aeration lagoon options).

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## 4.3 LAGOON EXPANSION OPTIONS

Three different treatment options have been explored for the preliminary design of the Oak Bluff Lagoon expansion:

- a facultative lagoon expansion;
- an aerated lagoon expansion; and
- an aerated lagoon expansion with a SAGR (submerged attached growth reactor) system.

The following sections provide a high-level description of each treatment option and design parameters. MECP's *Design Objectives For Wastewater Treatment Lagoons* was followed for preliminary design. Plans of the three options are presented in **Appendix E**.

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### 4.3.1 OPTION 1 – FACULTATIVE LAGOON EXPANSION

A facultative lagoon is a simple and proven system and is used extensively throughout rural Manitoba for wastewater treatment. Large ponds with long retention times provide adequate treatment even under conditions where large fluctuations in wastewater flow and strength are common. Facultative lagoons are effective at reducing BOD, TSS and fecal coliforms, and are somewhat effective at ammonia reduction depending on temperature and pH. However, they are not effective at phosphorus reduction, and generally require chemical addition to meet the provincial total phosphorus limits. Odours are a consistent problem during spring as the ice melts, and is a major reason for the provincial requirement of a minimum setback distance (300 m) from nearby residents.

Facultative lagoons typically have very low maintenance costs as they require little to no energy inputs as they are generally designed to operate by gravity flow. They are also much less vulnerable to operational challenges and potential failures when compared with mechanized treatment facilities as they mostly have no automated parts.

In Manitoba, facultative lagoons can only be constructed with a maximum operating depth of 1.5 m and have a required 230-day storage period. This means as communities grow in population, a facultative lagoon will require more and more land for treatment and storage, which in certain cases may not be readily available or cost-effective. Currently, all the wastewater treatment lagoons in the RM are facultative, including the Oak Bluff Lagoon.

#### 4.3.1.1 DESIGN DETAILS

The facultative lagoon expansion option was sized to accommodate the 20-year design loadings. The proposed design has one enlarged primary cell and two new secondary cells to accommodate the hydraulic loading requirements. Earthworks are balanced with excess topsoil that can be used to construct the outer shoulder of the new perimeter berms. The topography of the site drops to the south and west, which allows the new cells to be tiered 0.2 m below the existing lagoon top of the berm and cell floor elevations. This is also beneficial for gravity flow through the cells. The new secondary cells will



discharge on the east side and flow through a perimeter ditch along the south side of the expanded lagoon footprint towards Atchison drain. The RM will be required to continue their existing practice of chemical dosing for phosphorus reduction prior to discharging the secondary cells.

Typical design parameters for the lagoon expansion (primary and secondary cells) are as follows:

- 1.5 m maximum operating depth;
- 1.0 m freeboard;
- 4:1 side slopes (interior & exterior);
- 5.0 m (min) top of berm width and widened corners for truck access around the perimeter berms;
- 3.0 m (min) top of berm width for interior berms;
- 2.0 m wide clay core cut off walls;
- 300Ø piping and gate valves (HDPE DR17 or PVC SDR35)
- Pipe inverts are set 0.3 m above the floor;
- 300 mm thick rip rap armouring with geotextile on interior slopes from the floor of the cell to a minimum of 0.3 m above the maximum operating depth, as well as around the pipe inverts;
- Perimeter wire fencing and signage; and
- Perimeter ditching (4:1 side slopes and minimum 1.2 m wide flat bottom) and culverts as required.

The following tables summarize the design parameters for the facultative lagoon expansion options.

**Table 4.3: Option 1 Design Parameters**

	<b>EXPANDED PRIMARY CELL #1</b>	<b>EXISTING SECONDARY CELL #1</b>	<b>NEW SECONDARY CELL #2</b>	<b>NEW SECONDARY CELL #3</b>	<b>TOTAL</b>
Top of Berm El.	238.10 m	238.10 m	237.90 m	237.90 m	---
Floor El.	235.60 m	235.60 m	235.40 m	235.40 m	---
Surface Area <sup>1</sup>	15.75 ha	---	---	---	<b>15.75 ha</b>
Total Volume	238,800 m <sup>3</sup>	146,000 m <sup>3</sup>	161,100 m <sup>3</sup>	172,700 m <sup>3</sup>	<b>718,600 m<sup>3</sup></b>
Storage Volume	119,400 m <sup>3</sup>	117,700 m <sup>3</sup>	129,800 m <sup>3</sup>	139,200 m <sup>3</sup>	<b>506,100 m<sup>3</sup></b>
<sup>1</sup> Measured at the maximum operating depth of 1.5 m					

### 4.3.2 OPTION 2 – AERATED LAGOON EXPANSION

Aerated lagoon systems have become more common in Manitoba in recent years, particularly in areas where facultative lagoons are no longer cost-effective generally due to a lack of available land or a requirement to treat high-strength industrial wastewater. In an aerated lagoon system, air is supplied through blowers and submerged diffusers to the primary cells. Typically, there are at least two deep primary cells (3 m or deeper) that are aerated. The provincial lagoon design guidelines also allow for deeper secondary cells (2.1 m maximum operating depth) after aerated primary cells, thereby reducing



the overall footprint of the lagoon even further when compared with a facultative system. Mechanization of treatment processes can also be added to an aerated lagoon, such as the automated addition of chemicals for phosphorus treatment.

Aerated lagoons can reliably meet current Provincial and Federal effluent targets (BOD, TSS, fecal coliforms and unionized ammonia) and are well suited for municipal wastewater treatment. However, similar to a facultative lagoon, ammonia and phosphorus reduction cannot reliably be achieved without additional processes to the treatment system. The removal of phosphorus requires chemical addition in order to meet the current effluent limit for total phosphorus in Manitoba. Ammonia reduction through nitrification can be achieved during the summer months if the environmental conditions are favourable in a lagoon system (facultative or aerated). This includes low flow rate (dry conditions), warmer wastewater temperatures (above 10C), available alkalinity, a pH range of 7.5 to 8.5, and enough dissolved oxygen in the wastewater. An aerated lagoon can be designed to introduce the precise amount of oxygen to allow for the nitrification of ammonia, however, the described environmental factors could still prevent total ammonia levels in the wastewater effluent from meeting specific discharge limits particularly during typical discharge windows (e.g., late June and October). Should the lagoon facility be required to meet a total ammonia limit, an additional process such as SAGR would be required to ensure ammonia reduction occurs during all different types of conditions. Based on our experience and from our discussions with MECP, we do not expect that unionized ammonia will be a concern. As discussed in Section 4.1, total ammonia limits for effluent are only introduced for early discharging (prior to June 15) or continuous discharge facilities.

Operation and maintenance of an aerated lagoon system is more intensive than a facultative lagoon, as there are blowers and aeration equipment to maintain on a consistent schedule as well as a chemical dosing system for phosphorus removal. Three-phase power is also required in order to operate the aeration equipment.

The following sections detail the proposed aerated lagoon expansion option for the Oak Bluff Lagoon.

#### **4.3.2.1 DESIGN DETAILS**

The aeration lagoon expansion option was sized to accommodate the projected 20-year design loadings. The proposed design includes two new deep primary aerated cells to be constructed within the north half of the existing footprint of the primary cell, the raising of the existing perimeter and intercell berms by 0.6 m, and the construction of a new secondary cell south of the existing lagoon. Furthermore, the south half of the existing primary cell will be converted into a secondary cell.

Constructing the new aerated primary cells within the north half of the existing primary cell will allow for gravity flow between cells as the topography of the site drops from north to south. It also allows for a shorter distance for the electrical power lines that need to be brought to the site. The existing forcemains and truck dump ramp and turnaround area will need to be relocated to the southwest corner of the new primary aerated cell. The existing truck turnaround pad can be repurposed for the new blower building.

The existing lagoon berms will be raised by 0.6 m, allowing the existing secondary cell to store a greater volume at a 2.1 m operating depth. This can be done by constructing the raised berms to the outside shoulder of the perimeter berms and towards the existing primary cell side of the intercell berm. Impervious clay will be used to raise the berms, meeting the necessary liner requirements.



The existing secondary cell and the new secondary cell will discharge on the east side and flow to Atchison Drain via a perimeter ditch along the east and south sides of the lagoon. The converted primary to secondary cell will discharge at its southwest corner directly to Atchison Drain.

Civil design parameters for the primary aerated cells are as follows:

- 4.0 m maximum operating depth;
- 1.0 m freeboard;
- 5:1 interior side slopes and 4:1 exterior side slopes;
- 3.0 m (min) top of berm width;
- Extension of the clay core to match the new top of berm elevation;
- Forcemain extensions, and a new truck dump ramp and turnaround area;
- 300 mm thick rip rap armouring with geotextile on interior slopes, approximately 4 m wide and centred on the maximum operating depth of the cells, as well as rip rap around the pipe inverts;
- 300Ø intercell piping and gate valves (HDPE DR17 or PVC SDR35);
- Alum dosing and flow splitting manholes; and,
- Nexom aeration system and blower building.

Civil design parameters for the secondary cells are as follows:

- 2.1 m maximum operating depth;
- 1.0 m freeboard;
- 4:1 side slopes (interior & exterior);
- 3.0 m (min) top of berm width;
- 2.0 m wide clay core cut off wall for the new secondary cell;
- 300Ø intercell and discharge piping and gate valves (HDPE DR17 or PVC SDR35); and,
- 300 mm thick rip rap armouring with geotextile on interior slopes from the floor of the cell to a minimum of 0.3 m above the maximum operating depth, as well as rip rap around the pipe inverts.

Rip rap currently on the existing primary cell berms can be salvaged and reused during construction. A new perimeter wire fencing, access gate and signage, will be needed as the raising of the berms will require the removal of the existing fence. New perimeter ditching (4:1 side slopes and minimum 1.2 m wide flat bottom) will also be needed due to the raising of the berms.



The following table summarizes the design parameters for the aerated lagoon expansion option.

**Table 4.4: Option 2 Design Parameters**

	<b>NEW AERATED PRIMARY CELL #1</b>	<b>NEW AERATED PRIMARY CELL #2</b>	<b>EXISTING SECONDARY CELL #1</b>	<b>CONVERTED PRIMARY TO SECONDARY CELL #2</b>	<b>NEW SECONDARY CELL #3</b>	<b>TOTAL</b>
Top of Berm El.	238.70 m	238.70 m	238.70 m	238.70 m	238.50 m	---
Floor El.	233.70 m	233.70 m	235.60 m	235.60 m	235.40 m	---
Total Volume	55,900 m <sup>3</sup>	55,900 m <sup>3</sup>	207,600 m <sup>3</sup>	76,100 m <sup>3</sup>	302,400 m <sup>3</sup>	<b>697,900 m<sup>3</sup></b>
Storage Volume	---	---	179,300 m <sup>3</sup>	66,100 m <sup>3</sup>	260,900 m <sup>3</sup>	<b>506,200 m<sup>3</sup></b>

#### 4.3.2.2 NEXOM AERATION SYSTEM

The OPTAER fine bubble partial mix aeration system, designed and installed by Nexom Inc., will provide the necessary aeration to the proposed aeration cells. Fine bubble membrane diffusers efficiently provide oxygen transfer to the wastewater. The diffusers are uniformly suspended near the bottom of the cells off of floating laterals which are anchored to the lagoon berms. These laterals are connected to shallow buried HDPE header pipes which supply the air produced by the blowers to the diffusers. Two 125 hp blowers and a control panel will be supplied by Nexom as part of the aeration system package. Each blower will provide a design airflow of 1,769 SCFM.

For more details, refer to Nexom’s proposal which is provided in **Appendix F**.

#### 4.3.2.3 CHEMICAL DOSING SYSTEM

To effectively dose and mix alum into the wastewater, a small portion of influent from primary aeration cell #1 is pumped into the blower building from the lagoon. Alum is dosed into this wastewater stream and then sent through a static mixer for rapid mixing. The dosing pumps are designed to deliver alum up to 500 mL/min. The alum dosed wastewater is then sent back to the dosing manhole prior to entering primary aeration cell #2. The aeration system within this cell will provide the slow mixing necessary for flocculation. This alum floc will then settle to the floor of cell #2.

Three double-walled chemical storage tanks (7,570 L each) will store the alum and come complete with a fill port, access hatch and venting. A 1,100 L clean water tank will also be provided for periodic flushing of the chemical dosing system.

#### 4.3.2.4 BLOWER BUILDING

A prefabricated 4.57 m x 19.81 m steel sandwich panel building is provided by Nexom to house the blowers, chemical storage tanks, dosing equipment, and the clean water tank. The building is typically constructed on a cast-in-place thickened edge slab on engineered fill and comes complete with electrical, heating, lighting, and ventilation systems.

#### 4.3.2.5 ELECTRICAL

There is currently no three-phase electrical power on-site. The nearest three-phase power line is located along Road 51NE, approximately 800 m north of the lagoon site. This power line will need to be extended



to the lagoon in order to power the aeration system. The power requirement for the blowers is estimated to be 70.3 kW. Additional power requirements for building HVAC and lighting will be determined during the detailed design phase. Nexom will provide the building that will include all electrical, including blower panels.

#### 4.3.2.6 CONSTRUCTION STAGING CONSIDERATIONS

Construction staging will be crucial for the design to be implemented successfully. It is proposed that the construction take place in the following sequence in order to construct the new primary aeration cells within the perimeter of the existing primary cell:

- Desludge the existing primary cell, particularly the build-up of sludge at the truck dump ramp. This can be done in the fall prior to construction so that the sludge can be directly land applied.
- Prior to the start of construction, completely discharge the existing secondary cell and transfer/pump all the liquid from the existing primary cell to the secondary cell.
- Install a temporary forcemain and temporary truck dump ramp and turnaround at the NW corner of the existing secondary cell.
- Construct the new primary aeration cells, raise the existing perimeter and intercell berms by 0.6 m, and construct the new secondary cell to the south of the existing secondary cell, complete with a clay core cut-off wall.
- Extend the forcemains and construct a new truck dump ramp and turnaround area at the SW corner of the new aerated primary cell.
- Install the Nexom aeration package complete with the new blower building.
- Complete the installation of the alum dosing and flow splitting manholes.
- Install all piping, valves, rip rap, perimeter fencing and perimeter ditching.
- Disconnect the temporary piping and commission the new aerated primary cells.

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#### 4.3.3 OPTION 3 – AERATED LAGOON EXPANSION WITH SAGR

In the past 15 years, aerated lagoons with the SAGR technology have been implemented successfully and are most commonly found in First Nations communities where continuous discharge lagoons are more common. The SAGR systems are designed to provide nitrification in cold climates, thereby reducing the total ammonia in the effluent, as well as providing BOD and TSS polishing. SAGR systems are also known to provide disinfection (reduction of coliforms) without the need for UV treatment. As such, this system allows the wastewater to be discharged continuously rather than just within the typical discharge window of June 1 to October 31 if the right receiving watercourse or water body exists.

A SAGR cell consists of a clean gravel bed with aeration piping and diffusers installed throughout. Wastewater that has already received treatment through the aerated primary cells is introduced at one end of the SAGR cell and flows with even distribution through the cell. A layer of mulch covers the gravel bed for insulation and wood-framed support walls with a 60-mil HDPE liner and non-woven geotextile wraps the interior walls and floor of the SAGR cell providing full containment of the wastewater.



SAGR cells are typically added to the end of an aerated lagoon system to allow for the continuous discharge of a lagoon treatment system into a flowing river or large body of water, or to allow for a longer discharge window (e.g., 180 days of storage) for lagoons that do not have an adjacent river or lake to discharge into. The addition of the SAGR process to an aerated lagoon would allow for the early and later discharge of the lagoon (e.g., May 15<sup>th</sup> to November 15<sup>th</sup>), which means less storage capacity is required, thus reducing the land needed for a lagoon. A shorter storage period (120 to 150 days) was reviewed, however, as the lagoon discharges into a drain that does not flow year-round it would be challenging to seek regulatory approval for an early spring or late fall discharge where freezing conditions would generally prevail.

However, as the SAGR cells cannot be emptied or “turned off” during the winter, wastewater is required to be recirculated through the entire lagoon system. Therefore, a small lift station is typically required at the discharge end of the SAGR cells in order to pump the wastewater back to the primary cells.

Operation and maintenance of an aerated lagoon with a SAGR system is similar to an aerated lagoon system, as there are blowers and aeration equipment to maintain on a consistent schedule as well as any chemical dosing system. This system is more power-intensive than an aerated lagoon system, as there are additional dedicated blowers required to provide aeration for the SAGR cells.

#### 4.3.3.1 DESIGN DETAILS

The aeration lagoon with SAGR expansion option was sized to accommodate the projected 25-year design loadings. Both this option and the aerated lagoon option are similar in terms of the proposed lagoon layout, the Nexom aeration system, chemical dosing system and construction staging considerations. For more details, refer to Nexom’s proposal which is provided in **Appendix F**.

As detailed in Section 4.3.2, the proposed lagoon design includes two new deep primary aerated cells to be constructed within the north half of the existing footprint of the primary cell, the raising the existing perimeter and intercell berms by 0.6 m, the construction of a new secondary cell south of the existing lagoon, and finally, the south half of the existing primary cell will be converted to a secondary cell. New perimeter ditching and fencing are required, as well as a new truck turnaround area which is relocated to the southwest corner of the new aerated primary cell #1.

Civil design parameters for the primary aerated cells are as follows:

- 4.0 m maximum operating depth;
- 1.0 m freeboard;
- 5:1 interior side slopes and 4:1 exterior side slopes;
- 3.0 m (min) top of berm width;
- Extension of the clay core to match the new top of berm elevation;
- Forcemain extensions, and new truck dump ramp and turnaround area;
- 300 mm thick rip rap armouring with geotextile on interior slopes, approximately 4 m wide and centred on the maximum operating depth of the cells, as well as rip rap around the pipe inverts;
- 300Ø intercell piping and gate valves (HDPE DR17 or PVC SDR35);
- Alum dosing and flow splitting manholes; and,



- Nexom aeration system and blower building.

Civil design parameters for the secondary cells are as follows:

- 2.1 m maximum operating depth;
- 1.0 m freeboard;
- 4:1 side slopes (interior & exterior);
- 3.0 m (min) top of berm width;
- 2.0 m wide clay core cut off wall for the new secondary cell;
- 300Ø intercell piping and gate valves (HDPE DR17 or PVC SDR35) to connect the secondary cells to the SAGR influent manhole; and,
- 300 mm thick rip rap armouring with geotextile on interior slopes from the floor of the cell to a minimum of 0.3 m above the maximum operating depth, as well as rip rap around the pipe inverts.

The following table summarizes the design parameters for the aerated lagoon with SAGR expansion option.

**Table 4.5: Option 3 Design Parameters**

	NEW AERATED PRIMARY CELL #1	NEW AERATED PRIMARY CELL #2	EXISTING SECONDARY CELL #1	CONVERTED PRIMARY TO SECONDARY CELL #2	NEW SECONDARY CELL #3	TOTAL
Top of Berm El.	238.70 m	238.70 m	238.70 m	238.70 m	238.50 m	---
Floor El.	233.70 m	233.70 m	235.60 m	235.60 m	235.40 m	---
Total Volume	55,900 m <sup>3</sup>	55,900 m <sup>3</sup>	207,600 m <sup>3</sup>	76,100 m <sup>3</sup>	105,300 m <sup>3</sup>	<b>500,800 m<sup>3</sup></b>
Storage Volume <sup>1</sup>	---	---	179,300 m <sup>3</sup>	66,100 m <sup>3</sup>	91,300 m <sup>3</sup>	<b>336,700 m<sup>3</sup></b>

<sup>1</sup> Required storage volume is based on a 180-day storage capacity.

#### 4.3.3.2 SAGR DETAILS

As discussed above, the SAGR process is designed to provide nitrification in cold climates which allows for an earlier treated effluent discharge to the environment for lagoons. The two SAGR cells consist of a clean gravel bed with aeration piping installed throughout the floor of the cell. Wastewater is distributed evenly across the width of the cells. A layer of mulch covers the gravel bed for insulation and wood-framed support walls with a 60-mil HDPE liner and non-woven geotextile wraps the interior walls and floor of the SAGR cells providing full containment. **Table 4.6** below provides details on the two proposed SAGR cell sizing.

**Table 4.6: SAGR cell design parameters**

Parameter	SAGR Cells
Dimensions	45.0 m x 90.0 m (each cell)
Water depth	2.59 m



Influent and effluent control manholes are required for the SAGR cells to maintain liquid levels. These are typically 1500Ø to 1800Ø concrete barrel manholes with riser pipes to control level and flow. A minimum 3.0 m wide berms are to be constructed around the perimeter of the SAGR cells to allow for vehicular access to the influent and effluent control manholes as well as to service the aeration system within the SAGR cells.

#### 4.3.3.3 DISCHARGE PUMP STATION

The effluent from the SAGR cells will be discharged to a pump station in order to recirculate the effluent back to the front of the lagoon during winter and to discharge to Atchison Drain during the allowable discharge period. A pre-engineered packaged pump station (e.g., Xylem) is best suited for this type of application, with submersible pumps in a fiberglass barrel. Controls can be either pole-mounted adjacent to the barrel or can be installed at the blower building. This will be investigated in more detail during the detailed design phase.

#### 4.3.3.4 BLOWER BUILDING

A prefabricated 4.57 m x 22.86 m steel sandwich panel building is provided by Nexom to house the blowers (4 total, 2 for the aeration system and 2 for the SAGR system), the chemical storage tanks, dosing equipment, and the clean water tank. The building is typically constructed on a cast-in-place thickened edge slab on engineered fill and comes complete with electrical, heating, lighting, and ventilation systems.

There will be a total of four positive displacement blowers to provide air supply for the treatment system, two for the lagoon aeration and two for the SAGR system. The two blowers for the lagoon aeration system will be 125 hp and provide 1,769 SCFM each, while the two blowers for the SAGR system will each be 200 hp and provide 2,735 SCFM.

#### 4.3.3.5 ELECTRICAL

Similar to the Aerated Lagoon Option #2, there is currently no three-phase electrical power on-site. The nearest three-phase power line is located along Road 51NE, approximately 800 m north of the lagoon site. This power line will need to be extended to the lagoon in order to power the aeration system. The power requirement for the four blowers is estimated to be 191.2 kW. Additional power requirements for building HVAC and lighting will be determined during the detailed design phase. Nexom will provide the building that will include all electrical, including blower panels. Electrical power will also need to be provided to the discharge pump station, which can be serviced from the blower building electrical panel.

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## 4.4 FORCEMAIN AND LIFT STATION UPGRADES

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### 4.4.1 OAK BLUFF WEST LIFT STATION

The Oak Bluff lift station is located near the intersection of Big Sky Drive and Carlington Crescent in the Oak Bluff subdivision. It conveys the wastewater to the existing Oak Bluff lagoon through a 250mm forcemain. There is also a 300mm forcemain from the lift station that terminates at the intersection of



Horizon Drive and PTH 3. The 300mm forcemain is presently not in service but was intended to be extended to the lagoon at a later date to increase the capacity of the system.

The present peak flow contributing to this lift station is 29.6 L/s. Drawdown tests that were recently conducted indicated that one pump was discharging at 30.6 L/s and the other at 35.9 L/s, however the theoretical pumping capacity should be 41.0 L/sec. At a minimum, both pumps should be performing at the same rate, so the one pump should be reviewed during a maintenance check to determine and correct the problem. The system as a whole should also be reviewed to determine why the pumps are not performing to their theoretical pumping capacity. This issue could be attributed to partially closed gate valves, worn impellers, or faulty check valves. If the pumps are underperforming, and with development continuing, upgrades will be required sooner than expected.

With the present pumping capacity of 35.9 L/sec, upgrades will be required when there are 411 serviced lots connected to the lift station. It is estimated that this number of connections will occur by 2024. *If the system was operating as per its theoretical capacity of 41.0 L/sec, upgrades will be required when there are 491 serviced lots, which is estimated to occur by 2026.*

The next step of recommended upgrades is to complete the 300mm forcemain to the lagoon, and therefore the lift station will operate with both a 250mm and 300mm forcemain. With the existing pumps, this will provide a theoretical capacity of 75 L/sec, which will provide capacity for 931 service lots, which is estimated to occur by 2037. At that time, the next upgrade would include the installation of larger pumps that would provide a capacity of over 90 L/sec, which would accommodate the full build-out of the Oak Bluff West subdivision.

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#### 4.4.2 MCGILLIVRAY COMMERCIAL DISTRICT LIFT STATION

The MCD lift station is located on Road 7E, south of McGillivray Boulevard. It collects the sewage from residents and commercial developments along and adjacent to McGillivray Boulevard, as well as from 9 commercial lots in the Oak Bluff industrial park located on the west side of PTH 100. The lift station pumps the effluent to the Oak Bluff lagoon through a 250mm forcemain.

The peak flow presently contributing to this lift station is 8.8 L/sec. Drawdown tests that were recently conducted indicated that both pumps were discharging at 15.2 L/sec, which equals the theoretical pumping capacity.

With the present pumping capacity, upgrades will be required when there are approximately 100 commercial serviced lots connected to the lift station. It is estimated this number of connections will occur by 2025. Recommended upgrades at or prior to this time are to twin the existing forcemain to the lagoon. This will provide sufficient capacity until further development will require upgrading of the pumps in the lift station.

It should also be noted that the existing 250mm collector LPS along McGillivray Boulevard will reach its capacity when there are approximately 190 commercial serviced lots connected to the collector sewer, which is estimated to occur in 2029. The twinning of the collector sewer will be required, but the exact size and extent of the twinning will be dependent on where development is occurring along McGillivray Boulevard.



Another consideration with development in this area is that there have been discussions with the RM and developers for a proposed gravity wastewater sewer system in this area, but details on the location and extent are only conceptual. Due to the nature of a gravity sewer, the contribution of infiltration and extraneous flows is significantly greater than for a low-pressure sewer. Although a gravity sewer system would delay the requirement to upgrade the existing collector LPS, it would accelerate the need for upgrades at the McGillivray Boulevard lift station, unless the future gravity sewer is a stand-alone system and bypasses the lift station on Road 7E.

## 5 COSTING

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### 5.1 OPINION OF PROBABLE COST

These opinions of probable construction costs herein referred to as cost estimates, are at a conceptual level and provide an indication of the relative costs of each option. Using the class system established by the Association for the Advancement of Cost Engineering International (AACEI), the estimates are classified as Class 4 with an accuracy range from -30% to +50%. Class 4 cost estimates are typically based on a 15% level of project definition.

These estimates are meant to be used to evaluate various alternatives and are in no way meant to present the full costs of a given work. These costs have been prepared from the information available at the time the estimate was prepared. The costs presented below are based on calculated quantities (e.g., earthworks volumes, linear metre piping, etc.) and associated rates from recent similar project tenders.

The capital cost estimate is based on the following key assumptions:

- Construction cost estimates are presented in 2022 dollars and 2027 dollars.
- Inflation is estimated at 4% per year for 2023 and 2024, and 2% per year for the remaining three years to estimate the construction cost in 2027 dollars.
- A typical Design-Bid-Build (DBB) project delivery method is assumed.
- No additional costs were assumed for construction scheduling or construction complexity associated with a project that takes place within existing infrastructure that remains in use.
- Costs for engineering by the Owner or third parties have been estimated at 15%.
- GST has been excluded.
- It is assumed that a competitive bidding environment will be present at the time of tender and that the economy of Manitoba is stable.
- Project contingency has been set to 10% based on this level of design.
  - This level of contingency has been based on the current level of project definition. This contingency is meant to cover cost impacts that cannot be readily predicted at this level of design and within the current scope of work. This contingency is an allowance to cover this limitation of this level of project definition. Project contingency is likely to be used to complete the work.
  - Project contingency is not intended to cover scope changes.



- These cost estimates do not account for strikes, lockouts or other industrial disturbances, public emergencies, civil disturbances, riots, war, sabotage, travel restrictions, blockades, embargos, supply chain disturbances, natural disasters including floods, inclement weather, sabotage, terrorism, epidemics, health emergencies, or other acts of God.

### 5.1.1 FACULTATIVE LAGOON

An opinion of the probable costs for the Facultative Lagoon Option 1 is provided in [Error! Reference source not found.](#) below. Refer to **Appendix G** for the full cost estimate.

**Table 5.1: Opinion of Probable Cost of Facultative Lagoon Option 1**

DESCRIPTION OF WORK	TOTAL PRICE (2022)	TOTAL PRICE (2027)
Mobilization and Insurance & Bonding (7%)	██████████	██████████
Earthworks	██████████	██████████
Piping	██████████	██████████
Rip Rap	██████████	██████████
Granular Surfacing	██████████	██████████
Miscellaneous	██████████	██████████
<b>SUBTOTAL</b>	██████████	██████████
Engineering (15%)	██████████	██████████
Contingency (10%)	██████████	██████████
MWSB Administration (10%)	██████████	██████████
<b>TOTAL</b>	██████████	██████████
<b>TOTAL (ROUND TO NEAREST 1000)</b>	██████████	██████████

### 5.1.2 AERATED LAGOON OPTION

An opinion of the probable costs for the aerated lagoon option is included in **Table 5.2**. Refer to **Appendix G** for the full cost estimate.

**Table 5.2: Opinion of Probable Cost of Aerated Lagoon Option**

DESCRIPTION OF WORK	TOTAL PRICE (2022)	TOTAL PRICE (2027)
Mobilization and Insurance & Bonding (7%)	██████████	██████████
Earthworks	██████████	██████████
Piping/Manholes	██████████	██████████
Rip Rap	██████████	██████████



DESCRIPTION OF WORK	TOTAL PRICE (2022)	TOTAL PRICE (2027)
Miscellaneous	██████████	██████████
Desludging Primary Cell	██████████	██████████
Aeration Package & Coordination	██████████	██████████
Electrical Site Works	██████████	██████████
Cash Allowance for Hydro	██████████	██████████
<b>SUBTOTAL</b>	██████████	██████████
Engineering (15%)	██████████	██████████
Contingency (10%)	██████████	██████████
MWSB Administration (10%)	██████████	██████████
<b>TOTAL</b>	██████████	██████████
<b>TOTAL (ROUND TO NEAREST 1000)</b>	██████████	██████████

### 5.1.3 AERATED LAGOON WITH SAGR OPTION

An opinion of the probable costs for the aerated lagoon option with SAGR is included in **Table 5.3**. Refer to **Appendix G** for the full cost estimate.

**Table 5.3: Opinion of Probable Cost of Aerated Lagoon with SAGR Option**

DESCRIPTION OF WORK	TOTAL PRICE (2022)	TOTAL PRICE (2027)
Mobilization and Insurance & Bonding (7%)	██████████	██████████
Earthworks	██████████	██████████
Piping and Manholes	██████████	██████████
Lift Station	██████████	██████████
Rip Rap	██████████	██████████
Miscellaneous	██████████	██████████
Desludging Primary Cell	██████████	██████████
Aeration Package & Coordination	██████████	██████████
SAGR Civil Works	██████████	██████████
Electrical Site Works	██████████	██████████
Cash Allowance for Hydro	██████████	██████████
<b>SUBTOTAL</b>	██████████	██████████
Engineering (15%)	██████████	██████████
Contingency (10%)	██████████	██████████



MWSB Administration (10%)	██████████	██████████
<b>TOTAL</b>	██████████	██████████
<b>TOTAL (ROUND TO NEAREST 1000)</b>	██████████	██████████

## 5.2 OPERATING COSTS

The estimated annual operating costs for each option are provided in the sections below. The operating cost estimates are based on the following key assumptions:

- Estimates are presented in 2022 dollars and GST has been excluded.
- The electrical rate is estimated at \$0.08 kWh.
- Diffuser membrane replacement is anticipated every 7-years based on their service life.
- Annual costs for the supply of alum will vary based on the dosing rate as determined by jar testing.
- Labour costs for operation and maintenance are excluded.

### 5.2.1 FACULTATIVE LAGOON OPTION

The only major annual cost associated with operating a facultative lagoon will be the supply and broadcasting of alum in the secondary cells. Currently, the RM uses one truck-load worth of alum to broadcast in the existing secondary cell prior to discharge at a cost of \$10,000 per truckload. The secondary cell storage volume approximately triples for the Facultative Lagoon Option 1. It is estimated that each cell will require approximately one truck-load worth of alum prior to discharge at \$10,000 per truck, and each cell will discharge up to twice per year. Thus, the anticipated annual operating costs will range from \$30,000 to \$60,000 per year depending on the number of discharges (one or two) per cell per year. It is important to note that costs for the supply of alum will vary based on actual jar test results.

### 5.2.2 AERATED LAGOON OPTION

Based upon information provided by Nexom, the following **Table 5.4** provides a high-level annual operating cost estimate for the Aerated Lagoon Option.

**Table 5.4: Annual Estimated Operating Costs of Aerated Lagoon Option**

DESCRIPTION	ANNUAL COST
Lagoon Blowers – Normal Operating Conditions (\$0.08/kWh)	██████████
Lagoon Blowers – Filters, Oil, and Belts	██████████
Diffuser Membrane Replacement (Amortized annual based on 7-year service life)	██████████
Life Cycle Annual Alum Addition (Estimated, costs will vary based on jar testing)	██████████
<b>Total Operations &amp; Maintenance</b>	██████████

### 5.2.3 AERATED LAGOON WITH SAGR OPTION

Based upon information provided by Nexom, the following **Table 5.5** provides a high-level annual operating cost estimate for the Aerated Lagoon with SAGR Option.

**Table 5.5: Annual Estimated Operating Costs of Aerated Lagoon with SAGR Option**

DESCRIPTION	ANNUAL COST
Lagoon Blowers – Normal Operating Conditions (\$0.08/kWh)	██████
Lagoon Blowers – Filters, Oil, and Belts	██████
SAGR Blowers – Normal Operating Conditions (\$0.08/kWh)	██████
SAGR Blowers – Filters, Oil, and Belts	██████
Diffuser Membrane Replacement (Amortized annual based on 7-year service life)	██████
Life Cycle Annual Alum Addition (Estimated, costs will vary based on jar testing)	██████
<b>Total Operations &amp; Maintenance</b>	██████

## 6 SUMMARY OF FINDINGS AND RECOMMENDATIONS

WSP has completed an assessment of the existing Oak Bluff Lagoon in terms of current wastewater loadings and has projected the 25-year design wastewater loadings based on the continued build-out of Oak Bluff West and the MCD. A summary of the findings for the needs assessment are as follows:

- The existing Oak Bluff Lagoon is currently sized to accommodate an organic loading of 460.3 kg-BOD<sub>5</sub>/d and has a storage capacity of 180,000 m<sup>3</sup>.
- Based upon the current loadings of 211.3 kg-BOD<sub>5</sub>/d and 78,480 m<sup>3</sup> (230-day storage period), the lagoon utilizes 46% of its organic capacity and 44% of its hydraulic capacity.
- The projected 25-year design loadings are 863.9 kg-BOD<sub>5</sub>/d and 505,840 m<sup>3</sup>.
- Based upon the 25-year design loadings, the existing lagoon is projected to reach its organic capacity in the design year 2032 and reach its hydraulic capacity in design year 2028.

Using the projected 25-year design loadings, three main expansion options were presented, Facultative Lagoon Option 1, Aerated Lagoon Option 2, and Aerated Lagoon with SAGR Option 3. Each option presented has significant differences in terms of capital costs, operational costs, ease of constructability, overall footprint and ability for future expansion. All options were sized to accommodate the estimated 25-year design wastewater loadings (organic and hydraulic). The following **Table 6.1** provides the benefits and drawbacks of each main option.

**Table 6.1: Benefits and Drawbacks of the Proposed Expansion Options**

	<b>FACULTATIVE LAGOON OPTION 1</b>	<b>AERATED LAGOON OPTION 2</b>	<b>AERATED LAGOON WITH SAGR OPTION 3</b>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>– Lowest capital cost of all three options.</li> <li>– Constructability is simple, as there is no reconfiguration of the site and expansion is mainly an earthmoving project on a greenfield site.</li> <li>– Gravity flow through the lagoon system.</li> <li>– Low operation and maintenance costs, no power requirements beyond the existing light standard on site.</li> <li>– Simple to operate, no new training required.</li> <li>– Sludge removal is not required.</li> </ul>	<ul style="list-style-type: none"> <li>– Deep primary cells (4.0 m) and secondary cells (2.1 m) allow for a smaller footprint, and better utilization of existing land.</li> <li>– Gravity flow through the lagoon system.</li> <li>– Treatment process includes inline chemical addition for phosphorus treatment.</li> <li>– Newer treatment technologies such as SAGR can be designed for and implemented more efficiently than a facultative system for future expansion.</li> </ul>	<ul style="list-style-type: none"> <li>– Deeper primary and secondary cells allowing for a smaller footprint, as well as a shorter storage duration requirement, allows for the best utilization of existing land.</li> <li>– Treatment process includes inline chemical addition for phosphorus treatment.</li> <li>– SAGR technology will allow the lagoon to consistently meet total ammonia limits.</li> </ul>
<b>Drawbacks</b>	<ul style="list-style-type: none"> <li>– Larger footprint required as cells can only operate at a maximum of 1.5 m depths.</li> <li>– Requires broadcasting alum from a truck or boat, which can lead to unpredictable results and over/under dosing.</li> <li>– Future expansion is more challenging as a large portion of the available land will be used for this expansion, and the difficulty of raising berms to allow for deeper storage cells in the future can be for a 4 or 5-cell lagoon.</li> </ul>	<ul style="list-style-type: none"> <li>– 66% increase in the capital cost for construction compared to the facultative lagoon.</li> <li>– Requires reconfiguration of the site, including a new truck turnaround area.</li> <li>– Sludge removal in the primary cell would be required.</li> <li>– Construction staging considerations, including a temporary forcemain diversion during construction.</li> <li>– Hydro power will need to be extended to site (approximately 800 m).</li> <li>– Higher operation and maintenance costs, including hydro costs.</li> <li>– Requires a higher degree of operator training and oversight of the facility.</li> </ul>	<ul style="list-style-type: none"> <li>– 82% increase in the capital cost for construction compared to the aerated lagoon.</li> <li>– Requires reconfiguration of the site, including a new truck turnaround area.</li> <li>– Sludge removal in the primary cell would be required.</li> <li>– Construction staging considerations, including a temporary forcemain diversion during construction.</li> <li>– Hydro power will need to be extended to site (approximately 800 m).</li> <li>– Lift station is required for discharge and recirculation of effluent.</li> <li>– Highest operation and maintenance costs, including hydro costs.</li> <li>– Requires a higher degree of operator training and oversight of the facility.</li> <li>– Slightly more intensive sampling and effluent monitoring program than other options, due to the earlier discharge.</li> </ul>



Based upon the significant capital cost to construct an aerated lagoon expansion with SAGR (Option 3), this option is not recommended, as the benefits to an earlier discharge are not great enough to justify the high construction and operational costs. Thus, the Facultative Lagoon Expansion Option 1 and the Aerated Lagoon Expansion Option 2 are the two options to focus on.

Option 1 can be constructed for approximately the two thirds of the cost and will operate at much lower annual cost of Option 2. It is simpler to construct, as there are no changes to the required configuration of the lagoon other than the addition of new cells to the south. Also, no additional training for the operators is required as the system is already well understood. However, it will require the most amount of land to construct the lagoon expansion and will not leave an adequate amount of space for expansion beyond the 25-year design, particularly when considering the potential future connection with La Salle. It is known that the existing La Salle lagoon only has capacity for up to a design population of 4,800. The current population of La Salle is approximately 3,000, and at a growth rate of 3% per year, La Salle lagoon will reach its capacity in the mid-2030s. Thus, a facultative lagoon expansion would not be able to accommodate both the 25-year design for Oak Bluff as well as future La Salle.

Option 2 will allow the greatest flexibility for expansion in the future as less land will be required for construction. Having deeper secondary cells is more efficient for storage in terms of land use, and treatment capacity can be more easily expanded beyond the 25-year design by simply adding more aeration equipment rather than needing to construct another primary cell in order to increase the surface area. However, the large capital and operation costs, as well as a higher degree of difficulty for construction make this option difficult to recommend.

Consequently, **WSP recommends pursuing the Aerated Lagoon Expansion Option 2**, as this option provides better flexibility for future expansion scenarios beyond the 25-year design.

It is important to note that the lagoon currently has ample capacity to deal with short-term future wastewater loadings, and an expansion is most likely only needed when the lagoon reaches its hydraulic capacity in approximately 6 years.



## 7 REFERENCES

- [1] L. de-Bashan and Y. Bashan, "Recent advances in removing phosphorus from wastewater and its future use as fertilizer (1997-2003)," *Water Research*, vol. 38, no. 19, pp. 4222-4246, 2004.
- [2] U.S. EPA, "Onsite Wastewater Treatment Systems Manual," Cincinnati, OH, U.S. EPA, 2002, pp. 4-38.
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- [4] Stantec, "SEWPCC Upgrading/Expansion Preliminary Design Report Section 13 - Septage Management," Stantec, Winnipeg, MB, 2008.
- [5] U.S. EPA, "Decentralized Systems Technology Fact Sheet Septage Treatment/Disposal," U.S. EPA, Washington, D.C., 1999.
- [6] Metcalf & Eddy, *Wastewater Engineering Treatment and Resource Recovery Fifth Edition*, New York, NY: McGraw-Hill Education, 2014.
- [7] WSP Canada Inc., "Oak Bluff-McGillivray Infrastructure Review - Water & Sewer Capacity & Upgrading Study," WSP Canada Inc., Winnipeg, MB, 2019.
- [8] GENIVAR, "Oak Bluff Lagoon Assessment Technical Memorandum," GENIVAR, Winnipeg, MB, 2008.
- [9] U.S. EPA, *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers*, Cincinnati, OH: U.S. EPA, 2011.
- [10] Manitoba Environment, Climate and Parks, "Information Bulletin - Design Objectives for Wastewater Treatment Lagoons," Manitoba Environment, Climate and Parks, Winnipeg, MB, 2022.

# APPENDIX

**A**

**GEO TECHNICAL  
REPORT**



# APPENDIX

# B

## DRAWDOWN TEST RESULTS



**McGillivray Lift Station - Pump Draw Down Calculator**

Project: Oak Bluff Lagoon/FM Study  
 Project No: 221-01415-00  
 Date: Mar 16, 2022  
 Completed by: DB & EK



**Input Data**

Wet well diameter [m] 2.438 m  
 Wet well dimensions [m] n/a m, length  
 n/a m, width  
 Wet well area [sq.m.] 4.615 sq.m.  
 Number of pumps 2  
 Measured outer diameter 2.9 m, W to E  
 Measured outer diameter 2.87 m, N to S

Pipes in pumping volume  
 150 dia A= 0.0177 sq.m. Pump 1 FM  
 150 dia A= 0.0177 sq.m. Pump 2 FM  
 150 dia A= 0.0177 sq.m. Incoming FM  
 Atotal= 0.0530 sq.m.

Lafarge MH size [mm]	Actual Inner Diameter [mm]	Wall thickness [mm]	Outer Diameter [mm]
1500	1524	152	1828
1800	1829	178	2185
2100	2134	203	2540
2400	2438	229	2896
3000	3048	279	3606

Pump	Start time	Start depth [ft]	Start depth [m]	End time	Ending depth [ft]	Ending depth [m]	Run Time [s]	Fill Time [s]	Uncorrected Pumped Volume [cu.m.]	Uncorrected Pumping Rate [L/s]	Inflow Rate [L/s]	Corrected Pumping Rate [L/s]	Corrected Pumped Volume [L]	Totalizer [cu.m.]	Totalizer Pumped Volume [cu.m.]	Difference in Pumped Volume (P-N) [cu.m.]	Percent Difference in Pumped Volume (P/N-1)
1	14:54:55		2.17	15:00:20		1.27	325	1632	4.15	12.78	2.74	15.52	5,045.26	504,621.2000	-	-	-
2	15:27:32		2.24	15:33:25		1.27	353	1693	4.48	12.68	2.45	15.28	5,394.01	504,626.2000	5,000.00	-394.01	-7.3%
1	16:01:38		2.17	16:07:00		1.27	322	1947	4.15	12.90	2.13	15.19	4,892.23	504,630.8000	4,600.00	-292.23	-6.0%
2	16:39:27		2.17	16:44:48		1.27	321	2067	4.15	12.94	2.01	15.01	4,818.68	504,635.3000	4,500.00	-318.68	-6.6%
1	17:19:15		2.17	17:24:33		1.27	318	2446	4.15	13.06	1.70	14.92	4,743.27	504,639.9000	4,600.00	-143.2676957	-3.0%
2	18:05:19		2.17	18:10:30		1.27	311	-65430	4.15	13.36	0.09	14.25	4,431.74	-	-	-	-
Average																-5.7%	

Pump 1 Average [L/s]	Measured 15.21 L/s	Totalizer 14.34 L/s	Commissioning
Pump 2 Average [L/s]	15.15 L/s	14.28 L/s	

Comparison of actual recorded pump run time and the hour meters

Pump	Actual	Actual	Hour Meters	Meters/Actual
1	965 s = 0.268 h	0.090	33.6%	
2	985 s = 0.187 h	0.190	101.5%	

Start time	Hour meters	
	P1	P2
End time	616.7	747.58
	616.79	747.77
	0.09	0.190
	324	684.0

Milltronics depth check

Milltronics [m]	Measurement [m]	Difference [m]
0.00	0.00	0.00

**Oak Bluff West Lift Station - Pump Draw Down Calculator**

Project: Oak Bluff Lagoon/FM Study  
 Project No: 221-01415-00  
 Date: Mar 16, 2022  
 Completed by: DB & EK



**Input Data**

Wet well diameter [m] 3.048 m  
 Wet well dimensions [m] n/a m, length  
 n/a m, width  
 Wet well area [sq.m.] 7.234 sq.m.  
 Number of pumps 2  
 Measured outer diameter 3.6 m, W to E  
 Measured outer diameter 3.6 m, N to S

Pipes in pumping volume  
 200 dia A= 0.0314 sq.m.  
 200 dia A= 0.0314 sq.m.  
 Atotal= 0.0628 sq.m.

Lafarge MH size [mm]	Actual Inner Diameter [mm]	Wall thickness [mm]	Outer Diameter [mm]
1500	1524	152	1828
1800	1829	178	2185
2100	2134	203	2540
2400	2438	229	2896
3000	3048	279	3606

Pump	Start time	Start depth [ft]	Start depth [m]	End time	Ending depth [ft]	Ending depth [m]	Run Time [s]	Fill Time [s]	Uncorrected Pumped Volume [cu.m.]	Uncorrected Pumping Rate [L/s]	Inflow Rate [L/s]	Corrected Pumping Rate [L/s]	Corrected Pumped Volume [L]	Totalizer [cu.m.]	Totalizer Pumped Volume [cu.m.]	Difference in Pumped Volume (P-N) [cu.m.]	Percent Difference in Pumped Volume (P/N-1)
2	10:26:30		1.65	10:28:05		1.20	95		3.26	34.27		35.66	3,388.08	930,716.0000	-	-	-
								2327			1.40						
1	11:06:52		1.65	11:08:45		1.20	113		3.26	28.81		30.50	3,447.06	930,720.0000	4,000.00	552.94	16.0%
								1630			2.00						
2	11:35:55		1.65	11:37:30		1.20	95		3.26	34.27		36.07	3,426.74	930,724.0000	4,000.00	573.26	16.7%
								2016			1.61						
1	12:11:06		1.65	12:12:58		1.20	112		3.26	29.06		30.55	3,421.75	930,728.0000	4,000.00	578.25	16.9%
								2394			1.36						
2	12:52:52		1.65	12:54:28		1.20	96		3.26	33.91		35.97	3,453.55	930,731.0000	3,000.00	-453.55	-13.1%
								1174			2.77						
1	13:14:02		1.65	13:16:00		1.20	118		3.26	27.59		30.81	3,635.30	930,734.0000	3,000.00	-635.30	-17.5%
								887			3.67						

Average 3.8%

Pump 2 Average [L/s]	Measured 35.90 L/s	Totalizer 37.27 L/s	Commissioning
Pump 1 Average [L/s]	30.62 L/s	31.79 L/s	

Hour meters

	P1	P2
Start time	1025.09	690.57
End time	1025.09	690.64
	0	0.070
	0	252.0

Comparison of actual recorded pump run time and the hour meters

Pump	Actual		Actual	Hour Meters	Meters/Actual
2	286 s	=	0.079 h	0.070	88.1%
1	343 s	=	0.095 h	0.000	0.0%

Milltronics depth check

Milltronics [m]	Measurement [m]	Difference [m]
0.00	0.00	0.00

# APPENDIX

# C

## WASTEWATER TEST RESULTS





WSP Canada Inc.  
ATTN: DANA BREDIN  
1600 Buffalo Place  
Winnipeg MB R3T 6B8

Date Received: 17-MAR-22  
Report Date: 24-MAR-22 16:00 (MT)  
Version: FINAL

Client Phone: 204-479-0014

## Certificate of Analysis

Lab Work Order #: L2692897  
Project P.O. #: NOT SUBMITTED  
Job Reference: 221-01415-00-02  
C of C Numbers:  
Legal Site Desc:



Hua Wo  
Chemistry Laboratory Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L2692897-1 MCGILLIVRAY LS-1 Sampled By: CLIENT Matrix: WASTEWATER									
<b>Nitrate + Nitrite</b>									
<b>Nitrate in Water by IC</b>									
Nitrate (as N)	<0.20	-	DLM	0.20	mg/L	-		17-MAR-22	R5748269
<b>Nitrate+Nitrite</b>									
Nitrate and Nitrite as N	<0.22	-		0.22	mg/L	-		21-MAR-22	
<b>Nitrite in Water by IC</b>									
Nitrite (as N)	<0.10	-	DLM	0.10	mg/L	-		17-MAR-22	R5748269
<b>Miscellaneous Parameters</b>									
Ammonia, Total (as N)	69.1	+/-2.7		2.0	mg/L	0		22-MAR-22	R5749523
BOD Carbonaceous	181	-		50	mg/L	-		17-MAR-22	R5748946
Phosphorus (P)-Total	7.39	+/-0.56		0.030	mg/L	0		22-MAR-22	R5748862
Total Kjeldahl Nitrogen	69.7	+/-8.9		2.0	mg/L	0	23-MAR-22	24-MAR-22	R5749915
Total Suspended Solids	275	+/-40		3.8	mg/L	0		17-MAR-22	R5748186
pH	7.66	+/-0.08		0.10	pH units	0		22-MAR-22	R5749282
L2692897-2 MCGILLIVRAY LS-2 Sampled By: CLIENT Matrix: WASTEWATER									
<b>Nitrate + Nitrite</b>									
<b>Nitrate in Water by IC</b>									
Nitrate (as N)	<0.20	-	DLM	0.20	mg/L	-		17-MAR-22	R5748269
<b>Nitrate+Nitrite</b>									
Nitrate and Nitrite as N	<0.22	-		0.22	mg/L	-		21-MAR-22	
<b>Nitrite in Water by IC</b>									
Nitrite (as N)	<0.10	-	DLM	0.10	mg/L	-		17-MAR-22	R5748269
<b>Miscellaneous Parameters</b>									
Ammonia, Total (as N)	66.6	+/-2.6		2.0	mg/L	0		22-MAR-22	R5749523
BOD Carbonaceous	164	-		50	mg/L	-		17-MAR-22	R5748946
Phosphorus (P)-Total	7.67	+/-0.58		0.030	mg/L	0		22-MAR-22	R5748862
Total Kjeldahl Nitrogen	76.2	+/-9.7		2.0	mg/L	0	23-MAR-22	24-MAR-22	R5749915
Total Suspended Solids	220	+/-32		5.0	mg/L	0		17-MAR-22	R5748186
pH	7.72	+/-0.08		0.10	pH units	0		22-MAR-22	R5749282
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

## Reference Information

## QC Samples with Qualifiers &amp; Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	L2692897-1, -2
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L2692897-1, -2

## Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

## Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
BOD-CBOD-WP	Water	Carbonaceous BOD		APHA 5210 B
Samples are diluted and seeded, have TCMP added to inhibit nitrogenous demands, and then are incubated in airtight bottles at 20°C for 5 days. Dissolved oxygen is measured initially and after incubation, and results are computed from the difference between initial and final DO.				
EC-SCREEN-WP	Water	Conductivity Screen (Internal Use Only)		APHA 2510
Qualitative analysis of conductivity where required during preparation of other test eg. IC, TDS, TSS, etc				
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen		APHA 4500 NorgD (modified)
Aqueous samples are digested in a block digester with sulfuric acid and copper sulfate as a catalyst. Total Kjeldahl Nitrogen is then analyzed using a discrete analyzer with colorimetric detection.				
NH3-COL-WP	Water	Ammonia by colour		APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.				
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-N-WP	Water	Nitrite in Water by IC		EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.				
NO3-IC-N-WP	Water	Nitrate in Water by IC		EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.				
P-T-COL-WP	Water	Phosphorus, Total		APHA 4500 P PHOSPHORUS-L
This analysis is carried out using procedures adapted from APHA METHOD 4500-P "Phosphorus". Total Phosphorus is determined colourmetrically after persulphate digestion of the sample.				
PH-WP	Water	pH		APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.				
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids		APHA 2540 D (modified)
Total suspended solids in aqueous matrices is determined gravimetrically after drying the residue at 103 105°C.				

\*\* The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

## Chain of Custody Numbers:

## Reference Information

### GLOSSARY OF REPORT TERMS

*Surr* - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

*mg/kg* - milligrams per kilogram based on dry weight of sample

*mg/kg wwt* - milligrams per kilogram based on wet weight of sample

*mg/kg lwt* - milligrams per kilogram based on lipid-adjusted weight

*mg/L* - unit of concentration based on volume, parts per million.

*<* - Less than.

*D.L.* - The reporting limit.

*N/A* - Result not available. Refer to qualifier code and definition for explanation.

*MU*: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

*Bias*: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



## Quality Control Report

Workorder: L2692897

Report Date: 24-MAR-22

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Client: WSP Canada Inc.  
 1600 Buffalo Place  
 Winnipeg MB R3T 6B8  
 Contact: DANA BREDIN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BOD-CBOD-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5748946</b>							
<b>WG3706945-2</b>	<b>LCS</b>							
BOD Carbonaceous			86.7		%		85-115	17-MAR-22
<b>WG3706945-1</b>	<b>MB</b>							
BOD Carbonaceous			<2.0		mg/L		2	17-MAR-22
<b>N-TOTKJ-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5749915</b>							
<b>WG3707740-3</b>	<b>DUP</b>	<b>L2692917-1</b>						
Total Kjeldahl Nitrogen		0.90	0.97		mg/L	7.5	20	24-MAR-22
<b>WG3707740-2</b>	<b>LCS</b>							
Total Kjeldahl Nitrogen			108.7		%		75-125	24-MAR-22
<b>WG3707740-1</b>	<b>MB</b>							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	24-MAR-22
<b>WG3707740-4</b>	<b>MS</b>	<b>L2692917-1</b>						
Total Kjeldahl Nitrogen			101.9		%		70-130	24-MAR-22
<b>NH3-COL-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5749523</b>							
<b>WG3709129-3</b>	<b>DUP</b>	<b>L2692620-1</b>						
Ammonia, Total (as N)		0.028	0.032		mg/L	11	20	23-MAR-22
<b>WG3709129-2</b>	<b>LCS</b>							
Ammonia, Total (as N)			104.9		%		85-115	22-MAR-22
<b>WG3709129-1</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.010		mg/L		0.01	22-MAR-22
<b>WG3709129-4</b>	<b>MS</b>	<b>L2692620-1</b>						
Ammonia, Total (as N)			96.7		%		75-125	22-MAR-22
<b>NO2-IC-N-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5748269</b>							
<b>WG3707234-3</b>	<b>DUP</b>	<b>L2692847-1</b>						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	17-MAR-22
<b>WG3707234-2</b>	<b>LCS</b>							
Nitrite (as N)			99.2		%		90-110	17-MAR-22
<b>WG3707234-1</b>	<b>MB</b>							
Nitrite (as N)			<0.010		mg/L		0.01	17-MAR-22
<b>WG3707234-4</b>	<b>MS</b>	<b>L2692847-1</b>						
Nitrite (as N)			102.6		%		75-125	17-MAR-22
<b>NO3-IC-N-WP</b>								
<b>Water</b>								



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Client: WSP Canada Inc.  
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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO3-IC-N-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5748269</b>							
<b>WG3707234-3</b>	<b>DUP</b>	<b>L2692847-1</b>						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	17-MAR-22
<b>WG3707234-2</b>	<b>LCS</b>							
Nitrate (as N)			98.0		%		90-110	17-MAR-22
<b>WG3707234-1</b>	<b>MB</b>							
Nitrate (as N)			<0.020		mg/L		0.02	17-MAR-22
<b>WG3707234-4</b>	<b>MS</b>	<b>L2692847-1</b>						
Nitrate (as N)			104.8		%		75-125	17-MAR-22
<b>P-T-COL-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5748862</b>							
<b>WG3708254-7</b>	<b>DUP</b>	<b>L2692587-2</b>						
Phosphorus (P)-Total		1.39	1.44		mg/L	4.0	20	22-MAR-22
<b>WG3708254-6</b>	<b>LCS</b>							
Phosphorus (P)-Total			94.0		%		80-120	22-MAR-22
<b>WG3708254-5</b>	<b>MB</b>							
Phosphorus (P)-Total			<0.0030		mg/L		0.003	22-MAR-22
<b>WG3708254-8</b>	<b>MS</b>	<b>L2692593-1</b>						
Phosphorus (P)-Total			N/A	MS-B	%		-	22-MAR-22
<b>PH-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5749282</b>							
<b>WG3708455-5</b>	<b>DUP</b>	<b>L2693459-2</b>						
pH		7.93	7.90	J	pH units	0.03	0.2	22-MAR-22
<b>WG3708455-2</b>	<b>LCS</b>							
pH			6.98		pH units		6.9-7.1	22-MAR-22
<b>SOLIDS-TOTSUS-WP</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5748186</b>							
<b>WG3707048-3</b>	<b>DUP</b>	<b>L2692952-1</b>						
Total Suspended Solids		24.2	23.6		mg/L	2.5	20	17-MAR-22
<b>WG3707048-2</b>	<b>LCS</b>							
Total Suspended Solids			104.3		%		85-115	17-MAR-22
<b>WG3707048-1</b>	<b>MB</b>							
Total Suspended Solids			<3.0		mg/L		3	17-MAR-22

# Quality Control Report

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Client: WSP Canada Inc.  
1600 Buffalo Place  
Winnipeg MB R3T 6B8  
Contact: DANA BREDIN

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## Legend:

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Limit ALS Control Limit (Data Quality Objectives)  
DUP Duplicate  
RPD Relative Percent Difference  
N/A Not Available  
LCS Laboratory Control Sample  
SRM Standard Reference Material  
MS Matrix Spike  
MSD Matrix Spike Duplicate  
ADE Average Desorption Efficiency  
MB Method Blank  
IRM Internal Reference Material  
CRM Certified Reference Material  
CCV Continuing Calibration Verification  
CVS Calibration Verification Standard  
LCSD Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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# Quality Control Report

Workorder: L2692897

Report Date: 24-MAR-22

Client: WSP Canada Inc.  
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Winnipeg MB R3T 6B8  
Contact: DANA BREDIN

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## Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
pH	1	Not provided	22-MAR-22 12:00	0.25	123	hours	EHTR-FM
	2	Not provided	22-MAR-22 12:00	0.25	123	hours	EHTR-FM

## Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.  
EHTR: Exceeded ALS recommended hold time prior to sample receipt.  
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.  
EHT: Exceeded ALS recommended hold time prior to analysis.  
Rec. HT: ALS recommended hold time (see units).

Notes\*:  
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2692897 were received on 17-MAR-22 08:34.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



# APPENDIX

# D

ENVIRONMENTAL ACT  
LICENSE



# APPENDIX

# E

## PRELIMINARY DESIGN DRAWINGS



# APPENDIX

# F

## NEXOM PROPOSALS





# OAK BLUFF, MB

**Preliminary Proposal for  
Design, Supply and  
Installation of the  
Wastewater Treatment  
System Upgraded with**



**November 09, 2022**

***technologies for cleaner water***

5 Burks Way • Winnipeg MB • R2J 3R8  
888-426-8180 • [www.nexom.com](http://www.nexom.com)

# Project Overview

An OPTAER™ Wastewater Treatment system is proposed for Oak Bluff, MB. The proposed system is designed for controlled discharge and would consist of the following processes and technologies:

- Within the footprint of the existing primary cell, implement new berms to create treatment cells 1 and 2, and secondary cell 3 (by others).
- Retain existing downstream cell for polishing/storage and implement additional cells as needed to provide **230 days of storage** (by others).
- Implement alum addition into a slip stream between cells 1 and 2 for TP settling within the following cells.
- Implement OPTAER® fine bubble partial mix aeration with floating laterals in treatment cells 1 and 2.

# System Design Parameters

Preliminary design loads, flows, and effluent objectives are presented in these tables:

		Lagoon Influent	Effluent Requirements
<b>Design Flow (Estimated Max Month)</b>	m <sup>3</sup> /day	3,330	
<b>cBOD<sub>5</sub></b>	kg/day	863.9	
<b>cBOD<sub>5</sub></b>	mg/l	260	<25
<b>TSS</b>	mg/l	275	<25
<b>TKN</b>	mg/l	76	*
<b>TP</b>	mg/l	6.5	<1.0

\* Nitrogen removal equipment is available, but outside the scope of Proposal A.

Aeration design parameters are presented in the following table:

	Cell 1 (PM)	Cell 2 (PM)	Cell 3 (Polishing)	Totals
<b>Alpha</b>	0.60	0.60	0.60	
<b>Beta</b>	0.95	0.95	0.95	
<b>Theta</b>	1.024	1.024	1.024	
<b>Site elevation (m)</b>	236	236	236	
<b>Water depth (m)</b>	4.0	4.0	2.1	
<b>Approximate water volume (m<sup>3</sup>)</b>	55,940	55,940	81,820	193,700
<b>Retention time (days)</b>	16.8	16.8	25.8	59.4
<b>Diffuser Submergence, Df (m)</b>	3.82	3.82		
<b># H3-4 diffusers (Fine Bubble)</b>	92	30		122
<b>SCFM per diffuser</b>	14.5	14.5		
<b>Total SCFM</b>	1,334	435		1,769

# OPTAER® Lagoon Treatment Processes

The primary purpose of the aerated ponds is to provide oxygen and residence and contact time to natural bacteria, which ultimately convert the wastewater contaminants (BOD<sub>5</sub>, ammonia, and TSS) to carbon dioxide, water, and inert ash and nitrates. Aerated ponds effectively control odors and provide internal sludge digestion.

## **PARTIAL MIX CELL**

With aerated partial mix cells, the diffuser density is based upon oxygen demand. The OPTAER system does not rely on algae or natural surface aeration for providing oxygen to the wastewater.

The diffusers are suspended near the bottom of the cells. Through the rise of the bubbles and subsequent mixing, convection cells are created between the diffusers. Not only does the water rise with the bubbles, but solids also settle out through the downward motion of the water between the diffusers where the circulation loop is completed. This combined with the slow rate of bubble rise contributes to the overall efficiency of the system. Because of low sludge production in the system, retention time is optimized for long term BOD<sub>5</sub> removal.

When the solids reach the bottom of the lagoon, additional oxygen for biodegradation is provided through the diffusers near the cell bottom. This process results in minimal organic bottom sludge accumulation. Aerobic digestion takes place within the aerated cells at the sludge water interface.

## **H3-4 FINE BUBBLE MEMBRANE DIFFUSERS**

H3-4 Fine bubble diffusers are used to provide oxygen to the wastewater. The diffusers consist of an air distribution body with individual tubular EPDM membranes extending outwards in a horizontal plane. This design prevents bubbles from coalescing, and results in an excellent oxygen transfer rate with minimal head loss.

The diffusers are suspended with a marine grade rope directly under the lateral, at a uniform depth. The rope is attached to the floating lateral for ease of diffuser retrieval. Each diffuser is attached to a small concrete weight, encased in HDPE pipe. Diffuser assemblies can be retrieved from a boat with no special equipment.

## OPTAER® HEADER SYSTEM

A metal manifold and discharge piping are used to dissipate the heat produced by the blowers. Shallow buried HDPE header piping connects to the galvanized steel manifold, and supplies air to the floating laterals. The header has flanged connections for each lateral as shown on the drawings. Each lateral is individually valved for ease of maintenance.

All header, lateral, and feeder piping is designed to accommodate increased airflow for high pressure and volume cleaning without increasing header friction losses by more than 1 psi. This allows for management of additional organic load, improved diffuser maintenance and additional odor control.

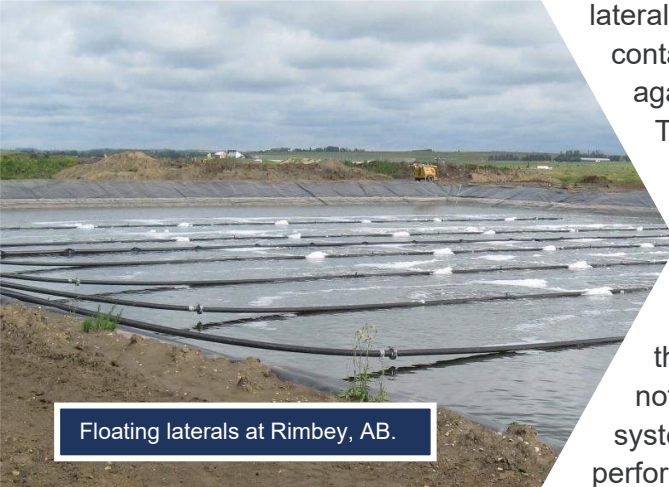
## AIR DISTRIBUTION SYSTEM: FLOATING LATERALS

Laterals connect to the shallow buried header with flanged connections, and float on the water surface. Each lateral is individually valved for ease of maintenance. With floating

laterals, there are no concrete weights required to be in contact with the bottom of the basin. Laterals are secured against wind action with a stainless-steel cable system.

The cables are fastened to anchors in the berm using a self-adjusting lateral tensioning assembly. The self-tensioners provide a clear visual indicator that the lateral tension is adjusted correctly.

All header and lateral piping, joints, and fittings are thermally fused HDPE. With floating laterals, the cells do not have to be dewatered or taken out of service for system installation or maintenance. All maintenance can be performed from a boat with a 2-person crew.



Floating laterals at Rimbey, AB.

## CHEMICAL DOSING AND MIXING

In order to effectively mix alum into the wastewater, a side stream of carrier water will be pumped into the process building from the lagoon. Alum will be dosed into this line prior to a static mixer for rapid mixing and chemical dispersion. The alum/water mixture will return to the front of cell 2. The aeration system will provide slow mixing within the cell to facilitate flocculation. Alum floc will settle in the lagoon.

The dosing pumps will be designed to deliver a flow of up to 500 mL/min of alum and have the ability for 1000:1 turn-down during initial operation. Dosing pump sizing is based on average daily flows.

A chemical dosing storage tank will provide storage based on design flows and assumed dosing rate. The tank will come complete with fill port, access hatch, venting, etc. Containment would be provided through double-wall tank construction. Assuming potable water is not available on site, a clean water tank (approx. 300 gal) will also be provided for periodic flushing of the dosing pumps, manifold, and feed piping.

## Blower Building

A 4.57 x 19.81 m (15 'x 65') prefabricated steel sandwich panel building will be provided. The panels used for construction have the following characteristics:

- Roof panels are 100mm thick (R-30), with standing seam joints
- Roof panels are 24ga. outside, 26 ga. metal skin inside
- Wall panels are 75mm thick (R-20), 26 ga. metal skin inside and outside
- Wall and roof panels interlock for a sealed joint (No aluminum channels needed)

Engineered welded HSS internal frames provide the structural framework for the building, designed as dictated by local building codes and snow loading conditions.



The proposed building would be constructed on a cast-in-place concrete foundation.

The building would come complete with all electrical, including blower panels, all wiring within building, and heating, lighting, and ventilation systems.

# Positive Displacement Blowers

Positive displacement blowers are used to provide air supply for the treatment system. Blowers are designed to provide the required airflow at normal system operating pressure and have the capability of operating at the maximum required pressure intermittently for diffuser purging. The blowers are equipped with sound attenuating enclosures. Blowers are summarized in the following table:

			Lagoons
<b>Number of blowers total</b>			2
<b>Number of blowers on duty</b>			1
<b>Number of blowers on standby</b>			1
<b>Motor nameplate horsepower</b>	hp		125
<b>Design airflow per blower</b>	SCFM		1,769
<b>Normal operating pressure</b>	psi		7.6
<b>Maximum Operating Pressure</b>	psi		8.8
<b>Estimated Power Consumption</b>	bhp		94.3
<b>Actual Sound level</b>	dB(A)		97

## Operation & Maintenance

Anticipated O&M costs can be broken down into the following categories:

	Quantity	Motor Power		Annual Cost
		bhp	kW	
<b>Lagoon Blowers</b>	2			
Normal Operating Conditions	1	94.3	70.3	
Filters, Oil and Belts	-			
<b>Diffuser Membrane Replacement**</b>	488			
<b>Life Cycle Annual Alum Addition (L)***</b>	110,342			
<b>Total Operations &amp; Maintenance</b>				

\* Electrical Rate (estimated by Nexom): **0.08** \$/kW-h

\*\* Amortized annual cost based on 7-year service life.

\*\*\* Estimated. Actual alum dosage to be determined based on jar testing.

# Budgetary Capital Costs

Included in the wastewater treatment system capital cost are:

- Nexom System Process Design
- CAD Drawings and specifications
- ***Equipment installation/start-up/commissioning/training***
- Operation and maintenance manuals
- Project Record Drawings

## **OPTAER® LAGOON AERATION SYSTEM:**

- HDPE shallow buried main header piping
- Floating lateral piping, feeder piping, fittings and lateral valves as required
- H3-4 Diffuser assemblies complete with EPDM Membranes and pre-cast diffuser weights.
- Self-tensioning lateral assemblies and anchor posts.

## **AIR SUPPLY**

- Two (2) 125 hp positive displacement blowers with sound attenuating enclosures
- Blower control panel with motor starters (shared)
- Galvanized metal blower header and connection pipe (heat dissipation)

## **CHEMICAL DOSING AND MIXING SYSTEM**

- Duplex Dosing skid
- Chemical dosing control panel
- Self-priming alum carrier line pump
- Static mixer with alum injection port
- One (1) 1100L Clean water tank for system flushing
- Three (3) 7570L Chemical dosing storage tanks

## **PREFABRICATED BLOWER BUILDING**

- CAD Drawings and specifications (Manitoba P. Eng stamped)
- One (1) 4.57 x 19.81 m (15 'x 65') prefabricated steel sandwich panel building
  - Complete with electrical and HVAC
  - Wiring of building, blowers, control panel
  - Precast concrete thickened edge slab floor on precast grade beams

## BUDGETARY COST FOR THE ABOVE SCOPE:

██████████ (Shipping allowed to jobsite, plus all taxes)

All prices are subject to final design review.

The quote being provided is in effect for 60 days. Should a purchase order be awarded during that 60-day period, it is understood that shipment of the product will be allowed within a period of 180 days from the date of the purchase order. Should the goods not be required to be delivered until after that time horizon, the company reserves the right to adjust pricing to reflect inflationary changes incurred and expected until the shipment date is reached.

## ITEMS SPECIFICALLY NOT INCLUDED:

- Material offloading and secure on-site storage.
- Civil works including lagoon cells design and construction, liner, transport piping, inter-cell piping, discharge piping, manholes, valves, access roads to site, site roads and landscaping, lagoon desludging etc. if required.
- Electrical hookup including work/permits to bring power to site (if required)
- Chemical procurement including initial fill (available on request)
- Site Preparation and Restoration



## Questions or Comments?

Any questions or comments can be directed to:

**Tanner Devlin**, Ph.D., P.Eng.  
Regional Sales Manager/Applications Engineering  
tanner.devlin@nexom.com  
204-560-0521



### Nexom

Info@nexom.com

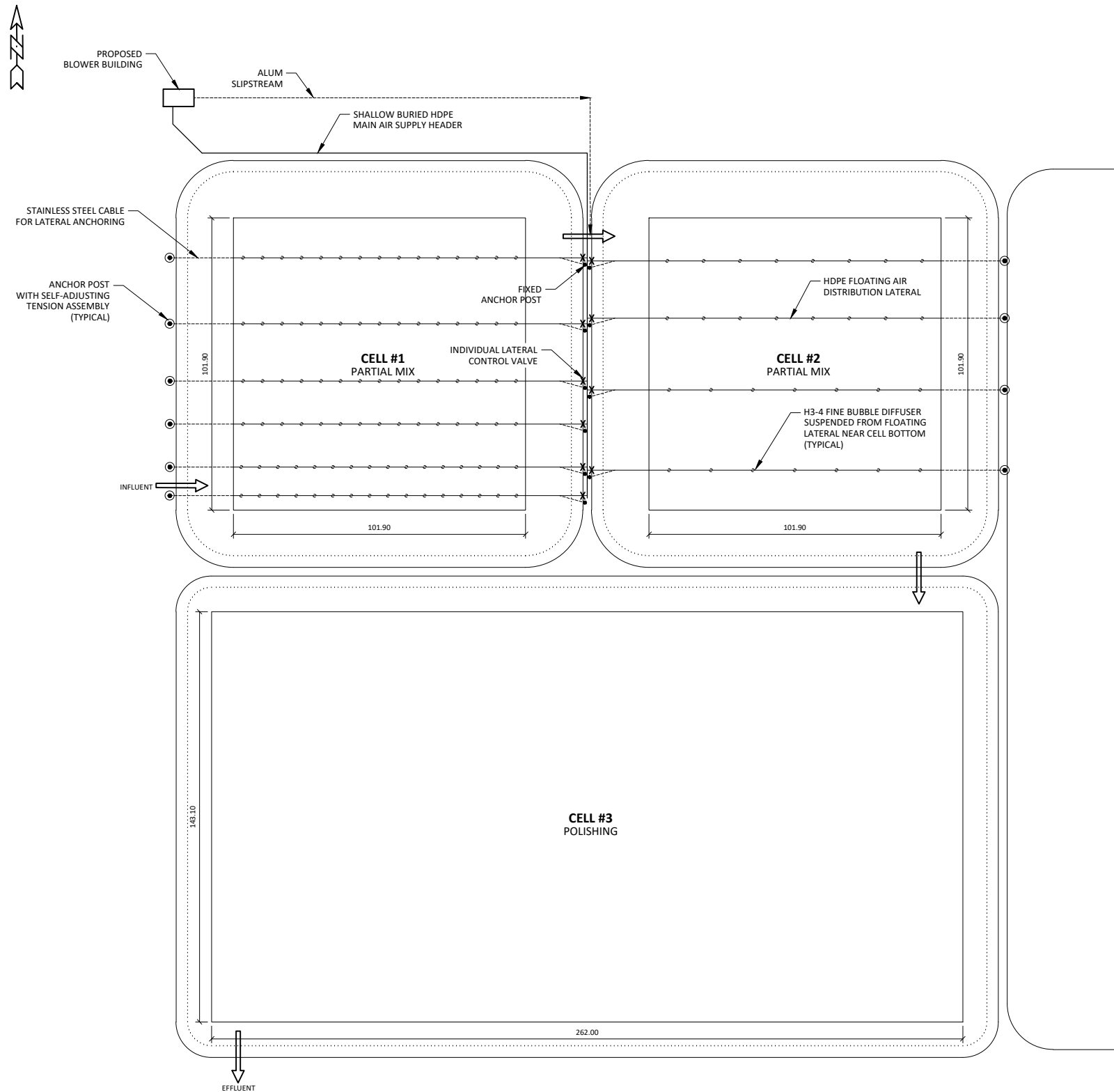
888-426-8180

5 Burks Way · Winnipeg MB · R5T 0C9

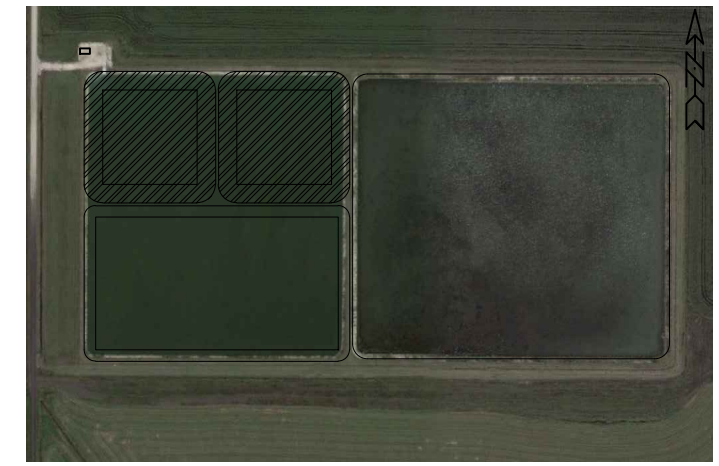
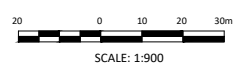
www.nexom.com

PLOT SIZE: 610mm x 914mm (24" x 36")

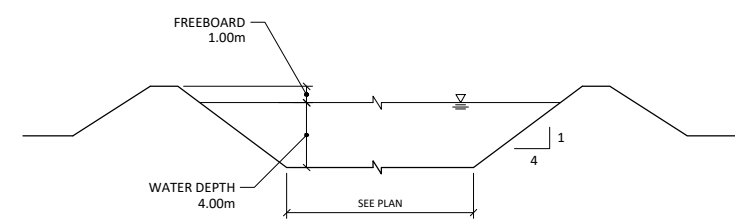
REDUCED SIZE PLOT - DO NOT SCALE



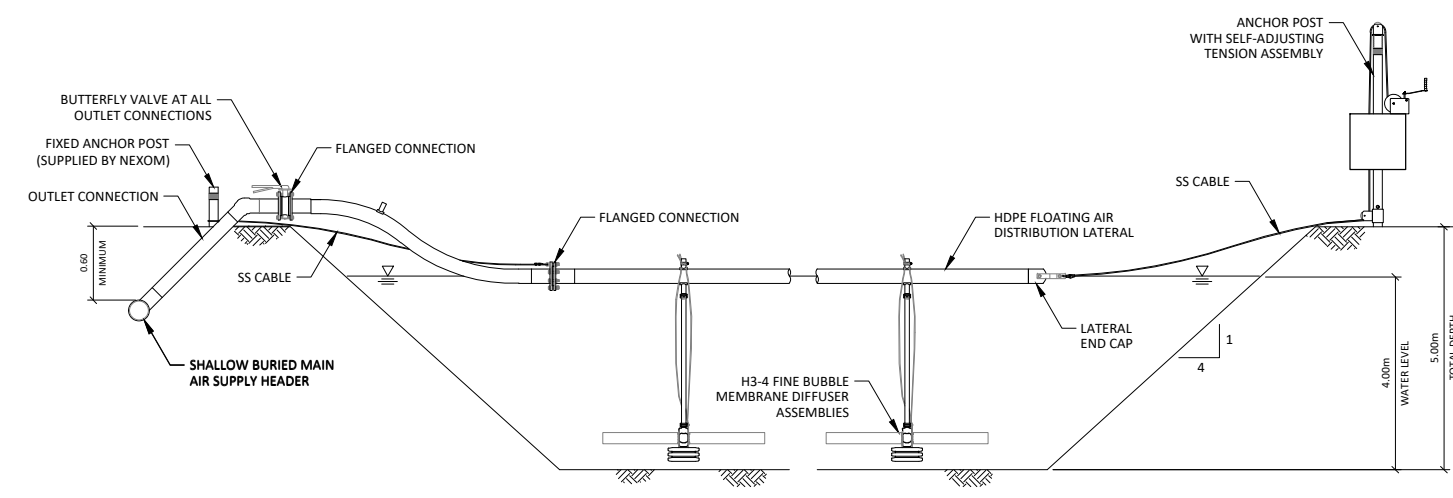
**AERATION LAYOUT - OPTION A**  
SCALE: 1:900



**LOCATION PLAN**  
SCALE: 1:4000



**TYPICAL SECTION - AERATED CELLS**  
SCALE: N.T.S.



**AERATED LAGOON SECTION**  
SCALE: N.T.S.



5 Burks Way  
Navin, Manitoba  
Canada R5T 0C9  
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PROJECT:		<b>OAK BLUFF, MB</b>	
		PROPOSED WASTEWATER TREATMENT SYSTEM - OPTION A	
TITLE:		OPTAER SYSTEM AERATION LAYOUT, TYPICAL SECTION, LOCATION PLAN	
DRAWN BY:	APPROVED BY:	SCALE:	DRAWING NO.:
MR	TD	AS NOTED	NE01
DATE:	FILE #		SHT. REV.
2022/11/08	CD11277.03		1 of 1 0