

Judique Wastewater Treatment Plant System Assessment Report

Final Report






172410.00 • Report • January 2018

Prepared for:



Prepared by:



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| Final Report |  | Jan 25, 2018 |  |
| Draft for Review | Dave Trudel | May 5, 2017 | Holly Sampson |
| <i>Issue or Revision</i> | <i>Reviewed By:</i> | <i>Date</i> | <i>Issued By:</i> |
|  <p>CBCL LIMITED Consulting Engineers</p> | | <p>This document was prepared for the party indicated herein. The material and information in the document reflects CBCL Limited's opinion and best judgment based on the information available at the time of preparation. Any use of this document or reliance on its content by third parties is the responsibility of the third party. CBCL Limited accepts no responsibility for any damages suffered as a result of third party use of this document.</p> | |



CBCL LIMITED

Consulting Engineers

January 25, 2018

Garett Beaton, P.Eng.
Director of Public Works
Municipality of the County of Inverness
375 Main Street,
Port Hood, NS, B0E 2W0

Dear Mr. Beaton:

RE: Judique Wastewater Treatment Plant System Assessment Final Report

We are pleased to submit this final report, which presents the results of a System Assessment Report (SAR) that was completed by CBCL Limited (CBCL) for the Judique Wastewater Treatment Plant. The SAR was completed in accordance with the requirements presented in the Nova Scotia Environment Approval to Operate No. 2016-096063-A01.

Yours very truly,

CBCL Limited

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Project No: 172410.00



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CHAPTER 1 INTRODUCTION

The Judique Wastewater Treatment Plant (WWTP) is an extended aeration package treatment plant owned and operated by the Municipality of the County of Inverness (Municipality). The plant is an E.A. Aerotor type treatment plant and is located at 1 Keltic Drive, Judique, Inverness County, Nova Scotia. Section 11 of the Approval to Operate No. 2016-096063-A01, issued by Nova Scotia Environment (NSE) on March 29, 2016, requires a System Assessment Report (SAR) be completed on the operation of the facility by a third party consultant with experience in Wastewater Treatment Facility operations. A System Assessment was completed by CBCL Limited (CBCL), and the results of the assessment are presented herein.

1.1 Background

The plant is reported to have been constructed around 1970. Based on a review of E.A. Aerotor literature, the rated capacity of the plant is estimated to be 75.7 m³/day. There are an estimated 60 homes that are serviced by the WWTP. Based on an assumption of 2.5 persons per home, this would result in a serviced population of 150 people.

The WWTP consists of the following unit operations:

- Aeration tank (extended aeration);
- Secondary clarification;
- Sludge holding tank (not in use);
- Effluent disinfection; and
- Effluent discharge (outfall).

Generally speaking, extended aeration activated sludge treatment is characterized by long aeration time (hydraulic retention time (HRT)); high MLSS concentration, high RAS pumping rate, and low sludge wastage requirements (long solids retention time (SRT)).

CHAPTER 2 SYSTEM ASSESSMENT

2.1 Effluent Quality Results

Section 9 of the NSE Approval to Operate requires sampling and analysis of the parameters listed below in Table 2.1:

Table 2.1 Sampling Requirements of NSE Approval to Operate

| Parameter | Sample Type | Frequency | Averaging Period | Location |
|-------------------|-------------|---------------------|------------------|------------------------------|
| CBOD ₅ | Grab | Monthly | Quarterly | Treated Effluent |
| TSS | Grab | Monthly | Quarterly | Treated Effluent |
| E. coli | Grab | Monthly | Quarterly | Treated Effluent |
| pH | Grab | Monthly | Quarterly | Treated Effluent |
| TRC | Grab | Monthly | Quarterly | Treated Effluent |
| Plant Volumes | N/A | Continuous | Annually | Influent or Treated Effluent |
| Fish Toxicity | Grab | As requested by NSE | N/A | Treated Effluent |

Since the NSE Approval to Operate was issued on March 29, 2016, there were monthly sample results available for CBOD₅, TSS, and E. coli for the period from April 2016 through March 2017 with the exception of July, August, and December 2016. Total Residual Chlorine (TRC) and pH measurements are collected monthly by plant operations staff. Results were not available for review at time of report preparation. There is no flowmeter at the plant recording plant volumes. The WTP operator estimates that the plant receives approximately 30,000 IGPD (136 m³/day) and that the effluent from the plant generally contains between 3 and 5mg/L TRC. The available sample results are summarized below in Table 2.2 along with quarterly averages. Quarterly averages are calculated as the arithmetic mean for CBOD₅ and TSS and the geometric mean for E. coli as per the NSE Approval. Two of the four quarters have less than three available sample results for the calculation of quarterly averages. Sample results and quarterly averages that are in exceedance of the limit specified in the NSE Approval to Operate are highlighted in yellow.

Table 2.2 Effluent Sample Results

| Parameter | CBOD ₅ | | TSS | | E. Coli | |
|---------------|-------------------|------------------------|--------|------------------------|-----------|------------------------|
| Unit | mg/L | | mg/L | | mpn/100mL | |
| Permit Limit | 25 | | 25 | | 200 | |
| Sampling Date | Result | Average ⁽¹⁾ | Result | Average ⁽¹⁾ | Result | Average ⁽²⁾ |
| 19-Apr-16 | 42 | 88 | 30 | 33 | 34000 | 445469 |
| 17-May-16 | 160 | | 48 | | 1300000 | |
| 14-Jun-16 | 62 | | 22 | | 2000000 | |
| 7-Sep-16 | 25 | 25 | 11 | 11 | 10 | 10 |
| 25-Oct-16 | <5 | 11 | 10 | 16 | <10 | 88 |
| 22-Nov-16 | 19 | | 21 | | 7700 | |
| 17-Jan-17 | 17 | 24 | 29 | 58 | 460 | 8 |
| 7-Feb-17 | <5 | | 36 | | <100 | |
| 14-Mar-17 | 53 | | 110 | | <100 | |

Notes:

(1) Quarterly averages for comparison against effluent requirements specified in the NSE Approval to Operate. Parameters reported as less than reportable detection limit have been included in average calculation as half of the detection limit.

(2) As per NSE Approval, quarterly E. coli average calculated as the geometric mean with results reported as less than detection limit included in the calculation as 1.

One of the quarterly averages exceeds the criteria for CBOD₅. Two of the quarterly averages exceed the criteria for TSS. One of the quarterly averages exceeds the criteria for E. coli. Although there is no available data for TRC, there is no de-chlorination system at the plant and the WWTP operator reports TRC concentrations between 3 and 5 mg/L. Therefore, the effluent is consistently in exceedance of the 0.02 mg/L limit. The NSE Approval to Operate requires that the TRC limit be met by December 31, 2020.

2.2 Treatment Process

The Judique WWTP is reported to have been constructed around 1970. The treatment plant is a small package type E. A. Aerotor extended aeration treatment plant. Wastewater flows by gravity from the community of Judique and enters the aeration chamber. Aeration is provided by a mechanical brush aerator. Mixed liquor flows by gravity from the aeration chamber to the clarifier in the centre of the plant. Supernatant from the clarifier flows by gravity to the chlorine contact chamber where chlorine is added via calcium hypochlorite tablets. Settled sludge is pumped from the clarifier back into the aeration chamber as return activated sludge (RAS). There is a sludge holding tank where excess sludge that has accumulated in the clarifier can be wasted to as waste activated sludge (WAS). However, the sludge holding tank is not in use at this plant. The clarifier is pumped down occasionally and excess sludge is removed although this occurs infrequently. Effluent from the chlorine contact chamber is discharged to an unnamed stream which ultimately discharges to the Atlantic Ocean.

2.3 Treatment Potential of Existing Plant

In order to evaluate the treatment potential of the WWTP, various operating parameters were evaluated for each unit operation and compared to the design guidelines presented in the Environment Canada document Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal, 2006 (ACWGM). Where available, the original design values for each of the parameters based on a review of A. E. Aerotor literature are also included for comparison purposes.

As drawings were not available, measurements were taken of the plant components during the site visit. Based on an outside diameter of approximately 8m, and a comparison to Table 1 of an E.A. Aerotor Plants document (see Appendix B), the plant appears to be sized for a design population of 200 people based on a flow of 100 gallons/person/day and a strength of 0.17 BOD/person/day. The treatment potential of each unit operation was evaluated based on available data and is discussed in this section.

2.3.1 Flows

Based on a review of E.A. Aerotor literature, it appears that the plant was designed to treat 75.7 m³/day. There is no flowmeter at the WWTP. The WWTP operator estimates that the plant receives an average flow of 30,000 IGPD (136 m³/day). There are an estimated 60 homes that are serviced by the WWTP. Assuming an average of 2.5 people per home, and a flow of 340 L/person/day, the estimated wastewater flow produced would be 51 m³/day. Inflow and infiltration may result in flows much higher than this.

2.3.2 Aeration Tank

ACWGM provides the following design parameters for an extended aeration process:

- RAS – 50 to 150 % of influent based on average flow
- Detention Time – 20 to 30 hours
- MLSS – 2000 to 5000 mg/L
- Volumetric Loading – 0.1 to 0.3 kg BOD/m³/day
- F/M – 0.04 to 0.1 kg BOD/kg MLVSS/day
- SRT – 20 to 40 days
- Aeration – Maintain a minimum of 2 mg/L DO in mixed liquor

Based on a review of E.A. Aerotor manufacturer data and measurements taken in the field, the volume of the aeration tank was calculated to be approximately 76.44m³. Aeration is provided by a mechanical brush aerator. The return sludge pump is a Flygt 3085 with an estimated capacity of 25 L/s at 3m of head.

RAS

The RAS pump is currently set to be on for 2 minutes and off for 10 hours. Based on an average flowrate of 136 m³/day, and current operating conditions for the return sludge pump, assuming it is pumping 25 L/s, the return sludge flow is calculated to be 7.2 m³/day for a RAS of 5.3%. This seems very low and is less than the recommended range of 50 to 150% for an extended aeration process as listed in ACWGM. However, the optimal RAS depends on the site and is typically controlled by the operator to achieve the best effluent quality and removal efficiency.

Detention Time

With an average daily flow of 136m³/day, the detention time in the aeration tank is calculated to be 13.5 hours, which is below the 20 to 30 hour range recommended by ACWGM.

MLSS, Volumetric Loading, F/M, SRT

These parameters were not evaluated as there were no MLSS, MLVSS, or influent BOD and TSS measurements available for review. It is recommended that some sampling and testing be conducted for these parameters for operational control of the plant in order to evaluate performance.

Aeration

There were no DO measurements available to review at the time of report preparation.

2.3.3 Secondary Clarifier

ACWGM provides the following design parameters for a secondary clarifier following an extended aeration process:

- Average Overflow Rate – 8 to 16 m³/m²/day.
- Average Solids Loading Rate – 1 to 5 kg/m²/hr.
- Peak Overflow Rate – 24 to 32 m³/m²/day (based on a sustained 2 hour peak).
- Peak Solids Loading Rate – 7 kg/m²/hr (based on a sustained 2 hour peak).

Based on a review of E.A. Aerotor manufacturer data and measurements taken in the field, the surface area of the clarifier was calculated to be 4.67m². The overflow rate was calculated to be 29.1 m³/m²/day at an average daily flow of 136 m³/day. This value is outside the range of 8 – 16 m³/m²/day recommended in ACWGM as summarized in Table 2.4.

As the peak hourly flowrate is unknown, the maximum peak hourly flowrate that would provide an acceptable overflow rate was calculated to be 6.23m³/hr (149.5 m³/day). Solids loading was not evaluated due to a lack of available MLSS data.

Table 2.4 Clarifier Overflow Rate

| Parameter | Units | Design ⁽³⁾ | Actual ⁽¹⁾ | ACWGM Guidelines |
|--------------------------|-------------------------------------|-----------------------|-----------------------|------------------|
| Population | | 200 | 150 ⁽²⁾ | - |
| Average Daily Flow | m ³ /day | 75.7 | 136 | - |
| Clarifier Overflow (avg) | m ³ /m ² /day | 16.2 | 29.1 | 8 - 16 |

(1) Based on estimate provided by WWTP Operator

(2) Based on an assumption of 60 homes and 2.5 people per home.

(3) Based on EA Aerotor Document (see Appendix B)

2.3.4 Disinfection

Treated wastewater is disinfected with calcium hypochlorite tablets in the chlorine contact chamber. TRC is reported to be in the range of 3 to 5 mg/L. De-chlorination is not practiced. The volume of the chlorine contact chamber is estimated to be 5.3m³ with a water depth of 0.85m based on measurements taken in the field. The ACWGM require that a chlorine contact tank provide 30 minutes of contact time at design average daily flow, or 15 minutes of contact time at the design peak hourly flow, whichever is greater. A TRC of 0.5 mg/L is required to ensure adequate disinfection of the effluent. The contact time in the chlorine contact tank was calculated using the reported average daily flowrate. There is sufficient contact time provided at the reported average daily flowrate. As the peak hourly flowrate is unknown, the maximum peak hourly flowrate that would provide the required 15 minutes of contact time was calculated to be 21.2m³/hr (508.8 m³/day).

Table 2.5 Chlorine Contact Time

| Parameter | Units | Reported Average |
|--------------|---------------------|------------------|
| Flowrate | m ³ /day | 136 |
| Volume | m ³ | 5.3 |
| Contact Time | min | 56 |

2.4 Receiving Water Quality

A sample of the receiving water quality was collected from both the brook where the WWTP discharges and the Atlantic Ocean on April 6, 2017 by CBCL. A summary of the receiving water quality data is shown in Table 2.6 with laboratory certificates included in Appendix C.

Table 2.6 Receiving Water Quality Summary

| Parameter | Units | BGJD1 (Upstream in Brook) | BGJD2 (Atlantic Ocean) |
|-------------------------------|-----------|---------------------------------|------------------------------|
| Carbonaceous BOD | mg/L | 6.0 | <5 |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 0.97 | 0.49 |
| Nitrogen (Ammonia Nitrogen) | mg/L | <0.05 | <0.05 |
| pH | pH | 7.26 | 7.37 |
| Total Phosphorus | mg/L | 0.039 | 0.052 |
| Total Suspended Solids | mg/L | <2 | 15 |
| E. Coli | MPN/100mL | <1 | <1 |
| Total Coliforms | MPN/100mL | 170 | 200 |

2.5 Inflow and Infiltration Assessment

Flow and rain gauging data was collected from March 22 to April 23. Graphs of the depth, velocity and rainfall data and the estimated flows using both area-velocity and Manning's equation are presented in Appendix D. Unfortunately, due to issues in the data collection process, the depth data collected from April 7 to April 23 was not usable and a portion of the velocity data erroneously recorded zero values. However, while the largest rainfall event during the monitoring period occurred on April 7, this event only had a rainfall volume of 9.6mm. The second largest rainfall event occurred on April 2 and had a rainfall volume of 7.6mm, and was therefore of a similar magnitude. A graph of the estimated I/I quantification for the April 2 rainfall event is presented in Appendix D along with an estimated breakdown of the wastewater, inflow and infiltration volumes for the event. It is noted that the Manning's flow was used for the I/I quantification, as the velocity readings at this time were not available. It should also be noted that since no significant rainfall event was captured during the monitoring period, a high level of uncertainty is associated with the estimated I/I quantification during larger events.

2.6 Treatment Upgrade Recommendations

The WWTP is not meeting effluent quality requirements, is hydraulically overloaded, and is nearing the end of its useful life. The WWTP effluent is regularly in exceedance of the allowable limits for CBOD₅, TSS, and TRC, and there have also been exceedances for E. coli. In order to meet the allowable TRC limit, either a de-chlorination system must be added, or the chlorine disinfection system must be replaced with UV disinfection. Signs of deterioration were noted during the site visit which included leaking between the aeration tank and chlorine contact tank, baffle wall deterioration, and flaking metal on tankage. There has been recent maintenance on the mechanical aerator after it was down for a period of time. The influent line to the plant is at grade and exposed to elements.

Additional sampling of the influent and mixed liquor is recommended for operational control and performance evaluation purposes. However, it is expected that replacement of the plant would be required to meet the WSER limits. A number of different treatment technologies are available for a plant of this scale. It is recommended that a pre-design study be completed to determine the recommended option for the Municipality



Prepared by:
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Intermediate Chemical Engineer



Reviewed by:
Dave Trudel, P.Eng.
Process Engineer

APPENDIX A

Approval to Operate No. 2016-096063-A01

March 29, 2016

Mr. Joseph O'Connor
Municipality of the County of Inverness
375 Main St
PO Box 179
Port Hood, NS
B0E 2W0

Dear Mr. O'Connor:

**RE: Approval to Operate - Sewage Treatment Plant
Approval No. 2016-096063-A01
PID # 50169796**

Enclosed please find Approval # 2016-096063-A01 to Operate the Sewage Treatment Plant at 1 Keltic Drive, Judique, Inverness County, Nova Scotia.

Strict adherence to the attached terms and conditions is imperative in order to validate this approval.

Despite the issuance of this Approval, the Approval Holder is still responsible for obtaining any other authorization which may be required to carry out the activity, including those which may be necessary under provincial, federal or municipal law.

Should you have any questions, please contact the Port Hawkesbury District Office at (902) 625-0791.

Yours truly


for Mark Farrell
District Manager

APPROVAL

Province of Nova Scotia
Environment Act, S.N.S. 1994-95, c.1

APPROVAL HOLDER: Municipality of the County of Inverness


SITE PID: 50169796

APPROVAL NO: 2016-096063-A01

EXPIRY DATE: March 31, 2026

Pursuant to Part V of the *Environment Act, S.N.S. 1994-95, c.1* as amended from time to time, approval is granted to the Approval Holder subject to the Terms and Conditions attached to and forming part of this Approval, for the following activity:

Operation of a Sewage Treatment Plant, and associated works, at or near 1 Keltic Dr, Judique, Inverness County in the Province of Nova Scotia.

Administrator 
Mark Farrell

Effective Date March 29, 2016

The Minister has delegated his powers and responsibilities under the Act with respect to this Approval to the Administrator named above. Therefore any information or notifications required to be provided to the Minister under this Approval can be provided to the Administrator unless otherwise stated in writing.

TERMS AND CONDITIONS OF APPROVAL

Nova Scotia Environment

Approval Holder: Municipality of the County of Inverness
Project: Sewage Treatment Plant
Site: 1 Keltic Drive,
Judique, Inverness County
PID # 50169796

Approval No: 2016-096063-A01

File No: 94300-30

Map Series: 11F14

Grid Reference: E616913 N5081655

Reference Documents:

- Department Issued "30-day Notification Of Amendment To Approval".
- Previous Approval 71-105
- Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal.

1. Definitions

- a) "Act" means Environment Act, Chapter 1 of the Acts of 1994-95, and includes, unless the context otherwise requires, all regulations made pursuant to the Act..
- b) "Acutely lethal" in relation to effluent, means that the effluent at 100% concentration kills, during a 96-hour period, more than 50% of the rainbow trout subjected to it.
- c) "Administrator" means a person appointed by the Minister to be responsible for processing applications respecting activities designated under the *Activities Designation Regulations*, and includes an acting administrator.
- d) "Approval" means an approval issued pursuant to this Act with respect to an activity.

- e) "Associated Works" means all piping, valves, instrumentation, controls, etc., required for the operation of the Facility and Sewage Collection System.
- f) "Composite Sample" means a representative sample which is taken from the combination of individual samples that are collected over a 24 hour period with at least one sample of 100 ml taken at two hour intervals.
- g) "Department" means Nova Scotia Environment, and the contact for the Department for this approval is:
 - Nova Scotia Environment
 - Eastern Region, Port Hawkesbury Office
 - Inspection, Compliance and Enforcement Division
 - Eastern Region, Port Hawkesbury Office
 - 218 MacSween Street, Suite 12
 - Port Hawkesbury, NS B9A 2J9

Phone: (902) 625-0791
Fax: (902) 625-3722
- h) "Extension" means an increase in size, volume or other physical dimensions of an activity such that the increase may cause an adverse effect if not properly mitigated.
- i) "Facility" means the Sewage Treatment Plant and associated works.
- j) "Grab sample" means an individual sample collected in less than 30 minutes and which is representative of the substance sampled.
- k) "Minister" means the Minister of Nova Scotia Environment.
- l) "Modification" means a change to an activity that may cause an adverse effect if not properly mitigated and includes, but is not limited to, the expansion of the same process, addition of product lines and replacement of equipment with different technology other than that presently in use.
- m) "NSE" means Nova Scotia Environment.
- n) "Quarter" means any of the four periods of three months that begin on the first day of January, April, July, and October.
- o) "Sewage Collection System" means the Facility and all auxiliaries for the collection, treatment, storage and discharge of sewage from the source of the sewage to the final discharge point.

- p) "Site" means the lands where an activity or proposed activity will take place.
- q) "Total Residual Chlorine" (TRC) means the sum of free chlorine and combined chlorine, including inorganic chloramines.

2. **Scope of Approval**

- a) This Approval (the "Approval") relates to the Approval Holder and their application and supporting documentation, as listed in the reference documents above, to construct, operate, and/or reclaim the Facility, situated at or near 1 Keltic Dr, Judique, Inverness County (the "Site").
- b) The Facility shall be operated in accordance with this Approval and the supporting documentation.
- c) The Site and/or Facility shall not exceed the area as outlined in the application and supporting documentation.
- d) This Approval is restricted to the operation of the Facility only. No other alteration or infill of a watercourse or water resource is permitted by this Approval. Works associated with the alteration or infill of a watercourse or water resource will require separate approval from the Department.
- e) This Approval does not apply to the electrical, roadways, and structural components of the project.

3. **General Terms and Conditions**

- a) The Approval Holder shall construct, operate and reclaim its Facility in accordance with the following provisions:
 - i) *Environment Act* S.N.S. 1994-1995, c.1, s.1 as amended from time to time;
 - ii) Regulations, pursuant to the above Act, as amended from time to time;
 - iii) Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal, 2006, or latest revision.
- b) No authority is granted by this Approval to enable the Approval Holder to construct or operate the Facility on lands which are not in the control or ownership of the Approval Holder. It is the responsibility of the Approval Holder to ensure that such a contravention does not occur.

- c) If there is a discrepancy between the reference documents and the terms and conditions of this Approval, the terms and conditions of this Approval shall apply.
- d) Any request for renewal or extension of this Approval is to be made in writing, to the Department, at least ninety (90) days prior to the Approval expiry.
- e) The Minister may modify, amend or add conditions to this Approval at anytime pursuant to Section 58 of the Act.
- f) This Approval is not transferable without the consent of the Minister.
- g)
 - (i) If the Minister determines that there has been non-compliance with any or all of the terms and conditions contained in this Approval, the Minister may cancel or suspend the Approval pursuant to subsections 58(1) and 58(2) of the Act, until such time as the Minister is satisfied that all terms and conditions have been met.
 - (ii) If the Minister cancels or suspends this Approval, the Approval Holder remains subject to the penalty provisions of the Act and regulations.
- h) The Approval Holder shall notify the Department prior to any proposed extensions or modifications of the Facility, including, but not limited to, process changes or waste disposal practices which are not granted under this Approval. An amendment to this Approval may be required before implementing any change.
- i) Extensions or modifications to the Facility may be subject to the Environmental Assessment Regulations. Written Approval from the Minister may be required before implementing any change.
- j) Pursuant to Section 60 of the *Act*, the Approval Holder shall submit to the Minister any new and relevant information respecting any adverse effect that actually results, or may potentially result, from any activity to which the Approval relates and that comes to the attention of the Approval Holder after the issuance of the Approval.
- k) The Approval Holder shall immediately notify the Department of any incidents of non-compliance with this Approval.
- l) The Approval Holder shall bear all expenses incurred in carrying out the environmental monitoring required under the terms and conditions of this Approval.

- m) Unless specified otherwise in this Approval, all samples required to be collected by this Approval shall be collected, preserved and analysed, by qualified personnel, in accordance with recognized industry standards and procedures.
- n) Unless written authorization is received otherwise from the Minister, all samples required by this Approval shall be analysed by a laboratory that meets the requirements of the Department's "Policy on Acceptable Certification of Laboratories" as amended from time to time.
- o) The Approval Holder shall ensure that this Approval, or a copy, is kept on Site at all times and that personnel directly involved in the Facility operation are made fully aware of the terms and conditions which pertain to this Approval.

4. Spills or Releases

- a) All spills or releases shall be reported in accordance with the *Act* and the *Environmental Emergency Regulations*.
- b) Spills or releases shall be cleaned up immediately in accordance with the *Act* and the *Contaminated Sites Regulations*.

5. Sludge Disposal

- a) All sludge generated at the Site shall be managed in accordance with a Sludge Management Plan accepted by the Department or disposed of and treated at a facility approved to accept this material.
- b) The Approval Holder shall submit a Sludge Management Plan, prepared by the operator or other third party consultant with experience in Wastewater Treatment Facility operations, to the Department by **July 4, 2016**. Any changes to the sludge management plan must be submitted in writing for review and be acceptable to the Department.

6. Operation

- a) The Approval Holder shall ensure that the Facility has measures in place to protect against failures of the power supply, treatment process, and equipment.

- b) The Approval Holder shall submit an Operations Manual, prepared by the operator or other third party consultant with experience in Wastewater Treatment Facility operations, to the Department by **July 4, 2016**. The Plan shall include all of the following:
 - i) Standard Operational Procedures (SOPs);
 - ii) Emergency Response and Notification Procedures;
 - iii) Contingency Plan;
 - iv) Procedures to record and respond to complaints.
- c) The Approval Holder shall ensure that the Operations Manual is reviewed, and if required updated, on an annual basis. The Operations Manual shall be kept up to date and maintained on-site at all times and made available for review upon request by NSE. The Approval Holder shall ensure that all employees involved in the operation of the facility are apprised of the Operations Manual.
- d) The Approval Holder shall not establish nor maintain a bypass to divert sewage around the Facility or any feature of the Facility treatment process unless the bypass has been approved by the Department. If deemed necessary and approved by the Department, in writing, the Approval Holder shall report the date, time, and duration of the by-pass until the normal treatment process resumes. This report shall be submitted within 24 hours of the conclusion of the by-pass event.
- e) The Approval Holder shall take immediate preventive or corrective action, when the Approval Holder and/or operator becomes aware of conditions which are detrimental to Facility operations, and/or result in adverse impact to the environment or public health.
- f) The Facility has been classified as a **Class I Wastewater Treatment Facility**. The Facility shall have a(n) operator(s) placed in Overall Direct Responsible Charge who hold(s) the appropriate certification. The Approval Holder shall provide the individual(s) contact information to the Department in writing within 6 weeks of the issuance of the Approval, on or before **May 15, 2016**, and when there is a change in the Facility's operator(s).
- g) All equipment must be installed, maintained and calibrated as specified by the manufacturer's instructions.

7. Performance And Limits

The Facility and Sewage Collection System shall be managed and operated in such a manner that the effluent being discharged from the Facility satisfies the following criteria subject to **Section 11** of this approval:

- a) Carbonaceous biological oxygen demand, CBOD₅, shall not exceed 25 mg/l.
- b) Total Suspended Solids, shall not exceed 25 mg/l
- c) E.Coli shall not exceed 200 E.Coli/100 mls
- d) pH shall be within the range of 6 to 9.
- e) Non-acutely lethal
- f) Total chlorine residual in the discharge shall not exceed 0.02 mg/L after December 31, 2020. The System Assessment Report required under Section 11(a) shall include any proposed modifications required to meet this discharge limit.

8. Odour Control

- a) The Approval Holder shall operate the Facility in a manner which will not result in the generation of offensive or hazardous odours/vapours.
- b) The Approval Holder shall be required to implement control measures if odour generation is deemed excessive by the Department.

9. Monitoring and Reporting

- a) The Approval Holder shall conduct sampling and analysis for the parameters at the frequency and locations listed in **Table 1**. Following a review of any of the analytical results required by this Approval, the Department may alter the frequencies, location, and parameters for analysis.

| TABLE 1 | | | | |
|------------------------|--------------------|--------------------------|-------------------------|----------------------------|
| PARAMETER | SAMPLE TYPE | MINIMUM FREQUENCY | AVERAGING PERIOD | LOCATION |
| CBOD ₅ | Grab | Monthly | Quarterly | Treated effluent discharge |
| Total Suspended Solids | Grab | Monthly | Quarterly | Treated effluent discharge |
| E.Coli | Grab | Monthly | Quarterly | Treated effluent |

| TABLE 1 | | | | |
|--|-------------|--------------------------------|------------------|----------------------------|
| PARAMETER | SAMPLE TYPE | MINIMUM FREQUENCY | AVERAGING PERIOD | LOCATION |
| | | | | discharge |
| pH | Grab | Monthly | Quarterly | Treated effluent discharge |
| If Chlorine is used: Total Chlorine Residual | Grab | Monthly | Quarterly | Treated effluent discharge |
| Plant Volumes | N/A | Continuous | Annually | Entering or leaving plant |
| Fish Toxicity | Grab | As requested by the Department | N/A | Treated effluent discharge |

- b) The Facility shall be considered in compliance with the treated effluent discharge criteria if the average value calculated for the averaging period meets the specified limit in **Section 7**. All average results must be the arithmetic mean with the exception of E.Coli, which must be the geometric mean. (Absence of E.Coli counts are to be included as 1 for calculation purposes).
- c) The Approval Holder shall prepare the averages of the results of sampling conducted at the locations indicated in **Table 1**. Exceedances must be submitted to the Department within 15 days of the end of the respective averaging period.
- d) The Approval Holder shall prepare and submit to the Department an annual report for the Facility by **April 5** and cover the period of the four previous quarters. The report shall contain the following information in a format acceptable to the Department:
 - i) A summary and discussion of the quantity of wastewater treated during the reporting period, and
 - ii) A summary and interpretation of analytical results obtained in accordance with this Approval; and

- iii) A description of any emergency or upset conditions, including bypass events, which occurred during the reporting period and any action taken to correct them; and
 - iv) A description of any complaints received and the follow-up actions taken.
 - v) Averaging period sampling result averages, as indicated in item 9 d).
- e) The Approval Holder shall notify relevant parties as per the Notification Procedures outlined in their Operations Manual in the event that effluent is released from the Facility which exceeds the treated effluent discharge criteria outlined in this approval. Notification shall occur within one business day of the Approval Holder becoming aware of the release.

10. Records

- a) The Approval Holder shall keep the following records and treated wastewater effluent quality analyses:
- i) CBOD₅, Total Suspended Solids, Chlorine Residual, and Bacteriological analyses shall be kept for five years;
 - ii) Flow meter readings shall be kept for 10 years.
- b) The Approval Holder shall also retain the following information for a period of three years:
- i) calibration and equipment maintenance records;
 - ii) continuous monitoring data;

11. Site Specific Conditions

- a) The Approval Holder shall submit to the Department on or before **May 1, 2017** a System Assessment Report (S.A.R.) on the operation of the Facility. The report shall be prepared by a third party consultant with experience in Wastewater Treatment Facility operations and contain the following:
- i) Results of effluent quality required by **Section 9**;
 - ii) A description of the treatment technology currently employed;
 - iii) Details on the treatment potential of the existing plant;
 - iv) A summary and conclusion of the existing Facility's capability to comply limits established in **Section 7**;
 - v) A summary of the receiving water quality;

- vi) An outline of the treatment upgrades, if any, required to comply with the limits established in **Section 7** and the information required under **Section 9**; and
 - vii) An assessment of the collection system for Inflow and Infiltration and a schedule for improvements should they be required.
- b) The Approval Holder is required to work towards adherence to the following guidelines and regulations by **January 1, 2020**:
- Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal, 2006, or latest revision.
- c) The Approval Holder shall be required to undertake modifications and/or upgrades to the Facility at the direction of the Department. If so directed to undertake modifications or upgrades the Approval Holder shall provide the following:
- i) An application for amendment of approval if required by the Department,
 - ii) A plan to complete the modifications and/or upgrades and a schedule for the completion of work. The plan shall be prepared by a third party consultant with experience in Wastewater Treatment Facility operations. Design drawings and specifications shall be prepared by an engineer licensed to practice in the Province of Nova Scotia if the plan requires engineering.
 - iii) The Facility upgrades and/or modifications shall be completed in accordance with the plan and in a time frame acceptable to the Department.

12. Deadlines

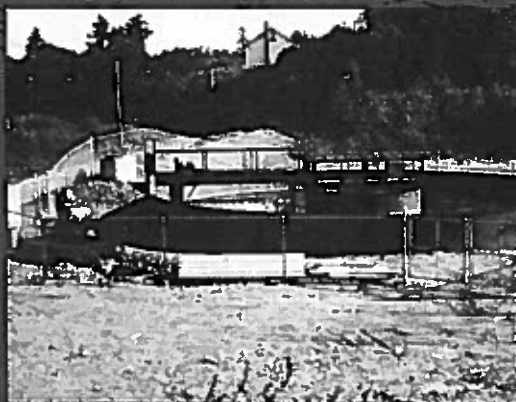
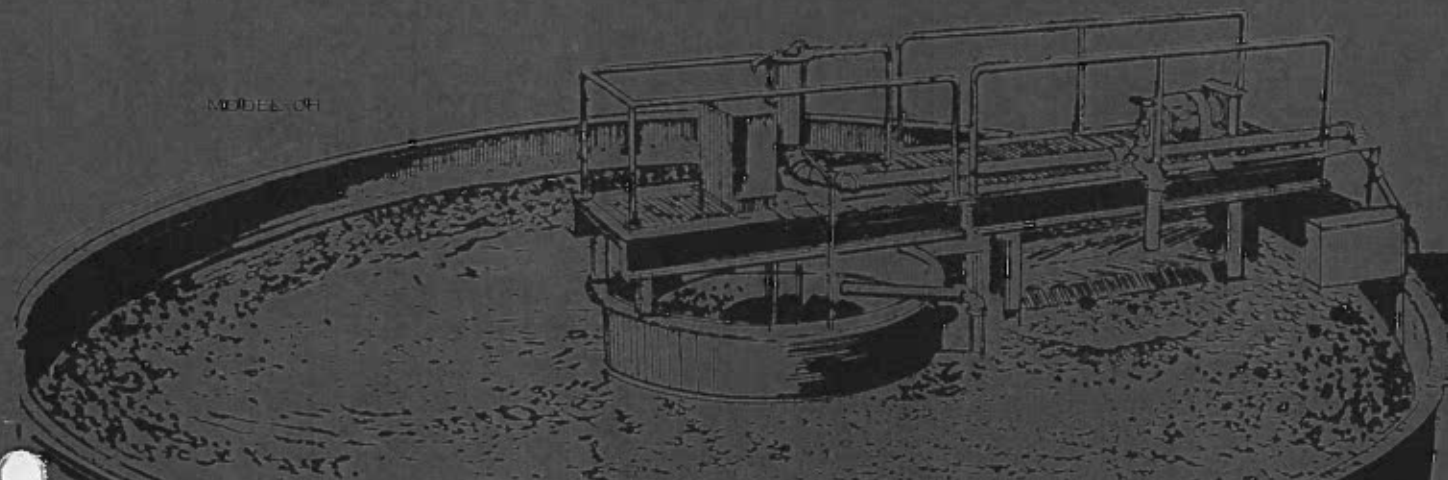
- **Condition 5(b) - July 4, 2016**, submission of Sludge Management Plan
- **Condition 6(b) - July 4, 2016**, submission of Operations Manual
- **Condition 6(f) - May 15, 2016**, submission of Operator(s) contact information
- **Condition 9(d) - April 5** (annually) the Annual Report, with the first report due April 5, 2017 to cover the period beginning the date of the issuance until December 31, 2016
- **Condition 11(a) - May 1, 2017**, submission of System Assessment Report (S.A.R.)

APPENDIX B

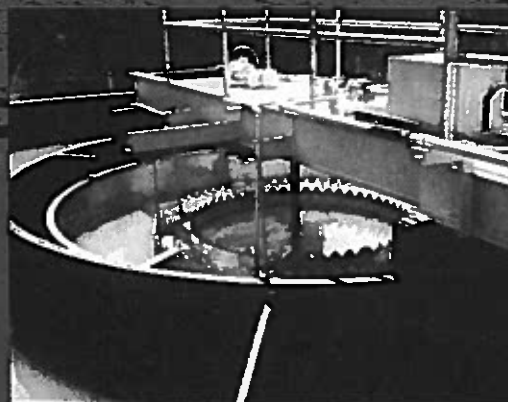
E.A. Aerotor Plants Document

E.A. Aerotor Plants

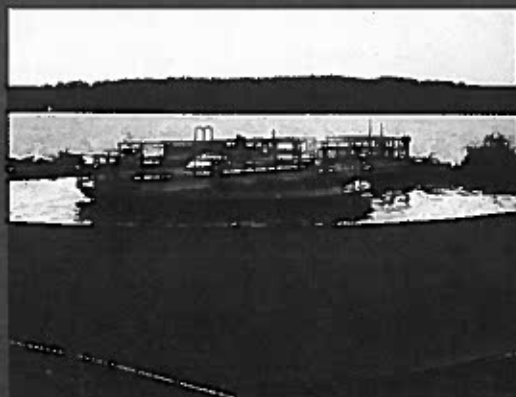
MODEL CH



MODEL CHA



MODEL CM



MODEL MM

LAKESIDE

LAKESIDE EQUIPMENT CORPORATION

1022 E. DEVON AVE., BARTLETT, ILL. 60103

E. A. AEROTOR PLANTS

The E. A. Aerotor plant presents a fresh and unique package type sewage treatment plant. Aeration is not by diffused air but a much more efficient mechanical surface aerator. The process utilized is a modified form of the activated sludge process and may be classified in the complete mix, long term aeration group. This plant provides a simple, compact, rugged, odor free and virtually fool-proof operation that is capable of 90 to 95 percent reductions of the polluting matter in the used water as measured in BOD and suspended solids. The process also accomplishes nitrification by conversion of ammonia, NH_3 to nitrates, NO_3 . The E. A. Aerotor plant has been developed from the Oxidation Ditch process with the ditch wrapped in an annulus around the final settling tank. This forms a compact structure which makes it adaptable for a package type plant.

Process Components and Flow Sheet

The plant components are the bar screen box, aeration chamber, final settling tank and excess sludge holding tank. The bar screen, rotor, final tank mechanism and return sludge and scum air lifts with compressor are the items of equipment.

Figure 1 shows a line diagram of the process flow sheet. Raw sewage passes directly through the bar screen to the aeration chamber. The bar screen is necessary for the protection of the rotor and air lifts. In the aeration chamber, the raw sewage is mixed with the active organisms previously formed by the process.

The rotor is the aeration device that entrains the necessary oxygen into the liquid, keeps the contents in the chamber mixed and moving and provides some comminution of the raw waste.

Mixed liquor in the aeration chamber passes through a port to the final settling tank. Quiescent conditions in the clarifier afford separation of the solids, formed in the aeration chamber, from the liquid. Supernatant or clarified liquid passes over the effluent weir and flows to a chlorine contact chamber or is discharged directly to the receiving stream.

Settled sludge is removed from the bottom of the clarifier by the return sludge air lift and is returned to the aeration chamber. All sludge formed by the process is returned to the aeration chamber. Periodically when the suspended solids in the aeration chamber become excessive, this excess sludge is wasted to the sludge holding tank. Excess sludge is concentrated and accumulated in the sludge holding tank for ultimate disposal. Scum which floats to the surface in the race of the clarifier is removed by the scum air lift and returned to the aeration chamber. Scum is always returned to the aeration chamber so that it may undergo additional treatment.

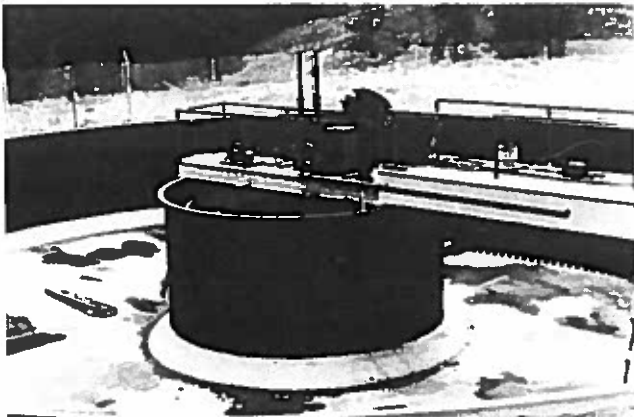
Features

If you are looking for a sewage treatment plant that has simplicity, ease of operation, flexibility, low cost of operation and low first cost, you should consider an E. A. Aerotor plant.

Simplicity of the plant may be observed by reviewing the model CH plant shown in figure 2 and noting the few components. The ease of maintenance results from the simplicity of the plant and the few components. The rotor with the exception of the tips of the blades, sits above the water level. The other operating equipment is all above the water level and sits on or adjacent to the bridge. The operator can see all of the major moving parts. To maintain this plant, there are no tanks to drain or diffuser tubes or spargers to pull and clean.

The basic process design results in simple, easy operation. The complete mix, long term aeration chamber carrying high mixed liquor suspended solids concentration, 3,000 to 8,000 mg/l, is capable of handling peak and shock loads without upsetting plant operation. There is no foam problem after solids build up, as experienced with other types of activated sludge plants. The built in flexibility affords better control of the operation.

Flexibility of operation is built into all E. A. Aerotor plants. By changing the rotor immersion while maintaining a constant speed, it is possible to vary considerably the rotor oxygenation capacity. Water level in the aeration reactor is controlled by the weir trough in the final settling tank. A slip pipe connection of the effluent pipe to the



CHESTERTON, IND.; MODEL CH
Showing plant under construction



PRINCETON, MAINE; MODEL CH
Plant covered with a plastic dome for Winter operation

effluent trough affords adjustment of tank water level and Rotor immersion by raising or lowering the effluent trough hanger rods. In some models, rotor immersion can also be changed by adjusting the elevation of the rotor support bridge. The quantity of air to the eductor bowl of the return sludge air lift can be adjusted to regulate the rate of activated sludge return. Skimming the clarifier race is automatic and may be adjusted to suit actual operating conditions by changing the time clock setting.

Operating costs are low. The rotor will require only one half of the power that would be required by the blower in a diffused air plant designed to do the same job. First costs are low because of the simplicity and few plant components.

Application

E. A. Aerotor plants are applicable for treating domestic wastes from small municipalities, housing developments, trailer camps, factories, schools and many other establishments of this type. The E. A. Aerotor plant is also applicable for treating many types of industrial wastes that are amenable to aerobic degradation.

These plants are available in four different models shown in figures 2, 3, 4 and 5. The contractor provides the concrete base slab, sets out anchor channel, erects the steel walls and installs the equipment. All material within the outer steel shell is furnished by Lakeside. Three of the models are provided with a normal liquid depth in the aeration chamber of 5'-6" which requires only a single height steel sheet which affords simple erection of the steel walls.

All of the figures show outer and inner walls as steel shells. The engineer can elect to furnish the outer or the outer and inner walls in concrete.

Table 1 is provided to illustrate some typical sizes for model - CH plants from 100 to 1,000 persons handling normal domestic waste. The general design criteria is given in note 2 on table 1. Upon request, Lakeside will provide you with a design to meet your specific application for either domestic or industrial waste. Various special features may also be added upon request.

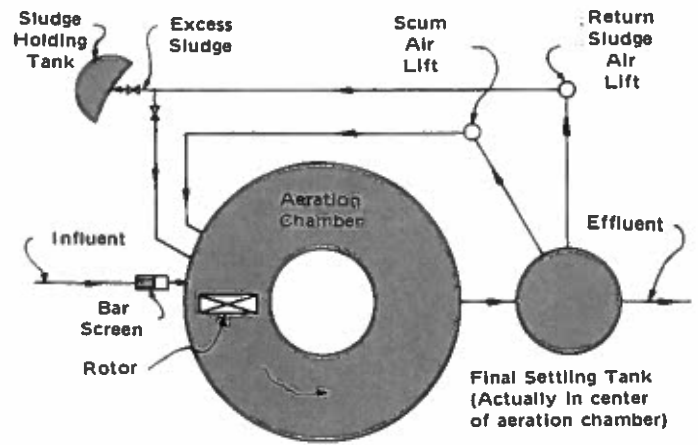
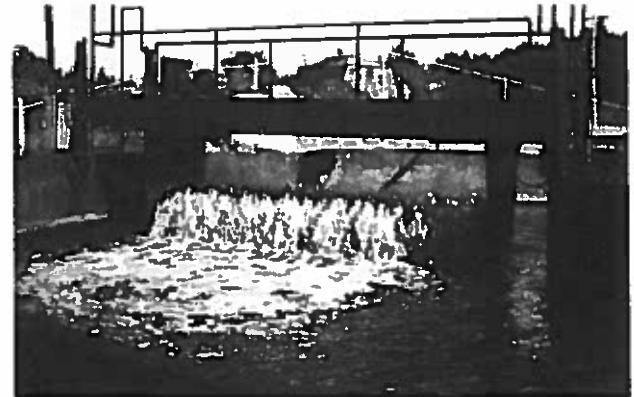


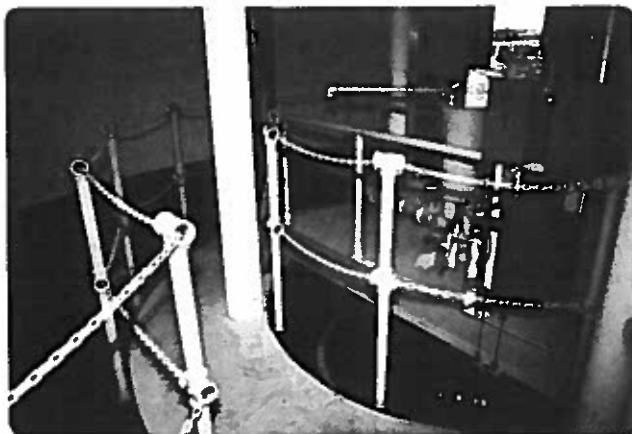
FIGURE 1
Line diagram of E. A. Aerotor Plant



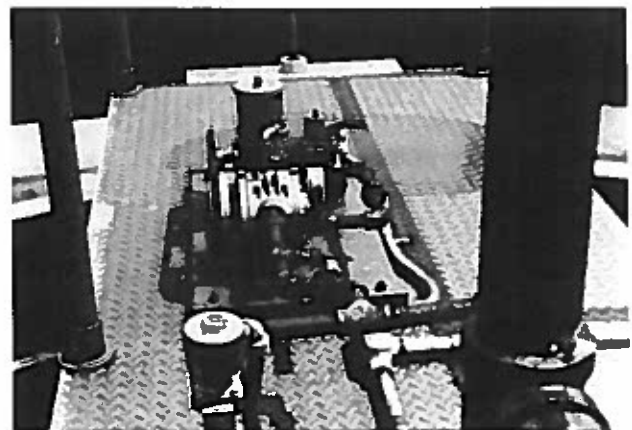
CENTRAL SAANICH, B. C.; MODEL MM
A 17' Magna Rotor operating 10'-0" liquid depth



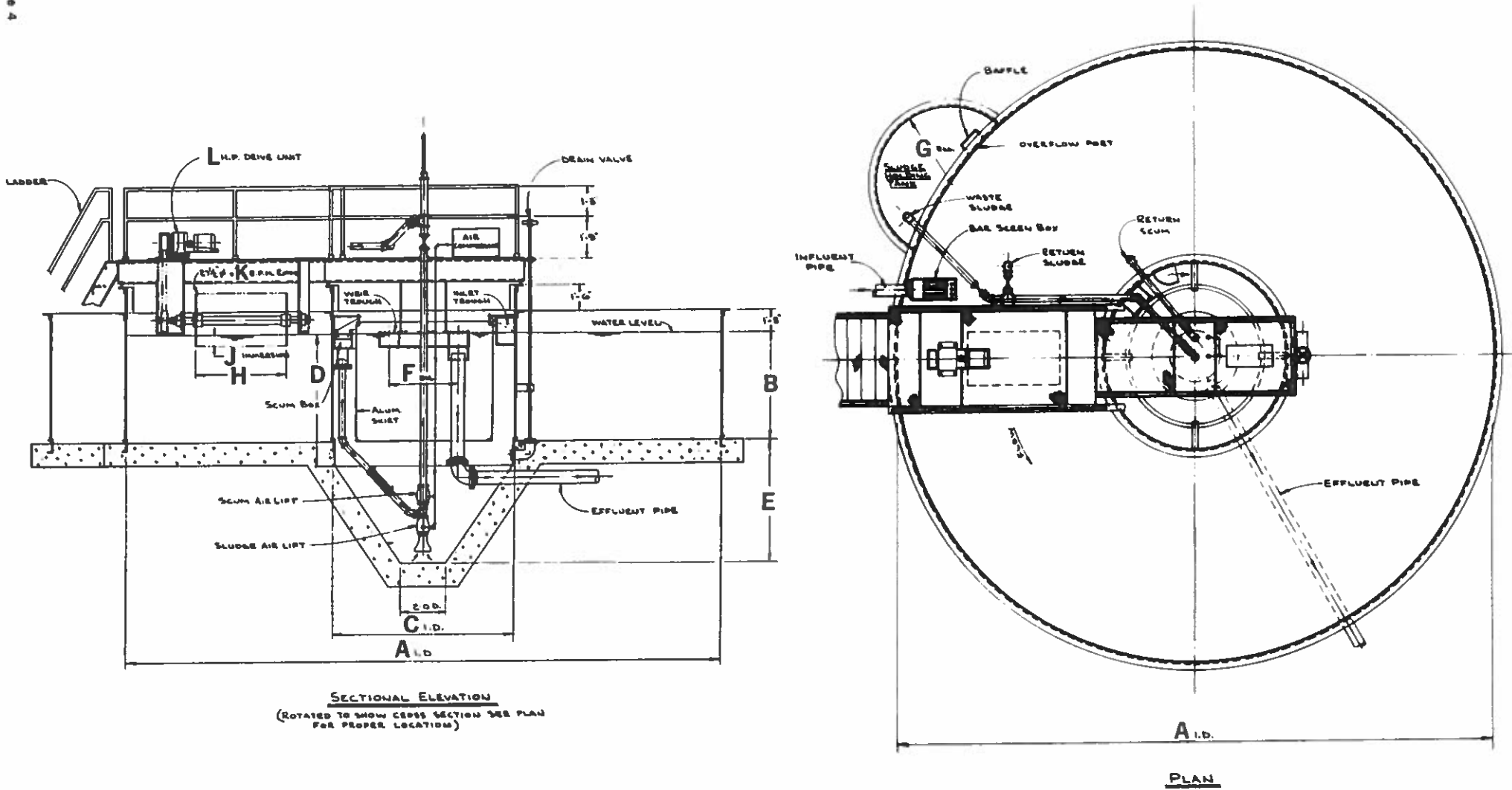
SALMON RIVER, N. S.; MODEL CHA
Rotor and liquid level adjustable from 2'-9" to 5'-6"



HARRINGTON, MAINE; MODEL CH
Concrete inner and outer shell



CHESTERTON, IND.; MODEL CH
Compressor with valve bypass to regulate discharge



MODEL - CH

Design Population - 100 to 1,500 persons. Aeration chamber normal liquid depth is 5'-6". Equipment is a 27½" diameter Cage Rotor suspended from an overhead walkway support and a non-mechanized Spiraflo Clarifier. A return sludge air lift and air lift skimmer with compressor and discharge piping, valves and fittings are also included.

FIGURE 2

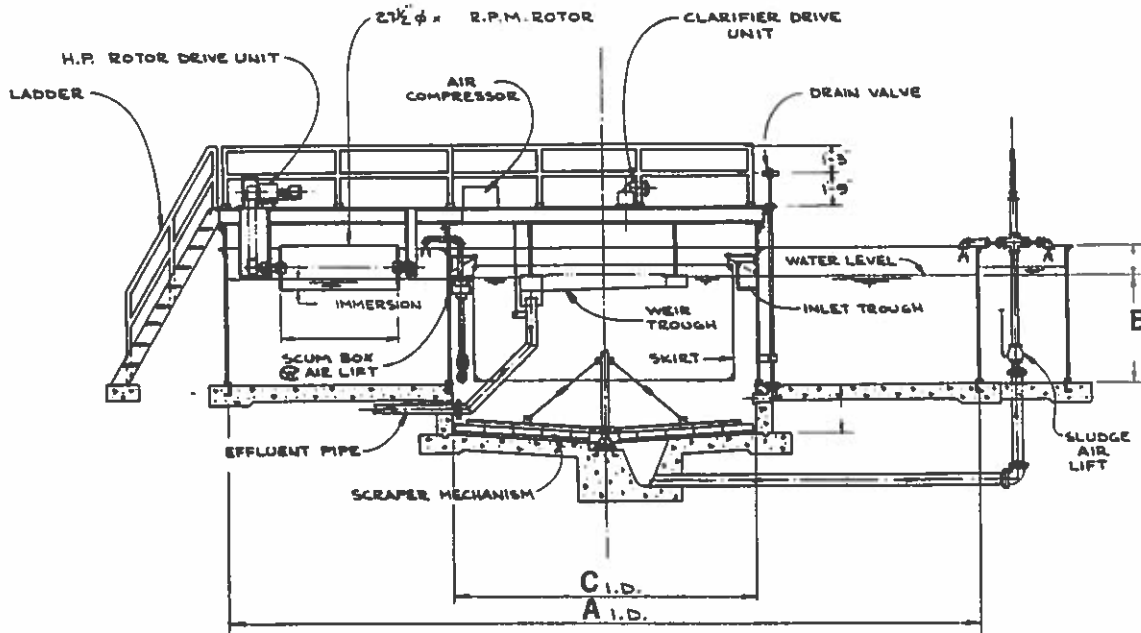
TYPICAL EA AEROTOR PLANT DIMENSIONS

MODEL CH

TABLE 1

| DESIGN POPULATION | Aeration Tank | | Final Settling Tank | | | | Sludge Holding Tank Radius | Rotor | | | | Return Sludge Airlift GPM |
|----------------------|-----------------|-----------------|---------------------|------------------------|-----------------|------------------------|-------------------------------------|--------|---------------------|-----|----|------------------------------------|
| | Outside Dia. | Liquid Depth | Outside Dia. | Side Water Depth | Hopper Depth | Trough Mean Dia. | | Length | Design Immersion | RPM | HP | |
| | A | B | C | D | E | F | G | H | J | K | L | N |
| 100 | 19'-6" | 5'-0" | 6'-0" | 5'- 0" | 3'- 6" | 2'-6" | 2'-6" | 3'-0" | 3" | 65 | 1½ | 10 |
| 150 | 23'-0" | 5'-5" | 7'-0" | 5'- 5" | 4'- 4" | 2'-9" | 2'-9" | 3'-0" | 4" | 65 | 1½ | 15 |
| 200 | 26'-3" | 5'-6" | 8'-0" | 5'- 6" | 5'- 3" | 3'-0" | 3'-3" | 4'-0" | 4" | 65 | 2 | 20 |
| 250 | 29'-6" | 5'-5" | 9'-0" | 5'- 5" | 6'- 1" | 4'-0" | 3'-9" | 5'-0" | 4" | 65 | 2 | 25 |
| 300 | 32'-0" | 5'-6" | 9'-0" | 6'- 4" | 6'- 1" | 4'-0" | 4'-0" | 6'-0" | 4" | 65 | 2 | 29 |
| 350 | 34'-6" | 5'-6" | 10'-0" | 5'- 9" | 6'-11" | 4'-6" | 4'-3" | 7'-0" | 4" | 65 | 3 | 31 |
| 400 | 37'-0" | 5'-6" | 11'-0" | 5'- 6" | 7'-10" | 4'-9" | 4'-6" | 8'-0" | 4" | 65 | 3 | 35 |
| 450 | 39'-0" | 5'-6" | 11'-0" | 6'- 0" | 7'-10" | 4'-9" | 4'-9" | 9'-0" | 4" | 65 | 3 | 39 |
| 500 | 41'-6" | 5'-5" | 12'-0" | 5'- 5" | 8'- 8" | 5'-3" | 5'-0" | 9'-0" | 4½" | 65 | 5 | 40 |
| 550 | 43'-6" | 5'-5" | 12'-0" | 6'- 0" | 8'- 8" | 5'-3" | 5'-3" | 10'-0" | 4½" | 65 | 5 | 42 |
| 600 | 45'-0" | 5'-6" | 12'-0" | 6'- 8" | 8'- 8" | 5'-3" | 5'-6" | 10'-0" | 4½" | 65 | 5 | 43 |
| 650 | 47'-0" | 5'-6" | 13'-0" | 5'-10" | 9'- 7" | 6'-0" | 5'-9" | 11'-0" | 4½" | 65 | 5 | 46 |
| 700 | 48'-6" | 5'-6" | 13'-0" | 6'- 5" | 9'- 7" | 6'-0" | 6'-0" | 11'-0" | 4¾" | 65 | 5 | 49 |
| 750 | 50'-6" | 5'-6" | 14'-0" | 5'- 7" | 10'- 5" | 6'-6" | 6'-3" | 11'-0" | 5" | 65 | 5 | 53 |
| 800 | 52'-0" | 5'-6" | 14'-0" | 6'- 2" | 10'- 5" | 6'-6" | 6'-6" | 12'-0" | 5" | 65 | 7½ | 56 |
| 850 | 53'-3" | 5'-6" | 14'-0" | 6'- 8" | 10'- 5" | 6'-6" | 6'-6" | 12'-0" | 5½" | 65 | 7½ | 59 |
| 900 | 55'-0" | 5'-6" | 15'-0" | 5'- 9" | 11'- 3" | 7'-0" | 6'-9" | 12'-0" | 5½" | 65 | 7½ | 63 |
| 950 | 56'-6" | 5'-6" | 15'-0" | 6'- 3" | 11'- 3" | 7'-0" | 7'-0" | 13'-0" | 5½" | 65 | 7½ | 66 |
| 1,000 | 58'-3" | 5'-6" | 16'-0" | 5'- 6" | 12'- 2" | 7'-6" | 7'-0" | 13'-0" | 5½" | 65 | 7½ | 70 |

- Notes: 1. Sizes given above are based on domestic waste with a flow of 100 gallons/capita/day and strength of 0.17# BOD/capita/day.
 2. Aeration chamber sized based on 79 ft.³/#BOD/day, final settling tank not more than 600 gallon/ft²/day surface settling rate with 3 hours detention time, and holding tank 2.23 ft³/100 people/day excess sludge.

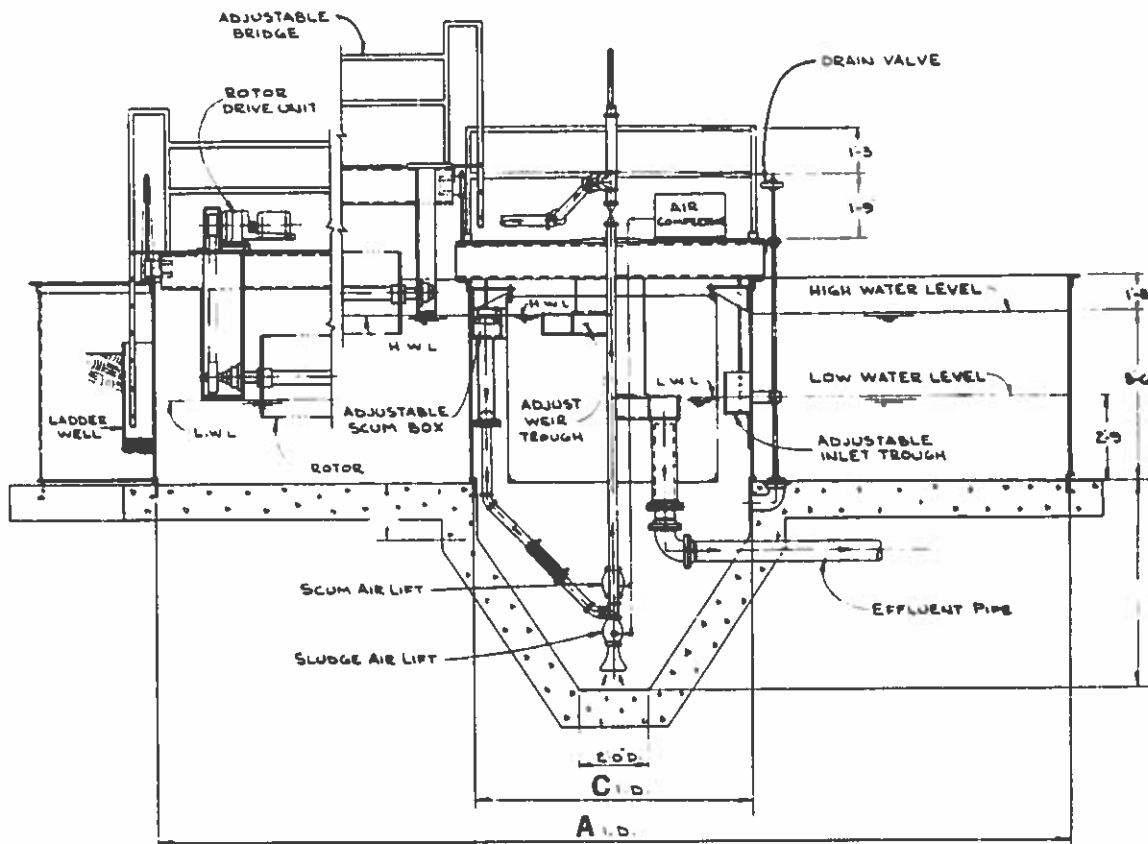


Model - CM

FIGURE 3

Design Population - 100 to 2,500 persons. Aeration chamber normal liquid depth is 5'-6". Equipment is a 27 1/2" diameter Cage Rotor suspended from an overhead walkway

support and a mechanized Spiraflo Clarifier. A return sludge air lift and air lift skimmer with compressor and discharge piping, valves and fittings are also included.

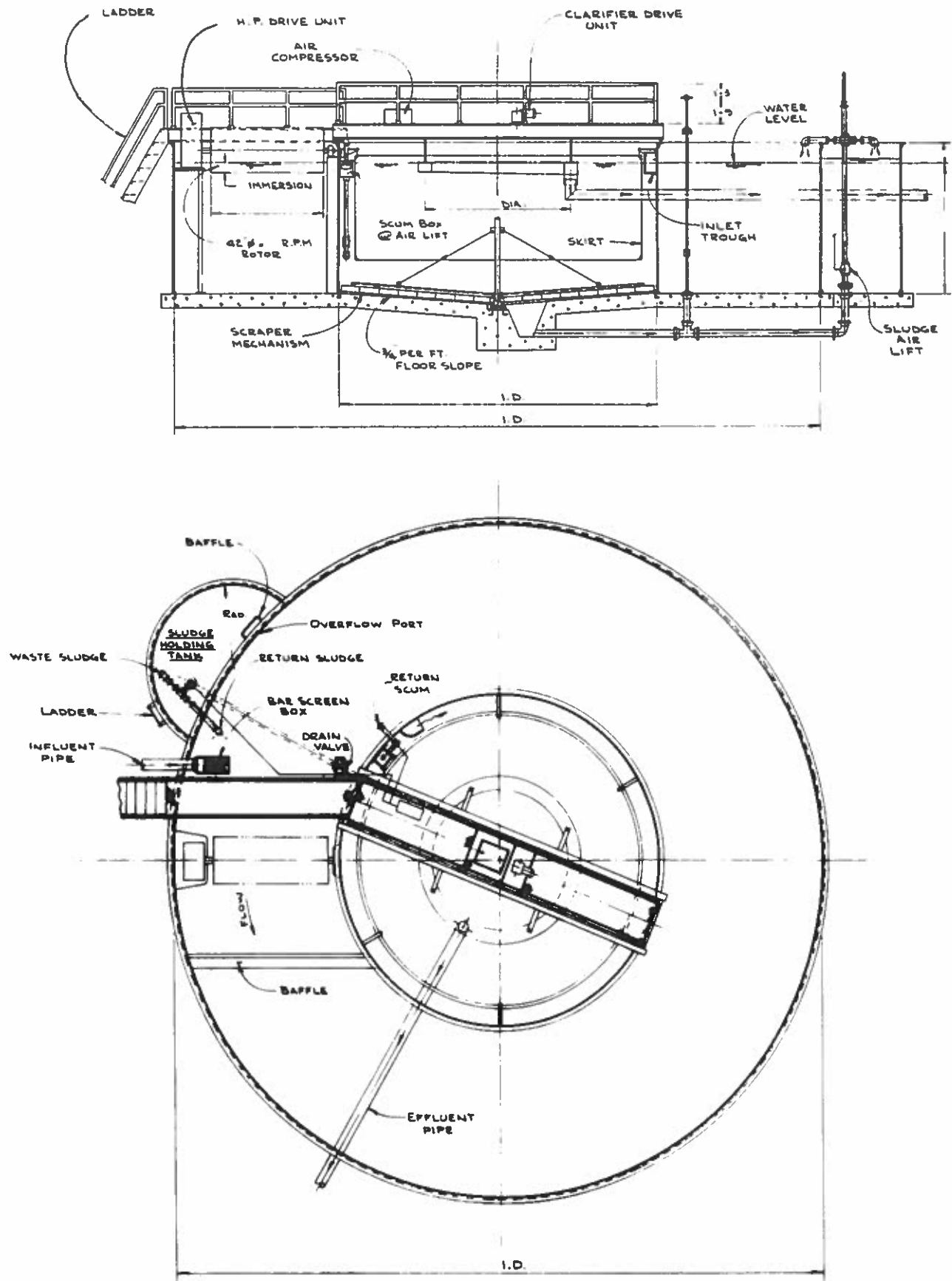


Model - CHA

FIGURE 4

Design Population - 100 to 1,250 persons. Aeration chamber for maximum design population is 5'-6". Equipment is a 27 1/2" diameter Cage Rotor suspended from an overhead walkway support mounted on adjustment rods

and a non-mechanized Spiraflo Clarifier. A return sludge air lift and air lift skimmer with compressor and discharge piping, valves and fittings are also included. Also review additional discussion of adjustable features.



Model - MM

FIGURE 5

Design Population - 1,250 to 5,000 persons. Aeration chamber normal liquid depth is 10'-0". Equipment is a 42" diameter Magna Rotor mounted on fixed fabricated steel

supports and a mechanized Spiraflo Clarifier. A return sludge air lift and air lift skimmer with compressor and discharge piping, valves and fittings are also included.

OPTIONAL FEATURES

Model — CHA Plant

The Model — CHA plant is an expandable plant which is ideal for subdivision planning. The flexibility of oxygenation capacity by change in rotor immersion affords the possibility of a special expandable feature and makes it possible to expand the plant 100 percent. Proper aeration tank volume, mixing and aeration can be provided in infinite increments from the initial design conditions to the future design conditions.

Extended aeration periods and excessive aeration can and do cause operation problems and can be responsible for reduced plant efficiency. In the expandable Model — CHA E. A. Aerotor plant, it is possible to operate the plant with the proper aeration volume and necessary aeration.

The rotor support structure is suspended in the tank by four rodded adjustment brackets. The final settling tank is fitted with a special adjustable influent baffle and the effluent trough and the scum trough are fitted with extended slip pipe connections. These special features make it possible to start operation with a 2'-9" liquid depth in the aeration tank. As the load to the plant increases the water level is increased and the Rotor immersion changed to comply with these new conditions. As the load continues to increase, the water level in the aeration tank is increased in increments until the full 5'-6" liquid depth is reached.

With the expandable E. A. Aerotor plant, the operation of the plant can be set to meet the actual flow and strength coming to the plant. This makes it easier to operate the plant at continuous high efficiency levels. The rotor set at a lower immersion, than required for the future design, will require less power which means that you will also save operating power costs with this plant.

Comminutors

The standard design for E. A. Aerotor plants is with the plant influent protected only by a bar screen. The rotor is self-cleaning and rags and other foreign matter will not hang up on the unit. The rotor does provide some comminution of the raw sewage solids.

Some of the State Regulatory Agencies make it mandatory that comminutors be furnished on all plants. There are also designers that feel a comminutor should be included. An extended bar screen box with stop gates and comminutor can be furnished upon request.

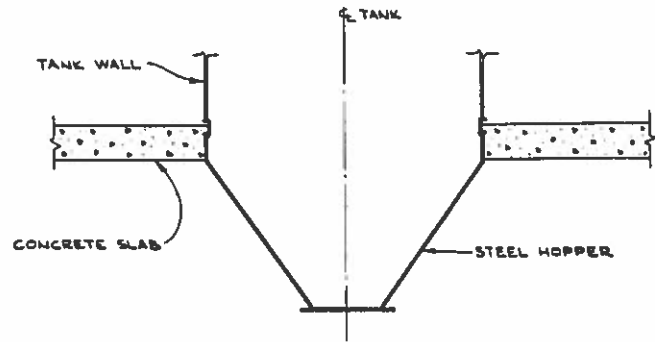
Control Panel

A factory wired control panel in Nema 3 or Nema 1 enclosure is also available. This unit is complete with main

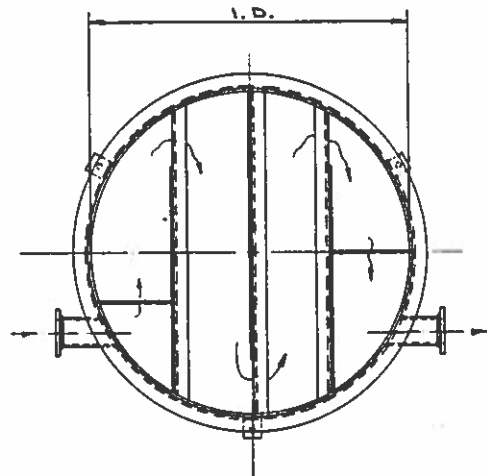
circuit breaker, magnetic starters with individual fuse clips, selector switches, running lights, a 115 volt take off and a time clock for control of air lift skimmer.

Fabricated Steel Hopper

For Models CH and CHA E. A. Aerotor plants, it is possible to substitute, for the reinforced concrete hopper in the non-mechanized Spiraflo Clarifier, a fabricated steel hopper. A typical fabricated steel hopper is illustrated below.



In many cases the fabricated steel hopper is a more economical approach, but its use should be investigated. The steel hopper reduces the complexity of the concrete base. Normally, if the plant is located where a high water table is anticipated, the concrete slab should be checked for uplift and the strength of the concrete slab and connection of the concrete slab at the fabricated steel hopper checked.



Chlorine Contact Tank

Fabricated steel chlorine contact tanks are also available. This is a separate structure which is set on an independent concrete slab. These units are circular tanks with return flow baffles and V-notched effluent box as illustrated above.



APPENDIX C

Laboratory Certificates for Background Water Quality Monitoring

Your Project #: 172410.00
 Site Location: JUDIQUÉ SAR
 Your C.O.C. #: 605209

Attention: Wade Davidson

CBCL Limited
 Sydney-Standing Offer
 164 Charlotte St
 Sydney, NS
 B1P 6J7

Report Date: 2017/04/19
 Report #: R4431328
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B769202

Received: 2017/04/07, 09:20

Sample Matrix: Water
 # Samples Received: 2

| Analyses | Quantity | Date | Date | Laboratory Method | Reference |
|------------------------------------|----------|------------|------------|-------------------|-------------------|
| | | Extracted | Analyzed | | |
| Carbonaceous BOD | 2 | N/A | 2017/04/12 | SYD SOP 00186 | SM 22 5210B m |
| Colilert - Coliform (MPN) in water | 2 | N/A | 2017/04/08 | SYD SOP 00187 | SM 22 9223B m |
| Nitrogen Ammonia - water (1) | 2 | N/A | 2017/04/13 | ATL SOP 00015 | EPA 350.1 R2 m |
| pH (1, 2) | 2 | N/A | 2017/04/11 | ATL SOP 00003 | SM 22 4500-H+ B m |
| Nitrogen TKN - water (as N) (1) | 2 | 2017/04/12 | 2017/04/17 | ATL SOP 00019 | EPA 351.2 R2 m |
| Phosphorus Total Colourimetry (1) | 1 | 2017/04/07 | 2017/04/17 | ATL SOP 00057 | EPA 365.1 R2 m |
| Phosphorus Total Colourimetry (1) | 1 | 2017/04/18 | 2017/04/19 | ATL SOP 00057 | EPA 365.1 R2 m |
| Total Suspended Solids | 2 | N/A | 2017/04/07 | SYD SOP 00165 | SM 22 2540D m |

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Bedford

(2) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.

Your Project #: 172410.00
Site Location: JUDIQUÉ SAR
Your C.O.C. #: 605209

Attention:Wade Davidson

CBCL Limited
Sydney-Standing Offer
164 Charlotte St
Sydney, NS
B1P 6J7

Report Date: 2017/04/19
Report #: R4431328
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B769202
Received: 2017/04/07, 09:20

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Natalie MacAskill, Sr. Project Manager
Email: NMacAskill@maxxam.ca
Phone# (902)567-1255 Ext:17

=====
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RESULTS OF ANALYSES OF WATER

| | | | | | | |
|---|--------------|---------------------|-----------------|---------------------|------------|-----------------|
| Maxxam ID | | EEG709 | | EEG710 | | |
| Sampling Date | | 2017/04/06 12:30 | | 2017/04/06 12:00 | | |
| COC Number | | 605209 | | 605209 | | |
| | UNITS | BGJD1 | QC Batch | BGJD2 | RDL | QC Batch |
| Inorganics | | | | | | |
| Carbonaceous BOD | mg/L | 6.0 | 4931712 | ND | 5.0 | 4931712 |
| Nitrogen (Ammonia Nitrogen) | mg/L | ND | 4938543 | ND | 0.050 | 4938543 |
| pH | pH | 7.26 | 4934666 | 7.37 | N/A | 4934666 |
| Total Phosphorus | mg/L | 0.039 | 4943110 | 0.052 | 0.020 | 4936752 |
| Total Suspended Solids | mg/L | ND | 4931308 | 15 | 2.0 | 4931308 |
| Total Kjeldahl Nitrogen | mg/L | 0.97 | 4936506 | 0.49 | 0.10 | 4936506 |
| RDL = Reportable Detection Limit QC Batch = Quality Control Batch ND = Not detected N/A = Not Applicable | | | | | | |

MICROBIOLOGY COLILERT (WATER)

| | | | | | |
|---|--------------|---------------------|---------------------|------------|-----------------|
| Maxxam ID | | EEG709 | EEG710 | | |
| Sampling Date | | 2017/04/06 12:30 | 2017/04/06 12:00 | | |
| COC Number | | 605209 | 605209 | | |
| | UNITS | BGJD1 | BGJD2 | RDL | QC Batch |
| Microbiological | | | | | |
| Escherichia coli | MPN/100mL | ND | ND | 1.0 | 4931112 |
| Total Coliforms | MPN/100mL | 170 | 200 | 1.0 | 4931112 |
| RDL = Reportable Detection Limit QC Batch = Quality Control Batch ND = Not detected | | | | | |

GENERAL COMMENTS

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|-------------|------|-----------------|-----------------------------|---------------|------------------|----------|---------------|-----------|
| 4931112 | KKP | Method Blank | Escherichia coli | 2017/04/08 | ND, RDL=1.0 | | MPN/10 0mL | |
| | | | Total Coliforms | 2017/04/08 | ND, RDL=1.0 | | MPN/10 0mL | |
| 4931308 | LBC | Spiked Blank | Total Suspended Solids | 2017/04/07 | | 89 | % | 75 - 125 |
| 4931308 | LBC | Method Blank | Total Suspended Solids | 2017/04/07 | ND, RDL=2.0 | | mg/L | |
| 4931712 | KKP | QC Standard | Carbonaceous BOD | 2017/04/12 | | 74 | % | 70 - 130 |
| 4931712 | KKP | Spiked Blank | Carbonaceous BOD | 2017/04/12 | | 108 | % | 70 - 130 |
| 4931712 | KKP | Method Blank | Carbonaceous BOD | 2017/04/12 | ND, RDL=5.0 | | mg/L | |
| 4931712 | KKP | RPD [EEG709-02] | Carbonaceous BOD | 2017/04/12 | 18 | | % | 25 |
| 4934666 | JMV | QC Standard | pH | 2017/04/11 | | 100 | % | 97 - 103 |
| 4934666 | JMV | RPD | pH | 2017/04/11 | 1.6 | | % | N/A |
| 4936506 | MCN | Matrix Spike | Total Kjeldahl Nitrogen | 2017/04/17 | | 97 | % | 80 - 120 |
| 4936506 | MCN | Spiked Blank | Total Kjeldahl Nitrogen | 2017/04/17 | | 97 | % | 80 - 120 |
| 4936506 | MCN | Method Blank | Total Kjeldahl Nitrogen | 2017/04/17 | ND, RDL=0.10 | | mg/L | |
| 4936506 | MCN | RPD | Total Kjeldahl Nitrogen | 2017/04/17 | 3.8 | | % | 25 |
| 4936752 | MCN | Matrix Spike | Total Phosphorus | 2017/04/17 | | 102 | % | 80 - 120 |
| 4936752 | MCN | Spiked Blank | Total Phosphorus | 2017/04/17 | | 84 | % | 80 - 120 |
| 4936752 | MCN | Method Blank | Total Phosphorus | 2017/04/17 | ND, RDL=0.020 | | mg/L | |
| 4936752 | MCN | RPD | Total Phosphorus | 2017/04/17 | 3.3 | | % | 25 |
| 4938543 | NRG | Matrix Spike | Nitrogen (Ammonia Nitrogen) | 2017/04/12 | | 97 | % | 80 - 120 |
| 4938543 | NRG | Spiked Blank | Nitrogen (Ammonia Nitrogen) | 2017/04/13 | | 105 | % | 80 - 120 |
| 4938543 | NRG | Method Blank | Nitrogen (Ammonia Nitrogen) | 2017/04/13 | ND, RDL=0.050 | | mg/L | |
| 4938543 | NRG | RPD | Nitrogen (Ammonia Nitrogen) | 2017/04/12 | 0.70 | | % | 20 |
| 4943110 | MCN | Matrix Spike | Total Phosphorus | 2017/04/19 | | 117 | % | 80 - 120 |
| 4943110 | MCN | Spiked Blank | Total Phosphorus | 2017/04/19 | | 102 | % | N/A |
| 4943110 | MCN | Method Blank | Total Phosphorus | 2017/04/19 | ND, RDL=0.020 | | mg/L | |
| 4943110 | MCN | RPD | Total Phosphorus | 2017/04/19 | 1.3 | | % | 25 |

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



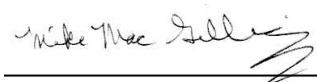
Eric Dearman, Scientific Specialist



Kevin MacDonald, Inorganics Supervisor



Michelle Mombourquette, Laboratory Manager



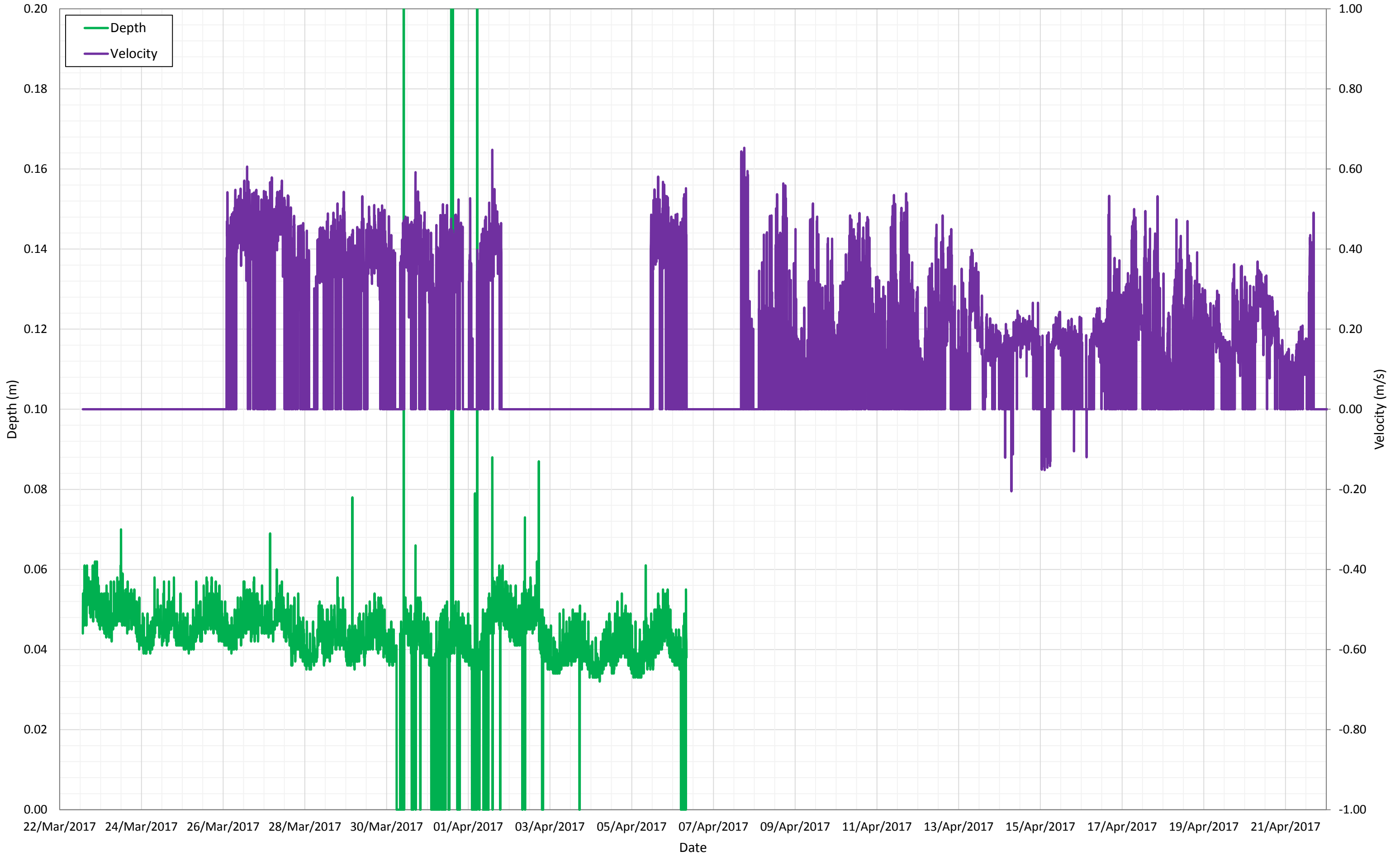
Mike MacGillivray, Scientific Specialist (Inorganics)

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

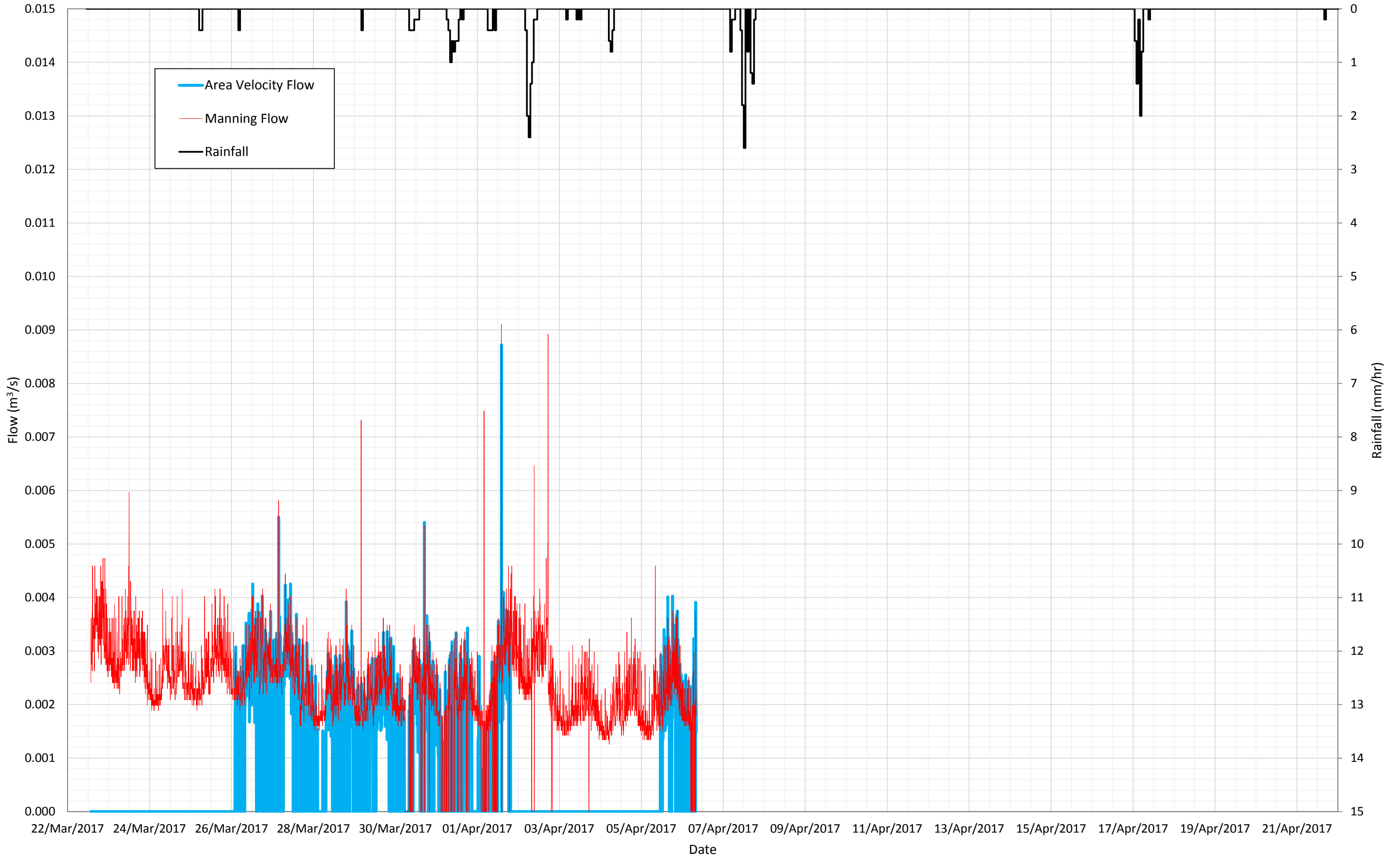
APPENDIX D

I&I Graphs

Judique - Depth and Velocity



Judique - Flow



Judique - I/I Quantification

