Moosonee Project Management Services

Town of Moosonee

Type of Document:
Request for Proposal for Project Management Services

RFP Number: 2023-12

The Corporation of the Town of Moosonee:
Box 727, 5 First Street
Moosonee, ON P0L 1Y0

Closing Date and Time:
2024-01-10; 2:00 PM

Proposal Number: 2023-12
Date: 29-11-23

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1. Introduction

The Corporation of the Town of Moosonee is one of two municipalities in the Far North of Ontario. The town is located on the Moose River 12 miles south of James Bay in the Hudson Bay Lowlands, the largest wetland area on earth. Moosonee is an important transportation hub and service centre for the James Bay coastal communities, including rail services, airport service and health care services.

The purpose of this RFP is to invite qualified firms to submit a proposal to provide Project Management services for major capital projects in the Town of Moosonee, with the objective that the Project Manager will represent the best interests of the Municipality on an ongoing basis. While the intention is to establish a long-term relationship with a Project Management service provider, the Town of Moosonee has an immediate need for Project Management assistance for a major capital project underway in the municipality involving the Weeneebayko Area Health Authority (WAHA) Redevelopment project.

WAHA Redevelopment Project

The WAHA redevelopment project includes the construction of a new 36 inpatient bed hospital, 32 bed Elder Care Lodge, visitor hostel, and staff accommodations in Moosonee. The construction of this project will have a major impact on the structure of the municipality including effects on physical infrastructure, socio-economic conditions as well as environmental impacts.

The WAHA redevelopment project is currently in the design phase, with construction tentatively scheduled for commencement in the Summer of 2024. Below are tentative milestone dates/duration for the WAHA redevelopment project:

- Site Plan Approval Submission: February 2024
- Building Permit Application: May 2024
- Site Plan Approval Target Date: July 2024
- Start of Construction: Summer 2024
- Construction Duration: 5.5 years

Related Infrastructure Projects

The servicing of the WAHA Redevelopment project will require the Town of Moosonee to embark on several projects to upgrade water and sanitary sewer services in the municipality. The Town has completed some preliminary work to determine necessary upgrades, and the list below provides a summary of upgrades and further investigations needed to meet the servicing needs of the WAHA facility**. The successful proponent for this RFP will assume full responsibility for the broad oversight and management of vendors supplying design, contract administration and related services for the projects and activities listed below.** The list is a work in progress, and additional scope may be required as the WAHA project progresses.

- Off Site Linear Infrastructure: Upgrades to water distribution system and sanitary sewer system (including related appurtenances) on Gardiner Road and Percy's Way. Estimated construction is $7.53M, excluding Contract Administration.
- Water Intake Upgrades – A recently completed study (see Appendix B) indicates that upgrades are needed to improve the Water treatment plant performance. The upgrades are to occur in two phases, with Phase I consisting of relocating the water intake, construction of a low lift pumping station, and treatment chemical modifications. Estimated construction cost is $1.42M. Phase II will include construction of a new aerated raw water reservoir, and a raw water pumping station. Estimated construction cost is $2.53M.

- Geotechnical Study – In conjunction with the Water Intake upgrades, a geotechnical investigation is required to assess soil conditions and provide foundation recommendations for the proposed raw water reservoir at the Water Treatment plant.
- Fire Protection Study – A study is required to assess the fire flow requirements of the new WAHA facility, and to determine the upgrades necessary to the municipal water system to meet the fire flow requirements of WAHA while continuing to meet necessary fire flow and fire storage requirements necessary for the remainder of the serviced area in the Town of Moosonee.
- Sanitary Sewer Study – A study is required to evaluate the sewage collection system, pumping stations and municipal treatment lagoon to assess the upgrades in capacity needed to safely accommodate the additional sewage flows generated by the new WAHA facility.

2. Scope

This scope of service generally includes the following components:

- Time/Schedule Management – Ensure that project activities that affect the Town of Moosonee are completed within agreed upon timeframes. Intervene when schedule is not being met and work collaboratively with stakeholders to develop strategies to return the project to the scheduled timeframe.

- Cost/Financial Management – Monitor project costs that are the responsibility of or that impact the Town of Moosonee and report on variances/cost overruns that will impact Moosonee's financial obligations on the project. Work with stakeholders to determine alternative materials/methods that will minimize cost overruns and the impact on the project budget.

- Quality Management – Ensure that all work performed by the Town of Moosonee and on behalf of the Town meets applicable specifications, regulations, standards, guidelines, and municipal quality requirements.

- Communication Management – In consultation with Town Council and staff, ensure that the Town of Moosonee formally communicates its position and requirements to all project stakeholders in an organized, cohesive, and clear manner on an ongoing basis.

- Scope Change Management – Identify, review and report on all potential changes in project scope that impact the Town of Moosonee, directly or indirectly, and work collaboratively with all stakeholders to ensure that any scope changes that impact Moosonee are optimized to minimize cost and schedule impacts that are of concern to Moosonee.
- Risk Management – Represent the Town of Moosonee's interests with respect to project risks and assist and assist in developing mitigation strategies for matters that have the potential to impact the Town of Moosonee.

- Stakeholder Management – Represent the Town of Moosonee's interests by attending meetings, preparing, and responding to correspondence and interacting with project stakeholders, including funding agencies, provincial and federal government industries, project end users, and ratepayers.

- Health and Safety (H&S) – Ensure that project activities are aligned with the Town of Moosonee's Health and Safety policy and monitor project activities to ensure that the Town's interests are protected with respect to Health and Safety at the jobsite.

- Gap Analysis – In consultation with project stakeholders, evaluate the project, identify gaps in service that the Town of Moosonee is responsible for addressing and facilitating activities to close identified service gaps.

2.1 Definitions

References to “the Town”, “Moosonee” or “Owner” in this document shall be interpreted to refer to **The Corporation of the Town of Moosonee.** References to “Engineer” or “Consultant” in this document shall be interpreted to refer to a **qualified engineering or consulting firm** that is responding to this Request for Proposal.

2.2 Questions

All **questions** regarding this Request for Proposal shall be forwarded **in writing by email**, no later than **5 business days** before closing to:

Trevor Keefe, Public Works Manager
Box 727, 5 First Street
Moosonee, ON P0L 1Y0
Email: trevorkeefe@Moosonee.ca

Responses to questions will be provided to all prospective consultants no later than three business days before closing.

3. Services & Qualifications

The Consultant is responsible for carrying out the activities listed below in support of the Town of Moosonee’s project activities. Tasks shall be carried out by the Project Manager or delegated to specialized support staff.

3.1 Time/Schedule Management

The Consultant shall monitor the overall project schedule, as well as any subsidiary schedules for related projects under the control of the Town of Moosonee. For aspects of the project that are under the direct control of the Town, the PM team shall identify areas where the project is falling behind schedule, propose alternative methods/materials or strategies to return the project to the original timeline, and shall report their findings to the Town of Moosonee. The team shall also identify and report on areas of concern in the future tasks of the schedule where an unrealistic timeline is proposed. On the overall project schedule, at Council’s direction, the PM team shall assist the overall project team to address any schedule items that may benefit from assistance the Town of Moosonee to improve completion dates.

3.2 Cost/Financial Management

The Consultant shall monitor the overall project budget, as well as manage budgets for subsidiary projects for related works that are under the control of the Town of Moosonee. The PM team shall report areas of concern to the Town of Moosonee on the overall project budget insofar as those items have an impact on Moosonee’s finances, and if directed by Council, assist the overall project team to address overruns. For subsidiary projects under Moosonee’s direct control, the PM team shall provide monthly project financial status reports to council, including identifying concerns for items that are or are expected to be over budget. The PM team shall collaborate with the contractor and other project stakeholders to develop alternate materials/methods or timing with a goal of minimizing cost overruns.

3.3 Quality Management

The PM team shall continuously monitor the quality of work being performed on the project. Project specifications shall be reviewed to ensure that materials and methods used comply with the requirements defined in the specifications. Areas of non-compliance shall be documented and reported to the Town of Moosonee, and an action plan to address the non-compliant items shall be implemented.

3.4 Communication Management

The PM team will play an important role in managing and organizing the communication on the project. The team will be responsible for managing all requests coming from the project stakeholders to the Town of Moosonee and ensuring that responses to all requests are addressed and documented by the responsible party in a timely fashion and in accordance with the Town of Moosonee wishes.

For subsidiary projects under the direct control of the Town, in addition to the above the PM team will be responsible for arranging, attending, and minuting all project meetings and distributing documents to the main project team.

The PM will be expected to provide regular (monthly) written reports to council, and to participate remotely (via Teams) in council meetings monthly.

3.5 Scope Change Management

The PM team will be responsible for creating and maintaining a project change register to document all potential changes in the work that would impact the Town of Moosonee either directly or indirectly. The Team is to participate in and follow up on the progress and decision-making activities relating to all potential changes and document the outcomes in the Change Register.

3.6 Risk Management

The PM team will be responsible for creating and maintaining a project Risk Register to document all potential risks in the work that would impact the Town of Moosonee either directly or indirectly. The Team is to participate in and follow up on the progress and decision-making activities relating to all Project Risks, assist in developing mitigation strategies, and document the outcomes in the Risk Register.

3.7 Stakeholder Management

In addition to the Communication task (Section 3.4) the PM team shall proactively engage with the project stakeholders to ensure that the commitments of the Town of Moosonee are being met, and that the stakeholders are receiving timely feedback and action from the Town, necessary to keep the project on track. The PM team will maintain an Action Item list for Town of Moosonee's obligations and follow up with the responsible parties to ensure all Action Items are adequately addressed.

3.8 Health and Safety

The PM team will monitor and participate in project Health and Safety activities that are the responsibility of the Town of Moosonee or that could impact the Town directly or indirectly. The team will review Health and Safety commitments by project stakeholders and assist in facilitating the completion of commitments that are in the best interest of the Town of Moosonee.

3.9 Gap Analysis

The PM team will review and analyze the project activities that are required for the Town of Moosonee and identify any service or infrastructure gaps that exist. The team will develop action plans and strategies to address identified service gaps and provide these options to the Town of Moosonee with recommendations on how to best implement the plans. The Team will consult with project stakeholders to solicit input from the stakeholder's perspective as to the gaps that exist and actions that the Town of Moosonee could take to address identified gaps.

3.10 Team Qualifications and Time Commitments

The Town of Moosonee is seeking a Consultant that can provide a strong project team, including a seasoned Project Manager ideally with experience in managing projects in the Far North. Additionally, several specialist support staff will be required to augment the services of the Project Manager. Details on the time requirements and the qualifications that the team should possess are provided below.

Consultants shall assume that the Project Manager will spend an average of 10-20 hours per week working on this assignment, and that the support team shall provide an aggregate of 10-20 hours per week (on average) working on this assignment. Note that Consultants have the option of having the Project Manager provide some of the services allocated to support staff, provided that the PM possesses the relevant skill set.

Project Manager

Moosonee is seeking a Project Manager that possesses the following attributes:

• A professional engineer, and/or PMP certified individual with a minimum of 10 years experience in managing multi-discipline complex infrastructure and/or development projects.

• PM experience on previous projects of similar scope and complexity as the proposed WAHA hospital project.

• Demonstrated experience managing projects in the Far North or remote communities. Previous experience with the Town of Moosonee shall be considered an asset.

- A proven track record of successfully delivering projects on time and on budget.
- Ability to lead a gap analysis review to determine service gaps that Moosonee must address and lead the team to address these gaps.
- Additional experience demonstrating skills in effective communication, consultation with stakeholders, consensus/team building, problem solving, leadership and conflict resolution.

The Town of Moosonee recognizes that the Project Manager will require support from specialists in several areas. Consultants shall provide support staff meeting the requirements laid out below as part of the project management team.

Support Staff

The skills required for support staff working on this assignment are outlined below:

- Time/Schedule Management – A senior scheduler with experience using Primavera P6, MS Project or other scheduling software with experience preparing and analyzing resource loaded project schedules.
- Cost/Financial Management – a cost analyst or economist with experience managing project budgets, change requests, payments and estimating of construction/development projects. This individual will also be responsible for leading the scope change portion of the project, creating, and managing a change register addressing all changes that impact Moosonee. Individuals with certified cost and/or estimating credentials are considered an asset.
- Quality Management – A quality auditor that can review specifications, regulations, standards, guidelines, and municipal quality requirements and identify and address instances of non-compliance with quality standards.
- Risk Management – A Risk Management analyst that can create and manage of a Risk Register for project issues that pose a risk for the Town of Moosonee, and who can develop mitigation strategies to minimize the impact of the risks.
- Health and Safety (H&S) – A Health and Safety specialist with experience in the OHSA and regulations thereunder that can analyze project activities and identify those that are of concern to the Town of Moosonee's Health and Safety policy. The specialist shall propose actions to mitigate the Health and Safety liability risks and ensure that the Town's interests are protected not only at the project site, but any activity within the municipality that is tied to the project.

As noted above, the PM may fill some of the roles allocated to support staff provided that the PM has the expertise in the relevant service area.

4. Proposal Terms and Conditions

The proposal instructions provided shall be strictly adhered to by the Consultants submitting in response to this RFP. The Town of Moosonee reserves the right to disqualify any proposal that does not comply with the proposal submission requirements provided herein.

4.1 Project Timelines

Below are the relevant dates governing the timelines for this project:

Issue RFP	November 29, 2023
Deadline for Questions concerning the RFP (5 bus. days before closing)	January 2, 2024
Response to RFP Questions (3 bus. Days before closing)	January 5, 2024
Proposal Submission Deadline 2:00pm Local Time	**January 10, 2024**
Notification to successful Consultant (no later than)	January 19, 2024

4.2 Communications

Consultants submitting a proposal in response to this RFP shall examine all instructions contained within this RFP and shall provide any questions and report any errors, omissions, or ambiguities to the Town of Moosonee in accordance with the instructions provided in Section 2.2 of this document. Informal questions, or communications directed at Town of Moosonee staff that are not in accordance with the requirements of Section 2.2 of this document will not be addressed. The Town of Moosonee is not obligated to provide additional information to Consultants, and any information provided is at the sole discretion of the Town.

The Town of Moosonee and its advisors make no representation or guarantee with respect to the accuracy of the information provided in the Request for Proposal document. Further, Consultant's shall undertake their own investigations and make their own determinations as to the additional information necessary to respond to this RFP. Consultants submitting a proposal in response to this RFP agree that the contents of the RFP shall form part of their proposal.

4.3 Proposal Content

Proposals submitted by Consultants in response to this RFP, shall at a minimum contain the following information:

- An overview of the Consultants organizational structure, practice area, and relevant experience.
- Provision of three examples of recent (within 5 years) relevant project experience with three client references (**including contact information)** provided.
- A description of the Consultants understanding of the project including a detailed methodology illustrating how the project objectives will be met.
- Details on the project team to be assigned to project including recent relevant project experience, experience working in the Town of Moosonee or other far north locations, and résumés. Note that the Consultant **shall not be permitted to substitute staff members on this project for those stated in their proposal submission without prior written approval of the Town of Moosonee.**
- A description of the Consultants quality control system including examples of methods to be applied to this project to ensure quality compliance.
- A statement confirming that the Consultant does not have a conflict of interest (as defined in this RFP) on this project.
- A statement confirming that the Consultant's submission complies with the Liability Insurance Requirement as outlined in this RFP.

The body of the proposal document submitted by the Consultants responding to this RFP shall not exceed 25 pages (single sided, minimum font size of 11), not including résumés, project sheets and corporate literature, all of which shall be presented as appendices to the body of the proposal.

4.4 Proposal Costing

Proposals shall include submission of the form found in **Appendix A** of this document. Consultants shall complete the table containing the **proposed hourly rates** for each team member, as well as the disbursements rates. Any additional support costs applicable that a consultant deems necessary shall be clearly identified and quantified in the submitted proposal.

The proposal submitted by the Consultant shall also contain a section on project fees, including a statement that shall identify any exclusions, additions, assumptions, and clarifications used in establishing the fees.

Labour Hours

Consultants shall assume that the Project Manager will spend an average of 10-20 hours per week working on this assignment, and that the support team shall provide an aggregate of 10-20 hours per week (on average) working on this assignment. The Project Manager will be required to be on site in Moosonee infrequently – on an as needed basis at the discretion of the Town of Moosonee.

Disbursements

It is anticipated that most of the Project Management work can be completed remotely, and that trips to site will be on an "as needed" basis only. In general, participation in Council meetings will be remote via Microsoft Teams.

For any necessary trips to site, Consultants shall assume the following when stating disbursement costs:

Flights – Round trip Flights from Timmins to Moosonee, or train fare from Cochrane to Moosonee will be reimbursed at cost when supported by receipts.

Consultants shall provide a lump sum "per trip" cost for travel time and expenses from their home office to Cochrane/Timmins, and a per diem rate for accommodation/meals and vehicles (if applicable) while on site.

Consultants shall provide a lump sum monthly cost for any additional disbursements they deem necessary to carry out the project.

4.5 Proposal Submissions

Three (3) hard copies and one digital copy (PDF format) of the proposal shall be submitted in a **sealed envelope** identifying the Consultant, and addressed as follows:

Trevor Keefe, Public Works Manager
Box 727, 5 First Street
Moosonee, ON P0L 1Y0
Email: trevorkeefe@Moosonee.ca

PROPOSAL SUBMISSION: MOOSONEE PROJECT MANAGEMENT SERVICES

Proposals must be received at the above noted address no later than 2:00 PM Local Time, on January 10, 2024. Bids received after this time will be returned unopened and faxed or emailed submissions will not be accepted. Valid proposals will be opened in Council Chambers.

4.6 Proposal Withdrawal or Amendment

Consultants may amend or withdraw their proposal, provided such withdrawal or amendment is received prior to the closing deadline. Amendments to the proposal must be submitted following the same terms and conditions as the main proposal and shall clearly identify the section(s) of the proposal that the amendment is replacing.

4.7 Period of Validity & Clarification

Proposals submitted in response to this RFP shall remain valid for a period of 60 days from the proposal submission deadline. The Town of Moosonee reserves the right to seek clarification of any aspect of proposals received in response to this RFP. Clarifications provided by Consultants shall be deemed to form part of the proposal submitted by the Consultant.

4.8 Award of Project to Successful Consultant & Notification to Unsuccessful Consultants

The Town of Moosonee will endeavour to select a consultant within 30 days of the Proposal Submission Deadline. Written notification will be provided to the successful consultant. The award of the project may be delayed or cancelled if the successful consultant's upset limit fee exceeds the Town's budget for the services.

The successful Consultant will be required to enter into an agreement for professional engineering services using the MEA/CEO standard Consultant/Client agreement. The agreement will include provisions requiring the consultant to not exceed the prescribed project scope or fees without the prior written consent of the Town. The agreement will also contain provisions requiring the consultant to comply with all applicable laws in Ontario and Canada in carrying out the project.

If the successful Consultant does not execute the Agreement or fails to comply with conditions of award within 15 business days of written notification of selection, the Town will have sole discretion to withdraw its offer to the successful Consultant, and the Town will incur no liability to the Consultant for taking such action.

When the signed Agreement is in place between the successful Consultant and the Town, written notification will be provided to the unsuccessful Consultants advising of the project award. Consultants submitting an RFP for this project agree that the selection of the successful consultant by the Town of Moosonee is final and binding, and at the sole discretion of the Town.

4.9 Restrictions on Communications

Consultants participating in this RFP, shall not initiate communication regarding this RFP with any member of Town of Moosonee staff (including elected officials), except for the contact identified in the RFP document. Consultants who violate this clause may be subject to disqualification at the sole discretion of the Town of Moosonee.

Consultants participating in this RFP, shall treat all information regarding the RFP provided by the Town as confidential, and shall not disclose such information to third parties, including the media unless approved in writing by the Town. Consultants shall return any project information provided by the Town to the Town of Moosonee if so requested.

4.10 Freedom of Information and Protection of Privacy

The Town of Moosonee may at any time, make public the names of all Consultants responding to this RFP.

Additional information may be released in accordance with the Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c.F.31, as amended. Any consultant proprietary or confidential information contained in the proposal should be clearly identified. The Town will maintain confidentiality on such information unless ordered to release the information by the Information and Privacy Commission or a court.

4.11 Rights of the Town of Moosonee

In addition to any other rights (expressed or implied) the Town of Moosonee reserves the following rights:

- Request clarification or supplementary information concerning a proposal from any Consultant.
- Confirm with the consultant, a third party or references (whether provided in the proposal or not) confirmation of any information provided by the Consultant in their proposal.
- Issue addenda which may substantially change the content of this RFP.
- Waive formalities and accept any proposal that substantially meets the intent of this RFP, and which complies with the Town Purchasing Policy.

- Negotiate different or additional terms with any consultant submitting a proposal in response to this RFP.
- Reject any or all proposals submitted in response to this RFP at its sole discretion.
- Select any consultant whose proposal is not the lowest cost to the Town.
- Disqualify any consultant whose actions or proposal violates terms and conditions stated within this RFP.

The Town of Moosonee will not be held responsible for Consultant or third-party costs, claims, direct or indirect damages caused by the Town exercising its rights reserved in this section or otherwise expressed or implied in this RFP.

5. Evaluation of Proposals

The Town of Moosonee will establish an Evaluation Committee to review and score all proposals submitted in response to this RFP.

For this assignment, proposals will be scored based on 80% qualifications, and 20% fee/disbursement rates. The maximum possible score is **100 points.** The scores for qualifications and fees are further detailed below:

Qualifications:

Criteria	Potential Points
Corporate Experience, including far north	15
Relevant Project Experience	20
Qualifications of Proposed Staff	20
References	10
Approach	15

Total Qualification Points: 80

Fees:

The evaluation committee shall review the costing component of all proposals and rank each proposal based on benefit to the municipality from a financial perspective. Each submission will be awarded a score (to a maximum of 20 points) based on the committee's discretion following a review of the costing component.

The review will consider hourly rates for the Project Manager and Support staff listed, as well as the disbursement costs for each submission.

6. Conflict of Interest

Consultant submitting an RFP for this project shall disclose any perceived or actual conflict of interest relating to this assignment to the Town prior to submission of the proposal and in such circumstances, shall obtain the approval of the Town to submit a proposal.

Conflict of Interest could include, but is not limited to, any situation or circumstance where:

- The consultant has access to confidential information from the Town that is not available to other consultants.
- The consultant has interacted with another person that has influence over the project to gain an advantage in the proposal evaluation process.
- The consultant has undertaken an act that could be perceived as compromising the integrity of the open and competitive RFP process, resulting in the consultant having an unfair advantage.

7. Insurance Requirements

The Consultant shall maintain and pay for Comprehensive General Liability Insurance with coverage limits of no less than **Five Million Dollars ($5,000,000.00)** inclusive per occurrence for bodily injury, death and damage to property including loss of use.

The policy shall include The Town of Moosonee as an additional insured for all work performed by or on behalf of the Consultant.

The Consultant shall carry standard automobile and non-owned automobile liability insurance, providing protection against all liability arising out of the use of owned or leased vehicles, used by the Consultant, its employees, or agents. The liability limits for owned and non-owned vehicles shall be a minimum of **Five Million Dollars ($5,000,000.00) per occurrence**.

The Consultant shall carry Professional Liability Insurance with coverage of at least **Five Million Dollars ($5,000,000) per claim**.

The Consultant shall be entirely responsible for the cost of any deductible that is required in any insurance claim.

All insurance policies referenced in this section shall be maintained in good standing throughout the duration of this project.

Appendix A

Consultants shall complete the tables below. If support roles will be provided by the PM, indicate this in the table below. Additional roles provided by the PM shall be considered as being at the same hourly rate as the PM and shall be drawn from the pool of hours allocated for support staff.

Labour:

Position	Hourly Rate ($/hr)
Project Manager	
Scheduler	
Budget Analyst	
Risk Analyst	
Quality Auditor	
Health & Safety Analyst	

Note: Anticipated hour commitment for the PM is (on average) 10 to 20 hours per week, and aggregate hours for support staff are estimated (on average) to be 10-20 hours per week.

Disbursements:

1. Lump sum "per trip" cost for travel time and expenses from home office to Cochrane/Timmins (for a round trip): _____$/per trip.
2. Daily rate for expenses* while on site: _____$/day.
3. Monthly** lump sum for all other expenses: _____$/month.

***Expenses include meals, accommodation, and vehicle rental (if applicable).**

**** Monthly lump sum only applicable during months when PM work is active and billing full hours.**

Consultant: _____

Authorized Signature: _____

Date: _____

APPENDIX B

Feasibility of increasing the WTP's throughput

Type of Document: Final report

Client: The Corporation of the Town of Moosonee
5 First Street, P.O. Box 727
Moosonee, ON P0L 1Y0

Job Number: NWL-21023706-00

Prepared By: Hui Wang, P.Eng.

Reviewed By: Brad Gilbert, Project Manager

EXP Services Inc.
310 Whitewood Ave. W.
New Liskeard, ON P0J1P0
Phone: +1.705.647.4311
Fax: +1.705.647.3111
www.exp.com

Date Submitted: February 14, 2023

Legal Notification

This report was prepared by EXP Services Inc. for Fotenn and Infrastructure Ontario with the Corporation of the Town of Moosonee. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

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1 Purpose

EXP Services Inc. (EXP) has been retained by Fotenn and Infrastructure Ontario with the Corporation of the Town of Moosonee to investigate the existing water treatment plant (WTP) in the Town of Moosonee in order to determine the capability of the WTP to meet the potable water requirements of the proposed WAHA Moosonee Hospital.

The scope of the mandate includes the review the treatment processes from the intake system to the discharge to the clear water reservoir.

2 Referenced Guidelines

The document referred to in preparing this report:

- MECP Design Guidelines for Drinking Water Systems 2008

3 Project Location

The existing WTP is located at 1 Airport Road in Town of Moosonee, ON. The WTP's water intake is located in the Moose River. A location plan of the WTP is shown in Figure 3-1 below.

Figure 3-1: Location of on of Existing WTP

4 Raw Water Source and Characteristics

4.1 General Description of Moose River

Moosonee generally has long cold winters and short warm summers. The Moose River freeze-up normally occurs in late October or early November. Spring break-up normally occurs in April. The mean daily minimum temperature in January is approximative is -27°C.

The Moose River is under tidal influences. According to the historical water level data registered at the Moosonee Station (Station 4810), the river has a semidiurnal tide cycle with two high and two low tides. Figure 4-1 shows the typical variation of the water level during ordinary days. The tidal elevation fluctuates between 0.5 m to 2.4 m.

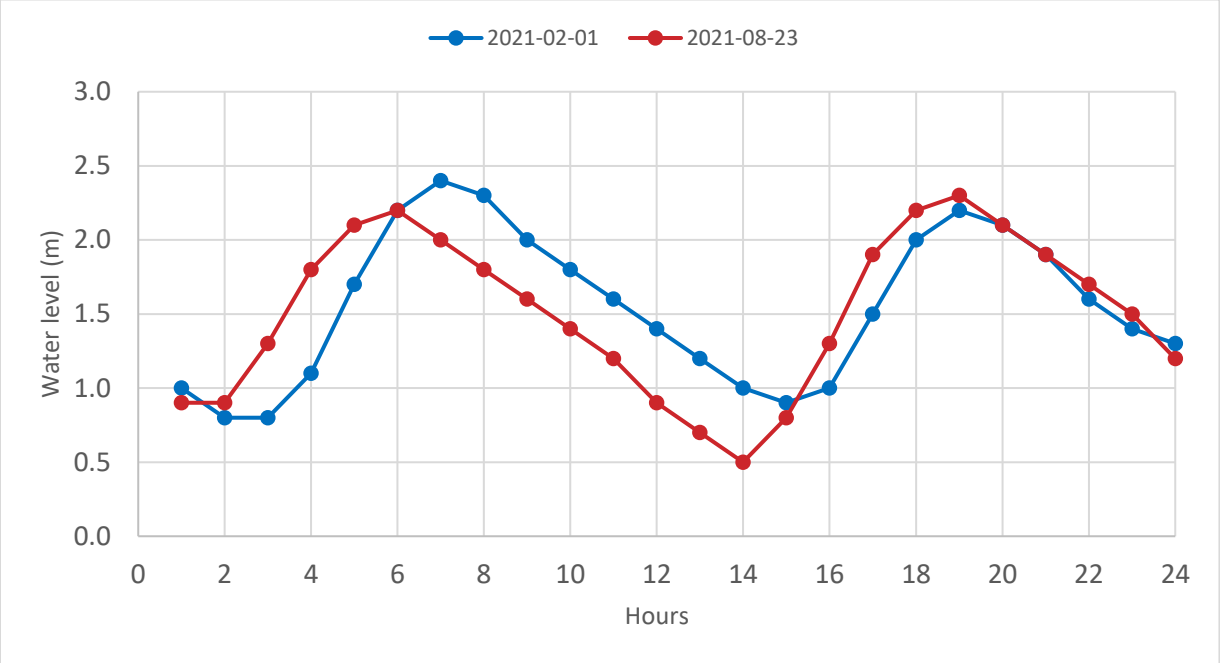

Figure 4-1: Moose River -Typical day water level variation

4.2 Raw Water Quality

E coli. in raw water is tested weekly. The E coli. statistics (min# - max #) are reported in the WTP's annual reports. The WTP did not report any issues with the disinfection performance. The assessment of the disinfection system is not included in the study.

Table 4-1 shows the statistics for years 2018 to 2020.

Year	Raw water E. Coli.
	Min - Max #/100 ml
2018	2 - 35
2019	2 - 25
2020	2 - 165

Table 4-1: Raw water E Coli. (2018 – 2020)

Grab samples of raw water are taken daily by the operator for turbidity and true color testing. Table 4-2 shows the statistics of raw water turbidity and true color.

Description	Turbidity (NTU)	True color (TCU)
Maximum	306	307
99th percentile	193	249
95th percentile	79.2	216
90th percentile	51.7	198.7
75th percentile	25.6	170
Avg	25.1	131.7

Table 4-2: Raw water turbidity and true color (2019 – 2021)

The histograms of raw water turbidity and color are shown in figures 4-2 and 4-3. The spring break-up of the Moose River brings about high turbidity in the raw water. During this period, the operator has to reduce the filtration flow in order to maintain the filtration process operation as well as the filtered water quality.

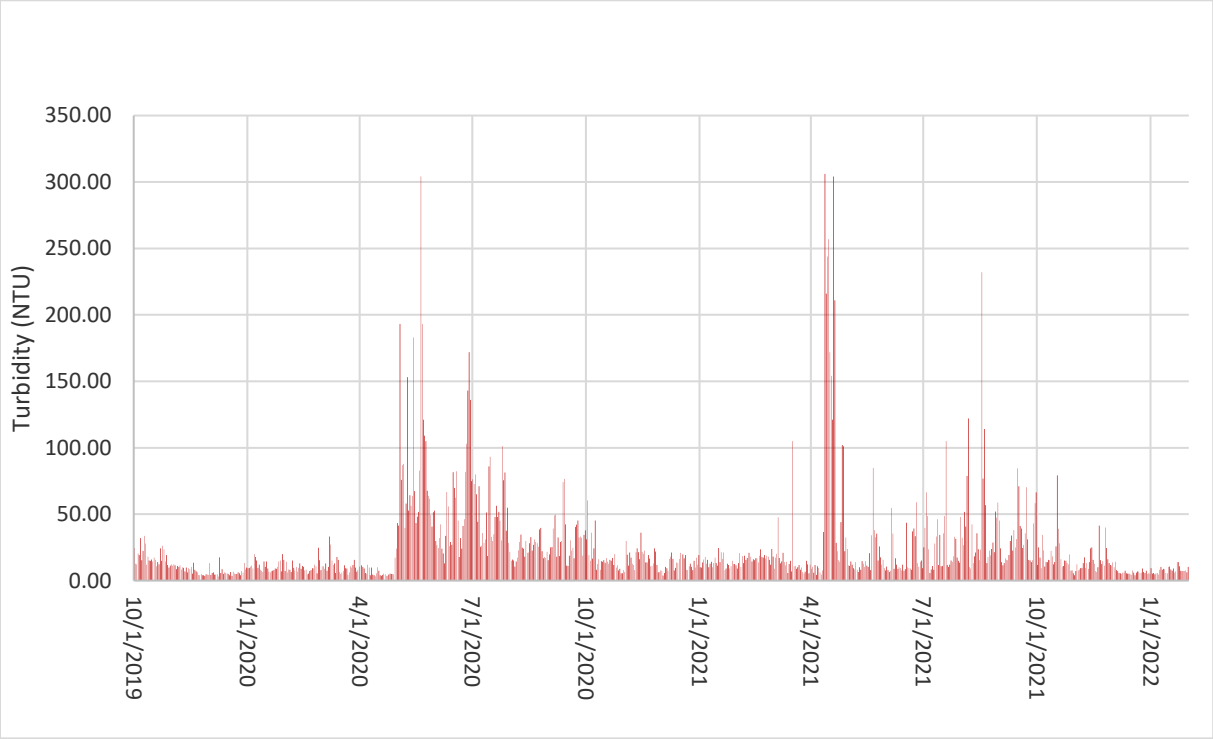

Figure 4-2: Moosonee WTP – Raw water turbidity (2019-2021)

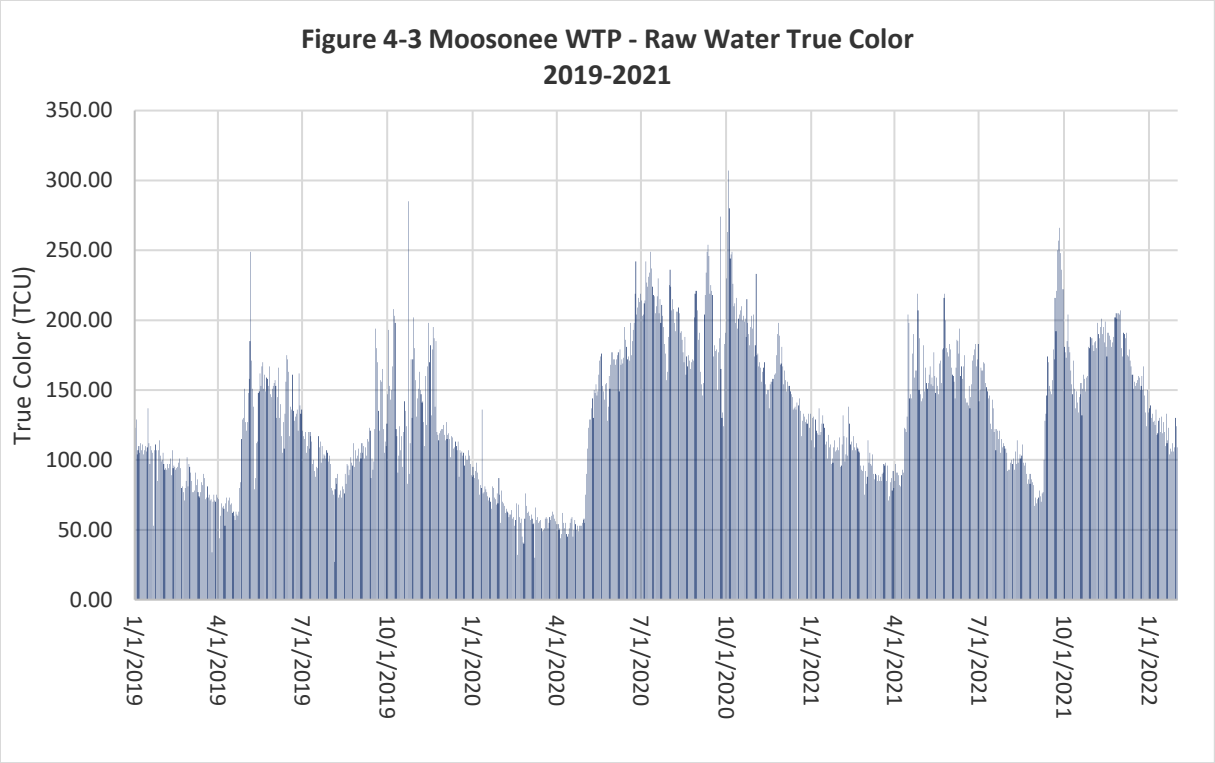

Figure 4-3: Moosonee WTP – Raw water true color (2019-2021)

For the study, raw water samples were collected in June and in November 2022. The samples were analysed as per recommendations of Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines. Results of raw water analysis in 2003 are also provided by the town. The analysis reports are provided in Appendix A.

We observe that the raw water quality remains similar year to year. The analysis results were compared to the Ontario drinking water standards, objectives and guidelines. Four parameters were found exceeding the Aesthetic Objective (AO): Iron, Dissolved Organic Carbon, True Color and Turbidity. Two parameters were found exceeding the Operational Guidelines (OG): Aluminum and Total Organic Nitrogen.

- Iron

Iron in surface waters may be the result of anaerobic decay in sediments and complex formations. The aesthetic objective for iron, set by appearance effects, in drinking water is 0.3 mg/L. Excessive levels of iron in drinking water supplies may impart a brownish colour to laundered goods, plumbing fixtures and the water itself; it may produce a bitter, astringent taste in water and beverages; and the precipitation of iron can also promote the growth of iron bacteria in water mains and service pipes.

Iron can be removed by air oxidation followed by sedimentation. On exposure to oxygen, divalent or ferrous iron is rapidly oxidized to the effectively insoluble trivalent or ferric state. In favourable circumstances the ferric iron may precipitate as a readily separating brown solid without additional complex treatment.

Dissolved Organic Carbon

High DOC is an indicator of possible water quality deterioration during storage and distribution due to the carbon being a growth nutrient for biofilm dwelling bacteria. High DOC is also an indicator of potential chlorination by-product problems, such as trihalomethanes (THMs). The four most commonly detected THM's in drinking water are chloroform, bromodichloromethane, chlorodibromomethane and bromoform. Primarily, THM's in drinking water are produced by the reaction of chlorine and the naturally occurring organics (precursors) left in the water after filtration.

DOC can be reduced by coagulation.

- Colour

Water can have a faint yellow/brown colour which is often caused by organic materials created by the decay of vegetation. Colour may also occur due to iron and manganese compounds produced by processes occurring in natural sediments.

- Turbidity

The aesthetic objective (AO) for turbidity is 5.0 NTU. Turbidity in excess of 5.0 NTU becomes visible to the naked eye and as such a majority of consumers may object to its presence.

Furthermore, Turbidity is an important indicator of treatment efficiency and the efficiency of filters. A significant relationship has been demonstrated between turbidity increases and the number of Giardia cysts and Cryptosporidium oocysts breaking through filters. Operational Guidelines (OG) for turbidity as an indicator of the efficiency of filters in relation to credits for Giardia cysts and Cryptosporidium oocysts removal have been provided in the "Procedure for Disinfection of Drinking Water in Ontario".

- Aluminum

Aluminum in untreated water is present in the form of very fine particles of alumino-silicate clay. These clay particles are effectively removed in coagulation/filtration.

Aluminum found in coagulant treated water is due to the presence of aluminum left over from use of the coagulant. Optimization of treatment should be applied to reduce this "residual" aluminum to under the operational guideline of 0.1 mg/L.

High residual aluminum can cause coating of the pipes in the distribution system resulting in increased energy requirements for pumping, interferences with certain industrial processes and flocculation in the distribution system.

Medical studies have not provided clear evidence that residual aluminum has any effect on health.

- Organic Nitrogen

High levels of organic nitrogen may be caused by septic tank or sewage effluent contamination. Organic nitrogen compounds frequently contain amine groups which can react with chlorine and severely reduce its disinfectant power. Certain chlorinated organic nitrogen compounds may be responsible for flavour problems that are associated with chlorophenol.

Organic nitrogen at levels above 0.15 mg/L would be typically associated with DOC contribution of 0.6 mg/L. Taste and odour problems are common with organic nitrogen levels greater than 0.15 mg/L.

Treatability studies have been conducted previously, one by XCG in 2003, another by Veolia in 2018. The Veolia study concluded that actual coagulant and polymer selection and dosages are adequate for reaching good clarified water quality with high organics removal and good filterability. In fact, all measured THM concentrations of distributed water have been below the ODWQS standard (100 μg/L) since 2014, although raw water has high organic content.

Since the raw water quality remains similar over the years, we conclude that the existing treatment process is adequate for the application in Moosonee WTP.

High raw water turbidity has not been observed by the laboratory analysis, but had been observed at the WTP, normally during the spring thaw period. This issue will be addressed in this study. As good practice, we recommend continuous follow-ups and optimization of the operating parameters. for example, adjusting the coagulant and polymer doses seasonally depending on the raw quality (turbidity, etc.).

5 Actual Water Demand

5.1 Actual Water Demand

Based on the historical water distribution flow data of the past three years (2019 to 2021), the actual drinking water demand is estimated to be,

- Average day demand: 612 m³/d
- Maximum day demand: 877 m³/d

The maximum day demand corresponds to the 99% percentile of the observed distributed flow rates. The extreme values of the observed flow data were excluded for the estimation as they resulted from abnormal conditions (water main breaks, or fire events, etc.)

The average raw water flow for the past three years (2019 to 2021) is 656 m³/d. The difference between the average raw water flow and the average distributed water flow is considered to be the wastewater flow generated from the treatment process (clarifier sludge and filter backwash wastewater). The average process wastewater volume is therefore estimated to be 44 m³/d, or 6.7% of the average raw water volume.

5.2 Water Demand of the Proposed Hospital

Water demands of the proposed WAHA Moosonee Hospital have been established by a previous study (Percy's Way Hospital Development, Town of Moosonee – Functional Servicing Report, Stantec, July 14, 2021).

- Average day demand:341 m³/d (3.94 L/s)
- Maximum day demand: 688 m³/d (7.96 L/s)

5.3 Total design flows

The design flows retained for the study are summarized in table 5-1. The wastewater volume from the treatment process is assumed to be 10% of the average raw water volume.

Parameter	Drinking water demand			Raw water Flow	Process wastewater	
	Actual	Hospital	Total			
	(m³/d)	(m³/d)	(m³/d)	(m³/d)	(%)	(m³/d)
Average Day Flow	612	341	953	1059	10%	106
Maximum Day Flow	877	688	1565	1671	6.3%	106

Table 5-1: Design Flows

6 Assessment of Treatment Process

6.1 Original design capacity of the WTP

The Moosonee WTP is operated under the Permit to Take Water PPTW 5052-BKFN8P. The permitted maximum volume of raw water taken is 3000 m³/d. The WTP's treatment process consists of two (2) parallel packaged filtration trains. Each train has a design capacity of 1500 m³/d.

The WTP has never been officially commissioned. The filtration trains have never been operated or tested at the design capacity. Since its installation in 2012, the WTP has been constantly operating at below 1/3 of its rated capacity (< 1000 m³/d).

The assessment of the treatment process is based on the design flows presented in section 5.3.

6.2 Water Intake

6.2.1 Description of the water Intake

The water intake was originally designed for 3000 m³/d. The intake consists of three tubular screens in stainless steel connected to a common header of 400 mm diameter.

The characteristics of the water intake are described below.

Number of screens:	3
Dimensions of screen:	300 mm dia. x 500 mm long.
Screen openings:	2.5 mm space + 2 mm bar width *Estimated from images
% Net opening:	+/- 48% (estimated)
Total screen opening area:	0.7 m²
Water level El.- Max.:	2.4 m
Water level El.- Min.:	0.5 m
Intake pipe invert El.:	- 4.0 m
Submergence @ min WL:	4.5 m
Riverbed to screen distance:	Design: +/- 0.9 m (Actual: +/- 0.5 m)

The raw water intake pipe is a 400 mm diameter Schedule 80 steel pipe. The intake pipe header is equipped with a 75 mm flushing port. Flushing water is supplied by the WTP's distribution pumps via a HDPE DR-11 pipe of 100 mm diameter.

There's no chemical addition to the intake for mussel control.

Photos of the water intake are provided in Appendix B.

6.2.2 Assessment of the existing water Intake

The original design of the intake is in accordance with general design guidelines and recommendation, in particular:

- Entry velocity is less than 75 mm/s at design flow
- Submergence at minimum water level is greater than 3.0 m

The original design provided 900 mm clearance above the river bottom. In an inspection carried out in 2015, it was observed that the clearance is only about 500 mm.

It's been observed that sand is drawn through the intake and carried over to the treatment process. It also appears that the intake site might have been damaged by a large tree trunk, causing accumulation of sand around the intake structure.

In the past, a backup intake has been used to temporarily replace the permanent intake. According to the plant operating staff, when the temporary intake was used "it has been the best period for the WTP's operation, with no problem of sand in the process."

The presence of sand has caused several problems, including loss of raw water pumping capacity, as well as mechanical failures of the pumps and the flocculation mixers.

6.2.3 Recommended modifications of the water Intake

We recommend extending the intake pipe by approximative 25 m and relocating the water intake structure. At the new location, the river bottom elevation is -5.6 m, that is 1.6 m deeper than the present intake site.

We recommend installing the intake screen at elevation -3.8 m or about 1.8 m above the river bottom.

The existing intake structure is in good condition and can be reused. The screen elements should be supported by a SS 304 structure. The proposed intake relocation is shown in Appendix E.

6.3 Raw water pumping station and forcemain

6.3.1 Description of existing raw water pumping station

The raw water pumping station consists of three submersible pumps installed in separate and inter-connected standpipes (pump pits). The common forcemain is a HDPE DR-11 pipe of 200 mm diameter.

The characteristics of the raw water pumping station are described below.

Number of pumps:	3 identical pumps
Pump model:	Grundfos 300S150-3
Capacity of each pump:	19.1 L/s @ 32 m TDH, 11.2 kW
Pumps C/L EL.:	n/a
Min. WL in pump pits @ design flow:	0.365 m
Max. WL in pump pits @ design flow:	2.265 m

6.3.2 Assessment of raw water pumping system

The operators have noted the following operational problems of the raw water pumping system:

- Accumulation of sand in the pump pits.
- Excessive pressure drops at raw water pipe entrance to the building (upstream of the in-line mixer) as the flow increases (to approximately 1000 m^3/d)
- Loss of pumping capacity. The operator has observed that a single low lift pump can only pump 13 L/s of flow, With the two pumps in operation, the total pumping flow is 17 L/s. which is far below the design capacity of 34.7 L/s (3000 m^3/d).

After a verification of the raw water pumping system's hydraulics, we conclude that there are abnormal hydraulic restrictions in the pumping/piping system. The probable causes may include localized clogging in pipe, or partially open valves.

The accumulation of sand had caused mechanical damage to the pumps. In fact, during a visit of Exp's engineer in May 2022, Raw Water Pump no. 1 was taken out of service because of mechanical problems.

The design of the existing raw water pumping system does easily permit the removal of sand from the pump pits.

Furthermore, the WTP has been experiencing a recurring problem of water quality deterioration during the spring thaw period. High turbidity in the order of 100 NTU to 300 NTU had been observed during this period.

6.3.3 Recommended modifications of raw water feed system

In order to correct the problems described earlier, we propose the following modifications to the raw water pumping system:

- A new low lift pumping station with 1 duty/1 backup raw water pumps and a concrete wet well;
- A new raw water reservoir;
- A new aeration system for oxidation of iron;
- A new raw water pumping station with 1 duty/1 backup low-lift pumps.
- During the construction, the raw water forcemain should be cleaned to flush out sediment in the pipe.

6.3.3.1 Raw water reservoir

The reservoir serves multiple purposes :

- It serves as a reserve of raw water supply during periods where raw water quality deteriorates. For example, during the Moose River spring break-up (high turbidity), the water intake may be shut off or have a reduced flow.
- Solids will settle in the reservoir and be removed periodically.

We propose to construct a concrete raw water reservoir of 2500 m³. The reservoir will provide a reserve of +/- 2 days under normal condition. We recommend also dividing the reservoir in 2 cells, so one can be taken out of service for cleaning maintenance when needed. The preliminary recommended dimensions of the reservoir are,

Number of cells:	2
Length of cell:	24 m
Width of cell:	12 m
Bottom elevation:	0.0 m
Normal water depth:	4.4 m

The preliminary layout of the raw water reservoir is shown in Appendix E.

6.3.3.2 Aeration system

We recommend installing an aeration system to oxidize soluble iron to particle form, which will then be removed in subsequent treatment units. The aeration system includes an aeration tank, an air blower and air diffusers.

The aeration tank will have a volume of 56 m³ to provide a hydraulic retention time of 27 minutes under average design flow. A normally closed sluice gate will be installed on the common wall between the aeration tank and the low-lift pumps wet well. This gate is used to flushing the raw water intake.

The aeration system will be designed to provide at lease 0.5 g O2/g Fe2+. The aeration system includes an air blower of 3 kW (Aerzen model GM 3S/50 DN), and coarse bubble air diffusers.

The air blower and electrical panels will be installed in a new building.

The preliminary layout of the aeration tank is shown in Appendix E.

6.3.3.3 Low-lift pumping station

The low-lift pumping station will pump water from the Moose River to the aeration tank. The proposed wet well measures 5 m by 3 m. The wet well bottom is at elevation – 4.0 m to connect to the existing incoming 400 mm diameter raw water pipe. We recommend installing 2 vertical turbine pumps (One duty + one standby), with the following characteristics:

- Pump capacity: 21 L/s at 6 m TDH
- Motor : 5 hp, 575 v/ 60 Hz / 3 ph, with VFD drive
- Wet well depth (floor to bottom) : 7.5 m

The low lift pumping station should be equipped with a level indicator-transmitter and floats. We also recommend installing a turbidity meter at the low-lift pumping station to continuously measure the turbidity of the river.

The design criteria for pump selection should be reviewed and revised as needed in the design phase. For example, should the raw water reservoir and pumping station be constructed in two phases (as described in section 7), a higher pump head will be needed so that the pumps can feed directly to the filtration process in phase 1. The existing raw water pumping station will be decommissioned and removed after the installation of the new pumping stations.

The preliminary layout of the low-lift pumping station is shown in Appendix E.

6.3.3.4 Raw water pumping station

The filtration trains will be fed by the new raw water pumps installed in the raw water reservoir. The preliminary layout of the raw water pumping station is shown in appendix E.

We recommend installing 2 vertical turbine pumps (One duty + one standby), with the following characteristics:

- Pump capacity: 21 L/s at 16 m TDH
- Motor : 7.5 hp, 575 v/ 60 Hz / 3 ph, with VFD drive
- Wet well depth (floor to bottom) : 6.2 m

The raw water pumping station should be equipped with a level indicator-transmitter and floats. We also recommend installing a turbidity meter at the pumping station to continuously measure the turbidity of the raw water.

6.4 Coagulation and Flush mixing equipment

6.4.1 Description of the existing coagulation system

The coagulant used at the WTP is Kemira SternPAC. The point of application is on the 200 mm diameter raw water pipe at the entrance of the building. The dosage is about 11 to 14 mg/L (Dry aluminum). The coagulant and its dosage have been optimised by a bench testing study done by Veolia Water Technologies Canada inc. in 2018. The study concluded that the coagulant and dosage used in the WTP are adequate for reaching good, clarified water quality with high organics removal and good filterability.

Rapid mixing of coagulant is provided by an in-line mixer installed on the raw water pipe. The mixer is of 200 mm diameter, with 3 mixing elements. According to the operator, the mixer has a head loss of 3 – 4 psi at 700 m^3/d.

6.4.2 Assessment of flush mixing equipment

The static mixer is effective only where the flow is constant and close to the design flow. The WTP is running at only about 20% to 25% of its design capacity. The existing in-line mixer does not provide effective mixing for the actual and future flows.

6.4.3 Recommended modifications

We recommend installing a power assisted in-line mixer. A quote for an InstoMix mixer by Walker Process Equipment is provided in Appendix F. The mixer should be designed to provide a mixing intensity of G = 1000 sec^{-1} for flow between 600 m^3/d to 1850 m^3/d.

During the site visit by Exp's engineer, it was noticed that the dosing pumps run occasionally at very low frequency (several seconds per stroke). In order to ensure the mixing homogeneity, we recommend readjusting the pump settings with more frequent strokes and shorter stroke length.

6.5 Polymer preparation and dosing system

6.5.1 Description of the existing polymer system

The polymer used in the WTP is Magnafloc LT20 (Non-ionic Polyelectrolyte powder). The actual polymer dosage is about 0.12 mg/L. The polymer dosage has been optimised by a bench testing study done by Veolia Water Technologies Canada inc. in 2018. The study concluded that the proposed polymer dosage can produce good, clarified water quality with high organics removal and good filterability.

The polymer preparation system consists of a 3000 L tank with a mixer of ¾ HP, 115 volt. There is no day tank. The polymer dosing pumps are fed directly from the solution tank.

6.5.2 Assessment of polymer preparation equipment

The polymer solution is prepared with 250 gallons (950 L) of cold water and 2 kg of polymer powder. At the actual average flow, the polymer consumption is about 38 L (0.21% solution). In theory, each batch of polymer solution may last 25 days. It is generally recommended to limit the polymer storage time to 24 hours, or the polymer solution will loss efficiency. We conclude that the polymer preparation equipment is oversized.

6.5.3 Recommended modifications

We recommend replacing the existing polymer preparation system with a smaller system. The proposed new polymer preparation system should consist of the following equipment,

- One preparation tank in HDPE, 200L, with a mechanical mixer.
- One Application tank in HDPE, 200L.
- Cold and hot water supply pipe to the preparation tank, with a mixing valve.
- Prepare polymer solution daily.

The Polymer solution should be prepared daily where possible. The two tanks should be installed so that the polymer solution in the preparation tank can flow by gravity to the application tank.

6.6 BCA Package filtration train

The WTP has two parallel packaged filtration plants. Each train consists of three flocculation tanks, a gravity settler with inclined tubes, and a dual media filter with sand and anthracite.

A description of the clarifier is provided in the Instruction Manual – BCA Model ST-X-550-2 packaged water treatment plant. Design documents and shop drawings of the packages plant are not available.

Each filtration train was originally designed for a capacity of 1500 m^3/d. The WTP has never been officially commissioned. The filtrations trains have never been operated or tested at the design capacity. Since the installation, the WTP has been constantly operating at below 1/3 of its rated capacity (< 1000 m^3/d).

The capacity of the treatment process should meet maximum day demand. The filtration trains are assessed under the following flow/operating conditions:

- Condition Q1: Maximum day flow (1671 m³/d), with two (2) filtration trains in operation.
- Condition Q2: Average day flow (1059 m³/d), with one (1) filtration train in operation.
- Condition Q3: Average day flow (1059 m³/d), with two (2) filtration trains in operation

6.6.1 Filtration train inlet

The two globe style control valves at the entrance of the filtration trains are configured for flow balancing and measurement. These valves are oversized for actual and future flows. They need to be closed to near cut-off position in order to obtain accurate flow control and measurement. This may cause floc break-up and undermine the coagulation efficiency. We propose modifying the control program so that,

- Replace the two globe style control valves by pinch valves. Only minor valve position adjustment should be made to balance the flow between the two filtration trains.
- Install two (2) magnetic flowmeters on the raw water pipe, one for each inlet pipe.

6.6.2 Flocculation

Each BCA train has three sequential flocculation tanks. Each tank has an effective volume of about 10.9 m³. Tanks no. 1 and no. 2 are each equipped with a ½ HP variable speed mixer. The maximum mixer speed is 8.75 RPM for the first tank, and 6 RPM for the tank. The mixers speed may be reduced to 25% of its maximum value. The third tank is a single stage hydraulic flocculator.

The two design parameters concerning the flocculator are hydraulic retention time (HRT) and mixing energy (G value). The Design guidelines for drinking water systems recommends:

- When sedimentation is included, detention times of 25 to 30 minutes are usually sufficient in summer.
- When water temperatures are <5°C (<41°F), floc formation is slower and longer detention times of 30 to 40 minutes or longer may be needed.
- G values of 10 to 70 1/sec are needed for successful flocculation. Optimum G and Gt (incorporating the time that the mixing intensity is applied) values are best determined by pilot studies.

The flocculation parameters under various design conditions are summarized in table 6-1.

Description	Unit	Condition Q1	Condition Q2	Condition Q3	Original design
Design flow	m³/d	1671	1059	1059	3000
Number of trains in operation	units	2	1	2	2
Design flow per train	m³/d	836	1059	530	1500
Flocculator stage 1					
- HRT	min	18.7	14.8	29.5	10.4
- G value (@ 25% of 1/2 HP)	1/sec	92.5	92.5	92.5	92.5
Flocculator stage 2					
- HRT	min	18.7	14.8	29.5	10.4
- G value (@ 25% of 1/2 HP)	1/sec	92.5	92.5	92.5	92.5
Flocculator stage 3					
- HRT	min	18.7	14.8	29.5	10.4
- G value	1/sec	-	-	-	-
Total HRT	**min**	**56.1**	**44.3**	**88.5**	**31.2**

Table 6-1: Verification of flocculation

The verification shows that the mixing energy (G value) in the mechanical flocculators is higher than the recommended typical values even at the minimum mixer rotation speed. This may have contributed to the problem of poor settling in the clarifier, since high mixing energy may cause flocs break-ups.

The flocculation tanks have sufficient volume to meet the recommended HRT under various flow conditions.

The problem of accumulation of sand in the flocculation tanks has been observed during operation. The accumulation of sand had causes mechanical problems for the mixers. During the site visit by EXP's engineer, the first stage flocculation mixers of both filtration trains were broken due to the accumulation of sand around the bottom bearing of the mixers. In fact, the operator must clean the flocculators regularly to fix the problem.

Based on the assessment, we recommend the following modifications to the flocculation units:

- Replace the existing mixers. The new mixers should allow lower mixing G-values to the recommended value of 20 to 70 1/sec. A preliminary selection of the mixer is provided in Appendix F;
- Provide separate polymer application points at different heights in the first flocculation tank, with a delay period of 3 to 5 minutes. The last application point should be near the entrance of the stage 2 flocculator, to be used under condition Q2 (average day flow with 2 filtration trains in operation).

6.6.3 Clarifiers

The settling clarifier is an up-flow solids contact unit complete with 60° settling tubes. The flow enters the bottom of the clarifier through a full-length distribution manifold, then passes upward to the effluent collection launder. Heavier particles settle to the bottom the tank. Lighter particles are retained in the inclined tubes, where fine flocs coalesce into larger flocs and settle to the bottom of the tank. Clarified water is collected near water surface by two full-length submerged collection launders.

The 60° inclined tube settler modules are self-cleaning during normal operation. Retained sediment continuously slides down to the bottom of the tank. Self-cleaning is enhanced during the automatic desludge cycle when the water level in the clarifier is slightly dropped. The desludge operation is controlled by the plant PLC. The actual desludge operation is programmed for about 30 seconds every hour of operation, as recommended in the BCA's instruction manual.

A sludge blanket is maintained in the lower portion of the clarifier. Its position can be monitored through four sampling ports with isolation valves.

The lower portion of the tank has a sloped hopper floor to encourage sludge collection and thickening. Settled sludge is periodically removed by static head through a full length, perforated, inverted V-shape collector located at the foot of the hopper.

The clarifier tank measures approximatively 9.14 m x 3.66 m. Thank height is about 3.85 m. The tube settler module covers 100% of the clarifier's surface area. At the original design flow of 1500 m³/per train, the clarifier provides 90 minutes of detention time and an average surface loading of 1.87 m/h.

Table 6-2 shows the surface overflow rate (SOR) at various flow conditions. The SORs are well below recommended design values.

Description	Unit	Condition Q1	Condition Q2	Condition Q3	Original design
Design flow	m³/d	1671	1059	1059	3000
Number of trains in operation	units	2	1	2	2
Design flow per train	m³/d	836	1059	530	1500
Surface overflow rate (SOR)	m/h	1.04	1.32	0.66	1.87
Design guidelines for SOR		2.5 to 5.0 m/h for tube settlers 1.6 to 6.0 m/h for solides contact upflow clarifiers			

Table 6-2: Verification of clarifiers

The BCA packaged filtration plant instruction manual recommends a monthly (or more frequent) maintenance cleaning of the clarifier. During the maintenance cleaning, the water level should be dropped to below the bottom surface of the tubes. The tubes should be washed down with a hose. The maintenance cleaning has not been practiced as recommended.

During the visit of the plant, we've noticed that the clarified water collection launders are not completely submerged. The water level in the clarifier is set to be at the level of the collection holes. As shown in photo 7 (Appendix B), the submergence depth is not equal for all collection holes. This operating condition may cause a preferential flow pattern in the clarifier. We recommend increasing the water level so that the effluent collection launders are completely submerged.

The clarifier automatic desludge operation is programmed for 30 seconds every hour (according to the plant's operation data). The difference between the average raw water flow and the average distribution flow for the past three years (2019 to 2021) is about 44 m^3/d. The difference represents the average volume of wastewater generated from the process (clarifier desludge and filter backwash). In actual operation, the filter is backwashed once every three weeks. Each backwash operation uses about 24.3 m^3 of water. On an annual basis, the filter backwashes use an average of 1.2 m^3/d. The average desludge blowdown volume is therefore estimated to be 42.8 m^3/d, or 1.8 m^2 per desludge operation.

The clarifiers have been experiencing problems resulting in poor settling performance. Flocs are carried over to the filters, causing clogging of the filters. During a visit to the WTP in June 2022, the EXP engineer conducted a stress test on the filtration process. A detailed description of the test is provided in Appendix D. The test results confirmed the problem of flocs carry-over. Due to this problem, the filtration train capacity is limited to about 12 L/s (1037 m^3/s).

Based on the assessment and the test, we conclude that the settling step is a bottleneck limiting the treatment capacity. The probable causes to the poor settling performance include:

- Coagulation and flocculation are not optimized (See sections 6.4, 6.5 and 6.6.1);
- Problems in the sludge collection components, such as clogging of the orifices, Sludge may have piled up and become compacted in zones due to uneven collection.

In order to improve the clarification performance, we recommend the following corrective/operational measures:

- Empty the clarifiers . Inspect and thoroughly clean all sludge collection and extracting elements.
- Increase operation water level in the clarifiers so that the collection launders are completely submerged.
- Practice maintenance cleaning of the clarifier as recommended in the BCA's instruction manual.
- Regularly verify the sludge blanket level in the clarifier as recommended in the BCA's instruction manual. When sampling, make sure that the sampling port is not jammed by flocs.

We also propose to install an air-scouring pipe on clarifiers' desludge pipe as shown in Figure 6-1. This modification allows use of the existing blower to air-scour the sludge collection components, and to even up the sludge accumulation in the tank. We recommend practicing the air scouring during maintenance cleaning.

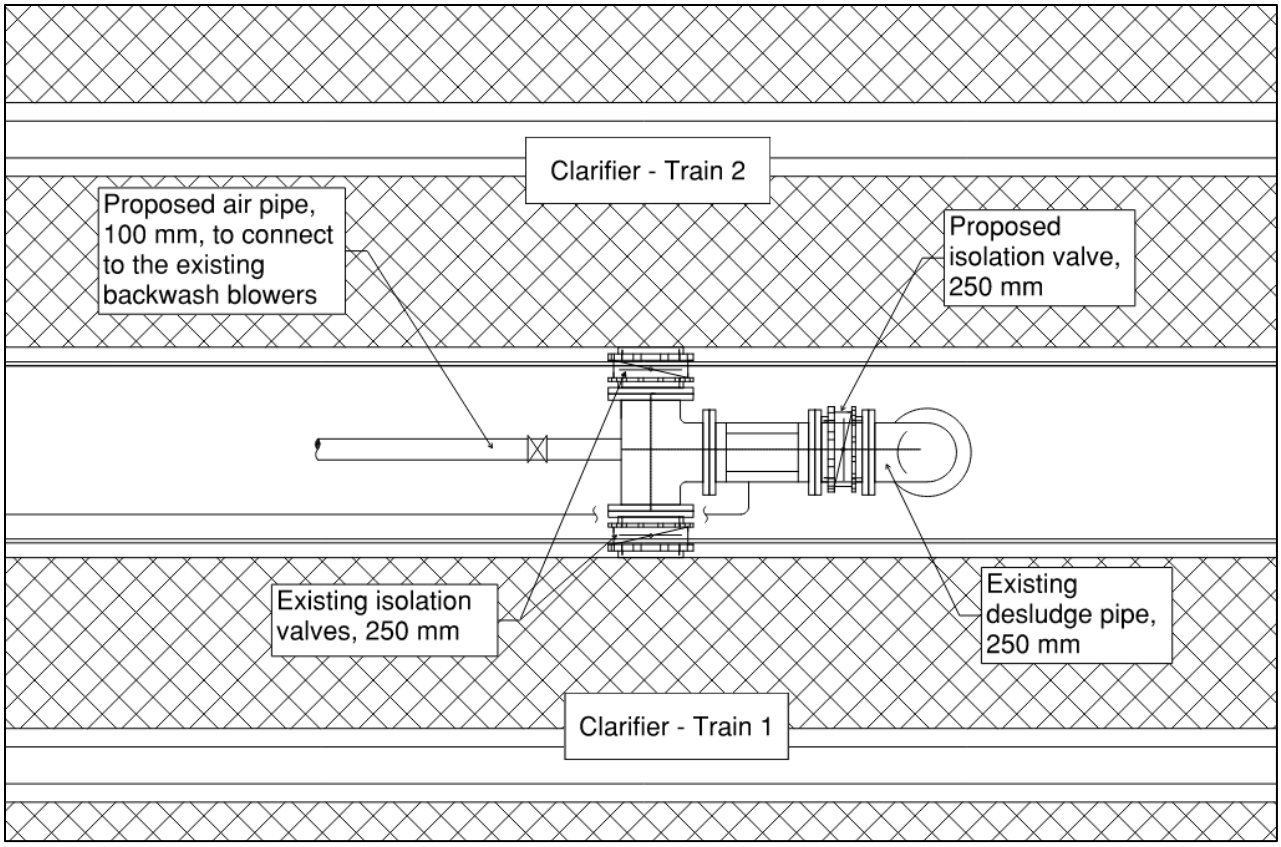

Figure 6-1: Proposed modification to clarifiers desludge piping

6.6.4 Filters

Each BCA train has a dual media filter. The filter tank measures 2.1 m by 3.6 m. The filtration media consists of 18 inches of anthracite and 18 inches of silica sand.

The filtration rates at various flow conditions are shown in table 6-3. The filtration rates are well below recommended values.

Description	Unit	Condition Q1	Condition Q2	Condition Q3	Original design
Design flow	m^3/d	1671	1059	1059	3000
Number of trains in operation	units	2	1	2	2
Design flow per train	m^3/d	836	1059	530	1500
Filtration rate	m/h	4.60	5.84	2.92	8.27
Design guideline for filtration rate		Maximum 11.7 m/h for Rapid rate gravity filters			

Table 6-3: Verification of filters

During the test conducted by Exp's engineer in June 2022 with raw water flow of 12 L/s (1036 m³/d), and one filter (F1) in operation, the turbidity of filtrated water ranged from 0.08 to 0.14 NTU.

Filter backwash is programmed for 5 minutes of backwash with water, followed by 5 minutes of air scouring. The backwash can be initiated manually or automatically. In auto mode, backwash is activated by the earliest occurrence of high media head loss, or high filtered water turbidity or pre-set elapsed run time. In actual operation, the filters are backwashed approximatively every three weeks.

Some anthracite (+/- 6 inches) has been added to the filters recently. No operational or performance issues were noticed during the EXP site visit.

It was noted that in actual operation the filters are backwashed every three weeks. Considering the high raw water turbidity, we recommend considering more frequent backwashes. Typically, daily backwash is commonly practiced in municipal water treatment plants.

6.6.5 Treatment process residuals

The WTP has two separate tanks for receiving of process rejects: backwash waste tank and sludge blowdown tank. A flow diagram of the process residuals management system is shown in Figure 6-2.

The filter backwash water is discharged to the backwash waste tank.

The settled sludge from the clarifiers is normally discharged to a sludge blowdown tank through a 250 mm diameter PVC pipe. From the tank, the sludge is pumped to a sludge thickening bagger system. The supernatant of the bagger system is sent to the filter backwash waste tank. Thickened sludge is disposed of at the municipal landfill site. A by-pass pipe is provided to discharge the settled sludge to the backwash waste tank when necessary.

The backwash waste tank is connected to a sanitary lift station (LS1). Wastewater from the treatment process is pumped to the sewage system and then to the municipal lagoon.

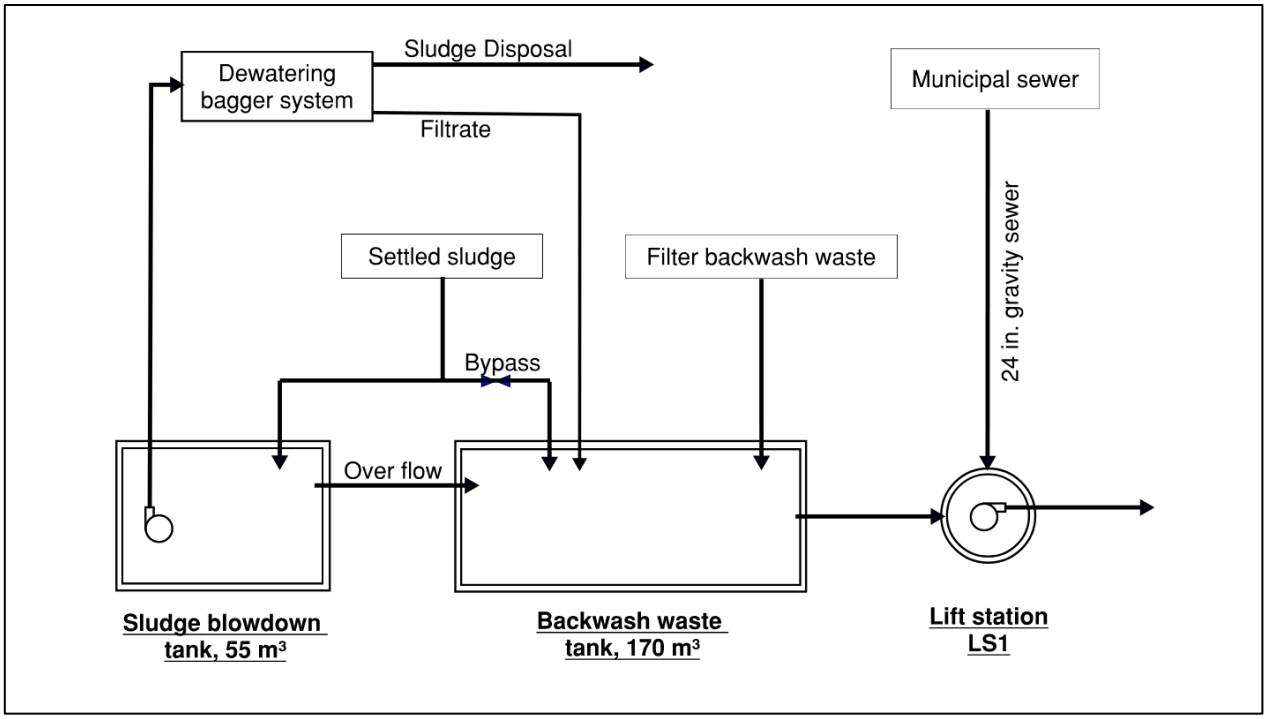

Figure 6-2: Residuals management system flow diagram

The estimated residuals volume as well as the tanks volume are,

- Average sludge volume : 44 m³/d
- Backwash wastewater volume : 24.3 m³/d
- Total residuals volume: 68.3 m³/d
- Sludge tank volume: 55 m³
- Backwash wastewater tank volume: 170 m³

In addition to the WTP's process residuals, municipal sewage is also discharged into LS1 by a 24-inch diameter gravity sewer. The sewer collects sewage from about 60 – 80 houses and a school. The flow from the municipal sewer is not available.

According to the preliminary record drawing PS-01 prepared by Reid Crowther in 2001/11/22, the pumping station has a capacity of 9.1 L/s, with allowance of 2 L/s from the WTP. According to the drop tests done by the WTP operator in January 2023, the actual pumping flow is below the design capacity: 5.86 L/s with one pump, and 7.27 L/s with two pumps. The actual pump flow is below the design capacity. In fact, overflows have been observed at the pumping station during spring thaw.

The capacity of the pumping station needs to be increased in order to safely accommodate the WTP's wastewater flow with no restrictions. Also, the hydraulic profile between the backwash wastewater tank and the lift station should be examined to make sure that there will be no backflow to the backwash waste tank at any time. An in-depth study of the lift station is recommended.

6.7 Instrumentation and control

The new pumps and instruments should be routed to the plant PLC and SCADA, including,

- The low lift pumps,
- The raw water pumps,
- The level transmitters in the pumping stations,
- The turbidity meters,
- The flowmeters.

7 Cost Estimate and Construction Phasing

The proposed works are divided in two categories: operational interventions and modification works. All works are required for the WTP to meet the projected water demand.

The recommended operational interventions are described below. These recommendations should be implemented immediately.

- Adjust the dosing pumps setting to avoid pumping at low frequency
- Prepare polymer solution in smaller batches. Discard aged polymer solution according to the recommendations of the supplier.
- Adjust the flocculation mixers speed to optimize floc formation. Theoretical verification indicates that the mixers RPM is higher than recommended values.
- Increase operation water level in the clarifiers so that the collection launders are completely submerged.
- Empty the clarifier and thoroughly clean all sludge collection and extracting elements.
- Practice monthly (or more frequent) maintenance cleaning of the clarifier as recommended in the BCA's instruction manual.
- Regularly verify the sludge blanket level in the clarifier as recommended in the BCA's instruction manual. When sampling, make sure that the sampling port is not jammed by flocs.

The proposed modifications include the relocation of the raw water intake, the construction of a raw water reservoir with new pumping stations, and modifications of the treatment process equipment. Where construction phasing is desired, we proposed construction in two phases:

- Phase 1: Relocation of the raw water intake
  Construction of the low lift pumping station
  Modifications of treatment process equipment
- Phase 2: Construction of the raw water reservoir with an aeration system
  Construction of the raw water pumping station

The preliminary cost estimate (Class D) is shown in table 7-1. The estimated total construction costs (before taxes) are:

Construction in a single phase: **$3,639,000**

Construction in two phases:

- Phase 1 : $1,419,000
- Phase 2 : $2,535 000

Total : **$3,954,000**

Item	Description	Construction	Construction in 2 phases	
		in 1 phase	Phase 1	Phase 2
1	Relocation of water intake	$300,000	$300,000	-
2	Raw Water Reservoir + pumping stations		-	-
2.1	Concrete tanks + excavation	$2,250,000	$450,000	$2,050,000
2.2	Low Lift Pumping Station	$150,000	$160,000	-
2.3	Raw Water Pumping Station	$150,000	-	$150,000
2.4	Aeration system	$65,000	-	$65,000
2.5	Maintaining operation during construction	$25,000	$15,000	$25,000
2.6	Decommissioning and removal of existing raw water pumping station	$5,000	$5,000	-
2.7	Building 3 m x 6 m	$75,000	-	$75,000
3	Power Assisted In-line Mixer	$50,000	$50,000	-
4	Flocculation mixers	$125,000	$125,000	-
5	Polymer preparation system	$25,000	$25,000	-
6	Process piping and instruments		-	-
6.1	Removal of existing in-line mixer	$3,000	$3,000	-
6.2	Flow control pinch valves, 2 x 150 mm	$36,000	$36,000	-
6.3	Magnetic flowmeters, 2 x 150 mm	$20,000	$20,000	-
6.4	Raw water turbidity meters	$30,000	$30,000	-
6.5	Air scour piping + valves (on desludge pipe)	$30,000	$30,000	-
7	Electrical works	$150,000	$85,000	$85,000
8	Instrumentation and modifications of SCADA	$100,000	$60,000	$60,000
9	Commissioning	$50,000	$25,000	$25,000
	Total (before taxes):	**$3,639,000**	**$1,419,000**	**$2,535,000**

Table 7-1: Preliminary cost estimate (Class D)

8 Conclusions and recommendations

EXP Services Inc. (EXP) has been retained by Fotenn and Infrastructure Canada with the Corporation of the Town of Moosonee to investigate the existing water treatment plant (WTP) in the Town of Moosonee in order to determine the capability of the WTP to meet the potable water requirements of the proposed WAHA Moosonee Hospital.

The WTP was constructed in 2002. It has never been officially commissioned. The treatment process was designed for a maximum capacity of 3000 m^3/d with two parallel packaged filtration trains, each having a maximum treatment capacity of 1500 m^3/d. Since its installation, the WTP has been constantly operating at below 1/3 of its rated capacity (< 1000 m^3/d). The actual water demand of the water distribution network is approximatively 656 m^3/d on average day.

With the future hospital, the demands for drinking water are estimated to be 953 m^3/d on an average day and 1565 m^3/d on maximum day.

Based on the test conducted by Exp's engineer in June 2022, we conclude that the treatment capacity of the treatment process is limited to about 1037 m^3/d (12 L/s) under actual conditions. Aeras limiting the treatment capacity have been identified as follow,

- Deteriorated condition at the raw water intake site. The buffer distance between the intake screens and the bottom of the river has greatly reduced due to accumulation of sand. Sand is constantly carried into the treatment process.
- Seasonal variation of the raw water quality, particularly high raw water turbidity (up to 300 NTU) during spring thaw periods.
- The process has been operating much below its design flow, causing inefficient coagulation.
- Floc is carrying over from clarifiers to filters. Probable causes include ineffective clarifier desludge and overdue maintenance cleaning.
- Insufficient wastewater pumping capacity of the lift station LS1, hindering clarifier desludge operation.

The carry-over of sand in the raw water had caused mechanical failures of the process equipment, for example, broken flocculation mixers. It may also have contributed to the problem of ineffective desludge from the clarifiers.

The process equipment downstream of the filtration trains are not included in the study. These include the disinfection system, the clear water reservoir and the distribution pumps. This part of the process had been designed for 3000 m^3/d, which is higher than the projected water demand.

Based on the assessment, we recommend immediately implementing the following operational interventions:

- Adjust the dosing pumps setting to avoid pumping at low frequency
- Prepare polymer solution in smaller batches. Discard aged polymer solution according to the recommendations of the supplier.
- Adjust the flocculation mixers speed to optimize flocs formation. Theoretical verification indicates that the mixers RPM is higher than recommended values.
- Increase operation water level in the clarifiers so that the collection launders are completely submerged.

- Empty the clarifier and thoroughly clean all sludge collection and extracting elements.
- Practice monthly (or more frequent) maintenance cleaning of the clarifier as recommended in the BCA's instruction manual.
- Regularly verify the sludge blanket level in the clarifier as recommended in the BCA's instruction manual. When sampling, make sure that the sampling port is not jammed by floc.

Furthermore, the following modification works are recommended in order to meet the future water demands,

- Extend the raw water intake pipe by 25 m into Moosonee River, where the riverbed is approximatively 2 m deeper that the existing intake site.
- Construct a new raw water reservoir of 2500 m^3. The reservoir will provide approximatively 2.4 days of raw water reserve in the event that the intake is shut down during spring break-up.
- Install an aeration system for oxidation of iron, with a 3 kW blower and coarse bubble air diffusers. The blower will be housed in a 3 m x 6 m building.
- Construct a new low lift pumping station to feed the raw water reservoir, with 2 vertical turbine pumps of 21 L/s at 6 m TDH, 5 HP, VFD, one duty and one standby.
- Construct a new raw water pumping station to feed the filtration trains, with 2 vertical turbine pumps of 21 L/s at 16 m TDH, 7.5 HP, VFD, one duty and one standby.

During the construction, the raw water forcemain should be cleaned to flush out sediment in the pipe.

We also recommend the following modifications to the treatment process:

- Replace the existing static mixer by a power assisted in-line mixer. The existing static mixer is oversized for the actual and future flows and does not provide the correct mixing intensity.
- Install a new polymer preparation system with one 200 L preparation tank + mixer and one 200 L application tank. The existing polymer preparation tank is over sized is not suitable for current and future flows.
- Provide multiple polymer injection points in the flocculation tanks.
- Replace the two globe style flow valves on the inlet pipes of the filtration trains by pinch valves and install two magnetic flowmeters.
- Install turbidity meters in the new pumping stations.
- Install a 100 mm pipe between the existing blower and the clarifiers desludge header to allow air scouring of the sludge pipe.
- Related electrical works.
- Related works on instrumentation and modification of SCADA.

Where construction phasing is desired, we proposed construction in two phases:

- Phase 1 : Relocation of the raw water intake
  Construction of the low lift pumping station
  Modifications of treatment process equipment
- Phase 2 : Construction of the raw water reservoir with an aeration system
  Construction of the raw water pumping station

The estimated total construction costs (before taxes) are:

Construction in a single phase:	**3,639,000 $**
Construction in two phases:	
• Phase 1 :	1,419,000 $
• Phase 2 :	2,535 000 $
Total :	**3,954,000 $**

Additional studies are recommended in the next steps of the project:

- Provisions for fire protection of the new hospital (fire flow and reserve);
- Evaluation of required capacity of the sanitary lift station LS1;
- Geotechnical study of the proposed raw water reservoir site.

Appendix A – Raw Water Analysis Results

Raw Water Analytical Results

Parameter	Unité	2003-04-11	2003-04-11	2003-05-12	2022-06-20	2022-11-24	ODWQS[1]
Temp (Field)	°C					2.9	
pH (Field)	-					7.91	
Alkalinity (as CaCQ)	mg/L	96.9	102	39.7	56	56	30 – 500 (OG)
Aluminum	mg/L	0.31	0.34	1.2	0.209	0.272	0.1 (OG)
Ammonia	mg/L	ND	ND	ND	<0.01	<0.01	-
Bicarbonate (as CaCO3)	mg/L	118	125	48.4	56	56	-
Bromide	mg/L	ND	ND	ND	<0.05	<0.05	-
Calcium, dissolved	mg/L	30.3	32.8	12.5	18.2	19	-
Calcium, total	mg/L	34	34	16	18.2	20.1	-
Carbonate (as CaCO3)	mg/L	ND	ND	ND	<1	<1	-
Chloride	mg/L	7.92	20.1	2.45	4.9	1.6	250 (AO)
Conductivity, dissolved	µS/cm	230	293	84	130	121	-
Copper	mg/L	0.0033	0.03	0.0033	0.003	0.006	1.0 (AO)
Fluoride	mg/L	0.1	0.1	0.1	<0.05	<0.05	1.5 (MC)
Hardness (as CaCO3)	mg/L	102	112	38.1	60.8	61.8	80 – 100 (OG)
Iron	mg/L	0.42	0.46	1.7	0.62	0.4	0.3 (AO)
Langelier Index	-	-0.76	-0.57	-1.7	-0.841	-0.843	-
Lead	mg/L	ND	ND	ND	0.0002	0.0004	0.01 (MC)
Magnesium, dissolved	mg/L	6.52	7.26	1.68	3.22	3780	-
Magnesium, total	mg/L	6.6	8.1	3.7	3.66	4370	
Manganese	mg/L	0.012	0.014	0.062	0.029	0.019	0.05 (AO)
Nitrate (as N)	mg/L	0.3	0.5	ND	<0.05	<0.05	10 (MC)
Nitrite (as N)	mg/L	ND	ND	ND	<0.05	<0.05	1.0 (MC)
Organic Carbon, Dissolved	mg/L	11.2	10.9	23	25.6	22	5 (AO)
Organic Nitrogen, total	mg/L	0.7	0.61	0.35	3.5	1.3	0.15 (OG)
Orthophosphate (as P), dissolved	mg/L	ND	0.006	ND	<0.005	<0.005	-
pH	-	8.08	8.23	7.91	7.65	7.63	6.5 - 8.5 (OG)
Potassium, dissolved	mg/L	0.672	1.14	0.461	0.38	0.39	-
Potassium, total	mg/L	0.82	1.3	0.73	0.56	0.46	-
Silicon, dissolved	mg/L	2.73	3.46	0.73	1.8	0.21	-
Sodium, dissolved	mg/L	6.75	14.1	1.82	3.89	0.153	-
Sodium, total	mg/L	6.7	16	2.4	3.84	0.157	200 (AO)
Sulphate	mg/L	11.2	15.1	1.5	2.7	2.4	.
Total Dissolved Solids	mg/L	123	155	44.3	120	70	500 (AO)
Total Kjeldahl Nitrogen (TKN)	mg/L	0.7	0.6	0.3	3.5	1.3	-
Total Organic Carbon	mg/L	12	11.4	24.5	26.6	21.8	-
True Colour	TCU	30	60	150	161	164	5 (AO)
Turbidity	NTU	5	5.2	14.5	16.1	16.2	5 (AO)
Zinc	mg/L	0.084	0.022	0.014	0.008	0.009	5.0 (AO)
THMFP[2]	µg/L	-	750	1400	-	-	-
Residual Chlorine	mg/L	-	-	-	-	0.05	-
Total THMs (calc.)	ug/L	-	-	-	-	<0.5	-
- Bromodichloromethane	ug/L	-	-	-	-	<0.3	-
- Bromoform	ug/L	-	-	-	-	<0.3	-
- Chloroform	ug/L	-	-	-	-	<0.3	-
- Dibromochloromethane	ug/L	-	-	-	-	<0.3	-
- Toluene-d8 (Surr.)	% Rec	-	-	-	-	97	-

Notes:
1. from Reg 169/03 (Ontario Drinking Water Quality Standar
   - MC = Maximum Concentratio
   - AO = Aesthetic Objectiv
   - OG = Operational Guideline
2. THMFP =THM formation potential in raw water

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CERTIFICATE OF ANALYSIS

Client:	Brad Gilbert	Work Order Number:	466947
Company:	exp. Services - New Liskeard	PO #:	
Address:	310 Whitewood Ave West New Liskeard, ON, P0J 1P0	Regulation: Project #:	None Moosonee WTP Raw Water Analysis
Phone:	(705) 647-4311	DWS #:	
Email:	Bradley.Gilbert@exp.com	Sampled By:	Krunal Patel
Date Order Received:	6/21/2022	Analysis Started:	6/21/2022
Arrival Temperature:	21.4 °C	Analysis Completed:	6/28/2022

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
Moose River	1768403	Raw Water	None		6/20/2022	1:40 PM

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Alkalinity (A1.0)	Kirkland Lake	Determination of Alkalinity by Titration	Modified from APHA-2320B
Ammonia Water (A42)	Kirkland Lake	Determination of Ammonia/Ammonium in Water	Modified from EPA 350.1
Anions Water (mg/L by IC) (A5)	Timmins	Determination of Anions in Water by Ion Chromatography	Modified from SW846-9056A
Carbonate (A94)	Kirkland Lake	Determination of Carbonate and Bi-Carbonate	Modified from APHA-2320
Colour, True (A26)	Kirkland Lake	Determination of Colour by Spectrophotometry	Modified from SM 2120 C
Conductivity of Water (A12)	Kirkland Lake	Determination of Conductivity in Water at 25°C	Modified from SM 2510 B
DOC Water (A55.1)	Timmins	Determination of Dissolved Organic Carbon in Water	Modified from SM-5310 C
DOP Water (A23.1)	Kirkland Lake	Determination of Dissolved Ortho-Phosphate in Water.	Modified from EPA 365.3 and ESS 310.2.
ICPMS Dis. Water (A13.3)	Timmins	Determination of Dissolved (Lab Filtered) Metals in Water by ICP/MS	Modified from SW846-6020A
ICPMS Reg. Water (A13.1)	Timmins	Determination of Metals in Water by ICP/MS	Modified from SW846-6020A
ICPMS Tot. Water (A13.2)	Timmins	Determination of Total Metals in Water by ICP/MS with Digestion	Modified from SW846-6020A

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exp. Services - New Liskeard

Work Order Number: 466947

Method	Lab	Description	Reference
Langelier Index (A93)	Kirkland Lake	Determination of Langelier Index	Modified from APHA-2330B
Organic Nitrogen (A58)	Kirkland Lake	Determination of Organic Nitrogen	Modified from APHA-4500
pH of Water (A2.0)	Kirkland Lake	Determination of Water pH by Ion Selective Electrode	Modified from APHA-4500H+ B
Reg. Hardness (A13)	Timmins	Determination of Total Hardness	Modified from APHA-2340B
Residual Chlorine/W (R98)	Garson	Determination of Residual Chlorine by Colorimetry	In-House
TDS (A27)	Kirkland Lake	Determination of Total Dissolved Solids in water by gravimetry	Modified from SM-2540
THMs Water (A14.4)	Garson	Determination of Trihalomethanes in Drinking Water by GC-MS	Modified from EPA 624
TKN Water Dig. (A58)	Kirkland Lake	Determination of Total Kjeldahl Nitrogen in Waters with Block Digestion.	Modified from SM-4500 NORG-D
TOC Water (A55.2)	Timmins	Determination of Total Organic Carbon in Water	Modified from SM-5310 C
Turbidity (A21)	Kirkland Lake	Determination of Turbidity by Nephelometry	Modified from APHA-2130B

This report has been approved by:

Madhavi Purohit, M.Sc.
Laboratory Director

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CERTIFICATE OF ANALYSIS

exp. Services - New Liskeard

Work Order Number: 466947

WORK ORDER RESULTS

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Anions	Result	MDL	Units
Bromide	<0.05	0.05	mg/L
Chloride	4.9	0.2	mg/L
Fluoride	<0.05	0.05	mg/L
Nitrate (as N)	<0.05	0.05	mg/L
Nitrite (as N)	<0.05	0.05	mg/L
Sulphate	2.7	0.5	mg/L

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Chlorine	Result	MDL	Units
Residual Chlorine	0.04	0.01	mg/L

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Colour	Result	MDL	Units
True Colour	161.0	1.5	TCU

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exp. Services - New Liskeard

Work Order Number: 466947

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

General Chemistry	Result	MDL	Units
Ammonia (as N)	<0.01	0.01	mg/L
Bicarbonate (Calc.)	56	1	mg/L as CaCO3
Carbonate (Calc.)	<1	1	mg/L as CaCO3
Conductivity	130	1	µS/cm
Dissolved Organic Carbon	25.6	0.4	mg/L
Dissolved Orthophosphate (as P)	<0.005 [0.005]	0.005	mg/L
Langelier Index (Calc.)	-0.841	N/A	NA
M-Alkalinity (pH 4.5)	56	2	mg/L as CaCO3
Organic Nitrogen (as N) (Calc.)	3.5	0.4	mg/L
pH	7.65	N/A	pH
Total Hardness (as CaCO3) (Calc.)	60.8	0.1	mg/L
Total Kjeldahl Nitrogen	3.5	0.4	mg/L
Total Organic Carbon	26.6	0.4	mg/L
Turbidity	16.10	0.06	NTU

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Metals	Result	MDL	Units
Aluminum	0.209	0.001	mg/L
Calcium	18.2	0.5	mg/L

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exp. Services - New Liskeard

Work Order Number: 466947

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Metals	Result	MDL	Units
Copper	0.003	0.001	mg/L
Iron	0.62	0.02	mg/L
Lead	0.0002	0.0001	mg/L
Manganese	0.029	0.001	mg/L
Zinc	0.008	0.001	mg/L

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Metals (Dissolved)	Result	MDL	Units
Dissolved Calcium	18200	50	ug/L
Dissolved Magnesium	3220	4	ug/L
Dissolved Potassium	380	100	ug/L
Dissolved Silicon	1800	600	ug/L
Dissolved Sodium	3890	100	ug/L

Sample Description	Moose River
Sample Date	6/20/2022 1:40 PM
Lab ID	1768403

Metals (Total)	Result	MDL	Units
Total Calcium	19200	50	ug/L
Total Magnesium	3660	4	ug/L

Date of Issue: 06/28/2022 16:56

1470 Government Rd, Kirkland Lake, ON, P2N 3J1
Phone: (705) 642-3361 Fax: (705) 642-3222 Web: www.testmark.ca

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exp. Services - New Liskeard

Work Order Number: 466947

Sample Description	Moose River		
Sample Date	6/20/2022 1:40 PM		
Lab ID	1768403		
Metals (Total)	**Result**	**MDL**	**Units**
Total Potassium	560	100	ug/L
Total Sodium	3840	100	ug/L

Sample Description	Moose River		
Sample Date	6/20/2022 1:40 PM		
Lab ID	1768403		
Solids	**Result**	**MDL**	**Units**
Total Dissolved Solids	120	20	mg/L

Sample Description	Moose River		
Sample Date	6/20/2022 1:40 PM		
Lab ID	1768403		
THMs	**Result**	**MDL**	**Units**
Bromodichloromethane	<0.3	0.3	ug/L
Bromoform	<0.3	0.3	ug/L
Chloroform	<0.3	0.3	ug/L
Dibromochloromethane	<0.3	0.3	ug/L
Toluene-d8 (Surr.)	105	N/A	% Rec
Total THMs (Calc.)	<0.5	0.5	ug/L

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exp. Services - New Liskeard

Work Order Number: 466947

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.
MDL: Method detection limit or minimum reporting limit.
[ ]: Results for laboratory replicates are shown in square brackets immediately below the associated sample result for ease of comparison.
% Rec: Surrogate compounds are added to the sample in some cases and the recovery is reported as a % recovered.
Quality Control: All associated Quality Control data is available on request.
Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.
Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.

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CERTIFICATE OF ANALYSIS

Client:	Brad Gilbert	Work Order Number:	484181
Company:	exp. Services - New Liskeard	PO #:	
Address:	310 Whitewood Ave West	Regulation:	None
	New Liskeard, ON, P0J 1P0	Project #:	Moosonee WTP Raw Water Analysis
Phone:	(705) 647-4311	DWS #:	
Email:	Bradley.Gilbert@exp.com	Sampled By:	Brodie Ranger
Date Order Received:	11/24/2022	Analysis Started:	11/24/2022
Arrival Temperature:	15.2 °C	Analysis Completed:	12/5/2022

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
Moose River	1828978	Raw Water	None		11/22/2022	1:35 PM

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Alkalinity (A1.0)	Garson	Determination of Alkalinity by Titration	Modified from APHA-2320B
Ammonia Water (A42)	Kirkland Lake	Determination of Ammonia/Ammonium in Water	Modified from EPA 350.1
Anions Water (mg/L by IC) (A5)	Garson	Determination of Anions in Water by Ion Chromatography	Modified from SW846-9056A
Carbonate (A94)	Garson	Determination of Carbonate and Bi-Carbonate	Modified from APHA-2320
Colour, True (A26)	Kirkland Lake	Determination of Colour by Spectrophotometry	Modified from SM 2120 C
Conductivity of Water (A12)	Garson	Determination of Conductivity in Water at 25°C	Modified from SM 2510 B
DOC Water (A55.1)	Kirkland Lake	Determination of Dissolved Organic Carbon in Water	Modified from SM-5310 C
DOP Water (A23.1)	Kirkland Lake	Determination of Dissolved Ortho-Phosphate in Water.	Modified from EPA 365.3 and ESS 310.2.
Field pH (R112)	Kirkland Lake	Client Supplied Field Determination of pH of Water	Field Test
Field Temp (R113)	Kirkland Lake	Client Supplied Field Determination of Temperature of Water	Field Test
ICPMS Dis. Water (A13)	Garson	Determination of Dissolved (Lab Filtered) Metals in Water by ICP/MS	Modified from SW846-6020A

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Work Order Number: 484181

Method	Lab	Description	Reference
ICPMS Reg. Water (A13)	Garson	Determination of Metals in Water by ICP/MS	Modified from SW846-6020A
ICPMS Tot. Water (A13)	Garson	Determination of Total Metals in Water by ICP/MS with Digestion	Modified from SW846-6020A
Langelier Index (A93)	Garson	Determination of Langelier Index	Modified from APHA-2330B
Organic Nitrogen (A58)	Garson	Determination of Organic Nitrogen	Modified from APHA-4500
pH of Water (A2.0)	Garson	Determination of Water pH by Ion Selective Electrode	Modified from APHA-4500H+ B
Reg. Hardness (A13)	Garson	Determination of Total Hardness	Modified from APHA-2340B
Residual Chlorine/W (R98)	Garson	Determination of Residual Chlorine by Colorimetry	In-House
TDS (A27)	Garson	Determination of Total Dissolved Solids in water by gravimetry	Modified from SM-2540
THMs Water (A14.4)	Garson	Determination of Trihalomethanes in Drinking Water by GC-MS	Modified from EPA 624
TKN Water Dig. (A58)	Kirkland Lake	Determination of Total Kjeldahl Nitrogen in Waters with Block Digestion.	Modified from SM-4500 NORG-D
TOC Water (A55.2)	Kirkland Lake	Determination of Total Organic Carbon in Water	Modified from SM-5310 C
Turbidity (A21)	Garson	Determination of Turbidity by Nephelometry	Modified from APHA-2130B

This report has been approved by:

Madhavi Purohit, M.Sc.
Laboratory Director

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exp. Services - New Liskeard

Work Order Number: 484181

WORK ORDER RESULTS

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Anions	Result	MDL	Units
Bromide	<0.05	0.05	mg/L
Chloride	1.6	0.2	mg/L
Fluoride	<0.05	0.05	mg/L
Nitrate (as N)	<0.05	0.05	mg/L
Nitrite (as N)	<0.05	0.05	mg/L
Sulphate	2.4	0.5	mg/L

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Chlorine	Result	MDL	Units
Residual Chlorine	0.05	0.01	mg/L

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Colour	Result	MDL	Units
True Colour	164.0	1.5	TCU

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exp. Services - New Liskeard

Work Order Number: 484181

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Field Parameters	Result	MDL	Units
Field pH	7.91	N/A	pH
Field Temp	2.9	N/A	°C

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

General Chemistry	Result	MDL	Units
Ammonia (as N)	<0.01	0.01	mg/L
Bicarbonate (Calc.)	56	1	mg/L as CaCO3
Carbonate (Calc.)	<1	1	mg/L as CaCO3
Conductivity	121	1	µS/cm
Dissolved Organic Carbon	22.0	0.8	mg/L
Dissolved Orthophosphate (as P)	<0.005	0.005	mg/L
Langelier Index (Calc.)	-0.843	N/A	NA
M-Alkalinity (pH 4.5)	56	2	mg/L as CaCO3
Organic Nitrogen (as N) (Calc.)	1.3	0.2	mg/L
pH	7.63	N/A	pH
Total Hardness (as CaCO3) (Calc.)	61.8	0.1	mg/L
Total Kjeldahl Nitrogen	1.3	0.4	mg/L
Total Organic Carbon	21.8 [21.9]	0.8	mg/L
Turbidity	16.20	0.06	NTU

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Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Metals	Result	MDL	Units
Aluminum	0.272	0.001	mg/L
Calcium	17.90	0.05	mg/L
Copper	0.006	0.001	mg/L
Iron	0.40	0.02	mg/L
Lead	0.0004	0.0001	mg/L
Manganese	0.019	0.001	mg/L
Zinc	0.009	0.001	mg/L

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Metals (Dissolved)	Result	MDL	Units
Dissolved Calcium	19000	50	ug/L
Dissolved Magnesium	3780	4	ug/L
Dissolved Potassium	390	100	ug/L
Dissolved Silicon	2100	600	ug/L
Dissolved Sodium	1530	100	ug/L

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Work Order Number: 484181

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Metals (Total)	Result	MDL	Units
Total Calcium	20100	50	ug/L
Total Magnesium	4370	4	ug/L
Total Potassium	460	100	ug/L
Total Sodium	1570	100	ug/L

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

Solids	Result	MDL	Units
Total Dissolved Solids	70	20	mg/L

Sample Description	Moose River
Sample Date	11/22/2022 1:35 PM
Lab ID	1828978

THMs	Result	MDL	Units
Bromodichloromethane	<0.3	0.3	ug/L
Bromoform	<0.3	0.3	ug/L
Chloroform	<0.3	0.3	ug/L
Dibromochloromethane	<0.3	0.3	ug/L
Toluene-d8 (Surr.)	97	N/A	% Rec
Total THMs (Calc.)	<0.5	0.5	ug/L

Date of Issue: 12/05/2022 11:01

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CERTIFICATE OF ANALYSIS

exp. Services - New Liskeard

Work Order Number: 484181

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.
MDL: Method detection limit or minimum reporting limit.
[ ]: Results for laboratory replicates are shown in square brackets immediately below the associated sample result for ease of comparison.
% Rec: Surrogate compounds are added to the sample in some cases and the recovery is reported as a % recovered.
Quality Control: All associated Quality Control data is available on request.
Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.
Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.
Reproduction of Report: Report shall not be reproduced, except in full, without the approval of Testmark Laboratories Ltd.
ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.
Regulation Comparisons: Disclaimer: Please note that regulation criteria are provided for comparative purposes, however the onus on ensuring the validity of this comparison rests with the client.

Appendix B – Photos

Photo 1 – Water intake screen

Photo 2 – Raw water pumping station (construction)

Photo 3 – Raw water pumping station

Photo 4 – Static mixer

Photo 5 – Filtration train inlet

Photo 6 – Filtration train – Floculation tanks

Photo 7 – Filtration train – Clarifier

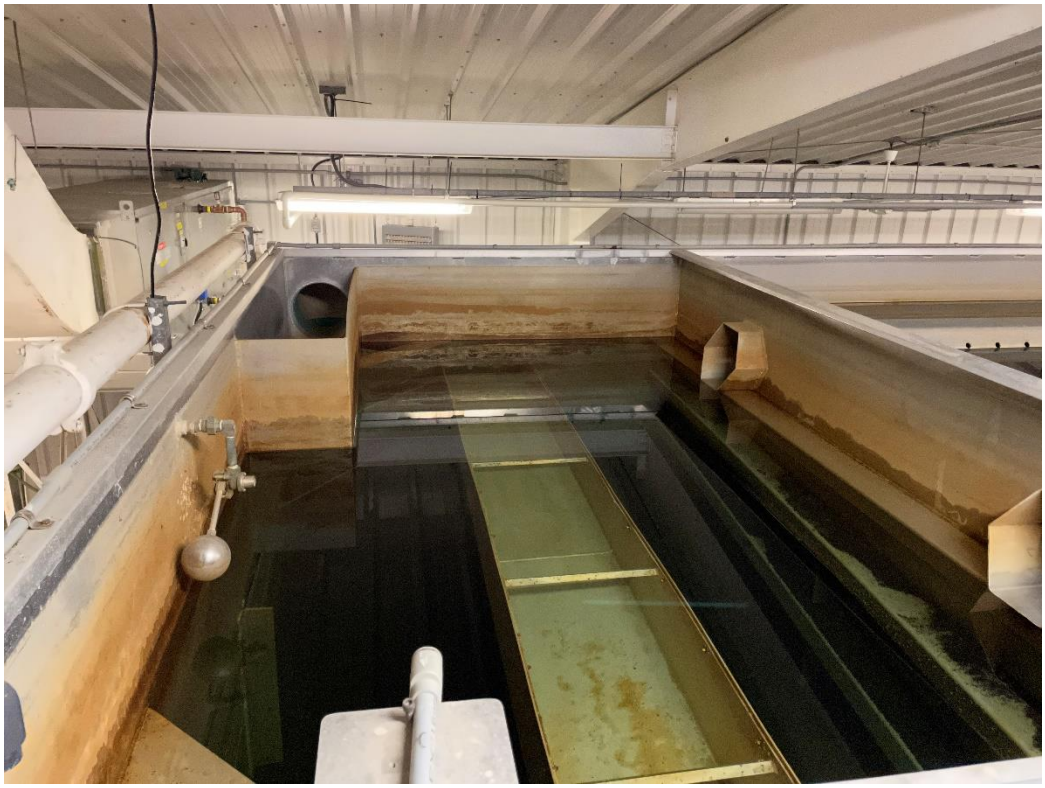


Photo 8 – Filtration train – Filter

Photo 9 – Space between the 2 filtration trains

Photo 10 – Chemical dosing pumps

Photo 11 – Chemical storage and preparation room

Photo 12 – Chemical storage and preparation room

Photo 13 – Dewatering bagger system

Photo 14 – Dewatering bagger system

Photo 15 – WTP Building + raw water pumping station

Photo 16 – WTP Building

Appendix C – Calculations

NWL-21023706-00 Fotenn - Moosonee Water Intake Study
2020-03-15, Hui Wang, P. Eng

Permit to Take Water PPTW 5052-BKFN8P
Amounts of Taking Permitted

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	Moose River	River	Municipal	Water Supply	2,040	24	2,937,600	365	17 526773 5681258
						Total Taking:	2,937,600		

Design flows

Parameter	Drinking water demand			Raw water Flow	Process wastewater	
	Actual	Hospital	Total			
	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)	(%)	(m^3/d)
Average Day Flow	612	341	953	1059	10%	106
Maximum Day Flow	877	688	1565	1671	6.3%	106

Notes
*Actual Day Flow = average of 2019-2021 (See SCADA data Analysis.xlsx)
*Actual Maximum Day Flow = 99th percentile of 2019-2021 (See SCADA data Analysis.xlsx)
*Assumption: wastewater reject = 10% of Qavg Raw water. Aaverage of 2019-2021 =6.7%
*WAHA Hospital demands: Percy's Way Hospital Development, Town of Moosonee
Functional Servicing Report, Stantec, July 14, 2021

NWL-21023706-00 Fotenn - Moosonee Water Intake Study
2020-03-15, Hui Wang, P. Eng
Verification of the water intake

MECP Design Guidelines:

4.2.3: The **minimum submergence** from top of intake structure to minimum recorded water level should be **3m (10 ft)** wherever possible.

4.2.4: The hydraulic design for the intake for its final capacity should assume a **Hazen-Williams coefficient, C, of 100**.

4.2.4: The design should provide for low entry velocities – below 75 mm/s and uniform acceleration of water from inlet to intake pipe.

Water level El.- Max	2.4	m
Water level El.- Min	0.5	m
Intake pipe invert El.	-4	m
River bed to intake invert:	+/- 0.5	m

Existing Intake
- Screen material: SS 304
- Screen opening: 2.5 mm
- Bar width: +/- 2 mm
- % opening 48.0%

Approching velocity

Description	Existing	Proposed	Unit
Design flow	3000	1671	m^3/d
#units	3	3	
Length	508	508	mm
Diameter	305	305	mm
Total surface area	1.4603	1.4603	m^2
Effective surface ares	0.701	0.701	m^2
Entry velocity	**0.050**	**0.028**	**m/s**

Guidelines: <75 mm/s; MPO code: 35 mm/s for eel protection

Inntake pipe	*400 mm Sch 80 Steel		PEHD DR11, 20 in.	
Flow	3000	1671	1671	m^3/d
Diameter	400	400	394	mm
Pipe area	0.13	0.13	0.12	m^2
Velocity	0.276	0.154	0.159	m/s

NWL-21023706-00 Fotenn - Moosonee Water Intake Study
2020-06-26, Hui Wang, P. Eng

Calculations for raw water reservoir
The reservoir will provide a reserve of +/- 2 days under normal condition
We propose to divide the reservoir in 2 cells, so one can be taken out of service for cleaning maintenance when needed.

# cells	2	
Length per cell	24	m
Width per cell	12	m
Total surface area	576	m^3
Site grading El.:	7.2	m
Burried depth	1.8	m
Top slab El.	5.4	m
Reservoir botton EL.	0	m
Normal water depth	4.34	m
Volume of reserve	2500	m^3
Avg raw water flow	1059	m^3/d
Retention time	2.4	days

Aeration tank for iron removal

O2 demand	0.14	mg O2/mg Fe2+	
	0.29	mg O2/mg Mn2+	
Length	2.5	m	
width	5	m	
Depth	4.5	m	
Volume	56.25	m^3	
HRT	27	min	Recommendation: 10 - 30 min
Design flow	3000	m^3/d	
	125	m^3/h	
Fe	1	mg/L	
	0.125	kg/h Fe2+	
O2/Fe	0.5	mg O2/mg Fe2+	
AOR	0.0625	kg O3/h	
SOR	0.171	kg O3/h @10 deg.C/1 mg/L O2	
Q air	0.37	m^3/min @ 4%OTE/24h	
	13	cfm	

Blower Aerzen G3S/DN50/3kW

Appendix D – Filtration Test Results

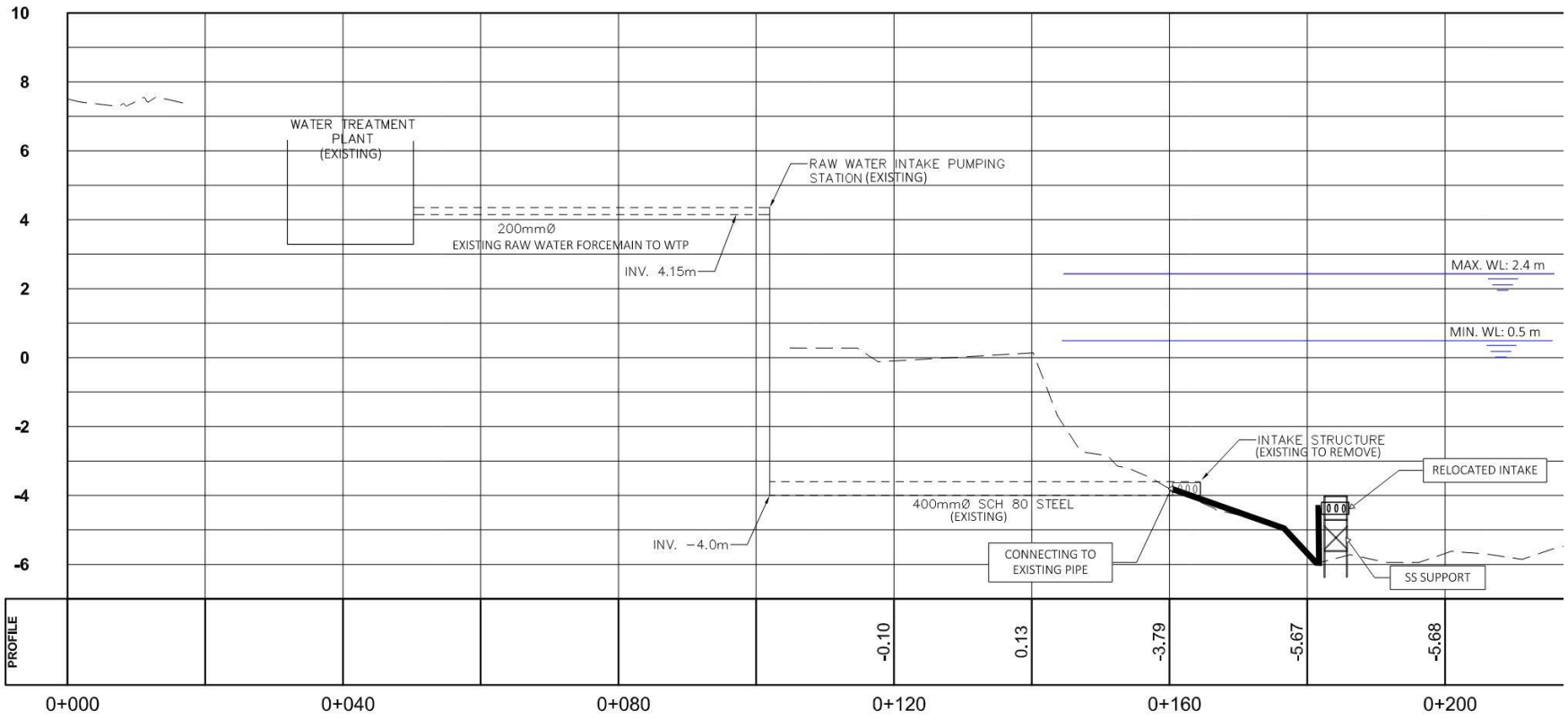
2022-06-01 Filtration test Moosonee WTP

Date	Time	Raw water							Clarifier effluent			Filtrer effluent			
	hh:mm	Flow	Temp.	pH	Turbidity	Tru color	App color	Alkalinity	pH	Turbidity	Alkalinity	Flow	Turbidity	Tru color	Eff pressure
		(L/s)	C		ntu			ppm CaCo3		ntu	ppm CaCo3	L/s	ntu		psi
2022-06-01	11:25	13.8	12	7.67	105	190	1273	49	6.63	1.04	24	13.8	0.28	17	3.8
2022-06-01	12:30	12.4	12.9	7.79	40.4	170	400	45	6.71	1.67	25	12.6	0.1	31	3.7
2022-06-01	13:35	11.6	13.2	7.81	30.1	176	362	46	6.65	1.33	26	12.5	0.11	24	3.6
2022-06-01	14:30	12	13.2	7.82	30.3	164	357	45	6.61	1.03	25	11.7	0.14	29	3.7
2022-06-01	15:30	12.1	13.2	7.8	24.9	184	367	45	6.61	0.869	25	13.8	0.12	18	3.6
2022-06-01	16:30	11.7	13.4	7.67	189	121	1210	47	6.62	1.67	24	0	0.1	13	3.6
2022-06-02	9:00	12.2	12.5	7.74	25.4	199	364	43	6.68	0.332	25	12.4	0.08	22	3.5
2022-06-02	10:00	12.4	12.7	7.71	19.1	192	307	43	6.62	0.728	23	12.6	0.08	73	3.5
2022-06-02	11:15	12.1	13.1	7.71	19.8	207	312	42	6.66	0.801	23	12.3	0.08	72	3.5
2022-06-02	12:15	12	13.1	7.72	18.8	186	310	43	6.61	1.02	25	12.2	0.09	22	3.5
2022-06-02	14:00	12.1	14	7.74	17.6	167	310	42	6.64	1.45	25	12.2	0.09	37	3.4
2022-06-02	15:53	12.4	14.3	7.74	20.4	182	343	42	6.64	1.29	25	13.3	0.09	25	3.4

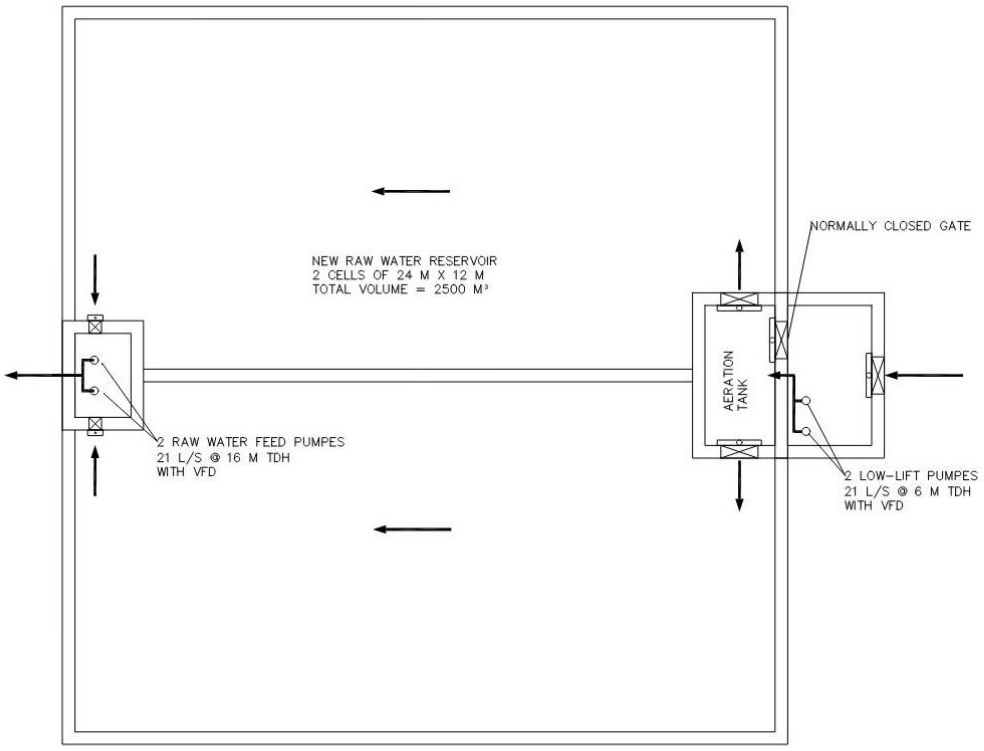
Description of the test
Date: 2 June 2022

The test was performed on the filtration train no. 1.
The mixer in the 1st stage flocculation tank was out of service due to mechanical problem.
Clarifier desludge : 30 seconds every hour.
Filter is backwashed prior to the test. No backwash during the test.
The flow rate was initially set at 14 L/s. At this flow, the filter's effluent turbidity increased rapidly.
Flow rate was then readjusted to 12 L/s.
The test lasted 28 hours.
Dosage of SternPAC: 0.26 ml/L
Dosage of polymer:40 ml/L

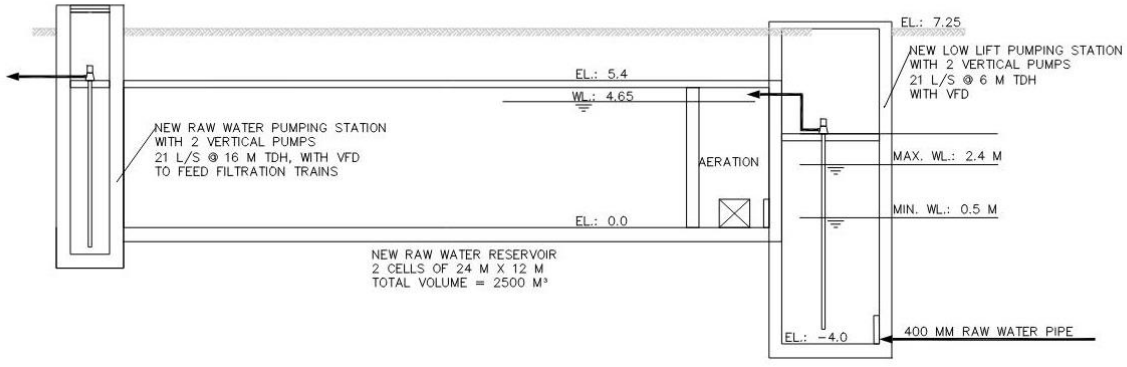
Appendix E – Preliminary drawings of proposed modifications



Proposed water intake relocation

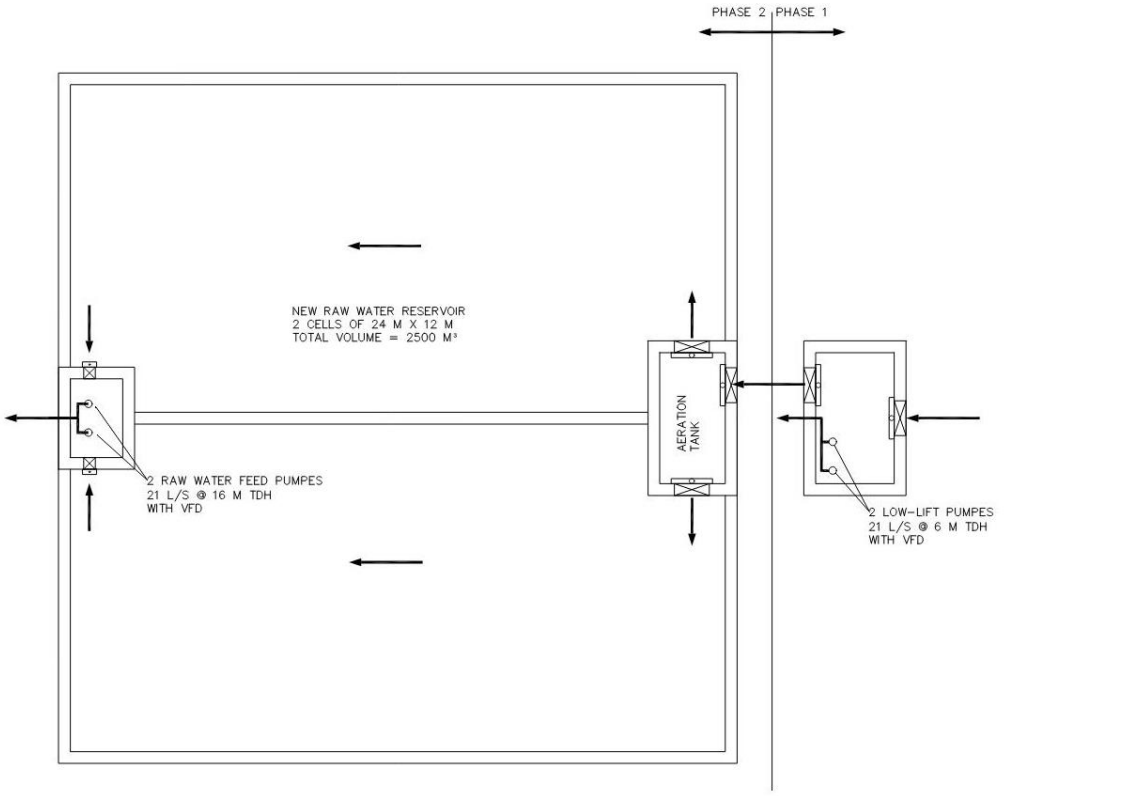


PLAN VIEW

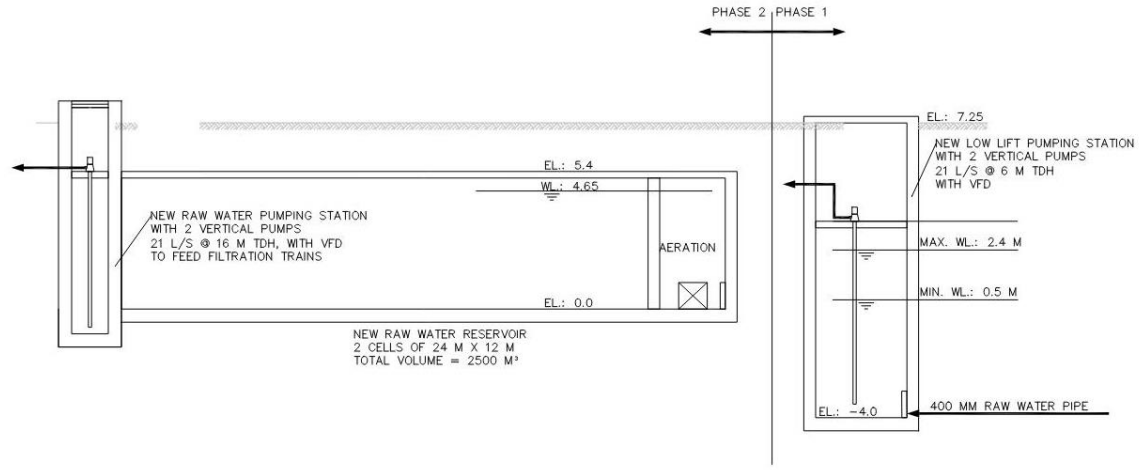


ELEVATION VIEW

Proposed raw water reservoir and pumping stations
Construction in one phase



PLAN VIEW



ELEVATION VIEW

Proposed raw water reservoir and pumping stations
Construction in 2 phases

Appendix F – Equipment Proposals

ACG | Envirocan
LEADERS IN INNOVATION & SUSTAINABILITY

Veolia
Att'n: Krunal Patel

Re: Inline Mixer

Project: Moosonee WTP
Quote Date: June 30, 2022
Submittals: 4-6 weeks
Ship Equipment: 12 weeks after approvals

Quote #: 22-8923
FOB: our shop, Woodbridge, ON
Expire Date : July 30, 2022
Terms: NET 30 DAYS

Line Item	QTY	Part No.	Description	Total Price
1	1		8" Instomix inline flash mixer with reciprocating mixer paddles and polymer injection tube.	$38,400

Terms and Conditions of Sale:

1. Price is in CDN funds, FOB our shop, Woodbridge, ON with freight **extra** to site.
2. HST is not included.
3. Payment Terms: 100% due 30 days from delivery.
4. Delivery **12** weeks after approved submittals.
5. Start-up services and operator training is not included.
6. Price is firm for acceptance for 30-days.
7. **NOT INCLUDED:** field measurements, installation, concrete work, air, piping or wiring connections and anything else not expressly mentioned above as included will be construed to be not included.
8. **LIABILITY:** It is expressly understood and agreed that ACG-Envirocan's liability for our products is limited to the furnishing of such replacement parts as are required under warranty and that we will not be liable for any other expense, injury, loss or damage whether direct or consequential, including but not limited to loss of profits, production, increased cost of operation or spoilage of material arising in connection with the resale or use of, or inability to use, our equipment or products for any purpose except as herein provided. ***Envirocan takes exception to all liquidated damages clauses or penalty clauses should they be called for.***
9. **CONFIDENTIAL INFORMATION:** All information and data herein furnished, relating to price, size, type and design is submitted with the understanding that it is for the buyer's own confidential use and is not to be shown or otherwise made known or available to any third party at any time without Envirocan's written consent.

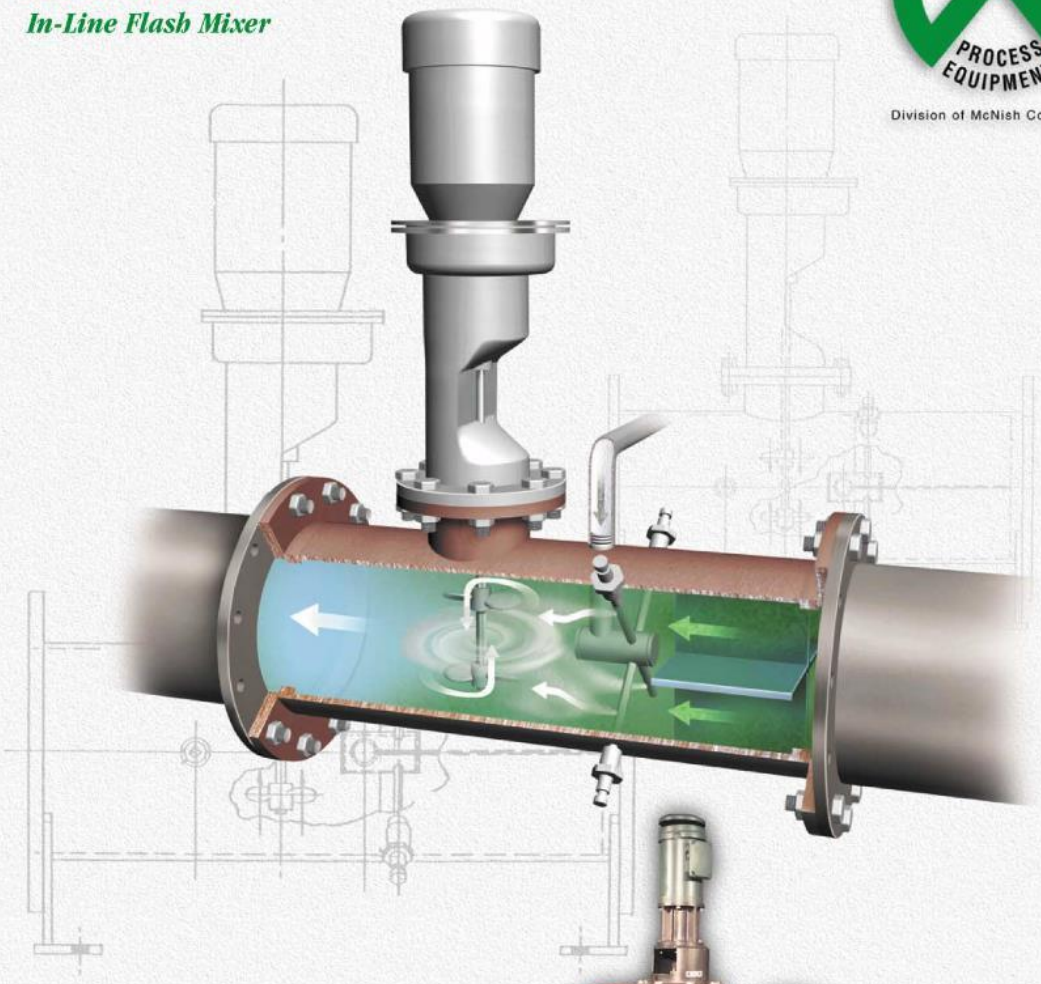
Best regards,

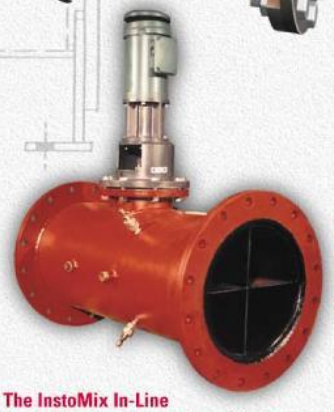
Mike Nelson
131 Whitmore Road, Unit 7
Woodbridge, ON L4L 6E3
Ph: (905) 856-1414
Fax: (905) 856-6401
Cell: (416) 806-3351

InstoMix

In-Line Flash Mixer

WALKER PROCESS EQUIPMENT
Division of McNish Corporation



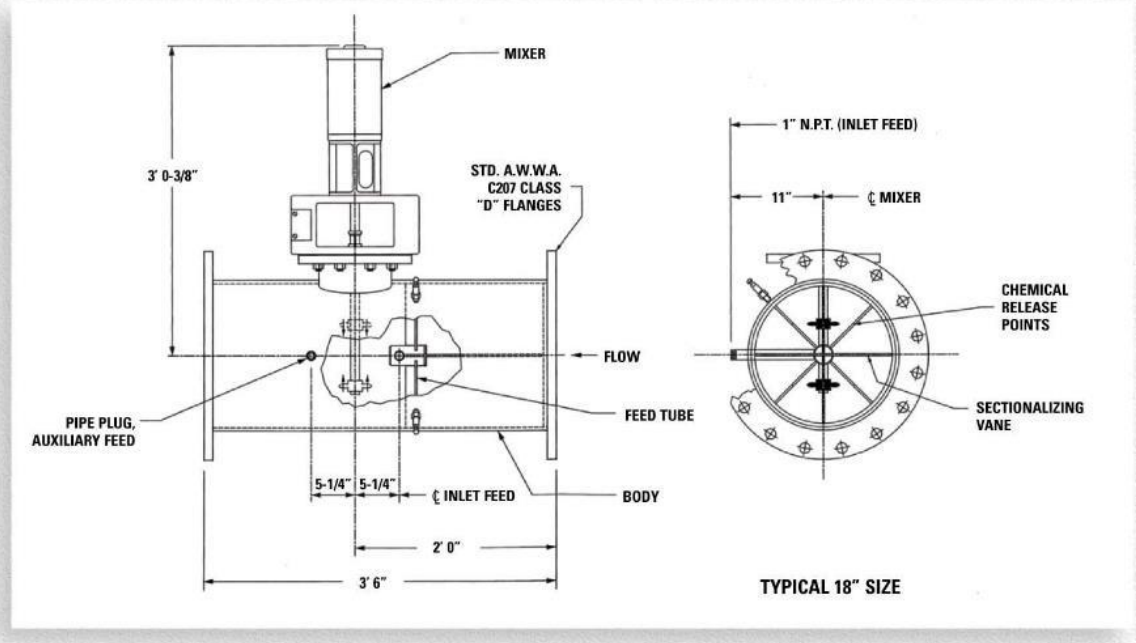


Instantaneous Mixing to Disperse Solutions

The In-Line InstoMix by Walker Process provides high-energy flash mixing to instantaneously (within milliseconds) disperse coagulant and other flocculent solutions into raw water flow.

The InstoMix In-Line Flash Chemical Mixer by Walker Process:

- Efficiently distributes small coagulant flow to large water flow.
- Provides very high G-value for instantaneous flash mixing and high diffusion efficiency.
- Distributes injected solutions within 10 milliseconds.
- Provides a more predictable and settleable floc.
- Reduces overuse of coagulants.
- Incorporates low energy input and low head loss.



Homogeneous, Millisecond Coagulant Blending

InstoMix In-Line Mixers provide continuous, instantaneous blending of coagulant in raw water prior to flocculation. The homogeneous, millisecond blending of coagulant results in optimum floc formation and maximizes chemical economy. Compact in-line units are constructed for flange mounting directly in the pipeline and are equipped with an internal feed manifold designed to distribute solutions uniformly throughout the sectionalized mixer body. The agitator (mixer) can be custom sized to produce a desired G-Value.

InstoMix units are available for 8-inch through 72-inch diameter pipelines.

Sizes - Diameter	8"	12"	18"	24"	30"	36"	48"	60"	72"
Flow Range MGD	1.0-1.8	1.8-4.0	4.0-9.0	8.0-16.0	12.0-25.0	16.0-37.0	33.0-65.0	50.0-100.0	75.0-145.0
Body	Carbon Steel Sch 40 pipe, NSF-Approved epoxy coated interior								
Manifold	316 stainless steel								
Mounting	Horizontal - Flanged Mounted								
Mixer	Direct connected, flange mounted, 316 stainless steel impellers and shaft								

Flash mixing coagulants and other chemicals is necessary because of the minute amounts of solutions added to the relatively large amount of raw water treated. Because a rapid chemical reaction starts the instant alum or other coagulant is blended with raw water, there must be instant diffusion of the coagulant solution or many particles will be missed, resulting in an overall higher turbidity or excessive use of coagulant.

Walker Process Equipment
Division of McNish Corporation
840 North Russell Avenue • Aurora, IL 60506 • Phone: 630-892-7921 • Fax: 630-892-7951
E-mail: walker.process@walker-process.com
www.walker-process.com

Sharpe Mixers
EBARA CORPORATION

Hayward Gordon GROUP | EBARA

QUOTATION

Customer: Moosonee (Ontario)

Date : February 7, 2023
validity: 30 Days
Proposal No. : Q3-73399
Est. Shipment : 18 weeks
>> after drawing approval or release
F.O.B. : Factory
Terms : NET 30 DAYS, OAC

Application :	**Flocculators** — **ON-CENTER MOUNTING**
Design conditions :	Viscosity(cps): 1 , Sp.Grav: 1.00 Temp.: Ambient Pressure: Atmospheric
Tank dimensions :	1800 Wide x 1800 mm long x 3800.0 mm overall height from mixer base to tank floor Tank Volume (cu.mtrs)= 11
Liquid levels:	Design max (from tank floor): 3300mm Min. Liquid Level: 50mm
Equipment :	**N-SERIES HELICAL DRIVE TOP-ENTERING MIXER** Quantity : 4 **Mixer Model # 0.33N1 -32**
Motor :	0.25 Kilowatts, @ 1750 RPM, 3PH, 60Hz, 575 VOLTS TEFC 56C Frame, Motor Furnished by Sharpe , Mounted by Sharpe VFD by other
Mixer Drive :	N1 Parallel Helical Gearbox 32.1:1 Ratio, Rated at 1.33 Kilowatts 1750 / 32.1 = 55 rpm (max)
Mixer mounting :	Mounting Plate Furnished
Wetted Parts :	SS316
Shaft :	38.10 mm Dia.x 2997 mm long from mounting base, turning @ 55 RPM Max. Includes No In-Tank Shaft Coupling
Impellers :	***521 mm min. opening required to install impeller*** 736.6 mm HYF-218 Hydrofoil Impeller 1-piece hub Pumping Down, Turning Clockwise Looking Down
Net Price ea CAN :	***$9,174*** ***Total, (4)mixers= $36698*** *Ship Wt.,each=* 136 kgs

Q1QP-020723

Please address your order to:
Hayward Gordon
5 Brigden Gate
Halton Hills, ON L7G 0A3

Note - This quote is valid for 30 days.
Any order placed as a result of this proposal is subject to Sharpe Mixers Terms and Conditions.

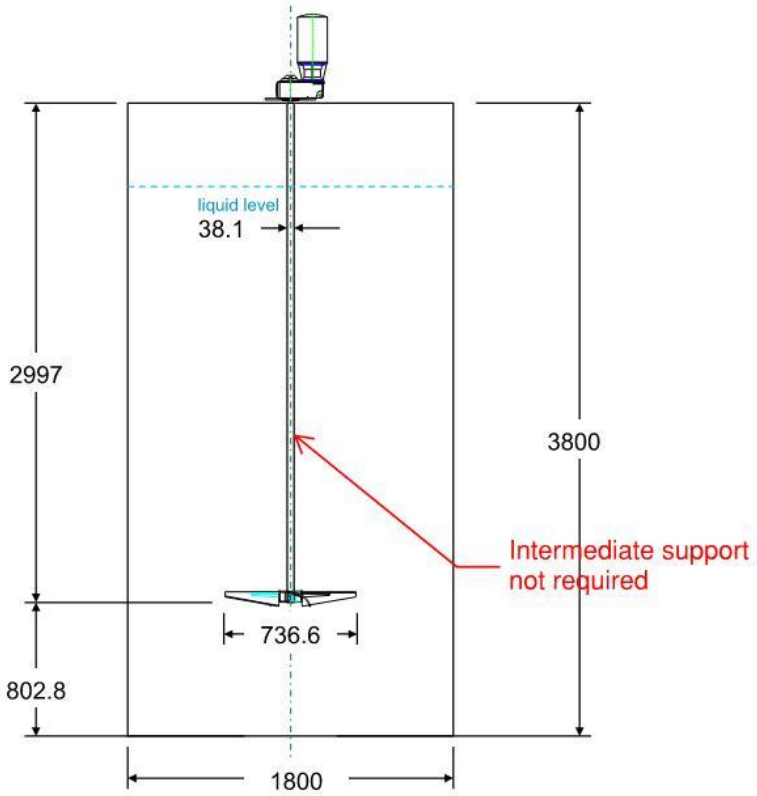
Sharpe Mixers
EBARA CORPORATION
Sharpe Mixers is now and EBARA Corporation Group Company.

Quotation prepared by: Kyle Sides
Sharpe Mixers

2/7/23 12:41 PM

exp.

For reference only; use certified drawings for construction. Dimensions are in mm



NOTES: Tank / Mixer Layout intended for scaled view of in-tank components only. Mixer drive proportions may vary slightly depending on motor type or other options. Please review drawing carefully and inform Sharpe Mixers immediately if any tank dimensions are inaccurate. Drawing generated by Sharpe Mixers Q1QP mixer selection program, Copyright 2005, Seattle, WA.

Mixer weight =	136 kgs	
Design Torque =	659 lbs-in	
Design OHM =	2653 lbs-in	
est. full tank volume =	53298697 gal	*(201758488 L)*
est. volume @ liquid level =	46285711 gal	*(175211318 L)*

Sharpe Mixers
EBARA CORPORATION

TOP ENTERING MIXER / TANK LAYOUT DETAIL

Mixer Model # ***0.33N1 -32*** ***Quantity:*** ***4***

Customer: ***Moosonee (Ontario)*** **Sharpe #** ***Q3-73399***

Application: ***Flocculators*** **Drawing #** ***L3-73399***

206-767-5660 - www.sharpemixers.com

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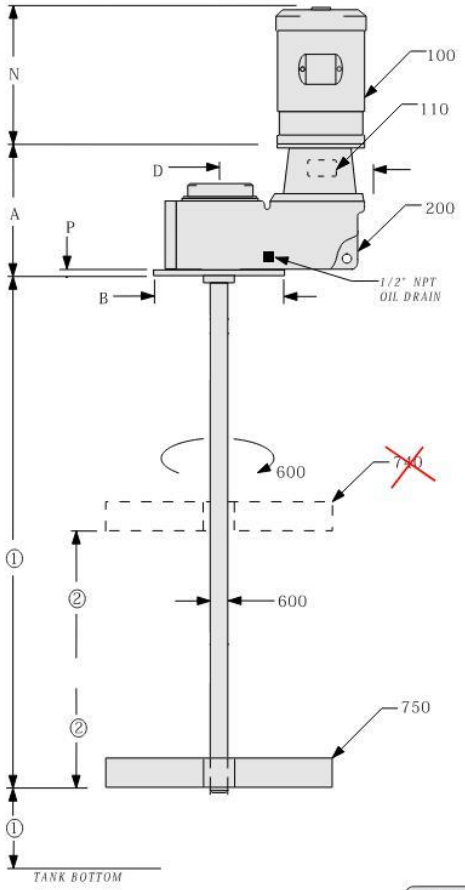
Drawing not to scale. Dimensions are for reference only. Use certified prints for construction. Dimensions in inches.



100 - MOTOR ①

110 - FLEXIBLE MOTOR COUPLING

200 - GEAR REDUCER ①

600 - SHAFT ①

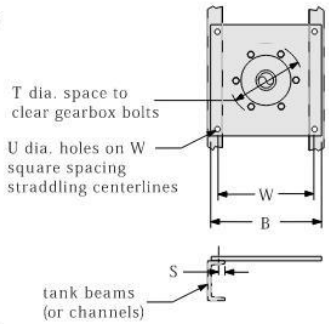
750 - LOWER IMPELLER ①

①Impeller(s), shaft and other details are dependent on specific application and will be described in the Quotation/Data Sheet.

② Items are optional and will be described in the Quotation/Data Sheet if provided

③Basic weight shown in lbs is for mixer drive only, less motor and wetted parts.

MOUNTING DETAIL
PLATE MOUNT
(furnished)



MOTOR DIM'S

HP *	NEMA FRAME	'N'	WT*
1/3 -2	56C	11	37
1-1.5	143TC	11.3	41
1.5-2	145TC	11.3	50
3	182TC	11.8	65
5	184TC	12.8	87
7.5	213TC	15	145
10	215TC	16.5	160
15	254TC	19.6	310
20	256TC	21.3	345
25	284TC	20.3	425
30	286TC	21.8	455
40	324TC	26.5	575
50	326TC	26.5	634

*NEMA frames shown are for 1750 rpm motors. Weights and Outline dimensions (A,B,D,M,N) are approximate.

OVERALL DIMENSIONS

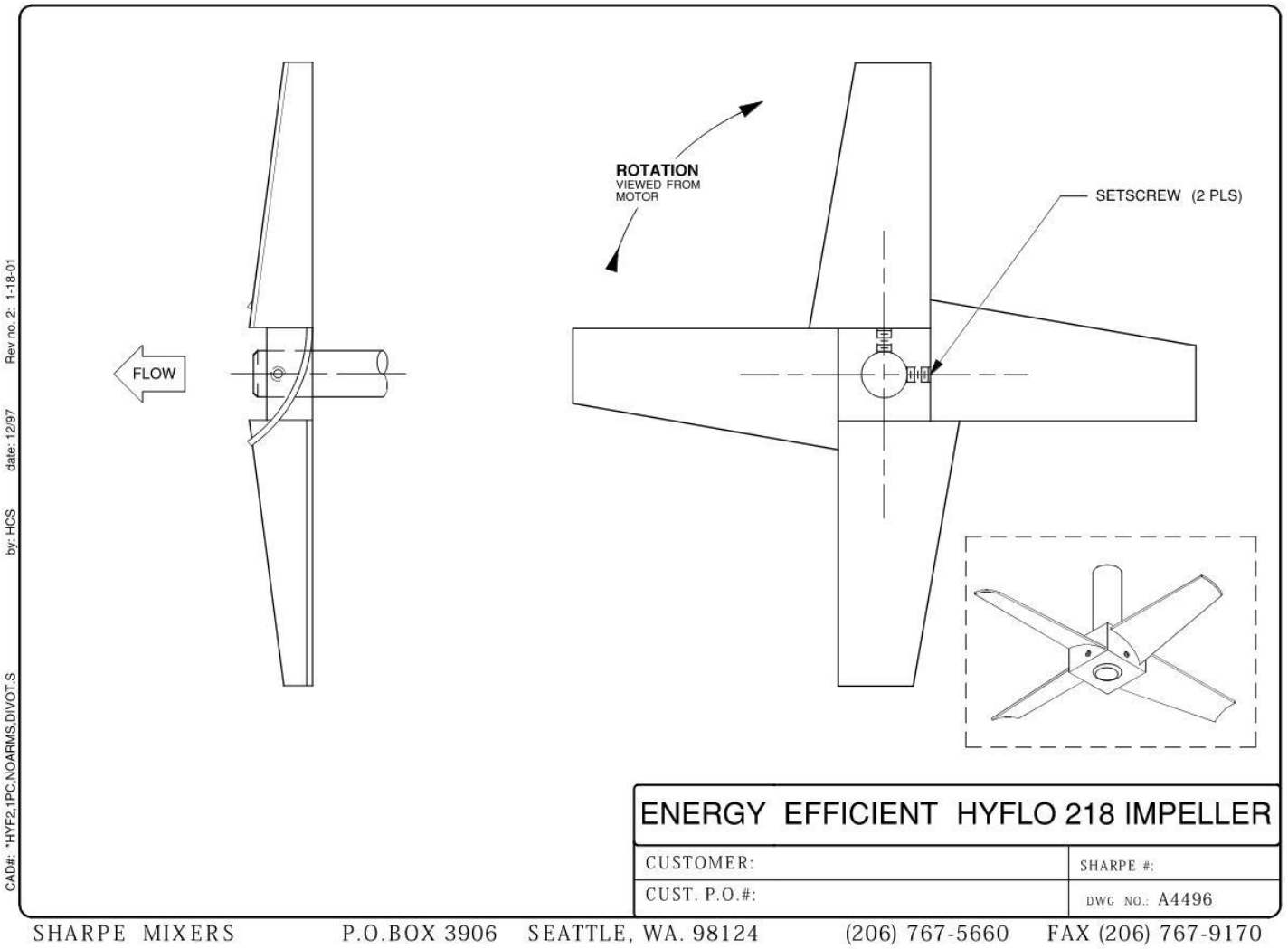
	N1	N2	N3	N4	N5	N6	N7	N8	N9
A (MAX)	10.94	11.77	12.83	15.33	17.23	18.03	21.78	23.49	24.89
B	11	11	12	14	16	18	21	24	30
D	7.95	9.73	11.03	13.03	15	16.1	17.75	20.63	25.95
J (MAX)	5.75	6.25	7	8	9	12.5	12.5	13	15
P	.38	.38	.5	.63	.75	.88	1	1.25	1.5
S	.63	.63	.75	.75	.88	.88	.88	.88	1
T	5.5	6	7.5	8.75	9.5	11.75	13.25	15.5	17.25
U	.43	.43	.56	.56	.68	.88	.94	1.13	1.31
W	9	9	10.5	12	14	16	18	21	27
③ WT	60	90	120	190	270	430	600	850	1400

CADD# N.PLATE.HOLLOW.CFACE.S 6-05

N - SERIES HOLLOW GEARBOX OUTPUT PLATE MOUNT W/ C-FACE MOTOR

DWG NO.: S4617

SHARPE MIXERS P.O. BOX 3906 SEATTLE, WA 98124 FAX (206) 767-9170 (206) 767-5660


ROTATION
VIEWED FROM
MOTOR
SETSCREW (2 PLS)
FLOW
CAD#: *HYF2.1PC.NOARMS.DIVOT.S
by: HCS
date: 12/97
Rev no. 2: 1-18-01
ENERGY EFFICIENT HYFLO 218 IMPELLER
CUSTOMER:
SHARPE #:
CUST. P.O.#:
DWG NO.: A4496
SHARPE MIXERS P.O.BOX 3906 SEATTLE, WA. 98124 (206) 767-5660 FAX (206) 767-9170

TERMS AND CONDITIONS OF SALE

FORMATION OF AGREEMENT

These Terms and Conditions of Sale apply to the purchase of Products, Services, or both, by Buyer from Sharpe Mixers, Inc.(hereinafter referred to as "Seller"), each as identified in Seller's quote. These Terms and Conditions, together with Seller's quote, comprise the entire agreement between the parties (the "Agreement").

Seller's agreement to furnish Product or Services is expressly conditioned on Buyer's agreement to these Terms and Conditions . An order for Products, Services or both, constitutes Buyer's acceptance of these terms and conditions. Seller rejects any terms, conditions, or warranties in Buyer's purchase order or other document or communication that are additional to or differ from those set out in this Agreement, unless set out in writing and signed by Seller's authorized representative.

PRICES **Quotes.** Prices in Seller's quote are valid for 30 days from the date of the quote unless otherwise specified in writing.

Currency. Prices are in the currency specified in Seller's quote. If no currency is specified, prices to buyers located in Canada are in Canadian dollars and prices to all other buyers are in US dollars.

Taxes excluded. Prices do not include any Taxes related to the Products or Services supplied under this Agreement, which are the responsibility of Buyer, unless Buyer presents a waiver or an exemption certificate acceptable to Seller.

PAYMENT **Terms.** Buyer will pay all invoiced amounts in full, without deduction, back charge or set-off, within 30 days from the date of Seller's invoice. Payment is not contingent on Buyer receiving payment from Buyer's customer.

Late Payment. If payment is not made when required, Seller may at its option take one or more of the following actions: (i) treat such failure as a repudiation of all or a portion of the order that has not been fully performed and immediately suspend performance, (ii) continue production and make shipment under reservation of title or a security interest, and demand payment against tender of documents of title; (iii) charge interest at the lesser of 1.5% per month and the maximum rate permitted under applicable law, from the due date until paid, plus Seller's reasonable costs of collection; and (iv) Buyer agrees that Seller may enter the premises where any Products for which Buyer has not paid are located, repossess such Products whatever the mode of their attachment to realty or other property, sell the repossessed Products, apply the proceeds to the overdue payment, and recover any deficiency from Buyer.

DELIVERY, RISK, TITLE

Delivery dates. Delivery dates stated in advance of shipment, including in Seller's quote, are estimates only and are not guaranteed. Seller will not be liable for or penalized as a result of delays in shipment for any cause. Seller reserves the right, upon prior notice to Buyer, to make partial deliveries or partial performance, which may be separately invoiced.

Buyer Delay. If Products cannot be shipped to or received by Buyer when ready because of any cause attributable to Buyer or its other contractors, Seller may store the Products at the sole expense and risk of Buyer; in such case, Seller will invoice Buyer and terms of payment will apply as if delivery had been made on the original delivery date.

Damage/Shortage. Claims for damages or shortages must be made within 5 days after receipt of Products.

CHANGES

Orders accepted by Seller are not subject to change or cancellation by Buyer, except with Seller's written consent. Where Seller authorizes changes (including changes to specifications, and special packaging, tests or inspections in addition to Seller's normal procedures and not set out in Seller's Quote), Seller may charge Buyer reasonable costs of such change.

Seller will make every effort to maintain initial prices throughout the drawing and submittals process. For the avoidance of doubt, in the instance of any change and resubmittal Seller reserves the right to adjust the price in accordance with equity and necessity.

Further, should the Buyer not respond to confirm drawings and submittals in 30 days the initial price quoted may no longer be valid and may be subject to change in accordance with equity and necessity.

INSTALLATION

All Products will be installed by and at the risk and expense of Buyer, unless otherwise specified in Seller's quote or agreed to in writing.

WARRANTY

Seller warrants that during the warranty period:

(a) all Products sold by it to Buyer pursuant to the Agreement, when properly stored, installed, used and maintained by Buyer, will in all material respects, conform to the specifications and be free from defects in materials and workmanship under normal usage; and

(b) the Services performed by Seller will be performed in a good and workmanlike manner in accordance with any mutually agreed specifications.

Warranty Period. The warranty period for Products is one year from date of shipment.

Warranty Claims/Seller's Obligations. A claim must be submitted in writing, within 30 days of discovery, within the warranty period, to give rise to Seller's obligations. Seller's sole liability and Buyer's exclusive remedy for a breach of this warranty is limited to repair or replacement by Seller, in the case of the Product warranty, and re-performance by Seller in the case of the Services warranty. Such repair, replacement or re-performance will not extend the warranty period. Seller may require access to complete and accurate records of operation and maintenance during the warranty period, or the return of defective parts, freight prepaid, before a warranty claim is recognized. Third-party components. Products may contain components from third party manufacturers. Seller will use reasonable commercial efforts to extend to Buyer the benefit of any warranty given by the component manufacturer to Seller where the third party manufacturer permits it to do so.

No other warranties.

All other warranties, representations, terms and conditions (express, implied or statutory) as to quality, condition, description, merchantability, fitness for purpose, compliance with sample, or non-infringement (except implied warranty of title) are expressly excluded to the fullest extent permitted by law.

LIMITATION OF LIABILITY Exclusions. Without limiting the foregoing, Seller will have no liability in respect of:

(i) failure to follow Seller's use restrictions, specifications, recommendations or instructions or any misuse of the Products; (ii) any alteration, modification, repair, or enhancement of the Products by Buyer or any third party without Seller's prior written consent;(iii) any defect in the Product arising from designs, specifications or materials supplied by Buyer; (iv) any shipping, storage or working conditions different than those advised by Buyer after Seller's delivery of Products to Buyer; (v) chemical attack or wear; (vi) normal wear and tear; (vii) accident; (viii) fraud, negligence or wilful misconduct of Buyer or any of its affiliates or representatives; (ix) any Product for which the purchase price has not been paid in full in accordance with the Agreement.

Limitation.

(i) In no event will Seller' liability, in the aggregate, for damages arising out of the use of the Product or Services, or arising under this Agreement, whether in contract, tort (including negligence), or otherwise, to Buyer or any other person exceed the amount paid by Buyer to Seller under the Agreement for the Products or Services to which such claim or damages relates;

(ii) Seller will not be liable for loss of profit or revenues, loss of use of equipment or systems, loss or deferral of production, interruption of business or loss of contract, loss of use, increased operating costs, or claims of Buyer's customers for any of the foregoing, any special, consequential, incidental, indirect, or punitive damages, whether or not foreseeable at the date of Seller starting performance of the Agreement and even if Seller is advised in advance of the possibility of any such loss or damages

INDEMNITY Each party will indemnify the other party from and against claims brought by a third party, on account of personal injury or damage to the third party's tangible property, to the extent caused by the negligence of the indemnifying party in connection with this Agreement. If the injury or damage is caused by joint or concurrent negligence of Buyer and Seller, the loss or expense will be borne by each party in proportion to its degree of negligence. For purposes of Seller's indemnity obligation, no part of a Product is considered third party property, and "third party" does not include Buyer or any subsequent owner of the Products, their subsidiaries, parents, affiliates, agents, successors or assigns, including any operation or maintenance contractor, or their insurer.

EXCUSED PERFORMANCE/FORCE MAJEURE

A party will not be liable in respect of the non-performance of any of its obligations to the extent such performance is prevented by any circumstances beyond its reasonable control including but not limited to, strikes, lock-outs or labour disputes of any kind (whether relating to its own employees or others), fire, flood, explosion, natural catastrophe, military operations, blockade, sabotage, revolution, riot, civil commotion, war or civil war, acts or threats of terrorism. If such an event occurs, the time for performance will be extended by the amount of time lost by reason of the event plus such additional time as may be needed to overcome the effect of the event.

GOVERNING LAW: Unless otherwise agreed to in writing, the laws of the jurisdiction from which Seller ships the Product(s) will govern the interpretation and construction of this Agreement, and the Parties agree to submit to the exclusive jurisdiction of the courts of such jurisdiction.

Waiver. No waiver of any of the provisions of this Agreement will constitute a waiver of any other provision (whether or not similar).

Severability. If any provision of this Agreement is determined to be illegal, invalid or unenforceable, that provision will be severed from this Agreement and the remaining provisions will remain in full force and effect

Assignment/Subcontracting. Seller may assign or novate its rights and obligations under this Agreement, in whole or in part, to any of its affiliates. Seller may subcontract portions of the work to any third party.

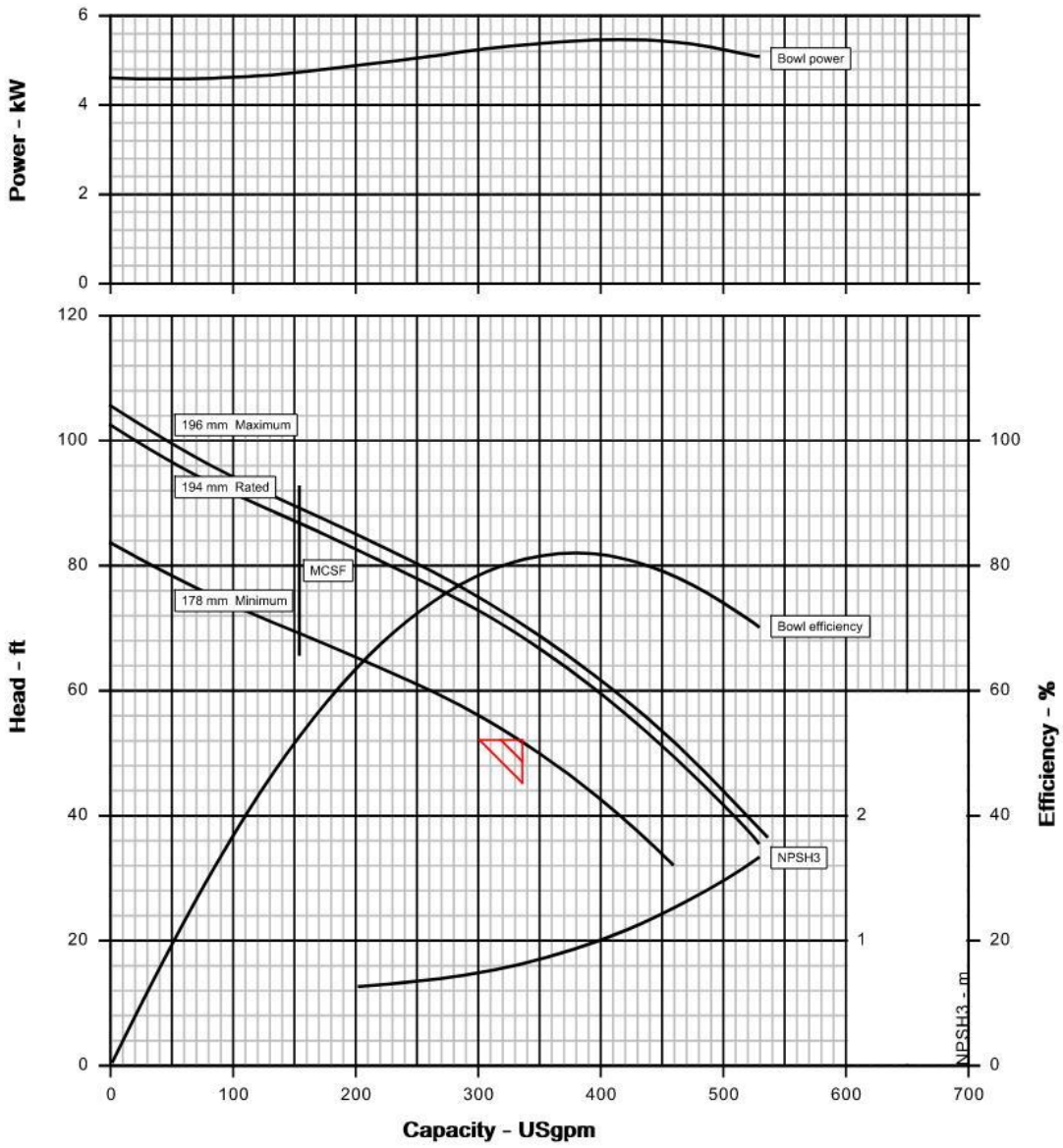
FLOWSERVE

Pump size & type / Stages	: 10EHL	/ 4	
Based on curve no.	: EC-2651		
Impeller diameter	: 194 mm		

Customer	: EXP	Capacity	: 336.0 USgpm
Item number	: LLP 1,2	Head	: 52.00 ft
Service	: Low Lift	Density / Specific gravity	: - / 1.000
Flowserve reference	: 4362909647	Pump speed	: 1,180 rpm
Date	: January 25, 2023	Ns / Nss (per eye)	: 56 / 192 (SI)
		Test tolerance	: ANSI/HI 14.6 Grade 1B

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 68.62 ft corresponds with 52 ft head at discharge flange adjusted for elevation and friction losses.

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FLOWSERVE

Hydraulic Datasheet

Customer	: EXP	Pump / Stages	: 10EHL	/ 4
Customer reference	: -	Based on curve no.	: EC-2651	
Item number	: LLP 1,2	Flowserve reference	: 4362909647	
Service	: Low Lift	Date	: January 25, 2023	

Operating Conditions

Capacity	: 336.0 USgpm
Water capacity (CQ=1.00)	: -
Normal capacity	: -
Rated head @ Discharge flange	: 52.00 ft
Water head (CH=1.00)	: -
NPSH available (NPSHa) @ Low liquid level	: 10.4 m
NPSHa less NPSH margin @ Impeller eye	: -
Maximum suction pressure	: Not applicable
Rated suction pressure	: Not applicable

Liquid

Liquid type	: Other
Liquid description	: Water
Temperature / Specific gravity	: 16 °C / 1.000
Viscosity / Vapor pressure	: 1.00 cP / -

Materials / Specification

Material column code	: B30

Other Requirements

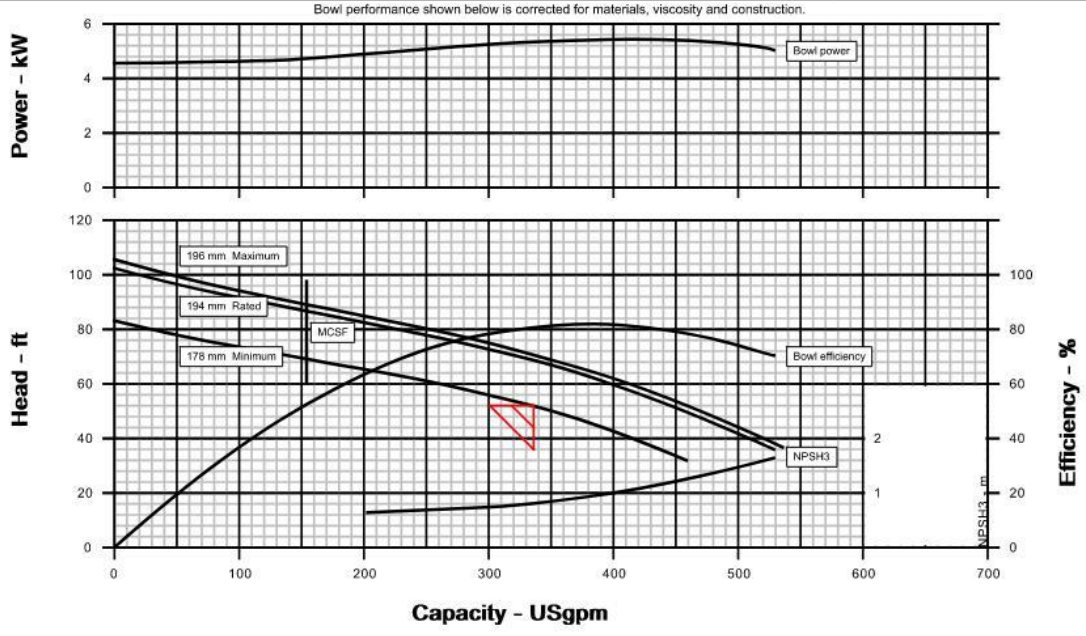
Hydraulic selection : No specification
Construction : NSF 61
Test tolerance : ANSI/HI 14.6 Grade 1B
Driver Sizing : Max Power(MCSF to EOC) using SF
Seal configuration : Packing

Performance

Pump speed	: 1,180 rpm	Impeller diameter	: Rated / Maximum / Minimum
NPSH required (NPSH3) @ Impeller eye	: 0.8 m		: 194 mm / 196 mm / 178 mm
Minimum submergence	: 533 mm	Impeller diameter ratio (rated/max)	: 99.0 %
Hydraulic power	: 4.32 kW	Maximum head at rated diameter	: 102.39 ft
Efficiency (Pump overall / Bowl) (CE=1.00)	: 80.3 % / 81.3 %	Head rise to shut off	: 49.2 %
Power (rated/max)	: 5.38 kW / 5.53 kW	Total head ratio (rated / max) / (max / rated)	: 96.9 % / 103.2 %
Driver power rating	: 7.50 hp / 5.59 kW	Flow at BEP	: 378.3 USgpm
Bowl pressure	: 305.6 kPa.g	Flow as % of BEP	: 88.8 %
(based on shut off @ cut dia/rated SG)		Minimum continuous flow	: 153.2 USgpm
Maximum allowable	: 3,254.3 kPa.g	Rated thrust (at Rated flow)	: 2,222.9 N
Bowl & column hydrotest	: 382.0 kPa.g	Maximum thrust (at Shut off flow)	: 3,089.1 N
Dischg Head Dischg Region MAWP	: 1,206.6 kPa.g	Min thrust - Runout flow / Max Suction	: 1,384.3 N
Ns / Nss (per eye)	: 56 / 192 (SI)	(A negative thrust value indicates an upthrust condition)	

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 68.62 ft corresponds with 52 ft head at discharge flange adjusted for elevation and friction losses.

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exp.

FLOWSERVE

Construction Datasheet

Customer	: EXP	Pump / Stages	: 10EHL	/ 4
Customer reference	: -	Based on curve no.	: EC-2651	
Item number	: LLP 1,2	Flowserve reference	: 4362909647	
Service	: Low Lift	Date	: January 25, 2023	

Construction

Bowl construction / lined	: Flanged - Std Wall / Lined bowls
Impeller type	: Enclosed
Impeller fastening	: Colleted
Suction strainer	: Basket strainer
Column construction	: Threaded
Column flange spec'n	: Taneytown Specification
Column dia (nominal)	: 152 mm
Column pipe length	: 4.09 m
Column section length	: 2,743 mm
Lineshaft brg spacing	: 2,743 mm
Lineshaft diameter	: 25 mm
Lineshaft coupling type	: Threaded coupling
Lineshaft bearings, qty	: 2
Lineshaft construction	: Open
Lineshaft lubrication	: Pumpage
Enclosing tube diameter	: -
Disch size/rating/face	: 6 in / 125 lb ANSI / FF
Pump/driver coupling	: No rigid coupling required
"W" - Cast / Above Grade Discharge	

Materials

Bowl	: Cast Iron A48 CL30
Impeller	: Bronze
Bowl bearing	: Bronze C84400
Bowl shaft	: 416SS A582 Gr 416
Bowl wear ring	: None supplied
Impeller wear ring	: None supplied
Suction strainer	: Galvanized Steel
Column	: Steel A53 Type E GrB
Lineshaft	: Carbon Steel
Lineshaft bearing	: Rubber Buna-N
Lineshaft sleeve	
Discharge head	: Cast Iron A48 CL30
Support plate	: None supplied

Weights (Approx.)

Complete pump	: -
Mounting plate	: -
Driver (net)	: -

Testing

Hydrostatic test	: None
Performance test	: -
NPSH test	: -

Driver Information

Manufacturer	: Flowserve Choice
Power / SF (Req' / Act')	: 7.50 hp / 5.59 kW / 1.15 / -
Vertical shaft type	: Hollow
Hollow shaft coupling	
Driver type	: NEMA Electric Motor
Frame size / Base dia	: -
Enclosure	: -
Duty type	
Efficiency type	
Hazardous area class	: -
Explosion 'T' rating	: -
Volts / Phase / Hz	: 575 / 3 / 60 Hz
Amps-full load/locked rotor	: - / -
Motor starting	: Direct on line (DOL)
Insulation	: -
Temperature rise	: -
Bearings / Lubrication	: - / -
Motor mounted by	: Customer
Motor Thrust rating down/up	: - / -

Seal Information

Arrangement	: Packed Box
Size	: -
Manufacturer / Type	: - / Packing
Material code (Man'f/API)	: - / -
Gland material	: -
Auxiliary seal device	: -
Seal flush plan	: -
Seal flush construction	: -

Paint and Package

Pump paint	: -
Support plate paint	: -
Shipment type	: -

Additional information

Pit / sump depth	: 5.50 m
Pump length mounting surface to bell/strainer bottom	: 5.47 m
Available well diameter	: 2,540 mm
Max dia below mtg surface	: 343 mm

Notes

-

Discharge flange is designed only to bolt up to an ANSI/ASME 125 lb flange but is not fully ANSI/ASME compliant.

-

-

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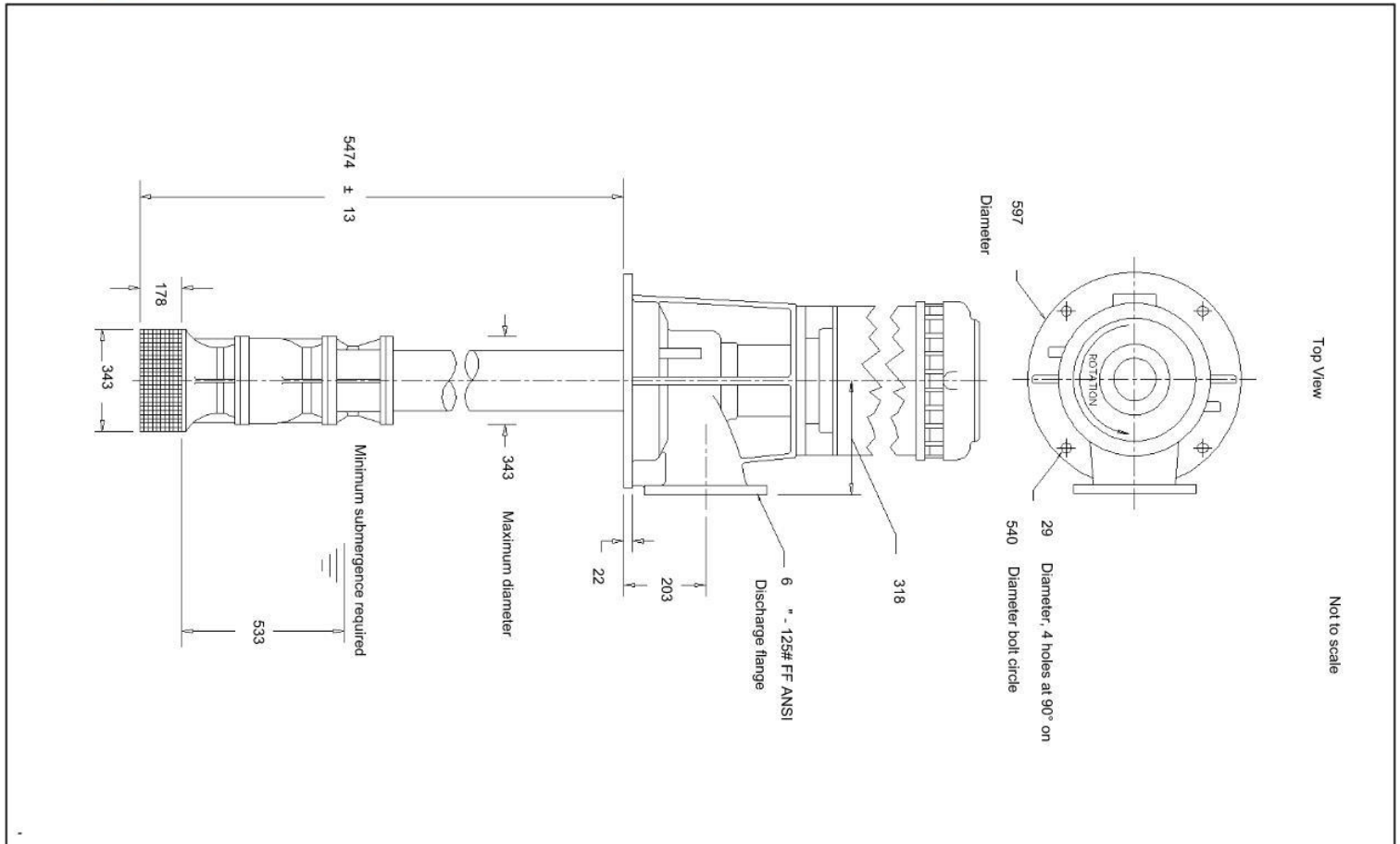
FLOWSERVE

Full Page GA Drawing



-

Customer	: EXP	Pump size & type	: 10EHL	Drawing number	: -
Item number	: LLP 1,2	Pump speed / Stages	: 1,180 rpm / 4	Date	: January 25, 2023
Service	: Low Lift	Flow / Head	: 336.0 USgpm / 52.00 ft	Certified by / Date :	: -
Customer PO #	: -	Driver power / Frame	: 7.50 hp / 5.59 kW / -	Seal type	: Packing
Flowserve reference	: 4362909647	Volts / Phase / Hz	: 575 / 3 / 60 Hz	Seal flush plan	: -

Affinity v2.21.0

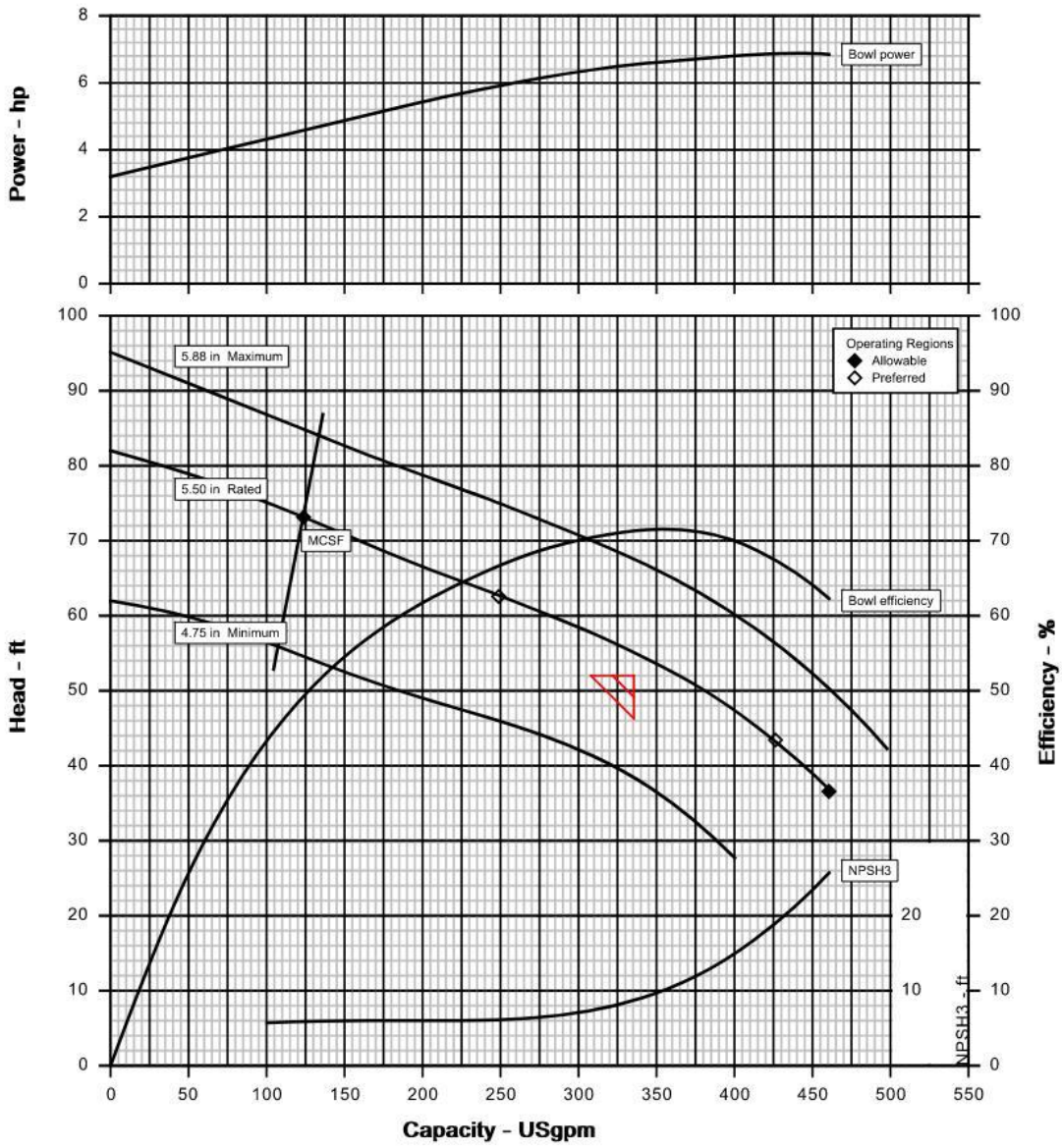
FLOWSERVE

Pump size & type / Stages	: 08ETMH	/ 2	
Based on curve no.	: 88376537		
Impeller diameter	: 5.50 in		

Customer	: -	Capacity	: 336.0 USgpm
Item number	: Raw water pump	Head	: 52.00 ft
Service	: -	Density / Specific gravity	: - / 1.000
Flowserve reference	: 4361100812	Pump speed	: 1,775 rpm
Date	: January 24, 2023	Ns / Nss (per eye)	: 2,606 / 5,320 (US)
		Test tolerance	: ANSI/HI 14.6 Grade 1E

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 55.14 ft corresponds with 52 ft head at discharge flange adjusted for elevation and friction losses.
The customer must provide a minimum NPSHa of 8.6 ft.

Affinity v2.21.0

FLOWSERVE

Hydraulic Datasheet

Customer	: -	Pump / Stages	: 08ETMH	/ 2
Customer reference	: -	Based on curve no.	: 88376537	
Item number	: Raw water pump	Flowserve reference	: 4361100812	
Service	: -	Date	: January 24, 2023	

Operating Conditions

Capacity	: 336.0 USgpm
Water capacity (CQ=1.00)	: -
Normal capacity	: -
Rated head @ Discharge flange	: 52.00 ft
Water head (CH=1.00)	: -
NPSH available (NPSHa) @ Low liquid level	: Ample
NPSHa less NPSH margin @ Impeller eye	: -
Maximum suction pressure	: Not applicable
Rated suction pressure	: Not applicable

Liquid

Liquid type	: Other
Liquid description	: -
Temperature / Specific gravity	: 140 °F / 1.000
Viscosity / Vapor pressure	: 1.00 cSt / -

Materials / Specification

Material column code	: B30

Other Requirements

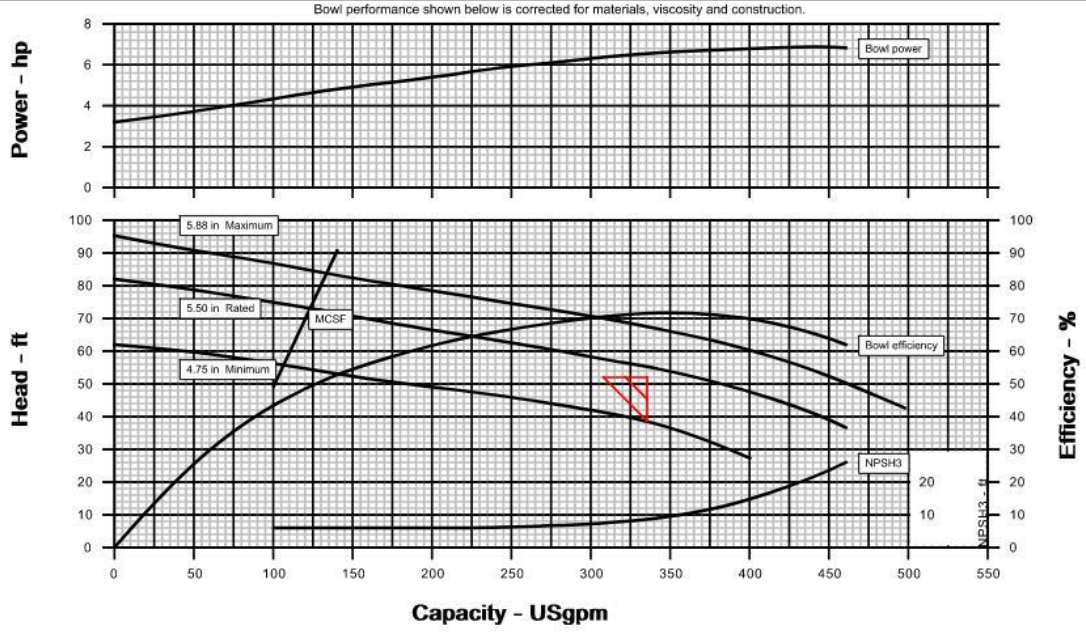
Hydraulic selection : No specification
Construction : No specification
Test tolerance : ANSI/HI 14.6 Grade 1E
Driver Sizing : Max Power(MCSF to EOC) not using SF
Seal configuration : Single Mechanical Seal

Performance

Pump speed	: 1,775 rpm	Impeller diameter	: Rated / Maximum / Minimum
NPSH required (NPSH3) @ Impeller eye	: 8.6 ft		: 5.50 in / 5.88 in / 4.75 in
Minimum submergence	: 18.00 in	Impeller diameter ratio (rated/max)	: 93.5 %
Hydraulic power	: 4.66 hp	Maximum head at rated diameter	: 81.92 ft
Efficiency (Pump overall / Bowl) (CE=1.00)	: 71.2 % / 71.6 %	Head rise to shut off	: 48.6 %
Power (rated/max)	: 6.55 hp / 6.91 hp	Total head ratio (rated / max) / (max / rated)	: 81.5 % / 122.7 %
Driver power rating	: 7.50 hp / 5.59 kW	Flow at BEP	: 355.6 USgpm
Bowl pressure	: 35.5 psig	Flow as % of BEP	: 94.5 %
(based on shut off @ cut dia/rated SG)		Minimum continuous flow	: 123.1 USgpm
Maximum allowable	: 419.0 psig	Rated thrust (at Rated flow)	: 307.8 lbf
Bowl & column hydrotest	: 44.3 psig	Maximum thrust (at Shut off flow)	: 443.6 lbf
Dischg Head Dischg Region MAWP	: 165.0 psig	Min thrust - Runout flow / Max Suction	: 211.6 lbf
Ns / Nss (per eye)	: 2,606 / 5,320 (US)	(A negative thrust value indicates an upthrust condition)	

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 55.14 ft corresponds with 52 ft head at discharge flange adjusted for elevation and friction losses.
The customer must provide a minimum NPSHa of 8.6 ft.

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Construction Datasheet

Customer	: -	Pump / Stages	: 08ETMH / 2
Customer reference	: -	Based on curve no.	: 88376537
Item number	: Raw water pump	Flowserve reference	: 4361100812
Service	: -	Date	: January 24, 2023

Construction

Bowl construction / lined	: Threaded / Lined bowls
Impeller type	: Enclosed
Impeller fastening	: Colleted
Suction strainer	: Basket strainer
Column construction	: Threaded
Column flange spec'n	: Taneytown Specification
Column dia (nominal)	: 6.00 in
Column pipe length	: 0.75 ft
Column section length	: 48.00 in
Lineshaft brg spacing	: 48.00 in
Lineshaft diameter	: 1.25 in
Lineshaft coupling type	: Threaded coupling
Lineshaft bearings, qty	: 1
Lineshaft construction	: Open
Lineshaft lubrication	: Pumpage
Enclosing tube diameter	: -
Disch size/rating/face	: 6 in / 125 lb ANSI / FF
Pump/driver coupling	: No rigid coupling required
"W" - Cast / Above Grade Discharge	

Materials

Bowl	: Cast Iron A48 CL30
Impeller	: Bronze
Bowl bearing	: Bronze C84400
Bowl shaft	: 416SS A582 Gr 416
Bowl wear ring	: None supplied
Impeller wear ring	: None supplied
Suction strainer	: 316SS
Column	: Steel A53 Type E GrB
Lineshaft	: 416 stainless steel
Lineshaft bearing	: Rubber Buna-N
Lineshaft sleeve	
Discharge head	: Cast Iron A48 CL30
Support plate	: Cast Iron A48 CL30

Weights (Approx.)

Complete pump	: -
Mounting plate	: -
Driver (net)	: -

Testing

Hydrostatic test	: None
Performance test	: None
NPSH test	: None

Driver Information

Manufacturer	: (To be determined)
Power / SF (Req' / Act')	: 7.50 hp / 5.59 kW / 1.15 / -
Vertical shaft type	: Hollow
Hollow shaft coupling	
Driver type	: NEMA Electric Motor
Frame size / Base dia	: -
Enclosure	: TEFC
Duty type	
Efficiency type	
Hazardous area class	: -
Explosion 'T' rating	: -
Volts / Phase / Hz	: TBD / TBD / TBD
Amps-full load/locked rotor	: - / -
Motor starting	: Direct on line (DOL)
Insulation	: -
Temperature rise	: -
Bearings / Lubrication	: - / -
Motor mounted by	: Customer
Motor Thrust rating down/up	: - / -

Seal Information

Arrangement	: Single Mechanical Seal
Size	: -
Manufacturer / Type	: Flowserve / ISC2-PX
Material code (Man'f/API)	: 5Z4Z / -
Gland material	: 300SS
Auxiliary seal device	: -
Seal flush plan	: Plan 13
Seal flush construction	: Tube

Paint and Package

Pump paint	: -
Support plate paint	: -
Shipment type	: -

Additional information

Pit / sump depth	: 18.00 ft
Pump length mounting surface to bell/strainer bottom	: 4.37 ft
Available well diameter	: 100.00 in
Max dia below mtg surface	: 9.25 in

Notes

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Discharge flange is designed only to bolt up to an ANSI/ASME 125 lb flange but is not fully ANSI/ASME compliant.

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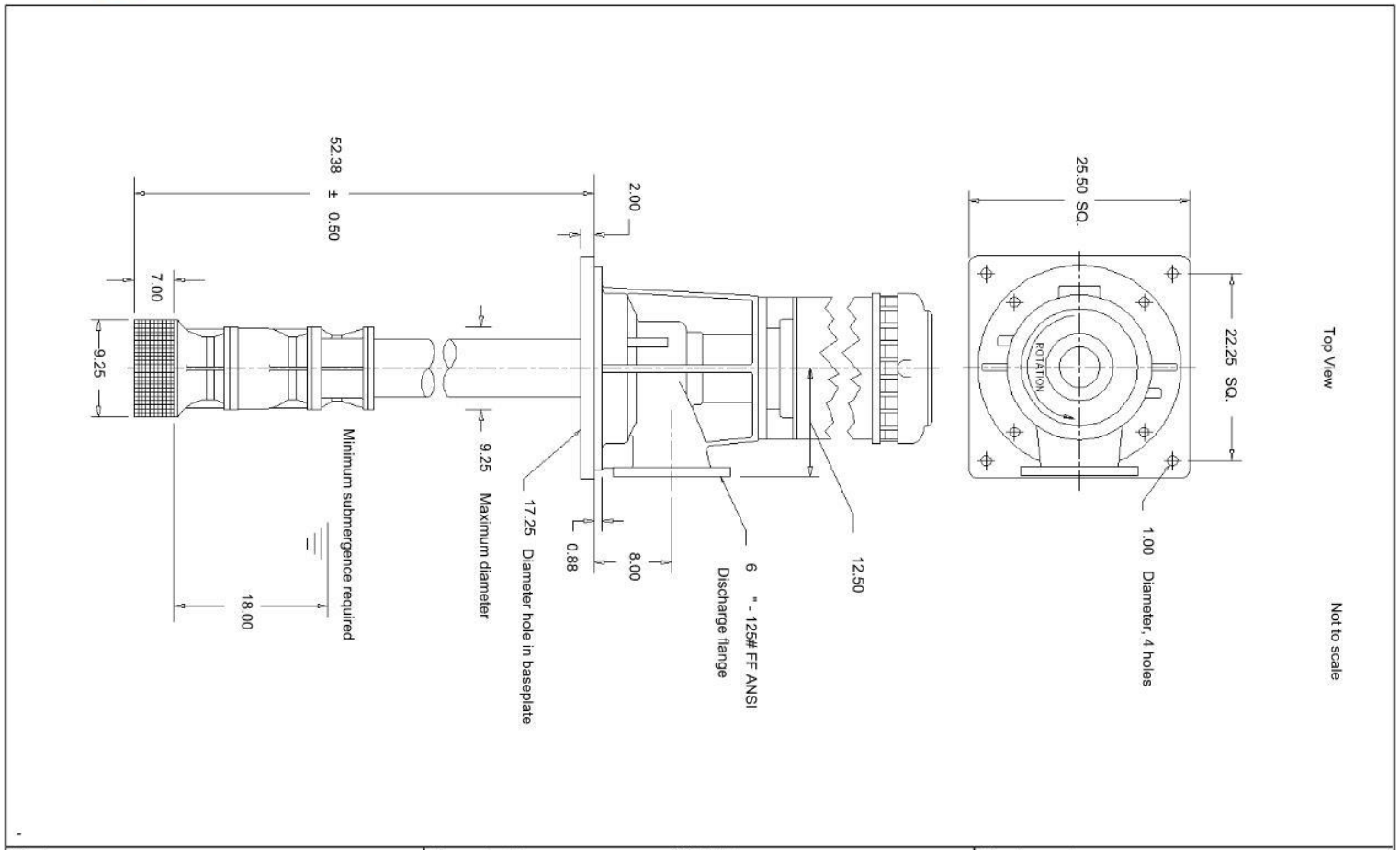
FLOWSERVE

Full Page GA Drawing



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Customer	: -	Pump size & type	: 08ETMH	Drawing number	: -
Item number	: Raw water pump	Pump speed / Stages	: 1,775 rpm / 2	Date	: January 24, 2023
Service	: -	Flow / Head	: 336.0 USgpm / 52.00 ft	Certified by / Date :	: -
Customer PO #	: -	Driver power / Frame	: 7.50 hp / 5.59 kW / -	Seal type	: ISC2-PX
Flowserve reference	: 4361100812	Volts / Phase / Hz	: TBD / TBD / TBD	Seal flush plan	: Plan 13

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