Sunshine Coast Regional District

Request for Proposal

Number: 2237019

for

Engineering Services for Wastewater Treatment Plant Upgrade

Issue Date:

November 28, 2022

Closing Date of

January 4, 2023 at 3:00 PM local time

OPTIONAL SITE MEETING: A optional site meeting will be held on Wednesday December 14, 2022, at 1:30 pm local time at 534 Oceanview Drive, Gibsons. Proponents need to RSVP to this optional site meeting by noon on December 13, 2022, if no RSVPs are received the site meeting will be cancelled.

CONTACT: All enquiries related to this Request for Proposals, including any requests for information and clarification, are to be submitted by **December 15, 2022,** and directed, in writing, to purchasing@scrd.ca, who will respond if time permits with a Q&A on BCBid by **December 20, 2022.** Information obtained from any other source is not official and should not be relied upon. Enquiries and any responses providing new information will be recorded and posted to BC Bid or otherwise distributed to prospective Proponents.

DELIVERY OF PROPOSALS: Proposals must be in English and must be submitted using one of the submission methods below, and must either **(1)** include a copy of this cover page that is signed by an authorized representative of the Proponent or **(2)** be submitted by using the e-bidding key on BC Bid (if applicable), in accordance with the requirements set out in the RFP.

BC Bid Electronic Submission: Proponents may submit an electronic proposal using BC Bid. Proposals must be submitted in accordance with the BC Bid requirements and e-bidding key requirements (found at www.bcbid.ca). Only pre-authorized electronic bidders registered on the BC Bid system can submit an electronic proposal using the BC Bid system. Use of an e-bidding key is effective as a signature.

OR

Hard Copy Submission*:* Proponents must submit **ONE (1)** hard-copies and **ONE (1)** electronic copy on a USB Drive of the proposal. Proposals submitted by hard copy must be submitted by hand or courier to:

Sunshine Coast Regional District
1975 Field Road
Sechelt, BC V7Z 0A8

Regardless of submission method, proposals must be received before Closing Time to be considered.

A proposal is deemed to incorporate the Confirmation of Proponent's Intent to Be Bound below, without alteration.

CONFIRMATION OF PROPONENT'S INTENT TO BE BOUND:

The enclosed proposal is submitted in response to the referenced Request for Proposal, including any Addenda. By submitting a proposal the Proponent agrees to all of the terms and conditions of the RFP including the following:

a) The Proponent has carefully read and examined the entire Request for Proposal;
b) The Proponent has conducted such other investigations as were prudent and reasonable in preparing the proposal; and
c) The Proponent agrees to be bound by the statements and representations made in its proposal.

PROPONENT NAME (please print): _____

NAME OF AUTHORIZED REPRESENTATIVE (please print): _____

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____

DATE: _____

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1. GENERAL TERMS & CONDITIONS

1.1 DEFINITIONS

Throughout this Request for Proposal, the following definitions apply:

"**Addenda**" means all additional information regarding this RFP, including amendments to the RFP;
"**BC Bid**" means the BC Bid website located at www.bcbid.ca;
"**Closing Location**" includes the location or email address for submissions indicated on the cover page of this RFP, or BC Bid, as applicable;
"**Closing Time**" means the closing time and date for this RFP as set out on the cover page of this RFP;
"**Contract**" means the written agreement resulting from the RFP executed by the Regional District and the successful Proponent;
"**Consultant" or** "**Contractor**" means the successful Proponent to the RFP who enters into a Contract with the Regional District;
"**Must**", or "**mandatory**" means a requirement that must be met in order for a proposal to receive consideration;
"**Proponent**" means a person or entity (excluding its parent, subsidiaries or other affiliates) with the legal capacity to contract, that submits a proposal in response to the RFP;
"**Proposal**" means a written response to the RFP that is submitted by a Proponent;
"**Request for Proposals**" or "**RFP**" means the solicitation described in this document, including any attached or referenced appendices, schedules or exhibits and as may be modified in writing from time to time by the Regional District by Addenda; and
"**Should**", "**may**" or "**weighted**" means a requirement having a significant degree of importance to the objectives of the Request for Proposals.
"SCRD", "Regional District", "Organization", "we", "us", and **"our"** mean Sunshine Coast Regional District.

1.2 FORM OF PROPOSAL

This Proposal must be completed in its entirety. Failure to properly complete this Proposal form may cause your Proposal to be rejected. The signing officer must initial all corrections. The Sunshine Coast Regional District (Regional District) reserves the right to permit a correction, clarification or amendment to the Proposal or to correct minor errors and irregularities.

1.3 SUBMISSION OF PROPOSAL

a) Proposals must be submitted before Closing Time to the Closing Location using one of the submission methods set out on the cover page of this RFP. Proposals must not be sent by fax. The Proponent is solely responsible for ensuring that, regardless of submission method selected, the Regional District receives a complete Proposal, including all attachments or enclosures, before the Closing Time.
b) For electronic submissions (BC Bid or email), the following applies:
   (i) The Proponent is solely responsible for ensuring that the complete electronic Proposal, including all attachments, is received before Closing Time;
   (ii) The Regional District limits the maximum size of any single email message to 20MB or less.
   (iii) Proponents should endeavour to submit emailed proposal submissions in a single message and avoid sending multiple email submissions for the same opportunity. If an electronic submission exceeds the applicable maximum single message size, the Proponent may make multiple submissions (BC Bid upload or multiple emails for the same opportunity). Proponents should identify the order and number of emails making up the email proposal submission (e.g. "email 1 of 3, email 2 of 3…");
   (iv) For email proposal submissions sent through multiple emails, the Regional District reserves the right to seek clarification or reject the proposal if the Regional District is unable to determine what documents constitute the complete proposal;
   (v) Attachments must not be compressed or encrypted, must not contain viruses or malware, must not be corrupted, and must be able to be opened using commonly available software (e.g. Adobe Acrobat). Proponents submitting by electronic submission are solely responsible for ensuring that any emails or attachments are not corrupted. The Regional District has no obligation to attempt to remedy any message or attachment that is received corrupted or cannot be viewed. The Regional District may reject proposals that are compressed encrypted, cannot be opened or that contain viruses or malware or corrupted attachments.
c) For BC Bid e-submissions only pre-authorized e-bidders registered on BC Bid can submit electronic bids on BC Bid. BC Bid is a subscription service ($150 per year) and the registration process may take two business days to complete. If using this submission method, Proponents should refer to the BC Bid website or contact BC Bid Helpdesk at 250-387-7301 for more information. An electronic proposal submitted on BC Bid must be submitted using the e-bidding key of an authorized representative of the Proponent. Using the e-bidding key of a subcontractor is not acceptable.
d) For email proposal submissions, including any notices of amendment or withdrawal referred to in Section 1.6, the subject line of the email and any attachment should be clearly marked with the name of the Proponent, the RFP number and the project or program title.
e) The Regional District strongly encourages Proponents using electronic submissions to submit proposals with sufficient time to complete the upload and transmission of the complete proposal and any attachments before Closing Time.
f) The Proponent bears all risk associated with delivering its Proposal by electronic submission, including but not limited to delays in transmission

between the Proponent's computer and the Regional District Electronic Mail System or BC Bid.

g) While the Regional District may allow for email proposal submissions, the Proponent acknowledges that email transmissions are inherently unreliable. The Proponent is solely responsible for ensuring that its complete email proposal submission and all attachments have been received before Closing Time. If the Regional District Electronic Mail System rejects an email proposal submission for any reason, and the Proponent does not successfully resubmit its proposal by the same or other permitted submission method before Closing Time, the Proponent will not be permitted to resubmit its proposal after Closing Time. The Proponent is strongly advised to contact the Regional District Contact immediately to arrange for an alternative submission method if:

(i) the Proponent's email proposal submission is rejected by the Regional District Electronic Mail System; or

(ii) the Proponent does not receive an automated response email from the Regional District confirming receipt of each and every message transmitted, within a half hour of transmission by the Proponent.

An alternate submission method may be made available, at the Regional District's discretion, immediately to arrange for an alternative submission method, and it is the Proponent's sole responsibility for ensuring that a complete proposal (and all attachments) submitted using an approved alternate submission method is received by the Regional District before the Closing Time. The Regional District makes no guarantee that an alternative submission method will be available or that the method available will ensure that a Proponent's proposal is received before Closing Time.

1.4 SIGNATURE REQUIRED

Proposals must be properly signed by an officer, employee or agent having authority to bind the Proponent by that signature.

1.5 CLARIFICATIONS, ADDENDA & MINOR IRREGULARITIES

If any Proponent finds any inconsistencies, errors or omissions in the proposal documents or requires information, clarification of any provision contained therein, they shall submit their query in writing or email, addressed as follows:

Purchasing Division
Sunshine Coast Regional District
1975 Field Road, Sechelt, BC V7Z 0A8

purchasing@scrd.ca

Any interpretation of, addition to, deletions from or any corrections to the proposal documents will be issued as written addendum by the Regional District.

All Addenda will be posted on BC Bid. It is the sole responsibility of the Proponent to check for Addenda on BC Bid. Proponents are strongly encouraged to subscribe to BC Bid's email notification service to receive notices of Addenda.

1.6 WITHDRAWAL OR REVISIONS

Proposals or revisions may be withdrawn by written notice provided such a notice of withdrawal is received prior to the closing date and time. Proposals withdrawn will be returned to the Proponent unopened. Revisions to the proposals already received shall be submitted only by electronic mail, or signed letter. The revision must state only the amount by which a figure is to be increased or decreased, or specific directions as to the exclusions or inclusion of particular words.

1.7 CONDUCT OF THE CONTRACT

Unless otherwise specified within this document, any queries regarding this Request for Proposal are to be directed to purchasing@scrd.ca. No other verbal or written instruction or information shall be relied upon by the Bidder, nor will they be binding upon the Regional District.

1.8 CONFLICT OF INTEREST/NO LOBBYING

(a) A Proponent may be disqualified if the Proponent's current or past corporate or other interests, or those of a proposed subcontractor, may, in the Regional District's opinion, give rise to an actual or potential conflict of interest in connection with the services described in the RFP. This includes, but is not limited to, involvement by a Proponent in the preparation of the RFP or a relationship with any employee, contractor or representative of the Regional District involved in preparation of the RFP, participating on the evaluation committee or in the administration of the Contract. If a Proponent is in doubt as to whether there might be a conflict of interest, the Proponent should consult with the Regional District Contact prior to submitting a proposal. By submitting a proposal, the Proponent represents that it is not aware of any circumstances that would give rise to a conflict of interest that is actual or potential, in respect of the RFP.

(b) A Proponent must not attempt to influence the outcome of the RFP process by engaging in lobbying activities. Any attempt by the Proponent to communicate, for this purpose directly or indirectly with any employee, contractor or representative of the Regional District, including members of the evaluation committee and any elected officials of the Regional District, or with the media, may result in disqualification of the Proponent.

1.9 CONTRACT

By submitting a proposal, the Proponent agrees that should its proposal be successful the Proponent will enter into a Contract with the Regional District on substantially the same terms and Conditions set out in https://www.scrd.ca/go/terms and such other terms and

conditions to be finalized to the satisfaction of the Regional District, if applicable.

1.10 SUSTAINABLE PROCUREMENT

The Regional District adheres to its sustainable consideration factors. Proposals will be considered not only on the total cost of services, but Proposals that addresses the environment and social factors.

1.11 INVOICING AND PAYMENT

Unless otherwise agreed, the Regional District payment terms are Net 30 days following receipt of services or approved invoices, whichever is later. Original invoices are to be forwarded to the accounts payable department of the Regional District. The purchase order number assigned by the Regional District must be stated on the invoice otherwise payment may be delayed.

1.12 PRICING, CURRENCY AND TAXES

Offered prices are to be attached as a price schedule in Canadian dollars with taxes stated separately when applicable.

1.13 IRREVOCABLE OFFER

This Proposal must be irrevocable for 90 days from the Proposal closing date and time.

1.14 TIME IS OF THE ESSENCE

Time shall be of the essence in this contract.

1.15 ASSIGNMENT

The Proponent will not, without written consent of the Regional District, assign or transfer this contract or any part thereof.

1.16 OWNERSHIP OF DOCUMENTS & FREEDOM OF INFORMATION

All documents submitted in response to this Request for Proposal shall become the property of the Regional District and as such will be subject to the disclosure provisions of the *Freedom of Information and Protection of Privacy Act* and any requirement for disclosure of all or a part of a Proposal under that Act.

The requirement for confidentiality shall not apply to any Proposal that is incorporated into a Contract for the Work. Further, the Regional District may disclose the top scoring proponent's aggregate pricing to the Regional District Board at a public meeting, when making a recommendation for the award of the Contract.

For more information on the application of the Act, go to http://www.cio.gov.bc.ca/cio/priv_leg/index.page.

1.17 AWARD OF CONTRACT

The Purchasing Policy at the Regional District offers contracts to businesses through an open, fair and consistent competitive bidding process. This ensures that the Regional District will receive the best overall value for the goods and services it requires. The Regional District reserves the right to cancel, award all or part of the scope of work described in this document to a single Proponent or may split the award with multiple Proponents.

All awards are subject to Board approval that meets the needs as determined by the Board. The Regional District, in receipt of a submission from a Proponent, may in its sole discretion consider the Proponent to have accepted the terms and conditions herein, except those expressly excluded or changed by the Proponent in writing.

The RFP shall not be construed as an agreement to purchase goods or services. The lowest priced or any proposal will not necessarily be accepted. The RFP does not commit the Regional District in any way to award a contract and that no legal relationship or obligation regarding the procurement of any good or service will be created between Regional District and the proponent unless and until Regional District and the proponent execute a written agreement for the Deliverables

1.18 COST OF PROPOSAL

The Proponent acknowledges and agrees that the Regional District will not be responsible for any costs, expenses, losses, damage or liability incurred by the Proponent as a result of or arising out submitting a Proposal for the proposed contract or the Regional District's acceptance or non-acceptance of their proposal. Further, except as expressly and specifically permitted herein, no Proponent shall have any claim for any compensation of any kind whatsoever, as a result of participating in this RFP, and by submitting a proposal each Proponent shall be deemed to have agreed that it has no claim.

1.19 PROPONENT'S RESPONSIBILITY

It is the Proponent's responsibility to ensure that the terms of reference contained herein are fully understood and to obtain any further information required for this proposal call on its own initiative. The Regional District reserves the right to share, with all proponents, all questions and answers related to this bid call.

1.20 EVALUATIONS

Proposals will be evaluated in private, including proposals that were opened and read in public, if applicable. Proposals will be assessed in accordance with the evaluation criteria.

If only one Proposal is received, the Regional District reserves the right to open the Proposal in private or if the total bid price exceeds the estimated budget for the Contract, the Regional District may cancel and re-tender, accept, not accept and cancel or re-scope the Work seeking a better response, with or without any substantive changes being made to the solicitation documents. If more than one Proposal is received from the same Proponent, the last Proposal received, as determined by the Regional District, will be the only Proposal considered.

1.21 ACCEPTANCE OF TERMS

The submission of the Proposal constitutes the agreement of the Proponent that all of the terms and conditions of the RFP are accepted by the Proponent and incorporated in its Proposal, except those conditions and provisions which are expressly excluded and clearly stated as excluded by the Proponent's proposal.

1.22 MANDATORY REQUIREMENTS

Proposals not clearly demonstrating that they meet the mandatory requirements will receive no further consideration during the evaluation process.

1.23 INSURANCE & WCB

The Proponent shall obtain and continuously hold for the term of the contract, insurance coverage with the Regional District Listed as "Additional Insured" the minimum limits of not less than those stated below:

(a) Commercial General Liability – not less than $2,000,000 per occurrence
(b) Motor Vehicle Insurance, including Bodily Injury and Property Damage in an amount no less than $2,000,000 per accident from the Insurance Corporation of British Columbia on any licensed motor vehicles of any kind used to carry out the Work.
(c) Error & Omissions Insurance – not less than $2,000,000 per occurrence
(d) A provision requiring the Insurer to give the Owners a minimum of 30 days' notice of cancellation or lapsing or any material change in the insurance policy;

The Proponent must comply with all applicable laws and bylaws within the jurisdiction of the work. The Proponent must further comply with all conditions and safety regulations of the Workers' Compensation Act of British Columbia and must be in good standing during the tern of any contract entered into from this process.

1.24 COLLUSION

Except otherwise specified or as arising by reason of the provisions of these documents, no person, or corporation, other than the Proponent has or will have any interest or share in this proposal or in the proposal contract which may be completed in respect thereof. There is no collusion or arrangement between the Proponent and any other actual or prospective Proponent in connection with proposals submitted for this project and the Proponent has no knowledge of the context of other proposals and has no comparison of figures or agreement or arrangement, express or implied, with any other party in connection with the making of the proposal.

1.25 CONFLICT OF INTEREST

Proponents shall disclose in its Proposal any actual or potential conflict of interest and existing business relationship it may have with the Regional District, its elected or appointed officials or employees.

1.26 LIABILITY FOR ERRORS

While the Regional District has used considerable efforts to ensure an acute representation of information in these bid documents, the information contained is supplied solely as a guideline for Proponents. The information is not guaranteed or warranted to be accurate by the Regional District nor is it necessarily comprehensive or exhaustive.

1.27 TRADE AGREEMENTS

This RFP is covered by trade agreements between the Regional District and other jurisdictions, including the following:

a) Canadian Free Trade Agreement; and
b) New West Partnership Trade Agreement.

1.28 LAW

This contract and any resultant award shall be governed by and construed in accordance with the laws of the Province of British Columbia, which shall be deemed the proper law thereof.

1.29 REPRISAL CLAUSE

Tenders will not be accepted by the Regional District from any person, corporation, or other legal entity (the "Party") if the Party, or any officer or director of a corporate Party, is, or has been within a period of two years prior to the tender closing date, engaged either directly or indirectly through another corporation or legal entity in a legal proceeding initiated in any court against the Regional District in relation to any contract with, or works or services provided to, the Regional District; and any such Party is not eligible to submit a tender.

1.30 FORCE MAJEURE (ACT OF GOD)

Neither party shall be liable for any failure of or delay in the performance of this Agreement for the period that such failure or delay is due to causes beyond its reasonable control including but not limited to acts of God, war, strikes or labour disputes, embargoes, government orders or any other force majeure event. The Regional District may terminate the Contract by notice if the event lasts for longer than 30 days.

1.31 CONFIDENTIAL INFORMATION OF PROPONENT

A proponent should identify any information in its proposal or any accompanying documentation supplied in confidence for which confidentiality is to be maintained by Regional District. The confidentiality of such information will be maintained by Regional District, except the total proposed value, which must be publicly released for all proposals, or otherwise required by the Freedom of Information and Protection of Privacy Act ("FOIPPA"), law or by order of a court or tribunal. Proponents are advised that their proposals will, as necessary, be disclosed, on a confidential basis, to advisers retained by Regional District to advise or assist with the RFP process, including the evaluation of proposals. If a proponent has any questions about the

collection and use of personal information pursuant to this RFP, questions are to be submitted to the RFP Contact.

1.32 DISPUTE RESOLUTION

All unresolved disputes arising out of or in connection with this Proposal or in respect of any contractual relationship associated therewith or derived therewith shall be referred to and finally resolved by arbitration as prescribed by Mediate BC services pursuant to its rules, unless otherwise mutually agreed between the parties.

1.33 DEBRIEFING

At the conclusion of the RFP process, all Proponents will be notified. Proponents may request a debriefing meeting with the Regional District.

2. INTRODUCTION

2.1 Purpose

The Regional District requests proposals from qualified Consultants to provide engineering services for the design of wastewater collection and treatment system improvements to reduce infiltration and inflow and bring the Woodcreek Park Wastewater Treatment Plant (WWTP) operation, effluent quality and discharge system into regulatory compliance.

3. SITUATION/OVERVIEW

3.1 Background

The WWTP was constructed in 1999 and services 73 single family homes in the Woodcreek Park neighbourhood located within the Regional District's Electoral Area E, west of Gibsons, BC. The WWTP is regulated by permit under the Provincial Environmental Management Act (see Appendix A for permitted discharge criteria), and consists of two 122 m^3 septic tanks, an enclosed pump house, a recirculating sand filter (RSF), and disposal field (see Appendix B for Record Drawings). The original headworks bar screen has been removed and the aeriation system is not operational. The RSF does not appear to be functioning to specifications due to a combination of short circuiting and plugging of the media.

In 2019 the Regional District retained MSR Solutions Inc. to provide final design and tendering services for the installation of a new recirculating geotextile filter system and reconstructing the sand filter to allow rotation between treatment systems, other related site improvements, and electrical and instrumentation/control improvements. During the filter system preliminary design and investigation, MSR identified additional improvements were required to provide a fully integrated and operational treatment system. The additional improvements include upgrades to the headworks and primary treatment tanks and several deficiencies within the sewer collection conveyance system that contributes to high infiltration and inflow. The required additional improvements significantly increased the project scope necessitating this expanded RFP for engineering services.

3.2 Project Objectives

3.2.1 Phase 2 – Final Design and Issued for Tendering Services

The Consultant shall carry out a validation review of MSR's Design Report dated October 13, 2020 and draft tender specifications (see Appendix C), and provide engineering design, tender specifications and drawings to improve the WWTP and collection system to industry operational and quality standards, and meet all regulatory requirements.

The existing collection and treatment system is required to always remain operational. Any proposed service interruptions and/or system shutdowns are to be requested to and approved by the Regional District and communicated well in advance to system users.

3.3 Scope

The scope of services required from the Consultant for this project will consist of the following categories of work:

<u>Current Scope of Work</u>

- Detailed Final Design
- Updating, finalization and issuance for construction ready Tender specifications, drawings and tender package preparation.

Tentative Future Scope –Pending Available Budget

- Construction Management Services for Future Budgeting Purposes Only
- Post Construction Engineering Services for Future Budgeting Purposes Only

Under the current scope of work, the Consultant, at minimum, will:

i) Review all design, construction, operation and maintenance records available from the Regional District (including review of existing collection system CCTV inspection information) combined with BC One Call for other utility services within the collection system and treatment plant corridor.
ii) Carry out a validation review of the MSR (2020) report and recommendations.
iii) Conduct any additional field work to complete an engineering review and condition assessment of the existing WWTP's conveyance system and entire wastewater treatment system including preliminary and primary treatment, electrical system and controls.
iv) Prepare detailed design and tender specifications for equipment supply and construction, with due consideration to safety, operation and maintenance requirements recognizing the Regional District's limited resources, while optimizing life cycle costs.
v) Prepare a Class B project cost estimate for budgeting purposes.

The Consultant shall prepare a technical memo summarizing the condition assessment and providing recommendations for improvements to the collection and treatment systems required to meet industry best practices and regulatory requirements. The Technical Memorandum shall also include due consideration to the requirements stipulated in the Investing in Canada Infrastructure Program (ICIP) grant agreement (see Appendix D for excerpt).

The Regional District is not limiting design solutions to the recommendations included in the MSR report, and Proponents are encouraged to explore alternative replacement options and include them in their written submissions to the Regional District.

The Construction Management Services and Post Construction Engineering Services will not be awarded as part of this scope of work, as completion of the construction phase of this project is dependent on future budget approval. The Proponent shall provide a detailed estimate of costs for performing these services which will be included in the budget proposal for the construction phase of this project, which will be brought forward to the Regional District Board for budget adoption. If the construction budget receives Board approval, the Regional District may award the Construction Management Services and Post Construction Engineering Services based on the estimates provided.

3.3.1 Detailed Design Services

Following Regional District review and approval of the technical memorandum and recommendations, the Consultant shall produce detailed design drawings and tender specifications for tendering and construction purposes.

The specifications shall be in the Canadian Construction Documents Committee (CCDC 2), most current version, format. The drawings shall be signed and sealed by a Professional Engineer in good standing with Engineers and Geoscientists British Columbia (EGBC) and submitted to the Ministry of Environment and Climate Change (MOECC) for approval.

The Consultant shall include a memorandum outlining how the design addresses the conditions stipulated in the MOECCS grant agreement and respond to enquiries and complete drawing revisions as necessary to satisfy MOECC and Regional District requirements.

Design drawings and construction cost estimates shall be submitted for Regional District review and comments at 30%, 60% and 90% completion stages. Proponents shall include provisions to host design review meetings for each stage, as well as one community public meeting to present the design and address questions. The construction cost estimate accuracy shall match the stage of design, ending with a Class B estimate at 90% design stage.

3.3.2 Construction Tendering Services –

The Consultant shall provide final issued for tender contract documents. The format of the construction tendering specifications shall be in the format of the CCDC2, most current version.

The Construction Tendering duties would include at minimum:

i) Defining scope of work and contractor's responsibilities
ii) Responding to technical inquiries from interested bidders
iii) Reviewing bid packages for completeness and qualification
iv) Preparation and completion of the complete Issued for Tender contract documents

3.3.3 Construction Management Services – Cost Estimate Only

While the construction phase will not be awarded at this time, the Proponent shall provide a cost estimate for Construction Management engineering services. The cost estimate for Construction Management services will be used to form the construction budget for the project, and the Regional District may choose to award this work to the Consultant if the construction budget is approved.

If awarded, the Construction Management duties would include at minimum:

i) Initiating kick-off meeting with contractor and Regional District
ii) Conducting at least 6 site meetings with contractor and Regional District
iii) Construction inspection as required
iv) Change order review and recommendation
v) Progress draw review and approval

3.3.4 Post Construction Engineering Services – Cost Estimate Only

While the post construction phase will not be awarded at this time, the Proponent shall provide a cost estimate for Post Construction engineering services. The cost estimate for Post Construction engineering services will be used to form the construction budget for the project, and the Regional District may choose to award this work to the Consultant if the construction budget is approved.

If awarded, the Post Construction duties would include at minimum:

i) Hazard and Operability Analysis and preparation of any required safe work procedures;
ii) Preparation of Operation and Maintenance documentation;
iii) System commissioning coordination and oversight; and
iv) Preparation and certification of record drawings, in electronic format, AutoCAD Civil 2018 or newer version.

3.3.5 Environmental Requirements

The proposed Woodcreek Park WWTP's conveyance system are to be designed and constructed to satisfy MOECCS regulatory requirements.

If the Construction Management Services scope is awarded, the Proponent will be responsible for ensuring that the contractor completes the work in compliance with all relevant environmental regulations.

3.3.6 PROJECT SCHEDULE

The tentative project schedule is as follows:

- Contract Issued – January 27, 2022
- System Review and Selection – March 2023
- 30% Design Package – April 2023
- 90% and Final Design Package – June 2023

4. CONTRACT

4.1 General Contract Terms and Conditions

Proponents should review carefully the terms and conditions set out in the General Service Contract, including the Schedules. The General Contract terms can be found at: https://www.scrd.ca/go/terms

4.2 Service Requirements

The Consultant shall provide detailed design and tender specifications to improve the WWTP to meet regulatory requirements and implement collection system infiltration and inflow reduction improvements that reduces influent flow rates to best practices levels.

The Consultant shall:

- Review all design, construction, operation and maintenance, and regulatory reporting records available from the Regional District combined with BC One Call for other utility services within the collection system and treatment plant corridor.
- Conduct site visit(s) to review, examine and document the existing treatment plant, collection system and ancillary equipment.
- Conduct a validation review of the 2020 MSR design report.
- Provide a technical memorandum outlining recommended treatment system process, design and equipment to meet safety, operator, maintenance and regulatory requirements.
- Prepare a technical memorandum summarizing the collection system condition assessment with recommended inflow and infiltration reduction improvements to deficient collection system infrastructure.
- Prepare detailed design drawings for the collection system and WWTP improvements.
- Carry out design reviews with Regional District staff at 30%, 60% and 90% design stages.
- Present the design to the user community at one evening public meeting. Venue and community engagement will be provided by the Regional District.
- Provide interim improvement recommendations that can be completed by operations staff prior to construction to meet permit requirements.
- Prepare construction cost estimates including equipment supply costs at each design review stage, with Class B estimate at 90% design stage for budgetary purposes.
- Prepare application for a Permit Amendment under the Environmental Management Act for the proposed works to the MOECCS for submission by the Regional District.
- Provide draft final and final construction tender drawings and specifications in CCDC2 format.
- Prepare and provide minutes of all project meetings.
- Provide provisional pricing for engineering services during construction, and completion/commissioning works.

5. REQUIREMENTS

In order for a proposal to be considered, a Proponent must clearly demonstrate that they meet the mandatory requirements set out in Section 7.1 (Mandatory Criteria) of the RFP.

This section includes "Response Guidelines" which are intended to assist Proponents in the development of their proposals in respect of the weighted criteria set out in Section 7.2 of the RFP. The Response Guidelines are not intended to be comprehensive. Proponents should use their own judgement in determining what information to provide to demonstrate that the Proponent meets or exceeds the Regional District's expectations.

Please address each of the following items in your proposal in the order presented. Proponents may find it helpful to use the individual Response Guidelines as headings for proposal responses.

5.1 Capabilities

5.1.1 Qualifications

The Proponent must have a P. Eng registered within British Columbia on the project team. Proponent should provide CVs for their project team and their associated roles.

5.1.2 Relevant Experience

The Proponent and any subcontractors of the Proponent included in its proposal shall have a minimum of 5 years within the last 10 years providing services of a similar scope and complexity. Similar scope and complexity is defined as the following:

- Proficiency in providing wastewater treatment and collection system process and design engineering services,
- Proficiency and accuracy in providing detailed and comprehensive construction specifications in the CCDC2 format.
- Proficiency and accuracy in providing Autocad Civil drawings.

5.1.3 References

Proponents need to provide a minimum of 3 references (i.e. names and contact information) of individuals who can verify the quality of work provided specific to the relevant experience of the Proponent and of any subcontractors named in the proposal. References from the Proponent's own organization or from named subcontractors are not acceptable.

The Regional District reserves the right to seek additional references independent of those supplied by the Proponent, including internal references in relation to the Proponent's and any subcontractor's performance under any past or current contracts with the Regional District or other verifications as are deemed necessary by it to verify the information contained in the proposal and to confirm the suitability of the Proponent.

5.2 Sustainable Social Procurement

A factor in the Regional District evaluation process is sustainable social procurement and the evaluation of proposals will take this into consideration.

As part of any submission the Proponent is encouraged to identify how they may contribute to the following key social, employment and economical goals, but not limited to the following:

a) Contribute to a stronger local economy by:
   - promoting a Living Wage
   - Using fair employment practices;
   - Increase training and apprenticeship opportunities;

b) Local expertise knowledge by:
    a. Being locally owned;
    b. Utilization of local subcontractors;
c) Environmental Cost of Ownership;
d) Energy efficient products;
e) Minimal or environmental friendly use of packing materials; and
f) Reducing hazardous materials (toxics and ozone depleting substances).

5.3 Approach

The Proponent shall provide a detailed summary of the activities it intends to include in the delivery of this project. The Proponent shall provide a detailed project schedule summarizing all the activities and durations required in order to complete the project within the specified schedule end date. The schedule shall include dependent activities and inter dependencies. The critical path shall also be provided as well.

5.4 Price

Proponents need to submit a fee proposal that sets out the separate costs of each project described as well as an all-inclusive cost for all the projects; the proposal should include a breakdown of the fix prices including time, travel, hourly billable rates and material costs.

Prices quoted will be deemed to be:

- in Canadian dollars ;
- inclusive of duty, FOB destination, and delivery charges where applicable; and
- exclusive of any applicable taxes.

6. PROPOSAL FORMAT

Proponents should ensure that they fully respond to all requirements in the RFP in order to receive full consideration during evaluation.

The following format, sequence, and instructions should be followed in order to provide consistency in Proponent response and ensure each proposal receives full consideration. All pages should be consecutively numbered.

a) Signed cover page (see section 7.1 Mandatory Criteria).
b) Table of contents including page numbers.
c) A short (one or two page) summary of the key features of the proposal.
d) The body of the proposal, including pricing, i.e. the “Proponent Response”.
e) Appendices, appropriately tabbed and referenced.
f) Identification of Proponent (legal name)
g) Identification of Proponent contact (if different from the authorized representative) and contact information.

7. EVALUATION

Evaluation of proposals will be by a committee formed by the Regional District and may include other employees and contractors.

The Regional District’s intent is to enter into a Contract with the Proponent who has met all mandatory criteria and minimum scores (if any) and who has the highest overall ranking.

Proposals will be assessed in accordance with the entire requirement of the RFP, including mandatory and weighted criteria.

The Regional District reserves the right to be the sole judge of a qualified proponent.

The Evaluation Committee may, at its discretion, request clarifications or additional information from a Proponent with respect to any Proposal, and the Evaluation Committee may make such requests to only selected Proponents. The Evaluation Committee may consider such clarification or additional information in evaluating a Proposal.

7.1 Mandatory Criteria

Proposals not clearly demonstrating that they meet the following mandatory criteria will be excluded from further consideration during the evaluation process.

Mandatory Criteria
The proposal must be received at the Closing Location before the Closing Time.
The proposal must be in English.
The proposal must be submitted using one of the submission methods set out on the cover page of the RFP
The proposal must either (1) include a copy of the cover page that is signed by an authorized representative of the Proponent, this is also required for email submissions or (2) be submitted by using the e-bidding key on BC Bid (if applicable), in accordance with the requirements set out in the RFP

7.2 Weighted Criteria

Proposals meeting all of the mandatory criteria will be further assessed against the following weighted criteria.

Weighted Criteria	**Weight (%)**
Capabilities	30
Proposal/Methodology	35
Sustainable Social and Environmental Procurement	5
Price	30
TOTAL	**100**

7.3 Price Evaluation

The lowest priced Proposal will receive full points for pricing. All other prices will be scored using the following formula: lowest priced proposal/price of this proposal* total points available for price.

8. Schedule A Fee Structure

Fee for engineering services for Woodcreek Park WWTP Phase 2 - design additional improvements to both the headworks and conveyance

	Description	Fee	GST	Total
1.	Detailed Design Services			
2.	Tendering Services			
3.	Construction Management Services (tentative)			
4.	Post Construction Engineering Services (tentative)			
5.	**Total fee for all components above**			

Optional work at the discretion of the Regional District:

	Description	Fee	GST	Total
6.	Engineering hourly rate for out of scope work (attach schedule as necessary)			
7.	Daily site visit rate inclusive of accommodations and travel			

9. APPENDIX A: Woodcreek Park Wastewater Treatment Permit #PE-04183 Discharge Criteria

- Maximum authorized rate of discharge is 75 cubic metres per day.

- The characteristics of the discharge shall not exceed the following parameters:
  - 5-day biochemical oxygen demand 45 mg/L
  - Total suspended solids (nonfilterable residue) 45 mg/L

10. APPENDIX B: Record Drawings

OPUS DAYTONKNIGHT

North Vancouver Office
604-990-4800

210-889 Harbourside Drive
North Vancouver BC
V7P 3S1, Canada

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
RECORD DRAWINGS

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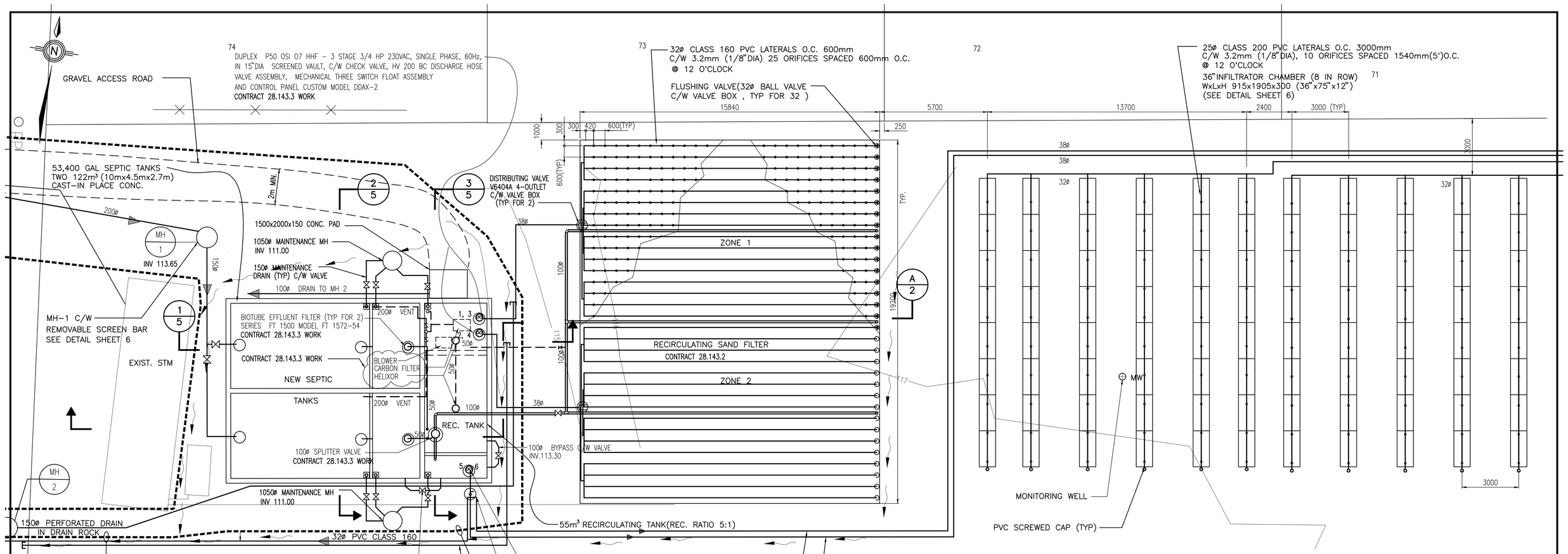
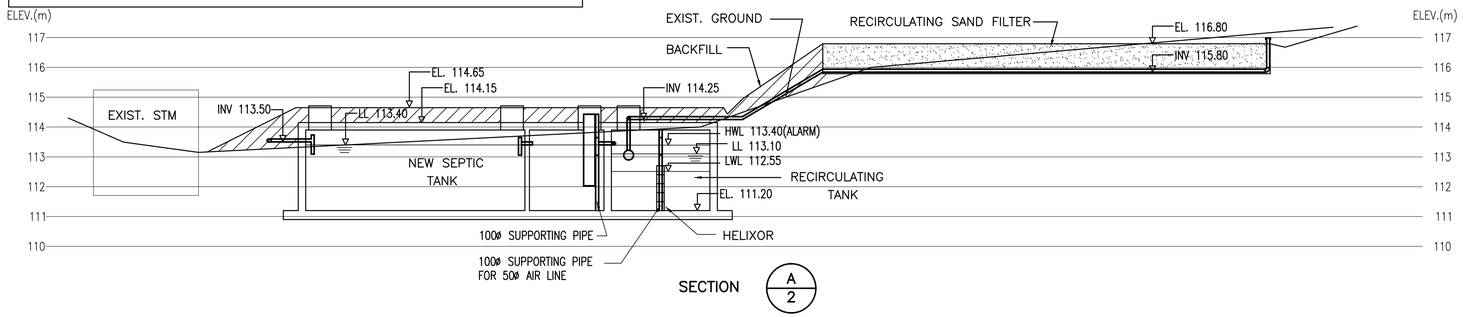


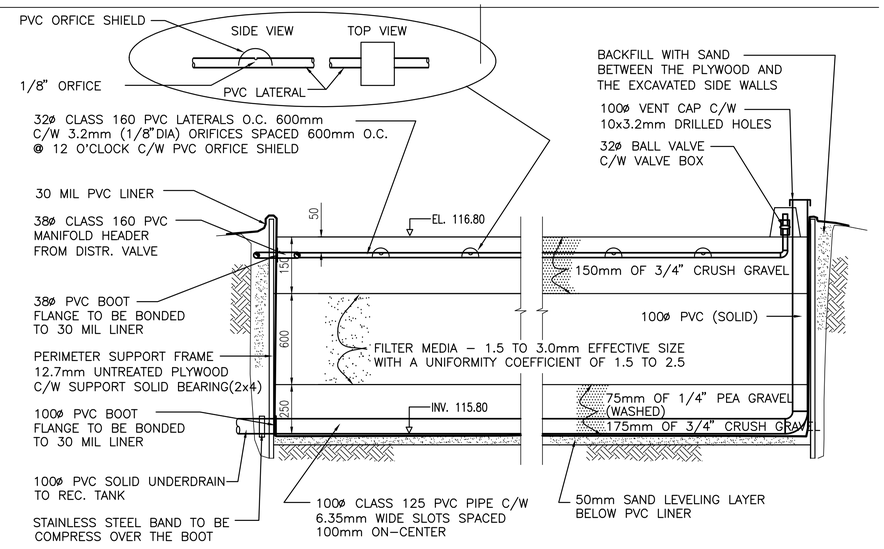
PLAN

SCALE 1:100

CONTRACT NO. 28.143.2 WORK
INCLUDES ALL REMAINING CIVIL CONSTRUCTION
(MECHANICAL AND ELECTRICAL IN CONTRACT 28.143.3 – BY OTHERS)



SECTION A/2



RECIRCULATING SAND FILTER

CONTRACT 28.143.2

ACAD DWG. 28-143-2A 1:100 99-03-02

AutoCAD DRAWING

REVISIONS

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C	FEB-99	IW			RECORD DRAWING						

DESIGNED AB/IW
DRAWN IW
CHECKED

DAYTON & KNIGHT LTD.
Consulting Engineers

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
SEPTIC TANKS,RECIRCULATING SAND FILTER

SCALE: 1:100
DRAWING No. 28.143.2
SHEET 2 OF 8 ISSUE C
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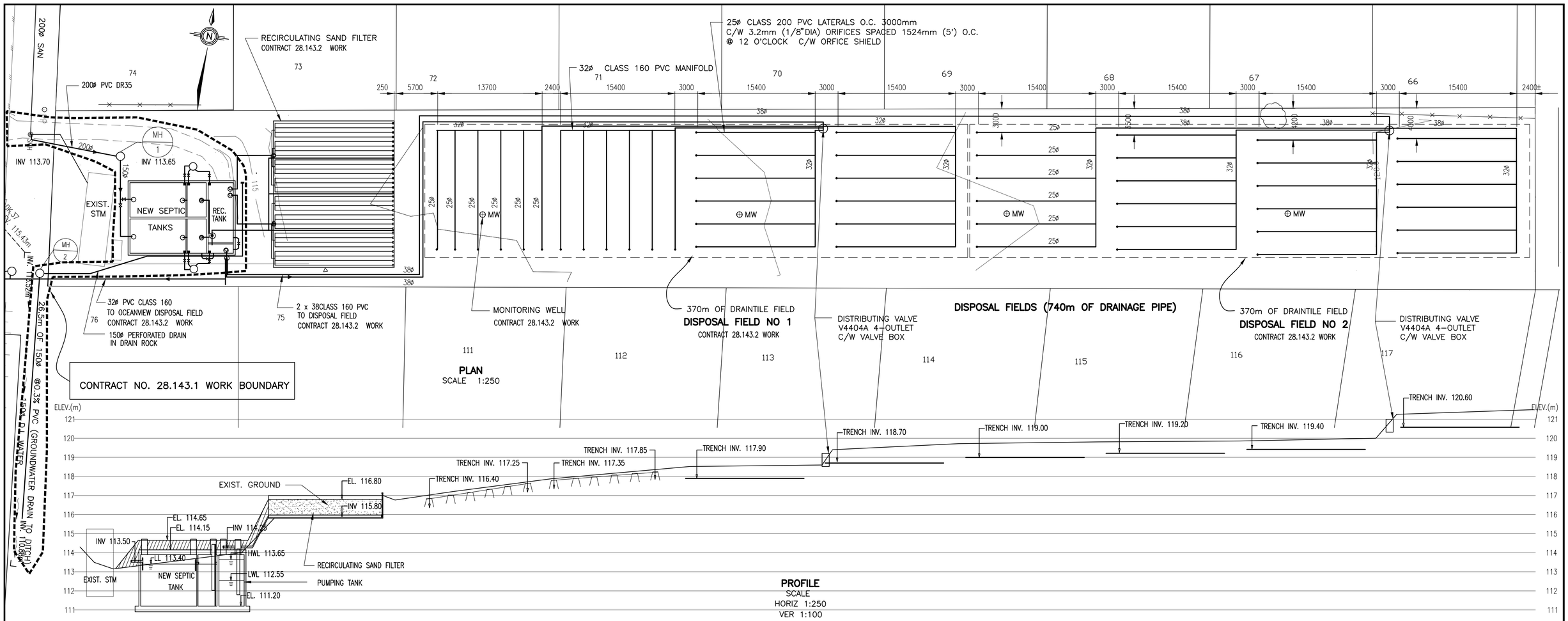

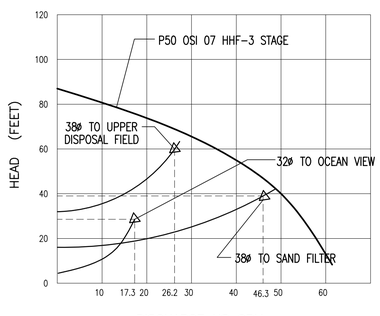

CONTROL OPERATION – DISPOSAL DRAIN FIELDS		CONTROL OPERATION – RECIRCULATION TANK (RATIO 5:1)
MONTH 1ST: DISPOSAL FIELD NO 1: 100% OF FLOW = 55m³/d DISPOSAL FIELD NO 2: RESTING OCEAN VIEW DISPOSAL FIELD : STAND BY	1. PUMP 5 TO BE ACTIVATED , RUN FOR 3.44MIN AND SHUT OFF. AFTER 5.57MIN RESTING TIME PUMP 6 TO BE RUN FOR 3.44MIN. AND WILL SHUT OFF FOR 5.57MIN. THE CYCLE TO BE REPEATED. THE PUMPS TO BE OPERATE @26.2 US gpm & 60 feet TDH.	INITIAL CYCLE, PUMPS 1 & 2 TO BE ACTIVATED AND RUN FOR 2.7MIN. THEN PUMPS 1& 2 WILL SHUT OFF. AFTER 2.3MIN RESTING TIME 3 & 4 DUPLEX PUMP TO BE ACTIVATED, RUN FOR 2.3MIN AND TO SHUT OFF FOR 2.7MIN. THE CYCLE TO BE REPEATED INDEFINITELY. THE PUMPS TO BE OPERATE @46.3 US gpm & 39 feet TDH.
MONTH 2ND: DISPOSAL FIELD NO 2: 100% OF FLOW = 55m³/d DISPOSAL FIELD NO 1: RESTING OCEAN VIEW DISPOSAL FIELD : STAND BY		
OCEAN VIEW DISPOSAL FIELD : STAND BY OPERATION	1. PUMP 5 TO BE ACTIVATED , RUN FOR 5.2MIN AND SHUT OFF. AFTER 3.8MIN RESTING TIME PUMP 6 TO BE RUN FOR 5.2MIN. AND WILL SHUT OFF FOR 3.8MIN. THE CYCLE TO BE REPEATED. THE PUMP TO BE OPERATE @17.3 US gpm & 29 feet TDH.	

SUMMARY SPECIFICATIONS FOR CONSTRUCTION OF DISPOSAL FIELD NO 1& 2 , AND OCEAN VIEW

1. LOCATION AND ELEVATION OF EXIST. SEWER PIPES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
2. CONSTRUCT DISPOSAL FIELDS AS ILLUSTRATED IN TYPICAL TRENCH DETAIL. REMOVE ALL TREES AND BUSHES. LEVEL AREA FOR EACH FIELD. IMPORT 1/4" PEA GRAVEL IF REQ'D TO ACHIEVE MIN FILL FOR TRENCH AND TO LEVEL FIELD. IMPORTED PEA GRAVEL TO BE COMPACTED.
3. 38ø AND 32ø PVC PIPES SHALL BE CLASS 160 PVC (DR 26) 25ø PIPES SHALL BE CLASS 200 PVC (DR21). ALL PIPES TO BE SOLVENT WELD JOINTS. FITTING SHALL BE SCHEDULE 40 AND SUPPLIED BY THE PIPE MANUFACTURER.
4. DISPOSAL FIELDS SHALL BE TESTED USING WATER AS DIRECTED BY ENGINEER.

ACAD DWG. 28-143-2B 1:250 99-03-02

AutoCAD DRAWING

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	C	MAR-99	KRC			RECORD DRAWING

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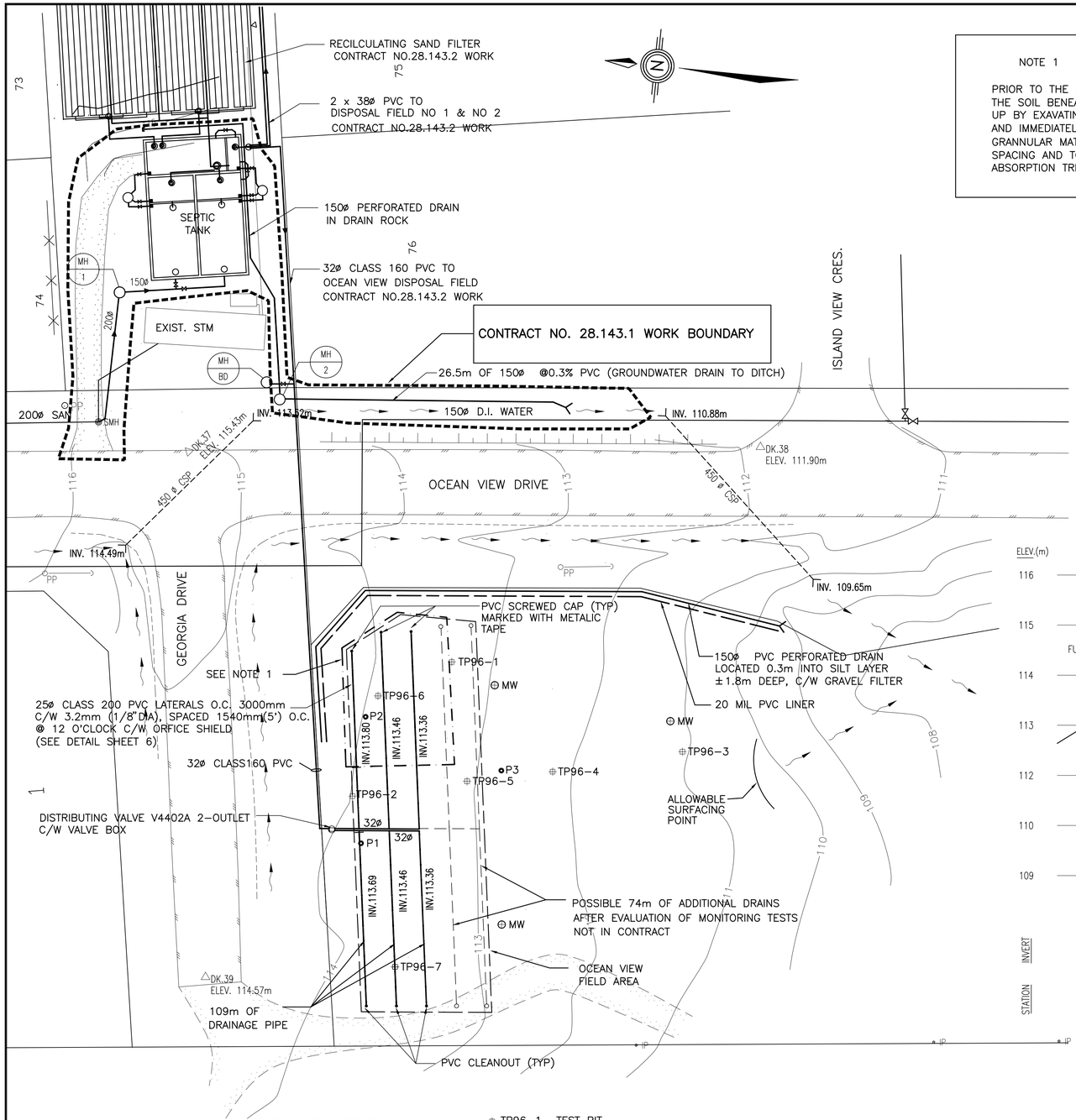
Consulting Engineers

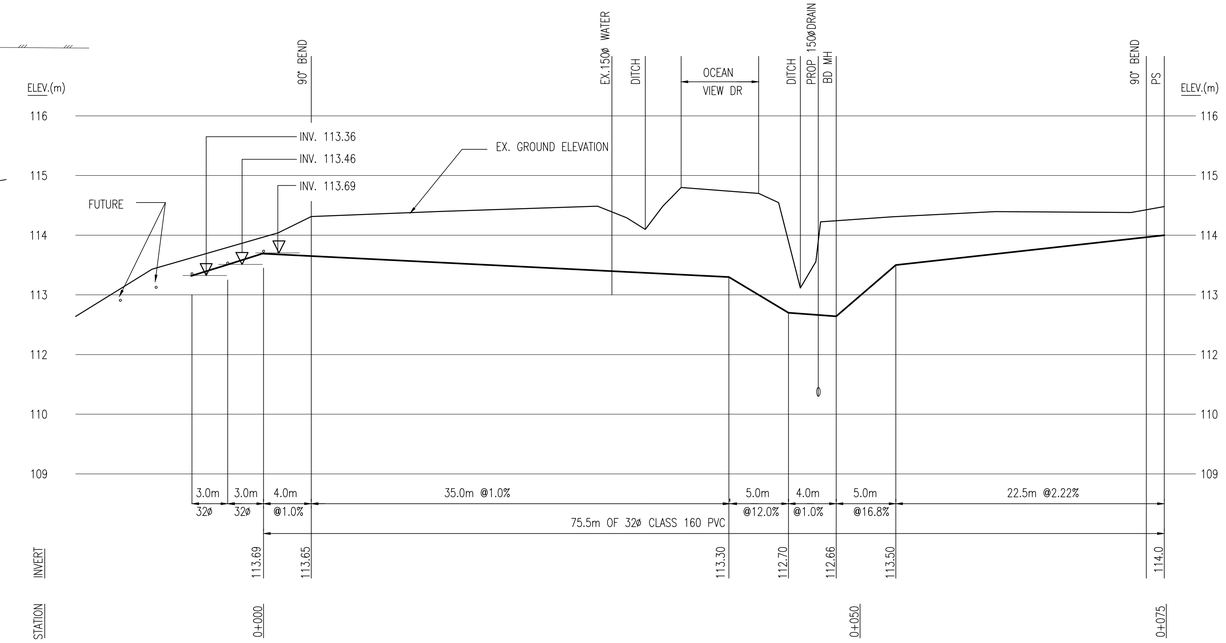
SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
DISPOSAL FIELD – DETAILS

SCALE: 1:250
DRAWING No. 28.143.2
SHEET 3 OF 8 ISSUE C
THIS DRAWING REDUCED TO HALF SIZE

NOTE 1

PRIOR TO THE INSTALLATION OF ABSORPTION TRENCH THE SOIL BENEATH THE MARKED AREA TO BE BROCKEN UP BY EXAVATING TRENCHES TO THE SILT SURFACE ±1.4m AND IMMEDIATELY BACKFILLING THE TRENCHES WITH GRANNULAR MATERIAL. THE TRENCHES TO BE AT 2.0m SPACING AND TO BE ALIGNED PERPENDICULAR TO THE ABSORPTION TRENCHES.





PROFILE

SCALE
VER 1:50
HOR 1:250

OCEANVIEW FIELD PLAN

SCALE 1:250

CONTRACT NO.28.143.2 WORK

TP96–1 TEST PIT
P2 PERCOLATION TEST
MW MONITORING WELL

ACAD DWG. 28-143-2C 4:1 99-03-02

AutoCAD DRAWING

REVISIONS

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C	FEB-99	IW			RECORD DRAWING

DESIGNED AB/IW
DRAWN IW
CHECKED

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Consulting Engineers

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
OCEANVIEW FIELD DRAIN AREA DETAIL

SCALE: 1:250
DRAWING No. 28.143.2
SHEET 4 OF 8 ISSUE C
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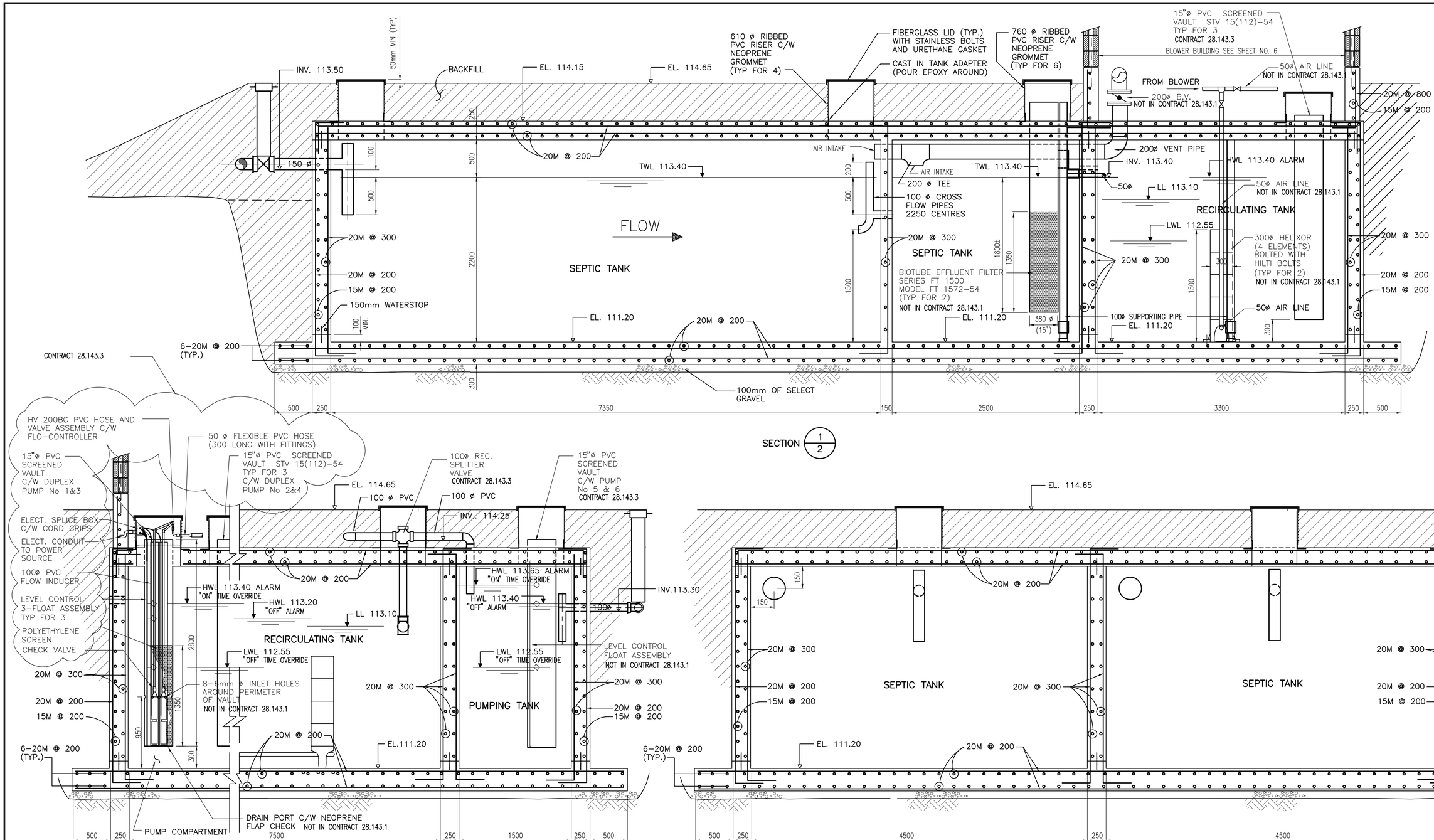

SEPTIC TANK SECTIONS
NOT IN CONTRACT 28.143.2

ACAD DWG. 28-143-2D 1:25 99-03-02

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	C	FEB-99	IW			RECORD DRAWING

DESIGNED A.B./IW
DRAWN KS
CHECKED

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Consulting Engineers

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGMENT UPGRADING
SEPTIC TANK – SECTIONS

SCALE: 1:25
DRAWING No. 28.143.2
SHEET 5 OF 8 ISSUE C
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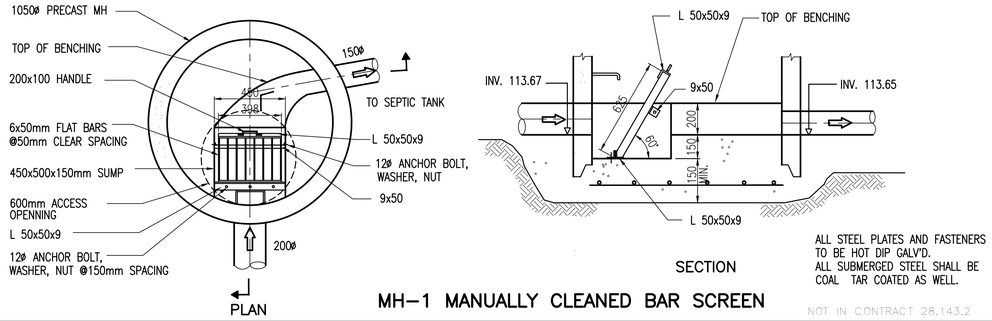
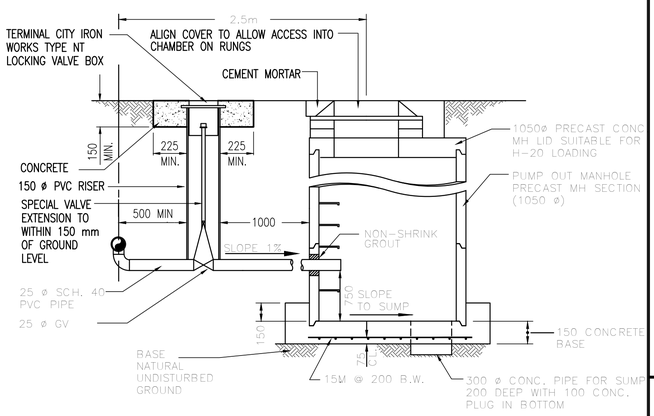
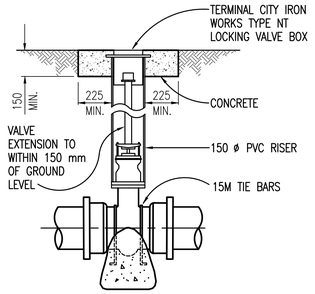


MH-1 MANUALLY CLEANED BAR SCREEN

NOT IN CONTRACT 28.143.2

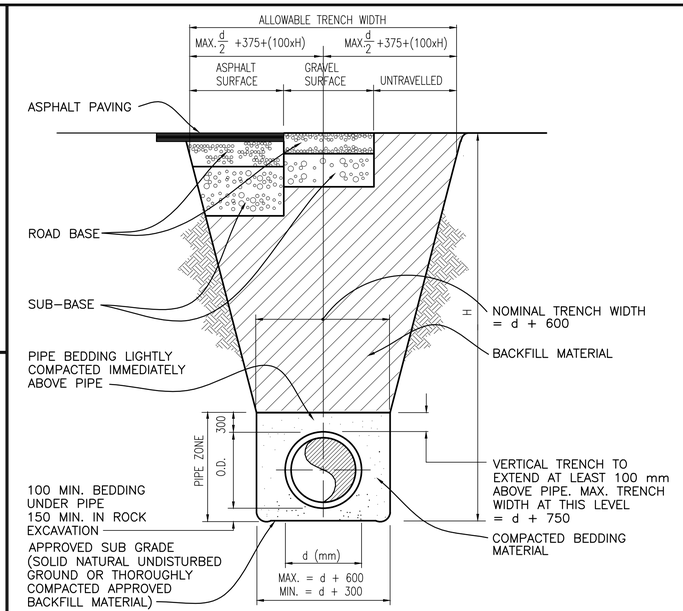


BLOWDOWN CHAMBER



TYPICAL BURIED VALVE

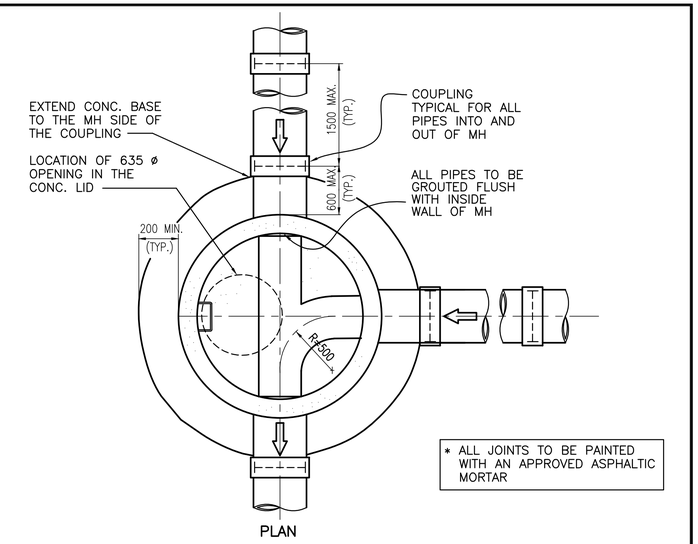
NTS

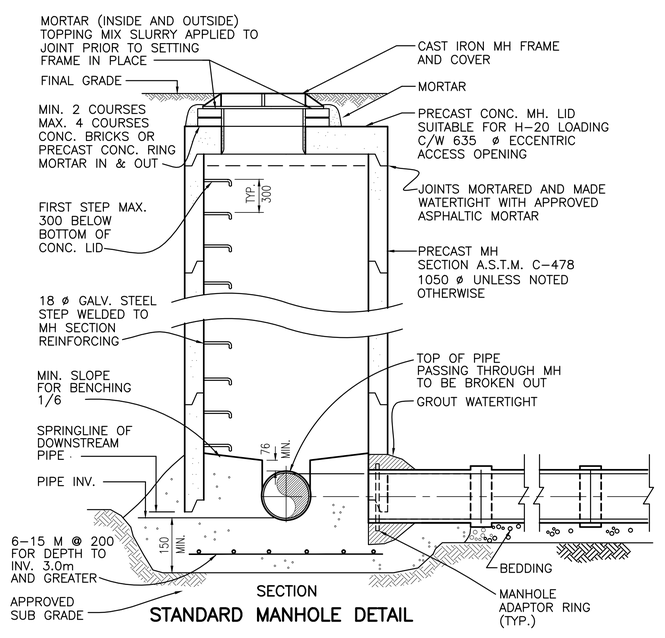


NOTES ;

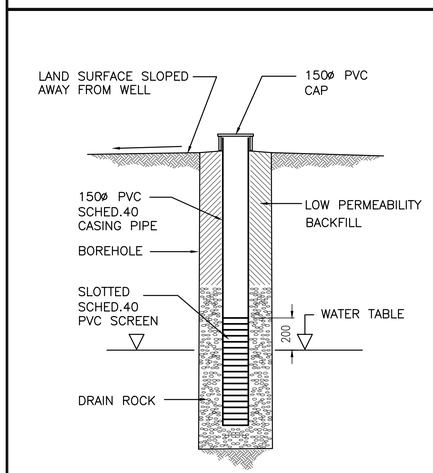
1. "d" IS THE OUTSIDE DIAMETER OF THE PIPE BARREL IN mm PLUS DISTANCES BETWEEN PIPES IN COMMON TRENCH. THE ALLOWABLE TRENCH WIDTH IS IN mm. "H" IS IN METRES.
2. IF PERMITTED BY THE DISTRICT, THE ALLOWABLE TRENCH WIDTH MAY BE EXCEEDED ON UNTRAVELLED AREA.

STANDARD TRENCH DETAIL

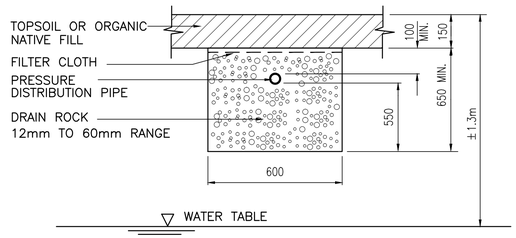




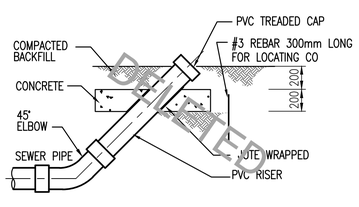
STANDARD MANHOLE DETAIL



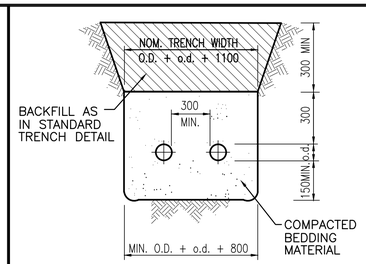
MONITORING WELL



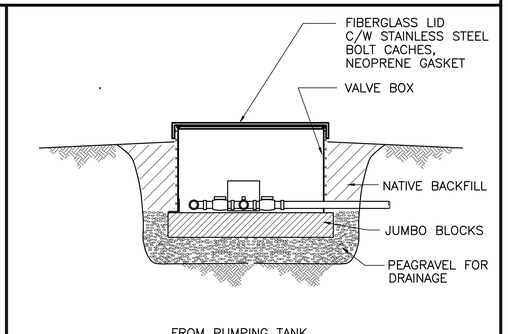
TYPICAL ABSORPTION FIELD TRENCH DATAIL

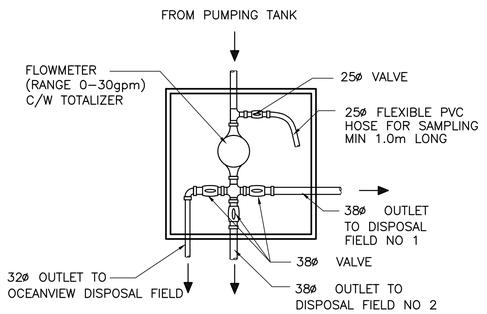


CLEANOUT STRUCTURE

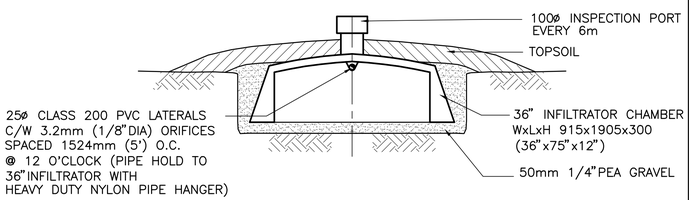


TYPICAL TRENCH FOR 38ø & 32ø PIPES





FLOW METER AND SAMPLING MANHOLE



INFILTRATOR DISCHARGE DETAIL

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	C	FEB-99	IW			RECORD DRAWING						

DESIGNED IW
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CHECKED

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SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER
MANAGEMENT UPGRADING
TYPICAL DETAILS

SCALE: N.T.S.
DRAWING No. 28.143.2
SHEET 6 OF 8 ISSUE C
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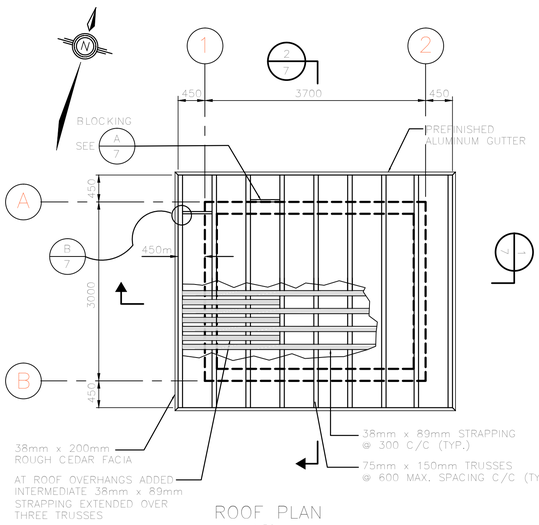
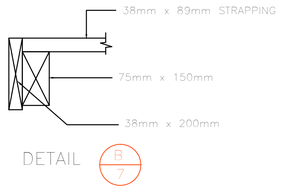
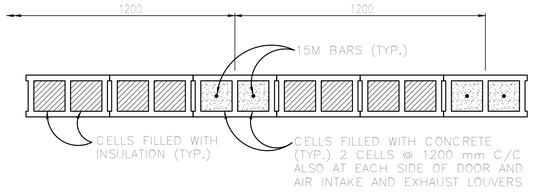


ROOF PLAN
1:50

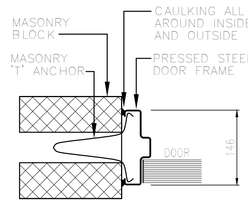


DETAIL B/7



NOTE : ALL BLOCKS METRIC DIMENSIONS

MASONRY DETAIL
NTS



MAN DOOR FRAME
NTS

DOOR SCHEDULE

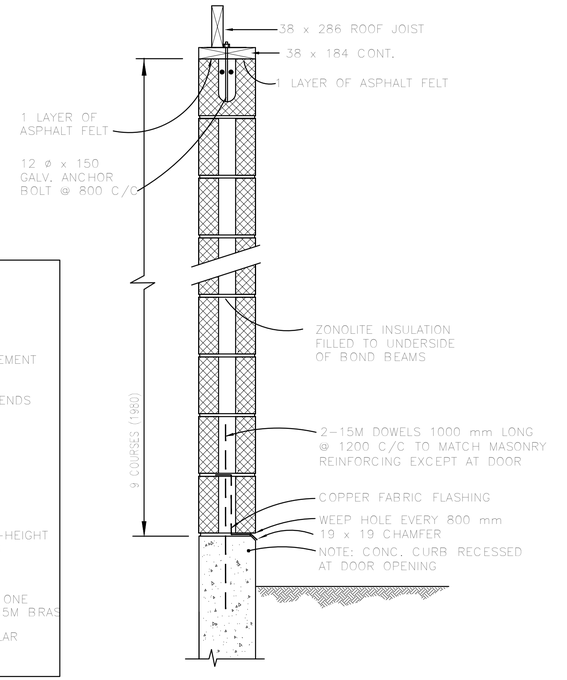
NUMBER	WIDTH-NOMINAL	HEIGHT-NOMINAL	THICKNESS	MATERIAL	FRAME	SWING	ANTI-SHEET/LOCK	DEADBOLT LOCK	PANIC BAR	PUSH BARS (2)	CLOSER	STOP	ASPHASAL	MOP PLATE	THRESHOLD	BUTTS (SETS)	REMARKS
1	1100	1850	45	STEEL	STEEL	1HR	✓	✓	✓	✓	✓	✓	✓	✓	✓	4	

WOOD STRUCTURAL NOTES

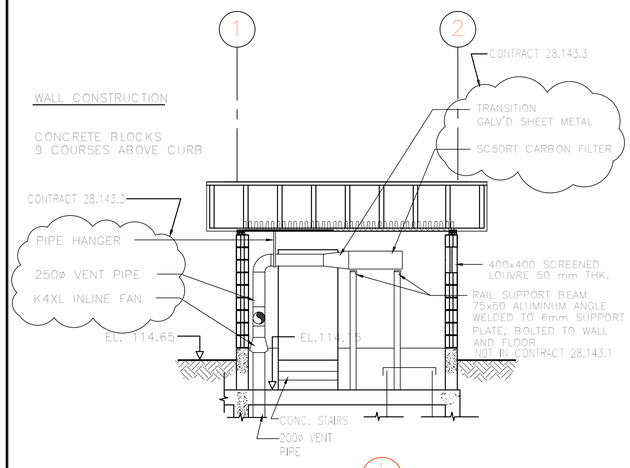
1. DESIGN LOAD – GROUND SNOW LOAD 2.5 KPa
2. TRUSSES, BEAMS AND POSTS No.1 STRUCTURAL DOUGLAS FIR ROUGH SAWN FULL DIMENSION TIMBER
3. TRUSS MANUFACTURER TO SUBMIT ENGINEERED DRAWINGS.
4. ALL CONSTRUCTION CONFORMS TO THE LATEST EDITION OF THE NATIONAL BUILDING CODE

REINFORCED MASONRY NOTES

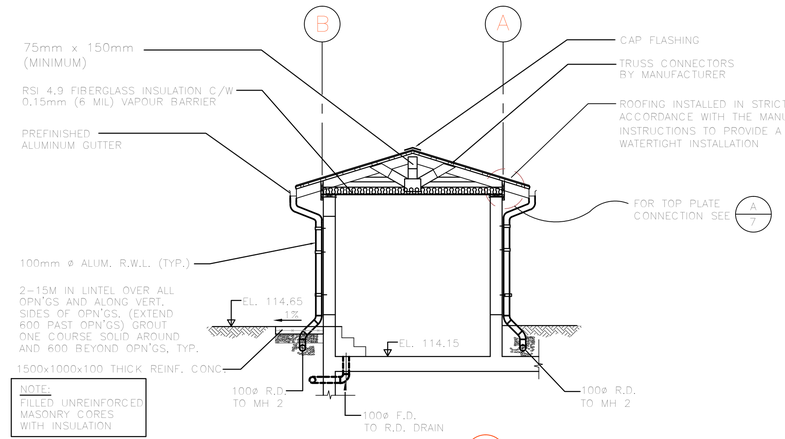
1. CONCRETE FILL TWO VOIDS EVERY 1200 mm C/C AND REINFORCED WITH 2–15M BARS
2. PROVIDE 4 mm (9 GAUGE) LADDER TYPE REINFORCEMENT HORIZONTALLY AT 400 mm C/C
3. ADD ONE EXTRA 15M BAR AND CONCRETE FILL AT ENDS OF WALLS AND EACH SIDE OF DOORS
4. MINIMUM BAR SPLICE 30 BAR DIAMETERS
5. CONCRETE FILL IS 20 MPa AT 28 DAYS
6. MORTAR TYPE 'S'
7. PROVIDE DOWELS FROM FLOOR SLAB TO MATCH ALL VERTICAL BARS
8. PROVIDE HORIZONTAL BOND BEAM AT TOP AND MID–HEIGHT OF ALL WALLS AS SHOWN. REINFORCE BOND BEAMS WITH 2–15M BARS
9. RUN VERTICAL BARS THROUGH BOND BEAMS FOR LINTELS OVER DOOR AND WALL OPENINGS, FILL ONE COURSE WITH CONCRETE AND REINFORCE WITH 2–15M BRAS
10. MASONRY BLOCK CELLS TO BE FILLED WITH GRANULAR INSULATION, VERMICULITE OR APPROVED EQUAL



TYPICAL WALL SECTION
NTS

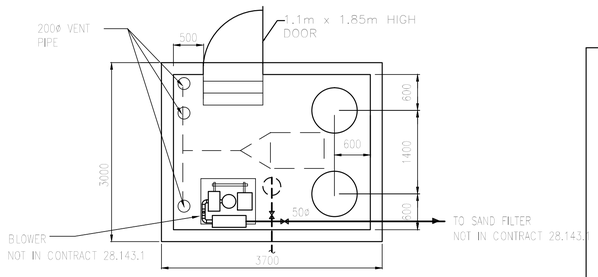


SECTION 1/7



NOTE:
FILLED UNREINFORCED MASONRY CORES WITH INSULATION

SECTION 2/7
1:50



PLAN

BLOWER AND CONTROL PANELS BUILDING
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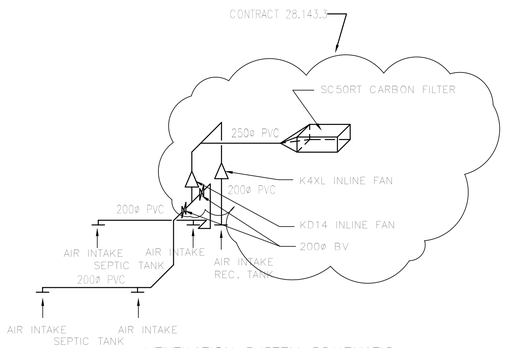
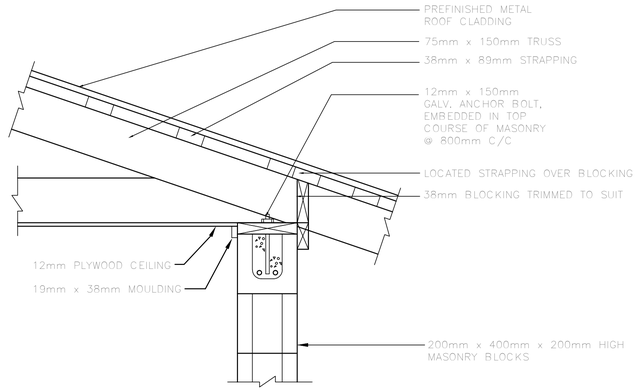


VENTILATION SYSTEM SCHEMATIC
NTS

ROOFING NOTES

1. PREFINISHED METAL ROOF CLADDING, 26 GAUGE PREPAINTED GALVANIZED SINGLE SKIN STEEL TO ASTM A446 GRADE A (VIC WEST STEEL DIAMOND RIB 30) 19mm RAISED RIB AT 150mm CENTERS
2. PAINTED BAKED ENAMEL TO DOFASCO 5000 COLOUR SERIES (VIC WEST PC – 306)
3. SCREWS #14 – 32mm GALVANIZED C/W WASHERS AND NEOPRENE SEALS
4. CAULKING TREMCO 440 PREFORMED POLYISOBUTYL 1.6mm x 13mm TAPE
5. ROOFING INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS TO PROVIDE A WATERTIGHT INSTALLATION



NOT IN CONTRACT 28.143.2

DETAIL A/7
1:10

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AutoCAD DRAWING

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	B	FEB–98				MOE PERMIT REQ'D						
	C	FEB–99	IW			RECORD DRAWING						

DESIGNED IW
DRAWN IW
CHECKED

DAYTON & KNIGHT LTD.
Consulting Engineers

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
BLOWER BUILDING

SCALE: AS SHOWN
DRAWING No. 28.143.2
SHEET 7 OF 8 ISSUE C
THIS DRAWING REDUCED TO HALF SIZE

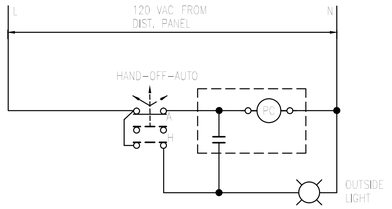
PANEL No. ____ , LOCATION ____ , TYPE COMBINATION

VOLTS 120/240 , PHASE SINGLE , WIRE 3 , CIRCUITS 32 , FEEDER B.G.H. , BREAKER 100 A , BUSS 125 CU , MOUNTING WALL ,

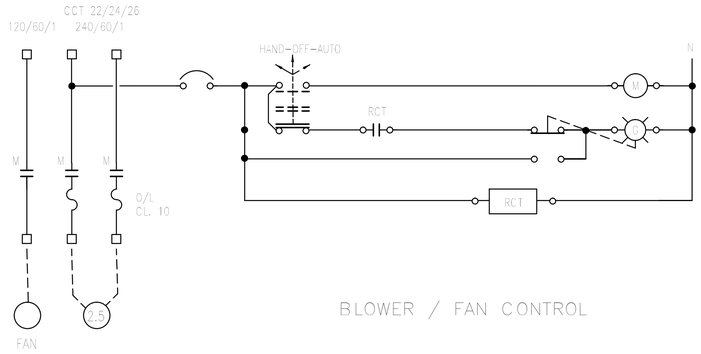
CIRC No.	No. POLES	TRIP AMPS	SERVICE	A ø KVA	B ø KVA	C ø KVA	WIRE SIZE	REMARKS
1	1	15	INSIDE LIGHTING	0.2			#12	
3	1	15	SECURITY LIGHTING		0.1		#12	
5								
7								
9	1		UTILITY REC.	0.4			#12	
11								
13								
15	2	15	HEATER		1.0		#12	
17	↓	↓		1.0			#12	
19								
21								
23								
25								
27								
29								
31								
SUB-TOTAL				1.6	1.1			

CIRC No.	No. POLES	TRIP AMPS	SERVICE	A ø KVA	B ø KVA	C ø KVA	WIRE SIZE	REMARKS
2	2	40	QUADPLEX PUMP	4.0			#8	
4	↓	↓	CONTROL PANEL "A"		4.0		#8	
6	2	20	DUPLEX PUMP	2.0			#10	
8	↓	↓	CONTROL PANEL "B"		2.0		#10	
10	1	15	CONTROL POWER	0.1			#14	
12								
14								
16								
18								
20								
22	3	20	BLOWER	0.9			#10	
24	↓	↓			0.9		#10	
26	↓	↓	FAN	0.1				
28								
30								
32								
SUB-TOTAL A				7.1	6.9			
TOTAL A				8.7	8.0			

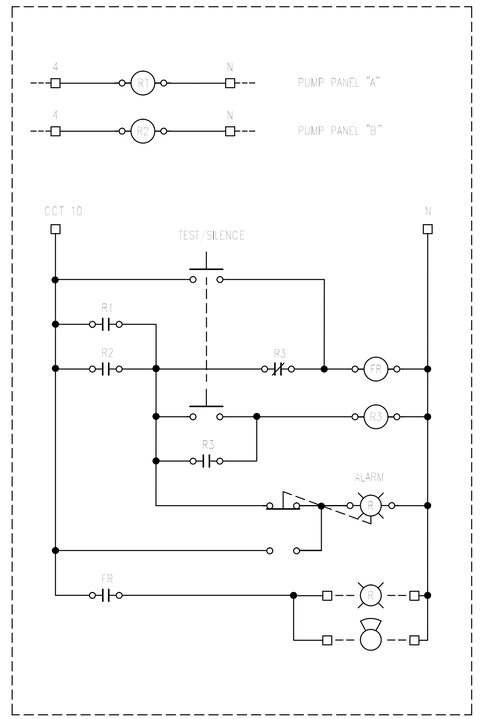
LIGHTING PANEL SCHEDULE



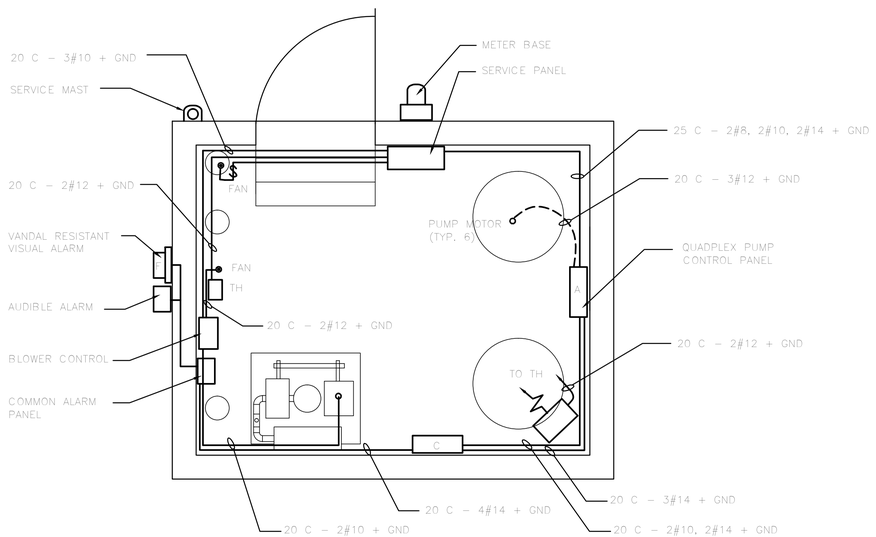
SECURITY LIGHT CONTROL (TYP.)



BLOWER / FAN CONTROL



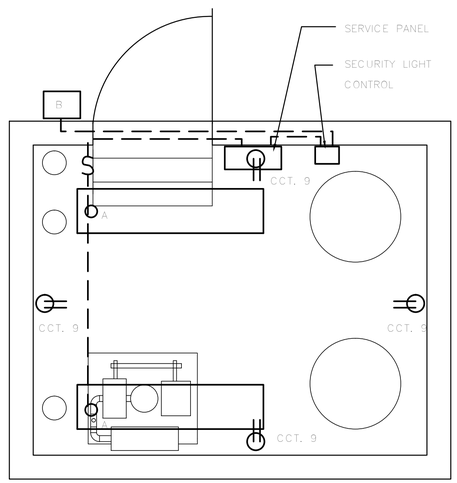
COMMON ALARM PANEL



PLAN

BLOWER AND CONTROL PANELS BUILDING
POWER AND CONTROL

1:25



PLAN

BLOWER AND CONTROL PANELS BUILDING
LIGHTING AND UTILITY

1:25

NOTE:
ELECTRICAL WORK NOT IN CONTRACT 28.143.2

ACAD DWG. 28-143-2G 1:1 99-03-02

AutoCAD DRAWING

REVISIONS	ISSUE	DATE	DRAWN	CHK'D	APP'D	DESCRIPTION	ISSUE	DATE	DRAWN	CHK'D	APP'D	DESCRIPTION
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DESIGNED DR
DRAWN IW
CHECKED

DAYTON & KNIGHT LTD.
Consulting Engineers

SUNSHINE COAST REGIONAL DISTRICT
WOODCREEK WASTEWATER MANAGEMENT UPGRADING
ELECTRICAL

SCALE: AS SHOWN
DRAWING No. 28.143.2
SHEET 8 OF 8 ISSUE C
THIS DRAWING REDUCED TO HALF SIZE

11. APPENDIX C: Design Report and Tender Documents (DRAFT)

Sunshine Coast Regional District
Woodcreek Park Subdivision
Sand Filter Replacement Options

Date: October 13, 2020

Prepared by:

MSR Solutions Inc.
125-662 Goldstream Avenue
Victoria, BC V9B 0N8
P: 1+(250)-479-5164
F: 1+(888)-277-2816

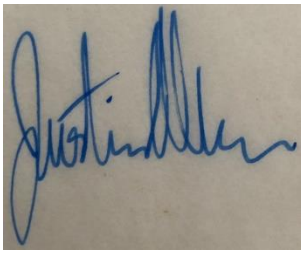
Submitted to:

Sunshine Coast Regional District
1975 Field Road
Sechelt, BC, V0N3A1
P: 1+(604)-885-6800
F: 1+(604)-885-7909

Prepared for:

Sunshine Coast Regional District
1975 Field Road
Sechelt, BC, V0N3A1
P: 1+(604)-885-6800
F: 1+(604)-885-7909

Prepared by:



Justin Allen,
Engineering Co-op Student
Email: justin@msrsolutions.ca

Reviewed by:

Mike Seymour, AScT, Eng.L
Manager, Water and Wastewater Systems
Email: mike@msrsolutions.ca

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1.0 Introduction

The Sunshine Coast Regional District (SCRD) has retained MSR Solutions Inc. to design a system to replace the existing recirculating sand filter (RSF) due to apparent ineffectiveness of current performance. The system is located at the Woodcreek Park Wastewater Treatment Plant (WWTP) in the Woodcreek Park residential neighborhood of Electoral Area E, Sunshine Coast Regional District. The system serves 73 homes under Permit # PE-04183 issued under the Municipal Wastewater Regulation (MWR) by the Ministry of Environment (MoE). Under the permit, maximum daily discharge shall not exceed 75 m^3/day, TSS shall not exceed 45 mg/L, and BOD_5 shall not exceed 45 mg/L.

Figure 1 - WWTP and Disposal Aerial View

2.0 Background

Originally constructed in 1999 the existing WWTP consists of a coarse bar screen, septic tanks, a recirculation tank, a pumping tank, a recirculating sand filter, and effluent disposal fields. Some minor modifications have been made to the system over the last 20 years.

The bar screen was removed at some point due to the manual cleaning requirements, which could not be provided regularly. The split of flows to the septic tanks is uneven, resulting in Septic Tank #1 receiving most of the flow. Flow from the first chamber of the septic tanks to the second is by a tee in the pipe, and short circuiting can cause disproportionate solids loading to the second chamber. Aeration in the secondary chamber has not operated in several years with the blowers now disconnected.

The recirculating filter does not appear to be functioning to specifications due to a combination of short circuiting and plugging of the media. The ground water table around the disposal field to sand filter interface can rise to near the surface in wet weather conditions, raising concerns of inflow & infiltration (I&I). The various conditions have resulted in the engineering assessment. See section 6.0 for a detailed description of the current system and Appendix D for record drawings.

3.0 Ministry of Environment Permit PE-04183

The Woodcreek Wastewater Facility operates under permit PE-04183 which requires that maximum daily effluent discharge shall not exceed 75 m^3/day, TSS shall not exceed 45 mg/L, and BOD_5 shall not exceed 45 mg/L. Failure to comply with the permit was first addressed by the Ministry of Environment (MoE), Environmental Protection Division staff on September 12, 2017 following an inspection that took place on July 27, 2017. The report indicated the following issues:

- BOD_5 of 93 mg/L on July 4, 2017
- Failure to notify the MoE of non-compliance within 24 hours
- Failure to provide a written non-compliance report within 30 days of non-compliance

A second non-compliance advisory was reported on January 22, 2018 following an inspection which took place on January 08, 2018. The report indicated the following issues:

- Discharge of 85.2 m^3/day on December 29, 2017
- Discharge of 106.45 m^3/day on January 02, 2018

A warning letter was identified in the MoE inspection report dated March 02, 2020. The inspection report was based on the results of the MoE inspection conducted from July 01, 2018 to December 31, 2019 which indicated the following issues:

- Discharge ranging from 80.2 m^3/day to 109.3 m^3/day on five occasions
- Effluent TSS ranging from 52.8 mg/L to 191 mg/L on four occasions
- Failure to notify the MoE of non-compliance within 24 hours
- Failure to provide a written non-compliance report within 30 days of non-compliance

Failure to comply with the terms and conditions set out in an authorization permit is an offence under the Environmental Management Act (EMA). Non-compliance will incur costs to both the SCRD and residents of the Woodcreek Park subdivision and should be remedied as quickly as possible. As a result of non-compliance addressed by the MoE, the SCRD sought solutions resulting in MSRS being retained to analyse the system and recommend cost-effective solutions to bring effluent back in line with Permit requirements. The SCRD has requested that MSRS generate multiple treatment options to correct, or replace the failing sand filter and provide a cost-estimate that details both upfront capital costs and annual maintenance costs. Once the most cost-effective solution has been determined and agreed upon by the SCRD, MSRS will provide a detailed cost estimate and a set of bid-ready tender documents.

4.0 System Performance Review

4.1 General

A review of the system's treatment performance over its lifetime will provide insight as to when the system first failed and the potential causes for failure. A review of the historical precipitation as it relates to recorded flow discharge rates will help to determine whether I&I is a significant contributor to flow exceedances. Furthermore, an analysis of the changes in effluent quality over time will be useful for determining potential causes of failure. This will be beneficial when considering the expected lifetime and maintenance requirements of a new system.

4.2 Treatment System Flow Information

The service area for Woodcreek Park wastewater treatment plant consists of a gravity collection system serving 73 homes. Flow into the system occurs from the homes as well as any inflow and infiltration (I&I) that reaches the collection system.

Measurement of flow is based on records from measurement taken by the SCRD at the facilities. A summary of effluent flow values from 2017-2019 can be seen in Appendix A - Table 3, Table 4, and Table 5, respectively. Earlier flow data is inconsistent yet indicates similar trends.

As seen in Table 3, Table 4, and Table 5, most of the daily effluent flow produced by the WWTP in 2017, 2018, and 2019 was within the permit regulations of 75 m^3/day. Data presented in Appendix B – Daily

Flow and Inflow Estimation suggests that inflow to the sand filter is not the sole contributor of excess flow, however; infiltration may still be a factor as the historical flow data shows a correlation between rain events and days of excess flow.

Historical flow data summarizing treated effluent flow and rainfall precipitation (PPT) for 2017, 2018, and 2019, can be seen in Figure 1, Figure 2, and Figure 3, respectively.

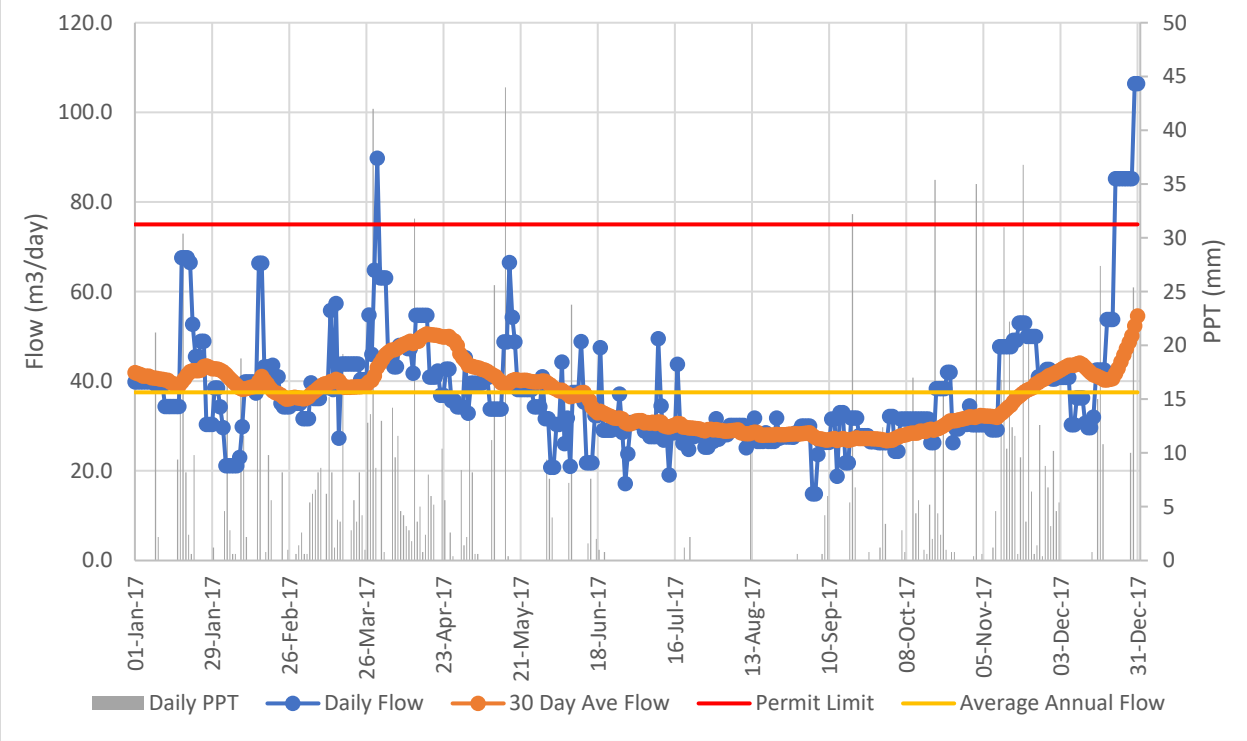


Figure 2 – Woodcreek Park WWTP 2017 Effluent Flow and Daily Rainfall

As seen in Figure 1, the maximum 30-day average flow in 2017 was approximately 55 m^3/day. Many of the highest daily flow rates are observed on days with rain events and days following rain events, suggesting that infiltration may be a contributing factor. Furthermore, the days with the lowest flow rates were observed when there were no rain events. The average annual flow in 2017 was approximately 38 m^3/day. A similar pattern occurred in 2018 and can be seen in Figure 2.

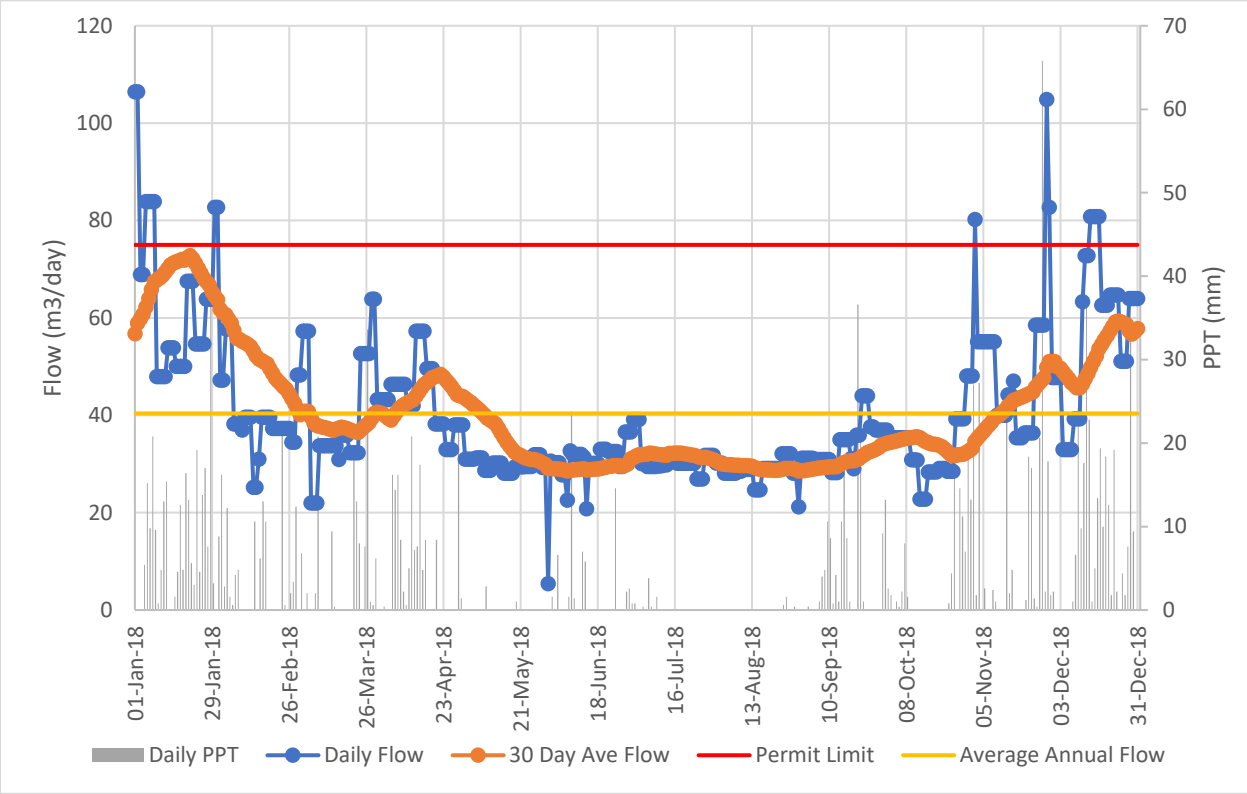


Figure 3 – Woodcreek Park WWTP 2018 Effluent Flow and Daily Rainfall

As seen in Figure 2, the maximum 30-day average flow in 2018 was 73 m^3/day due to high flow rates through December 2017 and into January 2018.Similar to 2017, many of the highest daily flow rates seen over this time period are observed on days with rain events and days following rain events, while many of the lower daily flow rates were seen on days without rain events. This trend continued in 2019 and can be seen in Figure 3.

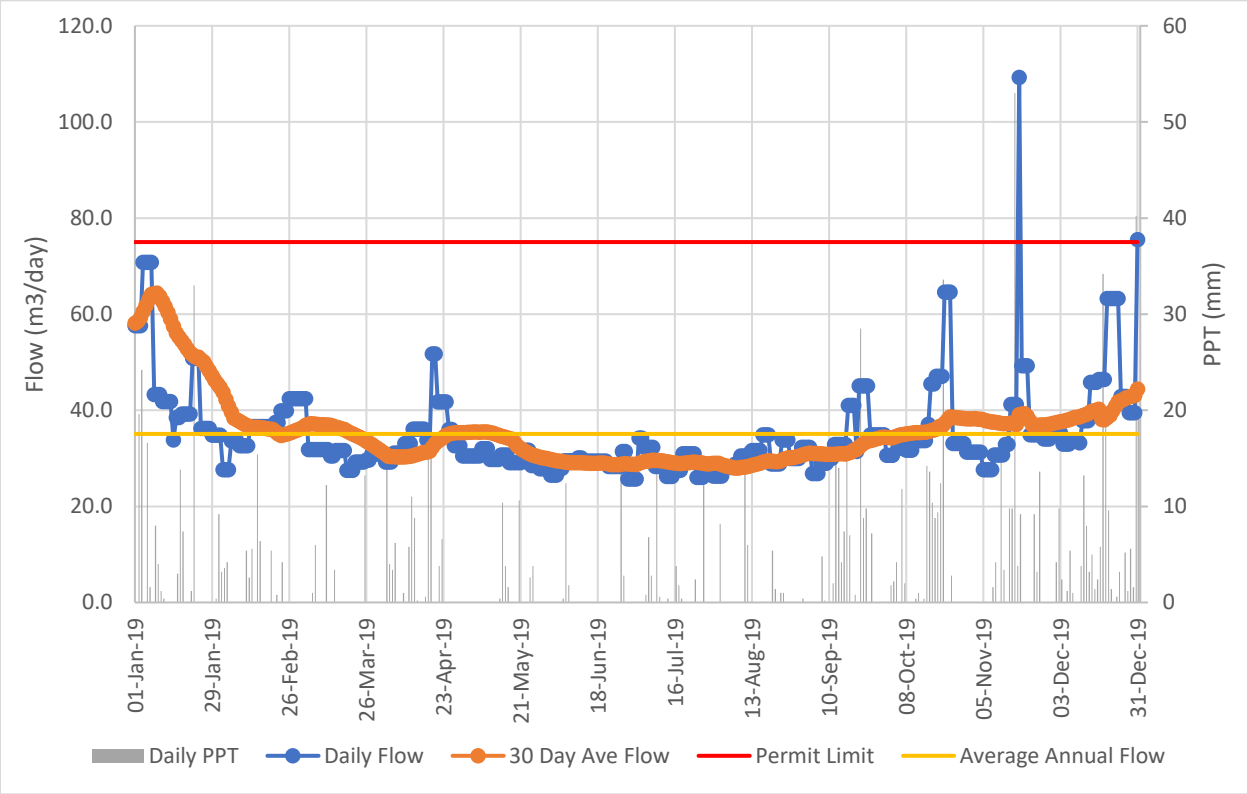


Figure 4 – Woodcreek Park WWTP 2019 Effluent Flow and Daily Rainfall

As seen in Figure 3, maximum 30-day average flow in 2019 was approximately 64 m^3/day, while average annual flow for 2019 was approximately 35 m^3/day. Similar to 2017 and 2018, many of the highest daily flow rates are observed on days with rain events and days following rain events, and many of lowest daily flow rates occurred on days without rain events, suggesting that infiltration may be a contributing factor.

4.3 Effluent Quality

Operations and maintenance are provided by SCRD staff who reported that the sand filter was taken out of service and bypassed between 2016 and May 30, 2018. The filter was briefly taken out of service and by-passed again between June 1, 2018 and June 6, 2018. Poor effluent quality was first noted by the MoE to be periodically compromised in 2017. Effluent quality continued to fluctuate leading the MoE to issue non-compliance advisories in 2018 and 2020. An analysis of effluent quality from 2017-2019 is

important for understanding recent treatment performance of the current system. Performance reports from earlier years are less pertinent but will provide insight into potential causes of failure and may reveal patterns in performance changes that have occurred over a longer timescale.

As seen in Appendix A, Table 6, BOD exceeded 45 mg/L for all of 2017 and much of 2018, although limited data was available for 2018. There were no reports of BOD greater than 45 mg/L in 2019. The reported TSS values were less than 45 mg/L for all of 2017 except June, and September through December. TSS in 2018 was greater than 45 mg/L in January, February, and September. Notes from the SCRD log suggest that a poorly functioning sand filter was to blame for the poor effluent quality.

According to notes from the SCRD, a plant pump-out of both septic tanks and the recirculation tank was completed on May 30th, 2018. Further cleaning and maintenance procedures were undertaken from May 31st to June 6th. Although BOD data is limited for 2018, the available data suggests that the cleaning and maintenance contributed to improved performance of the WWTP. BOD and TSS values in 2019 were all below 45 mg/L except in January, March, and April where TSS was reported as 52.9 mg/L, 61 mg/L, and 53.5 mg/L, respectively. Reports from the SCRD logs indicate that a clogged filter was the cause. After the filter was cleaned, BOD and TSS values were below 45 mg/L for the rest of the year.

A summary of effluent quality from 2005-2019 can be seen in Appendix A, Table 6. Issues with effluent quality began in 2012 and became a consistent problem in 2014. From 2014-2016 the reported BOD value was greater than 45 mg/L for every month, with some months reporting values over 4 times the permit allowance. Maintenance reports for this time were not available.

A summary of the number of months where effluent exceeded permit allowances in terms of flow, BOD, and TSS, can be seen in Figure 4.

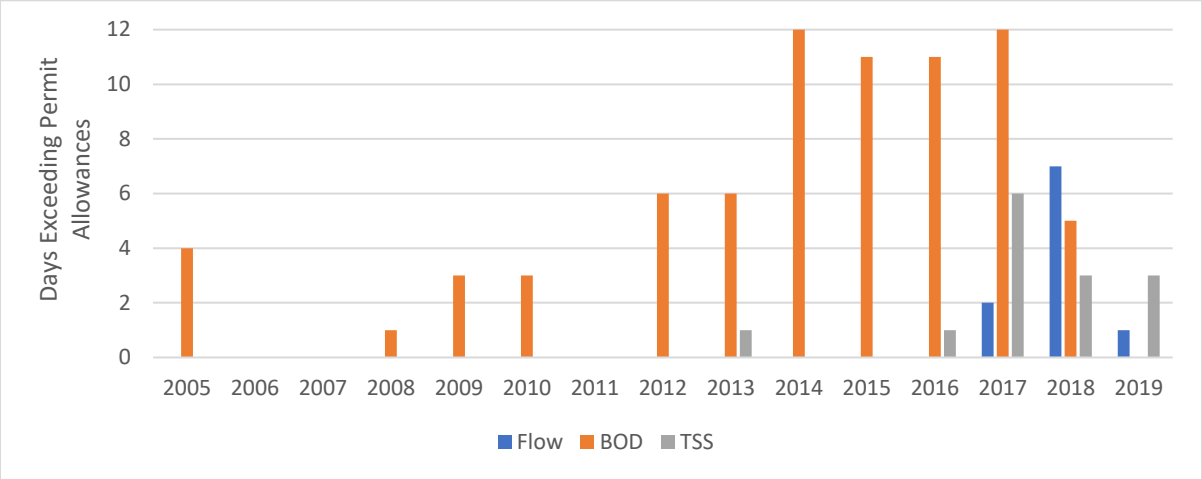


Figure 5 – Days Exceeding Flow, BOD, and TSS Permit Allowances, 2005-2019

As seen in Figure 4, issues with effluent quality were consistently an issue beginning in 2014 and continued until a plant pump-out was conducted in 2018. Flow data was unavailable from 2005-2016, however we suspect exceedances in the 1% range.

4.4 Additional Factors to the Treatment and Disposal Operations

Based on log reports, the installation of gas services over the lifetime of the subdivision purportedly resulted in several directional drilling connections piercing the gravity sewer pipe (material not known). This was not noticed until abnormal flows were seen in late 2017 and early 2018. An infiltration study was started in early 2018 and later resumed once the wet weather returned.

The collection system was assessed on December 26, 2018 using closed circuit television camera methods which revealed several locations of pipe joint separation, pipe joint offset, breaks, and service connection failures in the system. The SCRD has reported that at least some of the damage has been repaired. It is possible that the damage observed in the collection system contributed to high flows which were observed and reported.

5.0 June 18th, 2020 Site Inspection

On June 18th, 2020, MSR Solutions staff inspected the existing WWTP and RSF along with SCRD staff, to better understand the system and to investigate some of the potential concerns with regards to operations and performance of the system. Discussions with the facility operator revealed that sewage flows via gravity and passes through a coarse screen area (bar screen since removed) before splitting into two septic tanks that operate in parallel. The operator explained that flow to each of the septic tanks is unequal, resulting in Septic Tank #1 receiving most of the flow. Generally, the cause of this issue can be attributed to solids attaching to sharp edges and pipe inlets acting as temporary flow dams until surge flows resuspend the solids. This is a factor in increased maintenance requirements.

An inspection of the various components noted aging equipment, non-functioning blowers, and concerns with solids accumulations in the second chamber and equalization chamber. A visual inspection of the existing sand filter, as seen in Figure 5 and Figure 6, showed that much of the surface of the sand filter is covered in vegetation.

Figure 6 – Surface of Zone 1 of the RSF

Figure 7 – Surface of Zone 2 of the RSF

In general, it is recommended that the surface of an RSF is kept free of vegetation to facilitate proper air circulation and re-aeration of the field, as well as to minimize additional organic loading.

As shown in Figure 7 and Figure 8 below, test pits were dug into the surface of the sand filter to inspect the filter media. The media was found to be saturated and showed evidence of uneven distribution and pooling. As shown in Figure 8, water mounding in Zone 2 was higher than in Zone 1, with heavy particulate build-up occurring around the roots of the vegetation. In general, the root zone was extending below the distribution laterals. The plugging interface where the solids were accumulating appeared thickest at 0.3 to 0.45 m below the top of the filter.

The clogged media has impeded the rate of drainage through the system which requires a slight driving head of the mounded water to effectively circulate the effluent.

Figure 8 – Test Pit #1, located in Zone 1 of the RSF

During the inspection, it was possible to hear when the field was receiving a dose. After listening to several doses, it became evident that at least one of the Orenco distributing valve assemblies in the distribution boxes was broken, resulting in continuous discharge to only one of the cells instead of alternating doses between cells.

Figure 9 – Test Pit #2, located in Zone 2 of the RSF

Figure 10 – Distribution Box to Zone 1 of the RSF

The purpose of the distribution box is to alternate flow between sets of laterals in the respective zones. The damaged flow valve has resulted in portions of the zone receiving constant flow which disturbs the cycle of flooding and draining. Resting time between doses is important to allow for aeration and to allow effluent to freely pass through void spaces. The aerobic bacteria within the sand filter need oxygen to metabolize waste – without it they essentially suffocate, resulting in solids accumulation throughout the void spaces. This results in performance issues for multiple reasons. With void spaces now filled with waste, the bacteria have less space to live and no access to oxygen. The population of aerobic bacteria within the sand filter will die off and may be replaced with anaerobic bacteria, resulting in foul odours. This illustrates the important balance that must be achieved through a well-regulated dosing cycle. Enough wastewater must be delivered to the sand filter to feed the aerobic bacteria and maintain a large population, but not to the point that clogging occurs.

In addition to the age of the existing sand filter, that is the accumulation of organic loading over the many years of operation, the combination of the issues seen during the site inspection verify the system is failing, and no longer able to maintain the design loading rate without the potential of ponding of partially treated effluent on the surface.

6.0 Treatment System and Disposal as Installed

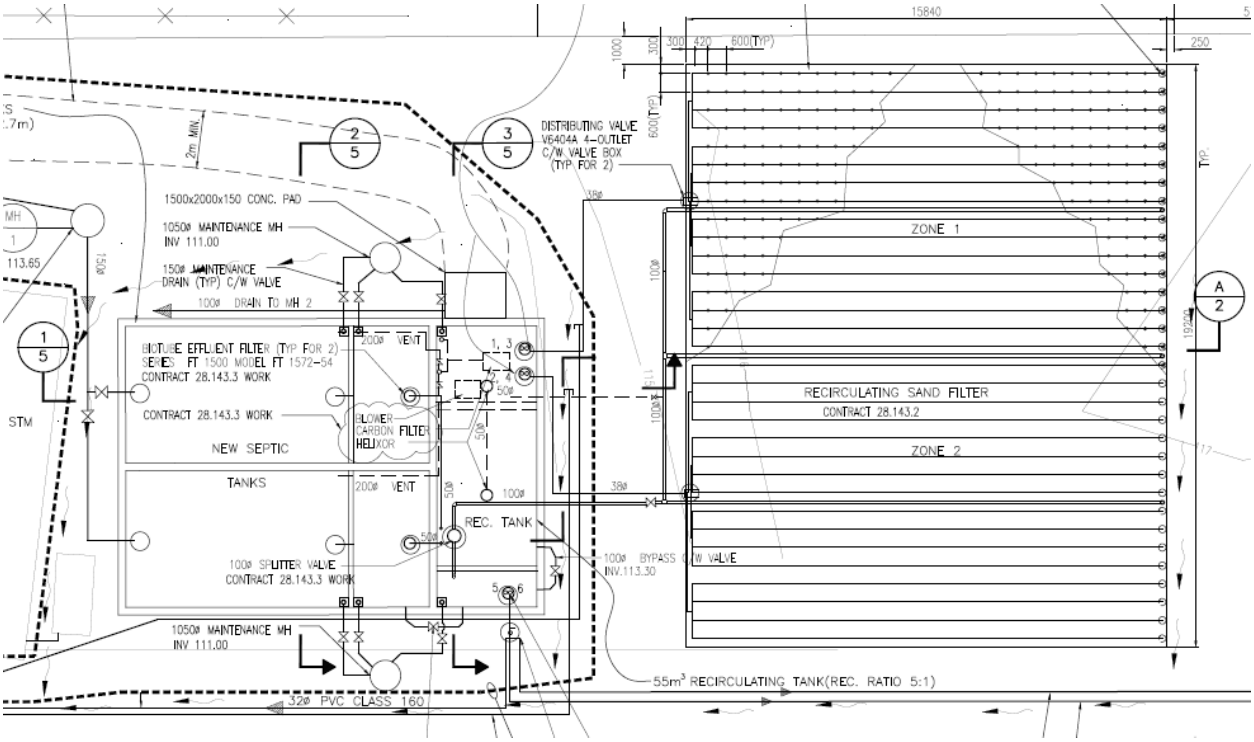


Figure 11 - Record drawings of the existing system can be seen in Appendix D for reference to the descriptions below.

6.1 Septic Tank

An equivalent 244 m^3 (54,000 Imp.gallon) septic tank is composed of two 122 m^3 cast-in place concrete tanks each with two chambers. The first chambers receive incoming sewage and begin primary treatment via settlement, where suspended solids sink to the bottom of the tank and fats, oils, and greases (FOG) rise to the top. The second chambers are equipped with Biotube Effluent Filters which further reduce particle flow enhancing further settling of solids before effluent flows to the recirculation tank.

6.2 Recirculation Tank

The recirculation tank is 55 m^3 (12,000 Imp.gallon) and is equipped with two sets of Duplex P50 OSI 07 HHF – 3 Stage ¾ HP 230VAC, single phase, 60 Hz pumps, referred to as pumps 1 & 2 and pumps 3 & 4, which deliver effluent to the recirculating sand filter via the distribution network on a cycle. Pumps 1 & 2 are activated and run for 2.7 minutes and then shut off. After 2.3 minutes of rest, pumps 3 & 4 are activated and run for 2.3 minutes. After 2.7 minutes of rest, the cycle is started over again, beginning with pumps 1 & 2. It is assumed that Pumps 1 & 2 deliver waste to Zone 1 and that pumps 3 & 4 deliver waste to Zone 2. This cycle repeats continuously, and the pumps are operated at 46.3 US gpm and 39 total dynamic head (TDH), equally distributing flow across the network. According to the SCRD, the dosing schedule can been modified so the current dosing schedule may be slightly different than described above.

6.3 Recirculating Sand Filter

The recirculating sand filter has an area of 15.8 m x 19.2 m, totalling 304 m^2, and is approximately 1 m deep. The sand filter media is noted in design drawings to be four layers composed of 150 mm of 19 mm (¾") crush gravel, followed by 600 mm of filter media that has an effective size of 1.5-3.0 mm, followed by 75 mm of 6 mm (¼") pea gravel, followed by 175 mm of 19 mm (3/4") crush gravel for the drainage media. Site conditions appeared to note that a pea gravel 5-9 mm is used full depth. A cross-section of the sand filter as described and installed by Opus can be seen in Appendix D, Figure 12.

The upper distribution network consists of 32 160 PVC laterals each with 25 – 3 mm diameter orifices, spaced 160 mm apart, for a total of 800 orifices. Each orifice is pointed upward and is equipped with a PVC orifice shield for better distribution across the sand filter.

A PVC underdrain is located within the 19 mm gravel and returns effluent to the flow splitter box. The system operates with a recirculation ratio of 5:1 which means that for every 5 parts of effluent that enters the splitter box, 1 part is delivered to the pumping tank, and 4 parts are delivered back to the recirculation tank. A cross section of the sand filter is shown below.

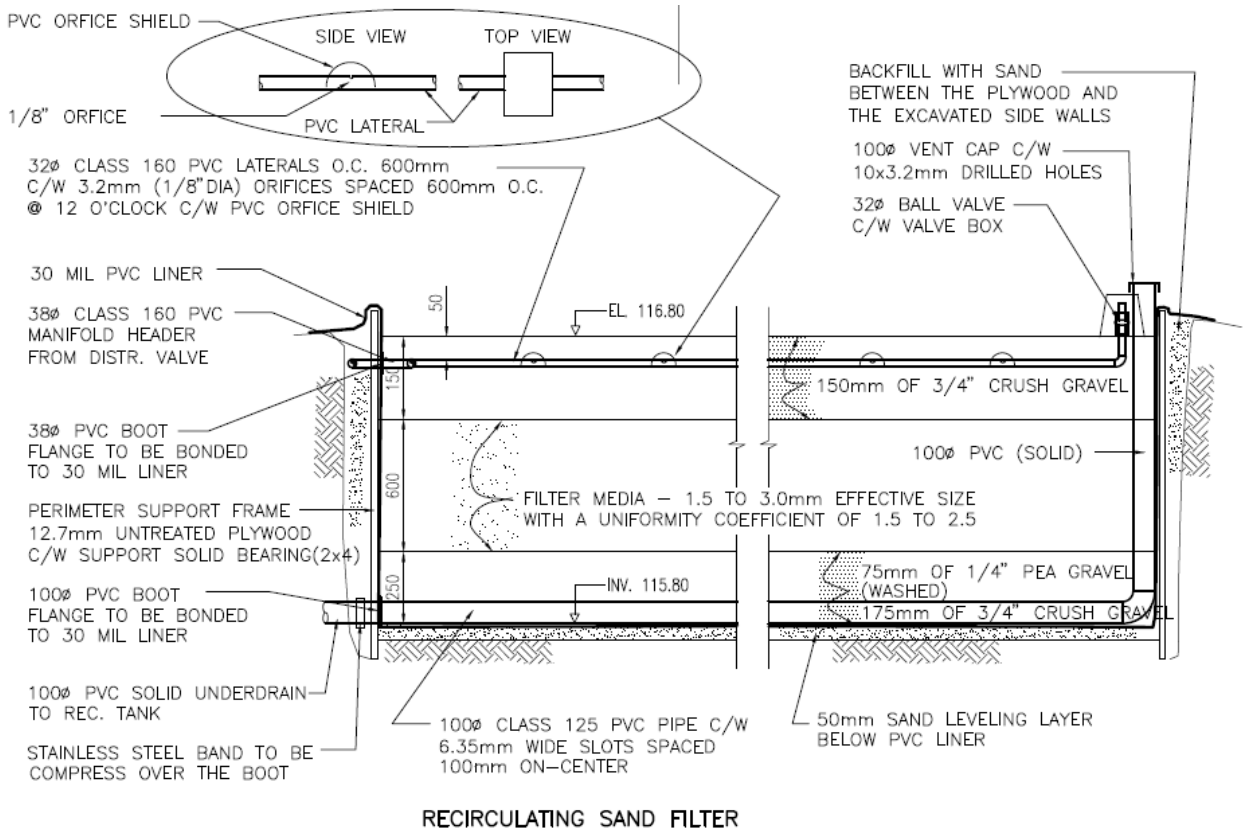


Figure 12 - Cross Section of Existing Filter

6.4 Pumping Tank

The pumping tank is located adjacent the recirculating tank. Treated effluent that is received in the pumping tank is delivered to the soil absorption system via one of two P50 OSI 07 HHF – 3 Stage ¾ HP 230VAC, single phase, 60 Hz, pumps, referred to as pump 5 and pump 6, which are run on a cycle. Each pump operates on an adjustable pump and rest time, allowing for adjustments as required. Delivery to the effluent disposal system drain fields is rotated monthly.

It is noted on the drawings that each field receives 55 m^3/day flow, during its monthly cycle, which is not in keeping with either the Permit, or actual measured flows.

6.5 Effluent Disposal System

Disposal fields 1 and 2 each consist of four sets of laterals fed by a 4-outlet V4404A distributing valve housed within a valve box. The laterals are each covered with eight 36" infiltrator chambers lined up in a row. A monitoring well is located at every other set of laterals. A third disposal field, titled Ocean View Disposal Field, is on standby. Use or discharge to the Ocean View Disposal Field is at the Operator's decision based on site observations and maintenance requirements.

7.0 Findings

In general, there are several factors which have an impact on the operations of the facilities and compliance with the Permit. Based on the review of information, we find the following key points:

- There were 10 periods where flow exceeds 75 m^3/day over one or more days, the past three years. This was most noticed during a period from December 23, 2017 until January 8, 2018 when the maximum discharge was exceeded 15 out of 17 days, at an average of 88 m^3/day. This was specifically during the holidays, and potentially maximum occupancy, as precipitation was not a factor.
- In 2018 and 2019, there were 8 other days of exceedances, and inflow and infiltration were again minor contributing flows.
- The Permit is based on about 1,000 Litres per home per day. Under the Municipal Wastewater Regulation, historical consideration has been based on about 1,300 Litres/home and an allowance for Inflow and Infiltration over the sand filter, or about 106 m^3/day, which would have negated most flow exceedances.
- The Permitted maximum discharge is inadequate to account for inflow over the filter in wet weather operation, or for infiltration because of a damaged collection system. This can be addressed longer term with the MoE as part of system modifications and updating the Permit.
- Following the plant pump-out in May 2018 and the introduction of regularly cleaning and maintenance procedures there were notable improvements in effluent quality.
- Headworks for the facility are inadequate for a proper balance of flow between the two cells.

- The septic tank volume is 244 m^3, or approximately 2.5 days of design flow, less solids accumulations. The recirculation tank has an additional 55 m^3 of storage, although it is smaller than recommended for recirculation. The pump chamber is 13.3 m^3 in capacity. There is opportunity to adjust for equalization of flows over a day to shave peak day flows through adjustment of float levels and pump timers.
- The aeration system in the recirculating tank is not operating and may be a factor in effluent quality or mixing of solids for circulation in the filter.
- The recirculating filter is a single cell that operates in zones. Individual zones cannot be isolated for maintenance purposes, meaning that the entire system must be taken offline when repairs are needed.
- The recirculating filter is near end of life, and alternatives are required to ensure secondary effluent quality can be maintained prior to discharge to the disposal fields.

8.0 Design Considerations

8.1 Sewage Flows and Permit Limits

Design considerations for the current system is 73 homes with an average of three bedrooms each at 1,360 L/home/day or 1.36 m^3/home/day, for a total of 100,640 L/day (100.6 m^3/day). Alternatively, Canada census data notes approximately 2.5 people per household, totalling 185 people for the neighbourhood. Using an average of 140 litres per capita per day (LPCD) for indoor use, this totals 25,900 L/day or 25.9 m^3/day. Doubling this value to estimate a maximum flow for the day results in 51, 800 L/day or 51.9 m^3/day, with the remainder of the Permit flow an allowance for inflow and infiltration.

As seen in section 2.2, daily discharge exceeding 75 m^3/day from 2017-2019 occurred a total of 10 times generally because of inflow and infiltration following rain events. Equalizing the flow between the recirculation tank and pump chamber can shave peak day flows, by storing flows over one day.

Adjusting timers on the effluent pumps to operate at a maximum discharge of 75 m^3/day will cause excess flows to go into storage. However, due to the likely maximum 50 m^3 of storage available in the tank, the peak flow period between December 2017 and January 2018 would still have occurred. A minor Permit Amendment to increase the allowable discharge by 10% to 82.5 m^3/day is a feasible option

to address regulatory or administrative aspects with the Ministry of Environment. It is not a consideration to add additional homes.

8.2 Headworks Improvements and Septic Tank Performance

The manual bar screen has been removed, leaving a trough and lip edge. This creates intermittent catching and clogging of solids to accumulate in the screen trough, allowing for intermittent dams, and flow redirection between the two outlet pipes discharging to the septic tanks.

Replacement of this infrastructure to remove barriers and evenly split the flow will be beneficial. The installation of a new coarse bar screen would require a continuous maintenance schedule to remove accumulated debris such as plastics, disposable wipes, and hygiene products. This would result in increased solids handling by operators; increase disposal risks; and increase operational costs.

Flow splitting is not easy with raw sewage due to solids settling or hanging up on any edges. Ideally, a sump would be provided with a higher inlet pipe, and two outlet pipes. This option is restricted on the existing setup as elevation differentials are not generally sufficient to allow the elevation changes desired.

From record drawings, we note the septic tank inlets are at 113.50 m, and the upstream manhole is at 113.65 m, and 11.5 m to the second tank inlet. Minimum grade on a 150 mm PVC pipe is 0.5%, allowing for a pipe drop of 9 cm at the manhole, which could support improved distribution at lower flows. A belled pipe entry (specialty) fitting would reduce debris holding to the pipe inlets.

An alternative would be to convert the tanks to series with one inlet, and new piping within the tanks. This option requires working in a confined space, yet offers benefits of a longer settling distance, and eliminates short circuiting. It is the more costly, and less desirable option.

8.3 Recirculation Tank Mixing

The absence of an aeration blower in the recirculation tank has likely contributed to solids build-up within the tank corners, which can lead to effluent quality issues. The two Helixor units have a bottom air inlet from the blower. As air rises, it draws in effluent and is designed to burp air, and the liquid, spraying it over the upper surface for mixing and suspending of solids, which are captured in the sand

filter. Without the blower, the solids can settle in corners and cause anaerobic zones, and incomplete effluent treatment.

8.4 Retaining the Existing Sand Filter

SCRD staff have expressed interest in the idea of keeping the current sand filter as a backup which can be used if the new system fails. This is an interesting idea that may add some peace of mind and flexibility, however; the current sand filter should be partially remediated before it is considered a reliable backup. Suggested maintenance includes but is not limited to inspecting and repairing distribution boxes, inspecting, and repairing the current distribution network, removing all vegetation from the surface of the sand filter, and replacing about 0.5 m of the media. As such, consideration for a whole replacement is considered in cost estimates

The extent of repairs will determine the capacity of the sand filter to treat wastewater on a continual basis as opposed to a backup to an alternative treatment system. The cost for repairing the existing sand filter will need to be considered with any option that includes keeping the existing filter as a backup. Additional costs will include new piping infrastructure that can accommodate two systems, allowing the operator to redirect flow to and from the recirculation tank as required.

9.0 Alternative Treatment System Options

9.1 General

The two types of systems that will be considered for this project are media-based recirculating filters and prefabricated treatment units. Media-based recirculating filters should generally be considered like-for-like by the Ministry of Environment and will likely require a minor permit amendment, while prefabricated treatment units will require a more costly new permit registration.

9.2 New Media-based Recirculating Filter

Appendix E details typical requirements of a recirculating media filter system. Recirculating sand filters have existed since the early 1900s, and although the primary principles have remained the same, minor improvements have been made throughout their iterations. Many of these improvements have made RSFs easier to inspect and maintain using well positioned inspection ports and clean-outs and a regular

maintenance schedule. The new RSF will aim to incorporate these improvements in the design to prolong the life of the filter while ensuring a high-quality effluent over its lifetime. Perhaps the most significant change is the emergence of new engineered media which is designed to have a higher void-ratio than sand or gravel, allowing greater surface area for biomass attachment and an increased capacity for air exchange.

9.3 Media-based Recirculating Filter Considerations

9.3.1 Location

There are two options regarding the location of a new filter. First, the existing sand filter can be removed, and a new filter can be built in its place. Second, it may be possible to build a new filter in the restricted area available on-site, located north of the pump hut. This would allow the existing sand filter to remain as a temporary use backup. The area is constrained by the access driveway, setbacks to property, buildings and the slopes of the existing media filter as shown below.

Figure 13 - Potential Area for Filter

The existing filter constrains the remaining available area to approximately 100 m^2. Any new filter must consider the hydraulic loading rate and biological loading rate of the selected media and the associate surface area limitations, as well as any regulatory requirements.

9.3.2 Hydraulic Loading

A hydraulic loading of at least 82.5 m^3/day forward flow will be considered for this system. This rate offers a basis for design which dictates the size of media that can be used for a given available area. Fine media has a lower hydraulic loading rate compared to coarse media. Media with a lower hydraulic loading rate consequently has a higher retention time, resulting in increased treatment potential with each pass, meaning a lower recirculation ratio is needed to produce the same quality effluent, provided there is sufficient wetting of the media to assure continued aerobic activity. This also means that fields composed of fine media need a longer resting time between doses compared to those with coarser media.

9.3.3 Dose

As described in Appendix E, standard dosing practice for a recirculating filter is 48-96 doses per day. Using a recirculation ratio of 4:1 with a forward flow of 82.5 m^3/day, the dose volume will be between 4.3 – 8.6 m^3/dose. At 100 Litres/min (26 USgpm), the existing 4 pumps would have an ON time of about 11 – 22 minutes, and an OFF time of about 4 – 8 minutes. This is higher than current pump times and will be an increase in energy costs.

Effluent quality is noted to increase with decreased dose volume and a subsequent increase in doses [3]. A higher dosing frequency will also reduce the surface area requirements; however, a balance must be achieved where the media is kept moist but not oversaturated, which is a factor of the surface area per volume.

9.3.4 Filter Media

The filter media provides an environment for bacteria to live and to aerobically digest waste found in the effluent. For this process to be successful, several key variables must be in balance. Bacteria attach

to the surface of the media and live and grow within the void-spaces that are found between adjacent media. The void-spaces provide channels for aeration and for effluent to travel through. The effluent provides the food supply for the bacteria who clean the effluent as they consume suspended and dissolved particulate. The distribution must be effective across the entire surface area to evenly saturate the surface and allow it to drain for drawing back in air around the media. This is provided by the pumps and the cycle between flooding and resting.

Potential media options that can be used to create a new filter are sand, gravel, rigid plastic media (Brentwood Industries structured-sheet plastic media), and plastic pieces (SuperBiomedia). Brentwood Industries structured-sheet plastic media is typically used in large trickling filter towers but the CFS-3000 cross flow media units can be used to retrofit shallow rock filters, making it a viable option for small projects due to its large hydraulic loading capacity [5]. A summary of the characteristics of each media option can be seen in the Table below.

Table 1 – Characteristics of Potential Media for New Media-based Recirculating Filter (Excluding Housing and Site Preparation)

Loading Characterization	Sand Media	Gravel Media	Plastic Media (Rigid)	Plastic Media (Pieces)
Hydraulic (m3/m2/day)	0.12 – 0.2	0.4 – 0.6	15 – 20	15 – 60
Organic (g/m3/day)	8 – 24	25 – 50	50 – 200	150 – 300
Media Surface Area (m2/m3)	280	69	157	600
Sloughing of Biomass	Poor	Fair	Very Good	Good
Depth of Media (m)	0.6 – 1	1-2	2-3	1-2
Filter Area (m2)	300	225	65	40
Volume of Media (m3)	300	225	120	48
Unit Rate ($/m3)	$90	$90	$360	$2,000
Material Cost	$27,000	$20,250	$43,200	$96,000

Regulatory requirements are a factor in the determination of selected media for the filter. The Ministry of Environment should generally consider plastic media as an alternative to a gravel filter based on modern practice for media selection. Of importance is the impact of the media on the environment. Small plastic media can blow away, so would require a cover. As this type of media is flexible, there is little structural integrity, requiring a fully supported cover. The rigid media will not blow away but is recommended to have a grating over top to allow for walking over to protect the edges of the media.

For gravel choices, smaller particle size will have an increased retention time, meaning that waste passes through it more slowly. A greater retention time is desirable as it allows more time for bacteria to digest waste as is passes through the media and will require a smaller recirculation ratio. As the size of media increases, retention time decreases and so more passes may be required to achieve the desired effluent quality – i.e. a higher recirculation ratio is needed. Furthermore, as media size increases, time to fouling is extended, maintenance decreases, and allowable hydraulic loading rate increases. Media life may be extended, and the field is less prone to freezing. Rigid plastic media offers the smallest footprint to accommodate site constraints, and will requires the lowest recirculation ratio, with typical ratios ranging between 1:1 and 3:1 [5].

9.3.5 Underdrain Media

The underdrain media functions to protect return piping, provide porous flow through of effluent, and provide structural support for the granular pieces of filter media. For all sand and gravel filter materials, this will typically be 25 – 50 mm drain rock. An example of a gravel filter can be seen in Appendix E.

The plastic media options do not require underdrain media but will require an underdrain collection system. Brentwood Industries structured-sheet plastic media trickling filters make use of their AccuPier Support System. An example of a structured-sheet plastic filter can be seen in Appendix H.

9.4 Orenco's AdvanTex AX100

The AdvanTex treatment was previously considered by the SCRD in other consultant reports. The system offers an alternative to traditional recirculating sand filters with a pre-built recirculating packed-bed cloth filter. The AX100 units are housed within fiberglass basins that are filled with a lightweight, engineered textile media [6]. The media is assembled in sheets that are slotted into the basins, providing a large amount of surface area for treatment, and allowing for removal for replacement. The AdvanTex system treats wastewater in the same way as a recirculating sand filter – receiving initial flow from primary treatment and recirculating treated flow through a recirculating chamber multiple times before delivering it to a disposal field.

Each AX100 unit can treat up to 18.9 m^3/day and can be installed above ground or partially buried. To meet the design flow of 82.5 m^3/day, a minimum of five AX100 units will need to be plumbed in parallel. The AX100 pods measure 4.87 x 2.43 m and require 1.0 m of space between adjacent units. In total the footprint required for this set-up would be approximately 4.87 x 17.15 m, resulting in an area of 84 m^2. The units will fit within the additional 100 m^2 available on site, or on top of the existing sand filter such that it can remain as a backup.

The primary advantage of these units is that they are pre-plumbed for easy hook-up, meaning that they can directly replace the existing filter by hooking up to the recirculation tank and flow splitting device. Additionally, the units are easy to service and maintain as the filters can be hosed off when saturated and replaced when worn out. It is expected that the filters will need to be replace approximately once every ten years.

The cost of each unit is approximately $28,700, totalling $143,500 for five units. Additional costs will include freight, site preparation, piping, installation, and registration for the new system.

Example drawings of AdvanTex units installed over the current sand filter have been provided by Opus and can be seen in Appendix F, Figure 16.

As the AdvanTex AX100 units are a modular treatment system, we have raised concerns that the change to this option would result in a significant change to the Permit, and result in a requirement to convert to the MWR Registration process. This is additional to the construction cost.

9.5 PremierTech Aqua's Ecoflo Coco Filter

The Ecoflo Coco filter is a pre-built secondary treatment unit that operates like a single-pass sand filter but makes use of a filter media derived from coconut husks instead of sand. The media has an average life expectancy of 10-15 years [7]. The SCRD has an operational example of this unit currently in operation at the Grantham's Hall septic system.

The Ecoflo Coco filters are designed to receive wastewater from an equalization tank that follows the septic tanks. The equalization tank accumulates wastewater during the daily peaks, regulating the flow supplied to the filters. A tipping bucket within the unit receives wastewater and, once full, tips over and splits the flow equally across the surface area of the filter. Wastewater is captured in the coconut husks and the organic material is consumed by bacteria. Once the filtrate reaches the bottom of the filter, it is delivered to the soil absorption system [7].

When considering a maximum daily design flow of 75 m^3/day, eighteen Ecoflo Coco Filters, model EC-7.3-P-G (polyethylene model with 7.3 m^2 of filtering media and gravity outlet), will be required to produce the desired effluent quality. A daily design flow of 75 m^3/day is considered for this approach due to the absence of recirculation.

The eighteen units will be divided into two clusters of 9 which will be fed by two pressurized flow dividers (model PFS-900C). Each cluster will receive half of the flow and each of the 9 units within the cluster will act in parallel, receiving equal volumes of wastewater. Each unit is 4.2 m long and 2.2 m wide and will require a minimum distance of 0.6 m between one another. In total the footprint required for this set-up would be approximately 19.0 m x 13.4 m, resulting in an area of 255 m^2. This would fit within the footprint of the existing sand filter.

Due to the single-pass design of these units, minor modifications to the current primary treatment system will be required. The system requires an equalization tank with a minimum volume of 25 m^3 and does not make use of recirculation. The existing 55 m^3 recirculation tank could be repurposed and used as an equalization tank. Flow from the units will drain via gravity back to the existing pump station for discharge to the disposal fields.

Wastewater characteristics are an important factor in specifying these treatment units and this system has been suggested based on the following assumed septic tank influent concentrations: 250 mg/L BOD_5; 300 mg/L TSS; 50 mg/L Total Kjeldahl Nitrogen (TKN); and 10 mg/L Total Phosphorous. The actual influent qualities are unknown.

Since this unit operates like a single pass sand filter, the MoE will not consider the replacement of the existing RSF with an Ecoflo Coco Filter system as like for like, meaning that a new registration application may be required.

An example of an Ecoflo Coco Filter system cluster can be seen in Appendix G, Figure 17. Due to the large surface area requirement for the Ecoflo Coco Filter system, it would need to be installed on top of the existing sand filter.

As noted previously, the surface of a recirculating sand filter should be free of vegetation and debris to allow for proper aeration. This raises concerns since the Ecoflo Coco Filter system would cover much of the surface of the existing filter. Furthermore, the additional weight of the units may result in compaction and a loss of void space, meaning that the treatment potential of the existing system may be compromised.

10.0 Operations and Maintenance

10.1 Primary Treatment O&M

Regular maintenance to preserve the health of the primary treatment system is important to ensure the effective treatment of wastewater. Preliminary treatment occurs in the septic tanks through settlement or sedimentation in the first chambers. Improved flow equalization to minimize solids settling will

reduce short circuiting and preferential flow to one tank over the other, as well as the potential for odours at the headworks.

During the June 18 site inspection, the operator noted that the coarse bar screen would fill with debris regularly, limiting flow to the septic tanks. Removing the bar screen is an appropriate fix but contributes to the varying flow paths to the septic tank inlets. Improvements should be considered.

Septic tank settling and the use of the BioTube effluent filter drastically reduce TSS and prepare the effluent for secondary treatment. A regular cleaning schedule can be established so that tanks and filters are cleaned before they clog. It is a potential in addition to the lack of the aerators, that long wait times in-between pump-outs allowed excess suspended solids into the recirculating tank which were then pumped into the sand filter. The cost for this maintenance will be roughly the same across all potential treatment options.

10.2 Media-based Recirculating Filter O&M

As mentioned previously, when comparing traditional media such as sand and gravel; as media size increases, time to fouling intervals extends; maintenance decreases; and allowable hydraulic loading rate increases. Furthermore, media life may be extended, and the field is less prone to freezing.

Basic maintenance requirements for a sand filter include the following:

- Measure the pressure head of the distribution network to check for clogging. If clogged, the caps at the end of each lateral can be removed one at a time while the pumps are running. This will flush the line. High pressure jetting can be used if needed [2].
- Regularly inspect the surface of the sand filter for ponding. If ponding is occurring, the dose may be too high, or the media has started to foul. Changes to the dose volume and/or recirculation ratio may remedy the situation [2].
- During inspection, remove any weeds by either hand pulling or raking. Vegetation build-up on the surface should be avoided to allow for aeration and to protect the distribution network.

Any solutions that include maintaining the existing filter should consider the cost associated with these maintenance activities. Cost will vary depending on the time required by the operator but should be limited if maintained regularly.

Alternative media options such as rigid plastic media (Brentwood Industries structured-sheet plastic media) and plastic pieces (SuperBiomedia) will have fewer maintenance requirements. The surface of these systems does not generally provide a medium for weeds to grow and the distribution networks are exposed. The increased void volume compared to sand and gravel means that effluent can travel more freely, greatly reducing the chances of clogging. Maintenance for the structured-sheet plastic media is limited to the distribution system and pumps.

10.3 Prefabricated Systems O&M

10.3.1 Orenco's AdvanTex AX100

A maintenance schedule described by AdvanTex includes monthly, quarterly, semi-annual, annual, and biannual maintenance. Subscribing to this schedule will ensure the long-term health of the system but comes at a cost.

10.3.2 PremierTech Aqua's Ecoflo Coco Filter

Annual maintenance and inspection are recommended to verify that the system is operating correctly. Annual cleaning is not generally required for these systems, as the media is sacrificial and requires periodic removal and replacement typically at 6-9 year intervals depending on loading.

10.4 Recirculation Ratio and Dosing

Costs for pumping will change depending on the recirculation ratio and dosing schedule. In general, systems that require a higher recirculation ratio will have greater costs associated with pumping. Recirculation ratios may need to be adjusted after installation depending on system performance. The following recirculation rates are expected for the systems described:

- Sand Filter: 3:1- 5:1
- Gravel Filter: 5:1-7:1

- SuperBiomeda Filter: 0.25:1-1:1
- Structured-sheet Filter: 1:1-1:3
- AdvanTex AX100: 2:1-4:1
- Ecoflo Coco Filter: N/A

10.5 Cost Comparison Summary

All potential systems will share similar costs associated with preliminary and primary treatment operations and maintenance. Maintenance costs associated with the described secondary treatment options are expected to be the greatest for the AdvanTex system and the least for the Brentwood Industries structured-sheet plastic filter. Costs associated with pumping are expected to be the greatest for a simple gravel filter and the least for the SuperBiomedia.

11.0 Recommended System Improvements

As mentioned in section 7.1, some improvements to the primary treatment system are recommended. These improvements are recommended for all treatment options if the budget allows.

Septic Tank

Woodcreek park wastewater treatment plant currently has two 122 m^3 cast-in place concrete tanks operating in parallel which perform primary treatment via settlement. It is recommended that improvements/repairs are made to ensure that flow is evenly distributed between the two tanks to allow for longer holding time, increased settlement, and slower loading of the recirculation tank.

Recirculation Tank

The aeration system is required to be operational for mixing and minimizing solids deposition, which can impact effluent quality.

12.0 Capital Costs and Life Cycle Costs

Table 2 summarizes the estimated costs of the various treatment options. These estimates are to provide grounds for comparison between potential treatment systems.

Table 2 – Estimate Capital Costs of Potential Treatment Options

Component	Gravel Filter	Media Filter	Advantex	Coco Filter
Mobilization Demobilization	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Demolition and Removal Works	$ 65,500			
Influent Headworks	$ 11,250	$ 11,250	$ 11,250	$ 11,250
Blower and Aeration	$ 19,000	$ 19,000	$ 19,000	$ 19,000
Site Preparation and Formwork	$ 76,000	$ 46,000	$ 46,000	$ 46,000
Media/Equipment Supply	$ 27,000	$ 96,000	$ 160,000	$ 170,000
Installation Piping	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Backfill and Landscaping	$ -	$ 16,000	$ 16,000	$ 16,000
Subtotal of Construction	$ 218,750	$ 208,250	$ 272,250	$ 282,250
Engineering Design and Tender	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Construction Engineering Service	$ 35,000	$ 35,000	$ 35,000	$ 35,000
MoE Registration Application	$ 10,000	$ 25,000	$ 25,000	$ 25,000
Taxes and Contingency (35%)	$ 98,000	$ 99,000	$ 122,000	$ 125,000
Estimated Construction Costs	$ 376,750	$ 382,250	$ 469,250	$ 482,250

Table 3 Life Cycle Costs of Replacement at 20 Years

Component	Gravel Filter	Media Filter	Advantex	Coco Filter
Mobilization Demobilization	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Media Replace 10 Yr	$ -	$ -	$ 10,000	$ 25,000
Media Replace 20 Yr	$ 93,000	$ -	$ 10,000	$ 25,000
Subtotal	$ 103,000	$ 10,000	$ 30,000	$ 60,000
Engineering (15%)	$ 15,450	$ 1,500	$ 4,500	$ 9,000
Taxes and Contingency (35%)	$ 41,458	$ 4,025	$ 12,075	$ 24,150
Estimated Construction Costs	$ 159,908	$ 15,525	$ 46,575	$ 93,150

Costs include an allowance for media replacement for comparative purposes in that the Coco Filter media requires replacement every ten years, and it is anticipated the gravel filter option would approach end of life at 20 years based on current experience and known ability to flush biomass from the system. Based on discussions with the SCRD Operations Staff, there is a desire to both remediate the gravel filter to ensure compliance with the existing Permit from the MoE, and to enhance the

treatment options with the installation of the Advantex cloth filter media due to operations comfort compared to the Brentwood media filter installation. Costs for this combined solution are below.

Table 4 - Combined Costs for Current Replacement and Advantex

Description	Units	Quantity	Rate	Total
Mobilization/Demobilization	lump sum	1	$ 10,000	$ 10,000
Demolition Works	lump sum	1	$ 10,000	$ 10,000
Hydrovac Gravel Removal	hourly	80	$ 225	$ 18,000
Disposal to Landfill	cu.m	300	$ 125	$ 37,500
Drain Rock	cu.m	50	$ 90	$ 4,500
Pea Gravel	cu.m	260	$ 100	$ 26,000
Base Collection Piping	lineal metre	100	$ 60	$ 6,000
Top Distribution Piping	lineal metre	530	$ 65	$ 34,450
Blower Installed	each	2	$ 9,500	$ 19,000
Headworks Manhole	each	1	$ 5,000	$ 5,000
Headworks Piping (150 dia)	lineal metre	25	$ 250	$ 6,250
Existing Liner Repairs	lump sump	1	$ 5,000	$ 5,000
Excavation for New Filter	cu.m	80	$ 75	$ 6,000
Advantex Media Filters Installed	each	5	$ 40,000	$ 200,000
Gravity Block Wall	square foot	250	$ 50	$ 12,500
TCOM Panel and electrical	lump sum	1	$ 20,000	$ 20,000
Backfill of Advantex Area	cu.m	60	$ 100	$ 6,000
Landscaping	lump sum	1	$ 10,000	$ 10,000
Subtotal of Construction				$ 436,200
Engineering Design and Tender	lump sum			$ 15,000
Construction Engineering Service	lump sum			$ 35,000
MoE Registration Application	lump sum			$ 25,000
Taxes and Contingency (35%)				$ 179,000
Estimated Construction Costs				$ 690,200

13.0 Summary

The Sunshine Coast Regional District has requested options to replace the existing recirculating filter at the Woodcreek Treatment facilities near Gibsons, BC. The works are Permitted under the Ministry of Environment, Municipal Wastewater Regulation for 75 m^3/day.

Investigations of available data and a site inspection note the recirculating filter is effectively plugged and in need of remediation or replacement. Other works were noted as either in need of improvement

(headworks) or replacement (recirculation tank mixers/aerators), and site constraints leave little area available for replacement of a similar structure without removal of the filter.

MSR examined alternative systems included replacement of the filter with the same, and secondary treatment options previously reviewed by the SCRD.

- The gravel filter replacement requires a total replacement and no redundancy in the system. It falls within the current Permit and is easily replaced.
- The option of using rigid plastic for the media filter can provide for a new location adjacent the septic tanks in the driveway area, with a footprint of about 65 m^2. For safety and to allow for foot traffic only, a grid grating is placed on top. This option is a minor change from the Permit and should be acceptable to the MoE as part of a minor Permit Amendment. It also provides for keeping the existing filter in place as a backup module.
- The Advantex media cloth filter system is very similar to the rigid media treatment polishing process using a sprayer over cloth, in an already fabricated housing. It is more costly and provides a simple operation and proven effluent quality.
- The PremierTechAqua treatment modules were considered as alternative options. Being a proprietary system with sacrificial media (peat), they are expensive and have future maintenance costs for media replacement. We believe this option will require a conversion of the Permit to the Registration process.

In addition to the treatment options prior to disposal, we have recommended improvements to the inlet piping to minimize solids plugging and to improve flow distribution.

The existing Permit is not sufficient for maximum day flows from the site. A minor Permit Amendment to increase the flow by 10%, along with minor changes to the pump circulation options to provide for flow equalization will support a reduction in flow exceedances.

Treatment options range from an estimated cost of $380,000 to provide a plastic media filter, to over $480,000 for alternative treatment systems, including engineering fees, taxes, and contingencies.

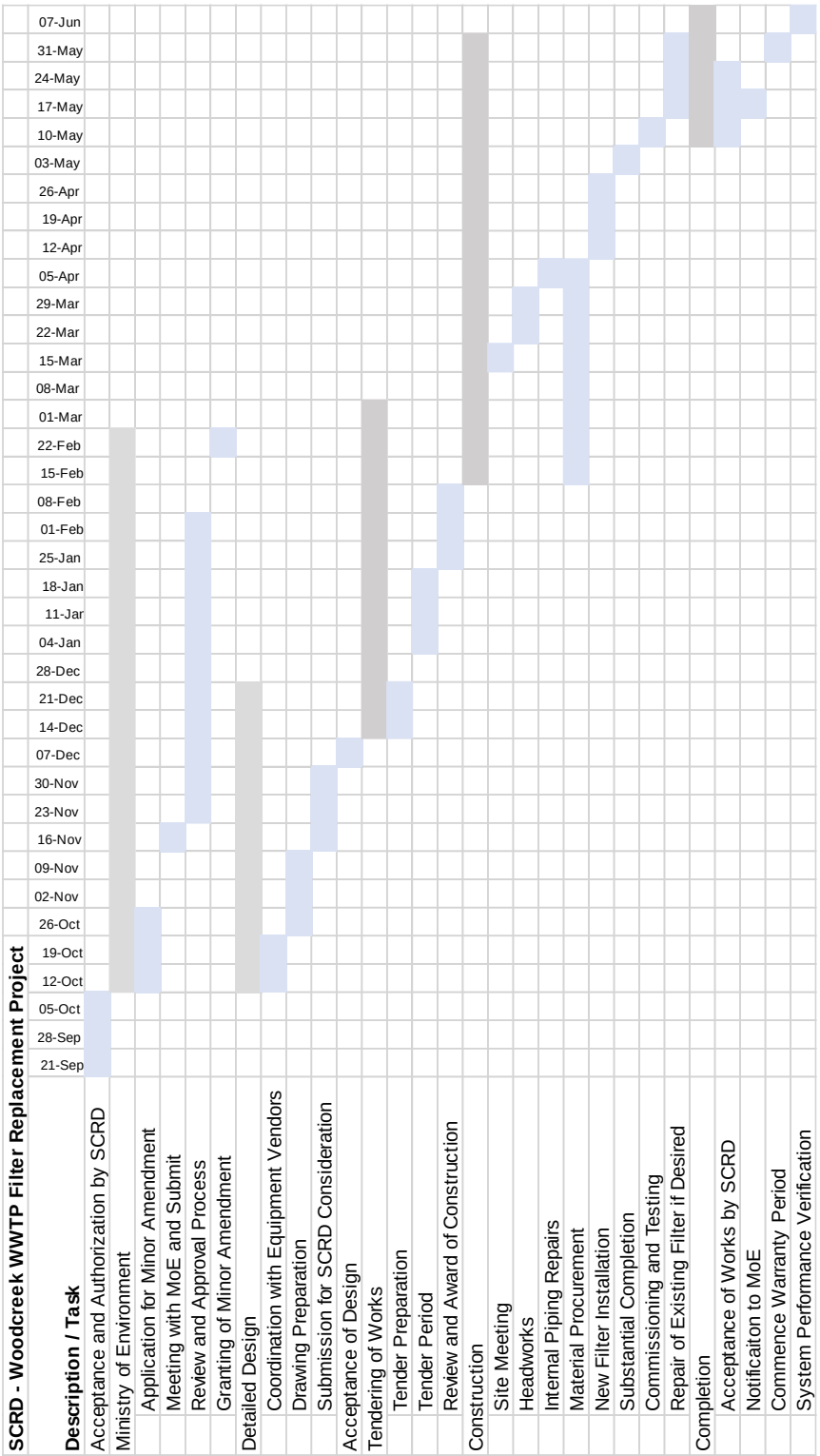
14.0 Recommendations

Based on an examination of the options available to the SCRD, the following works are recommended to provide for the improvements to the treatment system.

- Submit an Application for a Minor Permit Amendment to the Ministry of Environment to 82.5 m^3/day.
- Replace the existing headworks to remove the current screen area, and to improve flow splitting between the tanks.
- Replace and connect the air compressors to the recirculation tank Helixors to enhance mixing and treatment efficiencies.
- Complete replacement and repairs to the existing gravel filter to ensure it can remain in service as a backup system.
- Install a new recirculating filter based on the Advantex package plant cloth filter solution.

15.0 Schedule Upon Acceptance by the SCRD

Should the SCRD concur with the above steps, or as amended, MSRS will proceed with detailed design of the accepted solution, and submission of a Permit Amendment to the Ministry of Environment. The following schedule is shown for discussion purposes and can be shortened as discussed further with staff. It is ideal to have works completed in late spring, outside of the wet weather periods.


SCRD - Woodcreek WWTP Filter Replacement Project
Description / Task
07-Jun
31-May
24-May
17-May
10-May
03-May
26-Apr
19-Apr
12-Apr
05-Apr
29-Mar
22-Mar
15-Mar
08-Mar
01-Mar
22-Feb
15-Feb
08-Feb
01-Feb
25-Jan
18-Jan
11-Jar
04-Jan
28-Dec
21-Dec
14-Dec
07-Dec
30-Nov
23-Nov
16-Nov
09-Nov
02-Nov
26-Oct
19-Oct
12-Oct
05-Oct
28-Sep
21-Sep
Acceptance and Authorization by SCRD
Ministry of Environment
Application for Minor Amendment
Meeting with MoE and Submit
Review and Approval Process
Granting of Minor Amendment
Detailed Design
Coordination with Equipment Vendors
Drawing Preparation
Submission for SCRD Consideration
Acceptance of Design
Tendering of Works
Tender Preparation
Tender Period
Review and Award of Construction
Construction
Site Meeting
Headworks
Internal Piping Repairs
Material Procurement
New Filter Installation
Substantial Completion
Commissioning and Testing
Repair of Existing Filter if Desired
Completion
Acceptance of Works by SCRD
Notificaiton to MoE
Commence Warranty Period
System Performance Verification

16.0 References

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Appendix A – Historical Flow and Effluent Quality

Table 5 – 2017 Treated Effluent Flow

Month	Average Daily Flow (m^3/day)	Minimum Daily Flow (m^3/day)	Maximum Daily Flow (m^3/day)	Days Exceeding 75 m^3/day
January	46.3	30.4	67.6	0
February	36.8	21.2	66.4	0
March	46.6	27.3	89.8	1
April	44.4	34.3	63.1	0
May	42.7	31.7	66.5	0
June	30.2	10	48.9	0
July	29.7	19.1	49.5	0
August	28.0	25.2	31.8	0
September	26.1	14.9	33	0
October	31.0	24.4	42	0
November	42.9	29.2	53	0
December	42.2	29.7	85.2	1

Table 6 – 2018 Treated Effluent Flow

Month	Average Daily Flow (m^3/day)	Minimum Daily Flow (m^3/day)	Maximum Daily Flow (m^3/day)	Days Exceeding 75 m^3/day
January	68.0	48.0	106.5	3
February	38.7	25.2	57.7	0
March	41.9	22.0	63.9	0
April	43.5	33.0	57.3	0
May	27.5	5.4	31.9	0
June	30.0	20.8	36.6	0
July	30.9	26.9	39.1	0
August	28.0	21.2	32.1	0
September	33.1	28.2	44.0	0
October	31.7	22.8	39.3	0
November	57.5	35.4	104.9	3
December	57.9	33.0	80.8	1

Table 7 – 2019 Treated Effluent Flow

Month	Average Daily Flow (m^3/day)	Minimum Daily Flow (m^3/day)	Maximum Daily Flow (m^3/day)	Days Exceeding 75 m^3/day
January	45.8	33.8	70.8	0
February	34.7	27.6	39.9	0
March	31.8	27.5	42.4	0
April	35.6	29.2	51.8	0
May	30.0	27.9	32.0	0
June	29.1	26.5	31.4	0
July	28.9	25.7	34.2	0
August	30.3	26.3	34.9	0
September	33.7	26.8	45.1	0
October	39.0	30.6	64.6	0
November	43.5	27.6	109.3	1
December	41.1	33.0	63.2	0

Table 8 – 2005-2019 Effluent Quality

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
2005	January	N/A	N/A
	February 1	**47**	29
	March 1	38	13
	April 1	34	7
	May 1	31	10
	June 1	**113**	20
	July	N/A	N/A
	August 1	**137**	18
	September	N/A	N/A
	October 1	**95**	37
	November	N/A	N/A
	December	N/A	N/A
2006	January	N/A	N/A
	February	N/A	N/A
	March 1	31	13
	April	N/A	N/A
	May 1	26	17

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
	June 1	24	11
	July	N/A	N/A
	August	N/A	N/A
	September	N/A	N/A
	October 1	18	6
	November 1	21	9
	December 1	44	11
2007	January	N/A	N/A
	February 19	36	19
	March 27	29	8
	April 25	41	13
	May 28	30	20
	June 25	20	12
	July 17	24	9
	August 15	18	12
	September 26	20	16
	October 29	27	13
	November 27	29	16
	December 11	29	41
2008	January	N/A	N/A
	February 21	**66**	15
	March 26	45	18
	April 16	33	16
	May 21	37	12
	June 9	38	10
	July 23	26	16
	August 28	23	10
	September 29	24	7
	October 27	37	10
	November 17	32	13
	December 9	31	12
2009	January 27	45	12
	February 11	42	18
	March 17	**47**	20
	April 27	35	29

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
	May 20	36	13
	June 10	22	9
	July 28	29	7
	August 26	25	14
	September 16	27	8
	October 1	35	11
	October 28	36	13
	November 12	38	19
	December 8	**50**	15
	December 17	**49**	18
	December 29	35	11
2010	January 14	36	13
	February 10	**46**	23
	March 11	43	12
	April 8	39	7
	May 6	43	14
	June 3	**56**	14
	July 14	27	15
	August 12	32	8
	September 8	30	14
	October 7	35	14
	October 20	22	11
	November 3	32	10
	December 1	**67**	30
	December 15	34	12
2011	January 6	40	14
	February 14	39	14
	March 8	37	13
	April 20	35	7
	May 5	40	11
	June 16	25	8
	July 19	33	12
	August 17	26	9
	September 15	20	6
	October 26	32	10

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
	November 23	29	9.8
	December 8	32	8.8
2012	January	N/A	N/A
	February 2	45	15
	February 16	**55**	14
	March 27	**49**	18
	April 12	**80**	18
	May 23	31.2	20.5
	June 7	**52.9**	12.5
	July 12	**176**	21
	August 7	**167**	26
	September 5	25	28.5
	October 3	26.2	8.5
	November 14	22.9	10
	December 11	19.9	10
2013	January	N/A	N/A
	February	N/A	N/A
	March 21	**56.9**	16
	April 30	38.1	16
	May 16	**191**	**66**
	June 12	36.6	15.5
	July 30	**169**	33.3
	August 26	**114**	N/A
	September 19	44	19.5
	October 23	0	17.5
	November 27	**92.4**	22
	December 12	**99.3**	22.7
2014	January 14	**73**	31.4
	February 12	**78**	28
	March 10	**88.2**	20
	April 23	**181**	25.3
	May 21	**182**	27
	June 19	**84.3**	22
	July 16	**99.8**	0
	August 27	**71.4**	0

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
	September 25	**77.7**	24
	October 21	**56.1**	35
	November 18	**68.2**	19
	December 2	**67**	14.5
2015	January 28	**87.3**	22
	February 26	**75**	19.7
	March 26	**94.2**	21
	April 29	**172**	32
	May 28	**213**	41
	June 24	**189**	41.5
	July	N/A	N/A
	August 13	**179**	59
	September 23	**156**	40
	October 22	**182**	42
	November 25	**124**	28
	December 9	**90.2**	21.5
2016	January 28	**75.9**	25
	February 25	**163**	30.4
	March 14	**77.9**	26
	April 21	**211**	**49**
	May 30	**143**	38
	June	N/A	N/A
	July 4	**120**	38
	August 31	**53.7**	26
	September 15	**59.3**	18.3
	October 27	**52.1**	17
	November 28	**54**	28.5
	December 14	**81.4**	36.8
2017	January 26	**102**	38
	February 20	**131**	30.4
	March 16	**202**	34
	April 27	**187**	42
	May 29	**198**	**47**
	June 28	**247**	**79**
	July 26	**93**	41

Year	Sampling Date	BOD (mg/L)	TSS (mg/L)
	August 23	**71.4**	22
	September 20	**55.1**	**131**
	October 18	**58.2**	**152**
	November 15	**49.3**	**172**
	December 6	**131**	**124**
2018	January 8	**80.2**	**61**
	February 14	**214**	**371**
	March 13	**131**	31
	April 16	**139**	25
	May 7	**124**	36.6
	June 12	8.4	10.5
	July 11	N/A	14
	August 16	N/A	38.5
	September 12	N/A	**191**
	September 26	N/A	17.5
	October 25	N/A	13.3
	November 15	10	18.3
	December 10	N/A	22.3
2019	January 10	17	**52.8**
	February 11	23	33.2
	March 12	17.8	**61**
	April 16	14	**53.5**
	May 10	13	30
	June 10	14	13
	July 10	8	7
	August 6	7	9
	September 11	11	20
	October 9	10	7.5
	November 12	14	13
	December 3	12	26

Appendix B – Gibsons Gower Point Station Precipitation Data [4]

The Gibsons Gower Point precipitation (PPT) data for 2017-2019 is summarized in Table 7 – 9. Average daily PPT was determined by summing all daily PPT values for the month and then dividing by the number of days. Total monthly PPT was determined by summing all daily PPT values for the month.

Table 9 – Gibsons Gower Point 2017 PPT Data

Month	Average Daily PPT (mm)	Min Daily PPT (mm)	Max Daily PPT (mm)	Total Monthly PPT (mm)
January	3.7	0.0	30.4	114.0
February	4.5	0.0	26.2	126.0
March	6.9	0.0	42.0	213.0
April	4.8	0.0	31.8	144.4
May	4.3	0.0	44.0	125.6
June	1.6	0.0	23.8	48.0
July	0.1	0.0	2.2	3.4
August	0.4	0.0	10.6	11.2
September	2.4	0.0	32.2	73.0
October	3.2	0.0	35.4	99.8
November	8.9	0.0	36.8	267.6
December	3.4	0.0	27.4	99.4

Table 10 – Gibsons Gower Point 2018 PPT Data

Month	Average Daily PPT (mm)	Min Daily PPT (mm)	Max Daily PPT (mm)	Total Monthly PPT (mm)
January	8.7	0.0	39.6	270.4
February	4.4	0.0	21.0	122.2
March	4.2	0.0	33.6	130.4
April	5.4	0.0	22.6	162.0
May	0.1	0.0	2.8	3.8
June	2.4	0.0	23.8	68.0
July	0.2	0.0	3.8	7.0
August	0.1	0.0	1.6	2.6
September	5.2	0.0	36.6	156.0
October	3.5	0.0	20.6	107.6
November	8.0	0.0	65.8	240.8
December	9.3	0.0	36.4	279.0

Table 11 – Gibsons Gower Point 2019 PPT Data

Month	Average Daily PPT (mm)	Min Daily PPT (mm)	Max Daily PPT (mm)	Total Monthly PPT (mm)
January	4.8	0.0	33.0	143.6
February	2.1	0.0	15.4	56.8
March	1.2	0.0	13.2	35.8
April	3.4	0.0	18.4	99.2
May	1.1	0.0	10.6	33.2
June	1.4	0.0	15.2	32.6
July	1.5	0.0	13.6	45.6
August	1.3	0.0	16.2	39.6
September	4.3	0.0	28.5	127.9
October	4.3	0.0	33.6	129.0
November	4.6	0.0	53.0	137.6
December	6.7	0.0	40.2	208.2

Appendix C – Daily Flow and Sand Filter Inflow Estimation

The daily flow as reported by in the SCRD logs, daily precipitation data from Gibsons Gower Point Station [4], and an estimate of possible inflow to the sand filter, for 2017-2019 can be seen in Table 10, Table 11, and Table 12, respectively. The comparison of daily flow and possible daily inflow is useful for determining if flows that exceeded the 75 m^3/day permit limit could be solely the result of direct inflow into the sand filter. Days with excess flow have been bolded.

Example Calculation of Daily Inflow

1) Daily PPT converted from mm to m

   Daily PPT: $21.2\ mm\ x\ \frac{1\ m}{1000\ mm} = 0.0212\ m$

2) Using a surface area of 304 m^2 and assuming 100% of daily PPT enters the field:

   Daily Inflow: $0.0212\ m\ x\ 304\ m^2 = 6.4\ m^3$

Table 12 – 2017 Daily Flow and Inflow Estimate

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
January	8	39.9	21.2	6.4
	11	39.0	0.0	0.0
	17	34.4	28.6	8.7
	20	67.6	2.4	0.7
	21	66.5	0.6	0.2
	22	52.7	9.8	3.0
	24	45.5	0.0	0.0
	26	49.0	0.0	0.0
	29	30.4	1.2	0.4
	31	38.5	0.0	0.0
February	1	34.3	0.0	0.0
	2	29.7	4.6	1.4
	7	21.2	0.0	0.0
	8	23.0	18.8	5.7
	9	29.9	11.6	3.5
	13	39.9	0.0	0.0
	14	37.4	26.2	8.0
	16	66.4	0.0	0.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	19	43.2	5.6	1.7
	20	43.6	0.0	0.0
	22	41.0	0.0	0.0
	23	35.1	8.2	2.5
	26	34.3	0.0	0.0
March	2	35.1	2.6	0.8
	5	31.7	5.4	1.6
	6	39.7	6.2	1.9
	9	36.2	8.6	2.6
	12	38.6	15.2	4.6
	13	55.8	8.2	2.5
	14	38.2	1.2	0.4
	15	57.4	3.8	1.2
	16	27.3	3.6	1.1
	23	43.9	8.2	2.5
	26	40.4	12.8	3.9
	27	54.8	13.6	4.1
	28	46.0	42.0	12.8
	29	64.8	8.6	2.6
	30	**89.8**	**0.0**	**0.0**
April	2	63.1	0.0	0.0
	4	45.7	14.2	4.3
	6	43.2	11.6	3.5
	9	48.0	3.2	1.0
	11	47.3	1.8	0.5
	12	41.8	31.8	9.7
	17	54.7	8.0	2.4
	20	41.0	0.0	0.0
	21	42.3	0.0	0.0
	23	36.9	5.6	1.7
	25	42.7	2.6	0.8
	27	35.7	0.0	0.0
	30	34.3	1.4	0.4
May	1	45.3	2.2	0.7
	2	32.9	15.8	4.8

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	7	39.6	8.2	2.5
	8	41.9	0.0	0.0
	9	40.8	0.0	0.0
	14	33.8	0.0	0.0
	16	48.8	0.4	0.1
	17	66.5	0.0	0.0
	18	54.3	0.0	0.0
	19	48.8	0.0	0.0
	25	38.2	0.0	0.0
	28	34.3	0.0	0.0
	29	41.0	0.0	0.0
	31	31.7	7.6	2.3
June	2	20.8	0.0	0.0
	4	30.4	0.0	0.0
	5	44.3	0.0	0.0
	6	26.1	0.0	0.0
	7	31.8	7.2	2.2
	8	21.0	23.8	7.2
	11	37.5	0.0	0.0
	12	48.9	0.0	0.0
	13	35.4	0.0	0.0
	16	21.8	0.0	0.0
	18	32.4	1.0	0.3
	19	47.5	0.0	0.0
	23	29.1	0.0	0.0
	25	30.9	0.0	0.0
	26	37.2	0.0	0.0
	26	10.0	0.0	0.0
	27	28.6	0.0	0.0
	28	17.2	0.0	0.0
	29	23.8	0.0	0.0
July	4	30.8	0.0	0.0
	6	28.9	0.0	0.0
	9	27.7	0.0	0.0
	10	49.5	0.0	0.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	11	34.5	0.0	0.0
	12	26.9	0.0	0.0
	13	28.3	0.0	0.0
	14	19.1	0.0	0.0
	16	28.5	0.0	0.0
	17	43.8	0.0	0.0
	18	29.5	0.0	0.0
	19	26.2	1.2	0.4
	20	27.0	0.0	0.0
	21	24.8	2.2	0.7
	23	27.7	0.0	0.0
	24	29.3	0.0	0.0
	26	28.1	0.0	0.0
	28	25.3	0.0	0.0
	30	26.6	0.0	0.0
	31	31.7	0.0	0.0
August	1	27.1	0.0	0.0
	4	28.1	0.0	0.0
	10	30.2	0.0	0.0
	11	25.2	0.0	0.0
	13	27.1	0.0	0.0
	14	31.8	0.0	0.0
	16	26.6	0.0	0.0
	17	26.6	0.0	0.0
	18	28.5	0.0	0.0
	21	26.6	0.0	0.0
	22	31.8	0.0	0.0
	23	27.3	0.0	0.0
	24	27.9	0.0	0.0
	27	27.6	0.0	0.0
	28	27.5	0.0	0.0
	30	28.5	0.0	0.0
September	3	30.0	0.0	0.0
	5	14.9	0.0	0.0
	6	23.7	0.0	0.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	7	26.6	0.6	0.2
	10	26.4	0.0	0.0
	12	31.6	0.0	0.0
	13	18.8	0.0	0.0
	15	33.0	0.0	0.0
	17	21.8	5.4	1.6
	20	31.8	0.0	0.0
	24	27.9	0.8	0.2
	27	26.5	0.0	0.0
October	1	26.3	0.0	0.0
	3	32.2	0.0	0.0
	5	24.4	0.0	0.0
	16	31.6	5.2	1.6
	18	26.3	35.4	10.8
	22	38.4	1.0	0.3
	24	42.0	0.8	0.2
	25	26.3	0.8	0.2
	27	29.4	0.0	0.0
	29	30.9	0.0	0.0
	30	30.4	0.0	0.0
	31	34.5	0.0	0.0
November	7	30.3	0.0	0.0
	10	29.2	0.0	0.0
	15	47.7	12.4	3.8
	17	49.1	0.6	0.2
	20	53.0	3.6	1.1
	24	50.0	1.4	0.4
	27	41.0	8.8	2.7
	29	42.7	3.2	1.0
December	1	40.5	4.6	1.4
	6	40.9	0.0	0.0
	8	30.3	0.0	0.0
	11	36.3	0.0	0.0
	12	30.7	0.0	0.0
	14	29.7	0.8	0.2

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	15	32.0	0.0	0.0
	19	42.5	0.0	0.0
	22	53.8	0.0	0.0
	29	**85.2**	**25.4**	**7.7**

As seen in Table 10, daily flows that were more than 75 m^3/day in 2017 occurred on March 30 (89.9 m^3) and December 29 (85.2 m^3) with estimated daily inflows of 0.0 m^3 and 7.7 m^3, respectively. The data presented here does not support the hypothesis that direct inflow through the surface of the sand filter is the sole contributor to excess flow, as the flow exceeding 75 m^3/day is not balanced by estimated inflow, suggesting that infiltration may be an issue.

Table 13 – 2018 Daily Flow and Inflow Estimate

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
January	**2**	**106.5**	**0.0**	**0.0**
	4	68.9	5.4	1.6
	8	**83.9**	**9.6**	**2.9**
	12	48.0	15.4	4.7
	15	53.9	1.6	0.5
	19	50.1	16.4	5.0
	22	67.5	3.0	0.9
	26	54.7	17.0	5.2
	29	63.9	3.2	1.0
	31	**82.7**	**8.8**	**2.7**
February	2	47.3	2.8	0.9
	5	57.7	0.6	0.2
	8	38.2	0.0	0.0
	9	37.0	0.0	0.0
	12	39.6	0.0	0.0
	14	25.2	0.0	0.0
	15	31.0	6.2	1.9
	19	39.6	0.0	0.0
	26	37.3	2.0	0.6
	28	34.5	12.4	3.8
March	2	48.3	6.8	2.1

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	5	57.3	0.0	0.0
	8	22.0	20.8	6.3
	15	33.8	0.0	0.0
	16	30.9	0.0	0.0
	19	35.9	0.0	0.0
	23	32.3	8.0	2.4
	27	52.7	1.0	0.3
	29	63.9	6.2	1.9
April	3	43.2	0.0	0.0
	9	46.4	0.6	0.2
	12	42.0	7.2	2.2
	16	57.3	8.4	2.6
	19	49.6	0.0	0.0
	23	38.3	0.0	0.0
	26	33.0	0.0	0.0
	30	38.0	0.0	0.0
May	4	31.0	0.0	0.0
	7	31.2	0.0	0.0
	10	28.7	0.0	0.0
	14	30.2	0.0	0.0
	18	28.1	0.0	0.0
	22	29.4	0.0	0.0
	25	29.5	0.0	0.0
	28	31.9	0.0	0.0
	30	29.3	0.0	0.0
	31	5.4	0.0	0.0
June	1	30.6	1.6	0.5
	4	30.3	0.0	0.0
	6	27.8	0.0	0.0
	7	22.6	1.6	0.5
	8	32.7	23.8	7.2
	12	32.0	7.0	2.1
	13	31.4	5.8	1.8
	14	20.8	0.0	0.0
	18	30.2	0.0	0.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	21	33.0	0.0	0.0
	25	32.6	0.0	0.0
	27	29.5	0.0	0.0
	30	36.6	0.8	0.2
July	3	39.1	0.0	0.0
	5	30.1	0.0	0.0
	9	29.5	1.6	0.5
	11	29.6	0.0	0.0
	13	29.8	0.0	0.0
	16	31.6	0.0	0.0
	23	30.2	0.0	0.0
	26	26.9	0.0	0.0
	30	31.8	0.0	0.0
August	2	30.2	0.0	0.0
	7	28.1	0.0	0.0
	9	28.5	0.0	0.0
	13	28.9	0.0	0.0
	16	24.7	0.0	0.0
	20	29.1	0.0	0.0
	23	29.1	0.0	0.0
	27	32.1	0.0	0.0
	29	28.1	0.0	0.0
	30	21.2	0.0	0.0
September	4	31.2	0.0	0.0
	10	31.0	8.6	2.6
	12	28.2	4.2	1.3
	13	28.2	1.0	0.3
	17	35.0	1.0	0.3
	18	31.1	0.0	0.0
	19	29.0	0.0	0.0
	21	35.9	24.0	7.3
	24	44.0	0.0	0.0
	26	37.7	0.0	0.0
October	1	36.9	2.6	0.8
	5	35.4	0.4	0.1

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	9	35.4	0.0	0.0
	11	30.9	0.0	0.0
	12	30.8	0.0	0.0
	15	22.8	0.0	0.0
	19	28.3	0.0	0.0
	22	29.1	0.0	0.0
	25	28.5	18.2	5.5
	29	39.3	7.0	2.1
November	1	48.1	27.0	8.2
	2	**80.2**	**1.8**	**0.5**
	9	55.1	1.0	0.3
	13	40.0	23.2	7.1
	15	44.2	4.8	1.5
	16	47.0	0.0	0.0
	19	35.4	0.0	0.0
	23	36.4	1.4	0.4
	27	58.5	2.2	0.7
	28	**104.9**	**17.8**	**5.4**
	29	**82.7**	**1.8**	**0.5**
December	3	47.7	0.0	0.0
	7	33.0	1.0	0.3
	10	39.3	9.8	3.0
	11	63.3	17.6	5.4
	13	72.8	22.8	6.9
	17	**80.8**	**19.4**	**5.9**
	20	62.6	12.6	3.8
	24	64.7	0.0	0.0
	27	51.1	7.6	2.3
	31	64.0	0.0	0.0

As seen in Table 11, daily flows that were more than 75 m^3/day in 2018 occurred on January 2 (106.5 m^3), January 8 (83.9 m^3), January 31 (82.7 m^3), November 2 (80.2), November 28 (104.9), November 29 (82.7), and December 17 (80.8) with estimated daily inflows of 0.0 m^3, 2.9 m^3, 2.7 m^3, 0.5 m^3, 5.4 m^3, 0.5 m^3, and 5.9 m^3, respectively. The data presented here does not support the hypothesis that direct inflow through the surface of the sand filter is the sole contributor to excess flow, as the flow exceeding 75

m^3/day is not balanced by estimated inflow for all dates. December 17, 2018 is the exception, where daily flow was 80.8 m^3 and inflow was estimated as 5.9 m^3. Here, subtracting inflow from daily flow results in a flow of 74.9 m^3.

Table 14 – 2019 Daily Flow and Inflow Estimate

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
January	3	57.6	24.2	7.4
	7	70.8	0.0	0.0
	10	43.3	1.2	0.4
	14	41.8	0.0	0.0
	15	33.8	0.0	0.0
	17	38.5	13.8	4.2
	21	39.2	1.2	0.4
	24	50.8	0.0	0.0
	28	36.2	0.0	0.0
February	1	34.8	3.2	1.0
	4	27.6	0.0	0.0
	7	33.6	0.0	0.0
	11	32.6	2.6	0.8
	20	36.6	0.0	0.0
	22	37.5	0.0	0.0
	25	39.9	0.0	0.0
March	4	42.4	0.0	0.0
	12	31.8	0.0	0.0
	14	30.5	3.4	1.0
	18	31.6	0.0	0.0
	21	27.5	0.0	0.0
	25	29.2	13.2	4.0
	27	29.6	0.0	0.0
April	1	30.9	0.0	0.0
	4	29.2	3.4	1.0
	8	31.1	1.0	0.3
	11	33.1	11.0	3.3
	16	36.1	0.6	0.2
	18	33.8	15.4	4.7
	20	51.8	0.0	0.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	24	41.8	0.0	0.0
	26	36.0	0.0	0.0
	29	32.6	0.0	0.0
May	6	30.5	0.0	0.0
	9	32.0	0.0	0.0
	13	29.8	0.4	0.1
	16	30.7	1.6	0.5
	21	29.1	0.0	0.0
	24	31.7	2.6	0.8
	27	28.5	0.0	0.0
	31	27.9	0.0	0.0
June	3	26.5	0.0	0.0
	5	27.9	0.4	0.1
	10	29.5	0.0	0.0
	12	30.1	0.0	0.0
	18	29.4	0.0	0.0
	21	29.4	0.0	0.0
	26	28.3	15.2	4.6
	28	31.4	0.0	0.0
July	2	25.7	0.0	0.0
	4	34.2	0.0	0.0
	8	32.3	0.0	0.0
	12	28.3	0.0	0.0
	15	26.2	0.0	0.0
	18	27.5	0.4	0.1
	23	30.9	2.4	0.7
	26	26.0	12.2	3.7
	29	28.6	0.0	0.0
August	2	26.3	0.0	0.0
	6	28.1	0.0	0.0
	8	28.8	0.0	0.0
	12	30.5	0.0	0.0
	16	31.6	0.0	0.0
	19	34.9	0.0	0.0
	23	28.8	1.0	0.3

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	26	33.8	0.0	0.0
	30	30.0	0.0	0.0
September	3	32.3	0.0	0.0
	6	26.8	0.0	0.0
	9	29.0	0.0	0.0
	11	30.0	2.0	0.6
	16	32.9	16.6	5.0
	19	41.0	0.8	0.2
	20	31.4	0.0	0.0
	24	45.1	0.0	0.0
	30	34.9	0.0	0.0
October	3	30.6	2.2	0.7
	4	34.2	0.0	0.0
	7	32.1	2.0	0.6
	10	31.7	0.0	0.0
	15	33.7	14.2	4.3
	16	37.1	13.6	4.1
	18	45.5	8.8	2.7
	21	47.1	33.6	10.2
	24	64.6	2.8	0.9
	29	33.1	0.0	0.0
November	4	31.3	0.0	0.0
	8	27.6	1.6	0.5
	12	30.7	3.4	1.0
	14	32.9	9.8	3.0
	17	41.2	3.8	1.2
	18	**109.3**	**9.2**	**2.8**
	21	49.3	0.0	0.0
	26	34.9	0.0	0.0
	29	34.0	0.0	0.0
December	3	35.3	2.4	0.7
	6	33.0	5.4	1.6
	9	33.8	0.0	0.0
	10	33.2	3.8	1.2
	13	37.8	3.2	1.0

Month	Date	Daily Flow (m^3/day)	Daily PTT (mm)	Daily Inflow (m^3/day)
	16	45.8	2.4	0.7
	19	46.4	19.4	5.9
	24	63.2	3.2	1.0
	27	42.9	1.2	0.4
	30	39.5	40.2	12.2

As seen in Table 12, daily flows that were more than 75 m^3/day in 2019 occurred on November 18 (109.3 m^3) with an estimated daily inflow of 2.8 m^3. The data presented here does not support the hypothesis that direct inflow through the surface of the sand filter is the sole contributor to excess flow, as the flow exceeding 75 m^3/day is not balanced by estimated inflow. Studies into other sources of inflow and infiltration may be beneficial if flow issues persist.

Appendix D – Record Drawings of Current System

Appendix E – General Design Parameters for Recirculating Sand Filters

A recirculating sand filter system consists of a standard septic tank, a recirculation tank, a pumping tank, a sand filter, a flow splitter, and an effluent disposal system.

Septic Tank

The septic tank acts as a receiving chamber for the raw wastewater coming from the community and works to separate the suspended solids from the wastewater through the process of settlement. During this process, solids are separated from waste and settle to the bottom of the tank while the remaining wastewater travels through an outlet toward the pump chamber. This is a very important step in the process as it is imperative that as many solids are removed as possible before the wastewater enters the sand filter. Failure to remove the bulk of the solids before the sand filter can quickly result in ponding and a failed system. Regular inspections of the septic tank and a consistent clean out schedule will help to keep the system running properly. Final septic tank should be equipped with effluent screens and a high-water alarm. Effluent screens must be sized smaller than the pressure distribution perforation diameter.

Recirculation/Pumping Tank

The recirculation/pumping tank receives septic tank effluent and treated effluent from the sand filter. Treated effluent from the sand filter will have significantly less TSS and BOD than septic tank effluent and acts to dilute the wastewater, reducing odours. Depending on the requirements of the system, the tanks are designed to either remain full or to be pumped down during periods of low wastewater flows [1].

Systems which have tight treatment performance parameters, such as those that treat single-family home systems, are designed to remain full and are typically sized to be 1.5 times the design peak daily flow. Depending on the existing volume of waste in the tank, filtrate exiting the sand filter will either re-enter the recirculation chamber or be discharged to the effluent disposal system. If the tank is full, filtrate will be discharged to the effluent disposal system. This is commonly controlled by a ball float valve, seen in Figure 1, which acts to seal entry to the tank if it is full. If the tank is not full, the filtrate re-enters the tank and mixes with waste received from the septic tank.

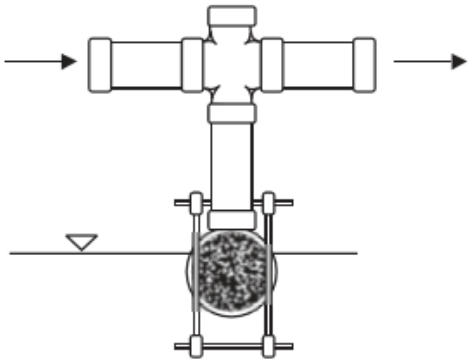


Figure 14 – Float Ball Valve Flow Splitter

Systems with large, more continuous flows, such as those that treat small communities, are designed to continuously split flow leaving the sand filter via an external flow splitting structure according to a recirculation ratio ranging from 3:1-7:1. This means that for every one part of filtrate that is delivered directly to the effluent disposal system, 3-7 parts re-enter the pump chamber to be delivered back to the sand filter. An of external flow splitting structures can be seen in Figure 2. The recirculation ratio of this flow splitter could be modified by capping unneeded pipes.

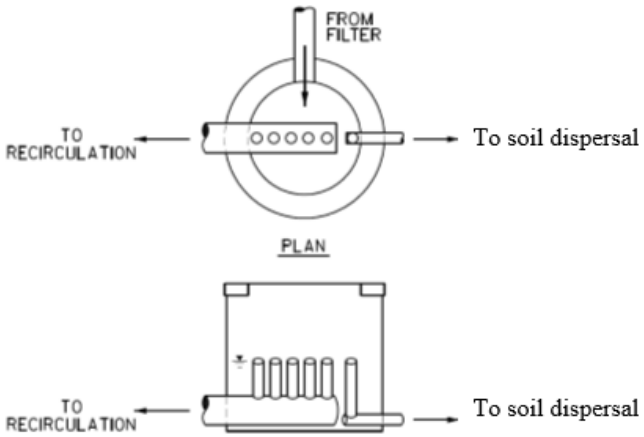


Figure 15 – External Flow Splitter

A higher recirculation ratio generally provides higher treatment, although it requires more energy to pump the wastewater through the filter each time. Ratios that exceed 7:1 can deplete alkalinity due to

complete nitrification and drop pH below acceptable levels. A low pH can allow filamentous organisms to form, which can lead to clogging in the distribution system [2].

Determining the appropriate recirculation ratio to meet the desired effluent quality is an iterative process and requires careful monitoring. For this reason, a flow splitting structure that can allow for adjustments of the recirculation ratio is desirable [2].

In both designs it is always important to have control over the volume of fluid entering and exiting the chamber to maintain the dosing cycle. For this reason, it is imperative that the system is tightly sealed and not susceptible to infiltration due to rain or other events.

Dose

A set dose is delivered from the pump chamber to the sand filter at a pre-determined frequency. The dose is determined based on the design flow, recirculation ratio, and the desired frequency. Typical dose frequencies are 48 times/day but can be as high as 96 times/day. Research suggests that higher dose frequency, with subsequently lower dose volume, will increase the BOD and TSS reductions of the system [3].

Small dose volumes allow the system to work more effectively because the wastewater can flow through the media at unsaturated conditions with higher moisture tensions. It is important to achieve a balance that keeps the media moist and provides enough food to maintain the bacteria populations, while keeping the media in an unsaturated state. Lastly, since this is an aerobic process, reaeration between doses is important to allow bacteria access to air to digest the waste.

Mass Loading

Media filters are typically designed based on hydraulic loading with the following parameters [1]:

Sand (1.0 – 5.0 mm): 3-5 gpd/ft^2 or 0.12-0.2 m^3/m^2

Gravel (3.0 – 20.0 mm): 10-15 gpd/ft^2 or 0.4-0.6 m^3/m^2

Alternatively, if influent qualities are known, design can be based on organic loadings:

Sand (1.0 – 5.0 mm): Up to 5 lb BOD_5/1000ft^2 or 0.02275 kg/m^2

Gravel (3.0 – 20.0 mm): Up to 15 lb BOD_5/1000ft^2 or 0.06825 kg/m^2

Distribution Network

The distribution network's primary function is to evenly distribute the dose across the media surface of the sand filter. Even distribution is important for effective effluent polishing as most bacteria will exist within the upper 9-15 inches of the sand filter. The distribution network can be pressure or gravity driven using orifices, spray nozzles, or drip emitters. If using orifices, it is recommended to use upward facing orifices with shields to minimize the potential for blockage and to allow air back into the pipe. In this case, a few downward facing orifices will be required to drain the pipe.

The system should maintain a minimum head that can be monitored at the end of laterals. An increase in head over time could indicate clogging. Inspection ports and cleanouts should be included for regular monitoring and maintenance.

Sand Filter

The sand filter provides an environment for bacteria to aerobically digest waste found in the effluent. For this process to be successful, several key variables must be in balance. The sand filter is composed of a filter liner, inspection pipes, distribution media, filter media, underdrain media, and an underdrain system.

Filter Liner

An impervious liner, such as 30 mil PVC, is recommended to line the sand filter. The liner will act to contain the filtrate and allow it to be collected by the underdrain system while also preventing infiltration. The liner should be watertight, defined as maintaining water for 24 hours with a loss of less than 1.6 mm. To ensure the selected liner is watertight, a 24-hour water balance test should be conducted after the underdrain system and media have been installed. It is also recommended to install a geotextile fabric liner in between the impervious liner and the underdrain media to prevent puncturing [2]. Pipe connections for the underdrain system must be fitted with a watertight boot. An alternative to an impervious liner is a watertight concrete tank [2].

Inspection Pipes

Inspection pipes allow operators to monitor the sand filter for ponding at different depths. Typical systems have inspection pipes made of 100 mm PVC pipe located at the following three depths:

- Just above the filter liner, with perforations that span the depth of the underdrain rock
- At the bottom of the filter media, with perforations that span 150-200 mm of the lower portion of the filter media
- At the top of the filter media, with perforations that run from the bottom of the distribution media up to the distribution network

Inspection pipes should be fitted with an elbow, tee, or cross at the bottom to secure the pipe and should be capped about the surface [2].

Distribution Media

The distribution media is typically composed of 200 mm of coarse drainfield rock and houses the distribution network in the middle of it. The distribution media helps to distribute wastewater evenly, provides some insulation to limit freezing, and allows air to reach the filter media.

Filter Media

The filter media of a sand filter serves two purposes – to provide a space for bacteria to live and to provide channels for waste to pass through. The bacteria exist on the surface of the media and within the voids located between individual grains. Typical media used for an RSF includes graded sand (1.0-5.0 mm diameter) and gravel. Crushed glass can also be used if it is available and has the benefit of being a recycled product. In all cases, the media should durable, rounded, washed, and fine particles passing the No. 200 sieve should be limited to less than 3%. Media that is too small or filled with fines will be susceptible to clogging and have limited space for bacteria. Lastly, the media should be uniform with a maximum uniformity coefficient of 4. Lower values indicate a more uniform media and are more desirable. A uniform media limits the chances of voids between media particles being filled by other smaller media particles, limiting clogging.

The media used can be selected based on availability and will be a primary factor in determining the recirculation ratio. Smaller media will have an increased retention time, meaning that waste passes through it more slowly. A greater retention time is desirable as it allows more time for bacteria to digest

waste as is passes through the media and will require a smaller recirculation ratio. As the size of media increases, retention time decreases and so more passes may be required to achieve the desired effluent quality – i.e. a higher recirculation ratio is needed. Furthermore, as media size increases, time to fouling increases, maintenance decreases, allowable hydraulic loading rate increases. Media life may be extended, and the field is less prone to freezing.

Underdrain Media

The underdrain media must be deep enough to cover the underdrain system and should be made of clean, hard, durable stone. It is recommended that underdrain media totals 305 mm of depth and is composed of 51 mm of 3/8" pea gravel followed by 254 mm of coarse media. The pea gravel is used to prevent the filter media from passing into the underdrain media.

Underdrain System

The underdrain system serves two purposes: to transfer filtrate to the flow splitter; and to provide a passage for air to enter the underdrain. To allow air to reach the underdrain, the upstream end of the underdrain should be directed upwards using two 45-degree bends and should terminate above the surface to allow access for cleaning. Typical underdrain systems are made of 100 mm PVC pipe slotted with 6 mm wide slots. It is important that the slots are large enough to allow free movement of water, but small enough to prevent underdrain media from entering the pipe. The bottom of the sand filter should be sloped at least one percent to the underdrain system. For sand filters with multiple zones, one underdrain system should be installed in each zone [2].

Example RSF Media Layering

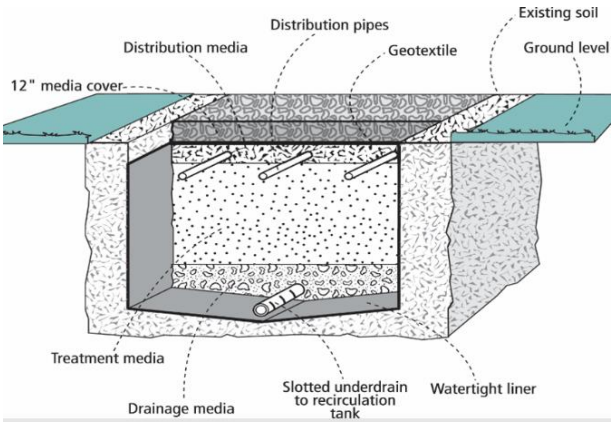


Figure 16 – Example of RSF Media Layering

An example of the multi-tiered media used in an RSF can be seen in Figure 12. The watertight liner can be seen spanning the bottom and sides of the RSF, acting to contain the filter and prevent infiltration. In this example, a geotextile fabric is placed above the distribution network to limit inflow. The distribution network can be seen within the coarse distribution media which allows for drainage and aeration. The treatment media makes up most of the sand filter, sitting below the distribution media and above a coarse drainage media. The coarse drainage media, pictured here as a single layer, allows the filtrate to pass freely towards the underdrain and back to the recirculation tank.

Appendix F – AdvanTex System Example Drawings

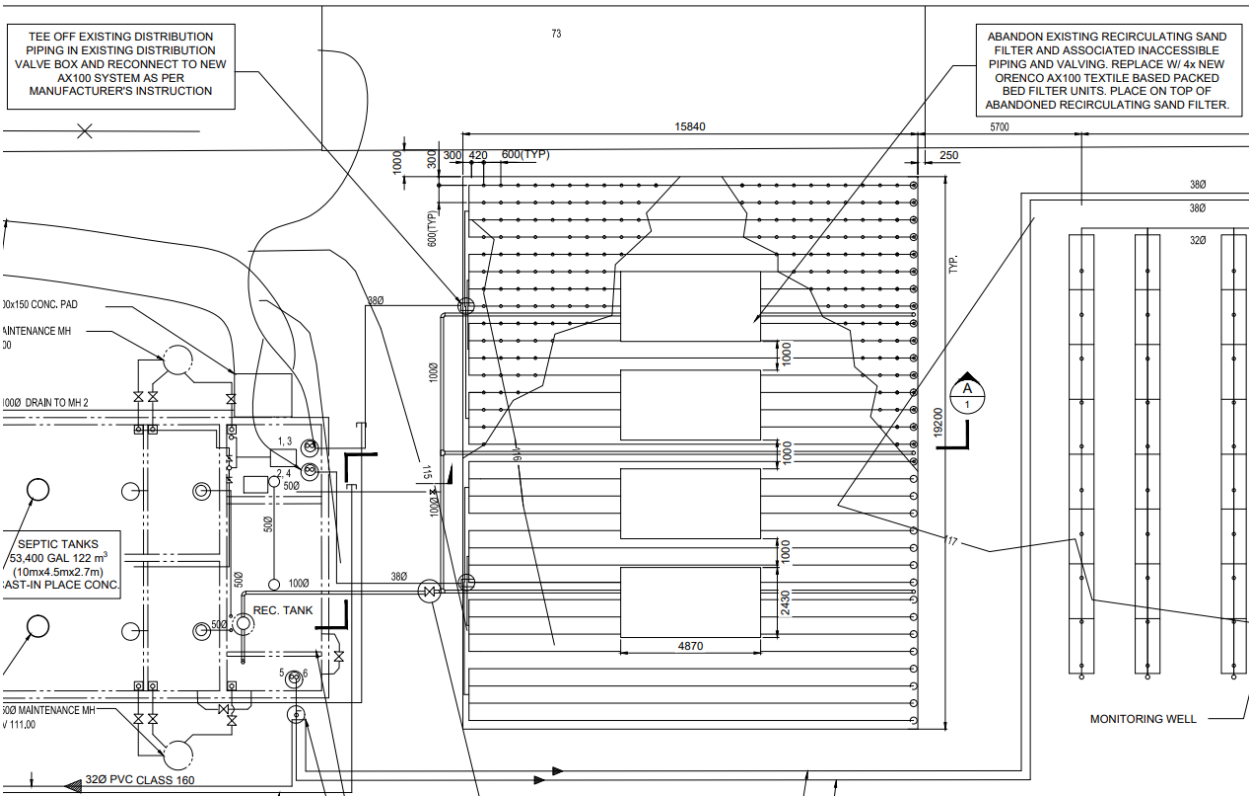


Figure 17 – AdvanTex System Example

Appendix G – Ecoflo Coco Filter Example

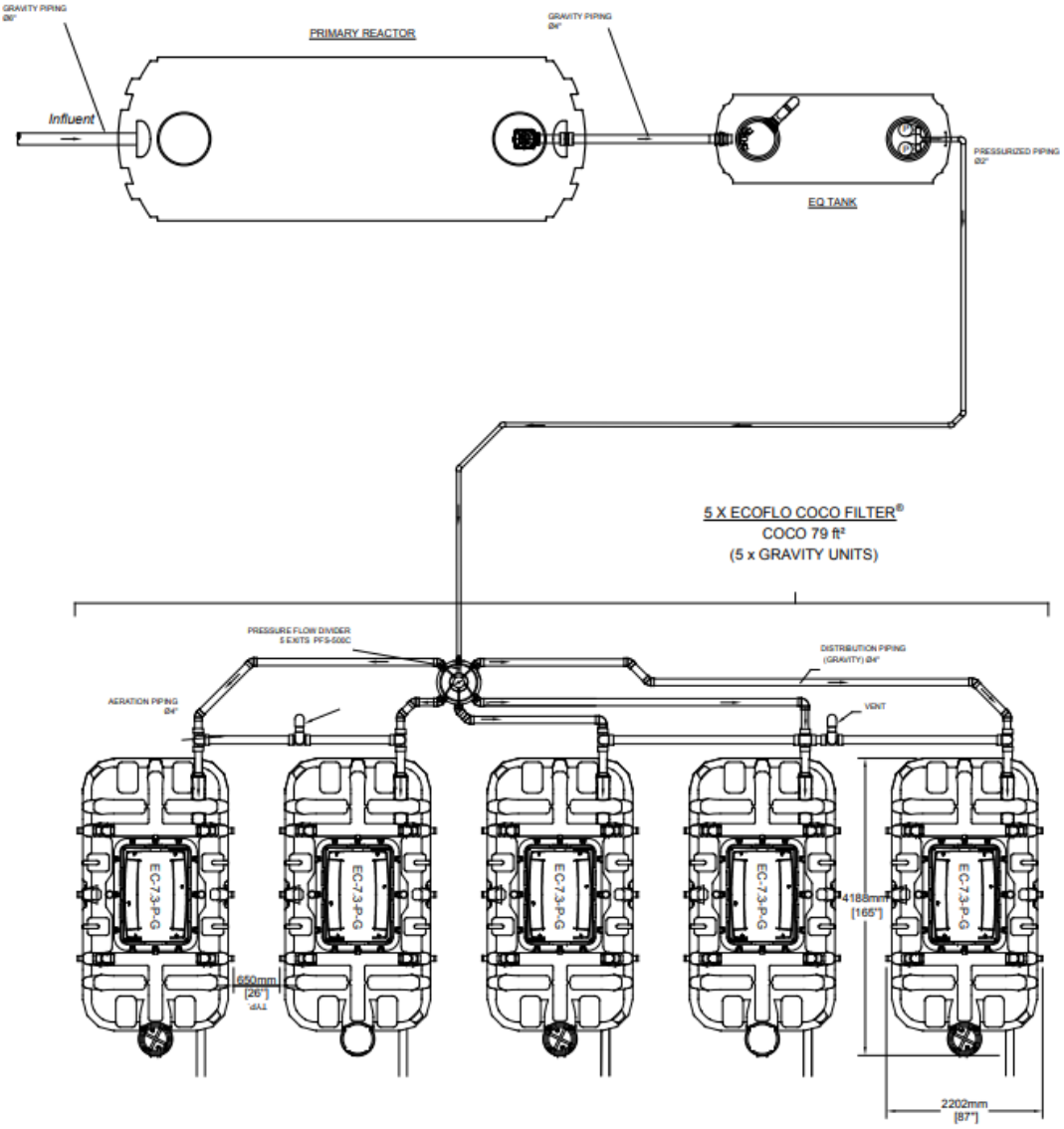


Figure 18 – Ecoflo Coco Filter System Example

Appendix H – Brentwood Industries Plastic Media Filter

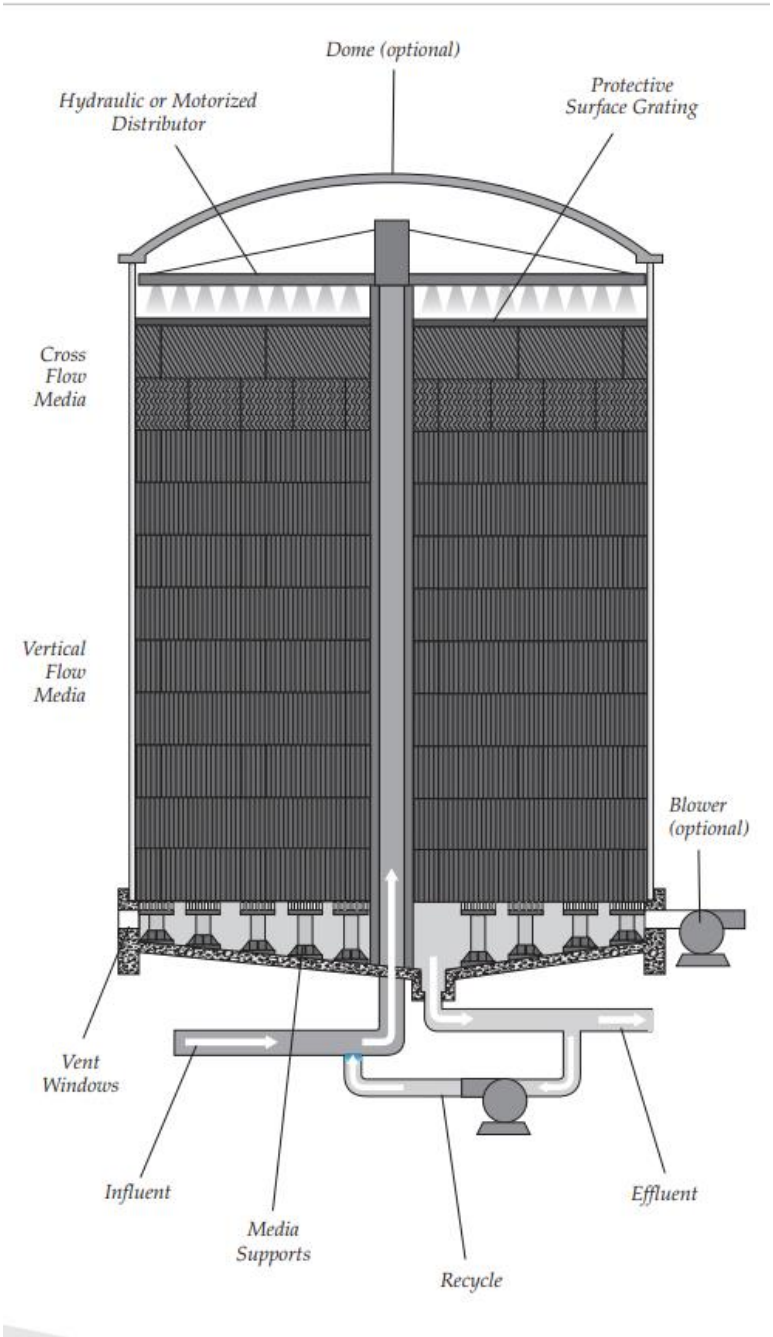


Figure 19 – Brentwood Industries Structured-sheet Plastic Media Tower

1. Division 01 – General Requirements

Section 011000 General Requirements

.1 DOCUMENTS

.1 This section forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts of the Contract Documents.

.2 The Specifications have been divided into approximate trade sections. However, the division of the Specifications into sections shall not operate to define or limit the responsibility of any Subcontractor.

.2 COORDINATION AND COOPERATION

.1 The Contractor shall coordinate the work of his Subcontractors with efficient and continuous supervision and be fully aware of the Work requirements including, without limitation, those of the Specifications and Drawings.

.2 The Contractor is responsible for determining which Subcontractor shall perform Work. Differences in interpretation of the Specifications or Drawings as to which Subcontractor shall perform certain Work shall not be grounds for claims for extras.

.3 The Contractor shall coordinate the use of Products and Construction Equipment, including cranes, hoists, ladders and scaffolds, and access to the Place of the Work, with the work of Subcontractors. The cost of use of Construction Equipment and Products by Subcontractors shall be governed by the agreements between the Contractor and the Subcontractors.

.3 DAILY RECORD

.1 From the day of commencement of the Work, the Contractor shall maintain a careful daily record of the progress of the Work on his standard record form, with applicable trades listed. This record shall be open to the Consultant's and the Owner's inspections at all reasonable times. A copy of the record shall be turned over to the Consultant at weekly intervals.

.2 Contractor's diary shall record all pertinent data such as:

.1 Daily weather conditions, including maximum and minimum temperatures.

.2 Commencement, progress, and completion of various portions of the Work.

.3 Dates of visits or inspections by government authorities, inspectors, and any other visitors to the Site.

.4 Record of work force employed, and work performed thereby.

.4 PERMITS AND FEES

.1 The Contractor shall obtain and pay for all other permits and licenses required for the Work.

.2 The Contractor shall conform to the codes, ordinances, regulations, and orders of all authorities having jurisdiction over the performance of the Work. Should conflicts arise, the Contractor shall forthwith request clarification from the Owner.

.5 WORK AREA

.1 The Work and the operation of vehicles and machinery, storage of equipment, materials and/or supplies must be contained within the Place of the Work.

.2 Streets beyond the limits of the work and other construction areas shall be kept clean.

.3 The Contractor is responsible for dust control within the Place of the Work and roadways beyond the limits of the Place of the Work that have been affected during construction. While performing the Work the Contractor shall control dust originating from the Work and shall take immediate corrective action if directed by the Owner.

.4 The Contractor shall provide for efficient drainage of all sections of the work during all stages of construction at his own expense. The Contractor will be held responsible for all damage which may be caused through his failure to provide proper drainage facilities. The Contractor shall restore any existing drainage works which are disturbed as a result of his construction activities.

.5 Prior to commencement of construction, the Owner and the Contractor will locate on site those property bars, baselines and benchmarks which are necessary to delineate the Working Area and to lay out the Work, all as shown on the Contract Drawings.

.6 The Contractor shall be responsible for the preservation of all property corners while the Work is in progress, except those property bars which must be removed to facilitate the Work. Any property bars disturbed, damaged, or removed by the Contractor's operations shall be replaced under the supervision of a British Columbia Land Surveyor, at no extra cost to the Owner.

.7 The Contractor will give the Owner at least 48 hours' notice in writing before requiring any baselines or benchmarks in connection with the work. The Contractor shall clearly state in such notice the exact location where levels, lines, or stakes are required. The Contractor must satisfy himself before commencing any work as to the meaning and correctness of all stakes and marks, and no claim will be entertained by the Owner for or on account of any alleged inaccuracies, unless the Contractor notified the Owner of such inaccuracies in writing before commencing the work.

.8 The Contractor will be held responsible for the preservation of all stakes and marks in their proper positions, and where any of them are disturbed, lost, or destroyed, it shall at once notify the Owner in writing, and all expenses incurred in replacing such stakes or marks will be billed against the Contractor and if not paid by the Contractor will be deducted from any monies due the Contractor under the Contract.

.9 All stakes and marks set will not in every case represent all the grades, levels, lines, angles, or surfaces in the finished work and in this regard the Contractor shall ensure that such stakes and marks are read correctly and used in a manner consistent with the plans, details, specifications, and directions of the Owner. Should the Contractor discover or suspect any errors in stakes, lines, and grades which have been established for its use, the Contractor shall at once discontinue the work until such suspicions are investigated and any errors or misunderstanding rectified, but no claims shall be made or allowed on this account, or because of any resulting delay.

.10 The Contractor shall assume full responsibility for alignment, elevations, and dimensions of each and all parts of the Work, regardless of whether the Contractor's layout work has been checked by the Owner.

.11 The Contractor shall furnish the Owner or any of his assistants with all reasonable help which may be required at any time in driving stakes or laying out the work. The Contractor will receive no additional compensation for this.

.12 In order to satisfy the Owner that the Contractor has addressed concerns regarding traffic control and safety it will be required to submit a sketch indicating its proposed method of barricades and/or signage for each of the work sites included in the Contract. This information shall be available for review and approval by the Owner at the Contract pre-construction meeting.

.13 Dusty materials shall be transported in covered haulage vehicles. Wet materials shall be transported in suitable watertight haulage vehicles.

.14 The Contractor shall take such steps as may be required to prevent dust nuisance resulting from its operations either within the limits of the work or elsewhere or by public traffic where it is the Contractor's responsibility to maintain a roadway through the Work.

.15 Where the Work requires the sawing of asphalt or the sawing or grinding of concrete, blades and grinders of the wet type shall be used together with sufficient water to prevent

the incidence of dust, wherever dust would affect traffic or wherever dust would be a nuisance to residents of the area where the Work is being carried out.

.16 Permitted dust control measures may include the application of calcium chloride, or water. More frequent applications of water should be employed in close proximity to watercourses.

.17 *SEWAGE SPECIFIC INSTRUCTIONS? ODOUR?*

.6 **CONSTRUCTION SCHEDULE**

.1 To co-ordinate the work, the Contractor or person(s) authorised to act for the Contractor will attend regular meetings with the Owner or his representative during the period over which the work under the Contract is carried out, at a time and place to be decided by the Owner.

.2 The Contractor shall commence the Work within 5 days after receiving Notice to Proceed from the Owner.

.7 **PRECONSTRUCTION MEETING**

.1 The Contractor shall attend a meeting with the Consultants, Subcontractors, field inspectors, supervisors, and the Owner to discuss and resolve administrative procedures and responsibilities, and scheduling prior to commencing the Work.

.2 Items to be discussed at such meeting shall include, but shall not necessarily be limited to the following:

.1 Confirmation of authorized representatives of the Owner, Consultant, other consultants and the Contractor and the name of the Contractor's Construction Safety Officer.

.2 Schedule of Work.

.3 Site security.

.4 Takeover procedures, and acceptance.

.5 Monthly progress pay requests, administrative procedures, and holdbacks.

.8 **PROGRESS MEETINGS**

.1 The Contractor shall hold progress meetings every week at the Owner’s office throughout the duration of the Work.

.2 The Contractor, and Subcontractors involved in the Work shall attend the weekly progress meetings.

.3 The Owner will record minutes of weekly progress meetings and circulate same to attending parties within three (3) days of meeting.

.9 **CONSTRUCTION SAFETY**

.1 The Contractor shall comply with the Workers' Compensation Prevention Regulations of British Columbia (latest edition) and provide all necessary safety requirements as prescribed by such regulations.

.10 **SECURITY**

.1 The Contractor shall be responsible for security of the Work and at the Place of the Work.

.2 The Contractor and his Subcontractors shall make their own arrangements to ensure the security of their own equipment and materials.

.3 The Owner, the Consultant, or other consultants and/or their respective representatives will not be liable for any loss or damage to materials, equipment, or other property of the Contractor, unless caused by their negligence.

.11 **CONCEALED OR UNKNOWN CONDITIONS**

.1 Before commencing any Work at the Place of the Work, the Contractor shall be responsible to locate in three dimensions all underground utilities and structures indicated on the Contract Documents as being at the Place of Work. The Contractor shall also be responsible to consult with all utility providers that provide electricity, communication, gas, or other utility services in the area of the Place of Work, to locate in three dimensions all underground utilities for which they have records. The Contractor shall also locate in three dimensions any other utilities or underground structures that are reasonably apparent in an inspection of the Place of the Work.

.12 OPERATING AND MAINTENANCE MANUALS

.1 Upon Substantial Performance of the Work, the Contractor shall submit to the Owner (2) copies of Operating and Maintenance Manuals, containing pertinent information on maintenance, inspection, and emergency procedures, receipts, test reports, warranties, equipment and finish schedules, and other Work information.

.13 RECORD DRAWINGS

.1 The Contractor shall keep one set of current white prints of all Drawings and all addenda, revisions, clarifications, change orders, and reviewed shop drawings in the site office; and have them available at all times for inspection by the Consultant. As the work progresses, he shall record, in a neat legible manner, all changes in the work. The following information shall be recorded for each change:

.1 Full Description of change

.2 Date

.3 Authority

.2 At completion of the Work, the Contractor shall employ competent personnel to transfer all deviations, including those required by addenda, revisions, clarifications, shop drawings, change directive and change order, to a set of white prints in paper and electronic format. Each as- built print shall bear the Contractor's identification, the date of record and the notation, “We hereby certify that these drawings represent the work 'Record Drawings'.” The Contractor's signature shall be placed below that notation. The electronic format shall be in AutoCAD version 2018 or newer.

.14 SYSTEMS DEMONSTRATION

.1 Prior to final inspection, the Contractor shall demonstrate operation of each system to the Owner and shall instruct personnel in operation, adjustment, and maintenance of equipment and systems, using data provided by operation and maintenance manuals as the basis for instruction.

.15 SUBSTANTIAL PERFORMANCE

.1 Prior to or at the time of applying for a review to establish Substantial Performance of Work, the Contractor shall submit to the Consultant the following items:

.1 Letters of Assurance for professional design and review from those professionals engaged by the Contractor under the provisions of the Contract, including all applicable sealed shop drawings.

.2 All required manufacturer’s inspections, certifications, guarantees, warranties as specified in the Contract Documents.

.3 All maintenance manuals, operating instructions, maintenance and operating tools, replacement parts or materials as specified in the Contract Documents.

.4 Certificates issued by all permit issuing authorities indicating approval of all installations requiring permits.

.5 Certificates issued by all testing, commissioning, cleaning, inspection authorities and associations as specified in the Contract Documents.

.6 All Drawings and as-installed documents in the form specified in the Contract Documents.

.7 A certificate issued by Workers Compensation Board confirming that the Contractor has paid all assessments.

.2 Prior to Substantial Performance of the Work and in addition to the lien holdback, a deficiency holdback shall be established for Work determined by the Consultant to be defective or incomplete (the "Deficiency Holdback"). The Consultant shall establish the amount of the Deficiency Holdback as twice the estimated cost to rectify defective work and finish incomplete Work using the services of another Contractor or the Owner's own forces. No part of the Deficiency Holdback shall become payable until all of the defective Work is corrected, and all of the Work is complete. If the defective or incomplete Work is not corrected or completed within a reasonable time as determined by the Consultant, then all or a portion of the Deficiency Holdback as determined by the Consultant may be retained by the Owner to be applied against the loss and damage suffered by the Owner to correct or complete the Work.

.16 **PROJECT COMMISSIONING**

.1 The Contractor shall:

.1 Promptly correct deficiencies and defects identified by the Owner.

.2 Review maintenance manual contents (operation, maintenance instructions, record drawings, spare parts, materials) for completeness.

.3 Submit required documentation such as statutory declarations, Workers' Compensation certificates, warranties, certificates of approval or acceptance from regulating bodies.

.4 Attend "end-of-work" testing and break-in or start-up demonstrations.

.5 Review inspection and testing reports to verify that the findings conform to the intent of the documents and that changes, repairs or replacements have been completed.

.6 Review condition of equipment that has been used in the course of the Work to ensure turning over at completion in "as new condition" with warranties, dated and certified from time of Substantial Performance of the Work.

.7 Arrange and coordinate instruction of Owner's staff in care, maintenance and operation of building systems and finishes by suppliers or Subcontractors.

.8 When partial occupancy of uncompleted Project is required by the Owner, coordinate Owner's uses, requirements, and access with Contractor's requirements to complete Project.

.9 Provide ongoing review, inspection, and attendance to building call back, and maintenance, and repair problems during the warranty periods.

.17 **END OF SECTION**

Section 011100 Summary of Work

1.0 GENERAL

1.1 Existing Conditions

Replace with ITT Description.

1.2 Work Covered by Contract Documents

.1 The work to be performed under this Contract shall include the labour, equipment, design, and Contractor provided engineering, electrical, and site civil improvements, more fully specified within these Contract Documents and Drawings.

.2 The Scope of Work includes, but is not limited to, the following elements:

.1 Remediation of existing sand filter

.2 Installation and testing of all piping modifications

.3 Completion of site civil works

.4 Installation and testing of electrical components

.5 Installation of Orenco AdvanTex AX100 Treatment System

.6 Add Contractor design and electrical start up etc

.3 The Work shall not be deemed complete until the Work is accepted by the Owner. The Work, unless specifically stated otherwise, shall include the furnishing of all labour, supervision, management, materials, installation of Owner Supplied Materials, temporary works, supplies, services, Contractor's Plant and Equipment, receiving and handling, transportation, foreign, federal, provincial, and municipal taxes, and duties of whatsoever kind, permits and licenses, and other things necessary for and incidental to the performance of all the Work. The Contractor shall advise the Owner prior to applying for any permits or licenses.

.4 Any minor or incidental item of the Work not called for in the Specifications or shown on the Drawings but clearly required to meet the intent of design and normally provided for the proper operation of the Work shall be provided as if specifically called for in the Contract Documents. The intent is that the Contractor provides a complete Project.

.5 The Work of the Contract consists of the construction of all Work described and as shown in the Contract Documents and by implication.

.6 The Work may commence at the Site immediately following a Notice to Proceed. The Work is to be substantially complete by the date indicated in Section 013200 – Construction Progress Schedule.

1.3 Contract Method

.1 The Contractor shall construct the Work under a unit bid lump sum price Contract.

1.4 OWNER FURNISHED EQUIPMENT

.1 The Owner Supplied Materials includes a ***IS AX100 PURCHASED BY CONTRACTOR?***

1.5 Responsibility

.1 The Contractor shall be responsible for the safe-keeping of the Owner Supplied Materials and shall immediately replace or repair lost or damaged Owner Supplied Materials, including any associated equipment, appurtenances, and accessories to the complete satisfaction of the Owner and Owner at no cost to the Owner.

.2 All Owner Supplied Materials damaged by the Contractor shall be immediately repaired or replaced by the Contractor to the satisfaction of the Owner, at no cost to the Owner.

.3 The Contractor shall be liable for and shall indemnify the Owner against all loss and damage to Owner Supplied Materials, including all defects and deficiencies which could have been discovered at the time of receipt and inspection by the Contractor, and all costs incurred for the replacement of such materials.

.4 The Contractor shall be responsible for all mechanical and electrical interface connections for Owner Supplied Materials and appurtenant connections.

.5 The Contractor shall be responsible for final assembly and alignment, and shall provide the necessary labour, supervision, materials, to ensure that the equipment meets the alignment tolerance specified by the Supply Contractor for the equipment. ***NOT RELEVANT TO THIS PROJECT?***

.6 The Contractor is responsible for providing all labour, equipment and supplemental specialist support necessary to ensure the proper installation, trial operation, performance testing and proof of successful operation to achieve the designated requirement. ***ORENCO TO DO COMMISSIONING?***

1.6 Milestone Dates

.1 Time and all time limits stated in the Contract Documents are of the essence of the Contract. The Contractor shall perform his work expeditiously and with adequate forces to achieve the milestone dates.

1.7 Permits

.1 It is the Contractor's responsibility to obtain all required permits.

2.0 Products

.1 Product specifications is as specified within these Contract Documents.

3.0 Execution

.1 Execution of work is as specified within these Contract Documents.

END OF SECTION

Section 011400 Work Restrictions

1.0 GENERAL

1.1 SPECIAL PROJECT NOTE:

.1 The Contractor shall substantially complete all work including Commissioning no later than December 31, 2021.

.2 MSR to comment on continuation of the existing treatment facility without interruption if this is possible

2.0 PRODUCTS

Not Applicable.

3.0 EXECUTION

Not Applicable.

END OF SECTION

Section 012900 Measurement and Payment

1.0 GENERAL

1.1 Measurement and Payment

.1 The Work, including any Materials, equipment, and services, will be paid for in accordance with the prices set out in Section 004200 – Form of Tender. The Section 004200 prices and any further breakdown do not limit the Work to the items listed therein. The Contractor has allowed for sufficient amounts to cover the cost of any Work or Materials not specifically listed in Section 004200 but included in the Drawings and Specifications by either direct mention or implication, by including all such amounts in the items to which they pertain most closely in Section 004200. Costs of a general nature that do not pertain to any one item have been distributed among all the items.

1.2 Applications for Payment

.1 Refer to Part 5 Payment – General Conditions (CCDC 18), and Section 007300 – Supplementary General Conditions.

.2 The Contractor shall use standard forms for submission of progress claims in the format agreed prior to the first application for payment.

.1 Show previous amount claimed and the amount claimed for the period ending.

.2 Show percentage of Work completed to date and holdback retained.

1.3 Changes in the Work

.1 Refer to Part 6 Changes in the Work – General Conditions (CCDC 18), and Section 007300 – Supplementary General Conditions.

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

Not Applicable

END OF SECTION

Section 013200 Construction Progress Schedule

1.0 GENERAL

1.1 Description

.1 Prior to the Owner's approval for the Contractor to commence Work at the Site, the Contractor shall produce and submit a detailed Baseline Schedule, acceptable to the Owner, which demonstrates the conformance to the requirements agreed to above and elsewhere in this Section. Once finalized and agreed to by the Owner, this schedule will be deemed the Contract Schedule, to which the Contractor shall base all future updates and from which further detail will be developed.

.2 Specifically, the Contract Schedule shall include, but not be limited to, a level of detail conforming to the following:

.1 Identify the work of both the Contractor and other Subontractors that access the Site.

.2 Include submission, review and approval of critical shop drawings, product data, samples, etc. The Contractor shall manage the cycle(s) of all other Submittals using a compatible spreadsheet or database program. Refer to Section 013300 – Submittals.

.3 Include performance testing, verification, start-up, and demonstration procedures by the Contractor, allowing appropriate intervals for commissioning by third parties, and for integrated system certification.

.3 The Contractor shall base the scheduled duration of each activity on the Work being performed during the work week established and agreed upon as of the date of the Notice of Award with allowances made for legal holidays and normal weather conditions.

.4 The Contractor shall advise the Owner within two (2) days of any problems anticipated by any activity shown in the Contract Schedule.

.5 The Contractor shall revise the schedule to reflect changes in the actual sequence and the future sequence of Work, should the actual sequence of Work performed by the Contractor deviate from the planned sequence indicated in the accepted Contract Schedule.

1.2 Submissions

.1 The Contractor shall provide Submittals in accordance with Section 013300 – Submittals and with the requirements noted herein.

.2 The Owner's acceptance of any schedule submission does not relieve the Contractor from any of its contractual responsibilities.

.3 For the initial submission of project controls documents, the Contractor shall submit one electronic copy of the following:

.1 Critical Path Schedule in bar chart and time scaled logic diagram formats.

.4 The Contractor shall submit *bi **monthly*** schedule status reports with the monthly progress claim consisting of one hard copy and one electronic copy of the following project control documents:

.1 Update of Critical Path Schedule in bar chart and time scaled logic diagram formats.

.5 The Contractor shall show the percentage of completion of each item or activity as projected for the last day of the month for which the schedule is issued. Modify the timing and duration of future activities to indicate current planning.

.6 The Contractor shall submit proposed revisions to the accepted Contract Schedule to the Owner for review. Changes in timing for activities may be modified with agreement of the Contractor and Owner. A change affecting the Contract Price, the completion time and sequencing of the Work may be made only by approved Change Order.

1.3 Project Milestone Dates

.1 The Contractor shall schedule the Work in accordance with the following Project Milestone Dates:

Substantial Completion by October 15, 2021

Total Performance	by November 15, 2021

2.0 PRODUCTS

Not Applicable.

3.0 EXECUTION

Not Applicable.

END OF SECTION

Section 013300 Submittal Procedures

1.0 GENERAL

1.1 General Requirements

.1 Unless otherwise noted, make submittals to the Owner for review.

.2 Make submittals with reasonable promptness and in an orderly sequence to avoid any delay in the Work. Failure to submit in ample time is not considered cause for an extension of Contract Time, and no claim for extension by reason of such default will be allowed.

.3 Do not proceed with Work affected by submittals until review is complete.

.4 The submittal reviews do not authorize changes in cost or time. Changes involving cost or time are authorized only by a signed change order.

1.2 Shop Drawings

.1 Arrange for the preparation of clearly identified shop drawings as specified or as the Owner may reasonably request. Shop drawings are to clearly indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop drawings must be submitted with the appropriate Specification Sections attached. Notify the Owner in writing of any deviations in shop drawings from the requirements of the Contract Documents.

.2 Examine all shop drawings prior to submission to the Owner to ensure that all necessary requirements have been determined and verified and that each shop drawing has been checked and coordinated with the requirements of the Work and the Contract Documents. Examination of each shop drawing shall be indicated by stamp, date, and signature of a responsible person of the Subcontractor for supplied items and of the Contractor for fabricated items. Shop drawings not stamped, signed, and dated will be returned without being reviewed and stamped "Resubmit".

.3 The Owner will review and return shop drawings in accordance with the schedule agreed upon or otherwise with reasonable promptness so as to cause no delay in the Work. Allow sufficient time for review and consideration by the Owner. Claims for costs or contract extensions due to such review time will not be allowed.

.4 Submit a reproducible original or digital copy, minimum of one (1) electronic copies of white prints and two (2) copies of all fixture cuts and brochures. If the Contractor needs more copies for his own distribution purposes, additional copies should be submitted.

.5 Shop drawing review by the Owner is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in shop drawings rests with the Contractor and review by the Owner shall not imply such approval.

.6 Review of Shop Drawings by the Owner shall not relieve the Contractor of his responsibility for errors or omissions in shop drawings or for proper completion of the Work in accordance with the Contract Documents.

.7 Responsibility for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation, and coordination of all parts of the Work rests with the Contractor.

.8 Shop drawings will be returned to the Contractor with one of the following notations:

.1 When stamped “NO EXCEPTIONS TAKEN”, distribute additional copies as required for execution of the Work.

.2 When stamped “MAKE CORRECTIONS NOTED”, ensure that all copies for use are modified and distributed, same as specified for “NO EXCEPTIONS TAKEN”. Resubmit for final records.

.3 When stamped “REVISE RESUBMIT”, make the necessary revisions, as indicated,

consistent with the Contract Documents and submit again for review.

.4 When stamped "REJECTED", submit other drawings, brochures, etc. for review consistent with the Contract Documents.

.5 Only shop drawings bearing "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall be used on the Work unless otherwise authorized by the Owner.

.6 It is understood that the following is to be read in conjunction with the wording on the Owner's shop drawing review stamp applied to each and every data sheet or drawing submitted:

"THESE (SHOP DRAWINGS) (SUBMITTALS), (PLANS)

HAVE BEEN REVIEWED FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED BY THE OWNER FOR QUANTITIES, CORRECTNESS OR DIMENSIONS OR DETAILS."

This does not mean that the Owner approves the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of the responsibility for errors or omissions in the shop drawing or of his responsibility for meeting all requirements of the Contract Documents. Be responsible for confirming and correlating dimensions at the Place of the Work, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades."

.9 After submittals are stamped "NO EXCEPTIONS TAKEN", no further revisions are permitted unless re-submitted to the Owner for further review.

.10 Any adjustments made on shop drawings by the Owner are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of work.

.11 Make changes in shop drawings which the Owner may require consistent with Contract Documents. When re-submitting, notify the Owner in writing of any revisions other than those requested by the Owner.

.12 Shop drawings indicating design requirements not included in the Contract Documents require the seal of a qualified Professional Owner, registered in British Columbia.

.13 Only two reviews of a shop drawing will be made by the Owner at no cost. Each additional review will be charged to the Contractor at the Owner's scheduled rates. The Owner's charges for additional work will be deducted from the Contractor's Progress Certificates.

1.3 Record Drawings

.1 After award of the Contract, the Owner will provide a complete set of drawings for the purpose of maintaining Project record drawings. These drawings shall consist of a full size white paper copy.

.2 Record on the white prints on a daily basis, work constructed differently than shown on the Contract Documents. Record all changes in the Work caused by site conditions, or originated by the Owner, the Contractor, or a Subcontractor and by addenda, supplemental drawings, site instructions, supplementary instructions, change orders, correspondence, and directions of regulatory authorities. Do not use these drawings for daily working purposes and make the set available for periodic inspection by the Owner.

.3 Make records in a neat and legibly printed manner with a non-smudging medium.

.4 Identify drawings as "Project Record Copy". Maintain in good condition and make available for inspection on site by Owner at all times.

.5 At completion of operational testing, neatly transfer notations to second set of prints and submit both sets of record drawings to Owner.

.6 Failure to provide acceptable "Record Drawings" may delay acceptance of the project by the Owner. The Owner may assess against the Contract a sum based on their calculations of costs

to prepare such plans.

2.0 PRODUCTS

Not Applicable.

3.0 EXECUTION

Not Applicable.

END OF SECTION

Section 013500 Special Project Procedures

1.0 GENERAL

1.2 Permits/Inspections

.1 The Contractor will be responsible for obtaining all project permits and coordinating the required inspections.

.2 The Contractor shall arrange and pay for the regulatory submittals and inspections necessary for the completion of the Work in accordance with Federal, Provincial, regulations, and by-laws.

1.3 Applicable Codes/Standards

.1 Conform to all Federal, Provincial, and District Codes, regulations and by laws.

.2 Orenco AdvanTex Ax100 Treatment System to be installed by authorized installer.

.3 MSR to provide comment on uninterrupted operation of existing facility if applicable.

2.0 PRODUCTS

Not Applicable.

3.0 EXECUTION

Not Applicable.

END OF SECTION

Section 015000 Temporary Facilities and Controls

1.0 GENERAL

1.1 Temporary Facilities

.1 Installation/Removal

.1 The Contractor shall:

.1 Provide temporary toilet facilities for the Site.

.2 Maintenance of Public Utilities

.1 The Contractor shall:

.1 Arrange Work to avoid interruption of utilities serving the Owner and the public. Pay all penalties and costs including legal fees and other expenses imposed on the Owner as a result of actions of the Contractor, its employees, or subcontractors.

1.2 Site Requirements – General

.1 Sanitary Facilities

.1 The Contractor shall:

.1 Provide temporary portable toilet facilities for the use of the Contractor's, subcontractors', and Owner's work forces.

.2 Disinfect facilities frequently.

.3 Dispose of sanitary wastes, in accordance with the applicable regulations.

.4 Contain all wastewater and later dispose of offsite at an approved facility at the Contractor's cost.

.5 Keep the Site and premises in a sanitary condition.

.6 Post notices and take such precautions as required by local health authorities or other public agency having jurisdiction.

.2 Construction Power

.1 Coordinate the supply of an electrical power supply for construction purposes with BC Hydro.

.2 The Contractor shall:

.1 Locate construction power at the designated location.

.2 Provide and distribute construction power and lighting as required for the execution of the Work.

.3 Pay for its power connection, routing, consumption, and similar costs.

.4 Provide its own source of construction power to operate other equipment when or where necessary.

.5 Supply and pay for its own independent power for the Work.

.6 Install and maintain temporary facilities for power such as pole lines and underground cables to approval of local inspection authority.

2.0 PRODUCTS

Not Applicable

3.0 EXECUTION

Not Applicable

END OF SECTION

Section 017500 Starting and Adjusting

1.0 GENERAL

1.1 Equipment and Systems Training

.1 General Requirements

Provide training during the Equipment Performance Testing period for the following equipment and systems:

.1 Orenco AdvanTex AX100 Treatment System

.2 MSR to comment on the entire plant start up commissioning.

1.2 Training Completion Forms and Payment

.1 One copy of **Form 101** and will be required for each major piece of equipment.

2.0 Products

2.1 PRODUCTS

Not Applicable

3.0 EXECUTION

.1 The Contractor shall demonstrate to the Owner satisfactory start up testing of all Contractor and Owner supplied equipment by completion of the following **FORM 101.**

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE

FORM 101

We certify that the equipment listed below has been continuously operated for at least three consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

REFERENCE SPECIFICATION: _____

(Authorized Signing Representative of the Supplier)	Date
(Authorized Signing Representative of the Contractor)	Date
(Authorized Signing Representative of the Owner)	Date

END OF SECTION

2. Construction Specifications

1.0 GENERAL

1.1 Construction Works

.1 Work to include:

.1 All work described in drawings and specifications.

.2 Furnishing and connecting of all utility services including all fees, permits and inspection of services for the connections.

.3 Making good any damage to adjacent City or private property at Contractor's cost.

.4 Making good any damage to existing building elements and materials of finished or portions thereof that are to remain unmodified under this contract.

.5 Cleaning, repairing, and patching damaged areas.

.2 Work shall be done in accordance with:

.1 Drawings, including approved shop drawings and additional drawings as required,

.2 National Masters Specifications (NMS) guidelines,

.3 Unless otherwise stated in the Tender.

1.2 Specifications

.1 When more than one set of requirements are specified for a particular unit of Work, the option is intended to be the Contractor's regardless as to whether it is specifically indicated in the text or not.

.2 Where compliance with two (or more) sets of requirements establishes two different levels or minimum for a particular quality, the more stringent level will be enforced.

.3 Refer instances of different-but-equal requirements or instance of uncertainty as to which of two levels of quality is more stringent, to the Owner for decision.

.4 NMS specifications include but are not limited to:

02 41 13 - Selective Site Demolition	31 11 00 - Clearing and Grubbing
02 50 00 - Site Remediation	31 22 13 - Rough Grading
02 56 13 - Waste Containment	31 23 33.01 - Excavating, Trenching and Backfilling
03 41 00 - Precast Structural Concrete	31 32 19.16 - Geotextile Soil Stabilization
22 05 00 - Common Work Results for Plumbing	31 37 00 - Rip-Rap
22 05 05 - Selective Demolition for Plumbing	32 01 90.33 - Tree Preservation
22 05 15 - Plumbing Specialties and Accessories	32 11 16.01 - Granular Sub-Base
22 13 16.16 - Sanitary Waste and Vent Piping - Plastic	32 32 34 - Reinforced Soil Retaining Walls
26 05 00 - Common Work Results for Electrical	32 31 26 - Wire Fences
26 05 20 - Wire and Box Connectors (0-1000 V)	32 91 19.13 - Topsoil Placement and Grading
26 05 21 - Wires and Cables (0-1000 V)	32 92 19.16 - Hydraulic Seeding
26 05 22 - Connectors and Terminations	32 92 23 - Sodding
26 05 31 - Splitters, Junction	32 93 10 - Trees, Shrubs and Ground Cover Planting
26 29 03 - Control Devices	33 31 11 - Public Sanitary Sewerage Gravity Piping
31 00 00.01 - Earthwork – Short Form	33 31 23 - Sanitary Sewerage Force Main Piping
31 00 99 - Earthwork for Minor Works	33 36 00 - Wastewater Utility Storage Tanks

31 05 10 - Corrected Maximum Dry Density for Fill	33 36 33 - Utility Drainage Field
31 05 16 - Aggregates for Earthwork	

1.3 Use of Premises

.1 Do not load or permit to be loaded, any part of the Work with a weight that will damage the Work.

.2 The Owner reserves the right to take possession of and use any completed or partially completed portion of the Work.

.1 Regardless of the time of completion of entire work, providing it does not interfere with the Contractor's Work.

.2 Such taking possession or use of the Work or part thereof shall not be construed as final acceptance of the building or any part thereof, or an acknowledgement of fulfillment of the Contract.

1.4 Testing

.1 Notify Testing authorities of the progress of the Work.

.1 Giving at least 48 hours notice of the start of any construction operation which is specified or required to be inspected.

.2 Inspection and Tests required to establish compliance with the Contract Documents except as otherwise provided for in the Contract Documents, will be made by a pre-qualified testing agency approved by the Owner.

.3 When initial test indicates non-compliance with the Contract Documents:

.1 Subsequent re-testing shall be performed by the same agency.

.2 Cost thereof borne by the Contractor by deduction from the Contract sum with an appropriate Change Order.

.4 Inspections and tests required by Codes or Ordinances, or by a plan approval authority.

.1 Will be the responsibility of and paid for by the Contractor, unless otherwise provided in the contract Documents.

END OF SECTION

3. Orenco AdvanTex AX100 Treatment System

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for Orenco AdvanTex AX100 Treatment System

1.2 DEFINITIONS

.1 “Dealer” shall refer to the supplier of Orenco AdvanTex AX100 Treatment System

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer’s printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer’s installation instructions.

.6 Closeout submittals

.1 Submit maintenance and engineering data for incorporation into manual

.2 Description of plumbing specialties and accessories, giving manufacturer’s name, type, model, year, and capacity.

.3 Details of operation, servicing, and maintenance.

.4 Recommended spare parts list.

.5 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.6 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.7 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.8 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.

.9 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.4 OPERATIONS AND MAINTENANCE DATA

.1 The Contractor shall prepare and assemble detailed operation and maintenance manuals. The manuals shall contain data that shall include but not be limited to the following:

1. Preventative maintenance procedures.
2. Trouble-shooting.
3. Calibration.
4. Testing.
5. Replacement of components.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting prior to beginning work of this Section and on-site installations.

.1 Include Orenco representative.

.2 Verify project requirements.

.3 Review installation and substrate conditions.

.4 Co-ordination with other building subtrades.

.5 Review manufacturer's installation instructions and warranty requirements.

.2 Installer required to be an Authorized AdvanTex Installer

.1 Contact local AdvanTex Dealer for training and authorization.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Delivery, storage, and handling to be in accordance with equipment manual.

1.7 WARRANTY

.1 Installation to be in accordance with equipment manual to avoid voiding warranty.

2.0 PRODUCTS

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3.0 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, and local authority having

jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

.1 If instructions aren't found in equipment manual, call Dealer for assistance.

.3 Seams and penetrations to be watertight.

3.4 GRAVITY PIPING

.1 Gravity transport piping installed at minimum slope of 10 mm per m or 1%. ***DRAWINGS SHOW 0.5%***

3.5 RISERS

.1 Risers set to 50 mm above final grade.

.2 Adhesive to set before backfilling.

3.6 AX100 UNITS

.1 75 mm bed of sand or pea gravel to be placed over unit location.

.2 Bottom of unit no more than 230 mm below natural grade.

.3 Minimum of 600 mm spacing between units.

3.7 MOUNT AND WIRE CONTROL PANEL

.1 Installation to be performed by a licensed and qualified electrician.

3.8 BACKFILL

.1 Slope fiished grade way from units.

.2 Maintain 75 mm clearance from top of unit to final grade.

3.9 START-UP AND COMMISSIONING

.1 Start-up and commissioning to be done by a certified Orenco Technician.

3.10 TESTING AND ADJUSTING

.1 Testing and adjustments to be made by a certified Orenco Technician.

END OF SECTION

4. Refurbishment of Sand Filter

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for recirculating sand filter.

.2 General requirements for environmental protections.

.1 Does not intend to identify all and/or specific requirements.

.2 The Contractor is required to be aware of all regulations required for safe handling and disposal of fill media.

1.2 DEFINITIONS

.1 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.2 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications, and datasheet for materials.

.2 Indicate dimensions, construction details, and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, dimensions, construction and assembly details, and accessories.

.4 Closeout submittals

.1 Submit maintenance and engineering data for incorporation into operations and maintenance manual.

.2 Details of operation, servicing, and maintenance.

.3 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval. Submission of individual data will not be accepted unless directed by Owner's Representative.

.4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.4 OPERATIONS AND MAINTENANCE DATA

.1 The Contractor shall prepare and assemble detailed operation and maintenance manuals. The manuals shall contain data that shall include but not be limited to the following:

1. Preventative maintenance procedures.
2. Trouble-shooting.
3. Replacement of components.

1.5 QUALITY ASSURANCE

.1 Sand Filter fill to meet ASTM standards

1.6 SALVAGE AND DEBRIS MATERIALS

.1 Unless specified otherwise, materials for removal become Contractor's property.

.1 Except for items indicated as being

.1 Reused

.2 Salvaged

.3 Or otherwise indicated to remain the Owner's property.

.2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of and avoid any environmental contamination.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Fill to be installed upon arrival to avoid stockpiling

.2 Do not discharge water containing suspended materials into watercourses, sewer, or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Federal, Provincial, and Municipal requirements.

2.0 PRODUCTS

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

.2 Piping sizing and type as indicated in sealed Drawings.

.3 Sand filter fill from top to bottom:

.1 150 mm of Crush Gravel (20 mm)

.2 600 mm of Filter Media (1.5 – 3.0 mm) with a uniformity coefficient of 1.5 – 2.5

.1 Filter meets Coarse Sand Media specification

.2 Or ASTM C-33 specification

.3 75 mm of Pea Gravel (4 mm)

.4 175 mm of Crush Gravel (20 mm)

3.0 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Written report from Contractor verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

.2 Testing of existing pipes to ensure working order, replaced or fixed as needed.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of debris and water before installation.

.2 Carefully inspect materials for defects before installing.

.1 Remove defective materials from site.

.3 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during refurbishment.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of refurbishment work.

.4 Protection of in-place conditions:

.1 Prevent movement, settlement or damage of adjacent structures, services, walks,

paving, trees, landscaping, adjacent grades properties, parts of existing building to remain.

.1 Provide bracing, shoring and underpinning as required.

.2 Repair damage caused by Works as directed by Owner's Representative.

.2 Support affected site elements and, if safety of site, adjacent structures, or services appears to be endangered, take preventative measures, stop Work and immediately notify Owner's Representative.

.3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

.4 Provide temporary drainage and pumping as necessary to keep Work site free from water.

3.3 INSTALLATION

.1 Install during dry weather.

.2 Fill layers to each be generally level.

.3 Dispersal laterals to be installed level and in accordance with Drawings.

.4 Geotextile layer installed over top of sand filter to prevent vegetative growth.

3.4 REMOVAL OF CONTAMINATED FILL

.1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site:

.1 In safe manner to minimize danger at site or during disposal.

.2 Following all health, safety, and environmental regulations

3.5 REMOVAL OPERATIONS

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 When removing pipes under existing or future pavement area, excavate at least 300mm below pipe invert.

.4 Removal from site

.1 Interim removal of stockpiled material will be required by Owner's Representative, if it is deemed to interfere with operations of Owner's Representative, Owner or other contractors.

.5 Sealing

.1 Seal pipe ends and walls of manholes or catch basins as indicated. Securely plug to form watertight seal.

3.6 RESTORATION

.1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEAN UP

.1 Upon completion of work, remove debris, trim surfaces and leave work site clean.

.2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

Section 221316.16 Sanitary Waste and Vent Piping - Plastic

1.0 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and vent piping – plastic.

1.2 RELATED SECTIONS

.1 Section 01 35 29.06 - Health and Safety Requirements.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 22 05 00 – Common Work Results for Plumbing.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D2235, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA)

.1 CSA-B1800 Series, ABS Drain, Waste and Vent Pipe and Pipe Fittings.

.2 CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.

.3 Underwriters Laboratory of Canada (ULC)

.1 CAN/ULC-S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.5 SUBMITTALS:

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

2.0 PRODUCTS

2.1 PIPING AND FITTINGS

.1 For buried DWV piping to:

.1 CSA-B181.1.

.2 CSA-B181.2.

.3 CSA-B182.1.

.2 For aboveground DWV piping for combustible construction to:

.1 CSA – B181.2

.3 For aboveground DWV piping for non-combustible construction:

.1 Flame spread rating less than 25 and smoke developed classification less than 50.

.2 CSA B181.2

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.1 NPS 1 ½ to 6: one step or two step cement

.2 NPS 8 and above: two step cement.

.2 Solvent weld for ABS: to ASTM D2235.

3.0 EXECUTION

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework and certified journeyperson.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling in accordance with Canadian Plumbing Code.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows in accordance with Section 23 05 53.01 – Mechanical Identification.

.6 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

Section 260500 Common Work Results for Electrical

1.0 GENERAL

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23, Division 27, Division 28, Division 33, and Division 34. Refer to Section 01 00 00 – Bid Depository Sections where applicable for bid depository.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA-22.3 No. 1, Overhead Systems.

.3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

.1 Instruct Owner's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.

.4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Owner's Representative.

.6 Manufacturer's Field Reports: submit to Owner's Representative within seven (7) working days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in paragraph 3.6- FIELD QUALITY CONTROL.

.7 Single Line Electrical Diagrams

.1 Provide single line electrical diagrams in glazed frames as follows:

.1 Electrical distribution system: locate in main electrical room.

.2 Electrical power generation and distribution systems: locate in power plant rooms.

.2 Provide fire alarm riser diagram, plan, and zoning of building in glazed frame at fire alarm control panel and annunciator.

.3 Drawings: 600 x 600 mm minimum size.

.8 The electrical contractor shall supply an arc-flash study of the building's entire distribution system, to be performed by the successful electrical equipment supplier. The contractor shall furnish the supplier with distances, wire lengths and transformer shop drawings as required. Supply also stick-on labels for all equipment, identifying the arc-flash hazard rating of each distribution board and panel board. Such labelling shall meet CSA Z462. Supply one full set of Personal Protective Equipment required for each identified hazard rating in the arc-flash study. The arc-flash study shall be submitted with the electrical distribution equipment shop drawings. The electrical distribution equipment shop drawings will not be reviewed until the arc-flash study is received. Refer to Section 26 05 73 – Power Systems Studies for further details.

.9 Shop Drawings:

.1 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or materials.

.2 Where applicable, indicate wiring, single line, and schematic diagrams.

.3 Include wiring drawings or diagrams showing interconnection with work of other sections.

.4 Each shop drawing will be stamped and signed by the Contractor before submitting, stating that he has checked the drawings against the requirements as called for in the Contract Documents and also in the case where the equipment is attached to or connects to other equipment, that is has been properly coordinated with this equipment, whether supplied under Division 26 or under other Divisions.

.5 Each shop drawing for non-catalogue items shall be prepared specifically for this project. If brochures are submitted for catalogue items, the brochures shall be marked deficiently indicating the item or items to be supplied.

.6 Work shall not be proceeded with on any of the equipment until final review of shop drawings received by the Contractor.

.7 Shop drawing review is for general compliance with Contract Documents. No responsibility is assumed by the Owner's Representative for correctness of dimensions or details. Corrections or comments, or lack thereof, made on the shop drawings during the Owner Representative's review does not relieve the Contractor from compliance with the requirements of the drawings and specifications.

.8 If changes are required, notify Owner's Representative of these changes before they are made.

.10 Operation and Maintenance Data:

.1 Provide operation and maintenance data for incorporation into operation and maintenance manuals. Manuals shall be supplied to Section 01 78 00.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements to permit effective start-up operation, maintenance, repair, modification, extension, and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, exploded views, technical description of items and part lists. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.5 Copy of reviewed shop drawings.

.11 As-Built Drawings: Submit in accordance with 01 78 00 – Closeout Submittals.

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Owner's Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.

.4 Notify Owner's Representative of changes required by Electrical Inspection Division prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Owner's Representative.

1.7 CO-ORDINATION

.1 Co-ordinate work with work of other divisions to avoid conflict.

.2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Locate all existing underground services and make all parties aware of their existence and location.

.4 Where interference occurs, Owner's Representative must approve relocation of equipment and materials regardless of installation order.

.5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Owner's Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

.1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

.1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

.2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

.3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

.4 Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

.1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

.1 Work shall be scheduled in phases as per other divisions of the architectural specifications.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

.1 Maintain fire ratings around conduits passing through floors, ceilings, and fire rated walls.

.2 Use 3M brand or equal fire barrier products at each penetration.

.3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

.4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

1.14 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Owner's Representative with schedule within 2 weeks after award of Contract.

1.15 SYSTEM START-UP

.1 Instruct Owner's Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start- up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant will aspects of its care and operation.

1.16 WASTE MANAGEMENT & DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring and metal materials from landfill to metal recycling facility as approved by Owner's Representative.

.5 Place materials defined as hazardous or toxic waste in designated containers.

.6 Ensure emptied containers are sealed and stored safely for disposal.

.7 Unused materials must not be disposed of into sewer system, streams, lakes, onto ground or in other locations, where it will pose health or environmental hazard.

.8 Do not dispose of preservative treated wood through incineration. Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Owner's Representative.

.9 Divert unused batteries and antifreeze to appropriate recycling facilities as approved by Owner's Representative.

1.17 EQUIPMENT SUPPORTS AND HOUSEKEEPING PADS

.1 Equipment supports supplied by equipment manufacturer are specified elsewhere in Division 26.

.2 Fabricate equipment supports not supplied by equipment manufacturer from structural grade steel meeting requirements of Division 5. Submit structural calculations with shop drawings. Ensure that supports meet the requirements of the National Building Code.

.3 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around.

1.18 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.19 ACCESS DOORS

.1 Supply access doors for concealed electrical equipment to allow operation, inspection, adjusting and servicing.

.2 Use flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Use stainless steel with brushed satin or polished finish in special areas such as tiled or marble surfaces and as directed by Owner's Representative.

.2 In remaining areas, use prime coated steel.

.3 Use ULC rated access doors in fire rated walls and ceilings.

.4 Installation

.1 Locate so that concealed items are accessible.

.2 Locate so that hand or body entry (as applicable) is achieved.

.3 Installation is specified in applicable sections.

2.0 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings, where applicable.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.

.3 Factory assemble control panels and component assemblies.

2.3 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner's Representative.

.2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

.3 Install adhesive backed polyester arc flash hazard labels on all major electrical components including the service entrance switchboard, bus duct breakers, panelboards, disconnects, splitters and master control centers/starters. Refer to Section 26 05 73 – Power System Studies for further details.

2.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Owner's Representative prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate and label.

.5 Identification to be English (and French where applicable).

.6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system name and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages, and transformer number.

.10 Panelboards: indicate name, voltage, capacity, and upstream panel serving mains.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1, Canadian Electrical Code.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit System	Prime Color	Auxiliary Color
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 MATERIAL SPECIFIED

.1 Where additional manufacturers are named under Articles entitled "Approved Manufacturers", the selection of a named manufacturer, in reference to a particular article, shall be the Contractor's responsibility.

.2 Materials or products specified without the clauses "or approved equal" or "approved manufacturers" shall be supplied as specified and no proposed substitution will be considered.

.3 Where approvals are granted for the use of other equipment, any and all changes or additions required for the installation or operation of the approved equipment will be made by the Contractor at their own expense and no claims will be approved for any such changes, notwithstanding approval of shop drawings. Equipment that is accepted and installed and then does not perform as represented by original submitted data shall be replaced by the Contractor with equipment as specified at no charge to the Owner.

.4 Trade names are given as a standard of quality and configuration.

2.10 EXAMINATION OF OTHER WORK

.1 This Division requires the examination of the material and work for all other Divisions under which the work of this Section depends for proper completion. Any defect in work, levels or materials shall be reported to the Owner’s Representative. The work of this Division shall not commence until such defects have been corrected. This also applied to existing work installed under other Contracts.

2.11 CUTTING, PATCHING, SLEEVES AND PLATES

.1 All drilling for hangers, rod, inserts and work of similar nature shall be done by Division 26.

.2 Have core drilled openings installed in foundation walls to accommodate the work of this Division. Seal conduit or cable through the cored opening using industrial duty round compression seals sized to suit diameter of conduit or cable. Cable seals to be Roxtec RS type or approved equal.

2.12 HANGERS AND EQUIPMENT SUPPORTS

.1 All equipment provided under the Electrical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation and to avoid strain on conduit, etc. Auxiliary supports where required shall be provided under this Division.

.2 Hammer driven hanger supports, eg. staples, nails, etc. will not be used.

.3 Expansion bolts, inserted after concrete has been poured are acceptable.

.4 Paint all hangers, eg. U-bolts, trapeze hangers, etc. BEFORE INSTALLATION.

.5 Wire is not an acceptable conduit support.

2.13 TESTING, ACCEPTANCE AND GUARANTEE

.1 The work of this Contract shall be tested and installed and any defects in operation shall be remedied immediately. Tests required by local authorities shall be the responsibility of the Contractor. When the work is completed, it shall be tested in its entirety and shall be in good working order before the Owner's Certificate of Acceptance shall be issued.

.2 A written guarantee shall be supplied to the Owner by the Contractor covering the prompt making good of any and all defects in material and workmanship for the period of one (1) year from the date of acceptance and the making good of any such defects shall be completely the responsibility of the Contractor.

3.0 EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits, and fittings to be embedded or plastered over, neatly, and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical at following heights unless indicated otherwise.

- .1 Local switches: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 300 mm.
  - .2 Above top of continuous baseboard heater: 200mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1400 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2400 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2400 mm.
- .10 Clocks: 2400 mm.
- .11 Doorbell pushbuttons: 1200 mm.
- .12 Exit lights: 2400 mm.
- .13 Emergency lighting heads: 2400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.

.3 Perform tests in Accordance with this section as noted and Section 01 91 13.13 – Commissioning (Cx) Requirements.

.4 Load Balance:

.1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers, and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.5 Contractor to conduct and pay for the costs the following tests (Cost of the following tests are not covered in cash allowance amounts identified in Section 01 21 00 – Allowance):

.1 Power generation and distribution system including phasing, voltage, grounding, and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters, and associated control equipment including sequenced operations of systems where applicable.

.5 Systems: fire alarm system, communications.

.6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.7 Insulation resistance testing.

.1 Measure and record circuits, feeders, and equipment up to 350 V with a 500 V instrument.

.2 Measure and record 350 – 600 V circuits, feeders, and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing and record value.

.8 Carry out tests in presence of Owner's Representative.

.9 Provide instruments, meters, equipment, and personnel required to conduct tests during and conclusion of project.

.10 Submit test results for Owner's Representative's review and include in Commissioning Manuals specified in Section 01 91 13.13 – Commissioning (Cx) Requirements.

3.7 PREPERATION FOR FIRESTOPPING

.1 Prepare the space between conduits and adjacent sleeve or fire separation for the use of fire proofing material.

.2 Where cables or conduits pass through fire rated walls or ceilings, sleeve with steel conduit and prepare the opening for fire and smoke sealing and seal with proper fire and smoke rated material.

.3 Where conduits pass through fire or smoke rated partitions, install a junction box in the conduit just prior to exiting the space. Use this junction box to install smoke stopping material.

3.8 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes that have been damaged too extensively to be primed and touched up.

3.9 TRIAL USAGE

.1 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Lighting system.

.2 Power distribution system.

.3 Communication systems.

.4 Security systems.

.5 Metering system.

.6 Fire alarm system.

.7 Public address system.

3.10 TESTS

.1 Give 24 h written notice of date for tests. Conceal work only after testing and approval by Consultant. Conduct tests in presence of Consultant. Bear costs including re-testing and making good.

.2 Equipment: test as specified in relevant sections.

.3 Prior to tests, isolate all equipment or other parts that are not designed to withstand test pressures or test medium.

3.11 DRAWINGS, CHANGES, ACCESSIBILITY

.1 The drawings shall be considered to show the general character and scope of work and not the exact details of the installation.

.2 The installation shall be complete with all supports and accessories required for a complete operative and satisfactory installation.

.3 The location, arrangement and connection of equipment and materials as shown on the drawings represent a close approximation to the intent and requirements of the Contract.

.4 The right is reserved by the Owner's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to the Owner unless the location, arrangement or connection is more than 3.0 m from that shown.

.5 Actual location of existing services shall be verified in the field where necessary before work is commenced.

.6 Changes and modifications necessary to ensure co-ordination and to avoid interference or conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Owner.

3.12 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

.3 Complete final cleaning of equipment and work area as acceptable to Owner's Representative.

.4 At time of final cleaning, clean lighting, reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

END OF SECTION

Section 260520 Wire and Box Connectors 0–1000 V

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

2.0 PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for copper bar.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Sized for conductors and bars as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

3.0 EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Section 260531 Splitters, Junction, Pull Boxes and Cabinets

1.0 GENERAL

1.1 REALTED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 91 13.13 – Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

.1 Submit shop drawings and product data for cabinets.

.2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia, Canada.

2.0 PRODUCTS

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

3.0 EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.5 Ensure all electrical boxes above drywall ceilings are accessible via a properly sized access door installed directly below the box in drywall ceilings. Temporary removal of electrical light fixtures are not considered safe access to above ceiling electrical boxes and shall not be permitted.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

Section 310000.01 Earthwork and Related Work

1.0 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).

.2 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A3000, Cementitious Materials Compendium.

1.2 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

.1 Shore and brace excavations protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.

.2 Comply with Explosives Act of Canada.

.3 Perform blasting in accordance with Provincial and Municipal regulations. Repair damage to approval of Owner's Representative.

.4 No blasting will be permitted within 3 m of any building and where damage would result.

1.3 TESTS AND INSPECTIONS

.1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Owner's Representative.

.2 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill for fill material proposed for use.

.3 Do not begin backfilling or filling operations until material has been approved for use by Owner's Representative.

.4 Not later than 48 hours before backfilling or filling with approved material, notify Owner's Representative so that compaction tests can be carried out by designated testing agency.

.5 Before commencing work, conduct, with Owner's Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey benchmarks and monuments which may be affected by work.

1.4 EXISTING CONDITIONS

.1 Examine soil report available from Owner's Representative.

.2 Before commencing work verify the location of all buried services on and adjacent to the site.

.3 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

.4 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

2.0 PRODUCTS

2.1 MATERIALS

.1 Granular B-Type I, B-Type II, Select Subgrade to OPSS1010. Sand to OPSS1004.

.2 Crushed Granular to CCDG14.02.

.3 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m ^{3}.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA-A23.1/A23.2,

.5 Cement: to CSA A3000, Type GU.

.6 Slump: 160 to 200 mm.

3.0 EXECUTION

3.1 PROTECTION/PROTECTION

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Owner's Representative's Consultants approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.2 CLEARING AND GRUBBING

.1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

.3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

3.3 EXCAVATION

.1 Shore and brace excavations protect slopes and banks and perform work in accordance with Provincial regulations.

.2 Perform blasting in accordance with Provincial regulations: repair damage as directed by Owner's Representative.

.3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.

.1 Stockpile topsoil on site for later use.

.4 Excavate as required to carry out work, in all materials met.

.1 Do not disturb soil or rock below bearing surfaces.

.2 Notify Owner's Representative when excavations are complete.

.3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Owner's Representative written authorization to be filled with concrete of same strength as for footings at Contractor's expense.

.5 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.

.1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.

.6 Excavate for slabs and paving to subgrade levels.

.1 In addition, remove all topsoil, organic matter, debris, and other loose and harmful matter encountered at subgrade level.

3.4 BACKFILLING

.1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Owner's Representative.

.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill.

.1 Fill excavated areas with selected subgrade material or gravel and sand compacted as specified for fill.

.5 Placing:

.1 Place backfill, fill and basecourse material in 150 mm lifts. Add water as required to achieve specified density.

.6 Compaction: compact each layer of material to following densities for material to ASTM D698,

.1 To underside of basecourses: 95%.

.2 Basecourses: 100%.

.3 Elsewhere: 90%.

.7 In trenches:

.1 Up to 300 mm above pipe or conduit: sand placed by hand.

.2 Over 300 mm above pipe or conduit: native material approved by Owner's Representative.

.8 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.

.9 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.

.10 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

.11 Underground tanks: use sand to bottom of granular basecourses or to bottom of topsoil, as applicable.

3.5 GRADING

.1 Grade so that water will drain away from buildings, walls, and paved areas, to catch basins and other disposal areas approved by the Owner's Representative.

.1 Grade to be gradual between finished spot elevations shown on drawings.

3.6 SHORTAGE AND SURPLUS

.1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.

.2 Dispose of surplus material off site.

3.7 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Section 310510 Corrected Maximum Dry Density for Fill

1.0 GENERAL

1.1 SUMMARY

.1 This Section defines correction to maximum dry density to take into account aggregate particles larger than 4.75 mm.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C127-88, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600kN-m/m³).

.3 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).

.4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 DEFINITIONS

.1 Corrected maximum dry density is defined as:

.1 D =(D1xD2)(F1 x D2) + (F2 x D1)

.2 Where: D = corrected maximum dry density kg/m^3.

.1 F1 = fraction (decimal) of total field sample passing 4.75 mm sieve.

.2 F2 = fraction (decimal) of total field sample retained on 4.75 mm sieve (equal to 1.00 - F1)

.3 D1 = maximum dry density, kg/m3of material passing 4.75 mm sieve determined in accordance with Method A C of ASTM D698.

.4 D2 = bulk density, kg/m3, of material retained on 4.75 mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.

.3 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253, dry method when directed by Owner's Representative.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

Section 310516 Aggregates for Earthwork

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 03 30 00 – Cast-in-Place Concrete.

.3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.4 Section 32 11 16.01 – Granular Subbase.

.5 Section 32 11 23 – Aggregate Base Courses.

.6 Section 32 12 16.02 – Asphalt Paving for Building Sites.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International).

.1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 SOURCE QUALITY CONTROL

.1 Source of materials to be incorporated into work or stockpiles requires approval.

.2 Inform Owner's Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

.3 If, in opinion of Owner's Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.4 Should a change of material source be proposed, advise Owner's Representative 4 weeks in advance of proposed change to allow sampling and testing.

.5 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if its field performance is found to be satisfactory.

1.4 SAMPLES

.1 Aggregate will be subject to continual sampling by Owner's Representative during production.

.2 Provide Owner's Representative with access to source and processed material for sampling and testing.

.3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

PRODUCTS

1.5 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed five times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel, or slag.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock or slag.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

EXECUTION

1.6 TOPSOIL STRIPPING

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Commence topsoil stripping of areas as indicated after area has been cleared and removed from site.

.3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 2.0 m.

1.7 DEVELOPMENT OF AGGREGATE SOURCE

.1 Contractor to produce aggregates off site.

.2 Contractor to develop aggregate source to prevent contamination of aggregates stockpiled.

1.8 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Owner's Representative.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Engineer /Architect.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

1.9 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination, and degradation.

1.10 STOCKPILING

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Owner's Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet Project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Owner's Representative within two (2) working days of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Max 1.0 m for coarse aggregate and base course materials.

.2 Max 2.0 m for fine aggregate and sub-base materials.

.3 Max 1.5 m for other materials.

.8 Complete each layer over entire stockpile area before beginning next layer.

.9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.10 Do not cone piles or spill material over edges of piles.

.11 Do not use conveying stackers.

.12 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

1.11 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Owner's Representative.

END OF SECTION

Section 311100 Clearing and Grubbing

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 35 43 - Environmental Procedures.

.2 Section 31 23 16.26 - Rock Removal.

.3 Section 31 23 33.01 - Excavation, Trenching and Backfilling.

1.2 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps, and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than a specified depth below existing ground surface.

1.3 QUALITY ASSURANCE

.1 Safety Requirements: worker protection.

.1 Workers must wear gloves, dust masks, eye protection, protective clothing, when applying herbicide materials.

.2 Workers must wear gloves, dust masks, safety boots, protective clothing, eye protection, safety vests when clearing and grubbing.

.3 Workers must not eat, drink, or smoke while applying herbicide material.

.4 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

1.4 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, benchmarks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, root systems of trees which are to remain.

.2 Repair any damaged items to approval of Owner’s Representative. Replace any trees designated to remain, if damaged, as directed by Owner’s Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.

.2 Trim limbs and tops and saw into saleable lengths. Stockpile adjacent to site.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION

3.1 PROTECTION

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain temporary erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove temporary erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

.1 Inspect site and verify with Owner's Representative, items designated to remain.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site:

.1 Notify Owner's Representative immediately of damage to or when unknown existing utility lines are encountered.

.2 When utility lines which are to be removed are encountered within area of operations, notify Owner's Representative in ample time to minimize interruption of service.

.3 Notify utility authorities before starting clearing and grubbing.

.4 Keep roads and walks free of dirt and debris.

3.3 CLEARING

.1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags brush and rubbish occurring within cleared areas.

.2 Clear as directed by Owner's Representative, by cutting at a height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.3 Cut off branches and cut down trees overhanging area cleared as directed by Owner's Representative.

.4 Cut off unsound branches on trees designated to remain as directed by Owner's Representative.

3.4 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Cut off branches down trees overhanging area cleared as directed by Owner's Representative.

.3 Cut off unsound branches on trees designated to remain as directed by Owner's Representative.

3.5 ISOLATED TREES

.1 Cut off isolated trees as directed by Owner's Representative at height of not more than 300mm above ground surface.

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4.0 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

3.6 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level.

3.7 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing area.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.8 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site.

.2 Cut timber greater than 125 mm diameter to 3000mm lengths and stockpile as indicated. Unless otherwise notified, stockpiled timber becomes property of the Owner.

.3 Dispose of cleared and grubbed materials off site.

.4 Remove diseased trees identified by Owner's Representative and dispose of this material to approval of Owner's Representative.

3.9 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations stripping of topsoil to approval of Owner's Representative.

3.10 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

SECTION 312213 ROUGH GRADING

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 11 00 - Clearing and Grubbing.

.2 Section 31 23 16.26 - Rock Removal.

.3 Section 31 23 33.01 - Excavation, Trenching and Backfilling.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³),

1.3 EXISTING CONDITIONS

.1 Examine subsurface investigation report which is available for inspection from Owner's Representative.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

.3 Refer to dewatering in Section 31 23 33.01 - Excavating Trenching and Backfilling.

1.4 PROTECTION

.1 Protect and/or transplant existing fencing trees, landscaping, natural features, benchmarks, buildings, pavement, surface, or underground utility lines which are to remain as directed by Owner's Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

2.0 PRODUCTS

2.1 MATERIALS

.1 Fill material: Type 3 in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Owner's Representative.

3.0 EXECUTION

3.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Owner's Representative.

.2 Commence topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.

.3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 2 m.

.5 Dispose of unused topsoil as directed by Owner's Representative.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

.1 250mm for concrete slabs and walks precast paving units.

.3 Slope rough grade away from building 1:50 minimum.

.4 Grade ditches to depth as indicated.

.5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.6 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas.

.2 95% under paved and walk areas.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Owner's Representative. Refer to Sections 01 29 83 - Payment Procedures for Testing Laboratory Services and 01 45 00 – Quality Control.

.2 Submit testing procedure, frequency of tests, to Owner's Representative for approval.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Owner's Representative.

END OF SECTION

SECTION 312316.26 ROCK REMOVAL

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedure.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

.3 Section 01 35 29.06 - Health and Safety Requirements.

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 DEFINITION

.1 Rock: any solid material in excess of 1.0 m^3 and which cannot be removed by means of mechanical excavating equipment having 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 PPV: peal particle velocity.

1.3 MEASUREMENT PROCEDURES

.1 Mass rock:

.1 Rock quantities will be taken from cross section showing original rock surface and actual grade line set by Owner's Representative, except that minimum depth or rock required to excavated to be considered as 300 mm.

.2 Volume of individual boulders and rock fragments will be determined by measuring three maximum mutually perpendicular dimensions.

.2 Trench rock: rock quantities measured will be actual volume removed within following limits:

.1 Width for trench excavation as indicated.

.2 Width for excavation for structures to be bounded by vertical planes up to 500 mm outside and parallel to neat lines for footings as indicated.

.3 Depth from rock surface elevations immediately prior to excavation, to elevation as indicated.

.4 Where design elevation is less than 300 mm below original rock surface depth will be considered to be 300 mm blow original rock surface.

.3 Replacement imported fill: Imported fill quantities will be measured in cubic metres, compacted in place.

.4 Quantities for measurement purposes are indicated in Tender Form. If no quantities are provided, rock removal and fill replacement considered inclusive to the work and will not be measured.

.5 Contractors shall provide all survey equipment needed and provide assistance to Owner's Representative in taking cross sections. Sections shall be taken at 5 m intervals for mass and trench rock excavation. Sections will be submitted to contractor's site representative for verification. Additional sections shall be taken at points or significant change in elevation or at any other locations as determined by Owner's Representative.

Contractor to schedule work to allow sufficient time for Owner's Representative to take necessary sections.

1.4 SUBMITTALS

.1 Blasting Operation

.1 Submit to Owner's Representative and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by blasting.

.2 Indicate proposed method of carrying out work, types, and quantities of explosives to be used, loading charts and drill hole patterns, type of caps, blasting techniques, blast protection measures for items such as flying rock, vibration, dust and noise control. Include details on protective measures, time of blasting and other pertinent details.

.3 Submit records to Owner's Representative at end of each shift. Maintain complete and accurate records for drilling and blasting operations.

.4 Prior to any blasting operations, the contractor shall carry out a pre-blast survey. This survey will be conducted by an independent agency. The survey report will be submitted to the Owner's Representative for review.

.5 No blasting shall take place without a minimum of two (2) working days notice to the Owner's Representative.

1.5 QUALIFICATIONS

.1 Retain licensed explosives expert to program and supervise blasting work, to interpret recommendations of pre-blasting report, and to determine precautions, preparation, and operations techniques.

1.6 BLASTING AND VIBRATION CONTROL

.1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION

3.1 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures. Sound warnings and display signs when blasting to take place.

3.2 ROCK REMOVAL

.1 Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements.

.2 Remove rock to alignments, profiles, and cross sections as indicated.

.3 Explosive blasting is not permitted at locations indicated.

.4 Do blasting operations in accordance with local and provincial codes, requirements of authority having jurisdiction.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.6 Excavate rock to horizontal surfaces.

.7 Scale, pressure wash and broom clean rock surfaces which are to bond to concrete.

.8 Excavate trenches to lines and grades to minimum of 300 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.

.9 Cut trenches to widths as indicated.

.10 Use pre-shearing, cushion blasting or other smooth wall drilling and blasting techniques directed by Owner's Representative.

.11 Remove boulders and fragments which may slide or roll into excavated areas.

.12 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 ROCK DISPOSAL

.1 Dispose of surplus removed rock off site. Dispose in locations acceptable to authorities having jurisdiction and Owner's Representative.

.2 Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Owner's Representative.

END OF SECTION

Section 312333.01 Excavating, Trenching and Backfilling

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 43 - Environmental Procedures.

.3 Section 01 56 00 - Temporary Barriers and Enclosures.

.4 Section 02 41 16 – Structure Demolition

.5 Section 31 05 16 – Aggregates for Earthwork.

.6 Section 31 22 13 – Rough Grading.

.7 Section 31 23 16.26 – Rock Removal.

.8 Section 33 11 16 - Site Water Utility Distribution Piping.

.9 Section 33 31 13 - Public Sanitary Utility Sewerage Piping.

.10 Section 33 41 00 – Storm Utility Drainage Piping.

.11 Section 33 46 13.01 - Foundation and Underslab Drainage.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric

.3 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock excavation: excavation of material from solid masses of igneous, sedimentary, or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.

.4 Waste material: excavated material unsuitable for use in work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of work.

.6 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

1.4 SUBMITTALS

.1 Inform Owner's Representative at least 4 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

.2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.3 Ship samples as directed by Owner's Representative in tightly closed containers to prevent contamination.

1.5 QUALITY ASSURANCE

.1 Submit design and supporting data at least 2 weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province of Newfoundland and Labrador.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional engineer who is registered or licensed in Province of Newfoundland and Labrador to design and inspect cofferdams, shoring, bracing, and underpinning required for work.

.5 Do not use soil material until written report of soil test results are reviewed and approved by Owner's Representative.

1.6 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

.6 Confirm locations of buried utilities by careful test excavations.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Owner's Representative before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct, with Owner's Representative condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey benchmarks and monuments which may be affected by work.

.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Owner's Representative.

.3 Where required for excavation, cut roots or branches as approved by Owner's Representative.

2.0 PRODUCTS

2.1 MATERIALS

.1 Backfill Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregates for Earthwork and the following requirements:

.1 Crushed, pit run or screened stone, gravel, or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing	
	Type1	Type2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

.2 Type 3 fill: selected material from excavation or other sources, approved by Owner's Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

3.0 EXECUTION

3.1 SITE PREPARATION

.1 Remove obstructions, ice, and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

.1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Owner's Representative's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas as indicated by Owner's Representative after area has been cleared of brush, weeds and grasses and removed from site.

.2 Strip topsoil to depths as indicated by Owner's Representative. Do not mix topsoil with subsoil.

.3 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 2 m.

.4 Dispose of unused topsoil as directed by Owner's Representative.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Owner's Representative. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 30 - Health and Safety Requirements and Occupational Health and Safety Act for the Province of British Columbia.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary works to depths, heights and locations as indicated or approved by Owner's Representative.

.4 During backfill operation:

.1 Unless otherwise as indicated or as directed by Owner's Representative remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore water courses as indicated and as directed by Owner's Representative.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while work is in progress.

.2 Submit for Owner's Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or any portion of work completed or under construction.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.7 EXCAVATION

.1 Excavate to lines, grades, elevations, and dimensions as indicated by Owner's Representative.

.2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by Owner's Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Owner's Representative.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material off site.

.9 Do not obstruct flow of surface drainage or natural watercourses.

.10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft, or organic matter.

.11 Notify Owner's Representative when bottom of excavation is reached.

.12 Obtain Owner's Representative approval of completed excavation.

.13 Remove unsuitable material from trench bottom to extent and depth as directed by Owner's Representative.

.14 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected maximum dry density.

.15 Hand trim make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Owner's Representative.

3.8 FILL TYPES AND COMPACTION

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 corrected maximum dry density.

.1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95%.

.2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 98%.

.3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

.4 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95%. For remaining portion, use Type 3 fill compacted to 95%.

.5 To correct over excavation in trenches: use Type 2 fill to underside of sand bedding compacted to 95%.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.10 BACKFILLING

.1 Vibratory compaction equipment: approved by Owner's Representative.

.2 Do not proceed with backfilling operations until Owner's Representative has inspected and approved installations.

.3 Areas to be backfilled to be free from debris, snow, ice, water, and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow, or debris.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.6 Backfill around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or overcast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure, and approval obtained from Owner's Representative, or

.2 If approved by Owner's Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Owner's Representative.

3.11 RESTORATION

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Owner's Representative.

.2 Replace topsoil as indicated by Owner's Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavement and sidewalks distributed by excavation to thickness, structure, and elevation which existed before excavation.

.5 Clean and reinstate areas affected by work as directed by Owner's Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.

END OF SECTION

Section 313700 Rip-Rap

1.0 GENERAL

1.1 DESCRIPTION

.1 This section specifies the requirements for riprap for culverts, storm sewer outlets, hydraulic structures and slope protection in locations shown on the drawings.

.2 The work includes supply of material and placing of :

a) gravel filter layer

b) filter cloth

c) pre-cast concrete riprap

d) bagged concrete riprap

e) rock riprap

f) cement mortar.

1.2 RELATED WORK

.1 Earthwork and preparation of slopes is included in:

a) Section 31 23 16.13– Trenching.

b) Section 31 22 00 – Site Grading.

c) Section 33 47 00 – Ponds and Reservoirs.

2.0 PRODUCTS

2.1 FILTER GRAVEL

.1 Uniformly graded gravel between 40 mm sieve and 75 mm sieve with less than 10% finer than 40 mm.

2.2 FILTER CLOTH

.1 Non-woven polyester in accordance with CGSB-148.1, 170 g/m2 1.7 mm thickness, Nilex 4545 or approved equivalent alternative.

2.3 PRECAST CONCRETE

.1 Use interlocking type concrete blocks.

.2 Concrete shall be 28 MPa.

.3 Minimum thickness of block 225 mm.

.4 Minimum weight of block 54 kg.

2.4 BAGGED CONCRETE

.1 Use burlap bags 0.03 to 0.05 m3 capacity.

.2 Fill bags 2/3 full with concrete and staple shut to form a straight closure.

.3 Use 20 MPa concrete.

2.5 ROCK RIPRAP

.1 Use selected round durable rock not subject to deterioration by water or weathering. Rock shall be in accordance with the following classes.

.2 Class 1 - Nominal size 300 mm dia. or 36 kg

100% smaller than 450 mm or 136 kg

20% larger than 350 mm or 68 kg

50% larger than 300 mm or 36 kg

80% larger than 200 mm or 11 kg.

.3 Class 2 - Nominal size 500 mm dia. or 180 kg

100% smaller than 760 mm or 680 kg

20% larger than 600 mm or 318 kg

50% larger than 500 mm or 180 kg 80% larger than 300 mm or 36 kg.

.4 Class 3 - Nominal size 760 mm dia. or 680 kg

100% smaller than 1200 mm or 2250 kg

20% larger than 900 mm or 1200 kg 50% larger than 760 mm or 680 kg

80% larger than 500 mm or 180 kg.

2.6 CEMENT MORTAR

.1 Cement - to CSA-A5/A8/A362 Type 10.

.2 Sand - to CSA-A179 (Mortar and Grout for Unit Masonry).

.3 Mix - 1 part cement to 3 parts sand, to consistency that can be placed with trowel.

3.0 EXECUTION

3.1 PREPARATION

.1 Prepare the slope to be protected by grading smooth to a maximum slope of 2H:1V unless shown otherwise on the drawings.

.2 Prepare a trench at the toe of slope if shown on the drawings or ordered by the ENGINEER.

3.2 FILTER

.1 Place a uniform layer of filter gravel to the thickness shown on the drawings, and to limits shown on the drawings.

.2 Place filter cloth in accordance with CGSB-148.1, to limits shown on the drawings.

3.3 PLACING ROCK RIPRAP

.1 Class of riprap shall be as shown on the drawings.

.2 Transport rock to the site, dump and place in a manner that minimizes cracking and spalling and avoids damage to filter.

.3 Remove material that does not comply with the gradation or Contract Specification.

.4 Place riprap in a manner such that segregation into different sizes does not occur.

.5 Do not use heavy machinery on material in place.

.6 Place riprap to a depth equal to or exceeding the largest permitted rock size for the class specified.

.7 Local slope irregularities shall not vary from the design slope by more than 200 mm measured at right angle to the slope.

3.4 PLACING BAGGED CONCRETE RIPRAP

.1 Place bags starting at the bottom row proceeding upward with fastened ends placed in the same direction.

.2 Stagger joints and lightly tamp bags together.

.3 Keep the concrete bags moist for a period of 24 hours following placing.

.4 Do not place bagged concrete on frozen ground or when air temperature is at or below 5°C or when there is a possibility of air temperature falling below 5°C within 24 hours of placing.

.5 Do not run equipment on concrete bagged riprap.

.6 Local slope irregularities shall not vary from the design slope by more than 200 mm measured at right angle to the slope.

3.5 PLACING PRECAST CONCRETE RIPRAP

.1 Place precast concrete in accordance with the manufacturer's recommendations.

.2 Submit shop drawings for precast blocks and anchoring method.

.3 Do not run equipment on precast concrete in place.

.4 Local slope irregularities shall not vary from the design slope by more than 100 mm measured at right angles to the slope.

3.6 PLACING CEMENT MORTAR

.1 Use mortar within 1 hour after water has been added. Do not re-temper.

.2 Commence applying mortar at the bottom courses and above water line and work upwards completely filling voids but leaving outer faces of stones exposed.

.3 Cure and protect mortar in accordance with CSA-A23.1/A23.2 using mats or fabric kept continuously wet.

END OF SECTION

Section 3231116.01 Granular Sub-Base

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 05 16 – Aggregates for Earthwork.

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.4 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.5 ASTM D4318, Standard Test Methods for Liquid Unit, Plastic Unit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

2.0 PRODUCTS

2.1 MATERIALS

.1 Granular sub-base material to Section 31 05 16 – Aggregates for Earthwork and following requirements:

.1 Crushed pit run or screened stone, gravel, or sand.

.2 Granulations to be within limits specified when tested to ASTM C136 and ASTM C117 - sieve sizes to CAN/CGSB-8.1.

.1 Granulation to:

Sieve Designation	% Passing (Base Type 2)
100 mm	-
75 mm	-
50 mm	75-100
38.1 mm	-

25 mm	-
19 mm	-
15.9 mm	45-80
12.5 mm	-
9.5 mm	-
4.75 mm	25-55
2.00 mm	-
1.20 mm	12-35
0.425 mm	-
0.180 mm	-
0.075 mm	3-6

.3 Other properties as follows:

.1 Liquid limit: to ASTM D4318, maximum 25

.2 Plasticity index: to ASTM D4318, maximum 6

3.0 EXECUTION

3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Owner's Representative.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Owner's Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density of not less than 98% corrected maximum dry density ASTM D698.

.3 Shape and roll alternately to obtain smooth, even, and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Owner's Representative.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Owner's Representative.

END OF SECTION

Section 329119.13 Topsoil Placement and Grading

1.0 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 11 00 - Clearing and Grubbing.

.2 Section 31 22 13 - Rough Grading.

1.2 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

.4 Qualifications: Provide proof of qualifications when requested by Owner's Representative.

.5 Contractor Qualifications:

.1 Landscape Contractor: to be a Member in Good Standing of Landscape Newfoundland Green for Life (LNL).

.2 Landscape Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.

1.3 SOURCE QUALITY CONTROL

.1 Advise Owner's Representative of sources of topsoil to be utilized seven (7) working days in advance of stating time.

.2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

2.0 PRODUCTS

2.1 TOPSOIL

.1 Topsoil for seeded areas: mixture of mineral particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 20% to 70% sand, minimum 7% clay, and contain 2 to 10 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Free from:

.1 Debris and stones over 50 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

.1 Fertilizer:

.1 Fertility: major soil nutrients present in following amounts:

.2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

.3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.

.4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

.5 Calcium, magnesium, sulfur, and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.

.6 Ph value: 6.5 to 8.0.

.2 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.5 pH range of 3.5 to 6.5.

.3 Sand: washed coarse silica sand, medium to course textured.

.4 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

3.0 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Commence topsoil stripping of areas as indicated after area has been cleared of brush weeds and grasses and removed from site.

.3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.4 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 2 m.

.5 Disposal of unused topsoil as directed by Owner's Representative.

.6 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct. If discrepancies occur, notify Owner's Representative, and do not commence work until instructed by Owner's Representative.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials, and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

.4 Course cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Owner's Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.

.3 For sodded areas keep topsoil 50/100 mm below finished grade.

.4 Spread topsoil as indicated to following minimum depths after settlement and 80% compaction:

.1 150 mm for seeded areas.

.2 135 mm for sodded areas.

.3 300 mm for flower beds.

.4 500 mm for shrub beds.

.5 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

.6 Avoid spreading or grading in wet, frozen, or saturated state.

3.5 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Owner's Representative. Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

.1 Owner's Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. Approval of topsoil material subject to soil testing and analysis.

.2 Testing of topsoil will be carried out by testing laboratory designated by Owner's Representative. Soil sampling, testing and analysis to be in accordance with Provincial regulations and standards. Owner's Representative will pay for cost of tests as specified in Section 01 45 00 – Quality Control.

3.7 RESTORATION OF STOCKPILE SITES

.1 Restore stockpile sites acceptable to Owner's Representative.

3.8 SURPLUS MATERIAL

.1 Dispose of materials not required where directed by Owner's Representative.

3.9 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.

END OF SECTION

Section 333111 Public Sanitary Sewerage Gravity Piping

1.0 GENERAL

1.1 RELATED WORK

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 – Common Product Requirements

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 03 30 00 - Cast-in-Place Concrete.

.5 Section 31 05 16 – Aggregates for Earthwork.

.6 Section 31 23 33.01 - Excavating Trenching and Backfilling.

.7 Section 33 05 13 – Maintenance Holes and Catch Basin Structures.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM B745/745M, Standard Specification of Corrugated Aluminum Pipes for Sewers and Drains.

.2 ASTM C117, Standard Test Method for Material Finer Than 75 [MU] m (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft^3 (600 kN-m/m^3)).

.5 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.2 American Water Works Association (AWWA)

.1 AWWA C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.3 Canadian General Standards Board (CGSB). CSA B137, Thermoplastic Pressure Piping Compendium.

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire.

.4 Canadian Standards Association (CSA International)

.1 CSA A257 Series, Reinforced Circular Concrete Culvert, Storm Drain, Sewer Pipe, and Fittings.

.2 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A5, Portland Cement.

.3 CSA B137, Thermoplastic Pressure Piping Compendium.

.4 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.2 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.5 CSA G401, Corrugated Steel Pipe Products.

1.3 DEFINITIONS

.1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.4 SUBMITTALS

.1 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.

.2 Inform Owner's Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.

.3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

.4 Ensure certification is marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 RECORD DRAWINGS

.1 Provide record drawings, including directions of operating valves, list of equipment required to operate valves, details of pipe materials, location of air and vacuum release valves, maintenance, and operating instructions in accordance with Section 01 78 00 – Closeout Submittals.

1.7 SCHEDULING

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Owner's Representative and building manager superintendent two (2) working days in advance of any interruption in service.

2.0 PRODUCTS

2.1 PLASTIC PIPE

.1 Type PSM Polyvinyl Chloride (PVC): to ASTM D3034.

.1 Separate gasket and integral bell system.

.2 Nominal lengths: 6.0 m.

2.2 SERVICE CONNECTIONS

.1 Type PSM Poly (Vinyl) Chloride: to CAN/CSA-B182.2.

.2 Plastic: to CAN/CSA B182.1, with push-on-joints.

2.3 CEMENT MORTAR

.1 Portland cement: to CAN/CSA-A5. Normal type 10.

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

2.4 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Section 31 05 16 – Aggregates for Earthwork and following requirements:

.1 Crushed or screened stone, gravel, or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.2 Table

Sieve Designation	% Passing Stone/Gravel	% Passing Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30 - 90
0.425 mm	10-25	10 - 50
0.180 mm	-	-
0.075 mm	0-8	0-10

.3 Concrete mixes and materials for cradles, encasement, supports to Section 03 30 00 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

.1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.0 EXECUTION

3.1 PREPARATION

.1 Clean and dry pipes and fittings before installation.

.2 Obtain approval of pipes and fittings from Owner's Representative prior to installation.

3.2 TRENCHING

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench alignment and depth require approval of Owner's Representative prior to placing bedding material and pipe.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as directed by Owner's Representative.

.2 Position pipe on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

3.4 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.5 INSTALLATION

.1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Owner's Representative.

.2 Handle pipe using methods approved by Owner's Representative. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Tolerances: 3mm in 3 m.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction, except as may be permitted by Owner's Representative.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.1 Install gaskets in accordance with manufacturer's recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel, and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned, and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Owner's Representative to prevent creep during down time.

.11 Plug lifting holes with pre-fabricated plugs approved by Owner's Representative, set in shrinkage compensating grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

.14 Use prefabricated saddles or field connections approved by Owner's Representative, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.

3.6 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Owner's Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.0 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum density to ASTM D698.

.7 When field test results are acceptable to Owner's Representative, place surround material at pipe joints.

3.7 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95 % maximum density to ASTM D698. In other areas, compact to at least 90 % maximum density to ASTM D698.

3.8 SERVICE CONNECTION

.1 Install pipe to CSA B182.11 and manufacturer's instructions and specifications.

.2 Maintain grade for sewers at 1 vertical to 50 horizontal unless directed otherwise by Owner's Representative.

.3 Service connection pipe: not to extend into interior of main sewer.

.4 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of four pipe diameters.

.1 Use long sweep bends where applicable.

3.9 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Owner's Representative, draw tapered wooden plug with diameter of 10 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do infiltration and exfiltration testing as specified herein and as directed by Owner's Representative. Perform tests in presence of Owner's Representative. Notify Owner's Representative two (2) working days in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.8 Exfiltration test:

.1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.

.2 Immediately prior to test period add water to pipeline until there is head of 1.0 m over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 hours.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.9 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.

.2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.

.3 Install watertight plug at upstream end of pipeline test section.

.4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.

.5 Prevent damage to pipe and bedding material due to flotation and erosion.

.6 Place 90 degrees V-notch weir, or other measuring device approved by Owner's Representative in invert of sewer at each manhole.

.7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.

.10 Infiltration and exfiltration not to exceed 5.5 L per hour per 100 m of pipe, including service connections.

.11 Repair visible leaks regardless of test results.

.12 Television and photographic inspections: carry out inspection of installed sewers by television camera, photographic camera or by other related means.

.13 Provide certification of test acceptance. Provide Owner's Representative with copy of video tape, VHS format and certification of corrected deficiencies. If retesting is required Contractor to pay cost.

END OF SECTION

Section 333633 Utility Drainage Field

1.0 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for trench type septic tank disposal fields.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 31 05 16 – Aggregates for Earthwork.

.4 Section 31 23 33.01 - Excavating Trenching and Backfilling.

.5 Section 33 36 00 - Wastewater Utility Storage Tanks.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422, Standard Method for Particle-Size Analysis of Soils.

.4 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.1 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

1.4 SUBMITTALS

.1 Submit to Owner’s Representative 20 kg samples of granular materials at least 4 weeks prior to beginning Work.

.2 Submit to Owner’s Representative copy of certification or licence of approved installers.

1.5 QUALITY ASSURANCE

.1 Use certified, licenced installers who comply with local authority having jurisdiction.

2.0 PRODUCTS

2.1 GRANULAR MATERIALS

.1 Granular material to Section 31 05 16 – Aggregates for Earthwork and following requirements:

.1 Pit run crushed or screened stone, gravel, or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve	% Passing Designation	
	Sand	Stone
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	80-100
19 mm	-	0-5
12.5 mm	100	-
9.5 mm	-	-
4.75 mm	80-100	-
2.00 mm	50-90	-
0.425 mm	10-50	-
0.180 mm	-	-
0.075 mm	0-5	-

2.2 IMPORTED FILTER MATERIAL

.1 Washed stone conforming to requirements of local authority having jurisdiction.

2.3 PIPE FOR DISPOSAL FIELDS

.1 Straight PVC pipe and fittings to CAN/CSA-B182.2. Perforated or unperforated as indicated.

2.4 DISTRIBUTION BOX

.1 Concrete: as indicated and to Section 33 36 00 - Wastewater Utility Storage Tanks.

2.5 SOURCE QUALITY CONTROL

.1 If requested, provide Owner's Representative with 3 certified copies of factory tests of pipe material.

3.0 EXECUTION

3.1 TRENCH TYPE DISPOSAL FIELD INSTALLATION

.1 Excavate to lines and depths as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Scarify trench base and walls under dry conditions.

.3 Obtain Owner's Representative approval to operate construction equipment across disposal field.

.4 Place minimum 150 mm of stone material in bottom of trench.

.5 Install distribution box between septic tank and absorption trenches. Installation to be water-tight construction.

.6 Distribution box: set level as indicated. Provide access with removable cover for inspection of distribution box.

.7 Connect lengths and place distribution pipe on stone material as indicated and cover with minimum 50 mm of stone material.

.8 Connect each distribution pipe individually to distribution box.

.9 Cap or plug free ends of distribution lines.

.10 Maintain pipe elevations within 5 mm of inverts indicated.

.11 Do not backfill trenches until pipe grade and alignment have been approved by Owner's Representative and authority having jurisdiction.

.12 Backfill trenching with material as indicated. Material to be approved by Owner's Representative. Do not compact. Overfill to allow for settlement.

END OF SECTION

SCRD WOODCREEK WWTP FILTER RENEWAL AND UPGRADE

INFRASTRUCTURE SERVICE SUNSHINE COAST REGIONAL DISTRICT

SCRD WOODCREEK WWTP UPGRADE
DRAWING INDEX:

CONTRACT DRAWINGS

CONTACT INFORMATION

CAPITAL CONTRACTS MANAGER

STEPHEN MISIURACK P.ENG.
CAPITAL PROJECTS MANGER
1975 FIELD ROAD SECHELT, BC V0N 3A1
TEL: 604-885-6800 EXT.6494

WATER

CODI ABBOTT
SUNSHINE COAST REGIONAL DISTRICT (SCRD)
WORKS DIVISION
5920 MASON RD, BC V0N 3A8
TEL: 604-885-6800 EXT.6311

NATURAL GAS

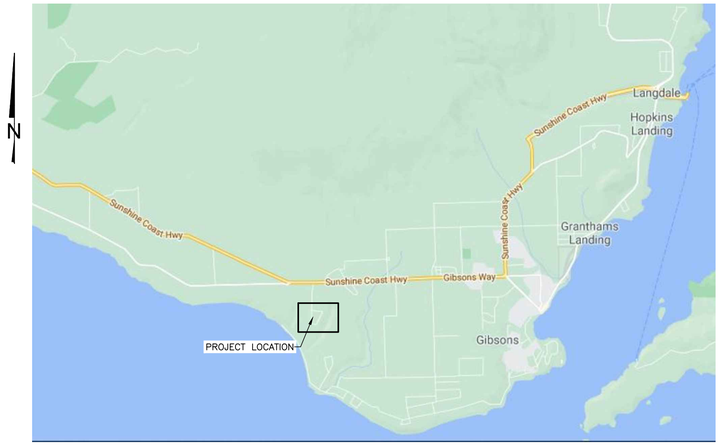
FORTIS BC ENGERGY INC.
16705 FRASER HIGHWAY
SURREY, BC V4N 0E8

POWER

BC HYDRO
333 DUNSMUIR ST.
VANCOUVER, BC V6B 5R3

TELECOMMUNICATIONS

TELUS COMMUNICATIONS
3777 KINGSWAY,
BURNABY, BC V5H 3Z7



LOCATION PLAN
SCALE: 1:30000

KEY PLAN
SCALE: 1:3000

GENERAL CONSTRUCTION NOTES –
REFER TO TENDER DOCUMENT, DIVISION 01

1. ALL CONSTRUCTION AND MATERIALS TO BE IN ACCORDANCE WITH THE LATEST REVISION OF THE SUNSHINE COAST REGIONAL DISTRICT (SCRD) SUBDIVISION AND DEVELOPMENT STANDARDS, THE MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE (MOTI), SUNSHINE COAST REGIONAL DISTRICT WATER SERVICES SCRD OPERATIONS FORCES ENGINEERING SPECIFICATIONS AND STANDARD DRAWINGS, VANCOUVER COASTAL HEALTH (VCH) AND CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE (CCDC) 2020, AND THE BC BUILDING CODE 2018, UNLESS OTHERWISE NOTED.
2. ALL CONNECTIONS/SERVICES PROVIDED BY SCRD, MOTI, OR SCRD OPERATIONS FORCES WILL BE COMPLETED AT THE APPLICANT'S EXPENSE FOR THE ESTIMATED AMOUNT OR THE APPLICABLE FEE.
3. CONTRACTOR TO PROVIDE PIPE INSPECTION VIDEO(S) OF SEWER AND DRAINAGE WORKS UPON COMPLETION OF CONSTRUCTION, IF APPLICABLE, ACCORDANCE WITH SECTION 33 3130.1 OF MMCD.
4. CONTRACTOR SHALL NOT TO COMMENCE BACKFILL OPERATION UNTIL THE EXCAVATION AND WORKS HAVE BEEN APPROVED BY THE ENGINEER.
5. IF A CONFLICT BETWEEN THE SPECIFICATIONS ARISES, THE MOST STRINGENT SPECIFICATION SHALL APPLY.
6. EXPOSE ALL EXISTING SERVICES AT CONNECTION AND CROSSING POINTS 48 HOURS PRIOR TO STARTING CONSTRUCTION OF SPECIFIED SERVICES. CONTRACTOR TO VERIFY LOCATION AND DEPTH OF EXISTING WORKS, NOTIFY ENGINEERING IMMEDIATELY OF ANY DISCREPANCIES.
7. OBTAIN A PERMIT TO CONSTRUCT WORKS ON A MUNICIPAL RIGHT OF WAY FROM THE MOTI ENGINEERING DEPARTMENT PRIOR TO THE START OF ANY UNDERGROUND CONSTRUCTION.
8. CONTRACTOR TO OBTAIN PERMIT FROM SCRD/MOTI PRIOR TO DEPOSIT OR REMOVAL OF SOILS ON THIS SITE.
9. ADJUST ALL PROPOSED AND EXISTING APPURTENANCES TO MEET THE FINAL DESIGN ELEVATIONS.
10. CONTACT & NOTIFY ALL HOMEOWNERS AFFECTED BY WORKS 4 WEEKS PRIOR TO CONSTRUCTION. IN WRITING. CONTRACTOR SHALL ALSO PROVIDE A CHANGEABLE MESSAGE SIGN SOLAR POWERED NOTIFYING THE HOMEOWNERS OF THE UPCOMMING CONSTRUCTION WORK, THEIR 24HR CONTACT INFORMATION AND DURATION OF WORK DATES AND SHALL BE SHOWN IN THE MOTI TRAFFIC CONTROL PLAN.
11. ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO MUNICIPALITY STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED ON THIS DRAWING.
12. REPAIR AND/OR REPLACE ALL INFRASTRUCTURE/PRIVATE PROPERTY DAMAGED OR REMOVED DURING CONSTRUCTION, TO BETTER THAN, OR EQUAL TO PRE-CONSTRUCTION CONDITION.
13. CONTRACTOR SHALL REGISTER WITH WORKSAFE BC.
14. ENSURE THE CURRENT MUNICIPAL O.H.&S. GROUND DISTURBANCE PRACTICE AND PROCEDURES ARE FOLLOWED. CONTACT BC1 AT 1-800-474-6886 FOR EXTERNAL UTILITY LOCATIONS AT LEAST 72 HOURS PRIOR TO THE START OF CONSTRUCTION. FOR ROADWAYS, CONTRACTOR SHALL CONTACT MOTI PRIOR TO THE START OF CONSTRUCTION.
15. NOTIFY THOSE HOMEOWNERS WHO WILL BE AFFECTED BY CONSTRUCTION 48HRS BEFORE BEGINNING WORKS.
16. CONFIRM LOCATION AND ELEVATION OF EXISTING UTILITIES AT ALL CROSSINGS AND CONNECTIONS PRIOR TO CONSTRUCTION.
17. ENSURE ALL EXISTING SERVICES STAY IN OPERATIONAL CONDITION DURING CONSTRUCTION.

GENERAL EXCAVATION, BACKFILL AND COMPACTION NOTES –
REFER TO NATIONAL MASTER CONSTRUCTION SPECIFICATION 31 23 01

1. EXCAVATE TO LINES AND LEVELS NECESSARY TO COMPLETE THE WORK. MINIMUM SIDE SLOPES EXCAVATIONS SHALL NOT EXCEED 1:1 IN SOIL AND 1:0.25 IN ROCK, UNLESS NOTED OTHERWISE GEOTECHNICAL CONSULTANT.
2. BACKFILL TO GRADES INDICATED IN LAYERS NOT TO EXCEED 300mm. ALL BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR 90% MODIFIED .

GENERAL ENVIRONMENTAL & SEDIMENT CONTROL NOTES –
REFER TO NATIONAL MASTER CONSTRUCTION SPECIFICATIONS SECTIONS:
31 32 19 GEOTEXTILE SOIL STABILIZATION
31 37 00. RIP-RAP
32 11 41 TREE PRESERVATION

USE BEST MANAGEMENT PRACTICES DURING CONSTRUCTION. ADJUST WORK ACTIVITIES DURING PERIODS OF HEAVY RAIN TO MINIMIZE SEDIMENTS ENTERING THE STORM DRAINAGE SYSTEM. SOME BMP'S TO CONSIDER:

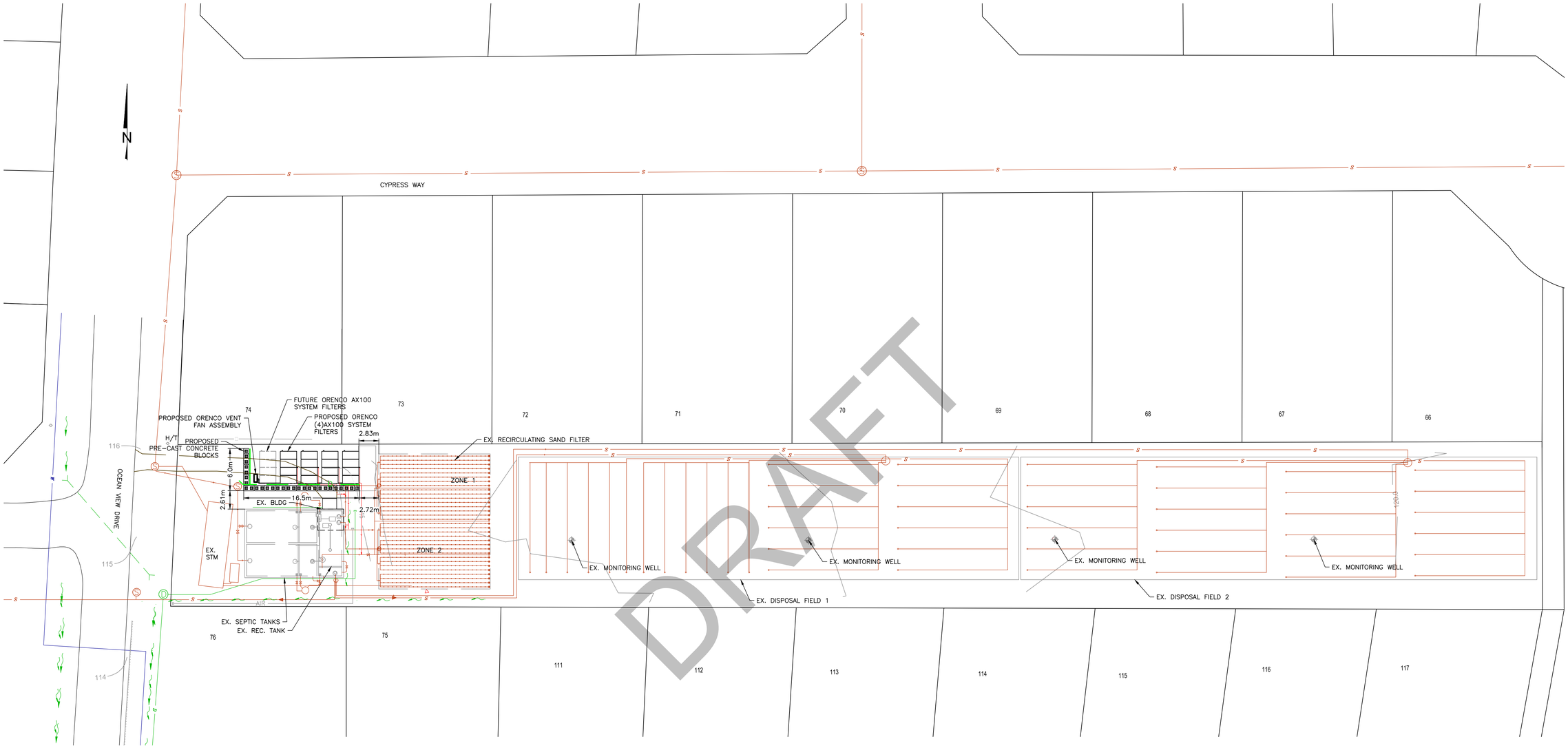
1. CHECK ALL EQUIPMENT FOR FLUID LEAKS PRIOR TO ENTERING THE WORK AREA.
2. NO EQUIPMENT RE-FUELING TO OCCUR IN THE WORK AREA UNLESS SPILL PROTECTION MEASURES ARE IN PLACE.
3. A SPILL KIT TO BE MAINTAINED ON SITE THROUGHOUT THE CONSTRUCTION PERIOD
4. SURFACE WATER IS TO BE HANDLED WITHIN THE WORK AREA AND TREATED BEFORE DISCHARGED. THIS MAY INCLUDE ONSITE DETENTION AND/OR CULVERT FILTRATION.
5. COVER EXPOSED SOILS IN INCLEMENT WEATHER ie TARP, HYDRO SEED OR ORGANIC LEAF MULCH
6. PROVIDE ROCK RIP RAP ENTRANCE FOR TRUCK TIRE WASH OUT STATION. CONTRACTOR TO HAVE ON SITE A DEDICATED SWEEPER FOR THE ROADWAY AND SHALL SWEEP AFTER ALL TRUCK MATERIAL HAUL AND OFFS TO KEEP ROADWAYS TRACKING DIRT.
7. TO PROTECT THE SOIL, WATER, AND VEGETATIVE RESOURCES OF THE DEVELOPMENT, ONLY THOSE AREAS NECESSARY TO CONSTRUCT THE WORKS AND SERVICES CONTAINED IN THE ENGINEERING DRAWINGS ARE TO BE DISTURBED.
8. PRIOR TO AND DURING CONSTRUCTION, THE CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR CONTROLLING EROSION AND SEDIMENT TRANSFER BY UTILIZING SUCH MEASURES AS CONSTRUCTION OF INTERCEPTOR DITCHES, SILT FENCES, HAY BALE STRUCTURES, SEDIMENT CONTROL PONDS, SEDIMENT TRAPS, STAGED GRAVEL FILTERS, OR OTHER METHODS HE MAY DEEM NECESSARY TO PREVENT DISCHARGE OF SEDIMENT TO WATERCOURSES.
9. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR DAMAGES RESULTING FROM IMPROPER EROSION AND SEDIMENT CONTROL MEASURES UNDERTAKEN BY THE CONTRACTOR.
10. PRIOR TO SUBSTANTIAL COMPLETION THE CONTRACTOR SHALL PREPARE AND REVIEW WITH THE OWNER A PLAN WHEREBY THE OWNER WILL UPON FINAL COMPLETION ASSUME RESPONSIBILITY FOR ONGOING EROSION AND SEDIMENT CONTROL MEASURES ON THIS SITE.

ISSUED FOR TENDER
APRIL 2021

1:3000 0 60 180m
1:30,000 0 600 1800m

SUNSHINE COAST REGIONAL DISTRICT

20-498 C00



SITE PLAN
SCALE: 1:300

ISSUED FOR TENDER
APRIL 2021

1:300 0 6 18m

SUNSHINE COAST REGIONAL DISTRICT

REVISIONS	
REVISION: 1 (ISSUED FOR APPROVAL)	2021.01.05.
REVISION: 2 (ISSUED FOR TENDER)	2021.04.22.

SUNSHINE COAST REGIONAL DISTRICT
INFRASTRUCTURE DEPARTMENT
1975 Field Road
Sechelt, BC V0N 3A1
Ph: 604-885-6800 1-800-687-5753 Fax: 604-885-7909

DESIGNED BY:		M.S.
DRAWN BY:		A.M.
CHECKED BY:		S.K.
APPROVED BY:		M.S.
SCALE	H: 1:300	V: 1:300
PLOT DATE: 2021.04.22.		

SCRD WOODCREEK WWTP FILTER RENEWAL AND UPGRADE

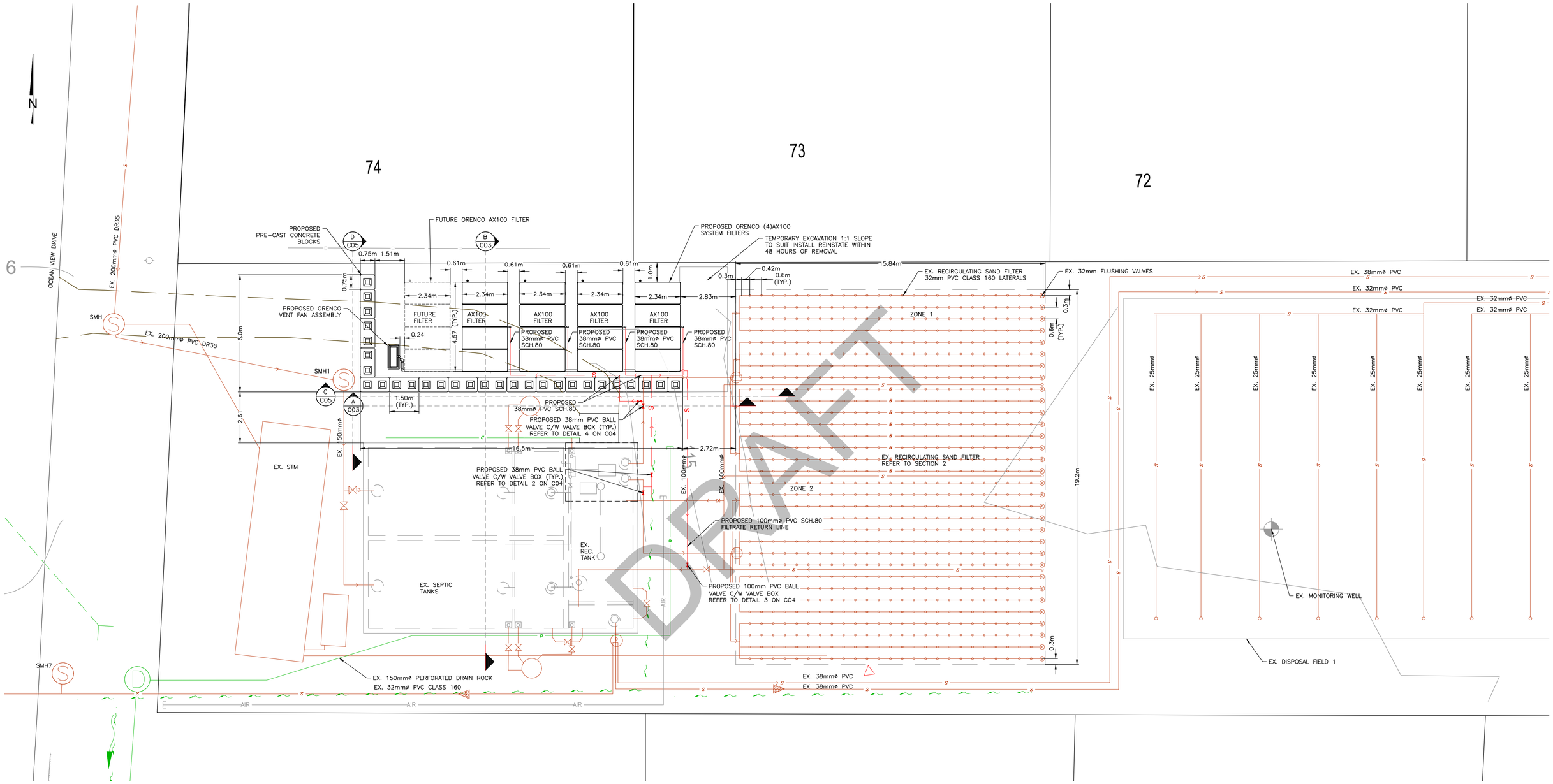
DRAWING : SITE PLAN

SEAL:

WORK ORDER NO. 1937009

DRAWING NO: 20-498 C01

SHEET NO : 2 OF 6



WWTP PLAN
SCALE: 1:100

ISSUED FOR TENDER
MARCH 2021

1:100 0 2 6m

SUNSHINE COAST REGIONAL DISTRICT

REVISIONS	
REVISION: 1 (ISSUED FOR APPROVAL)	2021.01.05.
REVISION: 2 (ISSUED FOR TENDER)	2021.03.17.

SUNSHINE COAST REGIONAL DISTRICT
INFRASTRUCTURE DEPARTMENT
1975 Field Road
Sechelt, BC V0N 3A1
Ph: 604-885-6800 1-800-687-5753 Fax: 604-885-7909

DESIGNED BY:		M.S.
DRAWN BY:		A.M.
CHECKED BY:		S.K.
APPROVED BY:		M.S.
SCALE	H: 1:100	V: 1:100
PLOT DATE:		

SCRD WOODCREEK WWTP FILTER RENEWAL AND UPGRADE

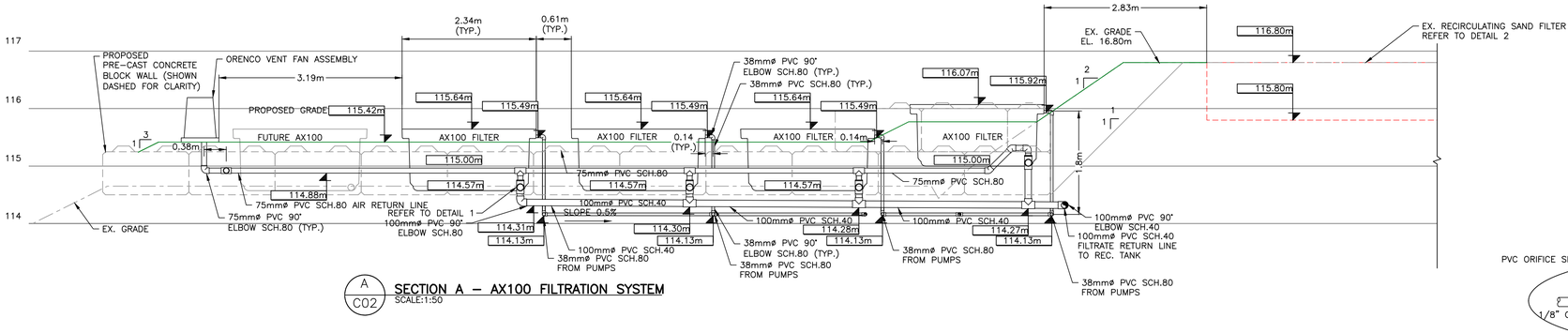
DRAWING : WWTP PLAN

SEAL:

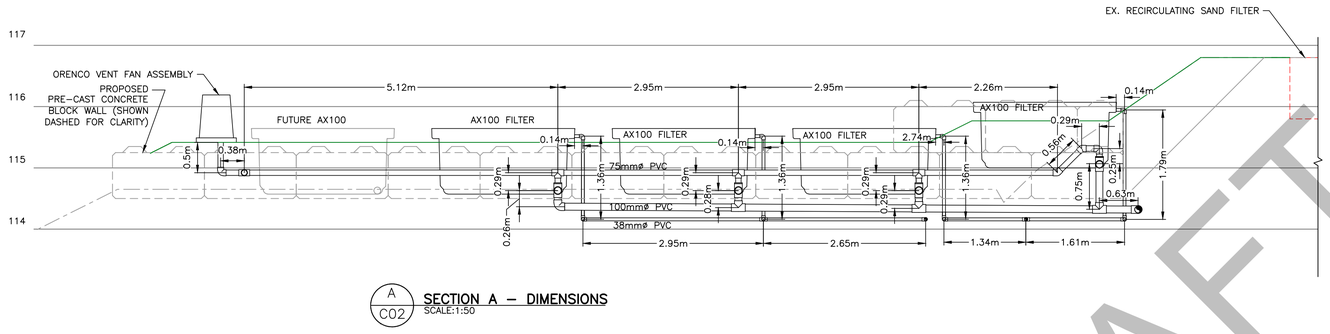
WORK ORDER NO. 1937009

DRAWING NO: 20-498 C02

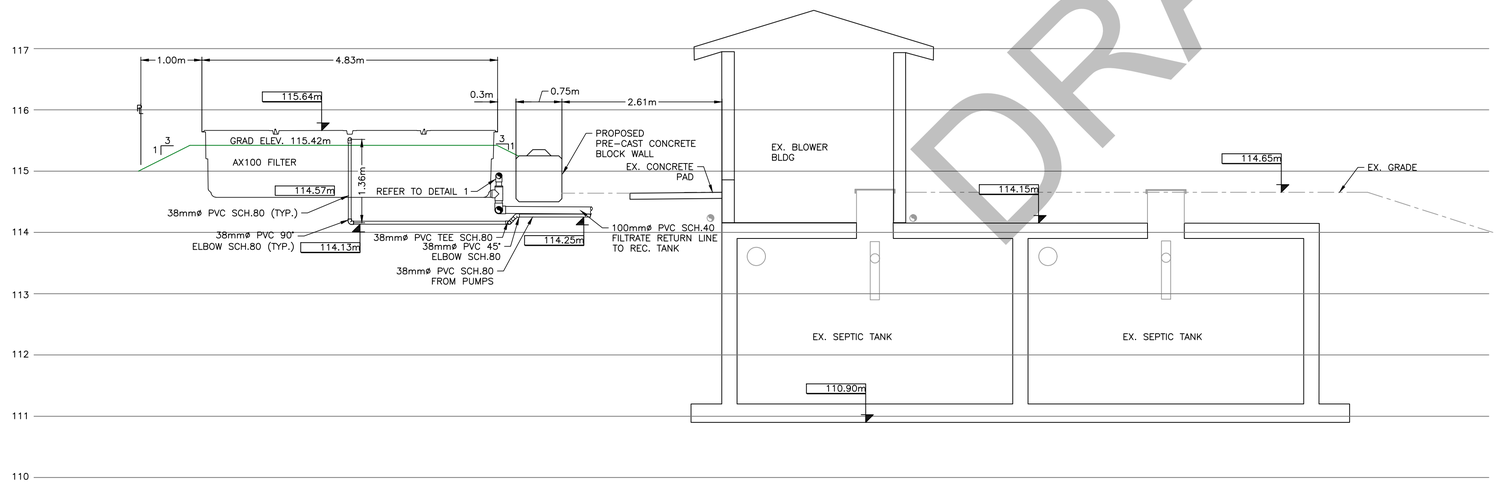
SHEET NO : 3 OF 6



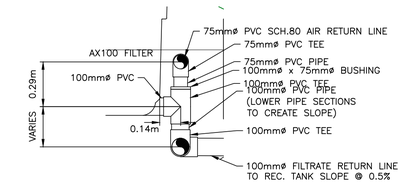
A C02 **SECTION A – AX100 FILTRATION SYSTEM**
SCALE:1:50



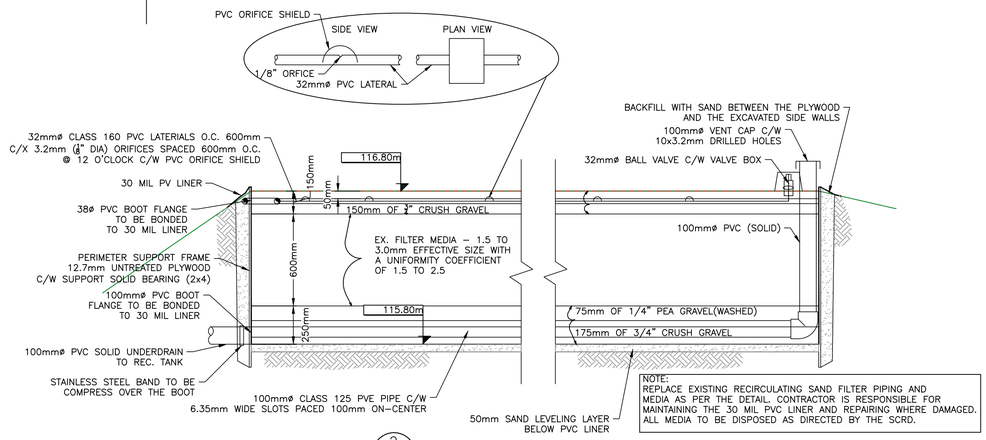
A C02 **SECTION A – DIMENSIONS**
SCALE:1:50



B C02 **SECTION B – AX100 FILTRATION SYSTEM**
SCALE:1:50

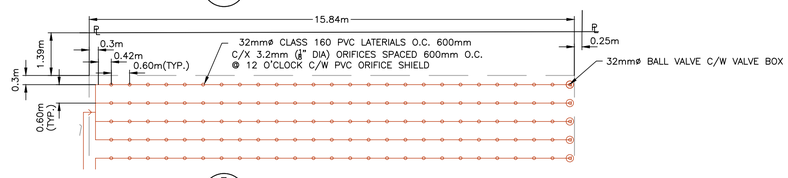


1 C02 **TYPICAL FILTRATE RETURN LINE**
SCALE:1:20

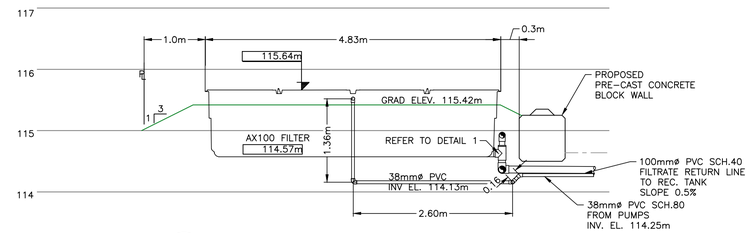


NOTE:
REPLACE EXISTING RECIRCULATING SAND FILTER PIPING AND MEDIA AS PER THE DETAIL. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE 30 MIL PVC LINER AND REPAIRING WHERE DAMAGED. ALL MEDIA TO BE DISPOSED AS DIRECTED BY THE SCRD.

2 C02 **RECIRCULATING SAND FILTER SECTION**
SCALE:1:20



3 C02 **RECIRCULATING SAND FILTER PLAN**
SCALE:1:100



B C02 **SECTION B – DIMENSIONS**
SCALE:1:50

ISSUED FOR TENDER
MARCH 2021

SUNSHINE COAST REGIONAL DISTRICT

1:50 0 1 3m
1:20 0 0.4 1.2m

REVISIONS	
REVISION: 1 (ISSUED FOR APPROVAL)	2021.01.05.
REVISION: 2 (ISSUED FOR TENDER)	2021.03.17.

SUNSHINE COAST REGIONAL DISTRICT
INFRASTRUCTURE DEPARTMENT
1975 Field Road
Sechelt, BC V0N 3A1
Ph: 604-885-6800 1-800-687-5753 Fax: 604-885-7909

DESIGNED BY:		M.S.
DRAWN BY:		A.M.
CHECKED BY:		S.K.
APPROVED BY:		M.S.
SCALE	AS SHOWN	-
PLOT DATE:		

SCRD WOODCREEK WWTP FILTER RENEWAL AND UPGRADE

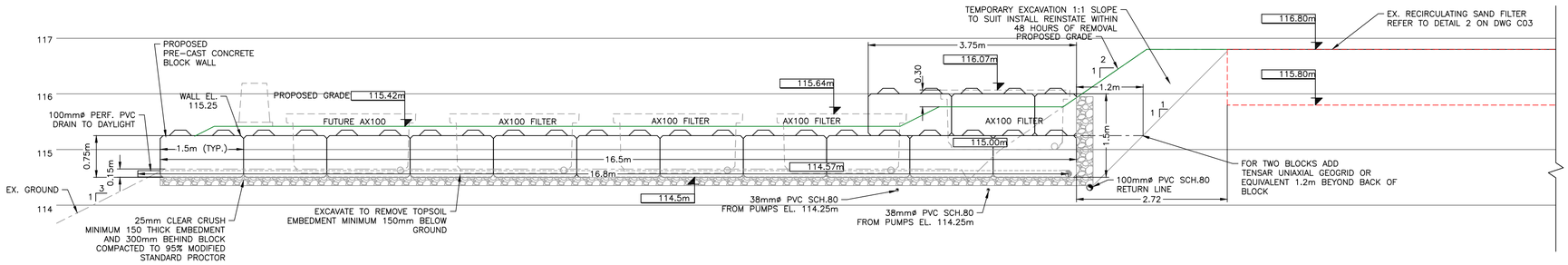
DRAWING :
FILTER AND TANK SECTIONS

SEAL:

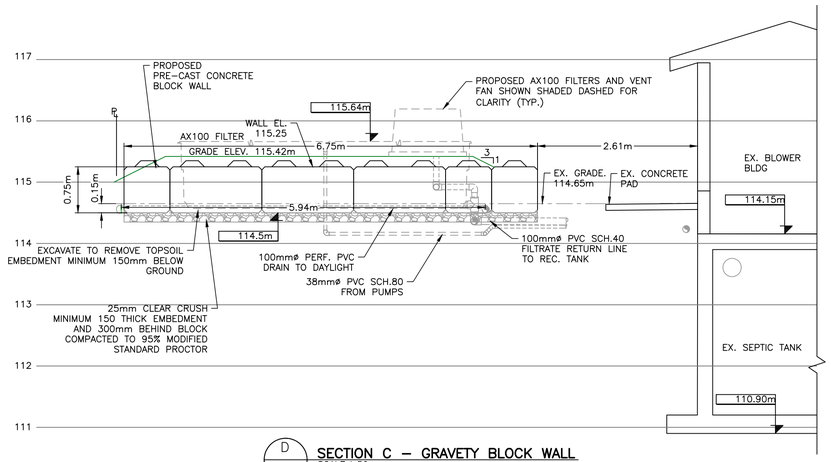
WORK ORDER NO. 1937009

DRAWING NO: 20-498 C03

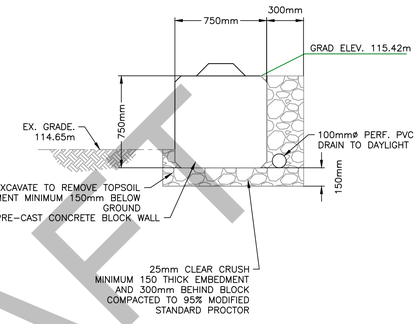
SHEET NO : 4 OF 6



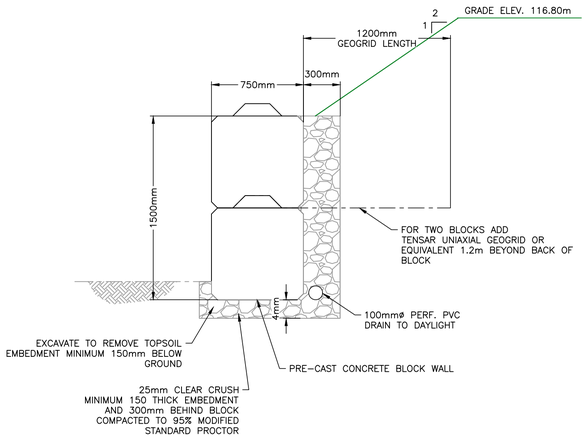
C / C02 **SECTION C – GRAVETY BLOCK WALL**
SCALE:1:50



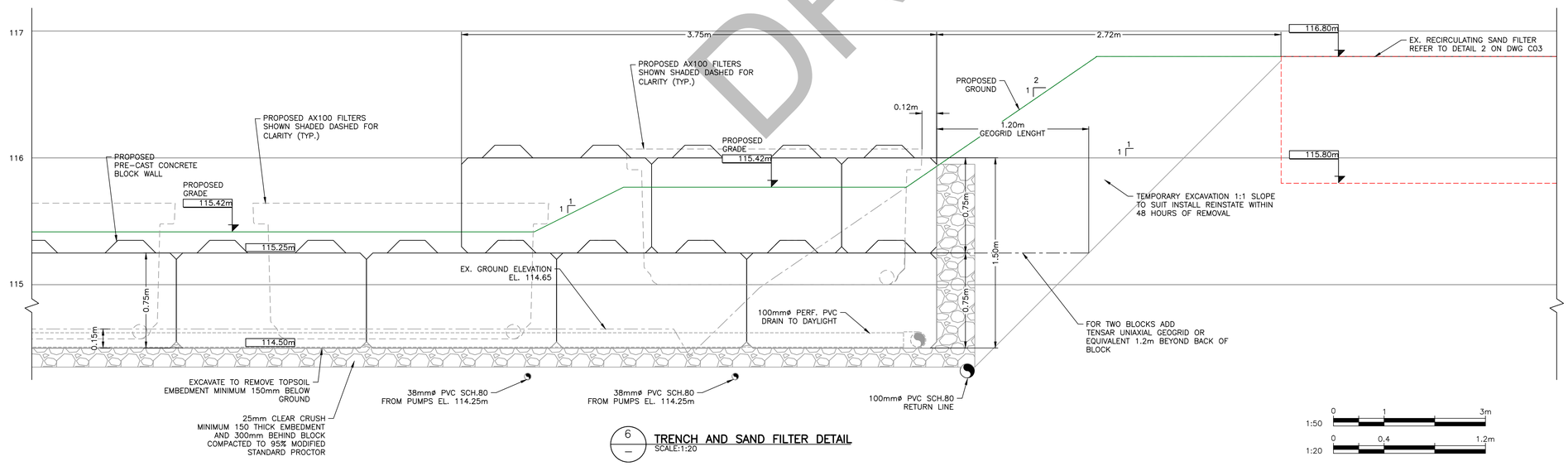
D / C02 **SECTION C – GRAVETY BLOCK WALL**
SCALE:1:50



7 / – **ONE BLOCK WALL HEIGHT**
SCALE:1:50



8 / – **TWO BLOCK WALL HEIGHT**
SCALE:1:50



6 / – **TRENCH AND SAND FILTER DETAIL**
SCALE:1:20

1:50 0 1 3m

1:20 0 0.4 1.2m

ISSUED FOR TENDER
APRIL 2021

SUNSHINE COAST REGIONAL DISTRICT

REVISIONS	
REVISION: 1 (ISSUED FOR APPROVAL)	2021.01.05.
REVISION: 2 (ISSUED FOR TENDER)	2021.04.22.

SUNSHINE COAST REGIONAL DISTRICT
INFRASTRUCTURE DEPARTMENT
1975 Field Road
Sechelt, BC V0N 3A1
Ph: 604-885-6800 1-800-687-5753 Fax: 604-885-7909

DESIGNED BY:		M.S.
DRAWN BY:		A.M.
CHECKED BY:		S.K.
APPROVED BY:		M.S.
SCALE	AS SHOWN	-
PLOT DATE: 2021.04.22.		

SCRD WOODCREEK WWTP FILTER RENEWAL AND UPGRADE

DRAWING :
GRAVITY WALL SECTIONS

SEAL:

WORK ORDER NO. 1937009

DRAWING NO: 20-498 C05

SHEET NO : 6 OF 6

12. APPENDIX D: Investing in Canada Infrastructure Program (ICIP) Grant Project Information excerpt

A.1 Project Title: Woodcreek Park Wastewater Treatment Plant System Upgrade Project No. 1R0285

A.2 The Woodcreek Park Wastewater Treatment Plant System Upgrade Project will consist of the following:

i. repair and reconfiguration to base collection system piping and manholes;
ii. remediation of service connections;
iii. improvements to equalization, recirculating tank, aeration system, and primary septic tanks;
iv. replacement of media-based recirculating filter, repairs to existing filter liner, and additional new lining;
v. installation of a new secondary treatment system;
vi. installation of a new and reconfiguring of a portion of the existing treatment plant distribution piping and headworks;
vii. demolition and removal of replaced equipment;
viii. and earthworks, mechanical, electrical, control/monitoring, roads/paths, lighting, signage; and,
ix. all related works and appurtenances.

A.3 The Commencement Date of the Project is February 9, 2022 which is the date the Project was approved.

A.4 The Completion Date of the Project shall be no later than March 31, 2026. All project works shall be completed by this date, The Project must also reach Substantial Completion before this date

13. APPENDIX E: URLs to Woodcreek Park Wastewater Collection System CCTV Inspection Records

The following are links to the Woodcreek Park wastewater collection system closed circuit television video inspection records.

1. Cypress Way MH 10 to MH 7
   https://www.youtube.com/watch?v=k4iofqIjVe4&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=95&t=0s
2. Oceanview Drive MH 7 to MH 8
   https://www.youtube.com/watch?v=813cHLI8Lf0&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=94&t=0s
3. Oceanview Drive MH 6 to MH 7
   https://www.youtube.com/watch?v=OPEFINUQ6Ng&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=93&t=0s
4. Oceanview Drive MH 7 to MH 6
   https://www.youtube.com/watch?v=UFde1nSb4Io&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=92&t=0s
5. Larchberry Way MH 2 To MH 3
   https://www.youtube.com/watch?v=W7nxw9RbZ9c&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=91&t=0s
6. Larchberry Way MH 1 to MH 2
   https://www.youtube.com/watch?v=ulDtlCrY4fI&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=82&t=0s
7. Larchberry Way MH 2 to MH 1
   https://www.youtube.com/watch?v=viRrbYTUUec&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=81&t=0s
8. Cypress Place MH 10 to MH 9
   https://www.youtube.com/watch?v=P9lOuIrzjNw&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=90&t=0s
9. Cypress Way MH 10 to MH 11
   https://www.youtube.com/watch?v=0Z1YXAJDirw&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=29&t=0s
10. Oceanview Place MH 10 to MH 9
    https://www.youtube.com/watch?v=-gFFNj_HqSU&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=28&t=0s
11. https://www.youtube.com/watch?v=Ac_g5NpM71k&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=27&t=0s
12. https://www.youtube.com/watch?v=3CVooL3t4Do&list=PL9Hlps7PhZUEb9XX52Zfdcv2Qz-tZfj0N&index=26&t=0s