COMMISSIONING

1. GENERAL

1.1 Intent

.1 Commission the various process, mechanical and electrical systems.

1.2 Submissions

- .1 The Contractor will submit to Engineer two draft copies of the Operation and Maintenance Manuals, four (4) weeks prior to Commissioning.
- .2 The Contractor shall furnish his detailed methodology and schedule for the commissioning of each system at least twenty (7) working days prior to planned start of commissioning for the process. The plan shall include the following:
 - .1 detailed schedule of events
 - 2 detailed list of attendees
 - .3 methods for introducing flow
 - .4 contingency plans in the event of a process malfunction
 - .5 drawings and sketches as required to illustrate the planned sequence of events.

1.3 Coordination

- .1 Coordinate with subcontractors to ensure their attendance as necessary to make any adjustments or to facilitate any minor repairs during commissioning.
- .2 Coordinate with the Engineer and operators of the wastewater treatment plant.

2. PRODUCTS

2.1 Equipment

.1 All equipment shall be satisfactorily installed and tested as per the requirements of Section 1670 – Systems Demonstration prior to commissioning. The electrical and the controls systems and any related services pertaining to each piece of equipment shall be completed and shall be operational.

2.2 Manpower

- .1 Supply all staff required during commissioning necessary to operate the plant processes.
- .2 Once a process has been successfully commissioned, provide supervisory staff to train and supervise the Owner's staff for a period of two full weeks, while still being responsible for the operation of the plant until takeover.

COMMISSIONING

.3 Be responsible for ensuring that maintenance staff are operating and maintaining systems in a proper manner and keeping schedules up-to-date.

2.3 Systems

In general, the systems which must be commissioned include, but are not limited to:

- .1 All wastewater pumping systems
- .2 Plant service water system
- .3 Heating and ventilation system
- .4 Process and plant control system
- .5 Standby Generator
- .6 Motor control centres
- .7 Monitors and alarms.

3. EXECUTION

3.1 Preparation

- .1 Each item of equipment included in the system to be commissioned shall be satisfactorily tested.
- .2 Piping systems shall be finished and tested.
- .3 Electrical connections shall be complete and inspected to the satisfaction of the governing authorities.
- .4 Control systems shall be fully operational.
- .5 The plant architectural finishes, painting, heating and ventilation, etc. shall be substantially complete.
- .6 The attendance of equipment manufacturer's representatives, as required during commissioning, shall be arranged.

3.2 Sequence

.1 The process systems shall be commissioned from upstream to downstream.

COMMISSIONING

3.3 Commissioning

- .1 Raw wastewater will be introduced in a manner which precludes the damage of any equipment or structures.
- .2 For a period of 24 hours, twice during commissioning, each process system shall be subjected to flows and loads as close to design conditions as possible. Where necessary to achieve this, augment flows from other sources or operate a part of the system at any time to exaggerate the naturally occurring flows and loads.
- .3 Operate all systems in automatic and manual-local modes as applicable.
- .4 Ensure all bypasses and backup provisions function satisfactorily.
- .5 Induce all minor and major alarm conditions. Ensure the controls react as designed, the application alarms are annunciated, and the plant dialing system functions.

3.4 Testing

- .1 Acquire all samples as directed by the Engineer to provide a basis for process evaluation.
- .2 Arrange and be responsible for the transportation to a qualified laboratory of all the samples to be tested at an outside facility.
- .3 Cooperate with the Engineer in undertaking all analysis of samples to be tested at the plant.

3.5 Acceptance

- .1 The commissioning of a continuously operating mechanical or electrical system shall be considered acceptable when the system has operated in a stable manner, satisfying the specified basic design criteria for a period of five (5) consecutive days.
- .2 Where system operated intermittently, commissioning shall be considered acceptable when the system has been operated in a stable manner, satisfying the specified basic design criteria, as often as required during a period of fourteen (14) consecutive days but in no case less than four (4) times.
- .3 When a system has been commissioned satisfactorily, Form 103, shall be endorsed by the Contractor, the Engineer, and the manufacturer's representatives for the items of equipment included in the system.

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COMMISSIONING

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) 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 Engineer)	Date
(Authorized Signing Representative of the Owner)	Data
(Additionized Signing Representative of the Owner)	Date
END OF SE	CTION

TAKE-OVER PROCEDURES

1. GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of the Work.

1.2 Related Sections

- .2 Section 01670 Systems Demonstrations.
- .3 Section 01735 Commissioning.

1.3 Inspection And Declaration Procedures

- .1 Contractor's Inspection prior to commissioning the facility: Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required to conform to Contract Documents. Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made. Provide fourteen (14) days advance notice when requesting an Substantial Inspection.
- .2 Substantial Completion: submit a written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents,
 - .2 Defects have been corrected and deficiencies have been completed,
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational,
 - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies etc. have been submitted,
 - .5 Operation of systems have been demonstrated to Owner's personnel, and
 - .6 Work is complete and ready for Substantial Inspection.
- .3 Substantial Inspection: Engineer and Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .4 Final Inspection: when defects or deficiencies are completed, request a final inspection of the Work by Owner, Engineer and Contractor. If Work is deemed incomplete by the Owner and the Engineer, complete outstanding items and request a reinspection.

1.4 Reinspection

.1 Should status of the Work require reinspection by Consultant due to failure of Work to comply with Contractor's claims for inspection, Owner will deduct amount of Consultant's compensation for reinspection services from payment to Contractor. This applies to both Substantial and/or Commissioning.

TAKE-OVER PROCEDURES

- 2. PRODUCTS NOT USED
- 3. EXECUTION NOT USED



TABLE OF CONTENTS

DIVISION 2 – SITE WORK

Section No.	Description
02056	Fill Materials
02305	Earthwork General Requirements
02311	Site Grading
02317	Building and Structure Excavating
02318	Building and Structure Backfilling
02362	Steel Pipe Piles
02821	Chain Link Fences and Gates

FILL MATERIALS

1. GENERAL

1.1 Intent

- .1 Read this Section in conjunction with:
 - .1 Earthwork General Requirements: Section 02305
 - .2 Building & Structure Excavating: Section 02317
 - .3 Building & Structure Backfilling: Section 02318
- .2 This Section is intended to be used as a reference Section; it is not a "section of work". All materials specified in Part 2, Products, may not necessarily be required.
- .3 Refer to other Sections for location, use, and placement of fill materials specified herein.

1.2 Reference Documents

.1 Specified sieve sizes are based on the nominal sieve opening sizes, in millimetres, under the Canadian Metric Sieve Series, as contained in Table 1 of CAN/CGSB-8.2-M88.

1.3 Source of Supply - Native Excavated Material

- .1 For bidding purposes, assume that where Native Excavated Material is specified to be used, only native material required to be excavated under this Contract may be used.
- .2 For bidding purposes, assume that where Native Excavated Material is specified to be used, sufficient quantities of such material, meeting specified requirements and acceptable to Engineer, will be available for use.
- .3 Notify Engineer if sufficient quantities of Native Excavated Material, meeting specified requirements and acceptable to Engineer, are not available for use where such material is specified to be used. Provide imported fill materials in lieu of Native Excavated Material, if and as directed by Engineer.
- .4 Provision of imported fill materials where Native Excavated Material is specified to be used, will, if directed by Engineer, be considered a change in the Work and will be valued in accordance with the General Conditions of Contract.

2. PRODUCTS

2.1 Aggregate Quality, Generally

.1 Aggregate fill materials shall be comprised of clean, sound, hard particles, and be free from silt, clay, soft shale, flaky particles, organic matter and foreign substances.

FILL MATERIALS

2.2 Gravel Fill Material

.1 Gravel: mixture of natural gravel, crushed gravel or crushed stone, and natural or crushed sand, meeting the gradation limits specified below for each type.

Fill Type	Sieve Size	% Passing By Weight
80 mm Gravel	80	100
	50	78 - 95
	20	42 - 82
	10	31 - 70
	5	22 - 60
	2	15 - 47
	0.4	9 - 28
	0.16	5 - 16
	0.063	2 - 9

2.3 Crushed Gravel Fill Material

- .1 Crushed Gravel: mixture of crushed gravel or stone and natural or crushed sand, meeting the gradation limits specified below for each type and meeting following requirements:
 - .1 Liquid limit of material passing 0.4 mm sieve shall not exceed 25%.
 - .2 Plasticity index of material passing 0.4 mm sieve shall not exceed 6%.
 - .3 Minimum of 50%, by weight, of material retained on 5 mm sieve shall have at least one face resulting from fracture.

Fill Type	Sieve Size	% Passing By Weight
20 mm Crushed Gravel	20	100
	10	64 - 86
	5	42 - 69
	2	24 - 45
	0.8	17 - 37
	0.4	10 - 29
	0.16	5 - 20
	0.063	2 - 8

2.4 Sand Fill Material

.1 Sand: natural or crushed sand, meeting the gradation limits specified below for each type.

FILL MATERIALS

Fill Type	Sieve Size	% Passing By Weigh
Coarse Sand	5	100
	2	80 - 90
	0.4	40 - 55
	0.063	2 - 10

2.5 Earth Fill Material

- .1 Native Excavated Material: Clean, native excavated soil, free from organic matter, frozen materials, stones larger than 75 mm, building debris and other foreign substances.
- .2 Imported Clay: inorganic fine grained soil, free from organic matter, stones larger than 50 mm, building debris, and other foreign substances.

3. EXECUTION

3.1 Placement

.1 Refer to other Sections for location, use, and placement of fill materials specified herein.

1. GENERAL

1.1 Intent

.1 This Section specifies general requirements common to all earthwork. Read this Section in conjunction with related Sections which specify requirements for specific types of earthwork.

1.2 Related Sections

.1 Changes in Sub-Surface Conditions:

General Conditions of Contract.

.2 . Subsurface Soils Information:

Division 0.

.3 Fill Materials:

Section 02056.

1.3 Definitions

.1 Earthwork: Earthwork means excavating of all types, backfilling, filling, compacting, grading and related work.

1.4 Classification of Excavation

- .1 The following classifications of excavation will be made when solid rock, rock in ledges, rock-hard cementitious aggregate deposits, large boulders or other similar obstructions are encountered:
 - Earth Excavation.
 - .2 Rock Excavation in Trenches and Pits.
 - .3 Rock Excavation in Open Excavations.
- .2 "Earth Excavation" includes:
 - .1 Removal and disposal of obstructions, the extent of which is visible on ground surface.
 - .2 Removal and disposal of underground structures and utilities, the extent of which is indicated, reflected or referred to in the Contract Documents.
 - .3 Removal and disposal of earth and other materials encountered, of any classification, except rock as defined below.
- .3 "Rock Excavation in Trenches and Pits" includes:
 - .1 Removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with a Caterpillar Model No. 215C LC equipped with a short stick and a 1070 mm wide rock bucket, or equivalent modern, track-mounted power

- excavator, rated at not less than 86 kW flywheel power and 142 kN drawbar pull, without prior drilling or blasting.
- .2 Trenches in excess of 3 m in width and pits in excess of 9 m in either length or width will be classified as open excavation.
- .4 . "Rock Excavation in Trenches and Pits" includes:
 - .1 Removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with a Caterpillar Model No. 973 or equivalent modern, track-mounted, heavy-duty, excavating equipment rated at not less than 157 kW flywheel power and 183 kN breakout force (with rock bucket) without prior drilling, blasting or ripping.
- .5 Intermittent drilling, blasting or ripping performed to increase production and not necessary to perform the Work, will be classified as earth excavation.

1.5 Basis of Excavation

- .1 For bidding purposes, assume that all excavation work will be "Earth Excavation".
- .2 Rock encountered within areas requiring excavation and classified by Engineer as "Rock Excavation in Trenches or Pits" or "Rock Excavation in Open Excavations", will be considered a change in the Work and valued in accordance with the General Conditions of Contract.

1.6 Unauthorized Excavation

- .1 Unauthorized excavation shall be any excavation beyond elevations and dimensions indicated, without specific direction by Engineer.
- .2 Fill unauthorized excavation to elevations and dimensions indicated, as directed by Engineer.
- .3 Unauthorized excavation and remedial work shall be at Contractor's expense.

1.7 Excavation Levels

- .1 For bidding purposes, assume that excavation levels will be as indicated on Drawings.
- .2 Notify Engineer if unsuitable bearing materials are encountered at indicated elevations. Carry excavation deeper and replace excavated material with suitable materials if and as directed by Engineer.
- .3 Notify Engineer if bearing conditions are fulfilled at elevations above those indicated. Adjust excavation elevations if and as directed by Engineer.
- .4 Adjustments in levels, if directed by the Engineer, will be considered a change in the Work and will be valued in accordance with the General Conditions of Contract.

2. PRODUCTS

2.1 Fill Materials

.1 Refer to Section 02056 for fill material product specifications.

3. EXECUTION

3.1 Preparation

- .1 Notify Engineer minimum 2 days prior to beginning excavating operations.
- .2 Prior to commencing excavation:
 - .1 Contact all affected utility companies regarding exact location and current status of all utilities, voltage of underground and overhead power lines and pressure of natural gas lines.
 - .2 Notify Engineer if any utility lines have been omitted from or incorrectly indicated on Drawings.
 - .3 Identify known underground utilities. Stake and flag locations. Identify and flag surface and aerial utilities.
 - .4 Notify specific utility companies to remove and/or relocate utility lines where noted on drawings.
- .3 Expose building connections, service connections, utilities to be crossed to confirm horizontal and vertical alignment of existing utilities.
- .4 Expose existing utility lines by hand excavation to confirm location before machine digging within 600 mm of lines.
- Maintain and protect existing above and below grade utilities which pass through work area. Protect active utility lines exposed by excavation, from damage. Hand excavate to final elevations and dimensions.
- .6 Where existing pipes, ducts or other underground services intersect a trench, support trench in a manner approved by Utility.
- .7 Where existing overhead line poles are adjacent to excavations, temporarily support poles in a manner approved by Utility.

3.2 Shoring and Bracing

- .1 If required to provide safe working conditions and to prevent cave-ins and loose soil from falling into excavations, protect excavations by shoring, bracing, sheet piling, underpinning, or other suitable methods.
- .2 Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases or cuts.

3.3 Dewatering

- .1 Maintain excavations free of water. Provide pumps, piping, temporary drains, trenches, sumps, and related equipment to remove water.
- .2 Do not use sanitary sewers or private property for discharge of water.

3.4 Excavating

- .1 Strip topsoil from areas to be excavated or filled.
- .2 Do not excavate under wet conditions or when such conditions are anticipated.
- .3 When excavating is necessary through roots of plant materials, which are to remain, perform work by hand and cut roots with a sharp axe.

3.5 Material Storage

- 1 Excavated topsoil, acceptable and required for use under this Contract: Stockpile on site until required.
- .2 Native excavated material, other than topsoil, acceptable and required for use as fill material under this Contract: Stockpile on site until required.
- .3 Stockpile locations shall be subject to Engineer's approval.

3.6 Disposal of Excess and Waste Material

- .1 Excavated topsoil, acceptable but in excess of that required for use under this Contract: Remove from site. Excess topsoil removed from site shall become Contractor's property.
- .2 Native excavated material, other than topsoil, acceptable but in excess of that required for use as fill material under this Contract: Remove from site.
- .3 Unacceptable excavated topsoil, unacceptable native excavated material, waste material, trash and debris: Remove from site and ensure proper disposal.

3.7 Backfilling

.1 Ensure areas to be backfilled are free of debris, snow, ice, water and that surfaces are not frozen. Do not backfill over porous, wet, or spongy subgrade surfaces.

.2 Backfill systematically, as early as possible, to allow maximum time for natural settlement.

3.8 Compaction

- .1 Compact fill materials using only mechanical methods. Do not use hydraulic methods.
- .2 Do not perform compaction using vehicles and other equipment not designed for compacting.
- .3 Maintain optimum moisture content of materials being compacted, as required to attain specified compaction density.

SITE GRADING

1. GENERAL

1.1 References

.1 ASTM D 698-00, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).

1.2 Existing Conditions

.1 Known underground and surface utility lines and buried objects are as indicated on site plan. Contractor to verify locations of all utilities prior to commencing work.

1.3 Protection

- .1 Protect natural features, buildings, surface or underground utility lines which are to remain as directed by Engineer. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of mud on roads.

2. PRODUCTS

2.1 Materials

- .1 Fill material:
 - .1 20 mm granular crush to be approved by Engineer prior to hauling to site.
 - .2 Excavated or graded material existing on site to be used as fill for grading work if suitable and approved by Engineer.

3. EXECUTION

3.1 Grading

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grades to be below finish grades as indicated.
 - .1 150 mm for graveled areas.
- .3 Slope grade away from building 2% minimum.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm and recompact to 95% to ASTM D698. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

SITE GRADING

- .5 Compact filled and distributed areas to corrected maximum dry density to ASTM D698, as follows:
 - .1 95% under gravel areas and structures
- .6 Finished grade: provide driving surface with 150 mm of 20 mm crush around circumference of lift station with 2% slope away from building and 4:1 side slopes off driving surface as indicated.
- .7 Grade ditches to depth as indicated.

3.2 Testing

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Engineer. Costs of test will be paid by Owner.

3.3 Surplus Material

.1 Stockpile surplus material on and/or off site as directed by Engineer.

BUILDING AND STRUCTURE EXCAVATING

1. GENERAL

1.1 Intent

- .1 Read this Section in conjunction with:
 - .1 Earthwork General Requirements:

Section 02305.

1.2 Section Includes

.1 This Section includes requirements for excavating for buildings and structures inside perimeter of each building or structure, and within a nominal distance outside perimeter of each building or structure, as required for foundation and other substructure construction.

2. PRODUCTS

Not used.

3. EXECUTION

3.1 Excavation

- .1 Excavate to elevations and dimensions indicated on Drawings within a tolerance of plus or minus 50 mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for inspection.
- .2 In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- .3 Protect bottom of excavations and soil around and beneath footings from frost.

BUILDING AND STRUCTURE BACKFILLING

1. GENERAL

1.1 Intent

.1 Read this Section in conjunction with:

.1 Fill Materials: Section 02056.

.2 .Earthwork General Requirements: Section 02305.

1.2 Section Includes

.1 This Section includes requirements for:

1 Backfilling, filling, and compaction inside perimeter of each building or structure and outside perimeter of each building or structure, adjacent to foundations.

2. PRODUCTS

2.1 Materials

Refer to Section 02056 for fill material product specifications.

3. EXECUTION

3.1 Placement and Compaction of Fill Materials

- Backfill excavations and fill to required subgrade elevations using fill materials specified in Backfilling and Filling Schedule.
- .2 Place fill materials in layers not exceeding loose thickness specified in Backfilling and Filling Schedule.
- .3 Compact each layer of fill to the minimum percentages of Standard Proctor Density specified in Backfilling and Filling Schedule.
- .4 Ensure that adequate permanent or temporary horizontal bracing is in place prior to backfilling against walls.
- .5 Take care to prevent damage to or displacement of waterproofing, insulation, weeping tile installation, pipe, conduit and other work.

BUILDING AND STRUCTURE BACKFILLING

3.2 Granular Base Construction Under Slabs

.1 Where slab is to be directly underlain by a sheet moisture/vapour barrier, provide a uniform top dressing of coarse sand, applied and compacted to produce a smooth surface to receive sheet and slab.

3.3 Backfilling and Filling Schedule

Location	Fill Material	Max. Lift Thickness	Minimum Compaction
Under interior	Earth Fill or	150 mm	95%
slabs-on-grade	Sand Fill	150 mm	95%
Under exterior slabs-on-grade	20 mm Crushed Gravel	150 mm	98%
Against exterior side of foundations and under paved areas	20 mm Crushed Gravel 80 mm Gravel	150 mm	98%
Against exterior side of foundations and under landscaped areas	Earth Fill Sand Fill	150 mm	95%

BUILDING AND STRUCTURE EXCAVATING

1. GENERAL

1.1 Intent

- .1 Read this Section in conjunction with:
 - .1 Earthwork General Requirements:

Section 02305.

1.2 Section Includes

.1 This Section includes requirements for excavating for buildings and structures inside perimeter of each building or structure, and within a nominal distance outside perimeter of each building or structure, as required for foundation and other substructure construction.

2. PRODUCTS

Not used.

3. EXECUTION

3.1 Excavation

- .1 Excavate to elevations and dimensions indicated on Drawings within a tolerance of plus or minus 50 mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for inspection.
- .2 In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- .3 Protect bottom of excavations and soil around and beneath footings from frost.