TECHNICAL SPECIFICATIONS

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PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

.1 Develop a written Site-specific health and safety plan prior to commencing any on-Site work and continue to implement, maintain, and enforce the plan until final demobilization from Site. The development, implementation, and maintenance of the Site-specific health and safety plan is Contractor's sole responsibility. Contractor's Site-specific health and safety plan, as a minimum, shall address the specifications contained herein.

.2 The Contractor will be provided a copy of the *Contractor Safety Guidelines Booklet* as prepared by the Contract Administrator. The information contained within this *Booklet* is to be followed while performing works onsite. It is the Contractor's responsibility to review the *Booklet* before commencing work. The Contractor is to provide this information to all employees including subcontractors and trades personnel. The Contractor's employees and subcontractors are also expected to follow the site specific Health and Safety Plan, the Contractors' Company Health and Safety Program and Procedures and all rules, standards, regulations, acts and codes that apply to the Work being performed.

.3 Should Contractor seek relief from or substitution for any portion or provision of the minimum health and safety guidelines specified herein or the reviewed Site-specific health and safety plan, such relief or substitution shall be requested of Contract Administrator in writing, and if accepted by Contract Administrator, will be authorized in writing.

.4 Responsibility: Contractor will be responsible for the safety of persons and property on Site and for the protection of persons off Site and the environment to the extent that they may be affected by the conduct of Works. Comply with and enforce compliance by Contractor employees and the employees of subcontractors, agents, and invitees, with safety requirements of Contract documents, applicable federal, provincial, and local statutes, regulations, and ordinances, and with Contractor's Site-specific health and safety plan. Contractor acknowledges that safety and environment protection obligations are of paramount importance regarding all of the Work to be performed under Contract documents. Any fines resulting from Contractor employees and the employees of subcontractors, agents, and invitees non-compliance to Workplace Safety and Health Acts (WSHA) and Regulations are the responsibility of the Contractor.

.5 Hazard communication requirements: Comply with the Workplace Safety and Health Act and WHMIS 2015. Before the Work starts, the Contractor shall provide a list of those products controlled under WHMIS which are expected to be used during the Contract. Related material safety data sheets (MSDS) shall accompany the submittal. Notify the Contract Administrator in writing of changes to the list and provide the relevant MSDS.

.6 Work stoppage: Contractor shall give precedence to the safety and health of the public and on-Site personnel and the protection of the environment over cost and schedule considerations for all project Work. The Health and Safety Officer shall be responsible for decisions regarding when Work will be stopped or started for health or safety consideration and shall have the authority to stop or start the Work for health or safety considerations. Contractor shall assign the responsibility and obligation to the Health and Safety Officer to stop or start the Work when, in the Health and Safety Officer's discretion, it is necessary or advisable for reasons of health or safety. Contract Administrator shall have the right to stop Work for health and safety considerations.

.7 Unforeseen hazards: Should any unforeseen or Site-specific safety-related factor, hazard, or condition become evident during the performance of Works at Site, bring such to the attention of Contract Administrator verbally and in writing as quickly as possible, for resolution. In the interim, take prudent action to establish and maintain safe working conditions and to safeguard Contractor employees and employees of subcontractors, agents and invitees, the public, the City of Winnipeg, Contract Administrator, and the environment.

1.2 WORKPLACE SAFETY AND HEALTH ACT

.1 It is the Contractor's responsibility under the provisions the Workplace Safety and Health Act (WSHA), Standards and Regulations to coordinate the activities of all employees and workers under the Contractor's control operating within the Contract limits to ensure that the requirements of the WSHA are satisfied.

.2 Submit proof that:

.1 All employees of Contractor and subcontractors have received training in occupational safety in accordance with the requirements of the WSHA.

.2 Contractor shall name a representative whom he/she shall designate as having responsibility for supervising the implementation of the Contract, and who is qualified as a "competent" person as defined in the WSHA.

1.3 SITE CHARACTERIZATION

.1 Work at Site will involve contact with municipal solid waste and associated contaminants including but not limited to landfill leachate, landfill gas, and landfill gas condensate.

.2 Landfill gas:

.1 Landfill gas will be present during excavations and on the surface of the landfill, in the soil adjacent to the landfill, in the piping and leachate collection system and in confined spaces.

.2 Landfill gas results from the decomposition of refuse and is primarily composed of 40 to 65 percent methane, and 30 to 50 percent carbon dioxide, < 2 percent nitrogen, < 1 percent oxygen, and trace gases including mercaptans, hydrocarbons, solvents, water vapour, and hydrogen sulfide.

.3 Methane is explosive in concentrations between 5 and 15 percent by volume in air. Methane, carbon dioxide, and nitrogen are simple asphyxiants.

.4 Trace gases in landfill gas may be toxic and odorous. Odorous gases cause nausea in some persons. Toxic gases may also be present at concentrations above or below the levels deemed safe for human exposure; there is always a potential for levels to be sufficient to cause permanent and irreversible damage and even death.

.5 All contractor employees performing Work at site must have hydrogen sulfide training.

.3 Asbestos:

.1 Asbestos filled bags can typically be identified by a bright yellow colouring and a written warning that describes the contents of the bag to be asbestos. However, colour and text may vary and caution should be used when handling any material that is brightly coloured or marked with text.

.2 The Contractor should ensure that all employees have an understanding of the health risks associated with breathing in asbestos fibres. As with any construction project, employees should be competent, have required training and use general common sense to ensure the protection of workers and the environment.

.3 In addition to all other applicable regulations or documents related to construction, all workers onsite should review the most recent publications of:

.1 Workplace Safety and Health Regulation, Part 37 – Asbestos.

.2 Workplace Safety and Health Division's Guidelines for Working With Asbestos.

Where applicable, these regulations must be followed to ensure the safety of workers and the environment.

.4 Refuse stability: Refuse must be considered prone to instability that may cause slope or sidewall failure due to the high void ratio, irregularity of material composing the refuse, and a typically lesser degree of compaction than soil.

1.4 SUBMITTALS FOR REVIEW

.1 Contractor's Site-specific health and safety plan:

.1 Within 5 days after receipt of the letter of intent and prior to mobilization to Site, submit a Site-specific health and safety plan. As a minimum, address aspects of worker protection and measures designed to prevent migration of hazardous or contaminated material to the environment, including but not limited to the provisions and guidelines contained herein, and the following specific topics:

.1 Worker training including Site-specific training and refresher sessions.

.2 A detailed description of the wash down area for decontamination of vehicles and equipment and the methods to be used to collect, store,

treat, and ultimately dispose of wash down decontamination waters and sediments.

.3 Confined space entry program and procedures if Contractor expects confined space work to be performed. The confined space entry program and procedures shall contain:

.1 Duties of workers

.2 Coordination documents (as required)

.3 Onsite rescue procedures, rescue equipment and methods of communication

.4 Personal protective equipment, clothing and devices

.5 Isolation of energy (lockout tagout) and control of materials movement

.6 Attendant, entrant and entry supervisor responsibilities

.7 Ingress and egress: Maintain a safe means of ingress and egress in place at all times when personnel are occupying a confined space.

.8 Atmospheric testing/air monitoring: Continuous air monitoring with an Oxygen/Combustible Gas/H_2S meter. Oxygen content must be above 19.5 percent and below 23 percent before entry will be allowed. Personnel must leave the confined space if the concentration of explosive gases exceeds 10 percent of the lower explosive limit (LEL). If hot work is to be conducted in the space, then explosive gasses cannot exceed 0 percent (LEL). Personnel must leave the confined space if the concentration of hydrogen sulphide approaches 10 ppm.

.9 Procedures for working in the presence of explosive or flammable substances

.10 Ventilation and purging

.11 Entry permit: Do not allow Site personnel to enter confined space without a written confined space work permit. Maintain properly completed permits readily available at Site.

.12 Worker training.

.4 Hot work program and procedures if Contractor expects hot work to be performed. Works including, but not limited to electrofusing, welding, and metal grinding will only be permitted under well-ventilated conditions and only with written approval of Contract Administrator.

.5 Personal hygiene and personnel decontamination procedures.

.6 Personal protective equipment types to be used including, but not limited to: gloves, hardhat, safety vest, safety boots, safety glasses, respirators. The following are the minimum PPE required for each level of protection as applicable:

.1 Level C:

.1 Individually assigned half- or full- face piece air-purifying respirations (NIOSH approved), with appropriate cartridges for organic vapours and particulates. Respirators shall be available at all times and donned when required as indicated by air monitoring.

.2 Chemical- resistant disposable coveralls (tyvek).

.3 Latex and/ or cotton inner gloves.

.4 Nitrile outer gloves.

.5 Work boots with steel toe and shank.

.6 Chemical- resistant over boots or booties.

.7 Hard hat.

.8 Safety glasses with side shields and/ or chemical-resistant goggles.

.2 Modified Level C:

.1 Chemical- Resistant disposable coveralls (tyvek).

.2 Latex and/ or cotton inner gloves.

.3 Nitrile outer gloves.

.4 Work boots with steel toe and shank.

.5 Chemical- resistant over boots or booties.

.6 Hard hat.

.7 Safety glasses with side shields and/ or chemical-resistant goggles.

.3 Level D:

.1 Hard hats.

.2 Safety glasses with side shields or goggles.

.3 Long pants and long-sleeve shirt.

.4 Safety boots.

.5 Safety vest.

.6 Any personal protective equipment necessary for specialized tasks (for example, welding goggles).

.7 Respirator protection program and procedures. Provide on-Site personnel engaged in activities on or directly adjacent to the landfill, with extensive training in the usage and limitations of, and qualitative fit test for, half- and full- face piece respirators as required.

.8 Air monitoring program and procedures. Establish action levels and levels of protection for each work area based on planned activity, location of activity, and air monitoring results. Monitor potential exposures to landfill gas with an intrinsically safe, multi-gas (O_2, CH_4/LEL, CO, and H_2S) continuous sampling air monitor and record results. Additionally, personal air monitors may be required if Site conditions warrant. Provide sufficient number of each instrument to

monitor the active work location and to provide back-up equipment in cases of equipment malfunctions.

Action Levels:

NON-CONFINED SPACE READING, GENERAL AREA

.1 Combustible Gases - The readings are generally given as a percentage of the lower explosion limit (percent LEL) and are collected in the general work area. An atmospheric oxygen level of less than 19.5 percent may affect the reading from a combustible gas meter and give lower than actual levels. Test oxygen content first.

Instrument Reading	Action to be Taken
1-10% LEL	Continue working and monitoring atmosphere for combustible gases. Inform personnel working in the area whenever reading >5% LEL.
11-20%	Continue working with caution. Inform personnel working in area of readings. Be prepared to cease operations.
>20% LEL	Cease operation and move to a safe place. Re-evaluate work plan. Engineering controls such as forced ventilation and use of non- sparking tools are to be implemented if operations are to continue. DO NOT CONTINUE WORKING UNTIL CONDITIONS ARE CONSISTENTLY BELOW 20% LEL.

.2 Oxygen

Instrument Reading	Action to be Taken
<19.5% or >23%	Cease operations and move to safe area. Re-evaluate work plan. Engineering controls such as forced ventilation are to be implemented if operations continue. DO NOT CONTINUE WORKING UNTIL OXYGEN LEVELS ARE BETWEEN 19.5 AND 23%. When oxygen levels are outside this range, combustible gas meter readings are not reliable. Supplied air or SCBA respiratory protection may be necessary.

.3 Hydrogen Sulfide (H_2S) - Whenever readings approach 10 ppm on a direct reading H_2S meter, cease work immediately, move to a safe area and contact the Health and Safety Officer. H_2S has a TWAEV level of 10 ppm. Supplied air or SCBA respiratory protection may be necessary.

Record daily air monitoring activities in a log book and maintain the log book onsite at all times. The following are to be recorded: site location/date, description of operation, temperature, wind speed/direction, chemicals/materials/equipment in use, engineering/ administrative controls in effect, PPE in use, sampling observations/comments and complaints.

.9 Lockout / Tagout.

.10 Emergency and first-aid equipment and supply. Provide person trained in first aid on Site at all times that work activities are in progress.

.11 Dust and particulate emission control.

.12 Monitoring and mitigation of worker heat and cold stress.

.13 On-Site and off-Site Contingency and Emergency Response Plans including procedures for injuries or illnesses, hazardous exposures, spills/accidental release, fire, and evacuations. The Contract Administrator and the Health and Safety Officer must be notified in all cases immediately.

.14 Illness/injury reporting and investigation procedures.

.15 Site Communication procedures.

.2 Contract Administrator will review Contractor's Site-specific health and safety plan and provide comments to Contractor within 7 days after receipt of the plan. Revise the plan as appropriate and resubmit the plan to Contract Administrator within 3 days after receipt of comments from Contract Administrator.

.2 Within 7 days after receipt of letter of intent and prior to mobilization to Site, Contractor will be required to submit the following to Contract Administrator:

.1 A copy of the Worker's Compensation Board (WCB) clearance documents (or equivalent) must be submitted as required.

.2 A copy of the Contractor's Health and Safety Program for review.

.3 A copy of the Contractor's General Liability Proof of Insurance.

.4 Proof of trade qualifications and training of Contractor's employees (i.e. crane, confined space, lockout/tagout, WHMIS, forklift, etc) as appropriate.

.5 WHMIS safety data sheets (SDS).

1.5 HEALTH AND SAFETY OFFICER

.1 Employ and assign to Works a representative whom shall be designated as having responsibility for supervising the implementation of the Contract and who is

qualified as a "competent" person as defined in the Workplace Safety and Health Act and Regulations. This competent and authorized representative herein will be referred to as Health and Safety Officer. Health and Safety Officer shall be on Site during the execution of Work and report directly to Superintendent.

.2 Health and safety officer responsibilities:

.1 Have a working knowledge of the Workplace Safety and Health Act and Regulations.

.2 Have working experience specific to the activities associated with municipal solid waste landfills including landfill gas.

.3 Have formal education and/ or training in occupational safety and health.

.4 Be responsible for completing health and safety training sessions and ensuring that personnel not successfully completing the required training are not permitted to enter the Site.

.5 Be responsible for the pre-construction indoctrination of onsite personnel with regard to the Site-specific health and safety plan and other safety requirements to be observed during performance of Works, including:

.1 Alerting appropriate onsite and/ or offsite emergency services and Contract Administrator before starting any particularly hazardous work

.2 Personal protective equipment and respiratory protection, including fit testing

.3 Personal hygiene principles

.4 Emergency procedures for dealing with fire and medical situations

.6 Be responsible for implementing and daily enforcing and monitoring the Site-specific health and safety plan.

.7 Have the authority and obligation to stop all, or any part of Works if, in his/her sole discretion, stoppage of Works is necessary or advisable for considerations of health or safety.

.8 Assist Contract Administrator in contacting and advising local authorities of Works to be performed.

1.6 PERSONNEL HEALTH, SAFETY AND HYGIENE

.1 Implement a hazard communication ("Right-to-Know") program in accordance with the WSHA and WHMIS Regulation.

.2 The City of Winnipeg may have a safety orientation program which must be attended by Contractor's personnel before they start Work onsite.

.3 All Contractors and sub-contractors shall ensure that their employees are trained in and familiar with the WSHA and applicable regulations to their trade(s) as applicable to the service to be provided.

.4 All Contractors and sub-contractors are required to participate in weekly Site health and safety meetings as requested by the Contract Administrator.

.5 Issue a written notice of violation to onsite personnel found to be disregarding the provisions of the Site-specific health and safety plan or the Project Specifications. The notice may be issued by the City of Winnipeg, Contract Administrator, the Health and Safety Officer, or any supervisory personnel of Contractor. Give a copy of the notice to the offending worker, to his/her immediate supervisor, to Contractor's Superintendent, and to Contract Administrator. Upon issuance of a second written notice of such violation, terminate the worker from employment at Site. Failure of Contractor's supervisory personnel to implement this warning/ termination provision shall be deemed a material breach of the Contract.

.6 Smoking is prohibited on site.

.7 Eating and drinking are prohibited except in designated lunch/break area.

1.7 SITE HEALTH AND SAFETY

.1 Work areas: Take necessary precautions to avoid hazardous conditions on Site. Open flame, matches, smoking, welding or other activity potentially capable of generating an explosion will not be allowed in any area associated with landfill gases.

.2 Hot work: Permits are required for welding, grinding, fusing and are issued by the Contract Administrator.

.3 Signs and symbols:

.1 Provide signs and symbols informing personnel of the danger of combustible gases. Signs such as:

.1 Danger – Keep Away- Explosive Gases.

.2 Danger – No open Flame or Matches.

.3 Danger – No Smoking.

.4 Temporary fencing: Erect temporary fencing with warning signs to delineate work areas and to control access to excavations in accordance with the Site-specific health and safety plan.

.5 Confined space entry: Do not allow Site personnel to enter confined space without a written confined space work permit and the required training. Maintain properly completed permits readily available at Site.

END OF SECTION 01 35 29

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PART 1 GENERAL

1.1 DESCRIPTION

.1 Requirements for the restoration of areas disturbed during the installation of landfill gas collection piping and associated landfill gas collection system infrastructure.

1.2 RELATED SECTIONS

.1 Section 31 23 00 – Excavation, Backfilling and Compacting.

.2 Section 33 52 16 – HDPE Wellfield Piping: Installation of landfill gas piping below the final cover.

1.3 REFERENCES AND CODES

.1 CW3540 – Topsoil.

.2 CW3520 – Seeding.

.3 MSCS 1298 – Supply and Place Erosion Control Blanket.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Stockpile material on Site in approved locations designated by Contract Administrator, and as specified in Section 31 23 00 – Excavation, Backfilling and Compacting.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Suspend operations whenever climatic conditions, as determined by Contract Administrator, are unsatisfactory for placing material to the requirements of this Section.

.2 After occurrence of heavy rains, do not operate equipment on previously placed material or on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.

.3 Do not place fill in a frozen state or against frozen excavations or previously placed material. Do not place fill on snow, ice, water, or other objectionable material or on improperly prepared excavations or previously placed material.

.4 Where excavations or previously placed material have been softened or eroded, remove soft and yielding material or otherwise objectionable or damage areas and replace with compacted fill as specified.

1.6 SEQUENCING AND SCHEDULING

.1 Sequence delivery of materials to Site in a manner to minimize stockpiling and obtain approval from Contract Administrator to stockpile.

.2 Schedule completion of piping and repair of final cover in waste prior to conducting works outside of waste footprint.

PART 2 PRODUCTS

2.1 CLAY

.1 Existing clay excavated to be stockpiled and reused. Clay is to be clean and free of refuse/litter.

.2 Additional clay may be available from on-site source as directed by the Contract Administrator.

2.2 TOPSOIL

.1 Existing topsoil to be stockpiled and reused.

.2 Additional growth media may be available from on-site source as directed by the Contract Administrator.

2.3 SEED AND MULCH AND EROSION BLANKET

.1 Seed: native ditch mix consisting of the following:

- .1 Creeping Red Fescue Festuca rubra: 20%
- .2 Smooth Brome Bromus inermis Leyess: 10%
- .3 Meadow Fescue Festuca pratensis: 10%
- .4 Slender Wheat Grass Elymus trachycaulus: 15%
- .5 Tall Wheat Grass Thinopyrum ponticum: 15%
- .6 Alfalfa (creeping variety) Medicago media: 15%
- .7 Alsike Clover Trifolium hybridum: 10%
- .8 Birdsfoot Trefoil Lotus corniculatus: 5%

.2 Water is <u>not</u> available from on-site hydrants for hydro-seeder.

.3 Mulch to be Type C (Cellulose Pulp).

.4 Application rate to be 1 kg per 100 sq. metres.

.5 Place Type ‘S’ erosion control blanket as per Manufacturer’s specification on restored and seeded areas as directed by the Contract Administrator. Straw fiber is to be a minimum 0.27 kg per sq. metre. Blanket to be type S75 as manufactured by North American Green or an approved equivalent.

PART 3 EXECUTION

3.1 GENERAL

.1 Restore all areas disturbed during the installation of landfill gas collection piping, associated landfill gas collection infrastructure to pre-construction conditions or better.

3.2 FINISH GRADING

.1 Restore all other locations affected by the Works of this Contract to pre-construction conditions.

3.3 TOPSOIL PREPARATION

.1 All surface areas designated for reseeding shall have a fine graded uniform surface free of humps and hollows.

.2 Apply a minimum of 50 mm of topsoil to all surface areas designated for reseeding.

PART 4 MEASUREMENT AND PAYMENT

4.1 WELLFIELD RESTORATION

.1 Schedule of Prices Item No. 3

.2 Measurement: Lump sum.

.3 Payment: Includes supply of materials and labour for restoration of the landfill gas collection system wellfield area to pre-construction conditions.

END OF SECTION 31 22 19

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PART 1 GENERAL

1.1 DESCRIPTION

.1 Requirements for excavation, backfilling and compacting during the installation of landfill gas collection piping and associated landfill gas collection system infrastructure.

1.2 RELATED SECTIONS

.1 Section 33 52 16 – HDPE Wellfield Piping

1.3 REFERENCES AND CODES

.1 CW2030 – Excavation, Bedding and Backfill.

.2 CW2160 – Concrete Underground Structures and Works.

.3 CW3110 – Sub-Grade, Sub-Base and Base Course Construction.

.4 CW3170 – Earthwork and Grading.

1.4 SUBMITTALS

.1 Certificates: Provide all necessary certificates prior to use of sheeting, shoring, trench boxes, or other facilities used for earth support.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Follow health and safety plan at all times.

.2 Protect open excavations against damage due to surface runoff and run-on. Take necessary precautions to prevent erosion of excavated or disturbed surfaces.

.3 Suspend operation whenever climatic conditions, as determined by Contract Administrator, are unsatisfactory for placing fill to the requirements of this Section.

.4 After occurrences of heavy rains, do not operate equipment on approved excavations until the material has dried sufficiently to prevent occurrence of excessive rutting.

.5 Where excavations have been softened or eroded, remove soft and yielding material or otherwise objectionable or damaged areas and replace with fill as specified by Contract Administrator.

.6 Clean equipment involved in excavation activities, which may have come into contact with refuse before being removed from the Site or being relocated to clean areas offsite.

.7 Do not obstruct flow of surface drainage or natural watercourses.

1.6 SEQUENCING AND SCHEDULING

.1 Sequence and schedule excavation activities with Work of other Sections.

.2 Do not commence excavation operations until the site-specific health and safety plan has been reviewed by Contract Administrator and implemented.

.3 Coordinate interruptions of utility services to existing facilities, which become necessary either directly or indirectly due to Work required under this Contract through Contract Administrator. Down time for service disruptions may be limited as to duration and time (weekend, nights, or holidays). Perform Works during the period designated.

.4 Coordinate and sequence excavation operations to minimize the need for temporary stockpiling excavated materials until required for back filling. Make every effort to balance cut and fill operations and to ensure that any excavated material designated for backfill is immediately placed as backfill in Works. Keep the time during which excavations remain open to the practicable minimum.

.5 Do not allow or cause any of Work performed to be covered up or enclosed prior to required inspections, tests, or approvals.

.6 The Contractor is to minimize amount of open trench on the landfill so as to minimize odours.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Sand Fill: Conform to CW2030.

.2 Unshrinkable Fill: Conform to Cement – Stabilized Fill in CW2160 with a maximum compressive strength at 28 days of 1.5 MPa.

2.2 ACCESSORIES

.1 Selected by Contractors for the purpose intended and subject to Contract Administrator's approval prior to use.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that survey benchmarks and intended elevations for Works are as indicated.

.2 Do not allow or cause any of the Work performed or installed to be covered up or enclosed by Work of this Section prior to required inspections, measurements, tests, or approvals.

.3 Obtain approval from Contract Administrator for completed excavations and previously placed material prior to placement of successive lifts.

.4 Obtain approval from Contract Administrator prior to placing fill against structures or around exposed buried utilities.

.5 Ensure areas to be backfilled are free from debris snow, ice, water, or frozen ground.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum locations.

.2 Locate, identify, and protect utilities that remain from damage. Confirm locations of buried utilities and structures by careful test excavations or other suitable means.

.3 Protect plant life, lawns, and other features remaining as a portion of final landscaping.

.4 Protect benchmarks, survey control points, existing structures, fences, paving and curbs from excavating equipment and vehicular traffic.

.5 Maintain and protect from damage wells, utilities, and structures encountered. In the event of disturbance of or damage to any utility or structure immediately notify Contract Administrator. Repair or replace any utility or structure damaged by Contractor operations.

.6 Protect existing buildings and surface features, which may be affected while Work is in progress.

.7 Protect existing building and structures where temporary unbalanced earth pressures are liable to develop on walls or other structures utilizing bracing, shoring, or other approved methods to counteract unbalance.

.8 Protect monitoring wells and any other structures and pipelines from any uplift and displacement or disturbance during excavation operations.

.9 Employ procedures for excavation and trenching such that disturbance of existing infrastructure, utilities, structures, and their foundations are avoided.

.10 Protect excavations and trenches from contamination.

.11 Obtain direction form Contract Administrator before moving or otherwise disturbing utilities or structures.

.12 Remove surface features or obstructions including, but not necessarily limited to, trees, shrubs, bush, and other vegetation from surfaces to be excavated, as required to construct the finished Work. Dispose of such obstructions to an on-Site disposal area as directed by Contract Administrator.

.13 Compact sub grade to density requirements for subsequent backfill materials.

.14 Cut out soft areas of sub grade not capable of compaction in place. Backfill with approved native fill and compact to density equal to or greater than requirements for subsequent fill material.

.15 Remove debris, snow, ice, water, or frozen ground from areas to be backfilled.

.16 Proof roll sub grade surface to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

.17 Decontaminate equipment, which has been used in refuse prior to being used for back filling operations.

3.3 TRENCHING FOR BURIED PIPING

.1 Excavate soil required for piping.

.2 Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Works.

.3 Do not interfere with 45- degree bearing splay of foundations.

.4 The banks of trenches shall be as nearly vertical as allowable and in accordance with the current Federal, Provincial and local safety legislation and requirements.

.5 In no case during performance of Works shall trenching advance ahead of the active installation more than necessary to facilitate proper placement.

.6 Accurately excavate and grade the bottom of trenches to provide uniform bearing and support for each section of the pipe on full thickness of approved bedding material at every point along its entire length.

.7 Remove lumped soil and boulders.

.8 Hand trim, make firm, and remove loose material, refuse and debris from trenches. Where natural or fill material at bottom of excavation is disturbed, compact disturbed soil to density at least equal to undisturbed soil or to the density specified for the succeeding layer of backfill, whichever is greater, or remove disturbed soil and refill the space as directed by Contract Administrator.

.9 Do not disturb soil within the 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. Seal cuts with approved tree wound dressing.

.10 Open trenches shall be Contractor's sole responsibility.

.11 Stockpile excavated material in area designated on Site.

3.4 BACKFILLING

.1 Granular materials: Place and compact materials in equal continuous layers not exceeding 200 mm (8 inches) uncompacted depth.

.2 Soil Native: Place and compact material in equal continuous layers not exceeding 200 mm (8 inches) compacted depth.

.3 Employ a placement method that does not disturb or damage other Work.

.4 Maintain optimum moisture content of backfill materials, other than refuse, required to attain specified compaction density of 95% Standard Proctor Density over, under and around all piping.

.5 Make gradual grade changes. Blend slope into level areas.

.6 Use fill types as specified. Completely use select native fill approved for backfilling before using imported fill.

.7 Do not use backfill material which is determined unsuitable by Contract Administrator.

.8 Backfill around exposed utilities by placing layers simultaneously on all sides to equalize loading. Do not dump directly against monitoring wells, utilities, or foundations.

.9 Do not operate heavy compaction equipment closer than 1 metre to foundations, underground utilities, or monitoring wells.

.10 Backfill around installations as follows:

.1 Place bedding and surround material as specified in the Section.

.2 Place layers simultaneously, on both sides of installed Work to equalize loading and minimize movement.

.3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, place material under, around, and over installations until 1.6 metres of cover is provided. Do not dump material directly on installations.

.11 Except as specified otherwise, place backfill continuously and in uniform layers not exceeding specified compacted thickness up to grades shown on Drawings.

.12 Compact each layer to the specified density before placing succeeding layers as specified in Article 3.5.

.13 When backfilling non-refuse material, it shall be free of refuse and litter.

3.5 COMPACTION

.1 Apply potable water as necessary during compaction to obtain the specified density. If the material to be compacted is excessively moist, aerate with suitable equipment and methods until the moisture content is corrected. In areas not accessible to rolling equipment, compact material to specified density with mechanical tampers approved by Contract Administrator.

.2 When granular material is wetted by sprinkling, after being spread on material in place, sprinkling shall be done by method approved by Contract Administrator. Do not direct jets of water at fill with such force that finer materials will be washed out.

.3 Compaction Equipment: The type, size, and efficiency of compaction equipment shall be capable of achieving specified degree of compaction. When operating equipment adjacent to and immediately above structures, exercise care so as not to cause damage or displacement of the structure.

3.6 EXCESS MATERIALS

.1 Dispose of surplus material onsite as directed by the Contract Administrator.

.2 Dispose of excavated refuse onsite in area as directed by the Contract Administrator.

3.7 FIELD QUALITY CONTROL

.1 Section 01 45 00 - Quality Control: Field inspection and testing.

.2 Testing by Contract Administrator:

.1 Contract Administrator may select samples of uncompacted fill intended for Works and samples of compacted fill in Works.

.2 Contract Administrator may perform tests in the field and in the laboratory on samples of backfill and imported fill to determine if materials meet specification. Testing of imported fill will include analysis for the presence of contaminates, grain size analysis, moisture content determination, bulk wet density, maximum dry density, and permeability. Testing for backfill will include moisture content determination, maximum dry density, and bulk wet density. Copies of test reports will be supplied to Contractor on request.

.3 Testing by Contract Administrator will in no way relieve Contractor of his responsibility to test all material prior to notifying Contract Administrator of the materials' suitability for the Work involved.

.3 Methods of Testing: Testing will be performed in accordance with CW2030.

.4 Failure to Meet Specified Requirements: If tests indicate that material specifications have not been achieved or cannot be obtained with equipment in use, the procedure being followed, or the material being incorporated, remove and replace Work and modify operations so that the equipment, procedures, and materials will produce the

required results. Additional testing required by Contract Administrator will be Contractor's account.

3.8 ADJUSTING

.1 Finish compacted soil surfaces to within 25 mm of grades shown on Drawings but not uniformly high or low. Correct surface irregularities by loosening and adding or removing material until the surface is within specified grade.

.2 Leave Work areas in a properly graded condition sloped as required to permit proper drainage and free of depressions that will pond or collect water or debris that will restrict flow.

3.9 CLEANING

.1 Clean and reinstate Work areas affected by equipment outside area specified to be excavated, to specified restoration condition.

.2 Upon completion of backfilling, remove excess material and debris from Work areas and travel routes.

3.10 TEMPORARY STOCKPILING

.1 Obtain Contract Administrator's approval for locations of temporary stockpiles. Obtain Contract Administrator's approval prior to placing material in such stockpiles.

.2 Construct stockpile sites so that they are level, well drained, free of foreign materials, and of adequate bearing capacity to support the weight of the materials to be placed thereon.

.3 Provide and maintain access to stockpiles.

.4 Separate differing materials with substantial dividers or stockpile apart to prevent mixing.

.5 Prevent intermixing of soil types or contamination or segregation.

.6 Direct surface water away from stockpile site to prevent corrosion or deterioration of materials.

.7 Maintain temporary stockpile slopes not steeper than 1.5 horizontal to 1 vertical. In no instance shall stockpiles be greater than 3 metres in height above original surrounding grade. Place hay bales or other soil erosion and sediment control fencing at the base of and around each temporary stockpile to contain soil that may be washed off the stockpile.

.8 Maintain area surrounding stockpiles in neat and tidy condition.

3.11 PROTECTION OF FINISHED WORK

.1 Reshape and recompact fills subjected to vehicular traffic.

PART 4 MEASUREMENT AND PAYMENT

4.1 EXCAVATION, BACKFILLING, AND COMPACTING

.1 No separate payment will be made.

.2 Payment: Included in other Payment Items.

END OF SECTION 31 23 00

TABLE OF CONTENTS

PART 1 GENERAL

1.1 DESCRIPTION

.1 Product and installation requirements for landfill gas collection piping in the wellfield.

1.2 RELATED SECTIONS

.1 Section 31 23 00 – Excavation, Backfilling and Compacting.

.2 Section 31 22 19 – Finish Grading.

1.3 REFERENCES AND CODES

.1 ASTM D3350 – Polyethylene (PE) plastics pipe and fittings materials.

.2 ASTM F714 – Polyethylene (PE) Plastic pipe (SDR-PR) based on outside diameter.

.3 ASTM D3035 – Polyethylene (PE) plastic pipe (DR-PR) based on controlled outside diameter.

.4 ASTM D2837 – Standard test method for obtaining hydrostatic design basis for thermoplastic pipe materials.

.5 ASTM D2513 – Standard Specification for Polyethylene Gas Pressure Pipe, Tubing, and Fittings.

.6 ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.

.7 ASTM F2619 – Standard Specification for High-Density Polyethylene Line Pipe.

.8 CSA B137.4 – Polyethylene Piping Systems for Gas Services.

.9 CSA Z662 – Oil and Gas pipeline Systems.

.10 CW2030 – Excavation, Bedding and Backfill.

.11 CW3110 – Sub-Grade, Sub-Base and Base Course Construction.

.12 CW3170 – Earthwork and Grading

1.4 SUBMITTALS

.1 Product Data: Piping, fittings, warning tape, and tracer wire.

.2 Manufacturer's Certificate: Quality control certificates pertaining to each lot of pipe produced.

.3 Manufacturer's Instructions: Indicate special procedures required to install products specified.

1.5 QUALITY ASSURANCE

.1 All high density polyethylene pipe will conform to the following requirements:

.1 Meet ASTM F2619 or have the same compound standards specified in CSA B137.4, Clause 4.1.1, for negative landfill gas pressure, compressed air, and condensate applications.

.2 Raw material will contain a minimum 2 percent carbon black, well dispersed by recompounding to protect the pipe from degradation by ultraviolet light.

.3 Pipe will not contain any recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material supplier.

.4 Pipe sizes will conform to ASTM F714. Pipe sizes are stated in metric units; however, equivalent IPS pipe sizes must be used to avoid fitting problems with valves and existing pipe.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle pipe in accordance with applicable requirements of the specified references, the manufacturer's instructions and as specified herein.

.2 Use every precaution to prevent damage to the pipe. Do not permit metal tools or heavy objects to unnecessarily come in contact with the pipe.

1.7 LAYOUT SURVEY

.1 Responsibility for Layout of the Work: Contractor shall be solely responsible for complete, timely and accurate layout of the Work including, but not necessarily limited to, horizontal and vertical control and dimensional coordination as necessary to construct the Work.

.2 Engineer will provide Contractor with a .csv or AutoCAD file for layout purposes.

.3 Prior to construction, the contractor shall layout and survey the proposed piping alignment. Ground surface survey shots shall be taken every 10m along the alignment, at all pipe connections, and at all high/low points of the pipe.

.4 Each survey point shall include: a point number, northing, easting, elevation and a description.

.5 Where there is a clear and distinct change in surface grade or slope, or where there are surface features that are acutely different from the surrounding area, additional survey shots should be taken at a higher density. The final survey data should be sufficient in detail to allow the Engineer to accurately profile the ground or waste profile with all unique features represented.

.1 Features may include ditches, roadways, changes in waste slope, valleys and mounds, stockpiles and all other surface features that, if not incorporated into the survey, will result in a surface profile that is not fully representative of conditions.

.2 5m offset shots shall also be taken on both sides of every alignment shot.

.6 The contractor shall provide the Engineer with a digital copy of the survey data in .csv or AutoCAD format. Based on the results of the survey data, the Engineer reserves the right to adjust pipe alignment and grades prior to preparing Issued for Construction drawings.

.7 Engineer will prepare Issued for Construction drawings within five business days of receipt of the layout survey provided by Contractor.

1.8 AS-BUILT SURVEY

.1 The contractor shall survey the as-built conditions of the Work.

.2 Each survey point shall include: a point number, northing, easting, elevation and a description. Descriptions shall be chosen in a manner that makes it clear and apparent what the survey point represents by anyone reviewing the data:

.1 Where survey point is of buried pipe, include reference to pipe diameter.

.2 Survey points along pipe alignment shall be top of pipe.

.3 Where survey point is of a design feature, utilize unique and consistent identifiers from drawing set in the description.

.3 As-built pipe survey shall include the following points, at a minimum:

.1 Every 10 metres;

.2 Any change in pipe slope;

.3 Any change in pipe slope;

.4 Any change in pipe diameter; and

.5 Any pre-fabricated pipe fittings (tees, wyes, sweeps, reducers, etc.).

PART 2 PRODUCTS

2.1 HDPE LANDFILL GAS, COMPRESSED AIR, AND CONDENSATE FORCEMAIN

.1 Landfill Gas Pipeline, Headers, Laterals and Sub-Laterals: HDPE SDR 17; size as shown on the drawings.

.2 Compressed Air piping: HDPE SDR 11; size as shown on the drawings.

.3 Forcemain piping: HDPE SDR 11; size as shown on the drawings.

.4 Piping Specifications: Chevron Performance Pipe Driscoplex 1000, 4000 or approved equal/equivalent in accordance with B7 *(substitutes clause)*

.5 Accessories:

.1 Fittings: Fabricated sweeps shall be used where shown on the drawings. Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, and other configurations required. Equivalent or greater pressure rating as pipe when installed.

.2 Joints: Thermal butt-fusion, except where connecting to valves, flanged connections at valves.

.3 Flanges: ASTM A536-84 ductile iron backing flanges with Class 150 ANSI B 16.5 standard drilling and corrosion resistant coatings. Complete with one-piece molded polyethylene stub ends. Connections to have same or greater pressure rating as pipe.

.4 Gaskets: Neoprene.

.5 Buried flanges: Where necessary to bury flanged connection, wrap flange in Denso LT tape over Denso Mastic.

.6 Electrofusion couplings: Friatec or approved equal/equivalent in accordance with B7 *(substitutes clause)*.

2.2 BEDDING AND COVER

.1 Bedding for landfill gas headers, laterals and sub-laterals, compressed air and condensate forcemain headers, laterals and sub-laterals: Imported sand unless indicated otherwise on the drawings.

.2 Cover: Final cover as specified in Section 31 22 19 – Finish Grading for pipes on landfill.

.3 Pipe bedding at road crossings should be unshrinkable fill and extend 2.0 meters past the road edges unless otherwise indicated on the drawings.

2.3 UNDERGROUND WARNING TAPE

.1 Description: 100 mm wide plastic tape, coloured yellow with suitable warning legend describing buried gas line.

2.4 TRACER WIRE

.1 A.W.G. No.10 gauge, insulated, solid copper wire, suitable for buried service.

.2 Minimum roll length: 300 m.

.3 Connections: Direct bury wire nuts for 10 gauge wire, wrap tightly with rubber, self fusing splicing tape, covered by vinyl tape to prevent corrosion.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verify that excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on the drawings.

3.2 PREPARATION

.1 Hand trim excavations to required elevations. Correct over-excavation with Granular A.

.2 Remove large stones or other hard matter, which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

.1 Excavate pipe trench in accordance with Section 31 23 00 – Excavation, Backfilling and Compaction for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Place bedding material at trench bottom, level materials in continuous layer not exceeding 150 mm compacted depth.

.3 Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 HDPE PIPE

.1 Prevent debris and water from entering inside of pipe.

.2 Do not bend in a radius smaller than recommended by manufacturer when staged on Site or installed in the trench.

.3 The joining of HDPE pipe and fittings shall be performed in accordance with CSA Z662.

.4 Thermal fusion will be performed in an area near the installation location to avoid excessive transportation and possible damage to the pipe.

.5 Prior to initiating thermal fusion in the field on any pipe on a given day, Contractor will provide a test weld and operating data to Contract Administrator including welding temperature, machine number, date of last service and clearance certificate.

.6 Install pipe, fittings, and accessories in accordance with ASTM D2321-00 and manufacturer’s instructions.

.7 Place pipe on minimum 100 mm deep bed of sand on landfill.

.8 Lay pipe to slope gradients noted on the drawings with maximum variation from true slope of 5 mm in 3 m. Maintain positive drainage for condensate on all pipe sections.

.9 Contract Administrator reserves right to modify design pipe alignments and profiles as deemed necessary.

.10 Install aggregate at sides and over top of pipe installation. Provide top cover to minimum compacted thickness of 300 mm, compact to 95 percent standard proctor density.

.11 Refer to Section 31 23 00 for trenching requirements. Do not displace or damage pipe when compacting.

.12 Install tracer wire continuous along top of pipe. Coordinate with Section 31 23 00 – Excavation, Backfilling and Compaction.

.13 Seal (cap) end of all landfill gas pipelines at the end of the working day or when work on a length of pipe is not scheduled to continue.

.14 Coordinate all thermal fusion joints to existing piping with the Contract Administrator to minimize excessive air intrusion into the existing landfill gas extraction system.

.15 The Contractor is to ensure that thermal fusion is conducted in a safe manner and explosive levels of landfill gas do not exist in the pipe to be joined using thermal fusion.

.16 For areas where minimum cover cannot be maintained, install insulation over HDPE pipe.

.17 Extrusion welding will not be permitted unless approved by Contract Administrator on a case by case basis.

3.5 FIELD QUALITY CONTROL

.1 Request inspection prior to placing aggregate cover over pipe.

.2 Compaction testing will be performed in accordance with CW2030.

.3 If tests indicate Works does not meet specified requirements, remove Works, replace and retest.

.4 Pressure and leakage test: Test as follows:

.1 Provide labour, equipment and materials required to perform leakage tests herein specified; notify Contract Administrator at least 24 hours in advance of all proposed tests; perform tests in the presence of Contract Administrator.

.2 Test at one time as much of the piping system as practical and authorized by Contract Administrator.

.3 Test all landfill gas piping at a pressure of 3 psi. Utilize compressed air to charge the pipelines and maintain pressure for adequate period to allow for expansion of the piping. All fittings, valves and expansion joints are to be accessible for inspection during the pressure test. A pressure test will be deemed successful if the designed pressure is maintained for a period of not less than 1 hour with no measurable drop in pressure. The temperature must be constant to within 1°C during this period or adjusted with the appropriate correction factor.

.4 Test all compressed air and forcemain piping at a pressure of 125 psi.

.5 Cap all seal and testing ports at the termination of the pressure test.

.6 Examine joints for leakage and remove any joints showing leakage from the pipeline, rejoin and retest the system.

.7 Ensure that normal safety precautions are observed for exposed piping.

.8 Locate and repair defects if leakage occurs.

.9 Repeat test until pressure drop is within specified allowance for full length of line.

.10 Use pressure gauge with appropriate range and scale.

.11 Submit pressure test report indicating date, test pressure, duration and pass/fail for each section of pipe tested.

3.6 PROTECTION OF FINISHED WORK

.1 Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

PART 4 MEASUREMENT AND PAYMENT

4.1 GENERAL

.1 Section 01 20 00 – Price and Payment Procedures: Requirements for measurement and payment.

4.2 FIELD SURVEYING

.1 Schedule of Prices Item No. 1.

.2 Measurement: Lump sum.

.3 Payment: Includes the completion of all field surveying required to complete the Work, including layout surveying and as-built surveying.

4.3 250 mm HDPE LFG COLLECTION LATERAL PIPE

.1 Schedule of Prices Item No. 2.

.2 Measurement: By the linear metre along the centerline of pipe.

.3 Payment: Includes excavation, bedding, pipe, connection to existing piping, all fittings including but not limited to tees, elbows and any other fittings, flanges, blind flanges, hardware, tracer wire, insulation, warning tape, pressure testing, disposal of excess refuse, backfill and compaction, and rough restoration.

END OF SECTION 33 52 16