

Garden River Remediation Design Specifications

Garden River, Wood Buffalo National Park Alberta

Prepared for Public Works and Government Services Canada

Environmental Services –Western Region

09 september 2016

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<u>Section Number</u>	<u>Section Title</u>	<u>No. of Pages</u>
Division 01	General Requirements	77
01 11 00	Summary of Work	5
01 14 00	Work Restrictions	2
01 31 19	Project Meetings	2
01 32 16.07	Construction Project Schedules – Bar (GANTT) Chart	4
01 33 00	Submittal Procedures	12
01 35 13.43	Special Project Procedures for Contaminated Sites	8
01 35 29.06	Health and Safety Requirements	4
01 35 29.14	Health and Safety for Contaminated Sites	8
01 35 43	Environmental Procedures	8
01 41 00	Regulatory Requirements	1
01 45 00	Quality Control	3
01 51 00	Temporary Utilities	2
01 52 00	Construction Facilities	4
01 53 00	Mobilization/Demobilization	2
01 56 00	Temporary Barriers and Enclosures	2
01 71 00	Examination and Preparation	3
01 74 11	Cleaning	1
01 77 00	Closeout Procedures	2
01 78 00	Closeout Submittals	4
Division 31	Earthworks	62
31 12 10	Cell A Construction Requirements	20
31 12 15	Removal of Waste from Old Dump	9
31 32 19.01	Geosynthetic Clay Liner	9
31 32 19.02	HDPE and LLDPE Geomembrane	18
31 32 19.03	Geotextile	6
Supporting Documentation		
	Appendix A to Specifications - May 30 2016 Site Photographs.Data	
	Gap Assessment – Garden River Old Dump Site. Prepared by SLR, September 2016.	
	Garden River Remediation Project – Groundwater Characterization Report. Prepared by SLR, Feb 2015.	
	Detailed Site Assessment – Garden River Old Dump in Wood Buffalo National Park. Prepared by Columbia Environmental Consulted Ltd. and Franz Environmental Inc, Feb 2011.	
	Contaminated Site Assessment Initial and Detailed Testing Programs, Wood Buffalo National Park, Various Locations in the Community of Garden River, Alberta. Prepared by EBA, Feb 2009.	
List of Drawings		
209.40380.00000-01	Existing Conditions	
209.40380.00000-02	Facility Layout for Cell A	
209.40380.00000-03	Proposed Final Cover Contours for Cell A	
209.40380.00000-04	Sections and Typical Details	
209.40380.00000-05	Details	
209.40380.00000-06	Old Dump Areas	

PWGSC
Section 00 01 10
Garden River Environmental Remediation
Garden River, Wood Buffalo National Park, AB

Issued for Tender
TABLE OF CONTENTS
20/09/2016
Page 2 of 2

END OF SECTION

Part 1 General

1.1 DEFINITION

- .1 The project shall be known as Garden River Landfill Remediation, including the excavation of wastes from the Garden River 'Old Dump' and transfer of these to a newly constructed containment cell known as 'Cell A'. The project is located in the community of Garden River approximately 200 km east of High Level, Alberta, near the western boundary of Wood Buffalo National Park (WBNP), at the end of Highway 58 at the confluence of Garden River and the Peace River.
- .2 Departmental Representative: Within the context of these Specifications, the term Departmental Representative refers to the person exercising the roles and attributes of Canada under the contract.
- .3 Contractor: The contractor procured to undertake the site management, remediation and restoration is defined, within the context of these specifications, as the Contractor.
- .4 Owner: within the context of these specifications, the term Owner refers to Parks Canada Agency that is the custodian of the Site.
- .5 Site: Area of ground on which the location of the work will be undertaken. This includes Cell A, the Old Dump (i.e. main dump site), and 3 satellite dump sites.
- .6 Old Dump: equals the main former dumpsite including smaller 'satellite' dump sites. which are all intended to be excavated and moved to newly constructed Cell A.

1.2 SUPPORTING DOCUMENTS

- .1 Data Gap Assessment – Garden River Old Dump Sites, Garden River, Alberta. Prepared by SLR Consulting, September 2016.
- .2 Detailed Site Assessment – Garden River Old Dump in Wood Buffalo National Park. Prepared by Columbia Environmental Consulting Ltd. and Franz Environmental Inc. February 2011.
- .3 Contaminated Site Assessment Initial and Detailed Testing Programs, Wood Buffalo National Park, Various Locations in the Community of Garden River, Alberta. Prepared by EBA. February, 2009.
- .4 Garden River Remediation Project – Groundwater Characterization Report. Prepared by SLR, Feb 2015.
- .5 Appendix A to Specifications - May 30 2016 Site Photographs.

1.3 RELATED REQUIREMENTS

- .1 Section 31 12 10 –Cell A Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 – Geotextile.

1.4 DESCRIPTION OF WORK

- .1 The required work to be undertaken by the Contractor for the project will include but not be limited to the construction of a new landfill cell (here-on-in referred to as Cell A), waste removal from the Old Dump and placement in Cell A, and final capping of Cell A, located at Garden River, Wood Buffalo National Park. Work:
 - .1 Project preparations including:
 - .1 Utility locates.
 - .2 Protection of existing monitoring wells at Cell A and at Old Dump.
 - .3 Road construction to new Cell A.
 - .4 Installation of fencing around new landfill Cell A.
 - .2 Construction of new landfill cell, Cell A.
 - .1 Complete Cell A earthworks which were commenced in 2016 but not completed. Remaining earthwork includes fine-grading and proof-rolling the base of Cell A, and construction of a perimeter berm around Cell A.
 - .2 Supply and installation of a base liner and leachate collection system in the base of Cell A comprised of:
 - .1 a geosynthetic clay liner (GCL);
 - .2 geomembrane;
 - .3 cushion geotextile;
 - .4 construction of an anchor trench;
 - .5 clear stone leachate drainage media as well as leachate extraction system comprised of HDPE pipes and sump.
 - .3 Excavation of waste materials from Old Dump located within the community of Garden River, including:
 - .1 Managing water in the excavation through dewatering and containment throughout as required.
 - .2 Segregating potentially hazardous waste during the excavation of the Old Dump, for subsequent removal for off-site disposal at a licenced off-site facility. Note: Volume of potentially hazardous waste listed in Bid Sheet have not been quantified.
 - .3 Facilitating collection of base and wall soil samples by the Departmental Representative.
 - .4 Transport of Old Dump wastes via road for placement in Cell A. Note: Volume of waste for relocation listed in Bid Sheet is approximate.
 - .5 Supply, transportation, and placement of fill and topsoil to reshape or regrade the Old Dump area, followed by seeding.
 - .4 Filling and Closure of Cell A:
 - .1 Waste grading and compaction in Cell A.
 - .2 Supply, transportation, and placement of grading fill materials and sand gas collection layer.
 - .3 Supply and installation of a final cover over Cell A comprised of:
 - .1 geomembrane;

- .2 cushion geotextile;
- .3 clear stone drainage layer;
- .4 separator geotextile;
- .5 construction of anchor trench;
- .6 topsoil and seeding.
- .4 Installation of gas vents.
- .5 Re-grading and ditch work around Cell A to direct surface water run-off away from Cell A.

1.5 WORK SEQUENCE

- .1 Conduct Work to provide for continuous public usage of the existing landfill during construction.
- .2 Required stages:
 - .1 Construction of road extension to Cell A.
 - .2 Construction of Cell A, including completion of earthworks, and installation of the base lining and leachate collection system.
 - .3 Plan excavation and backfilling activities to accommodate 10 day turnaround time for sample analysis following removal of waste material from the Old Dump.
 - .4 Complete waste placement in Cell A Backfill Old Dump as indicated.
 - .5 Place final cover over Cell A.
 - .6 Complete final grading, seeding, fence installation, restore all disturbed areas, and complete final cleaning.
- .3 Maintain fire access/control.

1.6 WORK BY OTHERS

- .1 Co-operate with the Departmental Representative in carrying out their respective work. Work on this project must include provisions for coordinating related work, identified in Contract Documents, for following principal items.
 - .1 Collection of soil samples from the base and walls of completed excavation by Department Representative.

1.7 CONTRACTOR RESPONSIBILITIES

- .1 Investigate all local conditions and services that will affect execution of the Work. Contractor's failure to adequately investigate local conditions will not be considered a valid reason for increase in project cost or extension of project schedule.
- .2 Designate date for submittals and delivery date for each product in progress schedule.
- .3 Obtain Departmental Representative approval for all materials supplied that meet specification requirements via submittal submission and approval procedures. Key materials include but are not limited to aggregate material, soils, geosynthetic clay liner, geomembranes, and geotextiles.

- .4 Produce shop drawings, product data, samples, independent conformance testing results, and other submittals. Submit to Departmental Representative, notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
- .5 Receive and unload products at site.
- .6 Inspect deliveries jointly with Departmental Representative or; record shortages, and damaged or defective items.
- .7 Handle products at site, including uncrating and storage.
- .8 Protect products from damage, and from exposure to elements.
- .9 Assemble, install, connect, adjust, and finish products.
- .10 Provide installation inspections required by public authorities.
- .11 Repair or replace items damaged on site until final acceptance of finished product/work.

1.8 CONTRACTOR USE OF PREMISES

- .1 Unrestricted use of site until Substantial Performance, however access must be maintained to allow:
 - .1 Public usage of the existing landfill adjacent to location of Cell A.
 - .2 Public usage of roads between Cell A and the Old Dump.

1.9 LOCAL CONDITIONS

- .1 No cellular telephone service is available in Garden River.
- .2 No commercial accommodations are available in Garden River.
- .3 An airstrip is located approximately 0.5 km from the community.
- .4 Highway 58 connects the community of Garden River with High Level, AB.

1.10 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings and Submittals.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

1.11 MEASUREMENT OF PAYMENT

- .1 Work under this contract will be paid as follows:
 - .1 Lump sum payment items will be paid at the lump sum price tendered as listed in the Bid Form provided in this solicitation. Percentage of payment will be relative to percentage of completion of activity indicated on the Bid Form.
 - .2 Unit price items will be paid at the unit price tendered as listed in the Bid Form provided in this solicitation.
 - .3 All direct costs for lump sum and unit price items are to be included in the appropriate price item in the Bid Form provided in this solicitation. Direct costs include all costs directly attributable to a particular pay item including equipment, operators, materials, equipment maintenance and depreciation, etc.
 - .4 All indirect costs associated with specific unit price or lump sum items shall be included in the lump sum or unit rate price item in the Bid Form provided in this solicitation. Indirect costs include all costs not directly attributable to the pay items including profit, supervision, overhead, administration, insurance, Worker's Safety Compensation Board (WCB), Contractor's allowance for equipment repairs and depreciation, and any other relevant costs.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

1.1 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services and provide for vehicle access.
- .3 Be responsible for providing sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.2 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Provide for pedestrian and vehicular traffic.
- .3 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 SPECIAL REQUIREMENTS - GENERAL

- .1 Carry out noise generating Work Sunday to Saturday from 07:00 to 19:00 hours.
- .2 Control generation of airborne dust as required in the Specifications and to the satisfaction of the Departmental Representative.
- .3 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.
- .4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .5 Keep within limits of work and avenues of ingress and egress.
- .6 Ingress and egress of Contractor vehicles at site is limited to pre-existing roads or new roads constructed to access work areas as indicated.

1.4 SPECIAL REQUIREMENTS – CELL A BASE LINER CONSTRUCTION SEQUENCE

- .1 Organize and sequence work so that on each day where GCL liner is installed, the same area of GCL is covered, on the same day, by the overlying HDPE geomembrane (including all welding, testing, and repairs), the cushion geotextile, and the 300 mm thick layer of clear stone drainage media.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting three (3) days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Ensure representative of Contractor, Subcontractor and suppliers attending meetings are qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within seven (7) days after award of Contract, request a meeting of parties in contract to discuss and confirm administrative procedures and responsibilities.
- .2 Departmental Representative, Owner, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time of teleconference meeting and notify parties concerned minimum five (5) days before meeting.
- .4 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
 - .3 Schedule and method for submission of shop drawings, samples, and all other submittals.
 - .4 Format of routine project communications (e.g. email, memoranda) and nomenclature for correspondence headings.
 - .5 Requirements for temporary facilities, onsite accommodations, site signs, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .6 Delivery schedule of specified equipment.
 - .7 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
 - .10 Appointment of inspection and testing agencies or firms.

1.3 WORKER ORIENTATION MEETING

- .1 Hold worker orientation meeting prior to start of construction.

1.4 DAILY TAILGATE SAFETY MEETINGS

- .1 Hold safety meetings with daily prior to start of work each day with all workers in attendance.
- .2 Review anticipated safety requirements and precautions.

1.5 PROGRESS MEETINGS

- .1 During course of Work and one (1) week prior to project completion, schedule progress meetings weekly.
- .2 Contractor, major Subcontractors involved in Work, Departmental Representative, and Owner are to be in attendance.
- .3 Notify parties minimum three (2) days prior to meetings.
- .4 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Health, safety, and environmental incidents.
 - .13 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Landfill Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 –Geotextile.

1.2 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Sunday to Saturday, inclusive, will provide seven (7) day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within seven (7) days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within seven (7) working days of receipt of acceptance of Master Plan.

1.5 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within five (5) working days.
- .3 Revise impractical schedule and resubmit within two (2) working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Submittals including Shop Drawings, Samples, Independent Conformance Testing, and all other submittals.
 - .3 Permits.
 - .4 Mobilization & Site Setup.
 - .5 Construction of Remainder of Cell A Earthworks.
 - .6 Surface Water Drainage System Construction.
 - .7 Access Road Construction and Culverts.
 - .8 Installation of Fencing and Gates.

- .9 Geosynthetic Clay Liner Installation in Base of Cell A.
- .10 Geomembrane Installation in Base of Cell A.
- .11 Geotextile Installation in the Base of Cell A.
- .12 Installation of Clear Stone Drainage Media in the Base of Cell A.
- .13 Milestone: Cell A is Ready to Accept Waste.
- .14 Preparation of Suspect Waste Holding Area.
- .15 Excavation from Old Dump and Waste Relocation.
- .16 Backfill and/or Regrading and Seeding of Old Dump.
- .17 Placement of Grading Layer over Waste in Cell A.
- .18 Placement of Gas Venting Layer in Cell A.
- .19 Geomembrane Installation in Cap of Cell A.
- .20 Cushion Geotextile Installation in Cell A.
- .21 Placement of Drainage Layer in Cell A.
- .22 Placement of Separator Geotextile in Cell A.
- .23 Application of Topsoil and Seeding to Cell A.
- .24 Installation of Gas Vents.
- .25 Site Restoration and permanent Erosion Controls.
- .26 Final Inspection.
- .27 De-Mobilization.

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Provide hard copy and electronic copy of each schedule update.
- .3 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule. Prepare a recovery plan to address activities behind schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Landfill Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 –Geotextiles.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed in this specification and summarized in Table 01 33 00 -1 for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and test results in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project requirements will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify that field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed hard copy of each submission on site.
- .11 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as PDF files as directed by Departmental Representative.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, panel layout drawings, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit all shop drawings stamped and signed by Professional Engineer registered or licensed in Province of Alberta, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow three (3) days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.

- .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .1 Submit one (1) electronic copy and one (1) hard copy of shop drawings in format requested for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
 - .2 Submit one (1) electronic copy and one (1) hard copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .3 Submit one (1) electronic copy and one (1) hard copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .4 Report signed by authorized official of testing laboratory that material or product identical to material or product to be provided has been tested in accordance with specified requirements.
 - .5 Submit one (1) electronic copy and one (1) hard copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .6 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .7 Certificates must be dated after award of project contract complete with project name.
 - .8 Submit one (1) electronic copy and one (1) hard copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .9 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .10 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.

- .13 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .14 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .15 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .16 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.4 SAMPLES

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address if prior to start of Work, or site office if Work has commenced.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .6 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, fine resolution as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: at least 2 locations.
- .4 Viewpoints and their location as determined by Departmental Representative.
- .5 Frequency of photographic documentation: per specification or as directed by Departmental Representative.

- .6 Photographs taken as follows:
 - .1 During access road construction (each operation).
 - .2 After completion of Cell A base preparation but prior to geosynthetic installation.
 - .3 During installation of base liner (each layer).
 - .4 Cell A when ready to accept waste.
 - .5 Old dump prior to excavation.
 - .6 Daily during excavation of waste from Old Dump.
 - .7 Daily during placement of waste in Cell A.
 - .8 Intermittently during backfill and/or regrading of Old Dump.
 - .9 Cell A prior to final cover installation.
 - .10 During installation of final cover (each layer).
 - .11 Final grading around cell A.
 - .12 Fencing installation.
 - .13 Final cleaning Work.
 - .14 As directed by Departmental Representative.

1.6 FINAL REPORTING

- .1 Final reports should be issued in both .doc and .pdf formats with relevant supporting documentation, site drawings and diagrams, and photographs included in the report.
- .2 Final Report:
 - .1 Site photographs.
 - .2 Copies of all laboratory and field quality control testing.
 - .3 Topographic survey data. Each survey provided as points files with descriptors in .csv format and contour plans prepared in AutoCad format. Surveys as per requirements of 01 77 00 Examination and Preparation.

1.7 SUBMITTALS TABLE

- .1 Adhere to the submittal items and deadlines identified in table 01 33 00-1, unless discussed with the Departmental Representative and agreed in writing.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE

Specification Section	Description	Date
Division 1		
01 31 19	Request for Project Pre-Construction Meeting	Seven (7) days after Award of Contract
01 31 19	Project Meeting Minutes	Two (2) days after meeting
01 31 19	Weekly Progress Report	Weekly for duration of project, reported in meeting minutes
01 31 19	Preliminary Project Schedule	Seven (7) days after Award of Contract
01 31 19	Worker Orientation meeting agenda and attendance sheet	Prior to commencing Work
01 32 16.07	Project Master Plan and Schedule	Seven (7) days after Award of Contract
01 32 16.07	Schedule updates	Weekly for duration of project
01 33 00	Progress Photographs	Weekly for duration of project
01 33 00	Final Photographs	Prior to final progress payment request
01 33 00	Equipment and Material Control Status Report	Upon request of Departmental Representative
01 33 00	Monthly Performance Measures Report	Monthly with Invoice
01 33 00	Daily Reports for Potential Additional Work	Daily, as required
01 35 13.43	Copies of site entry and work area logbooks	Weekly
01 35 13.43	Site layout drawings showing existing conditions and facilities, construction and temporary facilities	21 days after Award of Contract
01 35 13.43	Decontamination facility design and location	21 days after Award of Contract
01 35 13.43	Site specific Pollution Control Plan	21 days after Award of Contract
01 35 29.06	Site Specific Health and Safety Plan	21 days after Award of Contract
01 35 29.06	Incident and accident reports	Weekly
01 35 29.06	Copies of Reports/Directions by Federal or Territorial Health and Safety Inspectors	Verbal report immediately followed by written report in 24 hours
01 35 29.06	On-site Contingency and Emergency Response Plan	With Health and Safety Plan
01 35 29.06	Correction Action report for non compliance Health and Safety issue	as required
01 35 29.06	Report corrective action for observed environmental non-compliance	as required

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE

Specification Section	Description	Date
01 35 29.14	Safety and health risk or hazard analysis	21 days after Award of Contract
Division 1		
01 35 29.14	Checklist of daily inspection items	21 days after Award of Contract
01 35 29.14	Personnel training requirements	21 days after Award of Contract
01 35 29.14	PPE Program requirements	21 days after Award of Contract
01 35 43	Environmental Protection Plan	14 days after contract award
01 35 43	Copies of Environmental Approvals (Where applicable)	Prior to commencing Work or as required
01 35 43	Inventory of Environmental Protection Supplies	Within seven (7) days of Mobilization
01 52 00	Erosion Sediment and Drainage Control Plan	As required when revised
01 53 00	Mobilization and Demobilization Plan	Seven (7) days after Award of Contract
01 53 00	Mobilization Notice	Five (5) days prior to Mobilization
01 71 00	Surveyor Information (name, address, certification etc)	Ten (10) days before start of construction
01 71 00	Calibration Information for Surveying Equipment	Ten (10) days prior to construction
01 71 00	Field Drawings of Services (maintained/re-routed/abandoned) and Equipment/Instrumentation	Upon request of Departmental Representative
01 71 00	Certified survey drawings	After completion of work or as required
01 71 00	Documentation to verify accuracy of field engineering work	Upon request of Dept Representative
01 71 00	Survey Documentation	Upon request of Dept Representative, immediately upon completion of survey and processing of data
01 77 00	Request for Final Inspection	As required
01 77 00	Record Notations on Drawings	After project completion and before final inspection
01 78 00	Project Record Documents	At Project Completion and before Demobilization
01 78 00	As built for completed Cell A and Remediated Old Dump Area	At Project Completion and before

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE		
Specification Section	Description	Date
		Demobilization
Cell A Construction Requirements		
31 12 10	The locations and name of the source of granular materials, sand, soil, and topsoil, and a A 20 kg sample of each material.	30 days prior to the start of construction
31 12 10	The name and location of the laboratory that will be used for soil analyses as specified.	30 days prior to the start of construction
31 12 10	Shop drawings all components of the piping systems and sump chamber including pipes, joints, fittings, welds, perforations, and caps.	30 days prior to the start of construction
31 12 10	Detail of gas vents.	30 days prior to the start of construction
31 12 10	Details of seed mixture proposed for final cover and restored Old Dump.	30 days prior to the start of construction
31 12 10	Details of fertilization and watering programme proposed for final cover and restored Old Dump.	30 days prior to the start of construction
31 12 10	Details of erosion control blankets	30 days prior to the start of construction
31 12 10	Initial set of laboratory test results for the granular materials, sand, soil, and topsoil.	30 days prior to the start of construction
31 12 10	Field Compaction Control	Ongoing, submit results immediately to the Dept Representative
31 12 10	Additional laboratory confirmatory testing of remedial excavation backfill and granulars	Within three (3) days of Dept Representative request
Removal of Waste from Old Dump		
31 12 15	Excavation Work Plan	14 days prior to the start of construction
31 12 15	Written description and volume measurement of materials removed from Old Dump and moved and moved to Cell A	Daily during waste movement to Cell A
31 12 15	Inventory, updated daily, of all hazardous materials segregated for shipment and disposal off-site.	Daily during waste excavation
31 12 15	Chain of custody information and disposal tickets for hazardous	Immediately as received

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE

Specification Section	Description	Date
	material disposed at off-site facility.	
Geosynthetic Clay Liner		
31 32 19.01	Qualifications of the GCL Manufacturer	90 days prior to delivery of GCL
31 32 19.01	Product details of GCL to be provided, including minimum average roll values from Manufacturer's testing for all parameters listed in Table 31 32 19.01-1.	90 days prior to delivery of GCL
31 32 19.01	Manufacturer's letter of certification that GCL to be supplied is in conformance with specification, signed by the quality control manager.	90 days prior to delivery of GCL
31 32 19.01	Name, location, and contact information of laboratory to be used for independent laboratory testing of GCL.	90 days prior to delivery of GCL
31 32 19.01	Submit GCL sample to Departmental Representative for independent conformance testing.	90 days prior to delivery of GCL
31 32 19.01	Written certification that components and the finished GCL are in compliance with this Specification	60 days prior to delivery of GCL
31 32 19.01	Results of independent conformance testing for parameters and frequencies in Table 31 32 19.01-1	60 days prior to delivery of GCL
31 32 19.01	Results of two (2) GCL/permeant compatibility tests as performed under the responsibility of the Contractor	60 days prior to delivery of GCL
31 32 19.01	GCL installation shop drawings	60 days prior to delivery of GCL
31 32 19.01	Qualifications of the GCL Installer	60 days prior to delivery of GCL
31 32 19.01	Shipment packing list, Bill of lading, Letter of certification, Roll identification numbers, Physical properties sheet with tests and frequency in accordance with this Specification, signed by the quality control manager.	On each delivery of GCL to site
HDPE and LLDPE Geomembrane		
31 32 19.02	Origin (supplier's name and production plant) and identification (brand name and lot number) of resin used to manufacture geomembrane.	90 days prior to delivery of geomembrane

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE

Specification Section	Description	Date
31 32 19.02	Copies of dated quality control certificates issued by resin supplier.	28 days prior to delivery of geomembrane
31 32 19.02	Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets the properties in this Specification.	28 days prior to delivery of geomembrane
31 32 19.02	Statement that amount of reclaimed polymer added to resin during manufacturing does not exceed 2% by weight.	90 days prior to delivery of geomembrane
31 32 19.02	Manufacturer's written certification that the geomembrane meets all the requirements stated.	90 days prior to delivery of geomembrane
31 32 19.02	Qualifications of Manufacturer	90 days prior to delivery of geomembrane
31 32 19.02	Name, location, and contact information for accredited Geosynthetic Quality Assurance Laboratory to be used	90 days prior to delivery of geotextiles
31 32 19.02	Quality control certificates	60 days prior to delivery of geomembrane
31 32 19.02	Certificate that extrudate to be used is comprised of the same resin as geomembrane to be used.	60 days prior to delivery of geomembrane
31 32 19.02	Results of independent laboratory conformance testing	60 days prior to delivery of geomembrane
31 32 19.02	Name, location, and contact information for qualified and accredited Geosynthetic Quality Assurance Laboratory to be used for independent geomembrane testing.	60 days prior to delivery of geomembrane
31 32 19.02	Minimum 2 m length of standard width membrane.	60 days prior to delivery of geomembrane
31 32 19.02	Minimum of 1 m seam with at least 300 mm of membrane on both sides of seam.	60 days prior to delivery of geomembrane
31 32 19.02	Shop drawings	60 days prior to delivery of geomembrane
31 32 19.02	Qualifications of Installer	60 days prior to delivery of geomembrane
31 32 19.02	Qualifications of master seamer and personnel performing seaming operations	60 days prior to delivery of geomembrane
31 32 19.02	Installation schedule	60 days prior to delivery of geomembrane
31 32 19.02	Construction Quality Control Plan	60 days prior to delivery of geomembrane
31 32 19.02	Written documentation of the product received including individual roll numbers, square metres of product per roll and total square metres of	With each shipment of geomembrane

TABLE 01 33 00-1 CONTRACTOR SUBMITTAL SCHEDULE

Specification Section	Description	Date
	product in the shipment.	
31 32 19.02	Quality control documentation recorded during installation.	As geomembrane installation proceeds
31 32 19.02	Sub-base surface acceptance certificates, which certify that the geomembrane installer has inspected the surface of the subgrade and that it conforms to these Specifications, for each area that will be covered directly by geomembrane shall be submitted prior to geomembrane deployment.	As geomembrane installation proceeds
31 32 19.02	Material and Installation Warranty from manufacturer	As geomembrane installation proceeds
31 32 19.02	Results of independent laboratory testing of destructive seam samples.	As geomembrane installation proceeds
31 32 19.02	As-built drawings as specified.	Following geomembrane installation
31 32 19.02	Geomembrane installer's quality control documentation as specified.	Following geomembrane installation
31 32 19.02	Written certification that the geomembrane system has been installed as specified.	Following geomembrane installation
Geotextile		
31 32 19.03	Manufacturer's certificate stating that the geotextile meets the requirements of this specification. Including statement re: metal detectors.	90 days prior to delivery of geotextiles
31 32 19.03	Mill certificates for each roll from manufacturer with minimum average roll values for all parameters identified in this Specification.	90 days prior to delivery of geotextiles
31 32 19.03	Method of sewing or fusing seams.	60 days prior to delivery of geotextiles
31 32 19.03	Shop drawings showing method of fastening geotextile to pipe penetrations.	60 days prior to delivery of geotextiles
31 32 19.03	2 m long sample of geotextile across entire roll width.	60 days prior to delivery of geotextiles
31 32 19.03	Results of independent laboratory testing for all parameters listed in this Specification.	60 days prior to delivery of geotextiles

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 - Landfill Construction Requirements.
- .2 Section 31 12 15 - Removal of Waste from Old Dump.

1.2 REFERENCES

- .1 Transportation and Dangerous Goods Act (1999).
- .2 Canadian Council of Ministers of the Environment (CCME) Documentation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submittals for Progress Meetings: make submittals at least 24 hours prior to scheduled progress meetings as follows:
 - .1 Updated progress schedule detailing activities. Include review of progress with respect to previously established dates for starting and stopping various stages of Work, major problems and action taken, injury reports, equipment breakdown, and material removal.
 - .2 Weekly copies of site entry and work area logbooks with information on worker and visitor access.
 - .3 Other information required by Departmental Representative or relevant to agenda for upcoming progress meeting.
- .3 Site Layout: within 21 days following Award of Contract and prior to mobilization to site, submit site layout drawings showing existing conditions and facilities, construction facilities and temporary controls provided by Contractor including following:
 - .1 Equipment and personnel decontamination areas.
 - .2 Means of ingress, egress and temporary traffic control facilities. Refer to Section 01 56 00 - Temporary Barriers and Enclosures for traffic control.
 - .3 Equipment and material staging areas.
 - .4 Wastewater storage tanks.
 - .5 Equipment Decontamination Facilities: submit drawings showing details and proposed location of equipment decontamination facilities to Departmental Representative for review seven (7) days after Award of Contract.
 - .6 Site Specific Pollution Control Plan: seven (7) days after Award of Contract, describing operation of equipment and personnel decontamination areas.

1.4 REGULATORY REQUIREMENTS

- .1 Provide erosion and sediment control in accordance with applicable regulations.
- .2 Comply with federal, provincial, and local anti-pollution laws, ordinances, codes, and regulations when disposing of waste materials, debris, and rubbish.
- .3 Work to meet or exceed minimum requirements established by federal, provincial, and local laws and regulations which are applicable.
 - .1 Contractor: responsible for complying with amendments as they become effective.
- .4 In event that compliance exceeds scope of work or conflicts with specific requirements of contract notify Departmental Representative immediately.

1.5 SEQUENCING AND SCHEDULING

- .1 Do not commence Work involving contact with potentially contaminated materials until decontamination facilities are operational and approved by Departmental Representative.

1.6 EQUIPMENT DECONTAMINATION FACILITIES

- .1 Prior to commencing work involving equipment contact with potentially contaminated materials, construct temporary equipment decontamination facilities.
- .2 Decontamination facility minimum requirements:
 - .1 Two facilities: at Old Dump excavation area, and at Cell A.
 - .2 Facilities large enough to accommodate largest haulage vehicle or piece of moving equipment on site.
 - .3 Lined such that wastewater generated from washing activities is contained.
- .3 Provide, operate, and maintain suitable portable, high-pressure, low-volume decontamination wash unit equipped with self-contained water storage tank and pressurizing system and capable of heating and maintaining wash waters to 80 degrees C and providing nozzle pressure of 1,035 kpa.
- .4 Provide, operate, and maintain necessary equipment, pumps, and piping required to collect and contain equipment decontamination wastewater and sediment and transfer materials to approved storage facilities.

1.7 WASTEWATER STORAGE TANK

- .1 Provide, operate, and maintain wastewater storage tanks to store wastewaters.
- .2 Wastewater includes water collected from dewatering operations; and water collected from Equipment Decontamination Facilities.
- .3 Discharges: comply with applicable discharge limitations and requirements; do not discharge wastewaters to site drainage systems that do not conform to or are in violation of such limitations or requirements; and obtain Departmental Representative's approval prior to discharge of wastewater.

- .4 Locate wastewater storage tanks in locations approved by Departmental Representative.
 - .1 Notify Departmental Representative 72 hours minimum in advance of when wastewater storage tank is anticipated to be full.
 - .2 Do not discharge additional liquids to filled tank following sampling by Contractor.
 - .3 Determine appropriate disposition of wastewaters based on sample analysis and as approved by Departmental Representative.
- .5 Transport and dispose of wastewaters that cannot be disposed of on-site, at off-site disposal facility as identified by Contractor and approved by Departmental Representative.

1.8 VEHICULAR ACCESS AND PARKING

- .1 Maintenance and Use:
 - .1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by Departmental Representative; transport and place into designated area approved by Departmental Representative. Clean access roads at least once per shift.
 - .2 Departmental Representative may collect soil samples for chemical analyses from traveling surfaces of constructed and existing access routes prior to, during, and upon completion of Work. Excavate and dispose of clean soil contaminated by Contractor's activities at no additional cost to Departmental Representative.

1.9 DUST AND PARTICULATE CONTROL

- .1 Execute Work by methods to minimize raising dust from construction operations.
- .2 Implement and maintain dust and particulate control measures as determined necessary by Departmental Representative during construction and in accordance with Federal and Province of Alberta regulations.
- .3 Provide positive means to prevent airborne dust from dispersing into atmosphere. Use water for dust and particulate control.
- .4 As minimum, use appropriate covers on trucks hauling fine or dusty material. Use watertight vehicles to haul wet materials.
- .5 Prevent dust from spreading to adjacent property sites.
- .6 Departmental Representative will stop work at any time when Contractor's control of dusts and particulates is inadequate for wind conditions present at site, or when air quality monitoring indicates that release of fugitive dusts and particulates into atmosphere equals or exceeds specified levels.
- .7 If Contractor's dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, stop work. Contractor must discuss procedures that Contractor proposes to resolve problem. Make necessary changes to

operations prior to resuming excavation, handling, processing, or other work that may cause release of dusts or particulates.

1.10 POLLUTION CONTROL

- .1 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.
- .2 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.
- .3 Promptly report spills and releases potentially causing damage to environment to:
 - .1 Authority having jurisdiction or interest in spill or release including conservation authority, water supply authorities, drainage authority, road authority, and fire department.
 - .2 Owner of pollutant, if known.
 - .3 Person having control over pollutant, if known.
 - .4 Departmental Representative.
- .4 Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measures used in cleanup or mitigating action.
- .5 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.
- .6 Provide spill response materials including, containers, adsorbent, shovels, and personal protective equipment. Make spill response materials available at all times in which hazardous materials or wastes are being handled or transported. Spill response materials: compatible with type of material being handled.
- .7 Decontaminate equipment after working in potentially contaminated work areas and prior to subsequent work or travel on clean areas.
- .8 Perform equipment decontamination on Contractor-constructed temporary equipment decontamination pad.
- .9 At minimum, perform following steps during equipment decontamination: mechanically remove packed dirt, grit, and debris by scraping and brushing without using steam or high-pressure water to reduce amount of water needed and to reduce amount of contaminated rinsate generated. Use high-pressure, low-volume, hot water or steam supplemented by detergents or solvents as appropriate and as approved by Departmental Representative. Pay particular attention to tire treads, equipment tracks, springs, joints, sprockets, and undercarriages. Scrub surfaces with long handle scrub brushes and cleaning agent. Rinse off and collect cleaning agent. Air dry equipment in Clean Zone before removing from site or travelling on clean areas. Perform assessment as directed by Departmental Representative to determine effectiveness of decontamination.

- .10 Each piece of equipment will be inspected by Departmental Representative after decontamination and prior to removal from site and/or travel on clean areas. Departmental Representative will have right to require additional decontamination to be completed if deemed necessary.
- .11 Take appropriate measures necessary to minimize drift of mist and spray during decontamination including provision of wind screens.
- .12 Collect decontamination wastewaters and sediments which accumulate on equipment decontamination pad. Transfer wastewaters to designated wastewater storage tank or drums.
- .13 Transfer sediments to a designated area approved by the Departmental Representative.
- .14 Furnish and equip personnel engaged in equipment decontamination with protective equipment including suitable disposable clothing, respiratory protection, and face shields.
- .15 Have on hand sufficient pumping equipment, of adequate pumping capacity and associated machinery and piping in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment. Maintain piping and connections in good condition and leak-free.

1.11 WATER CONTROL

- .1 Maintain excavations free of water.
- .2 Prevent surface water runoff from leaving work areas.
- .3 Do not discharge decontaminated water, or surface water runoff, or groundwater which may have come in contact with potentially contaminated material, off site or to municipal drainage systems.
- .4 Direct surface waters that have not contacted potentially contaminated materials to existing surface drainage systems.
- .5 Control surface drainage including ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.
- .6 Dispose of water in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.
- .7 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.
- .8 Have on hand sufficient pumping equipment, machinery, and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.
- .9 Contain and collect wastewaters and transfer such collected wastewaters to Contractor supplied wastewater storage tanks.

1.12 EROSION AND SEDIMENT CONTROL

- .1 Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas. Prevent erosion and sedimentation.
- .2 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical. Strip vegetation, regrade, or otherwise develop to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as directed by [Departmental Representative] [DCC Representative] [Consultant].
- .3 Provide and maintain temporary measures which may include, silt fences, hay or straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other construction required to prevent erosion and migration of silt, mud, sediment, and other debris off site or to other areas of site where damage might result, or that might otherwise be required by Laws and Regulations. Make sediment control measures available during construction.
- .4 Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- .5 Do not disturb existing embankments or embankment protection.
- .6 Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- .7 If soil and debris from site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where in Departmental Representative's determination it is undesirable, remove accumulation and restore area to original condition.

1.13 PROGRESS CLEANING

- .1 Maintain cleanliness of Work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.
- .2 Co-ordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.

1.14 FINAL DECONTAMINATION

- .1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from site.
- .2 Perform decontamination as specified to satisfaction of Departmental Representative. Departmental Representative will direct Contractor to perform additional decontamination if required.

1.15 REMOVAL AND DISPOSAL

- .1 Remove surplus materials and temporary facilities from site.

- .2 Decommission equipment decontamination facilities:
 - .1 Only after all waste has been transferred to Cell A.
 - .2 Only after confirmation by Departmental Representative that Old Dump remedial excavation is complete, based on results of confirmatory sampling.
 - .3 Only after all equipment, vehicles, and tools that have come into contact with waste have been decontaminated.
 - .4 Dispose of decommissioned portions of decontamination facility in Cell A only if approved by Departmental Representative. (i.e. potentially contaminated granular pads, flexible liners, etc.).
 - .5 Dispose of portions of decontamination facility not disposed of in Cell A at off-site facility approved by Departmental Representative.
- .3 Dispose of non-contaminated waste materials, litter, debris, and rubbish off site, or in on-site facilities with the approval of the Departmental Representative.
- .4 Do not burn or bury rubbish and waste materials on site.
- .5 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
- .6 Do not discharge wastes into streams or waterways.
- .7 Dispose of following materials at appropriate off-site facility identified by Contractor and approved by Departmental Representative, or in on-site facilities with the approval of the Departmental Representative and the Garden River Public Works department:
 - .1 Debris including excess construction material.
 - .2 Non-contaminated litter and rubbish.
 - .3 Disposable PPE.
 - .4 Wastewater generated from decontamination operations or from wastewater storage tank.
- .8 Wastewater sample and analysis: Departmental Representative will perform sampling and analysis of stored wastewater for disposal purposes prior to removal from site. Results of analyses will determine appropriate methods of disposal. Upon receipt of analytical results, transfer tank contents without spills or release, as directed by Departmental Representative, to liquid waste tankers or disposal area. Following completion of tank emptying, decontaminate tank interior with steam or high-pressure water wash supplemented by detergent. Dispose of tank decontamination water with tank contents.
- .9 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

1.16 RECORD KEEPING

- .1 Maintain adequate records to support information provided to Departmental Representative regarding exception reports, annual reports, and biennial reports.

- .2 Maintain bills of lading for minimum of 375 days from date of shipment or longer period required by applicable law or regulation.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Landfill Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 – Geotextiles.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Alberta
 - .1 Occupational Health and Safety Act, R.S.A. - Updated [2013].
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .4 Transportation of Dangerous Goods Act (1999).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Submit site-specific Health and Safety Plan: Within 21 days after Award of Contract and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
 - .3 Site health and safety measures to minimize hazards.
 - .4 Emergency medical procedures that will be followed in case of accident requiring medical attention, including a muster point, contact list of emergency personnel and hospitals, and fire department.
 - .5 List of health and safety equipment that will be on-site, including but not limited to personal protective equipment (PPE), first aid kit, fire extinguishers, and spill kits.
- .3 Submit two (2) copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors to Departmental Representative.
- .5 Submit copies of incident and accident reports to Departmental Representative.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets to Departmental Representative.

- .7 Departmental Representative and Owner will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within two (2) days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.
- .2 Comply with Acts and regulations of the Province of Alberta.
- .3 Comply with specific standards and regulations to ensure safe operations at site.
- .4 In event of conflict between any provisions of specified standards and regulations, the most stringent provisions apply.

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Unknown landfill contents, including but not limited to: household waste; soil and groundwater potentially contaminated with petroleum hydrocarbons, inorganic elements, polycyclic aromatic hydrocarbons, volatile organic compounds; large debris including appliances, etc.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, Alberta.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Alberta having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with landfill construction and landfill excavation.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Alberta having jurisdiction, and in consultation with Departmental Representative.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Definitions:
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2 Reference Standards:
 - .1 Canadian and Alberta Environmental Protection Acts and pursuant regulations including but not limited to:
 - .1 Canadian Environmental Assessment Act (1999) and pursuant regulations.
 - .2 Transportation of Dangerous Goods Act and pursuant regulations.
 - .3 Environment Canada's "Best practices for the Reduction of Air Emissions from Construction and Demolition Activities".
 - .4 Canadian Council of Ministers for the Environment (CCME) Documentation, including but not limited to:
 - .1 Canadian Environmental Quality Guidelines.
 - .5 Alberta Environmental Protection and Enhancement Act (2000) and pursuant regulations.
 - .6 Alberta Tier 1 and Tier 2 Soil and Groundwater Remediation Guidelines.
 - .7 Department of Fisheries and Oceans (DFO) "Measures to Avoid Causing Harm to Fish and Fish Habitat".
 - .2 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005-[92], Storm Water Management for Construction Activities, Chapter 3.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements, and 01 35 29.14 – Health and Safety Requirements for Contaminated Sites.

- .3 21 days after Award of Contract and before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and EPA 832/R-92-005, Chapter 3.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
 - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .11 Waste disposal plan for wastes generated by contractor.
 - .12 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
 - .13 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing

provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

- .14 Wastewater Management Plan identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as clean-up water, dewatering of ground water, etc.

1.3 DISPOSAL OF WASTE

- .1 With the exception of excavated waste from the Old Dump to be transported and placed in Cell A, and selected other materials as directed by Departmental Representative, do not bury rubbish and other liquid and solid waste materials in Cell A.
- .2 Do not dispose of waste or volatile materials, such as oils, etc., onto the ground or into waterways, streams, or drainage ditches.
- .3 Separate and dispose of accumulated waste generated from the construction work in accordance with Federal and Provincial regulations. Dispose of waste in appropriate offsite facilities, or in onsite facilities with the approval of the Departmental Representative and the Garden River Public Works department. Waste materials include but are not limited to:
 - .1 Debris including excess construction materials.
 - .2 Non-contaminated litter and rubbish.
 - .3 Disposable PPE.
 - .4 Wastewater from decontamination operations or from wastewater storage tank.
- .4 Implement appropriate procedures for handling of excavated wastes and impacted soils during all phase of the project. Non-hazardous wastes excavated from the Old Dump of an appropriate size shall be relocated to Cell A. Oversized items excavated from the Old Dump shall be stockpiled at a location designated by the Departmental Representative for processing prior to being transported to Cell A. Suspect waste materials such as sealed drums will be segregated and disposed of in accordance with work plans approved by the Departmental Representative.
- .5 Disposal/recycling of other waste generated during the project shall be done in compliance with Alberta Waste Regulations and the facilities used will be approved by the Departmental Representative.

1.4 VEHICLE ACCESS AND PARKING

- .1 Maintenance and Use:
 - .1 Prevent contamination of access and haul roads. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by Departmental Representative.
 - .2 Departmental Representative may collect soil samples for chemical analysis from traveling surfaces of constructed and existing access routes prior to, during, and upon completion of Work. Excavate and dispose of

soil contaminated by Contractor's activities at no additional cost to Departmental Representative.

- .3 Vehicles/equipment shall be in good working order and not be leaking any fuel or fluids.
- .4 During construction, if fuel is brought in and stored on site, store it in compliance with applicable Federal and Provincial regulations in a designated fuelling area approved by the Departmental Representative.
- .5 Implement traffic management measures (such as 'Traffic Control Person'), if required, at site access points to direct traffic and minimize impacts to the community.

1.5 EQUIPMENT DECONTAMINATION

- .1 Commence work involving equipment contact with potentially contaminated materials only after Equipment Decontamination Pads are operational.
- .2 Decontaminate equipment after working in potentially contaminated work areas and prior to subsequent work or travel on clean areas.
- .3 Perform equipment decontamination on Contractor-constructed equipment decontamination pad to prevent cross contaminating unimpacted areas.
- .4 Equipment Decontamination Pads to include pad, potable wash water system, and a lined dyked containment area with a water collection sump. Remove equipment decontamination pads prior to conclusion of the project.
- .5 Decontamination steps to include, but are not limited to:
 - .1 Mechanically remove packed dirt, grit, and debris by scraping and brushing without using steam or high-pressure water to reduce the amount of water needed and to reduce amount of contaminated rinsate generated.
 - .2 Use high-pressure, low-volume, hot water or steam supplemented by detergents or solvents as appropriate and as approved by Departmental Representative. Pay particular attention to tire treads, equipment tracks, springs, joints, sprockets, and undercarriages.
 - .3 Scrub surfaces with long handled scrub brushes and cleaning agent. Rinse off and collect cleaning agent.
 - .4 Air dry equipment in Clean Zone before removing from site or travelling on clean areas.
 - .5 Perform assessment as directed by Departmental Representative to determine effectiveness of decontamination.
 - .6 Each piece of equipment will be inspected by Departmental Representative after decontamination and prior to removal from site and/or travel on clean areas. Departmental Representative will have right to require additional decontamination to be completed if deemed necessary.
 - .7 Take appropriate measure necessary to minimize drift of mist and spray during decontamination including provision of wind screens.

- .8 Collect decontamination wastewater which accumulates on equipment decontamination pad. Transfer wastewater to designated wastewater storage tank.
- .9 Collect decontamination sediment which accumulates on equipment decontamination pad. Transfer sediment to designated area approved by the Departmental Representative.
- .10 Furnish and equip personnel engaged in equipment decontamination with protective equipment including suitable disposable clothing, respiratory protection, and face shields.
- .11 Provide sufficient pumping equipment, of adequate pumping capacity and associated machinery and piping in good working condition for ordinary emergencies, including power outages, and competent workers for operation of pumping equipment. Main piping and connections in good condition and leak-free.

1.6 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.7 DRAINAGE

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water. Potentially impacted water within the Old Dump excavation footprint or landfill Cell A (i.e. groundwater or rainwater in direct contact with potentially contaminated soils) will be pumped to wastewater storage tanks for testing by Departmental Representative.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.8 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .3 Minimize stripping of topsoil and vegetation.
- .4 Restrict tree removal to areas indicated or designated by Departmental Representative.

- .5 All trees planned for removal must be removed by forestry professionals.

1.9 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Waterways to be kept free of excavated fill, waste material and debris.
- .3 Design and construct temporary crossings to minimize erosion to waterways.
- .4 Do not skid logs or construction materials across waterways.
- .5 Avoid indicated spawning beds when constructing temporary crossings of waterways.

1.10 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment in accordance with local authorities' emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- .4 Execute work by methods to minimize raising dust from construction operations.
- .5 Implement and maintain dust and particulate control measures as determined necessary by Departmental Representative during construction and in accordance with Federal regulations.
- .6 As minimum, use appropriate covers on trucks hauling fine or dusty materials. Use watertight vehicles to haul wet materials.
- .7 Prevent dust from spreading to adjacent sites.
- .8 Departmental Representative will stop work at any time when Contractor's control of dusts and particulates is inadequate for wind conditions present at Site, or when air quality monitoring indicates that release of fugitive dusts and particulates into atmosphere equals or exceeds specified levels.
- .9 If Contractor's dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, stop work. Contractor must discuss procedures that Contractor proposes to resolve problem. Make necessary changes to operations prior to resuming excavating, handling, processing, or other work that may cause release of dusts or particulates.
- .10 Ensure hazardous substances (including fuel) are stored, handled and applied in a manner to prevent release to the environment and in a manner in accordance with applicable regulations including hazardous waste regulations.
- .11 Secure all materials when not in use and at non-productive times (night and shut-down).
- .12 Vehicles shall be shut off when not in use. No vehicle idling on-site.

- .13 Store hazardous or toxic substances in a designated area as approved by Departmental Representative.
- .14 Comply with requirements of WHMIS regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of MSDS acceptable to Labour Canada.
- .15 Regularly inspect work areas and surrounding lands to collect wind-blown litter. During placement and compaction of waste in Cell A, limit the working face at any given time to a small and distinct area to allow better control of potential litter dispersal.

1.11 NOISE CONTROL

- .1 Operate all construction equipment with exhaust systems in good repair to minimize noise.
- .2 Restrict construction activities that could create excessive noise to daylight hours.
- .3 Ensure that noise control devices (i.e. mufflers, silencers) on construction equipment are properly maintained.

1.12 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with codes that apply at the Federal, Provincial or local level such that in case of conflict or discrepancy between applicable codes, the more stringent requirements apply.
- .2 Meet or exceed requirements of the following items; if there is a discrepancy between the items the more stringent requirement applies:
 - .1 Contract documents, including amendments.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Stop work immediately and notify Departmental Representative if designated substances, toxic and/or hazardous waste are discovered during excavation of the Old Dump.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

1.4 NATIONAL PARKS ACT

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Landfill Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 –Geotextiles.

1.2 REFERENCES

- .1 Not used.

1.3 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies may be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at

no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store test samples.

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative and Owner.

1.8 REPORTS

- .1 Submit copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested or manufacturer or fabricator of material being inspected or tested.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Landfill Construction Requirements.
- .2 Section 31 12 15 – Removal of Waste from Old Dump.
- .3 Section 31 32 19 01 – Geosynthetic Clay Liner.
- .4 Section 31 32 19 02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19 03 – Geotextiles.

1.2 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.5 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water. Potentially impacted water within the Old Dump excavation footprint (i.e. groundwater or rain water in direct contact with excavation footprint) will be pumped to wastewater storage tanks for testing by Departmental Representative.

1.6 WATER SUPPLY

- .1 Contractor will provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3 Pay for utility charges at prevailing rates.

1.7 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps, or arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

1.8 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.9 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 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 sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .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.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z321-[96(R2001)], Signs and Symbols for the Occupational Environment.
- .2
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas for temporary access roads and gate, construction laydown, vehicle parking, equipment decontamination pad, and topsoil stockpiling.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.5 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Maintain existing, new and temporary roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.6 ACCOMODATIONS

- .1 The Contractor is informed that there are no onsite accommodations available.

- .2 Provide an onsite construction camp, including its facilities, utilities, services, location and operation, subject to the approval of the Departmental Representative. The camp is to be designed, established and operated in accordance with applicable Federal and Provincial codes, regulations and requirements governing construction camps.
- .3 Provide two rooms for the Departmental Representative for the duration of the project.

1.7 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Departmental Representative's Site office.
 - .1 Provide temporary office for Departmental Representative.
 - .2 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 50% opening windows and one lockable door.
 - .3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.
 - .6 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
 - .7 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3 drawer filing cabinet, one plan rack and one coat rack and shelf.
 - .8 Maintain in clean condition.
 - .9 Offices shall be locked at all time when not occupied.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 CONSTRUCTION SIGNAGE

- .1 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages and the local dialect.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. Where required, construct temporary pull over areas in order to allow for the safe passing of heavy equipment.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.

- .14 Remove, upon completion of work, access and haul roads designated by Departmental Representative.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 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, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .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.

END OF SECTION

1.1 GENERAL

- .1 Provide all labour, equipment and materials, and performance of all Work necessary for mobilization to, and demobilization from site. This will include all Departmental Representative provided supplies, equipment and material.
- .2 Mobilization to include transportation to site of Contractor's labour, equipment, materials, and assembling, erecting, and preparing site in readiness to start Work, all in accordance with Contractor's Schedule.
- .3 Demobilization to include dismantling and removal from site, of all Contractor's equipment, camp facilities and materials, waste resulting from cleanup of site and transportation of labour from site.
- .4 Decontaminate and clean all equipment used on the Project prior to demobilization.
- .5 Do not mobilize to the site without written authorization from the Departmental Representative.
- .6 Summarize the proposed mode, route, equipment, labour and all other requirements for the mobilization and demobilization of all required equipment, materials, waste and personnel to complete the remediation of the project, as indicated in these specifications, in a Mobilization and Demobilization Plan. Submit the Mobilization and Demobilization Plan to the Departmental Representative a maximum of seven (7) days after Award of Contract.
- .7 All mobilization and demobilization methods to comply with the requirements of all applicable codes, standards, guidelines and permits, approvals and/or authorizations.
- .8 A Post-Demobilization site visit will be required as part of the Post-Demobilization Inspection. Once demobilization is completed, Departmental representative will request a Post-Demobilization inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 SUBMITTALS

- .1 Submit Mobilization and Demobilization Plan seven (7) days after Contract Award in accordance with Section 01 33 00 – Submittal Procedure for review by Departmental Representative.
- .2 Submit to Departmental Representative, three (3) hard copies and one (1) electronic copy of the Mobilization and Demobilization Plan, 10 days after contract award.

1.3 MEASURE OF PAYMENT

- .1 All costs for Mobilization to site of all equipment and materials, including the submission of the Mobilization and Demobilization Plan, are to be included in the lump sum price for Mobilization Item 01 53 00-1 and Demobilization Item 01 53 00-2 , as indicated in the Combined Pricing Form. The lump sum price for mobilization is to include all labour, equipment, materials, meals, accommodation, flights and any other costs necessary to undertake work required.

1.4 NOT USED

- .1 Not Used.

Part 2 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 – Cell A Construction Requirements.
- .2 Section 31 12 15 - Removal of Waste from Old Dump.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-[M1978(R2003)], Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 HOARDING

- .1 Erect temporary site enclosure around Cell A and Old Dump using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Drive fence posts 0.6 m into ground. Provide one lockable truck gate per enclosure. Maintain fence in good repair and remove at end of project.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
- .3 Erect additional barriers (e.g. fencing and silt fencing) as deemed necessary by the Departmental Representative.

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations,.
- .2 Provide as required by governing authorities.

1.6 INSTALLATION OF PROTECTIVE FENCING AROUND MONITORING WELLS

- .1 Contractor is advised that there are 6 monitoring well locations near Cell A, and 6 at the Old Dump.
- .2 Install temporary fencing to provide an enclosure with a 2 m radius centered around each monitoring well or monitoring well nest.

- .3 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Drive fence posts 0.6 m into ground. Provide access point for personnel entry into enclosure. Maintain fence in good repair and remove at end of project.

1.7 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.9 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

Part 2 Products

2.1 TEMPORARY HORDING AND PROTECTIVE FENCING

- .1 Prefabricated, brightly coloured plastic snow fencing 1.2 m high.
- .2 1.8 m long supporting posts: Steel 'T' bars or 50 mm x 50 mm wooden stakes.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 - Landfill Construction Requirements.
- .2 Section 31 12 15 - Removal of Waste from Old Dump.
- .3 Section 31 32 19.01 – Geosynthetic Clay Liner
- .4 Section 31 32 19.02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19.03 – Geotextiles.

1.2 REFERENCES

- .1 Owner's identification of existing survey control points and property limits.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 14 days prior to start of construction, submit surveyor information.
- .2 14 days prior to start of construction, submit most recent calibration data for survey equipment.

1.4 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.5 SURVEY REFERENCE POINTS

- .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to Departmental Representative.
- .3 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require surveyor to replace control points in accordance with original survey control.

1.6 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement.
- .4 Stake slopes and berms.

- .5 Establish pipe invert elevations.
- .6 Topographic survey upon completion of:
 - .1 Access road following subgrade preparation but prior to placement of granulars.
 - .2 Access road following placement of granulars.
 - .3 Cell A base following preparation but prior to geosynthetic installation.
 - .4 Cell A ready to accept waste (top of granular).
 - .5 Old Dump area prior to excavation.
 - .6 Old Dump following completion of excavation.
 - .7 Cell A following completion of waste placement.
 - .8 Old Dump following completion of excavation.
 - .9 Old Dump following completion of backfilling.
 - .10 Cell A following completion of final cover construction.
 - .11 Following completion of surface water ditches and fencing installation.
 - .12 As directed by Departmental Representative.
- .7 Record surveys to include:
 - .1 Topographic shots on at least a 10m x 10m grid. If this is not practical determine survey shot frequency per Departmental Representative instruction.
 - .2 All topographic break lines (top of bank, bottom of bank, etc.).
 - .3 All drainage features (creek alignments, culverts).
 - .4 All structures and manmade features.
 - .5 All access roads or trails (centerline, shoulder and ditch alignments).
 - .6 Shoulders and edge of pavement of adjacent roads.
 - .7 All spoil piles and stockpiles of a materials with descriptions.
 - .8 Any survey monuments found in the field.
 - .9 Benchmark used for set-up.
- .8 On a daily basis measure volume of waste removed from Old Dump, as well as volume of waste placed in Cell A. Reconcile any differences between measured volume material excavated and placed to satisfaction of the Departmental Representative.
- .9 Submit survey data to Departmental Representative immediately following survey completion. Data submitted to include points files with descriptors in .csv format, and contour plans in AutoCad format.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.

- .2 On completion of and major site work, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of utility lines.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform, and do not conform, with Contract Documents.

1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris generated through project work.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris in accordance with arrangements and permits from local authorities.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris generated through project work.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor to conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.3 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 12 10 - Landfill Construction Requirements.
- .2 Section 31 12 15 - Removal of Waste from Old Dump.
- .3 Section 31 32 19.01 – Geosynthetic Clay Liner
- .4 Section 31 32 19.02 – HDPE and LLDPE Geomembrane.
- .5 Section 31 32 19.03 – Geotextiles.

1.2 REFERENCES

- .1 Not Used.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to completion of work with Contractor Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide evidence, if requested, for type, source and quality of products supplied.

1.5 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by section numbers and sequence presented in the Table of Contents.

- .6 Text: manufacturer's printed data, or typewritten data.
- .7 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .8 Provide 1:1 scaled CAD files in dxf and dwg and PDF format on CD.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, at site for Departmental Representative, one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
 - .9 Results of Independent Conformance Testing.
 - .10 Complete documentation of disposal records of hazardous materials disposed of off site:
 - .1 Chain of Custody records for wastes shipped for off-site disposal.
 - .2 Disposal tickets
- .2 Store record documents and samples in field office apart from documents used for construction.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawing and specifications over to Departmental Representative on completion of work. Submit files on CD.
- .7 If project is completed without significant deviations from Contract drawings and specifications, submit to Departmental Representative one set of drawing and specifications marked "AS-BUILT".

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.8 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 WARRANTIES

- .1 Where applicable, submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .2 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

- .3 Obtain warranties, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties until time specified for submittal.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 FAMILIARIZATION

- .1 Prior to implementing any of the work described in this Section, Related Sections, and Drawings, become thoroughly familiar with the division of work. Confirm with Departmental Representative the applicable portions of this Section and Related Sections.
- .2 Carefully review (including site inspection and review of all related construction documentation) any work specified in this Section, Related Sections, and Drawings, which has already been completed. Verify that all work is complete to the point where the work of this Section may properly commence without adverse effect to any completed works.

1.2 SECTION INCLUDES

- .1 Fine grading and proof rolling of Cell A excavation.
 - .2 Construction of Cell A perimeter berms.
 - .3 Excavation, proof rolling, and grading of surface water ditches.
 - .4 Excavation of anchor trench for base liner and cover system.
 - .5 Supply and placement of granular drainage media in Cell A.
 - .6 Supply and placement of HDPE perforated and non-perforated piping in Cell A.
 - .7 Supply and placement of soil grading layer over waste in Cell A.
 - .8 Supply and placement of gas venting layer for Cell A final cover.
 - .9 Supply and installation of passive gas vents for Cell A final cover.
 - .10 Supply and placement of drainage layer for Cell A final cover.
 - .11 Backfilling remediated Old Dump excavation.
 - .12 Supply and placement of topsoil for Cell A final cover and remediated Old Dump excavation.
 - .13 Supply and installation of erosion control blankets.
 - .14 Seeding Surface Water Ditches, Cell A final cover, and remediated Old Dump excavation.
 - .15 Proof rolling and fine grading of subgrade for Cell A access road.
 - .16 Supply and placement of granulars for Cell A access road.
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- .17 Supply and installation of culverts.
- .18 Supply and installation of fencing and access control gate.

1.3 RELATED SECTIONS

- .1 Section 31 12 15 Removal of Waste from Old Dump.
- .2 Section 31 32 19.01 Geosynthetic Clay Liner (GCL).
- .3 Section 31 32 19.02 HDPE and LLDPE Geomembrane.
- .4 Section 31 32 19.03 Geotextile.

1.4 REFERENCES

- .1 AWWPA Standard M4-06. Standard for the Care of Preservative-Treated Wood Products.
 - .2 ASTM International (ASTM):
 - .1 ASTM C131-01 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine (AASHTO Designation: T 96-02 (2015))
 - .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63 (Reapproved 2007), Standard Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³ (600 kN m/m³)).
 - .5 ASTM D2216-10, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 - .6 ASTM D2974-07a, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
 - .7 ASTM D3350 - 12e1 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
 - .8 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .9 ASTM D4643-08, Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating.
 - .10 ASTM D4972-01(2007), Standard Test Method for pH of Soils.
 - .11 ASTM D5268-07, Standard Specification for Topsoil Used for Landscaping Purposes.
 - .12 ASTM D6938-10, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - .3 Canadian Standards Association (CSA):
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- .1 CSA B182.11. Standard Practice for the Installation of Thermoplastic Drain, Storm and Sewer Pipe and Fittings.
- .2 CSA O80-97 (R2007) Wood Preservation
- .3 CSA O80.2-97 Preservative Treatment of Lumber, Timber, Bridge Ties and Mine Ties by Pressure Processes.
- .4 CSA G401, Corrugated steel pipe products.
- .4 CAN3-G401.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 At least 30 days prior to the start of construction submit to the Departmental Representative:
 - .1 The locations and name of the source of:
 - .1 Granular materials (100 mm Minus Granular, 19 mm Minus Granular) to be used for access roads.
 - .2 50 mm clear stone to be used for leachate drainage media in Cell A.
 - .3 Soil used for construction of berms, the grading layer above the waste and sand venting layer, and backfill for the remediated Old Dump.
 - .4 Topsoil.
 - .2 A 20 kg sample of each material.
 - .3 The name and location of the laboratory that will be used for soil analyses as specified.
 - .4 Shop drawings, stamped by a Professional Engineer registered in the Province of Alberta, showing:
 - .1 all components of the piping systems and drainage sump chambers including pipes, joints, fittings, welds, perforations, pipe boots, and caps.
 - .2 detail of gas vents.
 - .5 Details of seed mixture proposed for final cover and restored Old Dump.
 - .6 Details of fertilization and watering programme proposed for final cover and restored Old Dump.
 - .7 Details of the erosion control blankets to be provided.
 - .3 At least seven (7) days before the start of construction provide one set of laboratory test results for each of the following materials and the following parameters:
 - .1 Soil for Cell A Perimeter Berms, Waste Grading Layer, and Remedial Excavation Backfill:
 - .1 Grain size analysis including hydrometer.
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- .2 Water content of the soil at its in-situ source.
 - .3 Standard proctor analysis.
- .2 Sand for Gas Venting Layer
 - .1 Grain size analysis.
 - .2 Standard proctor analysis.
- .3 Clear Stone:
 - .1 Grain size analysis.
 - .2 L.A. Abrasion Test Analysis.
- .4 Granular Aggregates:
 - .1 Grain size analysis.
 - .2 Standard proctor analysis.
- .5 Topsoil:
 - .1 Organic matter per ASTM D2974.
 - .2 Physical Evaluation per ASTM D5268.

1.6 METHOD OF PAYMENT

- .1 Cell A Perimeter Berms. Payment for supply, placement, and compaction of soil for Cell A perimeter berms shall be based on the volume of materials completed in place in accordance with the Specifications and according to the final limits and grade shown in the Drawings. If the final limits and grade are changed by the Departmental Representative the volume for payment shall be based on the revised limits and grade. The tendered unit price shall include the following:
 - .1 purchase, loading, and haulage of material from their sources to the work area;
 - .2 processing and conditioning of material as specified, including removal of debris and moisture adjustment (moisture adjustment shall include the blending of wet soils with dry soils as required);
 - .3 variation in the characteristics of the soil sources;
 - .4 placement, spreading, and compaction;
 - .5 rough and fine grading including regrading to remove ruts, water and excessively wet material.
 - .6 any materials, labour, equipment, or other expense necessary for the construction of the Cell A perimeter berm in accordance with the Drawings and Specifications.
 - .2 Proof-Rolling. Payment for proof-rolling shall be paid on based on the area proof-rolled completed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the area for payment shall be based on the revised limits. The tendered unit prices shall include:
-

- .1 proof-rolling as specified;
 - .2 moisture adjustment;
 - .3 correction of soft spots including excavation of soft spots and placement, compaction, and grading of replacement material as required;
 - .4 any materials, labour, equipment, or other expense necessary for the proof-rolling in accordance with the Drawings and Specifications.

 - .3 Base Liner and Final Cover Anchor Trench. Payment for the anchor trench shall be paid on based on the linear length of trench competed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the length for payment shall be based on the revised limits. The tendered unit prices shall include:
 - .1 trench excavation;
 - .2 placement of base liner and final cover geosynthetics into the anchor trench;
 - .3 supply, placement, and compaction of anchor trench backfill;
 - .4 any materials, labour, equipment, or other expense necessary for the construction of the anchor trench in accordance with the Drawings and Specifications.

 - .4 Clear stone, 100 mm minus granular, 19 mm minus granular. Payment for haulage, placement and compaction granulars shall be based on the area of material completed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the volume for payment shall be based on the revised limits. The tendered unit prices shall include:
 - .1 purchase, loading, and haulage of material from their sources to the work area;
 - .2 placement, spreading; and compaction;
 - .3 rough and fine grading;
 - .4 moisture adjustment;
 - .5 special measures to prevent damage around pipes and other structures;
 - .6 special measures to prevent damage of geotextiles and geomembranes; and
 - .7 any materials, labour, equipment, or other expense necessary for the haulage and placement of granulars in accordance with the Drawings and Specifications.

 - .5 HDPE Pipes and Chambers. Payment for HDPE pipes shall be based on a Lump Sum basis for pipe supplied and installed in place in accordance with the Specifications and according to the limits and grade specified in the Drawings. The tendered price shall include:
-

- .1 the cost of supply of material including pipes, elbows, bends, caps, curved sections, and junctions;
 - .2 supply of pipes according to the diameters and DR values, and either perforated or non-perforated as specified;
 - .3 proper delivery, handling, and storage;
 - .4 laying and joining of pipes as specified;
 - .5 connections to supports;
 - .6 co-ordination with all other associated work; and
 - .7 any materials, labour, equipment, or other expense necessary for the supply and construction of the HDPE pipes in accordance with the Drawings and Specifications.
- .6 Cell A Grading Layer over Waste, Gas Venting Layer, Topsoil Layer. Payment for haulage, placement and compaction of the grading layer, gas venting layer and topsoil layers shall be based on the area of material completed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the volume for payment shall be based on the revised limits. The tendered unit prices shall include:
- .1 purchase, loading, and haulage of material from their sources to the work area;
 - .2 placement, spreading; and compaction;
 - .3 rough and fine grading;
 - .4 moisture adjustment;
 - .5 special measures to prevent damage around pipes and other structures;
 - .6 special measures to prevent damage of geotextiles and geomembranes; and
 - .7 any materials, labour, equipment, or other expense necessary for the haulage and placement of the specified layers in accordance with the Drawings and Specifications.
- .7 Backfill of Old Dump Remedial Excavation. Payment for backfilling of the remedial excavation shall be based on the volume of materials completed in place in accordance with the Specifications and according to the final limits and grade shown in the Drawings. If the final limits and grade are changed by the Departmental Representative the volume for payment shall be based on the revised limits and grade. The tendered unit price shall include the following:
- .1 purchase, loading, and haulage of material from their sources to the work area;
 - .2 processing and conditioning of material as specified, including removal of debris and moisture adjustment (moisture adjustment shall include the blending of wet soils with dry soils as required);
 - .3 variation in the characteristics of the soil sources;
 - .4 placement, spreading, and compaction;
-

- .5 rough and fine grading including regrading to remove ruts, water and excessively wet material; and
 - .6 any materials, labour, equipment, or other expense necessary for backfilling in accordance with the Drawings and Specifications.
- .8 Seeding. Payment for seeding shall be based on the area of seeding completed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the volume for payment shall be based on the revised limits. The tendered unit prices shall include:
- .1 purchase, supply, and spreading of seed mix;
 - .2 spreading;
 - .3 watering and fertilization;
 - .4 special measures to prevent damage around pipes and other structures;
 - .5 special measures to prevent damage of geotextiles and geomembranes; and
 - .6 any materials, labour, equipment, or other expense necessary for the seeding of the specified layers in accordance with the Drawings and Specifications.
- .9 Passive Gas Vents in Cell A Final Cover. Payment for gas vents shall be based on a Lump Sum basis for each vent supplied and installed in place in accordance with the Specifications and according to the limits and grade specified in the Drawings. The tendered price shall include:
- .1 the cost of supply of material including pipes, elbows, screens, an caps;
 - .2 sealing of penetrations through the final cover; and
 - .3 any materials, labour, equipment, or other expense necessary for the supply and construction gas vents in accordance with the Drawings and Specifications.
- .10 Excavation of Surface Water Ditches. Payment for the excavation of the surface water ditches shall be paid on based on the linear length of ditch competed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the length for payment shall be based on the revised limits. The tendered unit prices shall include:
- .1 ditch excavation;
 - .2 rough and fine grading;
 - .3 grade control; and
 - .4 any materials, labour, equipment, or other expense necessary for the construction of the surface water ditches in accordance with the Drawings and Specifications.
- .11 Erosion Control Blankets. Payment for erosion control blankets shall be according to the area that is actually covered by the blankets after installation
-

according to the limits and grades shown in the Drawings. If the final limits and grade are changed by the Departmental Representative the area for payment shall be based on the revised limits and grade. Materials constructed beyond the final limits and grades as specified shall not be measured for payment. The tendered unit prices shall include:

- .1 supply of erosion control blankets;
 - .2 delivery, handling, and storage on-site;
 - .3 all surface preparation required prior to installation;
 - .4 all labour and equipment for installation including connections and anchoring;
 - .5 all repair work;
 - .6 any material wastage; and
 - .7 any materials, labour, equipment, or other expense necessary for the supply and installation of erosion control blankets in accordance with Drawings and Specifications.
- .12 Fencing. Payment for the fencing shall be based on the linear length of fencing competed in place in accordance with the Specifications and according to the limits specified in the Drawings. If the final limits are changed by the Departmental Representative the length for payment shall be based on the revised limits. The tendered unit prices shall include:
- .1 purchase and supply of all fencing materials including fabric, poles, and all fasteners and hardware;
 - .2 setting of fence posts and conducting load test;
 - .3 attachment of fencing fabric; and
 - .4 any materials, labour, equipment, or other expense necessary for the construction of the fencing in accordance with the Drawings and Specifications.
- .13 Access Gates. Payment for the gates shall be based on a Lump Sum basis for gates competed in place in accordance with the Specifications and according to the limits specified in the Drawings. The tendered unit prices shall include:
- .1 purchase and supply of all gate materials including frames, fabric, and all fasteners and hardware;
 - .2 setting of gates;
 - .3 attachment of fencing fabric; and
 - .4 any materials, labour, equipment, or other expense necessary for the construction of the gates in accordance with the Drawings and Specifications.
-

Part 2 Materials

2.1 SOIL FOR CELL A PERIMETER BERM CONSTRUCTION, GRADING LAYER OVER WASTE, AND OLD DUMP REMEDIAL EXCAVATION BACKFILL

- .1 Soil as approved by the Departmental Representative or select native sand excavation spoil from Cell A.

2.2 SOIL FOR LANDFILL GAS VENTING LAYER

- .1 Select native sand excavation spoil from Cell A.
- .2 Sand to be screened or otherwise processed to be free of stones or debris greater than 100 mm in any dimension.

2.3 GRANULAR AGGREGATES

- .1 Granular aggregate shall be composed of inert, clean, tough, durable particles of crushed rock, gravels, sand and fines capable of withstanding the deleterious effects of exposure to water, freeze-thaw, handling, spreading and compacting. The aggregate particles shall be uniform in quality and free from clay lumps, wood and free from an excess of flat or elongated pieces. Screen granular to remove all stones in excess of maximum diameter specified. Gradation of aggregates shall be as follows:

- .1 100 mm Minus Granular

Sieve Designation	Percent Passing	
100 mm	--	100
75 mm	--	100
50 mm	70	100
25 mm	50	100
4.75 mm	22	100
2.36 mm	10	85
0.075 mm	2	8

- .2 19 mm Minus Granular

Sieve Designation	Percent Passing	
19 mm		100
12.5 mm	75 –	100
9.5 mm	60 –	90
4.75 mm	40 –	70
2.36 mm	27 –	55
1.18 mm	16 –	42
0.600 mm	8 –	30
0.300 mm	5 –	20
0.075 mm	2 –	8

- .3 CLEAR STONE: Uniformly graded clear stone, 50 mm diameter. L.A. Abrasion test result: 40% loss or less.

2.4 TOPSOIL

- .1 Mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
- .2 Soil texture to consist of 20 to 70 % sand, minimum 7 % clay, and contain 5 to 15 % organic matter by weight.
- .3 Contain no toxic elements or growth inhibiting materials.
- .4 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material greater than 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .5 Consistency - friable when moist.

2.5 SEED

- .1 Mixture of grass varieties native to northern Alberta.
- .2 Draught resistant.
- .3 Provides good soil retention.
- .4 Mixture to the satisfaction of the Departmental Representative.

2.6 LEACHATE COLLECTION PIPE AND SUMP CHAMBER

- .1 200 mm, DR9 high-density polyethylene (HDPE) perforated and non-perforated pipes with the following properties:
 - .1 Where approved by the Departmental Representative, 8 inch nominal size DR9 pipe may be substituted for 200 mm size.
 - .2 The pipe is made from a polyethylene resin compound with a minimum cell classification of 345464C as defined in ASTM D3350.
 - .3 The pipe is made from materials meeting the designation of PE3408 or PE3608 as assigned by the Plastic Pipe Institute.
 - .4 The pipe material shall contain minimum 2% of well dispersed carbon black as UV stabilizer.
 - .5 The pipe shall be supplied by a manufacturer with a proven track record of producing quality HDPE pipes.
 - .6 Classification shall be marked on the pipe.
 - .7 Perforated piping as per Drawings.
 - .8 HDPE End caps, couplings, elbows, T-sections manufactured for use with the 200 mm DR9 pipe.
-

- .2 Sump Chambers shall be composed of HDPE 500 mm non-perforated DR9 piping with the following properties:
 - .1 The pipe is made from a polyethylene resin compound with a minimum cell classification of 345464C as defined in ASTM D3350.
 - .2 The pipe is made from materials meeting the designation of PE3408 or PE3608 as assigned by the Plastic Pipe Institute.
 - .3 The design hydrostatic stress at 23 deg. C shall be minimum 800 psi (5.5 MPa).
 - .4 The pipe material shall contain minimum 2% of well dispersed carbon black as UV stabilizer.
 - .5 HDPE End caps, couplings, elbows, T-sections manufactured for use with the 500 mm DR9 pipe.
 - .6 The pipe shall be supplied by a manufacturer with a proven track record of producing quality HDPE pipes.
 - .7 Classification shall be marked on the pipe.

2.7 CULVERTS

- .1 Nominal diameters 600 mm (for culvert at Road 58) and 450 mm (for culvert at Cell A).
- .2 Manufactured from high quality, hot dipped zinc Steel Pipe coated culvert sheet. Culvert to be #14 gauge and are to be of helical lock-seam CSP with 68 mm x 13 mm corrugation profile.
- .3 Provided and installed with a galvanized apron end section at both ends. Galvanized end sections shall be of approved manufacture to match size and style of culvert.

2.8 EROSION CONTROL BLANKETS

- .1 Blanket consisting of a layer of 100% straw fiber stitched between biodegradable natural fiber top and bottom nets.
- .2 Nets composed of biodegradable jute fibre.
- .3 Fully biodegradable thread.
- .4 Rated for 12 months of erosion protection and mulching.
- .5 Weight of top and bottom nets between 3.7 to 4.5 kg/100 m².
- .6 Straw fiber weight approximately 0.27 kg/m².

2.9 LANDFILL GAS VENTS

- .1 300 mm diameter stainless steel, with stabilizing collar and cap w/ bird screen.
 - .2 Perforated section for installation within sand gas venting layer.
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2.10 PERMANENT FENCING

- .1 Wood Posts
 - .1 Straight peeled jack pine or lodgepole pine 4300 mm long with a minimum tip diameter of 150 mm and a maximum butt diameter of 200 mm. The bottoms of the wood posts must be tapered to a rounded end for driveability. Round wood posts shall be treated in accordance with CSA O80-97, and in particular, CSA O80.5-97 Preservative Treatment of Posts by Pressure Processes. Sawn timber posts and members shall be treated for ground contact in accordance with CSA O80-97, and in particular, CSA O80.2-97 Preservative Treatment of Lumber, Timber, Bridge Ties and Mine Ties by Pressure Processes.
- .2 Preservative Treatment for Protecting Field Cut Wood and Bolt Holes
 - .1 Field cuts and bolt holes shall be protected in accordance with AWWA Standard M4. The colour of the preservative treatment used for protecting field cut wood and bolt holes shall match the original preservative treatment colour, where possible.
- .3 Fabric
 - .1 Fence fabric shall be 2.44 m (8 ft) high with 150 mm (6 in) horizontal and graduated vertical spacing, 12.5 gauge high tensile wire with a twisted friction type joint at each horizontal/vertical contact point. The fence fabric will have a minimum of 20 horizontal wires, with graduated vertical spacing ranging from 7.62 cm (3 inches) at the bottom to 17.78 cm (7 inches) at the top. The fence material will be galvanized to a retention of not less than Class 3 coating, 240 g/m². The horizontal wires will have a minimum tensile strength of 1234 MPa (179 ksi).

2.11 ACCESS CONTROL GATE

- .1 Double swing gate spanning entire width of entrance.
- .2 Galvanized steel-framed gate with either 11 gauge, 50 mm wire mesh or fence fabric noted in this specification.
- .3 Galvanized hinges, ties, and fittings.

Part 3 Execution

3.1 EXISTING CONDITIONS

- .1 Before commencing work verify location of buried services on and adjacent to site.

3.2 GENERAL REQUIREMENTS

.1 Drainage of Water and Prevention of Contamination

- .1 Keep area free of standing water at all times during the Contract period. Discharge points are to be agreed with the Departmental Representative prior to any discharge occurring.
- .2 Take measures to ensure that no contamination will take place of the natural ground and surface water as a result of run-off from the works.
- .3 Fuel tanks and drums stored at a location approved by the Departmental Representative.

.2 Inclement Weather

- .1 Inclement weather may comprise high winds, rain, snow, freezing, excessive temperatures or a combination of these conditions.
- .2 When weather conditions are such that the quality of the Works may be impaired or the conditions of the materials impaired then the Works will be stopped, as directed by the Departmental Representative.
- .3 Make good any works carried out in inclement weather conditions that have been adversely affected.

.3 Finished Tolerances

- .1 Within plus or minus 15 mm of specified grade and cross-section but not uniformly high or low.
- .2 Ensure finished subgrade surface has no irregularities exceeding 15 mm when checked with a 3 m straight edge placed in any direction.
- .3 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.4 Preparation and Protection

- .1 Protect excavations from freezing.
 - .2 Do not place frozen soil.
 - .3 Protect soil, sand, and granular stockpiles from freezing.
 - .4 Seal stockpiles of soil at the end of each working day by crowning pile to shed runoff and packing stockpile surface with compactor or dozer tracking.
 - .5 Keep excavations clean, free of standing water, and loose soil.
 - .6 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
 - .7 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.
 - .8 Protect buried services that are required to remain undisturbed.
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3.3 COMPLETION OF CELL A EARTHWORKS AND SURFACE WATER DITCHES

- .1 Assume full responsibility for, and execute complete layout of Cell A and ditches to locations, lines, and grades indicated on Drawings.
- .2 Carry out topographic survey in Cell A base to confirm existing grades.
- .3 Carry out additional excavation in Cell A as required. Carry out ditch excavation. Do not disturb soil beneath grades shown.
- .4 Notify Departmental Representative when excavations are complete.
- .5 Following confirmation of excavation grades, adjust soil moisture to within 2% of optimum moisture content prior to compaction. Compact base and side-slopes of Cell A excavation, and surface water ditches, to achieve 95% Standard Proctor Density.
- .6 Conduct further compaction to achieve 98% Standard Proctor Density in Cell A sump area.
- .7 Any soft spots identified in the excavated surface shall be excavated and backfilled, or compacted, at the discretion of the Departmental Representative.
- .8 Place replacement fill in 150 mm lifts and compact each lift to minimum 95% Modified Proctor density within 2% of optimum moisture content.
- .9 Build perimeter berms by filling in 150 mm lifts. Compact each lift to minimum 95% Modified Proctor density, within 2% of optimum moisture content.
- .10 Following compaction, smooth-roll Cell A, ditches, and berm surface to create a smooth surface free from ruts to the satisfaction of the Departmental Representative.

3.4 HDPE PIPING AND SUMPS IN CELL A

- .1 Piping
 - .1 Install plastic pipe and fittings in accordance with CSA B182.11.
 - .2 Ensure granular materials or debris does not enter pipes during installation. Temporarily cover open pipe ends with geotextile to prevent granular entry.
 - .3 Join pipe sections in accordance with manufacturer's recommendations and as accepted by the Departmental Representative.
 - .4 Install slip-fit end caps on all pipe ends.
 - .2 Sumps
 - .1 Place sump chamber as shown in Drawings.
 - .2 Exercise extreme caution when placing chamber base to prevent damage to underlying geotextile and geomembrane.
-

- .3 Place minimum of 100mm 19 MM minus gravel on geotextile surface beneath sump and compact to minimum 95% Standard Proctor Density. Bedding, laying and jointing in accordance with the specification and manufacturers recommendations.
- .4 Construct sumps in general accordance with the lines, grades and locations specified on the drawings. Culverts are to be field fitted by the Contractor to reflect actual conditions encountered on site and approved by the Departmental Representative.
- .5 Place 50 mm clear stone in layers alternately on each side of the sump so as not to displace it. Compact each layer to a minimum 95% Standard Proctor density taking special care to obtain required density under haunches.

3.5 PLACEMENT OF GRANULAR DRAINAGE MEDIA CELL A BASE AND FINAL COVER

- .1 Place clear stone to cover the geotextile within time limits in accordance with Specification 31 32 19.03.
- .2 Ensure granular placement is carried out in a manner which does not damage or disturb the geotextile and work below.
- .3 Prevent equipment or vehicle traffic directly on the exposed geotextile.
- .4 Build up and maintain minimum 1 m thick layer of granular beneath vehicles delivering granular to Cell A.
- .5 Place granular material in loose lifts of maximum 0.3 m thickness using low ground pressure equipment fitted with a toothless blade or bucket.
- .6 Spread granular material in a fan shape pattern, lifting the dozer or excavator blade or bucket gradually as granular material is spread.
- .7 Avoid spinning tracks and sharp turns when operating equipment.
- .8 Place granular material from bottom to top on slopes.
- .9 Use one or more workers as spotters at granular placement location, to watch for and eliminate formation of wrinkles in geotextile and underlying geomembrane.
- .10 Isolate and cover small wrinkles as quickly as possible to prevent their growth.
- .11 Prevent wrinkles from being folded over.
- .12 Where damage is suspected, notify Departmental Representative immediately. Stop placement operation, remove granular material from suspected areas by careful excavation using a spotter at the excavation face. Inspect geotextile for damage.

3.6 PLACEMENT OF GRADING LAYER OVER WASTES AND GAS VENTING LAYER

- .1 Proof roll final waste surface with minimum of 5 passes of 15 tonne sheepfoot roller.
 - .2 Haul and place a 0.2 m layer of grading soil over entire regraded waste surface. Compact soil with minimum 4 passes of a smooth drum roller. Place additional soil, as required, to eliminate any waste visible at surface.
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- .3 Ensure final surface of grading soil is smooth and free from ruts, troughs, or depressions to the satisfaction of the Departmental Representative.
- .4 Haul and place a 0.2 m gas venting layer over entire regraded waste surface. Compact with 4 passes of a smooth drum roller.
- .5 Construct final cover system as per Specifications and as shown in Drawings.

3.7 CELL A GAS VENTS

- .1 Install vents after placement of LLDPE geomembrane and overlying cushion geotextile.
- .2 Cut opening through geomembrane and drill to required depth for firm anchoring of vent in underlying layers.
- .3 Ensure perforated portion of vent is situated within sand gas venting layer.
- .4 Backfill around vent with sand and compact.
- .5 Repair geomembrane and geotextile as per Specifications.
- .6 Minimize disturbance of vent during placement of subsequent final cover layers and ensure vent is plumb.

3.8 BACKFILLING OF REMEDIATED OLD DUMP

- .1 Upon completion of excavation of all waste materials and confirmatory sampling, and confirmation that the excavation has been remediated, backfill excavation.
- .2 Place backfill in maximum 0.3 m thick lifts and compacted to 95% Standard Proctor Density for the backfill material.

3.9 TOPSOIL

- .1 Topsoil for Cell A final cover shall be 500 mm thick, measured in place.
 - .2 Topsoil for Restoration of Old Dump shall be 150 mm thick, measured in place.
 - .3 Place topsoil after Departmental Representative has accepted subgrade.
 - .4 Spread topsoil in one uniform layer.
 - .5 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
 - .6 Consolidate topsoil using equipment approved by Departmental Representative.
 - .7 Leave surfaces smooth, uniform and firm against deep footprinting.
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3.10 PLACEMENT OF EROSION CONTROL BLANKETS

- .1 Prepare grade soil surface smooth to design profile and remove debris and large rocks and place topsoil.
- .2 Seed before the placement of blanket.
- .3 Dig a 150 mm x 150 mm anchor trench both up-slope and down-slope of the area to be covered.
- .4 Secure the blanket with staples in the trenches every 0.3 m and backfill and compact. Ensure staples to not damage LLDPE cover layer.
- .5 Roll the blankets vertically down the slope or in the direction of flow for channels.
- .6 Staple the blanket at 0.6 m horizontal and vertical spacing.
- .7 Overlap blankets 150 mm at all sides and staple. Place downslope blanket underneath upslope blanket to form a shingle pattern. Install additional staples to ensure blanket is sufficiently secured.
- .8 Ensure intimate contact between blanket and soil.

3.11 SEEDING

- .1 Apply seed to topsoil surfaces of Cell A Final Cover and Remediated Old Dump.
- .2 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .4 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.
- .5 Fertilize and water during establishment and until acceptance according to an agreed upon program between the Contractor and Departmental Representative.
- .6 Reseed dead or bare spots to allow establishment of vegetation until acceptance by Departmental Representative.
- .7 Seeded areas will be accepted by Departmental Representative when plants are uniformly established and seeded areas are free of rutted, eroded, bare or dead spots.

3.12 PLACEMENT OF GRANULARS FOR CELL A ACCESS ROADS

- .1 General Requirements
 - .1 Road Construction will generally comprise of the following materials unless specified otherwise:
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Material	Material	Thickness (mm)	Special Requirements
FINISHING	Rolled and crowned 3% cross fall		
GRANULAR SURFACE COURSE	19mm minus gravel	50	Placed and compacted as specified
GRANULAR BASE COURSE	100 mm minus gravel material	300	2 layers of 150mm thickness, compacted as specified
GEOTEXTILE	As specified in 31 32 19.01		
SUBGRADE	Proof rolled and tested		

.2 Preparation of Subgrade

- .1 Defer final excavation to subgrade level until immediately before compaction of subgrade.
- .2 Soft spots must be brought to the attention of the Departmental Representative. Obtain instructions before proceeding.
- .3 Subgrade must be dry at time of compaction.
- .4 Compact subgrade with minimum of three (3) passes of 15 tonne sheepsfoot compactor, or to satisfaction of Departmental Representative.
- .5 Where use of a roller is impractical use a suitable mechanical tamper.
- .6 Where local excavation and backfilling has taken place make additional passes of the roller.
- .7 The completed surface of the sub-grade shall conform to the line, grade and cross section to an accuracy ± 50 mm, neither uniformly high nor low.
- .8 Place separator geotextile in accordance with 31 32 19.01.

.3 Placement and Compaction of Granulars

- .1 Do not place granular base until finished subgrade surface, and the geotextile, is inspected and approved by the Departmental Representative.
- .2 Place material only on clean unfrozen surface, properly shaped and compacted and free from snow or ice.
- .3 Begin spreading base material on crown line or on high side of one-way slope.
- .4 Place base material using methods which do not lead to segregation or degradation of aggregate.

- .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Departmental Representative may authorise thicker layers if specified compaction can be achieved.
- .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .7 Remove and replace portion of any layer in which material has become segregated during spreading.
- .8 Compact to density not less than 95% Standard Proctor density.
- .9 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .2 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction.
- .3 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
- .4 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.13 INSTALLATION OF CULVERTS

- .1 Place minimum of 100mm of 19 mm minus gravel as bedding on bottom of excavation and compact to minimum 95% Standard Proctor Density. Bedding, laying and jointing in accordance with the specification and manufacturers recommendations.
- .2 Construct culverts in general accordance with the lines, grades and locations specified on the drawings. Culverts are to be field fitted by the Contractor to reflect actual conditions encountered on site and approved by the Departmental Representative.
- .3 Place 100 mm minus gravel in 150 mm thick full width, alternately on each side of the culvert so as not to displace it. Compact each layer to a minimum 95% Standard Proctor density taking special care to obtain required density under haunches. Protect installed culvert with minimum 600mm of compacted fill before heavy equipment is permitted to cross during construction of the project. Width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1 in 2.

3.14 CELL A FENCING AND ACCESS CONTROL GATE

- .1 Install wood posts plumb and to a depth of 1500 mm.
 - .2 Posts may be either driven or set in excavated holes, provided that a rigid installation is achieved, capable of withstanding a horizontal load of 32 kg (70 lb), applied 1.5 m above the ground, in any direction in the horizontal plane, without any movement in excess of 25 mm.
 - .3 When a wood post is set in an excavated hole, compact soil around the wood post to the satisfaction of the Departmental Representative.
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- .4 Conduct load test after the post is installed but before the fabric wire is attached.
- .5 Record load test and submit to the Departmental Representative.
- .6 Adjust gate lock assemblies to work in the field.
- .7 Set gates to achieve a minimum of 150mm clearance from the ground.

Part 4 Quality Control/Quality Assurance

4.1 CONTRACTOR'S QUALITY CONTROL

- .1 Provide field quality control for compaction of various materials in accordance with the following:
 - .1 Following proof-rolling of Cell A (side slopes, base, and sump), surface water ditches, and Cell A access road: minimum one test per 625 m².
 - .2 Following placement of fill for correction of soft spots in Cell A, surface water ditches, and Cell A access road: Minimum one test per lift per 625 m² of berm constructed
 - .3 Cell A perimeter berm construction: Minimum one test per lift per 625 m² of berm constructed.
 - .4 Granular roadways: Minimum one test per lift per 625 m² of roadway constructed.
 - .5 Backfill in remedial excavation: Minimum one test per lift per 625 m² of backfill placed
- .2 Provide field topographic survey control to measure volume of materials removed from remedial excavation and volume of materials placed in Cell A. On a daily basis measure volumes removed from excavation and volume placed and provide written record of these volumes to Departmental Representative.
- .3 Provide field quality control for compaction of remedial excavation backfill, at a minimum frequency of one test per 625 m² for each lift placed.
- .4 Provide confirmatory laboratory analysis for the following parameters:
 - .1 Soil for backfill of remedial excavation within three (3) days of request of Departmental Representative (allowance for two sets of tests):
 - .1 Grain size analysis.
 - .2 Water content of the soil at its in-situ state.
 - .3 Standard proctor analysis.
 - .2 All Granular Aggregates (every 350 m³ material placed):
 - .1 Grain size analysis.
 - .2 Standard proctor analysis.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Prepare suspect waste holding area.
- .2 Excavation of waste from Garden River Old Dump and placement in Cell A.
- .3 Disposal of hazardous wastes at licensed off-site facility.

1.2 RELATED SECTIONS

- .1 Section 31 12 10 Landfill Construction Requirements.
- .2 Section 31 32 19.01 Geosynthetic Clay Liner (GCL).
- .3 Section 31 32 19.02 HDPE and LLDPE Geomembrane.
- .4 Section 31 32 19.03 Geotextile.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 At least 21 days after Award of Contract submit an Excavation Work Plan to the Departmental Representative that addresses:
 - .1 Schedule of Activities.
 - .2 Method of excavation and equipment to be used.
 - .3 Features of equipment to limit generation of sparks during excavation.
 - .4 Excavation Sequencing Plan.
 - .5 Shop drawings showing details and proposed location of Suspect Waste Holding Area.
 - .6 Excavation Support and Protection Plan.
 - .7 Water Management Plan.
 - .8 Storage methods and locations for suspect or liquid wastes encountered.
 - .9 Method for safely removing suspect or liquid wastes and haulage to a licensed disposal facility.
 - .10 Methods for reducing size of encountered waste materials prior to placement in Cell A.
 - .11 Method for placement of waste in Cell A so that damage to liner system is prevented.
 - .12 Proposed temporary haul routes.
 - .13 Method to decommission Suspect Waste Holding Area.
 - .14 Facility to be used for disposal of hazardous wastes.
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- .15 Chain of custody procedures for shipment of hazardous wastes.
- .3 No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved by the Departmental Representative.
- .4 No adjustment for time or money shall be made if re-submittals of the Work Plan are required.
- .5 Submit to Departmental Representative as excavation proceeds:
 - .1 Written record of volume of waste removed from excavation and volume placed in Cell A.

1.4 METHOD OF PAYMENT

- .1 Suspect Waste Holding Area. Payment shall be a Lump Sum for preparation of the suspect waste holding area in accordance with the Specifications and Drawings. The tendered Lump Sum price shall include:
 - .1 earthworks to prepare the bermed holding area;
 - .2 supply and installation of sand cushion layer;
 - .3 supply and installation of 80 mil smooth HDPE liner;
 - .4 supply and installation of 16oz cushion geotextile;
 - .5 supply and installation of 19 mm thick plywood sheeting;
 - .6 supply of overpack drums; and
 - .7 any materials, labour, equipment, or other expense necessary for the preparation of the holding area in accordance with the Drawings and Specifications.
 - .2 Excavation of Waste from Old Dump and Placement in Cell A. Payment shall be based on the volume of waste placed in Cell A. Measurement will be made by topographic survey of Cell A wastes after placement, compaction, and grading. The ultimate extent of removal will be determined based on confirmatory sampling by the Departmental Representative. If the final limits are changed by the Departmental Representative the volume for payment shall be based on the revised limits. The tendered unit prices shall include:
 - .1 excavation, loading, and hauling to Cell A;
 - .2 breaking down of size of wastes for suitable placement in Cell A;
 - .3 placement of initial and subsequent lifts of waste in Cell A in accordance with the specification;
 - .4 rough and fine grading of the waste in Cell A;
 - .5 topographic control at both the excavation area and at Cell A;
 - .6 standby time for labour and equipment, if required, until Departmental Representative conducts confirmatory sampling and confirms extent of remedial excavation;
 - .7 dismantling of the suspect waste holding area and transfer of materials to Cell A; and
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- .8 any materials, labour, equipment, or other expense necessary for the removal of the waste from the Old Dump and haulage, placement and compaction in Cell A in accordance with the Drawings and Specifications.
- .3 Disposal of hazardous wastes at licensed off-site facility. Disposal of hazardous wastes shall be paid on the basis of tonnes of material disposed of at a licensed facility. The tendered unit prices shall include:
 - .1 preparatory administrative procedures to identify suitable facilities and establish proper approvals including chain of custody procedures;
 - .2 removal of wastes from the excavation, and transfer to the suspect waste holding area for further examination and confirmatory sampling;
 - .3 packaging of wastes in preparation for loading;
 - .4 haulage to disposal facility, including management of chain of custody procedures;
 - .5 payment of all associated disposal fees;
 - .6 tracking of tonnage of material disposed;
 - .7 standby time for labour and equipment, if required, until Departmental Representative conducts confirmatory sampling and confirms nature of suspect waste; and
 - .8 any materials, labour, equipment, or other expense necessary for the removal of hazardous waste from the Old Dump and haulage and disposal at a licensed off-site facility, in accordance with the Drawings and Specifications.

Part 2 Materials

2.1 WASTE TO BE EXCAVATED

- .1 The following information on the wastes contained in the Garden River Old Dump is appended to these Specifications:
 - .1 Data Gap Assessment – Garden River Old Dump Sites, Garden River, Alberta. Prepared by SLR Consulting, September 2016..
 - .2 Detailed Site Assessment – Garden River Old Dump in Wood Buffalo National Park. Prepared by Columbia Environmental Consulting Ltd. and Franz Environmental Inc. February 2011.
 - .3 Contaminated Site Assessment Initial and Detailed Testing Programs, Wood Buffalo National Park, Various Locations in the Community of Garden River, Alberta. Prepared by EBA. February, 2009.
 - .2 The Contractor is advised that site conditions may be different than documented in these reports. In particular, the Contractor is advised that the waste to be excavated may contain suspect or liquid waste which may not be placed in Cell A.
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2.2 EQUIPMENT

- .1 All cabs of equipment used for the excavation of waste and placement of waste in Cell A shall be enclosed and have a standard air filtration system. Air filtration systems shall be operational at all times during waste excavation.
- .2 Edges of excavator buckets or dozer blades shall be toothless and equipped with heavy gauge brass plate to minimize potential for sparking on stones or other debris encountered in the remedial excavation or Cell A.
- .3 Haulage truck boxes and tailgates shall be watertight such that release of soil or liquids from the box during haulage activities is prevented to the satisfaction of the Departmental Representative.
- .4 Dozers used to maneuver and place waste in Cell A shall exert a ground pressure of no more than 35 KPa.
- .5 Provide pad foot compactor to compact waste in Cell A.

Part 3 Execution

3.1 PREPARATION/PROTECTION

- .1 Keep excavations free of standing water.
- .2 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.
- .3 Protect buried services that are required to remain undisturbed.

3.2 SUSPECT WASTE HOLDING AREA

- .1 Prepare Suspect Waste Holding Area prior to commencing excavation as per Specifications.
 - .2 Prepare suspect waste holding area adjacent to the Old Dump, in a location as approved by the Departmental Representative.
 - .3 Suspect Waste Holding Area:
 - .1 10 m x 10 m footprint area, situated immediately adjacent to the Old Dump footprint.
 - .2 Perimeter of holding area delineated by a compacted earthen berm 0.5 m high. Clean native soils may be used for constructing berm.
 - .3 Surface of berm and holding area proof-rolled with smooth-drum roller to create a smooth, unbroken surface free of irregularities greater than 5 cm deep.
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- .4 Berm and holding area surface inspected and any debris, wood, stones greater than 1 cm in any dimension removed.
- .5 100 mm thick layer of native sand excavation spoil from Cell A area to be spread over ground surface to provide additional cushioning. Surface of sand to be rolled with a minimum 4 passes of a smooth drum roller to create a smooth, unbroken surface free of any visible irregularities or ruts.
- .6 Surface of berm and holding area lined with a smooth, 80 mil high density polyethylene liner. Liner supply and installation as per Section 32 31 19.02.
- .7 Geomembrane liner overlain with 16oz cushioning geotextile. Geotextile supply and installation as per Section 32 31 19.03.
- .8 Geotextile surface within holding area to be protected with 19 mm thick plywood sheeting laid on the geomembrane surface. Plywood sheets to be tight fit with adjacent sheets.
- .9 Provide a minimum of 10 x 85 gallon over-pack drums with removable lids.
- .10 Decommission Suspect Waste Holding Area after completion of Old Dump remedial excavations.

3.3 TEMPORARY ROADS AND ACCESS RAMPS

- .1 Construct and maintain all temporary access roads and ramps into and within Cell A to allow efficient waste placement to the satisfaction of the Departmental Representative.
- .2 Relocate temporary access roads as appropriate to suit the waste placement operations.

3.4 WASTE EXCAVATION

- .1 Confirm area and depth of required excavation with Departmental Representative prior to commencing excavation.
 - .2 Excavate in a manner that limits spills and the potential for waste to come into contact with clean material.
 - .3 Load excavated waste directly into trucks and haul to Cell A for placement subject to segregation requirements specified herein. Load waste to minimize spillage outside of truck boxes.
 - .4 Completely tarp each load before permitting truck to leave loading area.
 - .5 For the initial layer of waste to be placed in Cell A (1 m thickness), select or process waste to be particles no larger than 100 mm.
 - .6 Utilize a spotter at the excavation area to identify oversize materials.
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- .7 Sealed drums, boxes and other containers encountered in the excavation shall be removed intact wherever possible and transferred to the Suspect Waste Holding Area for examination or sampling by the Departmental Representative.
- .8 Entry into excavations shall be limited to required personnel only. If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by applicable legislation.
- .9 Suspend excavation during periods of rain, snow, or prolonged freezing temperatures, at the discretion of the Departmental Representative.

3.5 SUSPECT WASTE MATERIALS

- .1 Segregate suspect or liquid wastes in accordance with submitted work plans approved by the Departmental Representative.

3.6 OVERSIZED MATERIALS

- .1 Oversized items shall be temporarily stockpiled at a location designated by the Departmental Representative for processing prior to being transported to Cell A.
- .2 Disassembling, crushing, cutting and/or similar suitable methods shall be carried out at the oversized items stockpile area where it is practicable to reduce voids in these items.
- .3 Items shall be processed by such suitable method(s) so that when they are placed in Cell A, spaces around and between them can be filled easily with other waste.

3.7 PLACEMENT OF INITIAL LAYERS OF WASTE IN CELL A

- .1 Place an initial layer of select/processed soil in Cell A to protect the base liner system. This initial layer shall not contain materials with any dimension exceeding 100 mm and shall be minimum 1.0 m thick.
 - .2 This initial layer shall be built up in two lifts, each 0.5 m thick, using a low ground pressure (maximum 35 kPA) tracked bulldozer.
 - .3 Wastes shall be placed so that the liner and drainage sump is not damaged or disturbed.
 - .4 Compact initial lift by tracking with low ground pressure bulldozer.
 - .5 After placement of the first 500 m² of the initial lift, hand-dig minimum of three test pits down to level of geotextile to confirm no damage to geotextile and geomembrane has occurred.
 - .6 Haulage trucks will only be permitted to travel on the surface of waste being placed in the cell where a minimum 1 m thick of waste has first been placed. Increase the thickness of the buffer layer if any evidence of rutting is observed at
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the interface between the soil and the underlying geotextile, as determined by the Departmental Representative.

- .7 The dozer operator shall be assisted at all times by a spotter on the ground to help confirm that the proper buffer thickness is being maintained and to spot for oversized debris in the waste.
- .8 In manoeuvring equipment when placing waste, exercise extreme care not to damage the underlying geotextile and geomembrane by avoiding spinning tracks and sharp turns. If unintentional track spinning or sharp turning of the dozer occurs, or if such occurrences are evident from the track patterns, the Departmental Representative shall be immediately be notified. The waste in the affected area shall be carefully removed and the geotextile and/or geomembrane inspected for potential damage. Where damage is identified, perform repairs following the relevant procedures in these Specifications, to the satisfaction of the Departmental Representative.

3.8 PLACEMENT OF SUBSEQUENT LAYERS OF WASTE

- .1 Each layer placed after the initial layer shall be typically 0.5 m thick. Wastes that are weak or soft shall be placed in thinner layers as necessary to maintain stability.
- .2 Distribute debris to minimize voids and to maximize packing of wastes around debris pieces.
- .3 Mix wastes of different properties by selective loading to haulage trucks, or during spreading of the waste to improve the physical properties of weak or soft materials.
- .4 Different types of waste shall be placed randomly where practicable to achieve a good spatial distribution to create a more homogeneous waste mass and to minimize differential settlement.
- .5 Compact wastes by three passes of a compactor except where the slope or the waste is not stable enough to support the equipment.
- .6 Grade final surface of waste in Cell A to form the specified slopes toward the perimeter of the cell, to the satisfaction of the Departmental Representative. Grade reversals (e.g. depressions) shall be eliminated.
- .7 Final surface of waste in Cell A shall be rolled with 5 passes of a minimum 15 tonne smooth drum roller to form a smooth surface free from ruts, troughs, or depressions to the satisfaction of the Departmental Representative.

3.9 INSPECTION AND DECONTAMINATION PROCEDURES

- .1 Inspect each haulage vehicle for waste or contaminated materials adhered to outside body, undercarriage, and tires.
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- .2 Decontaminate equipment, vehicles, and tools that come into contact with waste materials at equipment decontamination facility before permitting removal or exit from excavation area.

Part 4 Quality Control/Quality Assurance

4.1 CONTRACTOR'S QUALITY CONTROL

- .1 Provide field topographic survey control to measure volume of materials removed from excavation and volume of materials placed in Cell A. On a daily basis measure volumes removed from excavation and volume placed and provide written description of materials moved and record of these volumes to Departmental Representative.
- .2 Inventory, updated daily, of all hazardous materials segregated for shipment and disposal off-site.
- .3 Chain of custody information and disposal tickets for hazardous material disposed at off-site facility. Submit as information as received.

4.2 DEPARTMENTAL REPRESENTATIVE'S QUALITY ASSURANCE

- .1 Departmental Representative will oversee the excavation and waste removal. Departmental Representative will collect soil samples at the estimated final extent (walls and base) of the excavations and submit samples for laboratory analysis. Sampling will be conducted on a 5 m grid at 1 m depth intervals or as required to provide adequate sampling coverage.
 - .2 Organize excavation activities as follows:
 - .1 Suspend excavation work to permit sampling by Departmental Representative. Provide assistance to Departmental Representative in collecting soil samples through provision of hand labour and excavator time, as directed.
 - .2 Suspend excavation work in area where samples have been collected to permit shipment of samples to laboratory and receipt of laboratory analyses. Contractor is advised that receipt of laboratory analyses may be seven (7) days following sample recovery or longer.
 - .3 Departmental Representative will delineate area where excavation work to be suspended.
 - .4 Contractor is advised that several iterations of excavation suspension, and confirmatory sampling, may be required in any area until Departmental Representative can confirm that final extent of excavation has been reached.
 - .3 Cost of sampling and laboratory analysis to be borne by Departmental Representative.
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- .4 Cost of sampling assistance (labour and machine time), and delays due to awaiting receipt of sample results as well as iterative sampling, to be borne by Contractor.
- .5 Do not backfill any excavation without the approval of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Supply and installation of Geosynthetic Clay Liner (GCL) in the base liner systems of Cells A and B.

1.2 RELATED SECTIONS

- .1 Section 31 12 10 Landfill Construction Requirements.
- .2 Section 31 12 15 Removal of Waste from Old Dump.
- .3 Section 31 32 19.02 HDPE and LLDPE Geomembrane.
- .4 Section 31 32 19.03 Geotextile.

1.3 REFERENCES

- .1 Society for Testing and Materials International (ASTM)
 - .1 ASTM D5261-92(2003), Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
 - .2 ASTM D5887-09, Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens using a Flexible Wall Permeameter.
 - .3 ASTM D5888-06, Standard Guide for Storage and Handling of Geosynthetic Clay Liners.
 - .4 ASTM D5890-06, Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.
 - .5 ASTM D5891-02, Standard Test Method for Fluid Loss of Clay Mineral Component of Geosynthetic Clay Liners.
 - .6 ASTM D5993-99(2004), Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners.
 - .7 ASTM D6072-09, Standard Practice for Obtaining Samples of Geosynthetic Clay Liners.
 - .8 ASTM D6243-09, Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.
 - .9 ASTM D6496-RevA, Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.
 - .10 ASTM D6766-09, Standard Test Method for Evaluation of Hydraulic Properties of Geosynthetic Clay Liners Permeated with Potentially Incompatible Liquid.
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- .11 ASTM D6768-04, Tensile Strength of Geosynthetic Clay Liners.

1.4 SUBMITTALS

- .1 All submittals are to be made to the Departmental Representative. Submittals are to be in accordance with Section 01 33 00.
- .2 At least 90 days prior to delivery of the GCL to the site:
- .1 Submit qualifications of the GCL Manufacturer. The GCL manufacturer selected for use on this project shall have successfully produced at least 1,000,000 square metres of needle-punched thermally reinforced GCL.
 - .2 Product details of GCL to be provided, including minimum average roll values from Manufacturer's testing for all parameters listed in Table 31 32 19.01-1.
 - .3 Manufacturer's letter of certification that GCL to be supplied is in conformance with specification, signed by the quality control manager.
 - .4 Name, location, and contact information of laboratory independent of GCL manufacturer to be used for independent laboratory testing of GCL.
 - .5 Submit GCL sample to Departmental Representative for independent conformance testing. Sample shall be obtained and packaged in accordance with ASTM D6072. Sample is to be full width by 1 m long.
 - .6 Submit written certification that components and the finished GCL are in compliance with this Specification and including certification that the GCL production includes continuous inspection for broken needles using full-width metal detector, and removal by hand or in-line full width magnet.
- .3 At least 60 days prior to delivery of the GCL to the site:
- .1 Results of independent conformance testing for parameters and frequencies in Table 31 32 19.01-1.
 - .2 Submit results of two (2) GCL/permeant compatibility tests as performed under the responsibility of the Contractor:
 - .1 Compatibility test is to be conducted according to ASTM D6766.
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- .2 Permeant for compatibility testing is to be produced by the testing laboratory and is to consist of an aqueous solution saturated in CaCO_3 with a neutral pH.
- .3 Vertical confining pressure is to be 35 kPa. For conformance, final measured hydraulic conductivity shall be less than 5×10^{-9} cm/s.
- .3 Shop drawings. Indicate installation layout, sequence, dimensions and details, including fabricated and field seams, anchor trenches and protrusion details where applicable. Installation shall generally be from high to low to minimize pre-mature hydration by rain and surface runoff.
- .4 Submit qualifications of the GCL Installer. The GCL installer shall have successfully installed not less than 200,000 m² of GCL in the last 5 years.
- .4 On each delivery of GCL to site:
 - .1 Shipment packing list.
 - .2 Bill of lading.
 - .3 Roll identification numbers.
 - .4 Manufacturer's letter of certification that each roll in shipment is in conformance with specification, signed by the quality control manager.
 - .5 Physical properties sheet with manufacturer's tests and frequency in accordance with this Specification, signed by the quality control manager.

1.5 METHOD OF PAYMENT

- .1 Payment for supply and placement of GCL shall be according to the area that is actually covered by GCL after installation according to the limits and grades shown in the Drawings. If the final limits and grade are changed by the Departmental Representative the area for payment shall be based on the revised limits and grade. Materials constructed beyond the final limits and grades as specified shall not be measured for payment. The tendered unit prices shall include:
 - .1 supply of GCL;
 - .2 delivery, handling, and storage on-site;
 - .3 assistance to the Engineer in collecting GCL samples prior to or during installation;
 - .4 moving materials from on-site storage areas to the installation area;
 - .5 all surface preparation required prior to installation;
 - .6 all labour and equipment for installation including overlap, bentonite placement;
 - .7 all repair work;
 - .8 any material wastage;
 - .9 installer's quality control testing; and
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- .10 any materials, labour, equipment, or other expense necessary for the supply and installation of geomembranes in accordance with Drawings and Specifications.
- .2 Payment for all submittals and independent conformance testing of the GCL shall be on a Lump Sum basis.

Part 2 Products

2.1 MATERIALS

- .1 The GCL product supplied to the project shall be in full accordance with the requirements of Table 31 32 19.01-1: GEOSYNTHETIC CLAY LINER PROPERTIES.
- .2 The GCL is to be needle-punched thermally reinforced and comprise of a uniform layer of granular sodium bentonite encapsulated between 2 non-woven geotextiles. The top layer is a staple fiber non-woven geotextile while the bottom layer is a scrim reinforced nonwoven geotextile. The needle-punched fibres are thermally fused to the scrim reinforced non-woven geotextile to enhance the reinforcing bond.
- .3 No glues, adhesives or other non-mechanical bonding processes shall be used in lieu of the needle-punch process.
- .4 The minimum acceptable dimensions for the GCL panels shall be 4.7 m wide and 45 m long unless smaller dimensions are agreed to by the Departmental Representative.
- .5 A 300 mm overlap line and a 375 mm match line shall be imprinted on both edges of the upper geotextile component of the GCL to assist in installation overlap quality control. Lines shall be printed as continuous dashes in easily observable, waterproof, non-toxic ink.
- .6 The separate components and finished GCL shall comply with the properties, test methods and testing frequencies given in this Specification. Material which does not comply will be replaced at the Contractor's expense.

Part 3 Execution

3.1 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle the GCL be in accordance with ASTM D 5888 and the manufacturer recommendations.
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- .2 Contact manufacturer prior to shipment to determine the correct unloading methods and equipment if different from the pre-approved and specified methods.
- .3 GCL delivered to the site shall be free from blisters, undispersed raw material, striations, any physical damage or contamination by foreign matter. Rolls exhibiting damage shall be marked and set aside for closer examination during deployment. Minor rips and tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
- .4 GCL rolls not indicated on GCL manufacturing quality control certificates will not be accepted.
- .5 Stockpile and maintain rolls in a dry condition in a flat location area away from high-traffic.
- .6 Do not store rolls outside on the ground; store on pallets or elevated structures.
- .7 Protect the GCL from moisture, direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents during unloading and storage.
- .8 Store GCL rolls no higher than three to four rolls high, as recommended by the manufacturer, or limited to the height at which the handling apparatus may be safely handled by installation personnel. Situate stacks or tiers of rolls in a manner that prevents sliding or rolling by "choking" the bottom layer of rolls.
- .9 Do not stack rolls on uneven or discontinuous surfaces in order to prevent bending, deformation, damage to the GCL or cause difficulty inserting the core pipe.
- .10 Use additional tarp or plastic sheet over the stacked rolls to provide extra protection for GCL material stored outdoors.
- .11 Store bagged bentonite material tarped and next to GCL rolls unless other more protective measures are available. Store bags on pallets or other suitably dry surface to prevent pre-hydration.
- .12 The presence of free-flowing water within the packaging shall be cause for rejection of that roll.
- .13 Clearly mark each roll with the following information:
 - .1 Manufacturer.
 - .2 Product type and width of roll.
 - .3 Total weight of roll.
 - .4 Type of GCL material.
 - .5 Production Lot Number and individual Roll Number.

3.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
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- .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
- .3 Fold up metal banding, flatten and place in designated area for recycling

3.3 SUBGRADE CONDITIONS

- .1 Maintain area of installation free of water and snow accumulation.
- .2 Replace soft and wet supporting materials.
- .3 Sub-grade Preparation - The finish of the sub-grade materials to be prepared and made suitable for the placement of GCL material.
- .4 The surface upon which the GCL material will be installed shall be inspected and certified by the Contractor and the Departmental Representative to be in accordance with the requirements of this specification.
- .5 Site specific compaction requirements shall be followed in accordance with the project drawings and specification of the subgrade materials where applicable. Equipment used in the handling and installation of GCL shall not damage the subgrade.
- .6 The subgrade surfaces shall be smooth and free of any debris, vegetation, roots, sticks, sharp rocks, or other deleterious materials larger than 50 mm as well as free of any voids, large cracks of standing water or ice.
- .7 Directly prior to deployment of the GCL, the sub-grade shall be final-graded to fill remaining voids or desiccation cracks, and proof-rolled to eliminate sharp irregularities or abrupt elevation changes. The surfaces to be lined shall be maintained in this smooth condition.
- .8 The sub-grade shall be inspected by the Departmental Representative prior to GCL placement.
- .9 Subsequent to the Departmental Representative's approval, it shall be the Contractor's responsibility to indicate to the Departmental Representative any change in the sub-grade condition that could cause it to be out of compliance with any of the requirements of this section or the project specification.

3.4 GCL HANDLING

- .1 GCL shall be supported during handling to ensure worker safety and prevent damage to the liner. Under no circumstances shall the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or pushed to the ground from the delivery vehicle.
 - .2 The Contractor shall verify that proper handling equipment will be used. The equipment shall not pose any danger to installation personnel or risk of damage or
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deformation to the liner material itself. Provided that it is demonstrated to be suitable, handling equipment may include, but not limited to, the following:

- .1 Spreader Bar Assembly - A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam.
- .2 Stinger - a stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.
- .3 Roller Cradles - Roller cradles consist of two large diameter rollers spaced approximately 75mm apart which both support the GCL roll and allow it to freely unroll. The use of roller cradles shall be permitted if the rollers support the entire width of the GCL roll.
- .4 Straps - Straps may be used to support the ends of spreader bars but are not recommended as the primary support mechanism. As straps may damage the GCL where strapped around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.

3.5 INSTALLATION

- .1 GCL Placement - GCL shall be placed in general accordance with the shop drawings and procedures specified below, or modified to account for site specific conditions upon approval of the Departmental Representative.
 - .1 Where possible, all slope panels shall be installed parallel to the maximum slope while panels installed in flat areas require no particular orientation.
 - .2 The GCL may be deployed on slopes by pulling the material from a suspended roll, or securing a roll end into an anchor trench and unrolling each panel as the handling equipment slowly moves backwards.
 - .3 Deployment on flat areas shall be conducted in the same manner as that for the slopes, however, care should be taken to minimize "dragging" the GCL. Slip-sheet may be used to facilitate positioning of the liner while ensuring the GCL is not damaged from underlying sources.
 - .4 The contractor shall only install as much GCL that can be covered at the end of the day. No GCL shall be installed when rain is anticipated before the GCL can be covered and protected adequately.
 - .5 Trimming of the GCL shall be done with great care such that fugitive clay particles do not come into contact with drainage materials.
 - .2 Joining - Adjacent GCL are to be joined by overlapping according to the following:
 - .1 Installers are to overlap GCL edges such that the minimum overlap guideline is covered and match line is not covered, thus ensuring a minimum of 300 mm overlap.
 - .2 Overlap seams shall be a minimum of 600 mm on panel ends.
 - .3 Loose granular bentonite should be placed between panels at a rate of 0.40 kg/m of seam.
 - .4 Overlaps shall be free of wrinkles, folds or "fish-mouths".
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- .5 GCL ends should be overlapped such that the upstream GCL is over the downstream GCL at the overlap (i.e. "shingled").
- .3 Damage Repair - Prior to cover material placement, damage to the GCL shall be identified and repaired by the Contractor. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.
 - .1 Rip and Tear Repair (Flat Surfaces) – Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 300 mm on all edges.
 - .2 Accessory bentonite shall be placed between the patch edges and the repaired material at a rate of 0.4 kg/m of edge spread in a continuous 150 mm fillet.
 - .3 Rip and Tear Repair (Slopes) - Damaged GCL material on slopes shall be repaired by the same procedures above; however, the edges of the patch shall also be adhered to the repaired liner with an adhesive to keep the patch in position during backfill or cover operations.
- .4 Panels - Displaced panels shall be adjusted to the correct position or orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.
- .5 Premature Hydration - If the GCL is prematurely hydrated, Contractor shall notify the Departmental Representative for a site specific determination as to whether the material is acceptable.
- .6 Covering:
 - .1 GCL shall not be covered until it has been inspected by the Departmental Representative.
 - .2 GCL shall be covered in a timely manner to reduce the potential for damage due to unconfined hydration of the GCL. It is essential that GCL installation be rapidly followed by installation of the geomembrane, geotextiles, and granular drainage layer.
 - .3 The cover materials shall be placed such that both the GCL and the underlying subgrade are not damaged.
 - .4 No GCL shall be left exposed overnight.
 - .5 The GCL shall be covered before a rainfall or snow event occurs.
 - .6 The uncovered edge of GCL panels shall be protected at the end of the working day with a waterproof sheet which is secured adequately with ballast.
 - .7 Protect installed liner from displacement, damage or deterioration before, during and after placement of material layers.

Table 31 32 19.01-1: GEOSYNTHETIC CLAY LINER PROPERTIES

Geosynthetic Clay Liner Properties	Test Method	Minimum Test Frequency	Required Value
Geotextile			
Cap – Nonwoven Mass per Unit Area	ASTM D5261	20,000 sq. m	200 g/m ² MARV ₁
Carrier - Scrim Nonwoven Mass per Unit Area	ASTM D5261	20,000 sq. m	240 g/m ² MARV ₁
Bentonite Properties			
Swell Index	ASTM D5890	50,000 kg	24 ml/2g min.
Fluid Loss	ASTM D5891	50,000 kg	18 ml max.
Moisture Content	ASTM D4643	50,000 kg	12% max.
Finished GCL Properties			
Bentonite Mass Per Unit Area ₂	ASTM D5993	4,000 sq. m	3.7 kg/m ² MARV
Moisture Content	ASTM D5993	4,000 sq. m	35% max.
Tensile strength, (machine direction)	ASTM D6768	4,000 sq. m	7.8 kN/m MARV
Peel Strength	ASTM D6496	4,000 sq. m	610 N/m MARV
Permeability ₃	ASTM D5887	25,000 sq. m	5 x 10 ⁻¹¹ m/s max
GCL Durability Permeability (35 kPa) ₄	ASTM D6766	One	1 x 10 ⁻⁸ m/s max
GCL Durability Permeability (500 kPa) ₄	ASTM D6766 (mod)	One	5 x 10 ⁻¹⁰ m/s max
Internal Shear Strength ₅	ASTM D6243	One	24 kPa Typical

Notes:

1. MARV = Minimum average roll value.
2. Mass of bentonite is measured after oven drying per the stated method.
3. Permeability to be tested under an effective confining stress of 35 kPa and hydraulic gradient of 20 using deionized water.
4. Value represents GCL permeability after permeation with a 0.1 M calcium chloride solution (11.1 g CaCl₂ in 1 litre water); for termination see GRI-GCL3.
5. Typical peak value for specimen hydrated for 24 hours and sheared under a 9.6 kPa normal stress.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Supply and installation of smooth high density polyethylene (HDPE) geomembrane in the base liner system of Cell A.
- .2 Supply and installation of textured linear low density polyethylene (LLDPE) geomembrane in the final cover system of Cell A.
- .3 Supply and installation of smooth HDPE geomembrane in the base liner of the Suspect Waste Holding Area.

1.2 RELATED SECTIONS

- .1 Section 31 12 10 Landfill Construction Requirements.
- .2 Section 31 12 15 Removal of Waste from Old Dump.
- .3 Section 31 32 19.01 Geosynthetic Clay Liner (GCL).
- .4 Section 31 32 19.03 Geotextile.

1.3 REFERENCES

- .1 Society for Testing and Materials International (ASTM)
 - .1 ASTM D1004-09 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
 - .2 ASTM D1238-10 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
 - .3 ASTM D1505-03 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
 - .4 ASTM D1603-06 Standard Test Method for Carbon Black Content in Olefin Plastics.
 - .5 ASTM D3895-07 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry.
 - .6 ASTM D4437-08 Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
 - .7 ASTM D4833-07 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - .8 ASTM D5199-01 Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
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- .9 ASTM D5397-07 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
- .10 ASTM D5596-03(2009) Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
- .11 ASTM D5721-08 Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
- .12 ASTM D5885-06 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.
- .13 ASTM 5994 Test method for measuring the core thickness of Textured Geomembranes.
- .14 ASTM D6392-08 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
- .15 ASTM D6693-04(2010) Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
- .16 ASTM D7002-03 Standard Practice for Leak Location on Exposed Geomembranes Using the Water Puddle System.
- .17 ASTM D7466 Test method for Measuring the asperity Height of Textured Geomembranes.

1.4 SUBMITTALS

- .1 Submittals shall be made in accordance with Section 01 33 00.
 - .2 Submit to Departmental Representative at least 90 days prior to delivery of geomembrane to the site:
 - .1 Origin (supplier's name and production plant) and identification (brand name and lot number) of resin used to manufacture geomembrane.
 - .2 Copies of dated quality control certificates issued by resin supplier.
 - .3 Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets the properties in this Specification.
 - .4 Statement that amount of reclaimed polymer added to resin during manufacturing does not exceed 2% by weight.
 - .5 Qualifications of Manufacturer.
 - .6 Manufacturer's written certification that the geomembrane to be supplied meet all the requirements stated in this Specification.
 - .3 Submit to Departmental Representative at least 60 days prior to delivery of geomembrane to site, including:
 - .1 Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests. Testing shall be for all parameters listed in this Specification.
-

- .2 Certificate that extrudate to be used is comprised of the same resin as geomembrane to be used.
 - .3 Results of independent laboratory conformance testing for all parameters listed in this Specification. Minimum testing frequency of one set of tests per production run of geomembrane used for project, on samples recovered from rolls to be provided for project.
 - .4 Name, location, and contact information for qualified and accredited Geosynthetic Quality Assurance Laboratory to be used for independent geomembrane testing.
 - .5 Minimum 2 m length of standard width membrane.
 - .6 Minimum of 1 m seam with at least 300 mm of membrane on both sides of seam.
 - .7 Shop drawings indicating installation layout with field panel and identification code, dimensions and details, including fabricated and field seams, anchor trenches, sealed pipe penetrations and protrusion details.
 - .8 Qualifications of Installer.
 - .9 Qualifications of master seamer and personnel performing seaming operations.
 - .10 Installation schedule, including information such as date of manufacturing, delivery dates, geomembrane installation by location (i.e. Cell number) testing schedule and final walk over.
 - .11 Construction Quality Control Plan.
- .4 Submit to Departmental Representative with each shipment of geomembrane:
- .1 Written documentation of the product received including individual roll numbers, square metres of product per roll and total square metres of product in the shipment.
 - .2 Submit to Departmental Representative as installation proceeds:
 - .1 Quality control documentation recorded during installation.
 - .2 Sub-base surface acceptance certificates, which certify that the geomembrane installer has inspected the surface of the subgrade and that it conforms to these Specifications, for each area that will be covered directly by geomembrane shall be submitted prior to geomembrane deployment.
 - .3 Material and Installation Warranty from manufacturer.
 - .4 Results of independent laboratory testing of destructive seam samples.
- .5 Submit to Departmental Representative following completion of geomembrane installation:
- .1 As-built drawings as specified.
 - .2 Geomembrane installer's quality control documentation as specified.
-

- .3 Written certification that the geomembrane system has been installed as specified.

1.5 MANUFACTURER

.1 Manufacturer:

Manufacturer shall have minimum 5 yrs continuous experience in manufacture of HDPE geomembranes and experience totaling 1,000,000 sq m of manufactured geomembranes for minimum of 10 completed facilities.

.2 Installer:

Personnel performing seaming operations shall be qualified by experience or successfully passing seaming tests. Minimum of one seamer shall have experience seaming a minimum of 200,000 sq m of smooth HDPE and 200,000sq m of textured LLDPE geomembrane using the same type of seaming apparatus in use at site.

1.6 METHOD OF PAYMENT

- .1 Payment for supply and placement of 80 mil HDPE geomembrane and for 40 mil textured LLDPE geomembrane shall be according to the area that is actually covered by geomembrane after installation according to the limits and grades shown in the Drawings. If the final limits and grade are changed by the Departmental Representative the area for payment shall be based on the revised limits and grade. Materials constructed beyond the final limits and grades as specified shall not be measured for payment. The tendered unit prices shall include:
 - .1 supply of smooth and textured geomembrane;
 - .2 delivery, handling, and storage on-site;
 - .3 assistance to the Engineer in collecting geomembrane samples prior to or during installation;
 - .4 moving materials from on-site storage areas to the installation area;
 - .5 all surface preparation required prior to installation;
 - .6 all labour and equipment for installation including overlap and seaming;
 - .7 all repair work including prefabricated pipe boots;
 - .8 any material wastage;
 - .9 installer's quality control testing; and
 - .10 any materials, labour, equipment, or other expense necessary for the supply and installation of geomembranes in accordance with Drawings and Specifications.
 - .2 Payment for all submittals and independent conformance testing of the 80 mil HDPE geomembrane and 40 mil textured LLDPE geomembrane shall be on a Lump Sum basis.
-

Part 2 Products

2.1 MATERIALS

- .1 The 2.0mm (80 mils) smooth HDPE geomembrane for the base liner shall have properties meeting or exceeding those requirements listed in Table 31 32 19.02-1: Smooth HDPE Geomembrane Properties'. The Contractor shall verify the quantity of HDPE geomembrane required for the work accounting for overlaps, seaming, repairs, and wastage.
- .2 The 1.0mm (40 mils) textured LLDPE geomembrane for cover system liner shall have properties meeting or exceeding those requirements listed in Table 31 32 19.02-2: Textured LLDPE Geomembrane Properties. The Contractor shall verify the quantity of textured LLDPE geomembrane required for the work accounting for overlaps, seaming, repairs, and wastage.
- .3 Geomembrane shall be manufactured from virgin polyethylene resin designed and manufactured specifically for use in HDPE and LLDPE geomembranes respectively. No post consumer resin of any type shall be used. Use of geomembrane recycled during manufacturing process shall be permitted if recycled geomembrane does not exceed 2% by weight and it is of the same type of material as the geomembrane roll. The virgin resin shall have the following properties:
 - .1 Minimum resin density of 0.932 g/cm³ (ASTM D792, Method B or ASTM D1505).
 - .2 Minimum formulated sheet density of 0.94 g/cm³ (ASTM D792, Method B or ASTM D1505).
 - .3 Maximum Melt Index of` 1.0 g/10 min. (ASTM D1238, Condition 190/2.16).
- .4 Geomembrane Characteristics:
 - .1 Supplied in rolls of 6.0 m minimum width.
 - .2 Contain maximum of 1% by weight of additives, fillers or extenders (not including carbon black).
 - .3 No pinholes, bubbles or other surface features that compromise geomembrane integrity. Free of blisters, non-dispersed raw materials, or other signs of contamination by foreign matter.

2.2 SEAMING AND TESTING EQUIPMENT

- .1 Welding:
 - .1 Maintain on-site minimum of 1 spare operable seaming apparatus, unless otherwise agreed upon at pre-construction meeting.
 - .2 Seaming equipment shall not damage geomembrane.
-

- .3 Use extrusion welding apparatus equipped with gauges giving temperature of extrudate at nozzle of apparatus.
- .4 Use fusion-welding apparatus which are self-propelled devices equipped with following:
 - .5 Gauge indicating temperature of heating element.
 - .6 Place electric generator on smooth base such that no damage occurs to geomembrane.
- .2 Vacuum Testing Equipment:
 - .1 Vacuum box assembly consisting of: rigid housing, transparent viewing window, soft neoprene gasket attached to bottom of housing, porthole or valve assembly, and vacuum gauge.
 - .2 Pump assembly equipped with pressure controller and pipe connections.
 - .3 Pressure/vacuum rubber hose with fittings and connections.
 - .4 Soapy solution to wet test area.
 - .5 Means of applying soapy solution.
- .3 Air Pressure Testing Equipment:
 - .1 Air pump (manual or motor driven), equipped with pressure gauge, capable of generating, sustaining, and measuring pressure between 160 and 240 kPa (24 and 35 psi), and mounted on cushion to protect geomembrane.
 - .2 Rubber hose with fittings and connections.
 - .3 Sharp hollow needle, or other approved pressure feed device.
 - .4 Air pressure monitoring device.
- .4 Tensiometer Testing Equipment:
 - .1 Tensiometer shall be capable of maintaining constant jaw separation rate of 50 mm per min, and shall be calibrated, with certificate of calibration less than 1 year old kept with tensiometer.

Part 3 Execution

3.1 DELIVERY, STORAGE AND HANDLING

- .1 Packing and Shipping:
 - .1 Manufacturer shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site. Each roll delivered to site is to be identified with following:
 - .1 Manufacturer's name.
 - .2 Product Identification.
 - .3 Thickness.
 - .4 Roll number.
 - .5 Roll dimensions.
 - .2 Acceptance at Site:
-

- .1 Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls unless defects or damages are found or suspected.
- .2 Defected or damaged rolls or portions of rolls will be rejected and shall be removed from site and replaced with new rolls.
- .3 Rolls or portions of rolls without Identification labeling will be rejected and shall be removed from site.
- .3 Storage and Protection:
 - .1 Contractor will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
 - .2 Contractor shall, protect geomembrane from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, rodents, water, and other sources of damage.
 - .3 Preserve integrity and readability of geomembrane roll labels.

3.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 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.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

3.3 PREPARATION

- .1 Surface Preparation:
 - .1 Contractor is responsible for preparing supporting surface for geomembrane placement. The surface must be smooth, unrutted, undamaged and with no visible stones or foreign materials that may damage the geomembrane.
 - .2 After prepared surface has been accepted in accordance with QAP, report to Departmental Representative any change in supporting surface condition that may require repair work. Maintain prepared surface.
 - .3 Do not place geomembrane onto area which has become softened by precipitation or cracked due to desiccation. Observe and report surface condition daily to evaluate degree of softening and desiccation cracking.
 - .4 Repair damage to prepared surface caused by installation activities at Contractor's expense.

3.4 INSTALLATION

- .1 Panel Nomenclature:
-

- .1 Field panel is defined as roll or portion of roll cut and seamed in field, excluding patches and cap strips.
 - .2 Identify each field panel with identification code (number or letter-number) consistent with Contractor's layout plan. This identification code shall be agreed upon by the Contractor and Departmental Representative.
 - .3 Writing on liner with colored markers shall be as follows:
 - .1 Contractor - white marker.
 - .2 Departmental Representative – yellow marker.
 - .3 Only authorized personnel shall be permitted to write on liner.
 - .2 Protection:
 - .1 Do not use equipment which damages geomembrane.
 - .2 Ensure prepared surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to geomembrane deployment.
 - .3 Keep Geosynthetic elements immediately underlying geomembrane clean, and free of water, snow and debris.
 - .4 Do not permit personnel to smoke or wear shoes that can damage geomembrane while working on geomembrane. Personnel shall not bring glass bottles on geomembrane.
 - .5 Unroll panels in manner which does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil.
 - .6 Place panels in manner which minimizes wrinkles (especially differential wrinkles between adjacent panels).
 - .7 Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags, tires) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges.
 - .8 Protect geomembrane in areas where excessive traffic is expected with geotextiles, extra geomembrane, or other suitable materials.
 - .9 Protect installed geomembrane from displacement, damage or deterioration before, during or after placement of material layers.
 - .10 Do not permit vehicular traffic directly on geomembrane.
 - .3 Field Panel Deployment:
 - .1 Install field panels at locations indicated on Contractor's layout plan.
 - .2 Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at the Contractor's cost. Repair less serious damage as specified. Departmental Representative shall determine if material shall be repaired or replaced.
 - .3 Remove damaged panels or portions of damaged panels which have been rejected from work area.
 - .4 Do not proceed with deployment at ambient air temperature below 5°C (41°F) or above 40°C (104°F) unless otherwise authorized, in writing, by Departmental Representative. Ambient air temperature is to be measured 300 mm above geomembrane. Welding at temperatures lower than 5°C may be undertaken if the contractor can demonstrate that their proposed method is in accordance with GRI Test Method GM9 - "Cold weather Seaming of Geomembranes".
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- .5 Do not deploy during precipitation, in presence of excessive moisture (fog, dew), or in presence of excessive winds.
 - .6 Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.
 - .7 Do not deploy more geomembrane field panels in one day than can be seamed during that day.
- .4 Seam Layout:
- .1 Orient seams parallel to line of maximum slope, i.e., oriented along, not across, slope unless it is not feasible and permitted by Departmental Representative.
 - .2 No horizontal seam shall be less than 1.5 m (5 ft) from toe of slope unless it is not feasible and permitted by Departmental Representative.
 - .3 In general, maximize lengths of field panels and minimize number of field seams.
 - .4 Align geomembrane panels to have nominal overlap of (75 mm) (3 in.) for extrusion welding and (100 mm to 150 mm) (4 to 6 in.) for fusion welding. Final overlap shall be sufficient to allow peel tests to be performed on seam.
- .5 Temporary Bonding:
- .1 Hot air device (Liestar) may be used to temporarily bond geomembrane panels to be extrusion welded.
 - .2 Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat to lightly tack geomembrane panels together. Control temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
 - .3 Do not use solvent or adhesive.
- .6 Seaming Methods:
- .1 Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to Departmental Representative for approval. Alternate procedures shall be used only after being approved in writing by Departmental Representative.
 - .2 Seams shall meet the requirements in Table 31 32 19.02-3: Minimum Field Seam Properties.
 - .3 Use double-fusion welding as primary method of seaming adjacent field panels.
 - .1 For cross seam tees, associated with fusion welding, extrusion weld to minimum distance of 100 mm on each side of tee.
 - .2 Place welder on protective pad to prevent geomembrane damage between seaming.
 - .3 When sub-grade conditions dictate, use movable protective layer (e.g. extra piece of geomembrane) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers. The movable protective layer shall not be left in place after seaming.
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- .4 Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.
 - .5 Purge heat-degraded extrudate from barrel of extruder under following conditions:
 - .1 Prior to beginning seam.
 - .2 Whenever extruder has been inactive.
 - .6 Place smooth insulating plate or fabric beneath hot welding apparatus after usage.
 - .7 Use clean and dry welding rods or extrudate pellets.
 - .8 Complete grinding process without damaging geomembrane within 1 hr of seaming operation.
 - .9 Minimize exposed grinding marks adjacent to extrusion weld. Do not allow exposed grinding marks to extend more than 6 mm outside finished seam area.
 - .10 Grind perpendicular to seam.
 - .7 Seaming Procedures:
 - .1 Seaming shall only be conducted when ambient air temperature is between 5°C and 35°C unless approved by the Departmental Representative.
 - .8 Seam Repair Procedures
 - .1 Repair portions of geomembrane exhibiting flaw, or failing destructive or non-destructive test.
 - .2 Final decision as to repair procedure shall be determined by the Departmental Representative.
 - .3 Acceptable repair procedures include following:
 - .1 Patching: Piece of same geomembrane material extrusion welded into place. Use to repair large holes, tears, non-dispersed raw materials, and contamination by foreign matter.
 - .2 Spot welding or seaming: Bead of molten extrudate placed on flaw. Use to repair, pinholes, or other minor, localized flaws.
 - .3 Capping: Strip of same geomembrane material extrusion welded into place over inadequate seam. Use to repair large lengths of failed seams.
 - .4 Extrusion welding flap: Bead of molten extrudate placed on exposed flap of fusion weld. Use to repair areas of inadequate fusion seams, which have exposed edge. Repairs of this type shall be approved by Departmental Representative and shall not exceed 30 m (100 ft) in length.
 - .5 Removal and replacement: Remove bad seam and replace with strip of same geomembrane material welded into place. Use to repair large lengths of failed seams.
 - .4 For each repair method:
 - .1 Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
 - .2 Ensure seaming equipment used in repairing procedures meet requirements of this Specification.
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Extend patches or caps at least 150 mm (6 in.) beyond edge of defect. Round corners of patches with radius of approximately 75 mm (3 in.).

- .5 Do not place overlying layers over locations which have been repaired until appropriate acceptable non-destructive and destructive (laboratory) test results are obtained.

- .9 Sealing of Penetrations

- .1 Seal penetrations of leachate extraction pipe and gas vents through LLDPE cover geomembrane in accordance with approved shop drawings.

Part 4 Quality Control/Quality Assurance

4.1 CONTRACTOR'S QUALITY CONTROL

- .1 Manufacturer and installer shall participate in and conform to items and requirements as outlined in this specification.
 - .2 Tests and inspections performed by geomembrane manufacturer shall at a minimum be in accordance with the requirements in this Specification.
 - .3 Material
 - .1 Independent laboratory test results from membrane rolls intended for use for this project. All parameters listed in this Specification to be tested at a minimum frequency of one set of tests per production run of geomembrane.
 - .4 Visual Inspection:
 - .1 Departmental Representative will examine seam and non-seam areas of geomembrane for identification of defects, holes, blisters, non-dispersed raw materials, and any sign of contamination by foreign matter.
 - .2 Clean and wash geomembrane surface if Departmental Representative determines that amount of dust or mud inhibits examination.
 - .3 Do not seam any geomembrane panels that have not been examined for flaws by Departmental Representative.
 - .4 Non-destructively test seams and any non-seam areas identified by Departmental Representative.
 - .5 Trial Seams:
 - .1 Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
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- .2 Make trial seams at beginning of each seaming period, and at least once each 5 hrs, for each production seaming apparatus used that day. Each seamer shall make at least one trial seam each day.
 - .3 Make trial seams under same conditions as actual seams.
 - .4 Make trial seams only under observation of Departmental Representative.
 - .5 Seam overlap shall be as indicated for finished seam.
 - .6 Trial seam sample shall be at least 1.6 m (5 ft) long by 0.3 m (1 ft) wide (after seaming) with seam centered lengthwise.
 - .7 Cut 3 specimens from sample with 25 mm (1 in.) wide die. These specimen locations shall be selected randomly along trial seam sample by Departmental Representative. Test specimens in peel using field tensiometer. The results shall meet the shear and peel criteria stated in this Specification.
 - .8 If specimen fails, entire trial seam operation shall be repeated. If additional specimen fails, do not use seaming apparatus and seamer until deficiencies are corrected and 2 consecutive successful trial welds are achieved.
 - .9 Cut remainder of successful trial seam into three pieces; one to be retained in Departmental Representative's archives, one to be retained by Contractor, and one to be retained by Departmental Representative for possible laboratory destructive seam testing. If required by Departmental Representative, remaining portion of trial seam sample may be subjected to destructive testing.
- .6 Non-Destructive Seam Testing:
- .1 General
 - .1 Purpose of non-destructive tests is to check continuity of seams. It will not provide quantitative information on seam strength.
 - .2 Non-destructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams or other Departmental Representative approved method. Document results.
 - .3 Perform non-destructive testing as seaming work progresses.
 - .2 Vacuum Testing for Extrusion Seam:
 - .1 Energize vacuum pump and reduce tank pressure to approximately 35 kPa gauge pressure.
 - .2 Wet strip of geomembrane approximately 0.3 m by 1.2 m (12 in. by 48 in.) with soapy solution.
 - .3 Place box over wetted area.
 - .4 Close bleed valve and open vacuum valve.
 - .5 Ensure that leak-tight seal is created. For minimum of 10 sec, apply vacuum and examine geomembrane through viewing window for presence of soap bubbles.
 - .6 If no bubbles appear within 10 sec, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 75 mm (3 in.) overlap and repeat process.
 - .7 Mark and repair areas where soap bubbles appear.
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- .3 Air Pressure Testing for Double-Fusion Seam:
 - .1 Seal both ends of seam to be tested.
 - .2 Insert needle or other approved pressure feed device into air channel created by fusion weld.
 - .3 Insert protective cushion between air pump and geomembrane.
 - .4 Pressurize air channel to pressure of approximately 200 kPa (30 psi). Close valve and allow pressure to stabilize for approximately 2 min.
 - .5 Observe air pressure 5 minutes after initial 2 minute stabilization period ends. If pressure loss exceeds Maximum Permissible Pressure Differential or pressure does not stabilize, locate faulty area and repair.
 - .6 Maximum Permissible Pressure Differential After Five Minutes:
 - .1 1.5 mm Material - 20 KPa
 - .7 Cut opposite end of tested seam area once testing is completed to verify continuity of air channel. If air does not escape, locate blockage and retest un-pressurized area. Repair cut end of air channel.
 - .8 Remove needle or other approved pressure feed device and repair hole in geomembrane.
 - .4 Inaccessible Seams:
 - .1 Cap-strip seams that cannot be non-destructively tested.
 - .2 Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
 - .3 Examine cap-stripping operations with Departmental Representative for uniformity and completeness. Document observations.
 - .7 Destructive Seam Testing:
 - .1 General:
 - .1 Purpose of destructive seam testing is to evaluate seam strength.
 - .2 Perform destructive seam test as seaming progresses. Document results.
 - .3 Failed destructive seam sample shall result if grips of testing machine cannot be closed on sample test flap (available flap is 13 mm long or less) due to excessive temporary welding.
 - .2 Location and frequency:
 - .1 Test at minimum frequency of one test location per 150 m (500 ft) of seam length performed by each welding machine. This minimum frequency to be determined as average taken throughout entire facility.
 - .2 Test locations shall be determined during seaming, at Departmental Representative's discretion.
 - .3 Contractor will not be informed in advance of locations where seam samples will be taken.
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- .4 Departmental Representative reserves right to increase frequency of testing in accordance with performance results of samples previously tested.
 - .3 Sampling Procedures:
 - .1 Cut samples at locations chosen by Departmental Representative.
 - .2 Departmental Representative shall number each sample and record sample number and location in panel layout drawing.
 - .3 Repair holes in geomembrane resulting from destructive seam sampling immediately in accordance with repair procedures described in this Specification.
 - .4 Continuity of repair and seams shall be tested in accordance with vacuum testing requirements.
 - .4 Sample Dimensions: Take two 25 mm wide samples for field testing prior to cutting full laboratory sample.
 - .1 Field Testing: Cut 25 mm (1 in.) wide samples, 200 mm long with seam centered parallel to width. Distance between these 2 samples shall be 1.1 m (42 in.). Test both samples on field tensiometer in peel. If both samples pass field test, take sample for laboratory testing.
 - .2 Laboratory Testing: Take laboratory test sample from between samples taken for field testing. Cut sample for laboratory testing 0.3 m (12 in.) wide by 1.1 m (42 in.) long with seam centered lengthwise. Cut this sample into three parts. Departmental Representative shall distribute parts as follows:
 - .1 One part to Contractor for optional laboratory testing, 0.3 m by 0.3 m (12 in. by 12 in.).
 - .2 One part to Geosynthetic Quality Assurance Laboratory for testing, 0.3 m by 0.5 m (12 in. by 18 in.).
 - .3 One part to Departmental Representative for archive storage, 0.3 m by 0.3 m (12 in. by 12 in.).
 - .3 Final determination of sample sizes shall be agreed upon at pre-construction meeting.
 - .4 Submit laboratory sample for quantitative testing.
 - .5 Destructive Test Failure Procedures: When sample fails destructive testing, Contractor has the following options:
 - .1 Repair seam between any 2 passing destructive test locations.
 - .2 Trace welding path to intermediate point 3 m (10 ft) minimum from point of failed test in each direction) and take small sample with 25 mm (1 in.) wide die for an additional field test at each location. If these additional samples pass test, then take full laboratory samples. If these laboratory samples pass tests, repair seam between these locations. If either sample fails, repeat process to establish zone in which seam should be repaired.
 - .3 Acceptable repaired seams shall be bound by 2 locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 50 m (150 ft) of repaired seam, Departmental Representative may have Contractor destructive test repair seam.
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- .4 When sample fails, Departmental Representative may require additional testing of seams that were welded by same welder and/or welding apparatus during same time shift.
- .5 Passing laboratory destructive tests of trial seam samples may be used as boundary for failing seam.
- .8 Repair Verification:
 - .1 Departmental Representative shall observe number and log each repair.
 - .2 Nondestructively test each repair.
 - .3 Nondestructive test results that pass shall indicate adequate repair.
 - .4 Repairs more than 50 m long may require destructive test sampling.
 - .5 Failed destructive or nondestructive tests indicate that repair shall be redone and retested until passing test results.
- .9 Large Wrinkles: Wrinkle is considered to be large when geomembrane can be folded over onto itself.
 - .1 When seaming of geomembrane is completed, and prior to placing overlying materials, Departmental Representative shall identify large geomembrane wrinkles which should be cut and resealed.
 - .2 Cut and reseat wrinkles identified by Departmental Representative. Seams produced while repairing wrinkles shall be nondestructively tested.
 - .3 Repair wrinkles identified by Departmental Representative. Repair during coldest part of installation period.
- .10 Electrical Leak Detection Survey
 - .1 Allow and facilitate the Departmental Representative to conduct leak detection survey by a company experienced in electrical leak detection survey. Make good all defects identified by the survey.

4.2 DEPARTMENTAL REPRESENTATIVE'S QUALITY ASSURANCE SAMPLING

- .1 Contractor shall make rolls available and assist Departmental Representative in obtaining material inventory and material samples.
 - .2 Rolls represented by quality assurance testing shall be rejected if test failure. Contractor may at their expense request additional testing to validate individual rolls. Rolls bracketed by passing tests will be allowed to be deployed and seamed.
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Table 31 32 19.02-1: Smooth HDPE Geomembrane Properties

Typical Properties ⁽¹⁾	Test Method	HDPE Specifications Smooth Sheet
1. Physical Properties a) Density of Formulated Sheet b) Thickness	ASTM D1505 or D792 Method B ASTM D5199 (for smooth sheet)	0.94 g/cc 80 mil, 2 mm (minimum average)
2. Mechanical Properties a) Tensile Properties ⁽²⁾ <ul style="list-style-type: none"> Tensile Strength at Yield Tensile Strength at Break Elongation at Yield Elongation at Break b) Puncture Resistance c) Tear Resistance	ASTM D6693 Type IV (33 mm gauge length) (50 mm gauge length) ASTM D4833 ASTM D1004	29 kN/m (168 lb/in) 53 kN/m (304 lb/in) 12 % 700 % 640 N (144 lb) 249 N (56 lb)
3. Environmental Properties a) Stress Crack Resistance ⁽³⁾ b) Carbon Black Content c) Carbon Black Dispersion d) Oxidative Induction Time, OIT ⁽⁶⁾ a) Standard OIT -----or----- b) High Pressure OIT e) Oven Aging at 85°C, % retained after 90 day ⁽⁷⁾⁽⁸⁾ a) Standard OIT -----or----- b) High Pressure OIT f) UV Resistance ⁽⁸⁾ a) High Pressure OIT, % retained after 1600 hrs. ⁽⁹⁾	ASTM D5397 Appendix ASTM D1603 ⁽⁴⁾ ASTM D5596 ASTM D3895 ASTM D5885 ASTM D5721 D 3895 D5885 D5885	500 hours 2% to 3% (See Note 5) 100 min. 400 min. 55% 80% 50%

Note:

- The average of the test results should be calculated per the respective standard cited and compared to the minimum value listed in the table, unless otherwise specified.
- In both directions based on 5 test specimens each direction
- The yield stress used to calculate the applied load for the SP-NCTL test should be the mean value based on the manufacturer's MQC testing or the independent laboratory testing as appropriate. For textured sheet, the test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet material.
- Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
- Carbon black dispersion (only near spherical agglomerates) for 10 different views: at least 9 in Categories 1 or 2 and, no more than 1 in Category 3.
- Either one of the OIT methods listed may be selected to evaluate the antioxidant content of the geomembrane.
- The samples should also be evaluated and recorded at 30 and 60 days to compare with the 90 day response.
- The condition of this test should be 20 hr. UV cycle followed by 4 hr. condensation at 60°C
- UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 31 32 19.02-2: Textured LLDPE Geomembrane Properties

Properties ⁽¹⁾	Standard	Specifications
1. c) Density of Formulated Sheet d) Thickness e) Asperity Height ⁽²⁾	ASTM D1505 or D792 Method B ASTM D5199 ASTM D7466	0.94 g/cc 40 mil, 1.0 mm (minimum average) 0.40mm
2. Mechanical Properties d) Tensile Properties ⁽³⁾ • Tensile Strength at Break • Elongation at Break e) Puncture Resistance f) Tear Resistance	ASTM D6693 Type IV (50 mm gauge length) ASTM D4833 ASTM D1004	11 N/mm 250 % 100 N 200 N
3. Environmental Properties g) Carbon Black Content h) Carbon Black Dispersion i) Oxidative Induction Time, OIT ⁽⁷⁾ b) Standard OIT -----or----- b) High Pressure OIT j) Oven Aging at 85°C, % retained after 90 day ⁽⁷⁾⁽⁸⁾ c) Standard OIT -----or----- d) High Pressure OIT k) UV Resistance ⁽⁹⁾ a) High Pressure OIT, % retained after 1600 hrs. ⁽¹⁰⁾	ASTM D1603 ⁽⁵⁾ ASTM D5596 ASTM D3895 ASTM D5885 ASTM D5721 D 3895 D5885 D5885	2% to 3% (See Note 6) 100 min. 400 min. 35% 60% 35%

- Note:
1. The average of the test results should be calculated per the respective standard cited and compared to the minimum value listed in the table, unless otherwise specified.
 2. The average of the 10 asperity height readings should not be less than the minimum stated in the table. Furthermore, at least 8 of the 10 readings must be greater or equal to 0.18 mm (7 mils), and no reading is less than 0.13 mm (5 mils).
 3. In both directions based on 5 test specimens each direction
 4. The yield stress used to calculate the applied load for the SP-NCTL test should be the mean value based on the manufacturer's MQC testing or the independent laboratory testing as appropriate.
 5. Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
 6. Carbon black dispersion (only near spherical agglomerates) for 10 different views: at least 9 in Categories 1 or 2 and, no more than 1 in Category 3.
 7. Either one of the OIT methods listed may be selected to evaluate the antioxidant content of the geomembrane.
 8. The samples should also be evaluated and recorded at 30 and 60 days to compare with the 90 day response.
 9. .1 The condition of this test should be 20 hr. UV cycle followed by 4 hr. condensation at 60°C
 10. UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 31 32 19.02-3: Minimum Field Seam Properties

Property	Method	HDPE Specified Value	LLDPE Specified Value
1. Shear Strength–	ASTM D 6392 (N/25mm)	525	263
2. Shear Elongation at Break	ASTM D 6392 (%)	50	50
3. Peel Strength (hot wedge seams)	ASTM D 6392 (N/25mm)	398	219
4. Peel Strength (extrusion fillet seams)	ASTM D 6392 (N/25mm)	340	190
5. Peel Separation	ASTM D 6392 (%)	25	25

Modifications to ASTM 6392:

1. Value listed for all tests are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.
2. For locus-of-break patterns for peel strength, the following are unacceptable break codes:
 - a. Hot wedge seams: AD and AD-Brk>25%
 - b. Extrusion Fillet Seams: AD1, AD2 and AD-WLD (unless strength is achieved)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Supply and installation of geotextiles as a separator layer between the subgrade and granulars in the new access roads;
- .2 Supply and installation of geotextiles as a protective layer over smooth high density polyethylene (HDPE) base liner in Cell A.
- .3 Supply and installation of geotextiles as a protective layer for the textured linear low density polyethylene (LLDPE) geomembrane in the final cover, and also a separation layer for the final cover drainage layer in Cell A.

1.2 RELATED SECTIONS

- .1 Section 31 12 10 Landfill Construction Requirements.
- .2 Section 31 12 15 Removal of Waste from Old Dump.
- .3 Section 31 32 19.01 Geosynthetic Clay Liner (GCL).
- .4 Section 31 32 19.02 HDPE and LLDPE Geomembrane.

1.3 REFERENCES

- .1 Society for Testing and Materials International (ASTM):
 - .1 ASTM D4354 - 99(2009) Standard Practice for Sampling of Geosynthetics for Testing.
 - .2 ASTM D4355-07, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 - .3 ASTM D4491-99a (Reapproved 2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .4 ASTM D4533-04 (Reapproved 2009), Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.
 - .5 ASTM D4632-08, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - .6 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - .7 ASTM D4759 - 02(2007) Standard Practice for Determining the Specification Conformance of Geosynthetics.
 - .8 ASTM D4833-07, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
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- .9 ASTM D4884 - 9 Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
- .10 ASTM D5261-10, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative at least 90 days prior to delivery of geotextiles to the site:
 - .1 Name, location, and contact information for qualified and accredited Geosynthetic Quality Assurance Laboratory to be used for independent geotextile material testing.
 - .2 Manufacturer's certificate stating that the geotextile meets the requirements of this specification. For needle punched geotextiles, the manufacturer shall also certify that the geotextile has been continuously inspected using permanent on-line full-width metal detectors.
 - .3 Mill certificates for each roll from manufacturer with minimum average roll values for all parameters identified in this Specification.
- .3 Submit to Departmental Representative at least 60 days prior to delivery of geotextile to the site:
 - .1 The method of sewing or fusing seams.
 - .2 Shop drawings showing method of fastening geotextile to pipe penetrations.
 - .3 2 m long sample of geotextile across entire roll width.
 - .4 Results of independent laboratory testing for all parameters listed in this Specification. One sample per production run of each geotextile type, from the rolls to be provided for this project, tested for parameters listed in this Specification.

1.5 METHOD OF PAYMENT

- .1 Payment for geotextiles shall be made according to the area covered by the geotextile supplied and installed in place according to the limits and grades shown in the Drawings. If the final limits and grade are changed by the Departmental Representative, the area for payment shall be based on the revised limits and grade. Materials constructed beyond the final limits and grades as specified shall not be measured for payment. Payment shall be according to the tendered lump sum price shall include:
 - .1 supply of geotextile materials;
 - .2 delivery confirmation data;
-

- .3 proper delivery, handling, and storage;
 - .4 assistance to the Departmental Engineer in collecting geotextile samples prior to or during installation;
 - .5 all surface preparation required prior to installation;
 - .6 all labour and equipment for installation including any overlap or sewing;
 - .7 any material wastage; and
 - .8 any materials, labour, equipment, or other expense necessary for the supply and installation of geotextiles in accordance with the Drawings and Specifications.
- .2 Payment for all submittals and independent conformance testing of the geotextiles shall be on a Lump Sum basis.

Part 2 Products

2.1 MATERIAL

- .1 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure.
- .2 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.
- .3 Geotextile to be supplied in rolls.
- .4 Properties per:
 - .1 Table 31 32 19.03-1: Woven Geotextile for Subgrade Separation
 - .2 Table 31 32 19.03-2: Nonwoven Geotextile for HDPE Base Liner and Final Cover Cushion Function:
 - .3 Table 31 32 19.03-3: Geotextile for Final Cover Separation Functions

Part 3 Execution

3.1 DELIVERY, STORAGE AND HANDLING

- .1 Deliver the geotextile in advance to allow time for quality assurance sampling, testing, and re-testing if required.
- .2 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

3.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
-

- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 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.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

3.3 INSTALLATION

- .1 Place geotextile by unrolling onto graded surface of work that was inspected and accepted by the Departmental Representative and retain the geotextile in position with sand bags or similar method.
- .2 Place geotextile smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile where feasible.
- .4 Join successive strips of geotextile by sewing.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 Cover geotextile with overlying layer within 24 hours of placement of geotextile unless otherwise agreed by the Departmental Representative.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Granular or soil materials on top of geotextile shall be placed in accordance with Specification Section 31 12 10 and 31 12 15.
- .9 Install double layer of geotextile within drainage sump in each cell.

3.4 CLEANING

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.5 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.
-

Part 4 Quality Control/Quality Assurance

4.1 CONTRACTOR'S QUALITY CONTROL

- .1 Collect quality control samples in accordance with ASTM D4354. Collect one sample per production run of each geotextile type from the rolls to be provided for this project and submit samples for independent laboratory testing for parameters listed in this Specification.
- .2 Discard the outer layer of the geotextile roll and collect by cutting a minimum 1 m sample over the full-width of the geotextile sheet. Cover the roll immediately with the protective covering immediately after sampling.
- .3 Samples will be tested to verify that geotextile meets the requirements of physical properties specified in this specification excluding UV Resistance per test method ASTM D 4355. Geotextile product acceptance shall be based on ASTM D4759.
- .4 Demonstrate to the Departmental Representative that field seam made by the proposed method sewing or fusion meet the requirements of this specification.
- .5 After placement of backfill on top of the geotextile, excavate test pits as directed by the Departmental Representative to allow inspection of the geotextile and seam. The Contractor shall repair any defect and improve the method of construction and/or the seam strength.

Table 31 32 19.03-1: Woven Geotextile for Subgrade Separation

Property	Test Method	Unit	Value
Tensile Strength	ASTM D4632	N	1110
Trapezoidal Tear	ASTM D4533	N	400
Puncture Strength	ASTM D4833	N	450
Mullen Burst	ASTM D3786	kPa	3447
Elongation	ASTM D4632	%	15
AOS	ASTM D4751	mm	0.6
Permittivity	ASTM D4491	sec ⁻¹	0.05
Flow Rate	ASTM D4491	l/min/m ²	160
UV Resistance %	ASTM D4355	500 hrs	70

Table 31 32 19.03-2: Nonwoven Geotextile for HDPE Base Liner and Final Cover Cushion Function

Property	Test Method	Unit	Value
Mass per unit area	ASTM D5261	g/m ²	542
Tensile Strength (any principal direction, wet condition)	ASTM D4632	N	1700
Elongation at Break (any principal direction)	ASTM D4632	%	Min. 50%
Seam Strength	ASTM D4884	%	60
Trapezoidal Tear	ASTM D4533	N	640
CBR Puncture	ASTM D6241	N	4820
AOS	ASTM D4751	mm	0.15
Permittivity	ASTM D4491	sec ⁻¹	0.6
UV Resistance	ASTM D4355	% retained after 500 hrs	70

Table 31 32 19.03-3: Geotextile for Final Cover Separation Function

Property	Test Method	Unit	Value
Mass per unit area	ASTM D5261	g/m ²	395
Tensile Strength (any principal direction, wet condition)	ASTM D4632	N	1330
Elongation at Break (any principal direction)	ASTM D4632	%	Min. 50%
Seam Strength	ASTM D4884	%	60
Trapezoidal Tear	ASTM D4533	N	511
CBR Puncture	ASTM D6241	N	3780
AOS	ASTM D4751	mm	0.15
Permittivity	ASTM D4491	sec ⁻¹	1.0
UV Resistance	ASTM D4355	% retained after 500 hrs	70

END OF SECTION

Specifications Appendix A

May 30 2016 Site Photographs



SITE PHOTOGRAPHS

Site Visit Photos
Existing Landfill and Old Dump Sites
Garden River, Alberta

Project No: 209.40380.00000



Photo 1: Aerial view of Cell A construction (on right) and existing landfill area (on left) on May 31, 2016.



Photo 2: Panoramic view of Cell A construction from southwest corner.



SITE PHOTOGRAPHS

Site Visit Photos
Existing Landfill and Old Dump Sites
Garden River, Alberta

Project No: 209.40380.00000



Photo 3: View of floor of existing excavation for Cell A, showing damage to base from unauthorized access and minor erosion on banks of cell.



Photo 4: Stockpiled material on south side of Cell A. Note monitoring well marked with snow fence in front of stockpile.



SITE PHOTOGRAPHS

Site Visit Photos
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Photo 5:

Stripping stockpile along perimeter of cleared area, consisting of a mix of sand, organics, tree branches, roots, etc.



Photo 6:

View of excavation for leachate sump located in southwest corner of Cell A. Note minor erosion on side slopes of excavation.



SITE PHOTOGRAPHS

Site Visit Photos
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Photo 7: View facing back towards site access road (upper right) from the northwest corner of Cell A.



Photo 8: Aerial view of Old Dump site, cleared area on bottom of photograph, showing proximity to community school building, top of photograph.



SITE PHOTOGRAPHS

Site Visit Photos
Existing Landfill and Old Dump Sites
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Photo 9: Panoramic view of Old Dump site, from northwest corner.



Photo 10: View of ground surface at Old Dump showing typical conditions in areas that have been previously cleared.



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