



Public Works and Government Services Canada

Requisition No. EZ899-211984

SPECIFICATIONS

For

Access Road and Culvert Upgrades

CSC Kwikwexwelhp Healing Village, Harrison Mills, BC

Project No. R.093708.001

June 2020

APPROVED BY:

Robertson, Ian

Digitally signed by: Robertson, Ian
DN: CN = Robertson, Ian C = CA O = GC OU =
PWGSC-TPSGC
Date: 2020.11.26 16:27:19 -08'00'

Regional Manager, AES

Date

Chris Patterson

Digitally signed by Chris Patterson
Date: 2020.11.25 15:40:56 -08'00'

Construction Safety Coordinator

Date


TENDER:

tang, tony

Digitally signed by: tang, tony
DN: CN = tang, tony C = CA O =
GC OU = PWGSC-TPSGC
Date: 2020.11.19 14:15:46 -08'00'

Project Manager

Date

DISCIPLINE	SEAL
PRIME CONSULTANT CIVIL ENGINEER	
GEOTECHINICAL ENGINEER <i>Division 03</i> <i>Division 31</i> <i>Division 32</i>	

END OF SECTION

SPECIFICATIONS

Division 00	Procurement and Contracting Requirements	
00 01 07	Seals Page	1 page
00 01 11	Table of Contents	4 pages
Division 01	General Requirements	
01 11 05	General Instructions	5 pages
01 14 00	Work Restrictions	2 pages
01 33 00	Submittal Procedures	4 pages
01 35 29.06	Health and Safety Requirements	7 pages
01 35 43	Environmental Procedures	4 pages
01 45 00	Quality Control	2 pages
01 51 00	Temporary Utilities	2 pages
01 56 00	Temporary Barriers and Enclosures	3 pages
01 71 00	Examination and Preparation	3 pages
01 74 11	Cleaning	2 pages
01 74 21	Construction/Demolition Waste Management and Disposal	8 pages
01 77 00	Closeout Procedures	2 pages
01 78 00	Closeout Submittals	8 pages
Division 03	Concrete	
03 20 00	Concrete Reinforcing	5 pages
03 30 00	Cast-In-Place Concrete	8 pages
03 48 00.01	Wet-Cast Precast Modular Retaining Wall Units	8 pages
Division 31	Earthworks	
31 00 99	Earthworks for Minor Works	7 pages
31 05 16	Aggregate Materials	5 pages
31 22 16.13	Roadway Subgrade Reshaping	2 pages
31 23 33.01	Excavating, Trenching, and Backfilling	10 pages

31 24 13	Roadway Embankments	7 pages
31 32 19.01	Geotextiles	3 pages
31 37 00	Rip-Rap	3 pages
Division 32	Exterior Improvements	
32 11 16.01	Granular Sub-Base	5 pages
32 11 23	Aggregate Base Courses	5 pages
32 12 16	Asphalt Paving	12 pages
32 15 40	Crushed Stone Surfacing	4 pages
Division 33	Utilities	
33 42 13	Storm Culverts	8 pages
Division 35	Waterway and Marine Construction	
35 42 19	Preservation of Water Courses and Wetlands	3 pages

APPENDICES

A	Geotechnical Assessment Report– Ryzuk Geotechnical	17 pages
B	Vehicle Safety Barrier Record Drawings – ISL Engineering & Land Services	2 pages
C	Pre-Construction Hazard Assessment Form	4 pages
D	Slope Failure Assessment and Stabilization – GeoWest Engineering	5 pages
E	KHV Healing Village Environmental Effects Evaluation Access Road Repairs, Regrading and Culvert Upgrades – Hemmera (separate package)	34 pages

DRAWINGS

Bound Separately

R.093708.001

KHV Access Road and Culvert Upgrades

G00	Cover Sheet / Key Plan
CV01	Stormwater Management Plan
CV02	Culvert Repairs, Culverts 3, 4, 5 and 6 Plan & Sections
CV03	Culvert Repairs, Culverts 7, 8, 9 and 10 Plan & Sections
CV04	Culvert Repairs, Culverts 11, 12, 13 and 14 Plan & Sections
CV 05	Culvert Repairs, Culvert 15 Plan & Section, Concrete Culvert Details
C01	Road Work Site Plan
C02	Road and Erosion Repair: Station 1+010 to 1+300 Plan and Profile
C03	Road and Erosion Repair: Station 1+300 to 1+586 Plan and Profile
C04 A	Road and Erosion Repair: Station 1+586 to 1+905 Plan and Profile
C04 B	Road and Erosion Repair, Road Lowering (Sightline), Station 1+691 to 1+737, Plan and Sections
C05	Road and Erosion Repair, Station 1+905 to 2+235 Plan and Profile
C06	Road and Erosion Repair, Station 2+235 to 2+565 Plan and Profile
C07	Road and Erosion Repair, Station 2+565 to 2+895 Plan and Profile
C08	Road and Erosion Repair, Station 2+895 to 3+180 Plan and Profile
C09	Road and Erosion Repair, Station 3+180 to 3+510 Plan and Profile
C10	Road and Erosion Repair, Station 3+510 to 3+800 Plan and Profile
C11	Road and Erosion Repair, Station 3+800 to 3+929 Plan and Profile
C12	Guardrail Details & Crossfall Schedule
C13	Ryzuk Geotechnical Retaining Wall Drawings 8-7522-13, 1 thru 6
X1	Sections, Station 1+020 to 1+280
X2	Sections, Station 1+290 to 1+680
X3	Sections, Station 1+700 to 2+050
X4	Sections, Station 2+060 to 2+380

X5	Sections, Station 2+390 to 2+750
X6	Sections, Station 2+760 to 2+915
X7	Sections, Station 2+920 to 3+180
X8	Sections, Station 3+190 to 3+470
X9	Sections, Station 3+475 to 3+720
X10	Sections, Station 3+430 to 3+920

END OF INDEX

Part 1 General

1.1 LOCATION OF SITE

- .1 The work is located at the Kwikwèxwelhp Healing Village (KHV) operated by Correction Services Canada (CSC) approximately 10 kilometers from Harrison Mills, BC.
- .2 The work is located on federal land.

1.2 GENERAL DESCRIPTION OF THE WORK

- .1 Principle Work under this contract comprises re-surfacing and re-profiling a gravel access road approximately 3 kilometers in length.
- .2 Work to be performed under this contract includes, however is not limited to, the following items covered in the contract documents:
 - .1 Cut/fill road subgrade to design elevations.
 - .2 Place and compact imported granular fill and road capping in accordance with design drawings and contract specifications.
 - .3 Replacement of multiple road culverts, c/w headwalls.
 - .4 Re-profiling of roadside ditching.
 - .5 Installation of erosion protection barriers.
 - .6 Removal and post-construction replacement of existing roadside traffic safety barriers.

1.3 CODES AND STANDARDS

- .1 Meet or exceed requirements of specified standards, codes, and referenced documents.

1.4 PROJECT MEETINGS

- .1 The Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.5 DRAWINGS

- .1 Contract Drawings:
 - .1 Contract drawings will be available for download from the PWGSC Buyandsell.gc.ca website.
 - .2 No additional contract drawings will be provided.
- .2 Record Drawings:
 - .1 Record Drawings to be completed and submitted per Section 01 78 00 – Closeout Submittals.
 - .2 Production of CAD Record Drawings not included within Contract.

1.6 SITE CONDITION

- .1 Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, surface, stream and road access conditions, and the nature and extent of the work.
- .2 Submission of a tender will be deemed confirmation that the Contractor is acquainted with the site and is conversant with all relevant conditions.

1.7 LAYOUT OF WORK

- .1 Construction layout is the responsibility of Contractor.
- .2 Point Files and survey data will be made available by the Departmental Representative.
- .3 Notify Departmental Representative immediately if the work cannot be completed as shown in the plans and specifications.

1.8 WORK SEQUENCE

- .1 Within 15 days of Contract award, Contractor to submit to the Departmental Representative for approval a plan clearly indicating proposed sequencing of Work.
 - .1 Include documents submittals warning Departmental Representative of forthcoming activities.
- .2 Sequencing to ensure that vehicle access is maintained to all areas affected by the Work throughout the duration of the project.
- .3 Whenever a variation from the schedule in excess of 5 working days occurs or is expected to occur, request approval from Departmental Representative for the change in writing.

1.9 TIME OF COMPLETION

- .1 Complete all work, including all required submittals, under the contract within sixteen (16) weeks of award.

1.10 USE OF SITE

- .1 Use of site is limited to work areas required for the work, including the storage of materials and equipment and to the access routes assigned by the Departmental Representative required for the completion of work as specified. Access keys will be provided to the contractor as required.
- .2 Hours of work to comply with local bylaws.
 - .1 Perform work during normal hours, Monday to Friday, except holidays.
 - .2 Work may be performed after working hours, on weekends and holidays as approved by Departmental Representative.

1.11 ASSISTANCE BY THE CONTRACTOR

- .1 Provide access to the work areas as required for the Departmental Representative to perform their duties.

1.12 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.13 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 72 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.
- .3 Provide alternative routes for pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services as directed by Departmental Representative to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.14 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of existing equipment and fixtures indicated or specified is to be considered as approximate.

1.15 INSPECTION SERVICES

- .1 Inspections will be carried out by Departmental Representative.
- .2 Where inspections reveal that work is not in accordance with the contract requirements, additional inspections to confirm acceptability of the corrected work will be conducted at the expense of the Contractor.

1.16 INTERPRETATION

- .1 In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.
- .2 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:
 - .1 The Plans and Specifications, the Specifications govern.
 - .2 The Plans, the Plans drawn with the largest scale govern; and
 - .3 Figured dimensions and scaled dimensions, the figured dimensions govern.

1.17 SAFE COMPANIES CERTIFICATION

- .1 The Contractor must ensure that all works are performed by contractors who:
 - .1 Have current WCB registration and clearance.
 - .2 Have required WHIMIS training.

1.18 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings and Waste Reduction Workplan.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .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.

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 01 11 05 – General Instructions.

1.2 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 to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions at a minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel and vehicular traffic.

1.5 SPECIAL REQUIREMENTS

- .1 Carry out noise generating Work Monday to Friday from 08:00 to 17:00 hours.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Ingress and egress of Contractor vehicles at site is limited to normal working hours.
- .5 Deliver materials outside of peak traffic unless otherwise approved by Departmental Representative.

1.6 SECURITY

- .1 Security clearances:
 - .1 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
 - .2 Contractor will be escorted at all times during the performance of this contract.
 - .3 Correctional Service Canada reserves the right to deny access to any institution/site or part thereof of any Contractor personnel, at any time.

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 Submit to Departmental Representative submittals listed under each Section 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 mock ups in SI Metric units.
- .4 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 will be returned without being examined and considered rejected.
- .5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 The review of the Environmental Emergency Response Plan by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .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 copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, 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 drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .3 Allow 5 days for Departmental Representative's review of each submission.
- .4 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.
- .5 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.

- .6 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.
- .7 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.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit electronic copies 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.
- .11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .12 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

- .13 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .14 Delete information not applicable to project.
- .15 Supplement standard information to provide details applicable to project.
- .16 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.
- .17 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC 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.
 - .2 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.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .3 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.
- .4 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .5 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, as directed by Departmental Representative.
- .2 Project identification: name of project and date of exposure indicated.

- .3 Frequency of photographic documentation: as directed by Departmental Representative.

1.5 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.

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 SECTIONS

- .1 Section 31 00 99 – Earthworks for Minor Works

1.2 REFERENCE STANDARDS

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of British Columbia
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety
 - .2 Occupational Health and Safety Regulation
- .3 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .4 Canadian Construction Association
 - .1 COVID-19 – Standardized Protocols for All Canadian Construction Sites, Provincial and Federal Regulations

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 All contractors shall follow Canadian Construction Association COVID-19 - Standardized Protocols for All Canadian Construction Sites, Provincial and Federal Regulations.
- .2 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00 – Submittal Procedures.
- .3 Work effected by submittal shall not proceed until review is complete.
- .4 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency Procedures.
 - .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

- .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.4 FILING OF NOTICE

- .1 The Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.7 REGULATORY REQUIREMENTS

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

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.
- .3 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .4 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

1.9 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary Requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/ Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.
 - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/ activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
 - .1 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.10 EMERGENCY PROCEDURES

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative and site staff.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Work on, over, under and adjacent to water.
 - .5 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.11 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00 – Submittal Procedures.

- .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
- .3 Provide adequate means of ventilation in accordance with Section 01 51 00 – Temporary Utilities.

1.12 FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.13 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.
- .3 The Contractor is to assume the role of the "prime contractor" for the duration of the job.

1.14 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act Part 3-Occupational Health and Safety
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- .3 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.15 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 Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.16 POSTING OF DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.

- .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
 - .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.17 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 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.18 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 RELATED REQUIREMENTS

- .1 Section 35 42 19 – Preservation of Water Courses and Wetlands

1.2 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 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 Name of person responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name and qualifications of person responsible for manifesting hazardous waste to be removed from site.
 - .3 Name and qualifications of person 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.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments, stream crossings, material storage areas, 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 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .11 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.

1.4 DISPOSAL OF WASTES

- .1 Fires and burning of rubbish on site is not permitted.
- .2 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner into streams or waterways.
- .3 Dispose of following materials at appropriate off-site facility identified by Contractor and approved by Departmental Representative:
 - .1 Debris including excess construction material.
 - .2 Non-contaminated litter and rubbish.
 - .3 Disposable PPE worn during final cleaning.
- .4 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

1.5 WORK ADJACENT TO WATERWAYS

- .1 Work adjacent to waterways to be completed in accordance with Section 35 42 19 – Preservation of Water Courses and Wetlands.
- .2 Construction equipment to be operated on land only.
- .3 Waterways to be kept free of excavated fill, waste material and debris.
- .4 Do not skid logs or construction materials across waterways.

1.6 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 directed by Departmental Representative.
- .3 Cover or wet down dry materials to prevent blowing dust and debris. Use potable water for dust and particulate control. Use of chemical means for dust and particulate control only with Departmental Representative's prior written approval.
- .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.

1.7 POLLUTION CONTROL

- .1 Ensure all equipment is in proper working order.
- .2 Control emissions from equipment to local authorities' emission requirements.
- .3 Spill kits and containment materials must be maintained on-site and ready for deployment in case of spills.
 - .1 Spills kits are to contain sufficient quantities of absorbent material on site in close proximity to working machinery.
 - .2 During the work, there is to be trained and qualified personnel on site that ready to deploy spill kits when necessary.

1.8 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 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 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 instructions, 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.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by the Contractor for purpose of inspecting and/or testing portions of Work. Selected Agency subject to approval 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.

1.3 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.

1.4 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 and cure test samples.

1.5 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 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 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.

1.6 REPORTS

- .1 Submit digital copies of inspection and test reports to Departmental Representative in accordance with Section 01 33 00 – Submittal Procedures.

1.7 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

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 REFERENCE STANDARDS

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 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 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

- .1 Departmental Representative will not provide continuous supply of potable water for construction use.

1.6 TEMPORARY COMMUNICATION FACILITIES

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

1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by 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 requirements of authorities having jurisdiction.
- .2 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.
- .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 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 11 – Cleaning.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .2 Public Works Government Services Canada (PSPC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

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 enclosures using one of the following:
 - .1 Construction grade lumber framing, exterior grade fir plywood to CSA O121.
 - .2 Temporary construction fencing made galvanized steel that is 2.235 m height and 2.965 m center on center.
 - .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. Maintain fence in good repair.
- .2 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .3 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations in excess of 0.6m.
- .2 Provide additional barricades as required by Departmental Representative on site and governing authorities.

1.6 WEATHER ENCLOSURES

- .1 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

- .1 Provide dust tight screens to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

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

1.9 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.

1.10 FIRE ROUTES

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

1.11 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.

1.12 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.14 SIGNAGE

- .1 Provide signage on fencing identifying:

- .1 DANGER – EXCAVATION
- .2 NO SMOKING AND NO IGNITION SOURCES
- .3 Personal Protective Equipment required to enter the fenced area.
- .4 Contractor point-of-contact information in event of emergency.
- .2 Signage to be constructed of plywood or aluminum backing.
- .3 Place signage in 1.14.1 at all entry points into area of 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 REFERENCE STANDARDS

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

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in the Province of British Columbia, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

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

1.4 SURVEY REQUIREMENTS

- .1 Establish 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 placement.
- .4 Establish pipe invert elevations.

1.5 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.6 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all required documentation in accordance with Section 01 33 00 – Submittal Procedures
- .2 Submit name and address of Surveyor to Departmental Representative.
- .3 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .4 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 Departmental Representative 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 Departmental Representative 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

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.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only (as applicable).
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

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 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Remove dirt and other disfiguration from exterior surfaces.
- .5 Sweep and wash clean paved areas.
- .6 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work, submit for approval a written Waste Management plan to the Department Representative. Approval must be obtained prior to beginning onsite work.
- .2 Minimize amount of non-hazardous solid waste generated by project and accomplish maximum source reduction, reuse and recycling of solid waste produced by CRD activities.
- .3 Protect environment and prevent environmental pollution damage.

1.2 RELATED REQUIREMENTS

- .1 Section 03 30 00 – Cast in place Concrete.
- .2 Section 31 32 19.01 – Geotextiles.
- .3 Section 33 41 00 – Storm Utility Drainage Piping.

1.3 DEFINITIONS

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Inert Fill: inert waste - exclusively asphalt and concrete.
- .3 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .4 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

- .9 Separate Condition: refers to waste sorted into individual types.
- .10 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .11 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.
- .12 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

1.4 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Audit (Schedule A).
 - .2 Waste Reduction Workplan (Schedule B).
 - .3 Waste Source Separation Program.
 - .4 Schedules A & B completed for project.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Electronic copies of completed Waste Audit (WA): Schedule A.
 - .2 Electronic copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Electronic copies of Waste Source Separation Program (WSSP).

1.6 WASTE AUDIT (WA)

- .1 Prepare WA prior to project start-up.
- .2 WA provides detailed inventory, estimated quantities and types of waste materials that will be generated as well as their potential to be reused and/or recycled and project's waste diversion goals and objectives.
- .3 After award of contract, contractor to review WA and confirm that anticipated quantities of waste generated are accurate and goals achievable.

1.7 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW (Schedule B) prior to project start-up.

- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
 - .1 Destination of materials identified.
 - .2 Deconstruction/disassembly techniques and schedules.
 - .3 Methods to collect, separate, and reduce generated wastes.
 - .4 Location of waste bins on-site.
 - .5 Security of on-site stock piles and waste bins.
 - .6 Protection of personnel, sub-contractors.
 - .7 Clear labelling of storage areas.
 - .8 Training plan for contractor and sub-contractors.
 - .9 Methods to track and report results reliably (Schedule D).
 - .10 Details on materials handling and removal procedures.
 - .11 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .6 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.
- .7 Post WRW or summary where workers at site are able to review content.
- .8 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

1.8 WASTE SOURCE SEPARATION PROGRAM (WSSP)

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimizes material damage.

- .7 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.

1.9 USE OF SITE AND FACILITIES

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

1.10 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .8 Separate and store materials produced during project in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.

1.11 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.

- .5 Reused or recycled waste destination.
- .4 Remove materials on-site as Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.12 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 APPLICATION

- .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.

- .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged, recovered, reusable, or recyclable materials is not permitted.
- .3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

- .4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	

3.4 WASTE DIVERSION REPORT

- .1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
 - .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
 - .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
 - .1 Supporting documentation.
 - .2 Waybills and tracking forms.
 - .3 Description of issues, resolutions and lessons learned.

3.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected Actual	(5) Recycled Amount (unit) Project Actual	(6) Material Destination
Wood and Plastics Material Description					
Chutes					
Warped Pallet Forms					
Plastic Packaging					
Cardboard Packaging					
Wood					
Metal					
Other					

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Departmental Representative Inspection:
 - .1 Notify the Departmental Representative in writing of satisfactory completion claim and request the Departmental Representative's inspection. A minimum of 7 days' notice is required.
 - .2 Department Representative will complete an inspection and prepare a list of deficiencies and/or outstanding work.
 - .3 Contractor to correct Work as directed by Departmental Representative.
 - .2 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 Operation of systems: demonstrated to required personnel.
 - .4 Work: complete and ready for final inspection.
 - .3 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
 - .4 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

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 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and 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.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 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 systems (i.e. utilities, controls) under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide Record Drawings and Final Survey data.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training (if applicable): refer to Section 01 79 00 - Demonstration and Training.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, onsite 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.
- .2 Store record documents and samples in field office apart from documents used for construction.

- .1 Provide files, racks, and secure storage.
- .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.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of Contract Drawings.
- .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: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards 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, and field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.7 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.

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.
- .15 Additional requirements: as specified in individual specification sections.

1.9 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 15 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond 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 and bonds, 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 and bonds until time specified for submittal.
- .6 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .7 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, items, and features of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.

- .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .3 Contractor's plans for attendance at 12 month post-construction warranty inspection.
- .4 Procedure and status of tagging of equipment covered by extended warranties.
- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.12 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

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 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI)
 - .1 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 ASTM International
 - .1 ASTM A 82/A 82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A 143/A 143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A 185/A 185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .5 ASTM A 775/A 775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
 - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice, ANSI/ACI 315, and ACI 315R.
- .3 Shop Drawings:
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacing, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacing and locations of chairs, spacers and hangers.
 - .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in Part 2.3 of this Section - SOURCE QUALITY CONTROL.
 - .1 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground on platform, skids, or racks, and protect from prolonged exposure to weather.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA-G30.18, bearing identifying marks indicating size and grade. .
- .3 Cold-drawn annealed steel wire ties: to ASTM A 82/A 82M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A 82/A 82M.

- .5 Welded steel wire fabric: to ASTM A 185/A 185M.
 - .1 Provide in flat sheets only.
- .6 Epoxy Coating of non-prestressed reinforcement: to ASTM A 775/A 775M.
- .7 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1 In this case, no restriction applies to temperature of solution.
 - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
 - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Departmental Representative.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
 - .1 Ship epoxy coated bars in accordance with ASTM A 775A/A 775M.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

- .1 Galvanizing to include chromate treatment.
 - .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A 143/A 143M.

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Ensure materials, before being placed, are free of loose scaly rust, dirt, oil, paint or other bond-breaking coating.
- .3 Use plain round bars as slip dowels in concrete.
- .4 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
 - .1 The Departmental Representative's approval indicates review for general conformance with the contract documents only and does not relieve the Contractor of his responsibility for the accuracy and correctness of the Work
- .5 Unless indicated otherwise on the Drawings, provide minimum concrete cover for reinforcement in cast-in-place concrete as follows.
 - .1 Cast-on-grade: 75 mm
 - .2 All other: 50 mm
- .6 Tolerances for placing reinforcing steel shall be in accordance with CAN/CSA-A23.1 as applicable, except that concrete cover to reinforcing steel shall not be reduced by more than 6 mm
- .7 Protect epoxy coated portions of bars with covering during transportation and handling.

3.4 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 31 00 99 – Earthworks for Minor Works.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 CAN/CSA-A23.1 Concrete Materials and Methods of Concrete Construction (Including Notes and Appendices in the Standard).
 - .2 ASTM C 260/C 260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .4 ASTM C 494/C 494M-10a, Standard Specification for Chemical Admixtures for Concrete.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ABBREVIATIONS AND ACRONYMS

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
 - .2 Type MS and MSb - Moderate sulphate-resistant cement.
 - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 Type HE, HEb and HEL - High early-strength cement.
 - .5 Type LH, LHb and LHL - Low heat of hydration cement.
 - .6 Type HS and HSb - High sulphate-resistant cement.
- .2 Fly ash:

- .1 Type F - with CaO content less than 15%.
- .2 Type CI - with CaO content ranging from 15 to 20%.
- .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure Departmental Representative attends.
 - .1 Verify project requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit concrete mix designs of any mix designed by the Contractor to the Departmental Representative for review 14 days prior to placement. Concrete mix design submittals shall include the mass in kilograms of fine aggregate, coarse aggregate, cement, fly ash, silica fume and water in each cubic metre of concrete. Concrete mix design submittals shall specify the properties of the concrete.
 - .1 At least four weeks prior to commencing work of this section, inform the Departmental Representative of proposed source of aggregates and provide access for sampling.
- .3 Provide testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
 - .1 Submission of test results will not relieve the Contractor from his obligation to interpret the test results and make necessary corrections or adjustments to his construction procedures or mix designs.
- .4 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
 - .1 Submit a letter of assurance that the proposed aggregate source will not produce concrete that will be compromised by deleterious effects from alkali-aggregate reaction
- .5 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 QUALITY ASSURANCE

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

- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .2 Packaging Waste Management: remove for reuse and return of pallets and crates in accordance with Section 01 74 21 – Construction Demolition Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.2 MATERIALS

- .1 Portland Cement and Supplementary Cementing Material : Type GU Portland cement to CAN/ CSA-A3000.
- .2 Water: to CAN/ CSA-A23.1.
- .3 Aggregates: to CAN/ CSA-A23.1, normal density.

- .4 Air Entraining Admixtures: to ASTM C260.
- .5 Chemical Admixtures: to ASTM C494. Departmental Representative to approve type and use of accelerating or set-retarding admixtures during cold and hot weather placing.
- .6 Curing Compound: to CSA A23.1 and ASTM C309.

2.3 FORMWORK MATERIALS

- .1 Formwork materials shall meet the requirements of CAN/ CSA-S269.3 and this section.
- .2 Contact surfaces or lining of formwork shall be suitably smooth to provide finished concrete surfaces meeting the requirements of this section.
- .3 Form Ties: threaded internal disconnecting type, leaving no holes larger than 1 in. diameter in concrete surface.
- .4 Form Release Agent: non-staining chemically active release agent, compatible with form material which will prevent adherence of concrete to forms.

2.4 MIXES

- .1 Select concrete mix proportions in accordance with CAN/ CSA-A23.1 to give the following properties for all cast-in-place concrete unless specified otherwise on design Drawings:
 - .1 Minimum Compressive Strength at 28 Days: 30 MPa.
 - .2 Maximum Water/Cementing Materials Ratio: 0.40.
 - .3 Exposure Class: C-1.
 - .4 Nominal Maximum Size of Coarse Aggregate: 20 mm.
 - .5 Slump at Time and Point of Discharge: 130 mm \pm 25 mm.
 - .6 Air Content: 5% to 8%.
- .2 Do not change concrete mix without prior approval of the Departmental Representative. Should change in material source be proposed, new mix design to be approved by the Departmental Representative.

2.5 CONCRETE PRODUCTION

- .1 Measure, batch and mix concrete in accordance with CAN/ CSA-A23.1.
- .2 Before unloading concrete at the Site, furnish the Departmental Representative with a delivery ticket for each batch of concrete in accordance with CAN/ CSA-A23.1

Part 3 Execution

3.1 GENERAL

- .1 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may

be placed to the lines and elevations shown on the Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.

- .2 Obtain the Departmental Representative's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.
- .3 Prior to placing concrete, obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and any Contractor's test samples taken.

3.2 FORMWORK

- .1 Construct and erect formwork in accordance with CAN/ CSA-S269.3
- .2 Assemble forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/ CSA-A23.1.
- .3 Align form joints and make watertight. Use minimum number of form joints.
- .4 Clean formwork in accordance with CAN/ CSA-A23.1 before placing concrete.

3.3 PREPARATION

- .1 Set sleeves, anchor bolts and other inserts as indicated or specified elsewhere. Sleeves and openings greater than 100 mm and not indicated on structural Drawings must be approved by the Departmental Representative.
- .2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Departmental Representative before placing of concrete.

3.4 PLACING OF CONCRETE – GENERAL

- .1 Handle, deposit and consolidate concrete in accordance with CAN/ CSA-A23.1 and ACI A309R. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete.
- .2 Ensure that spare internal vibrators or external form vibrators are on hand during placing of concrete.
- .3 Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CAN/ CSA-A23.1.

3.5 CONSTRUCTION JOINTS

- .1 Make construction joints in accordance with CAN/ CSA-A23.1.

- .2 Locate construction joints as indicated on the Drawings or as approved by the Departmental Representative. Construction joints not indicated on the Drawings will not be permitted without the prior authorization of the Departmental Representative.

3.6 FINISHING UNFORMED SURFACES

- .1 Top surfaces of concrete which will ultimately receive additional concrete:
 - .1 Screed the surface across the grade strips or forms so that the resulting surface will have no irregularities greater than the maximum size aggregate.
 - .2 Roughen the surface with 6 mm amplitude.
 - .3 Prior to placing additional concrete, clean the surface of: laitance, dirt, excess water, and other deleterious material. Do not use hydro-milling until sufficient time has elapsed to prevent loosening of the top aggregate.
- .2 Top Surface of Exposed Concrete:
 - .1 Initial Finishing: immediately after placing concrete, screed the surface to the indicated grade and Work the surface with a bull float, or with a darby and highway straight edge, in accordance with CAN/ CSA-A23.1. Complete initial finishing before any bleeding or free water is present on the concrete surface.
 - .2 Begin final finishing operations after the bleed water has disappeared and the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. Do not add water to facilitate finishing. Carry out final finishing operations in accordance with CAN/ CSA-A23.1.
 - .3 Unless noted otherwise, exterior surfaces shall receive a light broom finish, with broom striations approximately 2 mm deep.
- .3 Finished surfaces shall conform to the slopes specified on the Drawings.

3.7 FINISHED FORMED SURFACES

- .1 Finish formed surfaces in accordance with CAN/CSA-A23.1 and as specified below.
- .2 Formed surfaces which may ultimately serve as forms for additional concrete pour or which will remain unexposed:
 - .1 The surface may contain shear keys, reinforcing steel, anchor bolts, or other embedment's as indicated on the Drawings.
 - .2 Repair honeycomb concrete and fill form-tie holes. Remove fins and ridges from concrete surfaces.
 - .3 Clean the surface of laitance, dirt, excess water, and other deleterious material prior to applying waterproofing treatment or placing additional concrete.

3.8 CURING AND PROTECTION

- .1 Cure and protect concrete in accordance with CAN/ CSA-A23.1 and as specified below.

- .2 Cure topping concrete by the application of wetted burlap immediately after completion of finishing operations. Maintain burlap in a saturated condition using soaker hoses wrapped in burlap and installed on top of the deck surface. When the daily mean ambient temperature is above 5 deg. C, curing shall be continuous for a minimum of seven days or for the time necessary to attain 70% of the specified 28 day compressive strength.
- .3 When the air temperature is at or above 27 deg. C, or when there is a probability of it rising to 27 deg. C during the placing period (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 305R - Hot Weather Concreting.
- .4 When the air temperature is at or below 5 deg. C, or when there is a probability of it falling below 5 deg. C within 24 hours of placing (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 306R - Cold Weather Concreting.

3.9 TOLERANCES

- .1 Tolerances for concrete Work as built shall conform to CAN/ CSA-A23.1 unless indicated otherwise.
- .2 Finish tolerances for concrete topping shall meet the requirements for the conventional (non-slip) Class B surface of CAN/ CSA-A23.1 Table 16.
- .3 The flatness of the topping surface will be determined by the straightedge method as outlined in CAN/ CSA-A23.1.

3.10 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting for Departmental Representative.
- .4 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.11 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
 - .2 Provide appropriate area on job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials from landfill to official hazardous material collection site as approved by Departmental Representative.
 - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
 - .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert.
 - .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation of wet-cast precast modular retaining wall units cast from first-purpose concrete with or without the inclusion of steel reinforcement. The precast units covered by this specification are machine-placed units intended for use in the construction of dry stacked modular retaining wall systems.

1.2 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing
- .2 Section 03 30 00 – Cast-in-Place Concrete
- .3 Section 31 23 33.01 – Excavating Trenching and Backfilling

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM A615/A615M, Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 - .2 ASTM A706/A706M, Specification for Deformed and Plain Low Alloy Steel Bars for Concrete Reinforcement.
 - .3 ASTM A767/A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - .4 ASTM A775/A775M, Specification for Epoxy-Coated Steel Reinforcing Bars.
 - .5 ASTM A884/A884M, Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 - .6 ASTM A1055/A1055M, Specification for Zinc and Epoxy Dual Coated Steel Reinforcing Bars.
 - .7 ASTM A1064/A1064M, Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .8 ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field.
 - .9 ASTM C33/C33M, Specification for Concrete Aggregates.
 - .10 ASTM C39/C39M, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - .11 ASTM C94/C94M, Specification for Ready-Mixed Concrete.
 - .12 ASTM C125, Terminology Relating to Concrete and Concrete Aggregates.
 - .13 ASTM C138/C138M, Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - .14 ASTM C143/C143M, Test Method for Slump of Hydraulic-Cement Concrete.
 - .15 ASTM C150/C150M, Specification for Portland Cement.

- .16 ASTM C173/C173M, Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- .17 ASTM C192/C192M, Practice for Making and Curing Concrete Test Specimens in the Laboratory.
- .18 ASTM C231/C231M, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- .19 ASTM C260/C260M, Specification for Chemical Admixtures for Concrete.
- .20 ASTM C595/C595M, Specification for Blended Hydraulic Cements.
- .21 ASTM C618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .22 ASTM C666/C666M, Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- .23 ASTM C823/C823M, Practice for Examination and Sampling of Hardened Concrete in Constructions.
- .24 ASTM C979/C979M, Specification for Pigments for Integrally Colored Concrete.
- .25 ASTM C989/C989M, Specification for Slag Cement for Use in Concrete and Mortars.
- .26 ASTM C1157/C1157M, Performance Specification for Hydraulic Cement.
- .27 ASTM C1611/C1611M, Test Method for Slump Flow of Self-Consolidating Concrete.
- .2 American Concrete Institute (ACI) Documents
 - .1 ACI 318, Building Code Requirements for Structural Concrete and Commentary.
- .3 Conform to applicable requirements of British Columbia Building Code, National Building Code and local authorities having jurisdiction.
- .4 Design and provide reinforcement, anchors and supports as required by codes and to Departmental Representative's approval. Submit relevant design data prepared by a professional engineer registered in the province of British Columbia for approval if so requested by the Departmental Representative.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Certification by the manufacturer stating conformance of the precast modular retaining wall units with this specification in the form of a written test report.
- .3 Submit grain size test results for aggregates to be used for the wall base and for unit fill.
- .4 Submit test results for borrow material to be used for common backfill and for select backfill (if used) including Proctor and grain size or Atterberg limits results.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Accept full responsibility for delivery, handling and storage of units.
- .2 Deliver, handle and store precast units using methods approved by the manufacturer.
- .3 Do not permit units to contact staining influences or to rest on corners.
- .4 Damaged material shall not be incorporated into the wall or the reinforced soil embankments.
- .5 A minimum of three (3) precast modular retaining wall units shall be randomly selected for measurement per delivery.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 WARRANTY

- .1 Provide standard CSA warranty with a duration of one (1) year in accordance with the General Conditions. Warranty shall be in writing and shall warrant work under this Section to be free from defects for the period stipulated.

Part 2 Products

2.1 PHYSICAL PROPERTIES

- .1 Concrete Compressive Strength – minimum 28MPA to ASTM C39/C39M at 28 days.
- .2 Air Content – 5% to 7%
- .3 Steel Reinforcement Concrete Cover – minimum 25mm.

2.2 DIMENSIONAL TOLLERANCES

- .1 Overall Height: +/- 5mm
- .2 Overall Length: +/- 13mm
- .3 Diagonal of Exposed Face: +/- 13mm

2.3 MINIMAL ACCEPTABLE STANDARD

- .1 Stone Strong units to ASTM C1776.

2.4 PRODUCTION QUALITY

- .1 Individual precast modular retaining wall units shall not be removed from the cell until the unit has reached a sufficient compressive strength that will permit the extraction to

occur without resulting in damage to the unit. The minimum permissible compressive strength of the precast modular retaining wall unit prior to removal from the form cell shall be established by the manufacturer before the units are cast.

- .2 Test cylinders prepared from concrete used in the production of the precast modular retaining wall units shall demonstrate 100% of the required minimum 28-day compressive strength prior to shipment or installation of the units.
- .3 All precast modular retaining wall units shall be sound and free of cracks or other defects that interfere with the proper placement of the unit.
- .4 Upon delivery to the purchaser, precast modular retaining wall units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted as follows:
 - .1 Chips smaller than 38mm in its largest dimension.
 - .2 Cracks not wider than 0.3mm and not longer than 25% of the nominal height of precast modular retaining wall unit.
 - .3 Other voids and/or inconsistencies not more than 19mm in its largest dimension.
- .5 The color and texture of the precast modular retaining wall units shall be selected from the range of colors and textures available from the manufacturer. The finished surface that will be exposed in the final construction shall conform to an approved sample consisting of not less than four (4) units representing the range of texture and color selected by the purchaser.
- .6 Measurements shall be reported on a minimum of three (3) precast modular retaining wall units annually or 1% of annual production of the unit type, whichever is greater.
- .7 Test cylinders for the purpose of compressive strength testing shall be prepared in accordance with ASTM C31/C31M or ASTM C192/C192M at the more frequent interval of once per week or once for every 115 m³ of concrete placed.
- .8 Tests for air content shall be conducted at the more frequent interval of once per day or once for every 115 m³ of concrete placed.

2.5 MARKINGS

- .1 The following information shall be legibly marked on each precast modular retaining wall unit:
 - .1 ASTM Specification Designation
 - .2 Date of Manufacture
 - .3 Name or Trademark of Manufacturer
- .2 Markings shall be indented in the precast modular retaining wall unit, painted thereon with waterproof paint, or applied with a permanent adhesive label.

Part 3 Execution

3.1 WALL BASE

- .1 The wall base shall consist of dense graded crushed aggregate. A minimum of 75% of coarse material shall have two (2) or more fracture faces. Wall base material shall meet the following gradation:

US Standard Sieve Size	Percent Passing
1 ½"	80-100
¾"	50-90
#4	0-40
#200	0-10

- .2 Concrete with a minimum 28-day compressive strength of 3,000 psi may be substituted for the granular base material. Concrete may be placed full thickness or as a topping over a compacted granular base. If used as a topping, the concrete shall have minimum thickness of 75mm.

3.2 UNIT FILL

- .1 Unit fill shall consist of a screened crushed aggregate. A minimum of 75% of coarse material shall have two (2) or more fracture faces. Wall base material shall meet the following gradation:

US Standard Sieve Size	Percent Passing
1 ½"	100
¾"	50-75
#4	0-40
#200	0-5

3.3 BACKFILL

- .1 If a granular reinforced zone is indicated, it shall consist of fill sand or other clean aggregate meeting the following gradation:

US Standard Sieve Size	Percent Passing
¾"	50-75
#200	0-5

- .2 All other backfill behind and in front of the wall shall consist of suitable onsite soil or imported borrow and shall be approved by the Geotechnical Engineer. Backfill shall generally consist of sands, silts, or lean clays with a liquid limit less than 45 and a plasticity index less than 20. Fat clay soils, cobbles, and large rock should generally be avoided unless approved by the Geotechnical Engineer based on local practices. Frozen soils, excessively wet or dry soils, debris, and deleterious materials should not be used.

3.4 DRAIN TILE

- .1 If specified on Contract Drawings, drain tile shall be a perforated or slotted PVC or corrugated HDPE pipe. The drain tile should be connected to storm drains or daylighted at low points and/or periodically along the wall alignment as shown on the plans.

3.5 GEOTEXTILE FABRIC

- .1 Provide a geotextile filter for separation from backfill at the tails of the blocks. The geotextile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds. The geotextile may cover the entire back face of the block or may be cut in strips to cover the gaps between tail units with a minimum of 150mm of overlap over the concrete tail on both sides.

3.6 CONCRETE FOR TAIL EXTENSIONS

- .1 Concrete for tail extensions shall have a minimum 28-day compressive strength of 3,000 psi. Higher mix strength may be necessary to achieve a strength of 2,000 psi before the wall is backfilled above the level of the tail extension.
- .2 Concrete shall have entrained air content between 5% and 7%.

3.7 INSTALLATION

- .1 Excavation
 - .1 Excavate as required for installation of the retaining wall system. Excavate to the base level for a sufficient distance behind the face to permit installation of the base.
 - .2 Slope or shore excavation as necessary for safety and conformance with applicable safety standards.
- .2 Wall Base
 - .1 Foundation soils shall be excavated to the dimensions shown on the plans. Foundation soil shall be observed by the Geotechnical Engineer to confirm that the bearing soils are similar to the design conditions or assumptions.
 - .2 Construct the wall base to the lines and grades shown on the plans. Place and consolidate concrete, strike, and finish plane and level. Over-excavated areas shall be filled with additional concrete or granular base material. Compact granular base material to provide a hard and level surface to support the wall units. Base material shall be compacted to a minimum of 95% of the maximum

dry density (ASTM D698, Standard Proctor.) Final base elevation shall be within 30mm of plan elevation.

- .3 Prepare and smooth the granular material to ensure complete contact of the first course with the base. The base may be dressed with fine aggregate to aid leveling.

.3 Until Installation

- .1 Place the first course of units directly on the wall base. Check units for level and alignment. Units shall be within 3mm of level from end to end and from front to back. Adjacent units should be in contact. Wherever possible, begin placing units at the lowest section of the wall.
- .2 Fill all voids between and within the blocks with granular unit fill. Additional unit fill is not required behind the units, but may be place for the convenience of the contractor.
- .3 Place backfill behind the units in maximum loos lifts of 200mm and compact. Compact all backfill to a minimum of 95% of the maximum dry density (ASTM D698, Standard Proctor). For cohesive soils, the moisture content at the time of compaction should be adjusted to within -1 and +3 percent of optimum. Place backfill in successive lifts until level with the top of the facing unit.
- .4 Remove all excess aggregate and other materials from the top of the units before laying up the next course.
- .5 For geogrid reinforced wall, place the correct geogrid at the locations and elevations shown on the plans or the shop drawings. Geogrid reinforcement shall be placed horizontally on compacted backfill. The length of the geogrid is measured from the front face of the wall. Extend the grid onto the front face flange of the facing unit. Orient the geogrid with the strong axis (machine direction) placed perpendicular to the wall face. Geogrid shall not be spliced by any means in the roll direction.
 - .1 Geogrid shall be placed side by side to provide complete coverage along the wall face. No overlap is required between adjacent grids on straight sections of the wall. On convex curves, place a minimum of 75mm of backfill material between overlapping geogrid layers.
- .6 Place the next course of precast modular block units in running bond with the previous course. Place wht web recess over the alignment hoop protruding from the unit below, and pull the unit forward to contact the hoop. Batter should be within 6mm tolerance (100mm from 24 SF unit below, 50mm from 6 SF unit below).
- .7 For geogrid reinforced walls, pull geogrids taught and stake the loose end before placing the next course of backfill. Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid. A minimum backfill depth of 150mm should be placed before operating equipment over the grids.

- .8 Continue placing successive courses to the elevations shown on the plans, Construct wall in level stages, placing the units at each course for the entire length of the wall, or as shown on plans. Unit fill and backfill should be placed to the level of the top of the facing unit before placing the next course.
- .9 Provide temporary swales to divert runoff away from wall excavation and away from face.
- .10 Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads.
- .11 Where tail extensions are indicated on the plans, concrete shall be placed in the center void between the blocks extending to the minimum width behind the blocks indicated on the drawings. Tail extensions may be formed or may be placed directly against a cut embankment. Tail extensions should be placed in lifts not to exceed 1.37m until the previous lift has fully set. Tail extensions should be allowed to reach 2,000 psi compressive strength before backfill is placed above the top of the extension.

3.8 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

- .1 Construction Quality Control
 - .1 The Contractor is responsible to ensure that all installation and material meet the quality specified.
 - .2 The Contractor shall verify that installation is in accordance with the specifications and contract drawings.
- .2 Quality Assurance
 - .1 The Departmental Representative shall engage testing and inspection services to provide independent quality construction assurance.
 - .2 Compaction testing shall be completed a minimum of every 300mm of vertical fill and every 30 lineal meters along the wall.
 - .3 Testing shall be done at a variety of locations to cover the entire backfill zone.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 If required, clean exposed face work by washing and brushing only, as precast is erected. Use approved masonry cleaner if washing and brushing fails to achieve required finish. Remove immediately materials that may set up or harden.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 – Excavating Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C136/C136M-14-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM C117-13, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- .2 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 REGULATIONS

- .1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.
- .2 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill or fill materials proposed for use.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative so that compaction tests can be carried out by designated testing agency.
- .5 Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.5 TESTS AND INSPECTIONS

- .1 Testing of materials and compaction of backfill and fill will be carried out by a certified testing firm, retained by the Contractor and approved by the Departmental Representative.

1.6 BURIED SERVICES

- .1 Before commencing work, verify the location of all buried services on and adjacent to the site using ground penetrating radar.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
- .3 Remove obsolete buried services within 2 m of foundations. Cap cut offs.

1.7 PROTECTION

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.
- .4 Protect natural and manmade features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

Part 2 Products

2.1 MATERIALS

- .1 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
- .2 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following sieve must have one or more fractured faces. Determination of the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.
- .3 Native material to be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for purposes of

payment if it is approved by the Departmental Representative. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.

.4 Granular Pipe Bedding and Surround Material

.1 Crushed or graded gravels: to conform to following gradation:

Percent Passing

Sieve	Type 1*	Type*2
25.0mm	100	100
19.0mm	90 - 100	90 - 100
12.5mm	65 - 85	70 - 100
09.5mm	50 - 75	--- ---
4.75mm	25 - 50	40 - 70
2.36mm	10 - 35	25 - 52
1.18mm	6 - 26	15 - 38
0.600mm	3 - 17	6 - 27
0.300mm	--- ---	3 - 20
0.075mm	0 - 5	0 - 8

*Type 1: standard gradation

*Type 2: to be used only in dry trench conditions and with Departmental Representative's prior approval.

.5 Top Soil for seeded areas: mixture of articulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.

- .1 Soil texture: The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
- .2 Contain no toxic elements or growth inhibiting materials.
- .3 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistencies: friable when moist

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions:
 - .1 Before commencing work verify locations of buried services on and adjacent to site.
- .2 Evaluation and Assessment:
 - .1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work.
 - .2 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

3.2 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Keep excavations clean, free of standing water, and loose soil.
 - .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
 - .3 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.
 - .4 Protect buried services that are to remain undisturbed.
- .2 Removal:
 - .1 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.
 - .2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
 - .3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
 - .4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
 - .5 Remove stumps and tree roots below footings, slabs, and paving, and to 200 mm below finished grade elsewhere.

3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations.
- .2 Topsoil stripping:

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
- .3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
- .4 Stockpile in locations as directed by Departmental Representative.
- .5 Dispose of topsoil to location as directed by Departmental Representative.
- .3 Excavate as required to carry out work, in all materials met.
 - .1 Do not disturb soil or rock below bearing surfaces. Notify Departmental Representative when excavations are complete.
 - .2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
 - .3 Fill excavation taken below depths shown without Departmental Representative's written authorization with concrete of same strength as for footings at no extra cost to Departmental Representative.
- .4 Excavate trenches to provide uniform continuous bearing and support for 100 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 300 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .5 Excavate for slabs and paving to subgrade levels.
 - .1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 SITE QUALITY CONTROL

- .1 Fill material and spaces to be filled to be inspected and approved by Departmental Representative.

3.5 BACKFILLING

- .1 Start backfilling only after inspection and receipt of written approval of fill material and spaces to be filled from Departmental Representative.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with selected subgrade material compacted as specified for fill.
- .5 Placing:

- .1 Place backfill, fill and base course material in 150 mm lifts. Add water as required to achieve specified density.
- .2 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.
- .6 Compaction: compact each layer of material to following densities for material to ASTM D1557:
 - .1 Boulevards and easements: minimum 90%.
 - .2 Roads, driveways, shoulders, re-shaped ditches and sidewalks: minimum 95%
 - .3 Basecourses: 100%.
 - .4 Elsewhere: 90%.
- .7 Under slabs and paving:
 - .1 In accordance with Contract Drawings.
- .8 In trenches:
 - .1 Up to 300 mm above pipe or conduit: sand placed by hand.
 - .2 Over 300 mm above pipe or conduit: native material approved by Departmental Representative.
- .9 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .10 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.
- .11 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.
- .12 Underground tanks: use sand to bottom of granular base courses or to bottom of topsoil, as applicable.

3.6 CONTAMINATED MATERIALS

- .1 If contaminated materials are detected during excavation operations, immediately notify the Departmental Representative. Any contaminated materials to be disposed of using methods approved by the Departmental Representative.

3.7 GRADING

- .1 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Departmental Representative. Grade to be gradual between finished spot elevations as indicated.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

- .1 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 24 13 – Roadway Embankments.
- .2 Section 31 37 00 – Rip-Rap.
- .3 Section 32 11 16.01 – Granular Sub-Base.
- .4 Section 32 11 23 – Aggregate Base Courses.
- .5 Section 32 15 40 – Crushed Stone Surfacing.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Allow continual sampling by Departmental Representative during production.
 - .3 Provide Departmental Representative with access to source and processed material for sampling.
 - .4 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.
 - .5 Supply new or clean sample bags or containers according appropriate to aggregate materials.
 - .6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Products

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
 - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
 - .2 Reclaimed asphalt pavement.
 - .3 Reclaimed concrete material.
 - .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.
 - .4 Reclaimed asphalt pavement.
 - .5 Reclaimed concrete material.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.

- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with topsoil stripping only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Aggregate source preparation:
 - .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.
 - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
 - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
 - .4 When excavation is completed dress sides of excavation to nominal 1.5:1 (horizontal : vertical) slope, and provide drains or ditches as required to prevent surface standing water.
 - .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
 - .6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.
- .2 Processing:
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

- .1 Use methods and equipment approved in writing by Departmental Representative.
- .3 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.
- .4 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
 - .1 Use only equipment approved in writing by Departmental Representative.
- .5 Stockpiling:
 - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
 - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
 - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
 - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
 - .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 1.5 m for coarse aggregate and base course materials.
 - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
 - .3 Maximum 1.5 m for other materials.
 - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
 - .9 Do not cone piles or spill material over edges of piles.
 - .10 Do not use conveying stackers.
 - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .5 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .6 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.
- .7 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 – Aggregate Materials
- .2 Section 32 11 16.01 – Granular Sub-Base

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³) 600 kN-m/m³.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roadway subgrade reshaping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

3.2 SCARIFYING AND RESHAPING

- .1 Scarify subgrade to full width and to depth of 150 mm minimum, unless otherwise instructed by the Department Representative.

- .2 Pulverize and break down scarified material to 100 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by Departmental Representative.
- .3 Blade and trim pulverized material to elevation and cross section dimensions as directed by Departmental Representative.
- .4 Where deficiency of material exists, add and blend additional subgrade material as directed by Departmental Representative.

3.3 COMPACTING

- .1 Compact to minimum 95% maximum dry density to ASTM D 1557.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than 2 % moisture above optimum value for compaction to ASTM D 1557.

3.4 SITE TOLERANCES

- .1 Reshaped compacted surface to be within plus or minus 10 mm of elevation as indicated.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect and maintain reshaped surface in condition conforming to this Section until succeeding material is applied or until after receipt of written acceptance from Departmental Representative acceptance.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 48 00.01 – Modular Block.
- .2 Section 31 00 99 – Earthworks for Minor Works
- .3 Section 31 05 16 – Aggregate Materials
- .4 Section 33 42 13 – Storm Culverts

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-63 2002, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D 1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - ASTM D 4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.0 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

- .3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .2 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .4 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .5 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.2.
 - .2 Table:

Sieve Designation	% Passing
2.00mm	100
0.10mm	45-100
0.02mm	10-80
0.005mm	0-45
 - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .6 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

- .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section. (Section 31 23 33.01 –Excavating, Trenching, and Backfilling)
- .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
- .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
- .5 Submit to Departmental Representative testing and inspection results and reports as described in PART 3 of this Section. (Section 31 23 33.01 – Excavating, Trenching, and Backfilling).
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field and location plan of relocated and abandoned services, as required.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
 - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
 - .4 Ship samples to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.
 - .5 At least 4 weeks prior to beginning Work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.
 - .1 Do not change source of Fly Ash without written approval of Departmental Representative.

1.5 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in British Columbia, Canada.
- .5 Keep design and supporting data on site.

- .6 Engage services of qualified professional Engineer who is registered or licensed in British Columbia, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill to local facility for reuse as directed by Departmental Representative.

1.7 EXISTING CONDITIONS

- .1 Examine soil reports.
- .2 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Confirm locations of buried utilities by careful test excavations or soil hydro vac methods.
 - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .7 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing, re-routing.
 - .8 Record location of maintained, re-routed and abandoned underground lines.
 - .9 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

- .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.
 - .3 Table:

Sieve Designation (mm)	% Passing	
	Type 1	Type 2
75	-	100
50	-	-
37.5	-	60-100
2	-	-
19	100	-
12.5	75-100	-
9.5	60-90	26-60
4.75	40-70	20-40
2.36	27-55	15-30
1.18	16-42	10-20
0.600	8-30	5-15
0.300	5-20	3-10
0.075	2-8	0-5

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.

- .2 Minimum strength of 0.07MPa at 24 h.
- .3 Concrete aggregates: to CSA-A23.1/A23.2.
- .4 Cement: Type GU.
- .5 Slump: 160 to 200 mm.

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, contractor prepared site specific sediment and erosion control plan.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 PREPARATION/ PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush and removed from site.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.

- .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements
 - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as approved by Departmental Representative.
- .4 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .6 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as indicated.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review and approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.

- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved collection areas and in a manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.8 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated by Contract Drawings.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material in approved location on site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .13 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density.
- .14 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

- .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.9 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 1557.
 - .1 Under concrete slabs: in accordance with Contract Drawings. Compact base course to 100% Modified Proctor.
 - .2 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95% Modified Proctor. For remaining portion, use Type 3 fill compacted to 95% Modified Proctor.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as specified in Section 31 00 99 – Earthwork for Minor Works.
- .2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

- .1 Mechanical vibratory compaction equipment.
- .2 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

- .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
- .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .7 Place recycled fill in areas as indicated.
- .8 Consolidate and level unshrinkable fill with internal vibrators.
- .9 Install drainage system in backfill as directed indicted.

3.12 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 – Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .3 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .4 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 00 99 – Earthwork For Minor Works
- .2 Section 31 32 19.01 - Geotextiles
- .3 Section 31 37 00 – Rip-Rap

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D 698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).
- .2 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO T99-[10], Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5lb) Rammer and 305 mm (12 in) Drop.

1.3 DEFINITIONS

- .1 Rock Excavation: excavation of:
 - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
 - .2 Boulder or rock fragments measuring in volume 1 cubic metre or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the Work.
- .4 Stripping: excavation of organic material covering original ground.
- .5 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
- .6 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .7 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .8 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
- .9 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Submit for approval and review blasting program including pre-shear details, powder factors fly-rock control, and vibration monitoring methods.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Adhere to regulations of authority having jurisdiction when blasting is required.
- .2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

Part 2 Products

2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Borrow material:
 - .1 Obtain from sources such as quarry, or borrow pit as approved or as designated by Departmental Representative.
 - .1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
 - .2 Rock Embankment material to consist of fragmented rock produced by drilling and blasting operations, and boulders which cannot be placed in layers as specified for Earth Embankments.
 - .1 Rock Embankment to conform to gradation as follows:

Sieve Designation	% Passing by Weight
150mm	100
100mm	85-100
75mm	10-50
No. 200	*0-3

- .2 * Gradation is determined by that portion passing 75 mm screen.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 COMPACTION EQUIPMENT

- .1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.
 - .1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
 - .2 Replace or supplement equipment that does not achieve specified densities.
- .2 Operate compaction equipment continuously in each embankment when placing material.

3.3 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution.

3.4 EXCAVATING

- .1 General:
 - .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
 - .2 Sub-excavate 300 mm below subgrade in cut sections unless otherwise directed by Departmental Representative.
 - .1 Compact top 150 mm below sub-excavate to minimum 95% maximum dry density, to ASTM D 698 AASHTO T99.
 - .2 Replace with approved embankment material and compact to specified embankment density.
 - .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.
 - .4 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.

- .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Provide ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
- .3 Rock excavation:
 - .1 Notify Departmental Representative, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 24 hour notification.
 - .2 Submit blasting program to Departmental Representative, for approval 48 hours minimum before start of Work.
 - .1 Do not proceed without written approval of blasting program from Departmental Representative.
 - .3 Shatter rock to 300 mm below subgrade elevation as indicated.
 - .4 Reduce overbreak and increase stability of rock faces by using smooth blasting techniques.
 - .5 Use smooth blast and excavate short sections in rock cuts to determine optimum spacing of holes when requested by Departmental Representative.
 - .6 Stem holes as necessary to contain blast.
 - .7 Do not use prilled type ammonium nitrate and fuel oil (ANFO) explosives within 4 m of final cut line.
 - .8 Form back wall by pre-splitting at least 10 m in advance of production blasting.
 - .1 Smooth wall blast just prior to or just after production blast as determined by approved blast program.
 - .9 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.
 - .10 Control blasting to minimize flying particles.
- .4 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Obtain embankment materials, in excess of what is available from cut areas, from designated borrow areas.
 - .1 Departmental Representative to designate extent of borrow areas and allowable depth of excavation.
 - .2 Remove waste and stripping material from borrow pits to designated locations.
 - .3 Slope edges of borrow areas to minimum 2:1 and provide drainage as directed.

- .4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.5 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
 - .1 Method used to be to be pre-approved in writing by Departmental Representative.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized by Departmental Representative.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
 - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
 - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
 - .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 450 mm of pavement subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.6 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and level, embankment material in layers 200 mm maximum thickness before compaction.
 - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
 - .2 Ensure required compaction for each layer before placing any material for next layer.

- .3 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.
- .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
 - .1 For tamping rollers, use equipment that exerts 1000 kPa minimum of pressure on tamping surface of each tamping foot in transverse row.
- .5 Compact each layer to minimum 95% maximum dry density: ASTM D 698 except top 150 mm of subgrade.
 - .1 Compact top 150 mm to 100% maximum dry density.
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.7 FINISHING

- .1 Shape entire roadbed to within 25 mm of design elevations.
- .2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable. Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.
- .3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of highway.
- .7 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation of polymeric geotextiles used in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and railroad beds purpose of which is to:
 - .1 Separate and prevent mixing of granular materials of different grading.
 - .2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Section 31 00 99 – Earthworks for Minor Works.
- .4 Section 31 37 00 – Rip-Rap.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .2 ASTM D4595-09, Standard Test Methods for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .3 ASTM D4716/D4716M-14, Standard Test Methods for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .4 ASTM D4751-16, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-4.2 No. 11.2-M89(R2013), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .3 No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
 - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

- .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .3 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 Ontario Provincial Standard Specifications (OPSS):
 - .1 OPSS 1860-March 1998, Material Specification for Geotextiles.
- .5 British Columbia Ministry of Health – British Columbia Onsite Sewage Association:
 - .1 Sewerage System Standard Practice Manual – Version 3, September, 2014.

1.4 SUBMITTALS

- .1 Submit to Departmental Representative 1 digital copy of mill test data and certificates at least 4 weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIAL

- .1 Geotextile, if required, type will be specified on a case by case basis.

Part 3 Execution

3.1 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 h of placement.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 00 99 – Earthworks for Minor Works.

3.2 CLEANING

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

3.3 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

1.1 RELATED REQUIREMENTS

- .1 Section 31 00 99 – Earthworks for Minor Works.
- .2 Section 31 32 19.01 – Geotextiles.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 144-17, Standard Specification for Aggregate for Masonry Mortar.
 - .2 ASTM C 618-17a, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-A3000-98, Cementations Materials Compendium.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Divert left over aggregate materials from landfill to local facility for reuse as approved by Departmental Representative.
- .5 Divert left over hardened cement materials from landfill to local facility for reuse as approved by Departmental Representative.
- .6 Divert left over geotextiles to local plastic recycling facility as approved by Departmental Representative.

Part 2 Products

2.1 RIP-RAP

- .1 Rip rap shall consist of clean, free draining, sound dense, durable crushed rock; free of organics, roots, silt, sand, clay, snow, ice, or other deleterious material.
- .2 Rock shall be hard, with a relative density not less than 2.65, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
 - .1 Standard armour rip-rap (10kg Class):
 - .1 Not more than 15% of total volume of stones with individual volume less than 1kg.

- .2 Not less than 50% of total volume of stones with individual volume of 10kg or more.
- .3 Not more than 15% of total volume of stones with individual volume of 30kg or more.
- .4 Approximate average dimensions: 200mm.
- .2 Heavy armour rip-rap (25kg Class):
 - .1 Not more than 15% of total volume of stones with individual volume less than 2.5kg.
 - .2 Not less than 50% of total volume of stones with individual volume of 25kg or more.
 - .3 Not more than 15% of total volume of stones with individual volume of 75kg or more.
 - .4 Approximate average dimensions: 300mm.

2.2 CEMENT MORTAR

- .1 Cement: to CAN/CSA-A3000, type 10.
- .2 Sand for mortar: to ASTM C 144.
- .3 Mortar mix: 1 part by volume of cement to 3 parts sand, to consistency approved by Departmental Representative.

2.3 GEOTEXTILE FILTER

- .1 Geotextile soil stabilization: in accordance with Section 31 32 19.01 – Geotextiles.

Part 3 Execution

3.1 GENERAL

- .1 Prior to commencing rip-rap Works, eliminate uneven areas and depressions on the area to be rip-rapped by fine grading to a uniform even surface. Fill depressions with suitable material and compact to provide firm bed.
- .2 Obtain Departmental Representative approval of finish slope prior to proceeding with rip-rap placement.

3.2 STOCKPILING

- .1 Temporarily stockpile all sand, gravel, and rock materials that have been processed by washing methods for a minimum of 48 hours to permit drainage of excess water. Do not place recently washed materials on top of or with drier stockpiled materials.
- .2 Use equipment and methods that minimizes the amount of material handling, and that do not cause segregation or material breakdown.
- .3 Do not stockpile materials where contamination with the underlying soils can occur.

3.3 PLACING

- .1 Place rip-rap as indicated on Contract Drawings.
- .2 Machine place. Do not dump at top of slope and spread.
- .3 Intermix the rip rap material to uniformly distribute the larger size material and utilize small size material to fill in the void spaces resulting in a well -keyed, void free, stable surface with a consistent gradation. Ensure the segregation does not occur during placement.
- .4 Do not dislodge or tear geotextile fabric during the placement of rip- rap. Repair as an incidental to the Works.
- .5 Ensure the completed rip-rap placed is stable with no tendency to slide.
- .6 Hand place as required to provide a neat and uniform surface.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075 mm (no. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D 1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D 1883-16, Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.
 - .7 ASTM D 4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 and authorities having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations and erosion and sedimentation control plan.
 - .2 Replace defective or damaged materials with new.
- .3 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.
 - .3 Table

Sieve Designation (mm)	% Passing
75	100
38	60 – 100
19	35 – 80
9.5	26 – 60
4.75	20 – 40
2.36	15 – 30
1.18	10 – 20
.600	5 – 15
.300	3 – 10
.075	0 – 5

- .4 Other properties as follows:
 - .1 Liquid Limit: to ASTM D 4318, Maximum 25.
 - .2 Plasticity Index: to ASTM D 4318, Maximum 6.
 - .3 Los Angeles degradation: to ASTM C 131.

- .1 Maximum loss by mass: 50 %.
- .4 Particles smaller than 0.02 mm: to ASTM D 422, Maximum 3%.
- .5 Soaked CBR: to ASTM D 1883, Minimum 40 when compacted to 100% of ASTM D 1557.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .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 drawings, 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.

3.3 PLACEMENT AND INSTALLATION

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Placing:
 - .1 Construct granular sub-base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow or ice.
 - .4 Begin spreading sub-base material on crown line or high side of one-way slope.

- .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace portion of layer in which material has become segregated during spreading.
- .3 Compacting:
 - .1 Compact to density not less than 95% modified proctor ASTM D 1557.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .4 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated.
 - .1 If use of non-standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this Section.
 - .3 Replace sub-base material and compact in accordance with Section.

- .4 Replace base material and compact in accordance with this Section.
- .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this Section at no extra cost.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 SITE TOLERANCES

- .1 Finished sub-base surface to be within 20 mm of elevation as indicated but not uniformly high or low.

3.6 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D 1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D 1883-16, Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils.
 - .7 ASTM D 4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 and authorities having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Storage and Handling Requirements:
 - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
 - .2 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Replace defective or damaged materials with new.
 - .4 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.
- .3 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.
 - .1 Gradation to:

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

- .2 Liquid limit: to ASTM D 4318, maximum 25.
- .3 Plasticity index: to ASTM D 4318, maximum 6.
- .4 Los Angeles degradation: to ASTM C 131. Max. % loss by weight: 45

- .5 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C 136.

Passing	Retained On	
19.0 mm	to	4.75 mm

Part 3 Execution

3.1 PREPARATION

- .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 drawings, 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.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after sub-base and/or subgrade surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
- .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
 - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
 - .1 Compact to density not less than 100% Modified Proctor ASTM D 1557.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated.
 - .1 If use of non-standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.
 - .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.
 - .4 Replace base material and compact in accordance with this Section.
 - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused granular material from landfill to local facility approved by Departmental Representative.

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 – Aggregate Base Courses.

1.2 REFERENCE STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-17, Standard Specification for Performance-Graded Asphalt Binder.
 - .2 AASHTO R29-15, Standard Specification for Grading or Verifying the Performance Grade of an Asphalt Binder.
 - .3 AASHTO T245-15, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C 88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C 117-17, Standard Test Method for Materials Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 123/C123M-14, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C 127-15, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - .5 ASTM C 128-15, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate.
 - .6 ASTM C 131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C 136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C 207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D 2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .10 ASTM D 3203/D3203M-17, Standard Test Method for Percent Air Voids in Compacted Asphalt Mixtures.

- .11 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-[88], Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-[M88], Sieves Testing, Woven Wire, Metric.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C 4 weeks prior to beginning Work.
- .3 Samples:
 - .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.
 - .2 Submit samples of following materials proposed for use 4 weeks prior to beginning Work.
 - .1 One 5L container of asphalt cement.
 - .2 1 kg of hydrated lime.
- .4 Test and Evaluation Reports:
- .5 Certificates:
 - .1 Certification to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.
 - .3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for approval at least 4 weeks prior to beginning Work.

- .4 Submit printed record of mix temperatures at end of each day.
- .7 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005, and authorities having jurisdiction.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan, and Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates.
 - .3 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
 - .2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.

Part 2 Products

2.1 MATERIALS

- .1 Performance graded asphalt cement: to AASHTO M320, grade PG 58 - 28 when tested to AASHTO R29.
- .2 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials: General and requirements as follows:
 - .1 Crushed stone or gravel.
 - .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.
 - .3 Table:

Sieve Designation (mm)	% Passing
12.5	100
4.75	55 - 75

2.36	38 - 58
1.18	28 - 47
0.600	20 - 36
0.300	10 - 26
0.150	4 - 17
.075	3 - 8

2.2 EQUIPMENT

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Drum diameter: 1200 mm minimum.
 - .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
 - .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.
 - .6 Plant testing facility: provide laboratory space at plant site for exclusive use of Departmental Representative, for performing tests, keeping records and making reports.

2.3 MIX DESIGN

- .1 Mix design to be prepared by Contractor and approved in writing by Departmental Representative.
- .2 Mix to contain maximum 20% by mass of RAP. Departmental Representative may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.
- .3 Design of mix: by Marshall method to requirements below.

- .1 Compaction blows on each face of test specimens: 75.
- .2 Mix physical requirements:

Property	Roads
Marshall Stability at 60°C (kN min)	5.5
Flow Value (mm)	2-4
Air Voids in Mixture (%)	3-5 surface course/2-6 lower course
Voids in Mineral Aggregate (% min)	15 surface course/ 13 lower course
Index of Retained Stability % minimum	75

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to AASHTO T245.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C 127 and ASTM C 128. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D 3203.
 - .4 Voids in mineral aggregates: to AI MS2.
- .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided to be reviewed by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .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 drawings, and 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.
- .2 Finished sub-base surface to be within 20 mm of elevation as indicated but not uniformly high or low.
- .3 Finished asphalt surface not to have irregularities exceeding 20 mm when checked with 4.5 m straight edge placed in any direction.
- .4 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
- .5 Apply prime coat and tack coat prior to paving.
- .6 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required.

- .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

3.4 TEST STRIP

- .1 Construct and test strip to approval of Departmental Representative.
- .2 During construction of test strip, Departmental Representative will establish optimum rolling pattern by taking nuclear densimeter readings and observations to:
 - .1 Determine sequence and number of passes.
 - .2 Determine correct operating characteristics of vibratory rollers.
 - .3 Determine maximum density of asphalt mix.
 - .4 Ensure smooth surface finish.
 - .5 Establish actual density achieved by coring in order to determine if additional or other rolling equipment is required to achieve density of not less than [98] % of density obtained with Marshall specimens prepared from samples of mix being used.

3.5 PLACING

- .1 Obtain Departmental Representative's approval of base and existing surface and tack coat and prime coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated on Contract Drawings and as directed by Departmental Representative.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

- .4 Place asphalt concrete in compacted lifts of thickness as follows:
 - .1 Levelling courses to thicknesses required but not exceeding 50 mm.
 - .2 Lower course in 1 layer of 50 mm.
 - .3 Surface course in 1 layer of maximum 50 mm.
- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Place individual strips no longer than 500 m.
- .7 On airport runways and taxiways, aprons and parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.
- .8 Spread and strike off mixture with self-propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative to review lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver.
 - .1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
- .9 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broadcast material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.

- .1 Reject material that has formed into lumps and does not break down readily.
- .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
- .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.6 COMPACTING

- .1 Roll asphalt continuously using established rolling pattern for test strip and to density of not less than 100 % of maximum density determined for test strip.
- .2 Do not change rolling pattern unless mix changes or lift thickness changes.
 - .1 Change rolling pattern only as directed by Departmental Representative.
- .3 Roll asphalt continuously to density not less than 98 % of 75 blow Marshall density to AASHTO T245.
- .4 General:
 - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling coarse less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of [25] impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .6 Overlap successive passes of roller by minimum of [200] mm and vary pass lengths.
 - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

- .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
- .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
- .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .5 Breakdown rolling:
 - .1 Begin breakdown rolling with vibratory roller immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
 - .4 Use only experienced roller operators.
- .6 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .7 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.
- .8 Dust entire area of sheet asphalt pavements with hydrated lime immediately after rolling to eliminate tendency to pick-up under traffic.

3.7 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.

- .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
- .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
 - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.
 - .2 Locate feather joints as indicated.
- .5 Construct butt joints as indicated.

3.8 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

- .3 Finished asphalt surface must be free draining such that no areas of standing water are created.
- .4 If the variance for grade is rejected by the Departmental Representative, the Contractor shall remove the lot to a depth of at least the thickness of the course involved and replace it with hot-mix asphalt meeting the Contract requirements – all at the Contractor's cost. Skin patching for correcting low areas will not be permitted. The Contractor shall bear the cost of the evaluation by the Departmental Representative.

3.9 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 32 19.01 - Geotextiles

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM D 4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .4 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Store crushed stone as and where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base: in accordance with Section 31 05 16 - Aggregate Materials, 32 11 16.01 - Granular Sub-base, and following requirements:

- .1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 Gradations: within limits specified when tested to ASTM C 136 ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation (mm)	% Passing
75	0 - 100
38	60 - 100
19	35 - 80
9.5	26 - 60
4.75	20 - 40
2.36	15 - 30
1.18	10 - 20
.600	5 - 15
.300	3 - 10
.075	0-10

.3 Granular base: in accordance with Section 31 05 16 - Aggregate Materials, 32 11 23 - Aggregate Base Course, and following requirements:

- .1 Crushed stone or gravel: hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.3 Table:

Sieve Designation (mm)	% Passing
19	100
12.5	75 - 100
9.5	60 - 90
4.75	40 - 70
2.36	27 - 55
1.18	16 - 42
.600	8 - 30

.300	5 - 20
.075	2 - 8

- .4 Liquid limit: ASTM D 4318 maximum 25.
- .5 Plasticity index: ASTM D 4318 maximum 6.
- .4 Granular topping:
 - .1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117.

Sieve Designation (mm)	% Passing
9.5	100
4.75	50-100
2.00	30-65
0.425	10-30
0.075	8-15

- .3 Liquid limit: ASTM D 4318 maximum 25.
- .4 Plasticity index: ASTM D 4318 maximum 6.

Part 3 Execution

3.1 SUBGRADE

- .1 Ensure subgrade preparation conforms to levels and compaction required, to allow for installation of granular base.

3.2 GEOTEXTILE FILTER

- .1 Install geotextile filter as indicated in accordance with Section 31 32 19.01 - Geotextiles.

3.3 GRANULAR SUB-BASE

- .1 Granular sub-base material minimum thickness: 200 mm for paved areas and 300 mm for non-paved areas.
- .2 Place material in uniform layers not to exceed 150 mm compacted thickness.
 - .1 Compact layer to 95 % maximum dry density in accordance with ASTM D 1557.

3.4 GRANULAR BASE

- .1 Granular base material thickness: 150 mm for paved areas and 225 mm for non-paved areas.
- .2 Spread and compact granular base material in uniform layers not exceeding 100 mm compacted thickness.
- .3 Compact to a density of not less than 95 % maximum dry density in accordance with ASTM D 1557.

3.5 EDGING

- .1 .1 Install edging true to grade, in location, and layout as indicated.

3.6 GRANULAR TOPPING

- .1 Place granular topping to compacted thickness 75 mm minimum.
- .2 Place material in uniform layers not to exceed 75 mm compacted thickness.
 - .1 Compact layer to 95 % maximum dry density in accordance with ASTM D 1557.

3.7 FIELD QUALITY CONTROL

- .1 Inspection and testing of crushed stone paving: carried out by designated testing laboratory.
- .2 Costs of passing tests: paid by Departmental Representative.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
 - .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

- .1 Prevent damage to roads and adjacent property.
 - .1 Repair damages incurred.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 00 99 – Earthworks for Minor Works.
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C 14M-07, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C 76M-10a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C 144-04, Standard Specification for Aggregate for Masonry Mortar.
 - .6 ASTM C 443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .7 ASTM D 698-07e], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft² (600 kN-m/m²)).
 - .8 ASTM D 1248-05, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .9 ASTM F 667-06, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 CSA International
 - .1 CSA A3000-08, Cementitious Materials Compendium.
 - .2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.
 - .3 CAN/CSA G401-07, Corrugated Steel Pipe Products.
- .4 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Certification: to be marked on pipe.
- .5 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.
 - .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
 - .3 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating the percentage of construction wastes were recycled or salvaged.
 - .4 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

- .1 Corrugated steel pipe: to CAN/CSA-G401.
- .2 Water-tight cut-off collars: as indicated.
- .3 Prefabricated end sections: as indicated.
- .4 Corrugated fluming: to CAN/CSA-G401.
 - .1 Shop drawing submittal required to Section 01 33 00 – Submittal Procedures.

2.2 CONCRETE BOX CULVERT

- .1 Reinforced concrete box culvert: to ASTM C 1433-16b.
- .2 Rubber gaskets for joints: to ASTM C990M.
- .3 Cement mortar joint filler:
 - .1 Portland cement: to CSA A3000 type 10.
 - .2 Sand: to ASTM C 144.
 - .3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

2.3 CONCRETE BOX CULVERT HEADWALL

- .1 Concrete box culvert headwalls: to CSA A23.4.
- .2 Minimum 28 day strength: 27.5 MPa
- .3 Handrails:
 - .1 Material: aluminum
 - .2 Height: 1.065m
 - .3 Shop drawing submittal required to Section 01 33 00 – Submittal Procedures.

2.4 GRANULAR BEDDING AND BACKFILL

- .1 Granular bedding and backfill material to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation (mm)	% Passing
75	0 – 100
38	60 – 100
19	35 – 80
9.5	26 – 60
4.75	20 – 40
2.36	15 – 30
1.18	10 – 20
.600	5 – 15
.300	3 – 10
.075	0 – 5

.3 Concrete mixes and materials for bedding, cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.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, contractor prepared sediment and erosion control drawings specific

to site, and that that comply 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.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 100% of corrected maximum dry density to ASTM D 1557.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.5 LAYING CORRUGATED STEEL PIPE CULVERTS

- .1 Begin pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream.
- .4 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.6 JOINTS: CORRUGATED STEEL CULVERTS

- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.

- .4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich epoxy paint.

3.7 LAYING CONCRETE BOX CULVERTS

- .1 Begin at downstream end of culvert with flanged end of first box section facing upstream.
- .2 Ensure bottom of each section is in contact with shaped bed throughout its length.
- .3 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

3.8 JOINTS: CONCRETE BOX CULVERTS

- .1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.
 - .1 Rubber gasket joints:
 - .1 Install in accordance with manufacturer's written recommendations.
 - .2 Ensure that tapered ends are fully entered into flanged ends.

3.9 JOINTS FOR POLYETHYLENE CULVERTS

- .1 Install couplings in accordance with manufacturer's instructions.

3.10 FLUMING

- .1 Assemble and install fluming as indicated.
- .2 Set top edges of fluming flush with side slope.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 00 99 – Earthworks for Minor Works
- .2 Section 31 37 00 – Rip Rap

1.2 ENVIRONMENTAL REQUIREMENTS

- .1 Operation of construction equipment in water is prohibited.
- .2 Use borrow material from watercourse beds only after receipt of written approval from Departmental Representative and authority having jurisdiction.
- .3 Design and construct temporary crossings to minimize environmental impact to watercourse and wetland.
- .4 Constructing temporary crossings of watercourses where spawning beds are indicated is prohibited.
- .5 Dumping excavated fill, waste material, or debris in watercourse or wetland is prohibited.
- .6 All works to be done in accordance with best management practices and mitigative measures identified in 'KHV Healing Village Environmental Effects Evaluation Access Road Repairs, Regrading and Culvert Upgrades', Hemmera, May 27, 2019.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 EXISTING CONDITIONS

- .1 Maintain existing flow pattern in natural watercourse systems.
- .2 In natural systems maintain existing riffle pool and step pool patterns.
- .3 In wetland systems, maintain existing hydrological conditions.

3.2 SITE CLEARING AND PLANT PROTECTION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Appropriate ESC perimeter controls (e.g. sediment fencing) to be implemented prior to the commencement of construction activities, as necessary.
 - .2 Installation and maintenance of temporary measures which may include; silt fences, straw bales, geotextiles, berms, temporary drainage piping or ditching,

- vegetative cover, and/or other mitigation measures to prevent erosion and migration of silt, mud, sediment, and other debris off site or to other areas of site where impacts to sensitive environmental receptors may result.
- .3 Soils exposed as a result of Project activities, and/or implementation of other erosion protection or sediment control measures should be covered with a liberal layer of scattered straw or poly material until such time that re-vegetation (soil stabilization) can be implemented.
 - .4 Disturbed areas should be restored as soon as possible, through hydroseeding or replanting, to ensure stabilization of exposed soils.
 - .5 All installed ESC measures should be regularly inspected and replaced/modified as required during construction.
 - .6 Culvert replacement should occur during dry weather conditions to reduce potential for sediment-laden waters to migrate to downstream fish-bearing watercourses.
 - .7 Instream works should be conducted in-the-dry and surface flow should be diverted around works, using techniques such as pumping and/or piping of flows.
 - .8 Any sediment-laden water should be discharged to areas that are at least 30m away from any aquatic habitats. Discharge locations should be in vegetated/forested areas to allow for infiltration back into the ground and filtration of sediment-laden water away from watercourses. Discharging should not be conducted in a manner that promotes further erosion and increased sedimentation at the discharge site (e.g., direct water at the face of a large rock to dissipate energy).
 - .9 Remove erosion and sedimentation controls at a suitable time after the site has been stabilized and erosion is no longer a concern.
- .2 Minimize disturbance to vegetated buffer zones and protect trees and plants on site and adjacent properties where indicated.
 - .3 Wrap trees and shrubs adjacent to construction work, storage areas and trucking lanes in burlap.
 - .4 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.
 - .5 Leave cuttings from trees and other vegetation on site as brush piles to allow for natural degradation.
 - .1 Secure large piles with degradable materials to prevent interference with watercourse.
 - .6 Remove only trees that may offer future blockage problems as instructed by Departmental Representative.
 - .7 Leave roots mass and stumps in place.
 - .8 Maintain temporary erosion and pollution control features installed under this contract.

3.3 PROTECTION OF SURFACE WATER QUALITY AND SPILL MANAGEMENT

- .1 Equipment must arrive onsite washed and free of leaks, invasive species, and noxious weeds.
- .2 All fueling, washing, and maintenance of equipment must be conducted at a safe distance (i.e. at least 30m away) from aquatic habitats to prevent the introduction of deleterious substances into these habitats (i.e., outside the riparian buffer area).
- .3 Use biodegradable fluids in heavy machinery associated with instream works, where practicable, and ensure equipment is clean and free of excess oil and grease prior to initiating work.
- .4 Ensure any gravels, rock, riprap or other materials placed on the banks or within watercourse channels is inert, and free from deleterious substances.
- .5 Ensure basic spill kits are available within every vehicle and piece of equipment operating within the construction site.

3.4 FISH AND FISH HABITAT

- .1 Instream work should be conducted during dry weather conditions.
- .2 All instream works will be conducted in isolation of flowing water. The contractor will be required to have isolation and diversion materials (e.g. sandbags, pumps, and polyethylene sheeting) on site and ready for deployment.
- .3 The Department Representative shall be notified prior to any watercourse diversions.
- .4 The duration of instream works should be minimized to the extent possible.

3.5 RIPARIAN VEGETATION

- .1 Minimize the area of vegetation clearing to the extent possible.

3.6 SITE RESTORATION

- .1 Establish vegetated buffer zones with suitable vegetation to minimum 3 m along edge of watercourse banks as determined by Departmental Representative.
- .2 Plant vegetation natural to area, suitable for application without requirement for fertilizers, pesticides and other chemicals.
- .3 Control stream bank erosion in lower section of watercourse with irregular shaped rip rap underlain with non-toxic filter cloth of size approved by Departmental Representative.
- .4 Control stream bank erosion in upper section of watercourse by planting suitable vegetation as directed by Departmental Representative.
 - .1 Ensure planting occurs within 7 days after work on watercourse is complete.

END OF SECTION

A	Geotechnical Assessment Report– Ryzuk Geotechnical	17 pages
B	Vehicle Safety Barrier Record Drawings – ISL Engineering & Land Services	2 pages
C	Pre-Construction Hazard Assessment Form	4 pages
D	Slope Failure Assessment and Stabilization – GeoWest Engineering	5 pages
E	KHV Healing Village Environmental Effects Evaluation Access Road Repairs, Regrading and Culvert Upgrades - Hemmera (separate package)	34 pages

RYZUK GEOTECHNICAL

Engineering & Materials Testing

28 Crease Avenue, Victoria, BC, V8Z 1S3 Tel: 250-475-3131 Fax: 250-475-3611 www.ryzuk.com

February 7, 2018
File No: 8-7522-13

Wedler Engineering LLP
221-2459 Cousins Avenue
Courtnay, BC
V9N 3N6

Attention: Sam Rogers, P.Eng.
(by email: srogers@wedler.com)

Re: Gravel Access Road - Geotechnical Assessment
Kwkwèxwelhp to Chehalis River Hatchery - Harrison Mills, BC

As requested, and in accordance with our proposal dated August 17, 2017, we have completed a geotechnical investigation of the subsurface soil conditions at the referenced site as such relates to the proposed works. Our observations and recommendations are summarized below.

PROPOSED DEVELOPMENT

The Kwkwèxwelhp Healing Village access road is located roughly 4.5 km north of the entrance to the Sandpiper Golf Course along Morris Valley Road in Harrison Mills, BC. Built within a mountainside, much of the road appears to have been constructed using cut and fill construction. As a result, there are a number of steep fill slopes located immediately adjacent to the road. The road itself is roughly 3.5 km in length and is currently finished with a gravel surface. We understand that recent issues with surface grading have resulted in channelized runoff and resultant slope instability of localized areas. We have previously provided an assessment of the gravel road in letter *Assessment of Existing Gravel Road – Kwkwèxwelhp Healing Village*, dated November 24, 2016.

In an effort to mitigate the potential for slope instability and to provide general road improvements, we understand that a number of works are proposed. These include regrading, the reconstruction of ditches along the up slope side, the installation of a number of culverts along the length of the road, and if required, the construction of retaining walls along some steep slope areas.

INVESTIGATION PROCEDURE

On October 24, 2017, we visited the subject site to complete a site reconnaissance and subsurface investigation. The site reconnaissance consisted of traversing the access road by foot and documenting features of engineering, geological, and topographical significance. The subsurface investigation included the excavation of 30 test pits (TP17-01 to TP17-30) to depths down to 3.4 m

below the existing ground surface. The test pits were completed using a subcontracted track-mounted excavator.

Prior to our investigation, we were provided with Wedler Engineering's 33% completion drawing set *Kwikwèxwelhp Healing Village Access Road Culvert Replacement and Road Repair/Regrade*, dated September 2, 2017. Based on discussions with Wedler, a total of 10 steep slope areas were targeted as being potentially susceptible to slope instability. Test-pits were excavated in these targeted areas in an effort to confirm if remediation is necessary, and if so, what type of remediation may be possible. Based on the stationing provided in the previously noted drawing set, a summary of the steep slope areas and the test-pits excavated within them is included in Table 1.

Table 1: Summary of test-pits completed in steep slope areas

Steep Slope Area	Upslope/downslope	Station*	Test-Pits
1	downslope	1+210 to 1+290	TP17-02, TP17-03, TP17-04
2	upslope	1+560 to 1+600	TP17-08, TP17-09
3	up/downslope	1+690 to 1+760	TP17-10, TP17-11, TP17-12, TP17-13
4	downslope	2+015 to 2+070	TP17-17
5	downslope	2+225 to 2+340	TP17-18, TP17-19
6	upslope	2+320 to 2+360	TP17-20
7	downslope	2+690 to 2+860	TP17-22, TP17-23, TP17-24
8	upslope	2+870 to 2+920	TP17-25
9	upslope	3+465 to 3+515	TP17-29
10	upslope	3+710 to 3+740	TP17-30
*Note, station values are estimates and based on stationing noted on Wedler drawings.			

A number of other test-pits were also excavated; however, these were generally exploratory in nature and completed with the anticipation that the results could be used for road regrading, culvert installation, and ditch construction. The location of all test test-pits completed as part of our subsurface investigation are noted on the attached Test-Pit Location Plan (drawing # 8-7522-13-1). Detailed test-pit logs are also attached.

INVESTIGATION RESULTS

Results and interpretations of the site reconnaissance and subsurface investigation follow.

General

As previously noted, the existing road is finished with a gravel surface. We understand that shortly prior to our attendance at the site, road maintenance had recently been completed, and as such, at the time of our investigation the road surface was in good condition. However, we understand that following periods of rainfall and snowmelt, flows tend to channelize within the gravel, resulting in gravel washout as well as large volumes of water discharging over localized areas of the steep slopes.

The road is constructed through mountainous terrain where natural and filled grades range from flat to near vertical. Vegetation throughout much of the road alignment consists of large trees with a low brush undercover; however, relatively recent logging in the area has left only the brush undercover on a number of downslope sections of the road. Bedrock is visible along many of the upslope portions of the road and it can even be seen in small sections of the road where overlying fill material has been worn away.

Surface and Subsurface Conditions

In general, soils encountered during the test-pit investigation consisted of variable depths of fill material over the native dense till-like gravelly sand with some cobbles atop bedrock. Where encountered, the depth to bedrock varied from at surface to 2.4 m below existing grades. Bedrock was often noted to be at/near the surface along the upslope side of the road. Likely the result of cut and fill construction techniques, fill materials were generally the most deep along the downslope side of the road. Fill was noted in test-pits to depths up to 3.0 m; however, greater depths of fill should be anticipated as rock/boulder fill, as deep as 6.0 to 7.0 m, was noted in localized downslope sections.

A detailed summary of the surface and subsurface conditions in each specific steep slope area follows.

Steep Slope Area #1 (1+210 to 1+290)

Steep Slope Area #1 is located on the downslope side of the road. From the edge of the road, the terrain slopes down to the south at about 1H:1V. Vegetation about the slope generally consists of dense brush cover; however, the area appears to have been previously logged and a number of large tree stumps, up to 1.0 m in diameter are scattered throughout the slope. Three test-pits (TP17-02, TP17-03, TP17-04) were excavated within the downslope side of the road. Excavation of the test-pits was completed to depths of between 1.5 and 2.3 m and was terminated at these depths due to a concern for undermining the existing road. Fill material, consisting of gravelly sand with some cobbles and trace organics, was encountered to the depths explored. At the base of each excavation, a soil probe was used to estimate the depth to native soil. Dense material, inferred to be glacial till, was noted at depths of between 2.4 and 3.0 m below the existing surrounding grades.

Steep Slope Area #2 (1+560 to 1+600)

Two test-pits (TP17-08, TP17-09) were excavated within the Steep Slope Area #2, on the upslope side of the road. Surficial bedrock was visible in numerous locations throughout this area. Test-pits in this area were completed to depths up to 0.40 m. Soils encountered during the excavation consisted of sand and gravel fills, likely placed in the area during road maintenance.

Steep Slope Area #3 (1+690 to 1+760)

Steep Slope Area #3 consists of both upslope and downslope portions of the road. Along the upslope side, the terrain slopes upwards to the north at roughly 4H:1V. Surficial cover consists of large trees with a low brush undercover. The downslope side slopes down towards the southeast at about 5H:1V

and like the upslope side, vegetation consists of large trees with a low brush undercover. A total of four test-pits were excavated within the area, two on the upslope side (TP17-10, TP17-11) and two on the downslope side (TP17-12, TP17-13). Exposed bedrock was visible throughout the majority of the upslope side, with test-pits exposing rock at depths no greater than 0.15 m. On the downslope side, fill material consisting of sand with some gravel, some cobbles, and trace organics was encountered to depths of between 1.0 and 1.7 m. The fill was found to be overlying the native compact to dense sand with silt, gravel and trace cobbles.

Steep Slope Area #4 (2+015 to 2+070)

Steep Slope Area #4 is located on the downslope side of the road. From the edge of the road the terrain slopes down to the east at about 1H:1V. Vegetation about the slope generally consists of dense brush cover; however, the area appears to have been previously logged and a number of large tree stumps, up to 1.0 m in diameter are scattered throughout the slope. Due to the steepness of the slope a lack of a downslope road shoulder, and in order to avoid further destabilization of the slope, no test-pits were excavated directly within the area. However, a shallow test-pit (TP17-17) was excavated just south of the area at 2+005. Again, in an effort to avoid destabilizing the slope, this test-pit was limited to a 1.2 m depth. Fill material, consisting of blast rock cobbles and boulders with some sand, gravel, and trace silt was encountered to the depths excavated. Upon visual inspection, this slope area appears to consist primarily of blast rock fill, with a significant amount of rocks up to 2.0 m in diameter.

Steep Slope Area #5 (2+225 to 2+340)

Two test-pits (TP17-18, TP17-19) were excavated within the Steep Slope Area #5, on the downslope side of the road. Excavation of the test-pits was completed to depths of between 2.1 and 3.0 m. In both test-pits, approximately 0.60 to 0.90 m of fill, consisting primarily of organics, was noted. The fill was overlying the native, dense, till-like sand with some gravel and cobbles. Of note, in this area the crest of the slope was located between 10 and 15 m from the edge of the road.

Steep Slope Area #6 (2+320 to 2+360)

One test-pit (TP17-20) was excavated within Steep Slope Area #6, on the upslope side of the road. Bedrock was encountered within 0.1 m of the surface. Of note, this upslope area is bordered by a vertical/near-vertical bank, measuring between 1.2 and 1.8 m in height. While much of the bank is covered with low brush vegetation, soils visible within the bank face consisted of till-like dense sand with some gravel and cobbles. From the top of the bank, the slope gently extends up to the north at about 4H:1V.

Steep Slope Area #7 (2+690 to 2+860)

Steep Slope Area #7 is located on the downslope side of the road. From the edge of the road, the terrain slopes down to the west at about 1H:1V. Vegetation about the slope generally consists of dense brush cover; however, the area appears to have been previously logged and a number of large tree stumps, up to 1.0 m in diameter are scattered throughout the slope. Three test-pits (TP17-22,

TP17-23, TP17-24) were excavated within the area. In TP17-22, 1.1 m of fill, generally consisting of sands, gravels, and trace cobbles, was found to overly dense, till-like sand with gravel and cobbles. In each of TP17-23 and TP17-24, 1.8 m of blast rock fill with some sand, silt, and gravel was found to overly bedrock. Bedrock was visible throughout the majority of the upslope area adjacent to the road. Of note, a culvert, located at about 2+800, discharges water directly onto the slope. Significant erosion was noted in the area of the culvert outfall.

Steep Slope Area #8 (1+870 to 1+920)

Steep Slope Area #8 consists of a roughly 50 m section located on the upslope side of the road. From the edge of the road, the terrain slopes up to the east at between 1.5H:1V to 1H:1V with an overall vertical relief of between 10 and 12 m. While a number of trees sit atop the crest of the slope, there is no vegetation on the slope itself. Signs of ongoing erosion were noted throughout the area, including eroded channels within the slope itself, and significant cobble and boulder deposits at the toe of the slope. Large boulders, up to 2 m in diameter, were noted midway up the slope, and appeared to be held in place by narrow wedges of sand and gravel. A significant flow of water was noted to be seeping out of the toe of the slope. To avoid further destabilization of the area, one test-pit (TP17-25) was excavated at the toe of the slope in an area immediately adjacent to the heavily eroded portions. Within the test-pit, 1.8 m of compact sands, gravels and cobbles, likely deposited relatively recently through erosion, overlay a dense till-like sand with cobbles and gravel. This dense till-like layer further extended down 0.6 m to bedrock. Seepage was noted near existing grade within the test-pit.

Steep Slope Area #9 (3+465 to 3+515)

In Steep Slope Area #9, previous road construction appears to have consisted of cuts in the order of about 0.5H:1.0V to heights up to about 7.0 to 8.0 m. Soils exposed in the cut faces consisted of dense till-like sands with gravel and cobbles. At the time of our investigation, erosion of the face had resulted in deposits, seated at about 1H:1V, extending from the road's edge up the slope roughly 3.0 to 4.0 m. In a test-pit (TP17-29) excavated at the toe of the slope, roughly 0.3 m of loose sand, gravel and cobbles, likely deposited through recent erosion, overlay a dense till-like sand and gravel with some cobbles.

Steep Slope Area #10 (3+710 to 3+740)

Within Steep Slope Area #10, setback from the upslope side of the road 5 to 6 m, eroded sands, gravels, and cobbles extend to the west at about 1.5H:1.0V to 2.0H:1V with a vertical relief of about 10 to 12 m. From the top of the eroded section, near-vertical till-like slopes extend a further 3 to 4 m. Little to no vegetation was noted about the slope; however, trees with a low brush undercover can be seen along a relatively flat area at the top of the slope. Ongoing erosion has resulted in exposure of the tree roots. A test-pit (TH17-30) excavated at the toe of the slope exposed roughly 1.2 m of loose sand, gravel, and cobbles overlying about 0.6 m of dense cobbles atop dense till-like and gravel with some cobbles.

GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

Based on our observations described above, the following conclusions and recommendations are provided.

General

The potential for slope instability does exist throughout portions of the road. Much of the instability is a direct result of the cut and fill techniques used during construction. Steep cuts along the upslope side have stripped away any vegetation, while the dense nature of the till-like material within these faces has allowed them to stand vertical/near vertical which is considered temporary. In the long term, these slopes will naturally tend to relax to about 1.5H: 1.0V to 2H:1.0V. As can be seen throughout a number of the upslope areas; much of this comes in the form of erosion. The rate at which this erosion occurs is highly dependent on a number of factors, and in this case, most notably natural factors. Stormwater runoff following periods of rain and snowmelt tends to soften the materials resulting in finer grained material being carried away with the water and larger material being dislodged and ultimately falling to the toe of the slope, if not beyond. Groundwater flows through the slope have much the same effect.

It is difficult to completely stop erosion; however, a number of measures are used to slow its pace and/or prevent any detrimental effects to infrastructure. Where possible, the addition of vegetation to a slope will greatly reduce its rate. However, vegetating a slope is not always possible, and the success of vegetative growth is dependent on the steepness of the slope and the material of which the slope is composed. Where vegetating a slope is not feasible, hazard mitigation in the form of a barrier is often considered. While they don't prevent erosion, barriers constructed at the toe of a slope are often used to prevent eroding material from reaching, and potentially damaging, infrastructure. This solution is often the most economical to construct; however, it normally requires routine maintenance to remove felled material from behind the barrier.

With respect to the downslope portions of the road, a number of factors may contribute to the potential instability. A considerable portion of these slopes are composed of fill material. This generally includes a mixture of sands, gravels, cobbles, silts, blast rock, and in some areas organics. During our investigation, these materials were found to be predominantly loose. The lack of compaction of these materials is a large contributing factor to their potential for instability. Furthermore, while the slopes were at one time vegetated, relatively recent logging in the area has reduced the effects of the vegetative cover. Throughout much of these areas tree stumps have been left in the ground. As these stumps decay over time, voids will form within their root system, and subsequently further destabilize the slopes.

The poor combination of loose fill material and reduced vegetation is further compounded when surface runoff is not properly controlled. As detailed in our report of November 24, 2016, it appears that uncontrolled stormwater accumulation along the road channelizes, resulting in a large volume of water being discharged over concentrated portions of the downslope. While this water has the potential to cause erosion to slopes in a similar fashion as it does with the upslope portions, when water is retained in the loose fill, it has the potential to reduce the soils internal strength. When this

strength is significantly reduced, failures larger than those associated with erosion may occur. This becomes a considerable concern when the downslope area is immediately adjacent to the road. Large failures in these areas will undermine and ultimately cause washout of road sections. This type of failure was recently seen, however since repaired, roughly 250 m from the roads entrance off of Morris Valley Road.

To eliminate the risks associated with potential downslope failures would require considerable work. Works would likely include the removal of much of the downslope fill material and replacement with adequately compacted engineered fill. Areas with oversteepened slopes would require flattening and/or the construction of retaining walls. Most importantly, the adequate control of stormwater runoff will be required. Such could be accomplished through a combination of road regrading, paving, and culvert installation. To prevent runoff over the downslope side, the road should be paved and graded so as to divert stormwater towards the upslope side of the road. Routinely maintained ditches on the upslope side would then concentrate the storm water to culverts that would pipe the water under the road towards the downslope side. Culverts should not discharge directly on to the downslope. From the downslope side of the culvert, the outflow should be piped to the base of the slope.

Steep Slope Areas

We understand that a complete road upgrade may not be feasible at this time. As such, based on the previously described Steep Slope Areas as well as Wedler’s proposed *Culvert Replacement and Road Repair/Regrade*, we have categorized each of the areas into requiring or not requiring immediate attention. A summary of the categorization is included in Table 2.

Table 2: Summary of Steep Slope Areas requiring and not requiring immediate attention

Steep Slope Areas Requiring Immediate Attention	Steep Slope Areas Not Requiring Immediate Attention
Steep Slope Area #1 (downslope)	Steep Slope Area #2 (upslope)
Steep Slope Area #4 (downslope)	Steep Slope Area #3 (up/downslope)
Steep Slope Area #7 (downslope)	Steep Slope Area #5 (downslope)
Steep Slope Area #8 (upslope)	Steep Slope Area #6 (upslope)
Steep Slope Area #9 (upslope)	Steep Slope Area #10 (upslope)

Note that areas that have been categorized as “do not require immediate attention” are not necessarily free of any risk from slope instability. They are simply judged to be at a comparatively less risk to failure than those areas included in “requires immediate attention”.

Areas not requiring immediate attention were generally found to consist of flatter slopes than those requiring immediate attention, near surface bedrock, and/or the crest of slopes were setback adequately from the road edge. In the case of Steep Slope Area #10, continued considerable erosion of the upslope side of the road should be expected. However, in this area, the toe of the slope is setback significantly from the road.

Remediation

A total of five Steep Slope Areas are deemed to require immediate action to remediate the potential for slope instability. Three are located along the downslope side of the road and two are located along the upslope side of the road.

Steep Slope Area #1 (1+210 to 1+290), Steep Slope Area #4 (2+015 to 2+070) and Steep Slope Area #7 (2+690 to 2+860)

Located along the downslope side of the road, these areas are sloped down at about 1.0H:1.0V. As previously noted, it appears that between 2.4 and 3.0 m of fill material was placed during road construction. In the case of Steep Slope Area #4 and Steep Slope Area #7, much of the fill appeared to consist of blast rock. During a previous investigation, it was noted that gravel channels had developed along the downslope side of the roads edge. Stormwater runoff appeared to flow through these channels and discharge directly on to the slope. Furthermore, culverts throughout this area appeared to be discharging directly onto the fill slope. Material below and surrounding the discharge points were significantly eroded.

As a long term solution, a retaining wall constructed along the downslope side of the road, in combination with road grading and paving is recommended. Adequately constructed retaining walls would result in the removal of much of the poor fill materials while providing a bridging support between the road structure and underlying glacial till and/or bedrock. As the slope in this area is of considerable height, it is not anticipated that fill materials below the wall would be removed. As such, it is critical that the road is regraded so as to divert water to a culvert system along the upslope side of the road. If the gravel surface of the road cannot be regularly maintained, it should be paved. Even if suitably regraded, a poorly maintained unpaved road, will be subject to channelized flow. The channelized flow will potentially undermine any wall, much in same manner as it does the existing road. Finally, water discharged from culverts to the downslope side of the road should be done so at or beyond the toe of the slope.

Steep Slope Area #8 (1+870 to 1+920)

Steep Slope Area #8, located on the upslope side of the road, consists of an eroding sand, gravel, cobble, and boulder slope. Ideally, remediation in this area would consist of flattening and vegetating the slope. Such would likely require encroachment of 5 to 6 m to the west, as well as the placement of an adequate growing medium atop the slope. In the event that this is not feasible, to prevent eroding material from falling onto the road as well as mitigating the hazards associated with boulders falling to the road, we recommend that a barrier be constructed at the toe of the slope. We envision such would consist of a series of concrete blocks capable of absorbing the energies associated with the falling material. It is important to note that routine maintenance, in the form of clearing felled material from behind the wall would be required.

Steep Slope Area #9 (3+465 to 3+515)

Steep Slope Area #9 is also upslope of the road. Similar to Steep Slope Area #8, ideal remediation would consist of flattening and vegetating the existing slope area. As portions of the slope are vertical/near vertical, we anticipate that upwards of 5 to 6 m of encroachment to the east would be required. Where this is not feasible, a barrier could be installed to stop eroding and sloughing material from reaching the road. However, along this portion of road, the sloped area is quite close to the edge of road. Installation of any barrier may require some slope scaling to attain the room necessary. Alternatively, it may be possible to narrow the road slightly to create adequate room for the barrier.

Retaining Walls

We anticipate that retaining walls will be required throughout a number of areas. We envision such would consist of a combination of concrete block and geogrid. While the height of the walls will ultimately depend on the depth of fill material in the area, we expect that walls will require heights of between 2 to 3 m. For walls of this height, geogrid lengths can be expected to be about 1.6 to 2.4 m. Construction of these walls will require encroachment into the existing road.

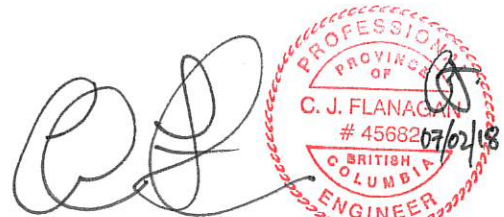
CLOSURE

We trust the preceding is suitable for your purposes at present. Please do not hesitate to contact our office if we can be of further assistance.

Kind regards,
Ryzuk Geotechnical



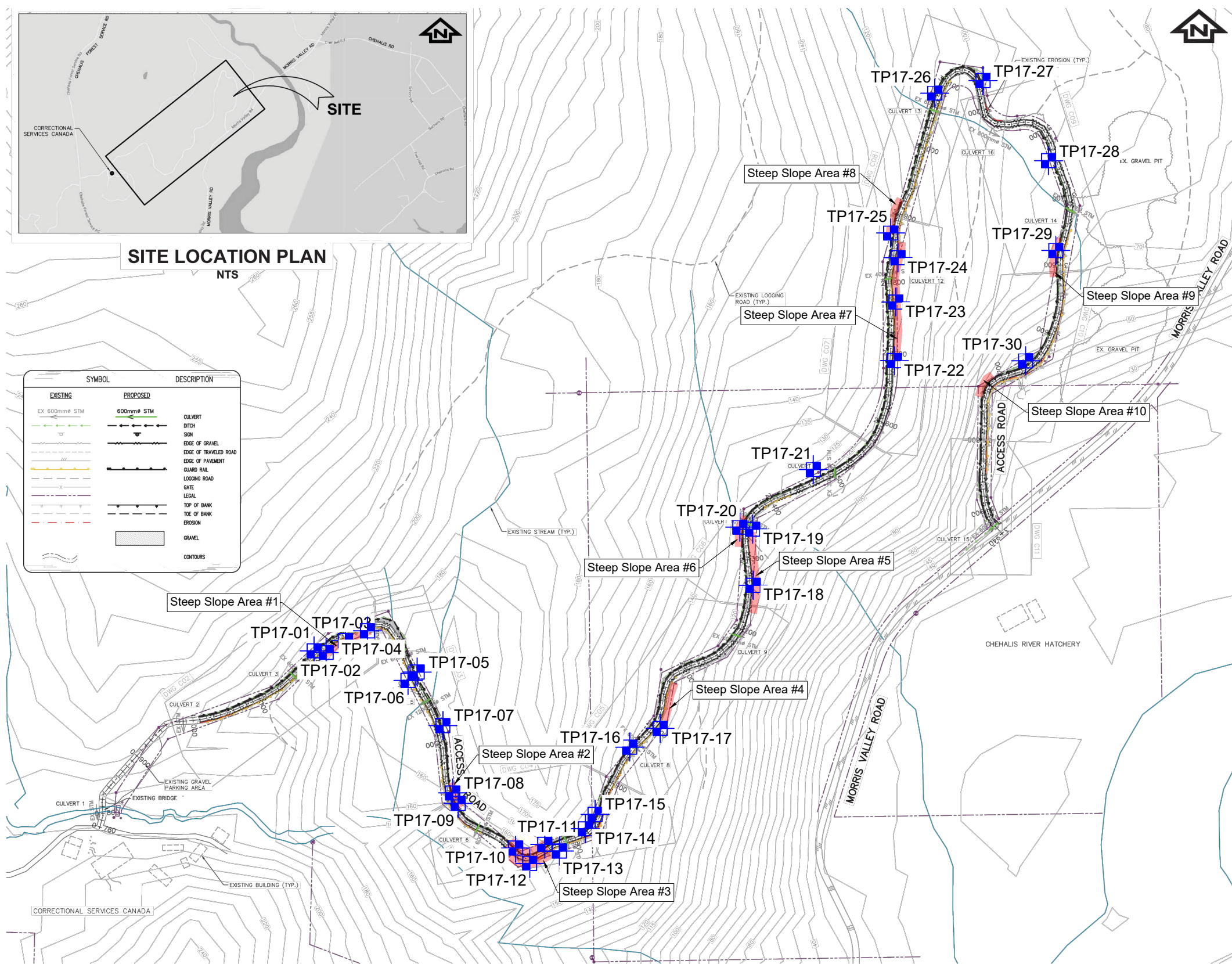
Jeff Ferraby, EIT
Project Engineer



Christian Flanagan, P.Eng.
Professional Geotechnical Engineer

Attachments

- Test Pit Location Plan, dwg. 8-7522-13-1
- Test Pit Logs TP17-01 to TP17-30





TEST-PIT #	DEPTH TO ROCK* (m)
TP17-01	-
TP17-02	-
TP17-03	-
TP17-04	-
TP17-05	1.00
TP17-06	0.00
TP17-07	0.10
TP17-08	0.40
TP17-09	0.00
TP17-10	0.15
TP17-11	0.00
TP17-12	-
TP17-13	-
TP17-14	0.00
TP17-15	0.00
TP17-16	0.00
TP17-17	-
TP17-18	-
TP17-19	2.10
TP17-20	0.10
TP17-21	1.50
TP17-22	-
TP17-23	1.80
TP17-24	1.80
TP17-25	2.44
TP17-26	0.30
TP17-27	-
TP17-28	-
TP17-29	-
TP17-30	-

*Bedrock depths noted only where encountered

NOTES:

Base plan taken from *Kwikwexwelhp Healing Village - Access Road Culvert Replacement and Road Repair/Regrade* provided by Wedler Engineering LLP, dated 2017/02/09

 TP17-00 Test-Hole Location (Approximate)

 Location of Indicated Steep Slope Area (Approximate)



Wedler Engineering LLP		DRAWN	JAF
Assessment of Existing Gravel Road		DATE	October, 2017
Test-Pit Location Plan		APPROVED	
Kwikwixwelhp Healing Village Harrison Mills, BC.		SCALE	As Noted
RYZUK GEOTECHNICAL Engineering & Materials Testing		DRAWING No.	8-7522-13-1

Summary of Test Pit Information

Test Pit 17-01 (TP17-01)

Stratigraphy:

0.00	to	0.30 m	Fill – brown, sand, gravelly, some silt, trace organics, wet
0.30	to	1.8 m	SAND & GRAVEL (till-like) – dense, brown, some cobbles, moist
	at	1.8 m	End of test pit – desired depth

- Notes:
- High side of road
 - Test-pit through ditch adjacent to road
 - No seepage encountered

Test Pit 17-02 (TP17-02)

Stratigraphy:

0.00	to	0.76 m	Fill – brown, gravel, some sand, trace silt, trace organics, damp
0.76	to	1.5 m	Fill – brown, sand, gravelly, some silt, some cobbles, trace organics, damp
	at	1.5 m	End of test pit due to potential road/slope stability

- Notes:
- Low side of road
 - No seepage encountered
 - Probe through base of test-pit to 2.4 m, refusal on inferred till

Test Pit 17-03 (TP17-03)

Stratigraphy:

0.00	to	0.76 m	Fill – brown, gravel, some sand, trace silt, trace organics, damp
0.76	to	1.8 m	Fill – brown, sand, gravelly, some silt, some cobbles, trace organics, damp
	at	1.8 m	End of test pit due to potential road/slope stability

- Notes:
- Low side of road
 - No seepage encountered
 - Probe through base of test-pit to 2.4 m, refusal on inferred till

Test Pit 17-04 (TP17-04)

Stratigraphy:

0.00	to	0.76 m	Fill – brown, gravel, some sand, trace silt, trace organics, damp
0.76	to	2.3 m	Fill – brown, sand, gravelly, some silt, some cobbles, trace organics, damp
	at	2.3 m	End of test pit due to potential road/slope stability

- Notes:
- Low side of road
 - No seepage encountered
 - Probe through base of test-pit to 3.0 m, refusal on inferred till

Test Pit 17-05 (TP17-05)

Stratigraphy:

0.00	to	1.0 m	Topsoil – dark brown, silt, some sand, roots, organics, moist
	at	1.0 m	End of test pit – refusal on bedrock

- Notes:
- Low side of road
 - No seepage encountered

Test Pit 17-06 (TP17-06)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

- Notes:
- High side of road

Test Pit 17-07 (TP17-07)

Stratigraphy:

0.00	to	0.10 m	Fill – brown, gravel, some sand, trace silt, trace organics, wet
	at	0.10 m	End of test pit – refusal on bedrock

- Notes:
- High side of road
 - Test-pit through ditch adjacent to road
 - Water at ditch surface

Test Pit 17-08 (TP17-08)

Stratigraphy:

0.00	to	0.40 m	Fill – brown, gravel, some sand, trace silt, trace cobbles, damp
	at	0.40 m	End of test pit – refusal on bedrock

- Notes:
- High side of road

Test Pit 17-09 (TP17-09)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

- Notes:
- High side of road

Test Pit 17-10 (TP17-10)

Stratigraphy:

0.00	to	0.15 m	SAND – loose, brown, silty, some gravel, trace organics, moist
	at	0.15 m	End of test pit – refusal on bedrock

Notes: • High side of road

Test Pit 17-11 (TP17-11)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

Notes: • High side of road

Test Pit 17-12 (TP17-12)

Stratigraphy:

0.00	to	0.90 m	Fill – brown, sand, some gravel, some cobbles, roots, trace organics, damp
0.90	to	1.00 m	Topsoil – dark brown, silt, some sand, roots, moist
1.00	to	1.40 m	SAND – compact, orange brown, trace gravel, moist
1.40	to	1.80 m	SAND (fine grained) – very dense, brown, trace silt, damp
	at	1.80 m	End of test pit – desired depth

Notes: • Low side of road
 • No seepage encountered

Test Pit 17-13 (TP17-13)

Stratigraphy:

0.00	to	1.50 m	Fill – brown, boulders (blast rock), cobbles (blast rock), sandy, some gravel, some silt, trace organics, moist
1.50	to	1.70 m	Topsoil – dark brown, silt, some sand, roots, moist
1.70	to	2.00 m	SAND (till-like) – dense, brown, silty, some gravel, trace cobbles, moist
	at	2.00 m	End of test pit – desired depth

Notes: • Low side of road
 • No seepage encountered

Test Pit 17-14 (TP17-14)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

Notes: • High side of road

Test Pit 17-15 (TP17-15)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

Notes: • High side of road

Test Pit 17-16 (TP17-16)

Stratigraphy:

0.00	to	0.00 m	Bedrock
	at	0.00 m	End of test pit – exposed bedrock at surface

Notes: • High side of road

Test Pit 17-17 (TP17-17)

Stratigraphy:

0.00	to	1.20 m	Fill – brown, boulders (blast rock), cobbles (blast rock), sandy, some gravel, some silt, trace organics, damp
	at	1.20 m	End of test pit due to potential road/slope stability

Notes: • Low side of road
• No seepage encountered

Test Pit 17-18 (TP17-18)

Stratigraphy:

0.00	to	0.60 m	Topsoil – dark brown, silt, some sand, roots, organics, moist
0.60	to	3.00 m	SAND (till-like) – dense, brown, some gravel, some cobbles, trace silt, damp
	at	3.00 m	End of test pit – desired depth

Notes: • Low side of road
• No seepage encountered

Test Pit 17-19 (TP17-19)

Stratigraphy:

0.00	to	0.60 m	Fill – dark brown, roots, organics, moist
0.60	to	0.90 m	Topsoil – dark brown, silt, some sand, roots, moist
0.90	to	2.10 m	SAND (till-like) – dense, brown, some gravel, some cobbles, trace silt, damp
	at	2.10 m	End of test pit – refusal on bedrock

- Notes:
- Low side of road
 - No seepage encountered

Test Pit 17-20 (TP17-20)

Stratigraphy:

0.00	to	0.10 m	SAND – loose, brown, silty, trace gravel, moist
	at	0.10 m	End of test pit – refusal on bedrock

- Notes:
- High side of road
 - Test-pit through ditch adjacent to road
 - No seepage encountered

Test Pit 17-21 (TP17-21)

Stratigraphy:

0.00	to	1.50 m	SAND (till-like) – dense, brown, silty, some gravel, some cobbles, trace boulders, moist
	at	1.50 m	End of test pit – refusal on bedrock

- Notes:
- High side of road
 - Test-pit through ditch adjacent to road
 - No seepage encountered

Test Pit 17-22 (TP17-22)

Stratigraphy:

0.00	to	0.20 m	Fill – grey, gravel, some sand, trace silt
0.30	to	1.10 m	Fill – brown, sand, some gravel, some silt, trace cobbles, trace organics, damp
1.10	to	1.80 m	SAND (till-like) – dense, brown, silty, some gravel, some cobbles, moist
	at	1.80 m	End of test pit – desired depth

- Notes:
- Low side of road
 - Immediately adjacent to road, roughly 1.5 m from top of slope
 - No seepage encountered

Test Pit 17-23 (TP17-23)

Stratigraphy:

0.00	to	1.80 m	Fill – brown, boulders (blast rock), cobbles (blast rock), sandy, some gravel, some silt, trace organics, damp
	at	1.80 m	End of test pit – refusal on inferred bedrock

- Notes:
- Low side of road
 - No seepage encountered

Test Pit 17-24 (TP17-24)

Stratigraphy:

0.00	to	1.80 m	Fill – brown, boulders (blast rock), cobbles (blast rock), sandy, some gravel, some silt, trace organics, damp
	at	1.80 m	End of test pit – refusal on inferred bedrock

- Notes:
- Low side of road
 - No seepage encountered

Test Pit 17-25 (TP17-25)

Stratigraphy:

0.00	to	1.40 m	SAND – compact, brown, silty, some gravel, some cobbles, trace boulders, damp
1.40	to	1.80 m	COBBLES – compact, brown, some gravel, trace sand, trace cobbles, trace organics, moist
1.80	to	2.44 m	SAND (till-like) – dense, brown, silty, some gravel, some cobbles, wet
	at	2.44 m	End of test pit – refusal on inferred bedrock

- Notes:
- High side of road
 - Groundwater seepage at 1.80 m

Test Pit 17-26 (TP17-26)

Stratigraphy:

0.00	to	0.30 m	Fill – brown, gravel, some sand, some silt, wet
	at	0.30 m	End of test pit – refusal on inferred bedrock

- Notes:
- High side of road
 - Test-pit through ditch adjacent to road
 - Water at ditch surface

Test Pit 17-27 (TP17-27)

Stratigraphy:

0.00	to	1.20 m	Fill – brown, sand, some gravel, some silt, trace cobbles, trace organics, damp
1.20	to	1.40 m	Topsoil – dark brown, silt, some sand, roots, moist
1.40	to	2.60 m	SAND (till-like) – dense, brown, silty, some gravel, some cobbles, damp
	at	2.60 m	End of test pit – desired depth

- Notes:
- Low side of road
 - Test-pit through ditch adjacent to road
 - No seepage encountered

Test Pit 17-28 (TP17-28)

Stratigraphy:

0.00	to	0.80 m	Fill – dark brown, roots, organics, moist
0.80	to	2.40 m	COBBLES – dense, brown, some gravel, some sand, trace silt, trace boulders, damp
	at	2.40 m	End of test pit – desired depth

- Notes:
- High side of road
 - No seepage encountered

Test Pit 17-29 (TP17-29)

Stratigraphy:

0.00	to	0.30 m	SAND – loose, brown, some gravel, some cobbles, trace silt, trace boulders, damp
0.30	to	2.40 m	SAND & GRAVEL (till-like) – dense, brown, some cobbles, trace silt, moist
	at	2.40 m	End of test pit – desired depth

- Notes:
- High side of Road
 - Groundwater seepage at 1.80 m

Test Pit 17-30 (TP17-30)

Stratigraphy:

0.00	to	1.20 m	SAND – loose, brown, some gravel, some cobbles, trace silt, trace boulders, damp
1.20	to	1.80 m	COBBLES – dense, red brown, some gravel, trace sand sand, trace silt, damp
1.80	to	3.40 m	SAND & GRAVEL (till-like) – dense, grey, some cobbles, trace silt, moist
	at	3.40 m	End of test pit – desired depth

- Notes:
- High side of Road
 - No seepage encountered

N:\16\16-8471A - PWGSC Civil SOA\4 - Kwikwexwelhp Healing Village - Access Road Repairs\CAD Drawings\30712-01-KWI Access Rd Cover.dwg

KWIKWEXWELHP HEALING VILLAGE ACCESS ROAD SAFETY UPGRADES

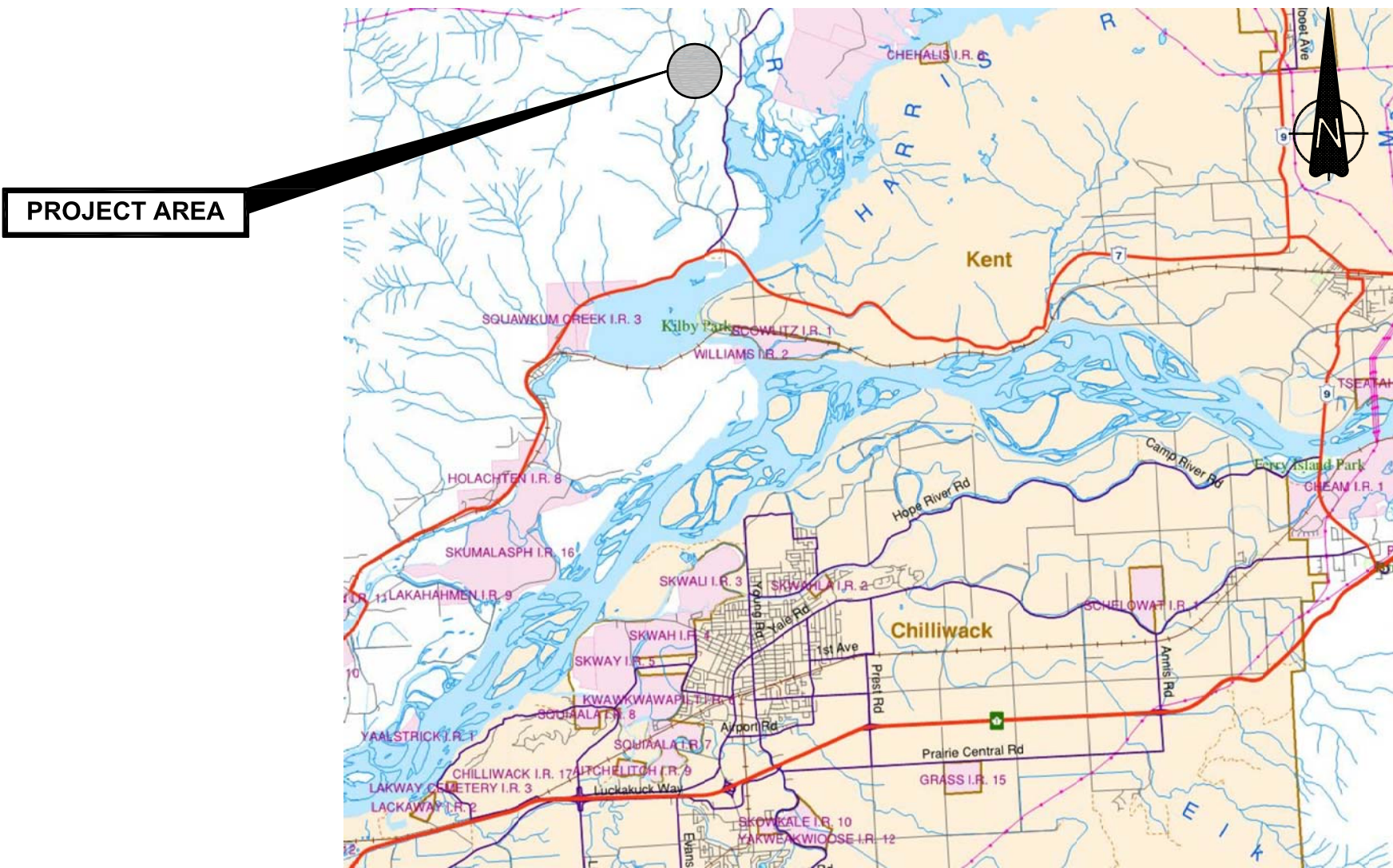


BC LOCATION MAP
NOT TO SCALE

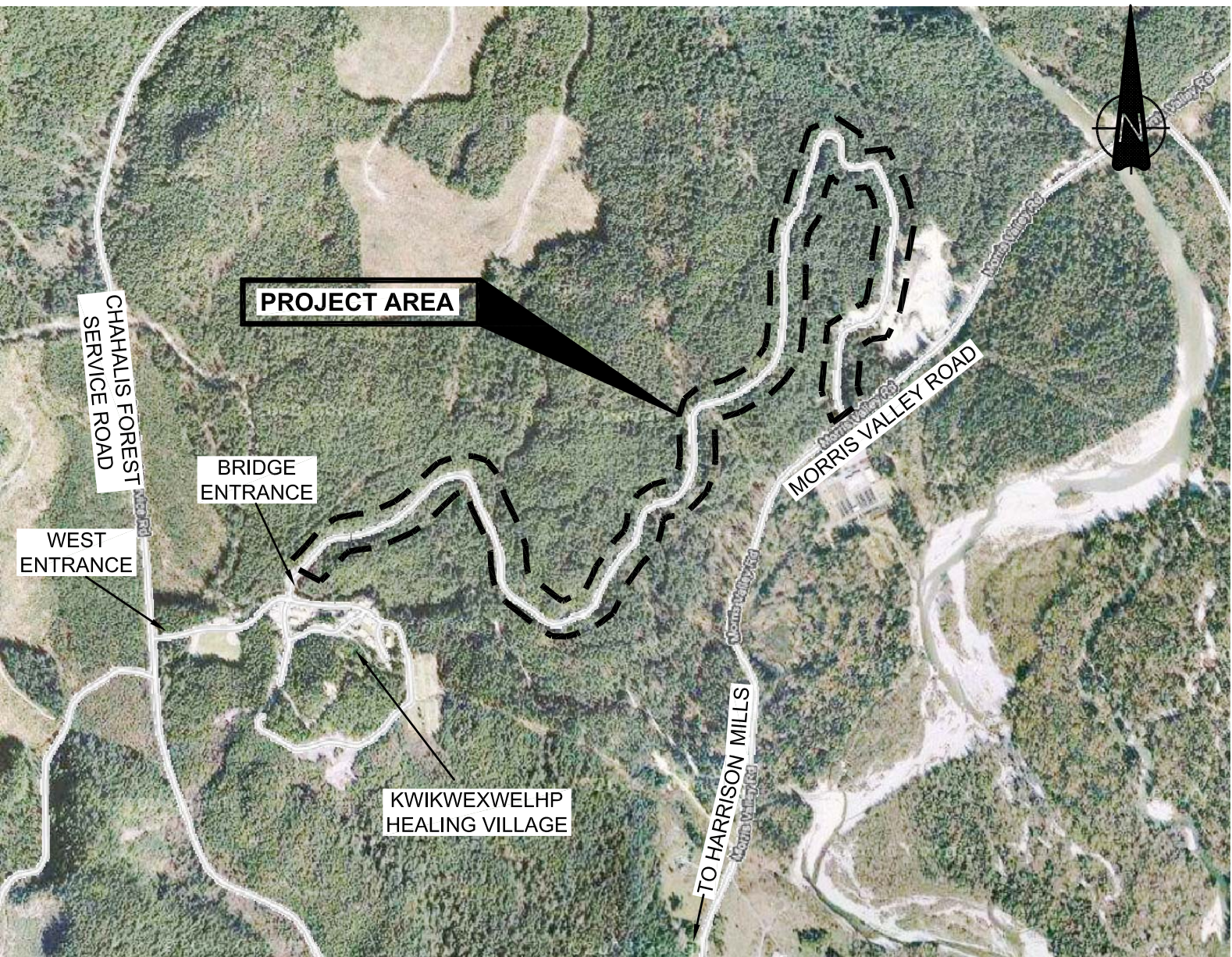
GENERAL NOTES

- ALL ELEVATIONS ARE GEODETIC AND ARE REFERENCED TO EXISTING INTEGRATED SURVEY MONUMENTS.
- THE CONTRACTOR SHALL REPAIR OR REPLACE ANY EXISTING PAVEMENTS, SERVICES, UTILITIES, OR ANY OTHER IMPROVEMENTS THAT MAY BE DAMAGED AS A RESULT OF CONSTRUCTION.
- THE CONTRACTOR SHALL ENSURE THAT THE WORK AREA AND ADJACENT SURFACE ARE KEPT CLEAN AND FREE OF EQUIPMENT AND MATERIALS AT ALL TIMES WHEN CONSTRUCTION ACTIVITY IS NOT UNDERWAY.
- COMPACT ALL EARTH FILLS AND GRANULAR MATERIAL LAYERS IN MAXIMUM 0.15 METER LIFTS TO 95% MODIFIED PROCTOR DENSITY (MPD), UNLESS OTHERWISE DIRECTED IN WRITING.
- DELETERIOUS MATERIALS SHALL BE PREVENTED FROM ENTERING THE EXISTING DRAINAGE SYSTEMS AT ALL TIMES.
- CONTRACTOR TO PROVIDE ALL LABOR EQUIPMENT AND MATERIALS TO COMPLETE THE INSTALLATION
- THE CONTRACTOR IS SOLELY RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING THE VARIOUS PARTS OF THE WORK. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT THERE IS NO DISRUPTION TO SERVICE, AND IF DISRUPTION IS ANTICIPATED, TO NOTIFY THE DEPARTMENTAL REPRESENTATIVE A MINIMUM OF 72 HOURS PRIOR, AND OBTAIN APPROVAL FOR THE DISRUPTION.

ISL ENGINEERING DRAWING INDEX	
SHEET No.	DESCRIPTION
01 of 02	COVER SHEET / LOCATION PLAN & DRAWING INDEX
02 of 02	W-BEAM AND SIGN DETAILS



LOCATION MAP
NOT TO SCALE



SITE PLAN
NOT TO SCALE

6		
5		
4		
3	RECORD DRAWING	11/03/22
2	ISSUED FOR TENDER	10/11/25
1	PRELIMINARY DESIGN SUBMISSION	10/11/23

Revision/ Édition	Description/Description	Date/Date
----------------------	-------------------------	-----------

Client/client
**CORRECTIONAL SERVICES
CANADA**

32560 SIMON AVENUE
ABBOTSFORD, B.C.

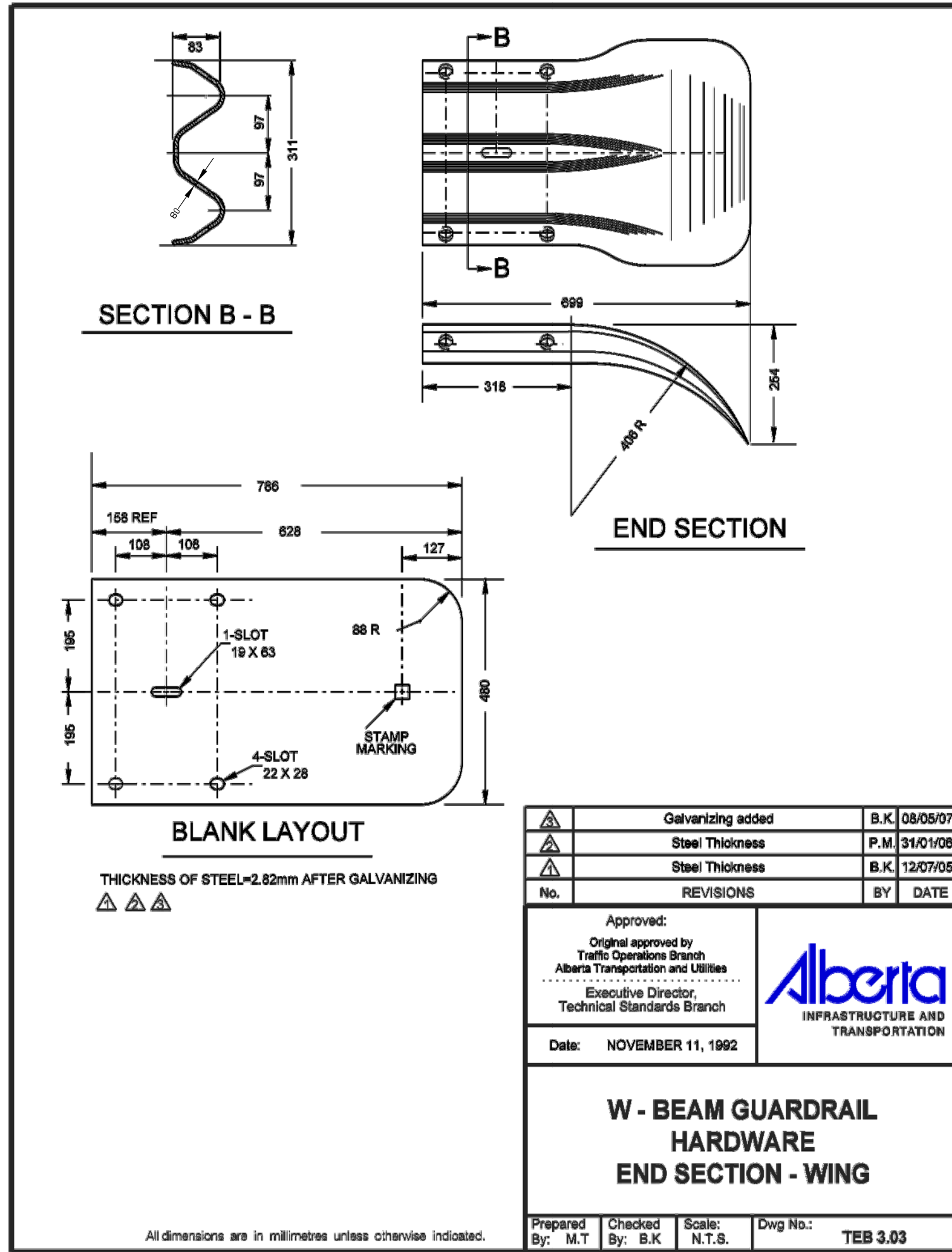
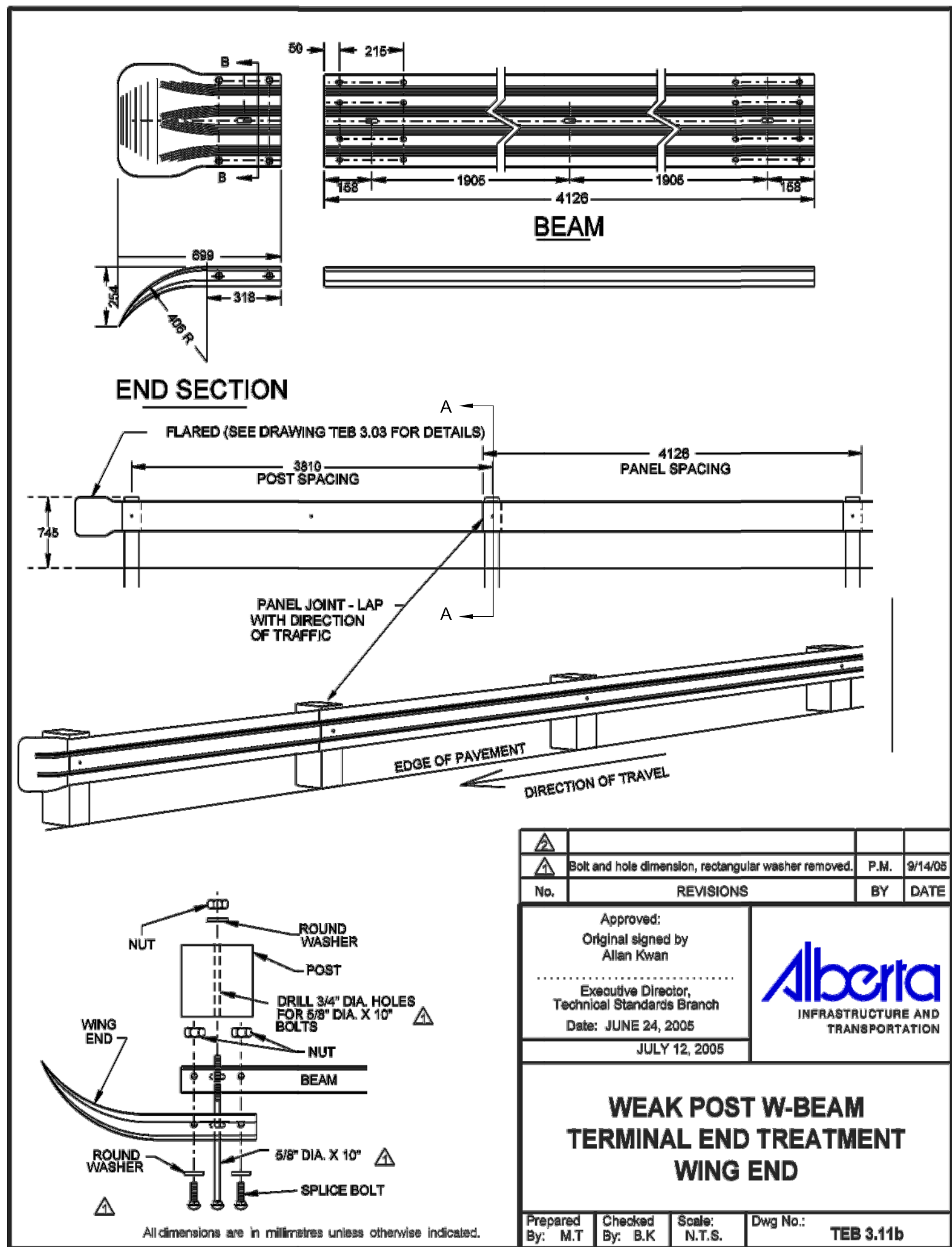
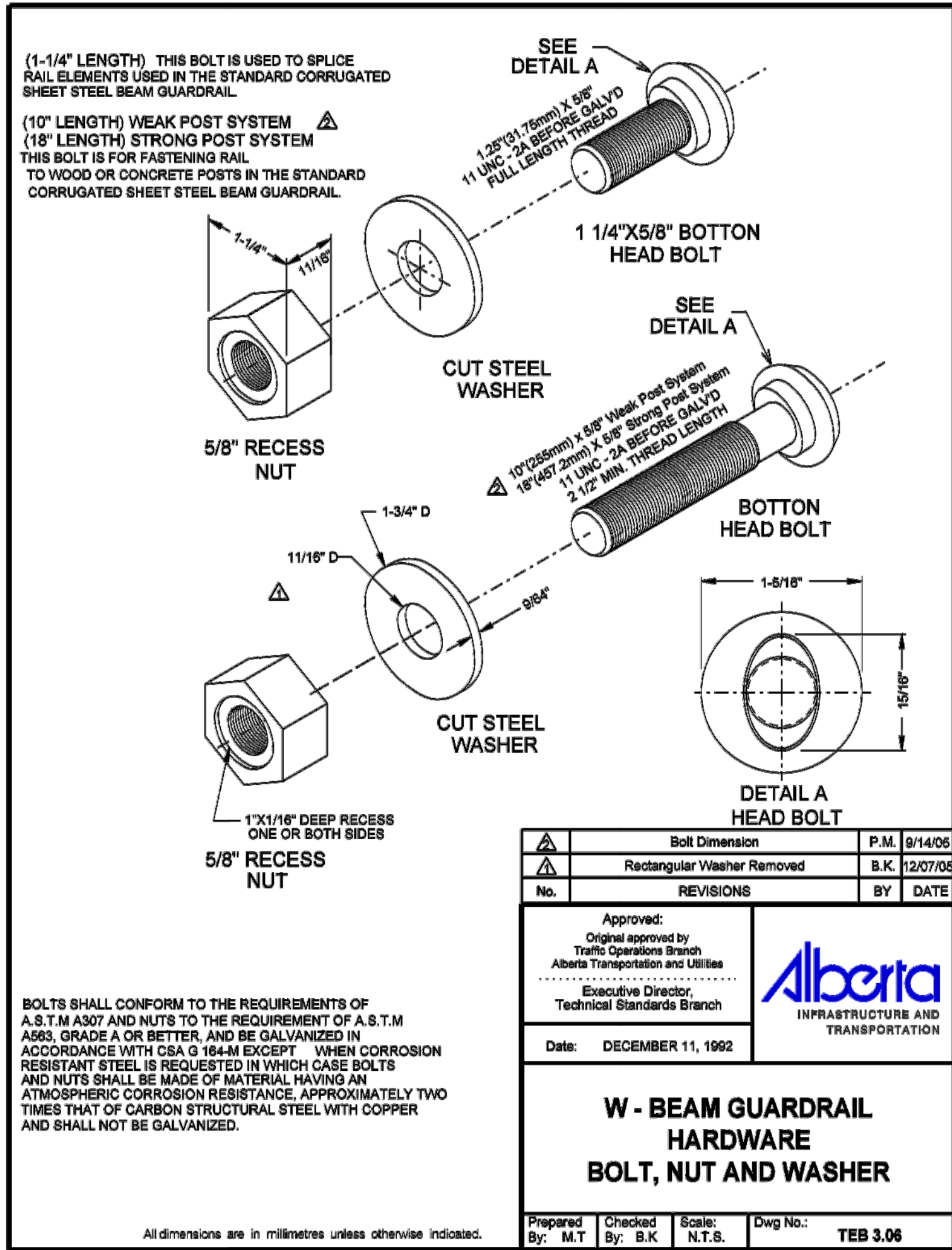
Project title/Titre du projet
**KWIKWEXWELHP HEALING LODGE
(OFF MORRIS VALLEY ROAD)
HARRISON MILLS, BC**
**KWIKWEXWELHP HEALING
VILLAGE ACCESS ROAD
SAFETY UPGRADES**

Consultant Signature Only
E. KOLLA
Designed by/Concept par
E. KOLLA/A.SANTOS
Drawn by/Dessiné par
D. SOUTHWELL
PWGSC Project Manager/Administrateur de Projets TPSGC
D. SINCLAIR
Regional Manager, Architectural and Engineering Services
Gestionnaire régionale, Services d'architectural et de génie, TPSGC

Drawing title/Titre du dessin
**COVER SHEET / LOCATION PLAN
& DRAWING INDEX**

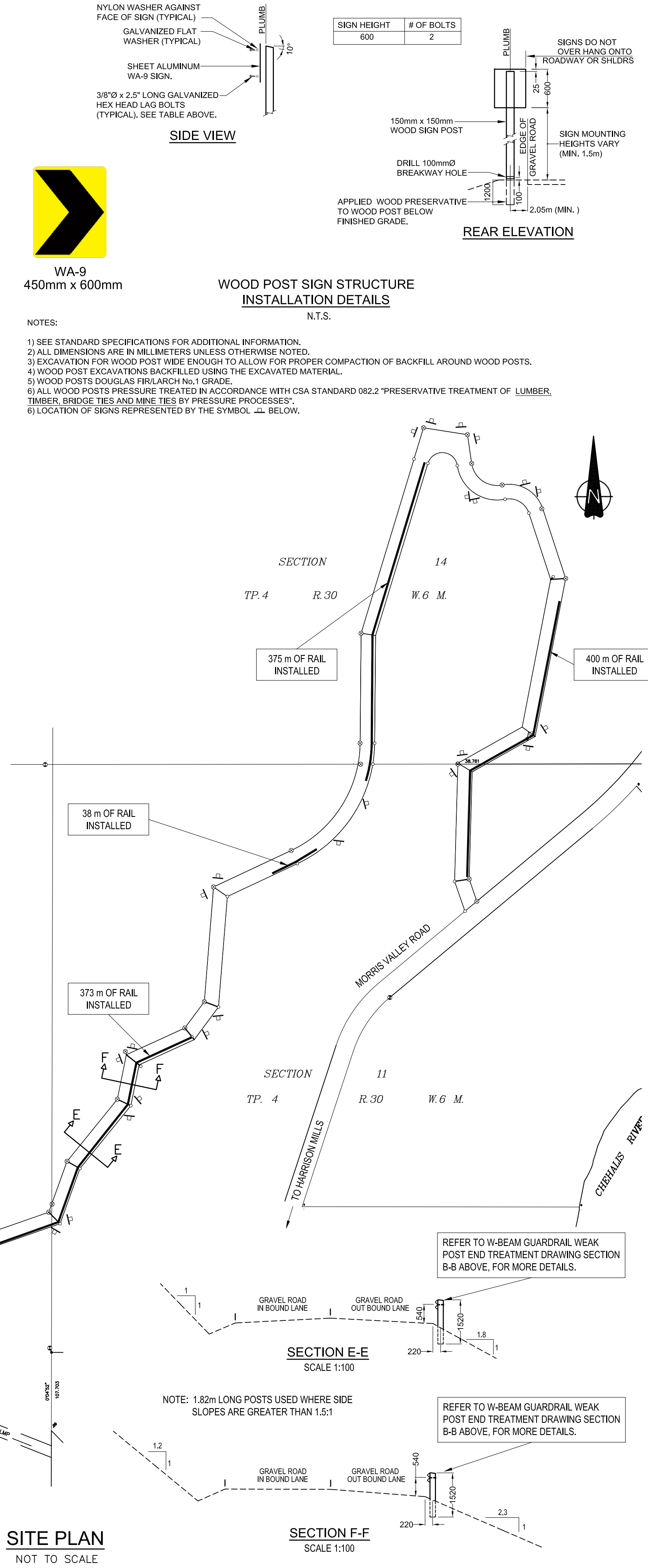
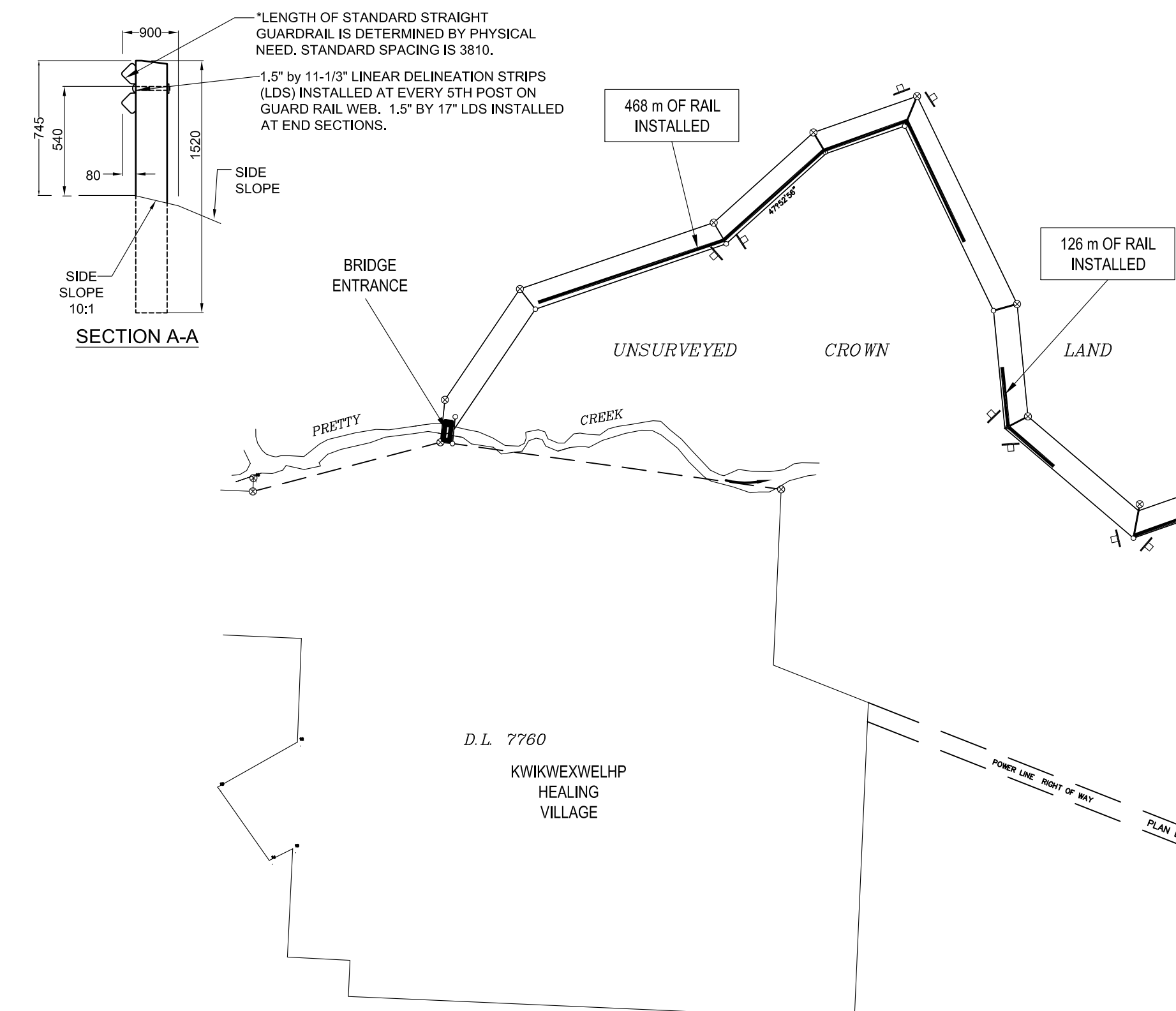
Project No./No. du projet R.045687.001	Sheet/Feuille 01 OF 02	Revision no./ La Révision no. 3
---	-------------------------------------	---


N:\16\16-8471A - PWGSC Civil SOA\4 - Kwikwexwelhp Healing Village - Access Road Repairs\CAD Drawings\30712-KWI Access Rd - Plan.dwg



SECTION A-A AND NOTES ARE A PART OF ALBERTA INFRASTRUCTURE AND TRANSPORTATION STANDARD DRAWING TEB 3.12

NOTES:
1) ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2) JOINTS LAPPED IN THE DIRECTION OF TRAFFIC.
3) THE ACCEPTABLE DESIGN RANGE FOR HEIGHT OF GAURDRAIL IS 475mm.
4) THE ACCEPTABLE TOLERANCE FOR HEIGHT OF GUARDRAIL AT TIME OF CONSTRUCTION OR MAINTENANCE IS SHOWN IN THE APPLICABLE SPECIFICATIONS.






Public Works and
Government Services
Canada

Travaux publics et
Services gouvernementaux
Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique



Engineering
and Land Services

SUITE 301, 20338 - 65 AVENUE
LANGLEY, BRITISH COLUMBIA, V2Y 2X3
[604] 530-2288 FAX : [604] 530-1132

6		
5		
4	RECORD DRAWING	11/03/22
3	GUARD RAIL LOCATION REVISIONS	11/01/03
2	ISSUED FOR TENDER	10/11/25
1	PRELIMINARY DESIGN SUBMISSION	10/11/23
Revision/Édition	Description/Description	Date/Date

Client/client

**CORRECTIONAL SERVICES
CANADA**

32560 SIMON AVENUE
ABBOTSFORD, B.C.

Project title/Titre du projet

**KWIKWEXWELHP HEALING LODGE
(OFF MORRIS VALLEY ROAD)
HARRISON MILLS, BC**

**KWIKWEXWELHP HEALING
VILLAGE ACCESS ROAD
SAFETY UPGRADES**

Consultant Signature Only

E. KOLLA

Designed by/Concept par
E. KOLLA/A.SANTOS

Drawn by/Dessiné par
D. SOUTHWELL

PWGSC Project Manager/Administrateur de Projets TPSCG
D. SINCLAIR

Regional Manager, Architectural and Engineering Services
Gestionnaire régionale, Services d'architectural et de génie, TPSCG

Drawing title/Titre du dessin

W-BEAM AND SIGN DETAILS

Project No./No. du projet	Sheet/Feuille	Revision no./Révision no.
R.045687.001	02 OF 02	4

PWGSC - A1 - 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R.093708.001
Location:	Kwikwexwelhp Healing Village Harrison Mills, BC
Date:	July 16, 2018
Name of PWGSC Departmental Representative and Senior Project Manager:	Tony Tang, P.Eng. PH (778) 580-5701
Name of Client:	Correction Services Canada
Name of Client Project Co-ordinator	

Site Specific Orientation Provided at Project Location Yes ☒ No ☐

Notice of Project Required Yes ☒ No ☐

NOTE:

PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:

OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PWGSC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PWGSC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	PWGSC, OGD's, or tenants		General Public or other contractors		Note: When thinking about this pre-construction hazard assessment, remember a hazard is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the risk is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	No	Yes	No	



Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	Yes		Yes		
Slip Hazards or Unsound Footing	Yes		Yes		
Working at Heights		No		No	
Working Over or Around Water	Yes		Yes		
Heavy overhead lifting operations, mobile cranes etc.	Yes		Yes		
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
High Noise Levels	Yes		Yes		
Excavations	Yes		Yes		
Blasting					TBD
Construction Equipment	Yes		Yes		
Pedestrian Traffic (site personnel, tenants, visitors, public)	Yes		Yes		
Multiple Employer Worksite	Yes		Yes		Example: Contractor working in an occupied Federal Employee space.
Electrical Hazards					Comments
Contact With Overhead Wires		No		No	
Live Electrical Systems or Equipment		No		No	
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions	Yes		Yes		
Earthquake	Yes		Yes		
Tsunami		No		No	
Avalanche		No		No	
Forest Fires	Yes		Yes		
Fire and Explosion Hazards	Yes		Yes		
Working in Isolation		No		No	
Working Alone		No		No	
Violence in the Workplace	Yes		Yes		
High Noise Levels	Yes		Yes		
Inclement weather	Yes		Yes		
High Pressure Systems		No		No	
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces		No		No	Review and provide confined space assessment(s) from PWGSC or client confined space inventories. Refer to PWGSC Standard on Entry into Confined Spaces. Contact the Regional Construction Safety Coordinator.
Suspended / Mobile Work Platforms		No		No	
Other:					



Biological Hazards					
Mould Proliferations		No		No	
Accumulation of Bird or Bat Guano	Yes		Yes		
Bacteria / Legionella in Cooling Towers / Process Water		No		No	
Rodent / Insect Infestation		No		No	
Poisonous Plants					TBD
Sharp or Potentially Infectious Objects in Wastes	Yes		Yes		
Wildlife	Yes		Yes		
Chemical Hazards					
Asbestos Materials on Site		No		No	
Designated Substance Present		No		No	
Chemicals Used in work		No		No	
Lead in paint		No		No	
Mercury in Thermostats or Switches		No		No	
Application of Chemicals or Pesticides		No		No	
PCB Liquids in Electrical Equipment		No		No	
Radioactive Materials in Equipment	Yes			No	Nuclear Densometer
Other:					
Contaminated Sites Hazards					
Hazardous Waste		No		No	
Hydrocarbons		No		No	
Metals		No		No	
Other:					

Security Hazards					Comments
Risk of Assault		No		No	
Other:					
Other Hazards					



Other Compliance and Permit Requirements ¹	YES	NO	Notes / Comments ²
Is a Building Permit required?		No	
Is an Electrical permit required?		No	
Is a Plumbing Permit required?		No	
Is a Sewage Permit required?		No	
Is a Dumping Permit required?			TBD (Materials to be disposed at an offsite disposal facility)
Is a Hot Work Permit required?		No	
Is a Permit to Work required?	Yes		
Is a Confined Space Entry Permit required?		No	
Is a Confined Space Entry Log required		No	
Discharge Approval for treated water required		No	

Notes:

- (1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.
- (2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		Date Signed	
RETURN EXECUTED DOCUMENT TO PWGSC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

MEMORANDUM

Attention:	Paul Rithaler, Sr. Project Officer Public Services and Procurement Canada	Date:	February 10, 2020
cc:	Gina Spencer, P.Eng., GeoWest	From:	Albany Van Vliet, GradTech Dejan Jovanovic, P.Eng.
Project:	KHV Morris Valley Road, Harrison	File:	GA20-1025-00
		Sent Via:	Email
Subject:	Slope Failure Assessment and Stabilization		

As requested, GeoWest Engineering Ltd. (GeoWest) visited the above-referenced site on February 6, 2020 to review a slope that failed during a period of recent heavy rainfall. The slope is adjacent to a gravel road that provides access to Kwikwèxwelhp Healing Village. The slope failure is located approximately 350 m north from the intersection of the access road with Morris Valley Road.

At the time of our site visit, the northbound lane of the road was closed for traffic. The scarp of the landslide extended approximately 0.3 m into the road surface. The scarp was approximately 11 m long, a maximum of 7 m high and inclined at about 60° from the horizontal, as measured with a hand-held clinometer. Two road fence posts along the scarp were undermined. The toe of the scarp was being actively undermined by a creek at the time of our review. Site photos are attached for reference.

Based on the results of our review, we recommend the following:

- The northbound lane should remain closed for traffic until a slope repair can be instituted.
- Polyethylene sheeting should be placed over the scarp to minimize the potential for erosion. Further slope failures, however, cannot be ruled out due to the steep slope inclination and toe of the slope being actively undermined by the creek.
- The scarp should be monitored daily for further sloughing or development of tension cracks in the road. GeoWest is to be contacted for review if evidence of additional instability is observed.
- The slope should be reinstated with riprap as shown on the attached drawings. We recommend that an experienced contractor be provided GeoWest's drawings and visit the site to review the site access and develop a construction methodology due to steep terrain and difficult access.

GeoWest should be given the opportunity to review the placement of riprap and provide additional recommendations, as required.

It should be appreciated that due to the granular composition of the natural soils, the existing creek will continue to scour material during periods of elevated creek flows. Irrespective of the proper implementation of the slope repair shown on the attached drawings, future repairs to this portion of the

slope or other areas may be required if the creek continues to scour material near or adjacent to the slope.

We trust the information presented herein meets your immediate requirements. Please contact the undersigned should you require further assistance.

GeoWest Engineering Ltd.



Per: Albany Van Vliet, GradTech
Junior Technician



Per: Dejan Jovanovic, P.Eng.
Senior Geotechnical Engineer

REVIEWED BY:

John Carter, M.Eng., P.Eng.
Senior Geotechnical Engineer

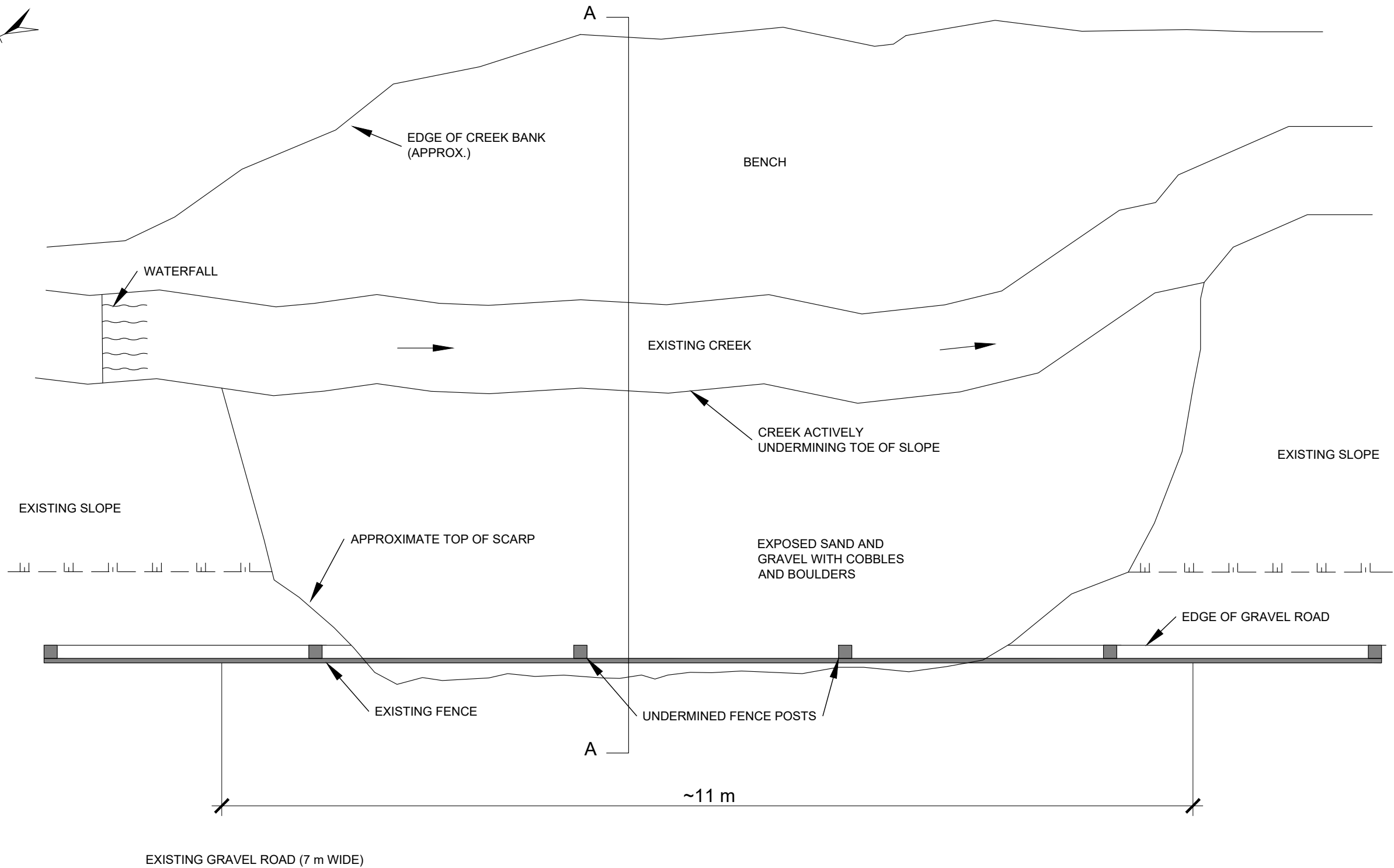
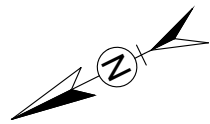
Attachments: Photos 1 and 2
Drawings 1 and 2

Photo 1




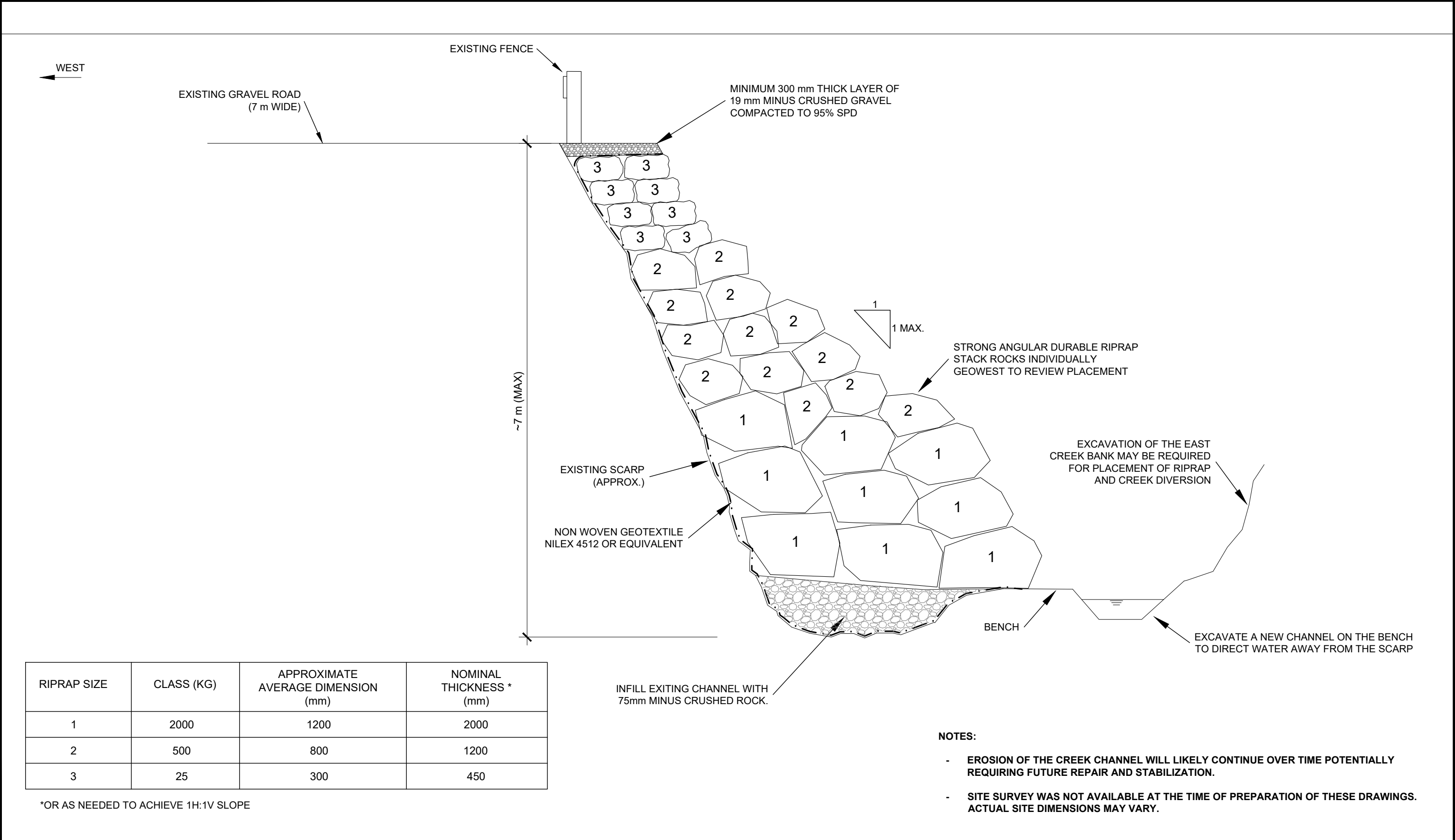
Photo 2






- NOTES:
- SITE PLAN BASED ON MEASUREMENTS TAKEN BY GEOWEST ON 06 FEBRUARY 2020
 - LANDSLIDE LOCATED ~350 m NORTH OF THE INTERSECTION WITH MORRIS VALLEY ROAD

REVISIONS					ADAPTED FROM:	PROJECT:	SEAL:	DESIGN BY:	DESIGN:	DATE:	
					N/A	LANDSLIDE STABILIZATION			DJ	FEB 2020	
					PROJ & DWG. NO:				N/A	CHECK:	SCALE:
					DATE/REV.:				N/A	JC	NTS
					This drawing is the sole property of GeoWest Engineering Ltd. and cannot be used or duplicated in any way without the expressed written consent of GeoWest.	DRAWING:			SITE PLAN	DRAWN:	AV
ADDRESS:	KHV MORRIS VALLEY ROAD, HARRISON	DRAWING NO:	1								
0	07 Feb 2020	Issued for Review			AV	JC	CLIENT:	PUBLIC WORKS CANADA			
REV	Date	Issue/Revision Description	Drawn	Check							



REVISIONS					ADAPTED FROM:		PROJECT:		SEAL:		DESIGN BY:		DESIGN:		DATE:	
					N/A		LANDSLIDE STABILIZATION						DJ		FEB 2020	
					PROJ & DWG. NO: N/A								JC		SCALE: NTS	
					DATE/REV.: N/A		DRAWING: CROSS SECTION A-A						AV		FILE NO: GA20-1025-00	
					This drawing is the sole property of GeoWest Engineering Ltd. and cannot be used or duplicated in any way without the expressed written consent of GeoWest.		ADDRESS: KHV MORRIS VALLEY ROAD, HARRISON						DRAWING NO:		2	
							CLIENT: PUBLIC WORKS CANADA									
0	07 Feb 2020	Issued for Review	AV	JC												
REV	Date	Issue/Revision Description	Drawn	Check												