



# Burke Mountain Athletic Park

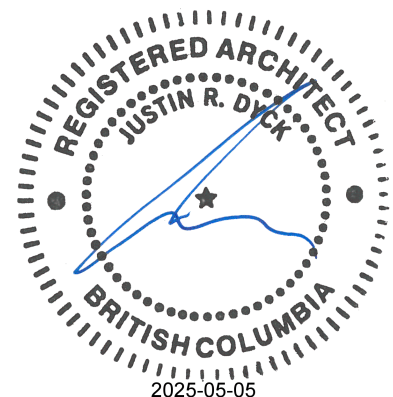
Coquitlam, BC

## Request for Proposal

May 2025

Coquitlam, BC

SOA # 24007



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# Burke Athletic Park - RFP for Construction Services

Burke Mtn. Athletic Park RFP for  
Construction Services

May 5, 2025



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## Section 00 00 02 PROJECT DIRECTORY

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**END OF SECTION**

## **Section 01 11 00 SUMMARY OF WORK**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 The Work of this Contract is for the construction of a rubber running track, artificial turf field, four tennis courts, lighting, landscaping, site furnishings, walking and driving paths and supporting infrastructure. This is a fully developed site that encompasses civil, landscaping, structural, and electrical assemblies and services.
- .2 Prior to site take-over, ESC is monitored by Aplin Martin Consultants and managed by Yellowridge Construction through the City. The General Contractor will need to co-ordinate with the neighbouring sites for any overlap areas. A full site ESC planning and implementation to be completed by the Contractor with monitoring by Aplin Martin Consultants. The work is the final phase of a major earthworks project completed in spring of 2025.

#### **1.3 CONTRACT METHOD**

- .1 The Work of the Contract is to be performed by a qualified Contractor bound by Canadian Construction Association Standard Document CCDC 2 2008, Stipulated Price Contract.

#### **1.4 CONTRACT DOCUMENTS**

- .1 If there is a conflict within the Contract Documents:
  - .1 The order of priority of documents, from highest to lowest, shall be
    - .1 The Agreement between Owner and Contractor,
    - .2 The Definitions,
    - .3 Supplementary Conditions,
    - .4 The General Conditions,
    - .5 Division 01 of the Specifications,
    - .6 Technical Specifications,
    - .7 Material and finishing schedules,
    - .8 The Drawings.
  - .2 Drawings of larger scale shall govern over those of smaller scale of the same date.
  - .3 Dimensions shown on Drawings shall govern over dimensions scaled from Drawings.
  - .4 Amended or later dated documents shall govern over earlier documents of the same type.
  - .5 Noted materials and annotations shall govern over graphic indications

## **1.5 COMPLEMENTARY DOCUMENTS**

- .1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents which leaves doubt as to the intent or meaning, abide by the order of priority of documents as outlined in the General Conditions.
- .2 Drawings indicate general location and route of conduit and wire/conductors. Install conduit or wiring/conductors and plumbing piping not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .3 Locate devices with primary regard for convenience of operation and usage.
- .4 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of the Consultant prior to that work proceeding.
- .5 Should conflicts occur between drawings and specifications, obtain a determination from the Consultant before proposal is submitted to the Owner. If no submission is made, then in the event of a conflict, it will be interpreted that the more expensive alternative has been allowed for.

## **1.6 SPECIFICATION LANGUAGE AND STYLE**

- .1 These specifications are written in the imperative mood and in streamlined form. The imperative language is directed to Contractor, unless stated otherwise.
- .2 Complete sentences by reading "shall", " Contractor shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.
- .3 Fulfill and perform all indicated requirements whether stated imperatively or otherwise.
- .4 When used in the context of a Product, read the word "provide" to mean "supply and install to result in a complete installation ready for its intended use".

## **1.7 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES**

- .1 Owner will supply Contractor with a complete set of Contract Documents in electronic form before commencement of the Work. Contractor may print hard copies for construction purposes as required.

## **1.8 DOCUMENTS AT THE SITE**

- .1 Keep the following documents at *Place of the Work*, stored securely and in good order and available to both *Owner and Consultant* in hard copy and/or electronic form:
  - .1 Current Contract Documents, including Drawings, Specifications and addenda.
  - .2 Change Orders, Change Directives, and Supplementary Instructions.
  - .3 Reviewed Shop Drawings, Product data and samples.
  - .4 Field test reports and records.
  - .5 Construction progress schedule.
  - .6 Meeting notes.
  - .7 Manufacturer's certifications.



- .8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.
- .9 Current as-built drawings.
- .10 Material Safety Data Sheets (MSDS) for all controlled Products.
- .11 B.C. Building Code 2024

#### **1.9 CONTRACTOR'S RESPONSIBILITIES**

- .1 The Contractor shall include for all labour and materials to complete the necessary work as indicated on the drawings and specifications.
- .2 The Contractor shall provide a "Notice to Work" 72 hours before work is to start and will begin work only after the owner provides a "Permission to Work".
- .3 The Contractor shall provide a construction management plan outlining phasing schedule, safety requirements, inspections schedule, permission to work procedures, handover guidelines and all required testing and inspections necessary to handover phases of work to be occupied.
- .4 The Contractor shall ensure that all work to be done in this contract will strictly follow a work schedule based on the level of noise, vibration and dust production caused by that subsequent work. As such, phasing and hoarding of the work will be done as so to provide the least amount of disruption to those in the surrounding environment.
  - .1 The Contractor to comply with the municipal noise and work bylaws of the municipality having jurisdiction.
- .5 The Contractor shall:
  - .1 Provide a weekly progress report at every weekly site visit, including a 3 week look ahead.
  - .2 Limit use of the premises to Work of this Contract, storage, and facilities required for completion of this Work.
  - .3 Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.
  - .4 Obtain and pay for the use of additional storage or work areas needed for operations so as to not encumber Project site.
  - .5 Maintain Project site in a neat and orderly manner to avoid accumulation of unnecessary debris, equipment, and materials.
  - .6 Prior to commencement of work on site identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
  - .7 Maintain pedestrian and vehicular access to and around site. Make provision for free, convenient, unencumbered, and direct access to park project.
  - .8 Establish program to maintain streets, walks, and other public ways in and around Project site free of spillage, tracking, dirt, and construction debris resulting from Work of this Contract.
  - .9 Promptly patch, repair, replace, or make reimbursement as necessary to return to original or better condition damage to existing walls, paving, utilities, planting,

and other property within the Project site as well as adjacent to the Project Site and outside of Project area as directed by Owner

#### **1.10 CODE OF CONDUCT**

- .1 The Contractor shall establish and post a Code of Conduct for all workers on the site with respect to the contact with City of Coquitlam staff. The Code of Conduct shall include the following provisions:
  - .1 All staff and students are to be treated with respect and courtesy.
  - .2 Park property and personal possessions of staff are to be respected by all workers.
  - .3 Smoking is not permitted on park property and on any sidewalk or boulevard that abuts park property.
  - .4 Vaping is not permitted on park property or on grounds and on any sidewalk or boulevard that abuts park property.
  - .5 Cannabis consumption/smoking or vaping is prohibited on park property and on any sidewalk or boulevard that abuts park property.

#### **1.11 DISCREPANCIES AND OMISSIONS**

- .1 Notify the Consultant of any discrepancies in, or omissions from the Drawings, Specifications or other Contract Documents or any doubt as to the meaning or intent of any part thereof. The Contractor will send written instructions, clarifications, or explanations. Neither the Contractor nor the Owner and Consultant will be responsible for oral instructions.

#### **1.12 EXAMINATION**

- .1 Make a careful examination of the site of the project, and investigate and be satisfied as to all matters relating to the nature of the work to be undertaken, as to the means of access and egress thereto and therefrom, as to the obstacles to be met with, as to the rights and interests which may be interfered with during the construction of the Work, as to the extent of the work to be performed and any and all matters which are referred to in the Drawings, Specifications and other Contract Documents, or which are necessary for the full and proper understanding of the Work and the conditions under which it will be performed.
- .2 No allowance will be made subsequently in this connection on behalf of the Subcontractor for any error or negligence on its part.
- .3 Before commencing the work of any Section, carefully examine the work of other Sections upon which it may depend. Report any defects which might affect the new work in writing to the Consultant. Commencement of new work shall imply acceptance of all work by other Sections upon which the new work depends.

#### **1.13 CODES AND STANDARDS**

- .1 Nothing contained in the Contract Documents shall be so construed as to conflict with any law, by-law or regulation of the municipal, provincial or other authorities having jurisdiction. Perform work in conformity with all such laws, by-laws and regulations.
- .2 Execute the Work in accordance with applicable bylaws, regulations, and the B.C. Building Code, 2024; applicable Provincial and Local Acts and Regulations, including Supplements and Amendments, conforming to the latest published revisions, addenda, supplementary or appropriate current standards presently recognized and enforced by

authorities having jurisdiction. Should conflicts arise between one document or one authority and another, obtain clarification from the Consultant before proceeding with Work. Generally, the most stringent regulation will govern.

- .3 References to standards shall be taken to mean the latest edition in effect at the date of award of the Contract. In the case of standards (dated or not) which appear in the Specifications, and which are referenced in the municipal building code, the specific edition of the standard referenced in the code shall govern. Where a standard is revised, supplemented or amended after award of the Contract, carry out the Work in accordance with latest edition of such standards. If the revision to the standard is such that a revision to the Contract Price is necessary, submit claims to the Consultant in accordance with Contract.
- .4 The purpose of specifying standard reference specifications is to establish minimum acceptable standards of materials and workmanship. Materials and workmanship shall meet or exceed requirements of the reference standards specified.
- .5 Conform to all standards as specified herein and provide the Consultant with material conformity if requested. Where published trade association standards manuals are called for in sections of the specifications, conform to those standards unless approval to vary from the standard is given by the Consultant.
- .6 Conform to WorkSafeBC and other regulations governing safety on and in the work site.
- .7 Where a material or product is specified in conjunction with a referenced standard, do not supply the material or product if it does not meet the requirements of the standard. Supply another specified material or product, or acceptable material or product of another approved manufacturer which does meet the standard, at no additional cost to the Owner.
- .8 Where no standard is referred to, materials or workmanship shall meet requirements of the applicable standards of the Canadian Standards Association, Canadian General Specifications Board or the Applicable Building Code.
- .9 Where a material or product is required to conform to a standard such as CSA, ASTM, ULC, ULI, CGSB, OBC, etc., supply to the Contractor, on request, satisfactory evidence that the material or product complies with the standard specification or test requirements.

#### **1.14 PERMITS**

- .1 The Contractor shall apply, arrange and pay for all permits and approvals from the required Authorities Having Jurisdiction required for execution of the Contract.

#### **1.15 QUALITY ASSURANCE REQUIREMENTS**

- .1 Quality-control services include inspections, tests, and related actions, including reports performed by the Contractor, by independent agencies, by commissionaires, and by governing authorities. They do not include contract administration activities performed by Owner, Contractor, or Consultant.
- .2 Ensure the following quality assurance standards will be met by trades either by certification or an equivalent quality level:
  - .1 MPDA standards for painting.
- .3 The Contractor will be responsible to pay, retain and assign the following testing agencies in the manner described for each test:
  - .1 Painting Inspection.
  - .2 Steel Inspection.

- .3 Soils Inspection and testing soils.
- .4 Compaction testing of backfill, road base and sub-courses, under slab fill, service trenches.
- .5 Concrete Testing.
- .6 Metal fabrications.
- .7 Concrete Mix Design.
- .4 Contractor's Responsibilities: Provide and pay for inspections and tests, not listed above but specified elsewhere and required by authorities having jurisdiction.

#### **1.16 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in the Contract Documents, install or erect all products in accordance with the manufacturer's instructions, obtained directly from the manufacturer.
- .2 Notify the Consultant in writing of any conflicts between the specifications and manufacturer's instructions.
- .3 When Work is specified to comply with the manufacturer's instructions, distribute copies to persons involved, and maintain one (1) set in field office.
- .4 Improper installation or erection of products, due to failure in complying with these requirements, may result in the Contractor requiring the Work be removed and re-installed according to manufacturer's instructions at no increase to the Contract Price.

#### **1.17 WORKMANSHIP**

- .1 The work of all Sections shall be fabricated and installed in accordance with the best practice by craftsmen skilled in the work of the respective Section. Unless otherwise specified, the manufacturer's latest printed instructions shall be rigidly complied with in the methods and materials to be used in the installation of the work.
- .2 Notify the Consultant in writing if these Specifications and/or Drawings conflict in any way with manufacturer's instructions. The Consultant will then rule which specifications shall be followed. If applicable, a copy of those instructions shall be made available at job site.

#### **1.18 PATCHING, EXTENDING AND MATCHING**

- .1 Work performed and materials used to patch, extend or match existing construction, shall be to new specified standards
- .2 These specifications will generally not describe existing products or standards of execution; the existing product is its own specification.
- .3 Replace work damaged during alterations, except at areas approved by the Contractor for repair.
- .4 Patch and extend existing work using skilled mechanics that can match the existing quality of workmanship.
- .5 Do not incorporate salvaged or used material in new construction, except where small quantities of finish material that are difficult to match or duplicate are approved for patching or extending purposes by the Contractor.
- .6 Provide adequate support or substrate for patching of finishes.
- .7 Where new work abuts or finishes flush with existing work, make the transition as smooth and workmanlike as possible. Patched work shall be made to be invisible in appearance to the eye at 3m.



- .8 Where wood, metal or other finished surface is cut in such a way that a smooth transition with new work is not possible, terminate the existing surface in a neat fashion along a straight line at a natural line of division and provide trim appropriate to the finished surface.
- .9 Restore existing work that is damaged during construction to a condition equal to its condition at the time of the start of work.

#### **1.19 TEMPORARY POWER AND WATER**

- .1 The Contractor will arrange and pay for all temporary power, water, heat, phone and Internet through the duration of construction.
- .2 The Contractor will be responsible for ensuring that the site's electrical circuitry is functioning properly at the end of each work shift and that extension cords, tools, hoses and equipment have been disconnected. Make good damage caused to the services.

#### **1.20 TEMPORARY HEAT AND HOARDING**

- .1 The Contractor will provide minimal heat as required to maintain adequate installation and curing temperatures as required by the specifications or manufacturer's printed installation instructions. Provide any additional heating or hoarding as required for the Work of This Contract.

#### **1.21 SANITARY FACILITIES**

- .1 The Contractor will provide and maintain sanitary facilities for use of all personnel employed on the Work.

#### **1.22 TEMPORARY FIRE PROTECTION**

- .1 The Contractor shall maintain access at all times to the site for the fire department or emergency vehicles.
- .2 The Contractor shall assist in maintaining access for the fire department to the Work.

#### **1.23 PRODUCT REQUIREMENTS**

- .1 Products provided shall be new unless otherwise specified in the Contract Documents.
  - .1 Proprietary products specified by manufacturer's name, brand name, or catalogue reference shall be the basis of the bid and shall be supplied for the Work without exception in any detail, subject to allowable substitutions as specified. If the sole sourced proprietary product becomes unavailable, for any reason, then the Contractor shall provide a product of equal quality and approved by the Consultant, without any increase to the Contract Price or construction schedule.
  - .2 Where several proprietary products are specified, any one of the several will be acceptable.
  - .3 Where one proprietary product is specified and followed by "or approved alternate", the approved alternate will be reviewed during the proposal period. The onus will be on the Contractor to establish that such approved alternate products meet the standards of construction and materials of the specified product and can be incorporated into the Work.
  - .4 For products specified by reference standards, the onus will be on the Contractor to establish that such products meet reference standard requirements. The Contractor may request certification from the supplier to prove compliance.

Products exceeding minimum requirements established by reference standards will be accepted for the work if such products are compatible with and harmless to work with which they are incorporated.

- .5 Ensure that substituted products can be both physically and dimensionally incorporated in the Work with no loss of intended function, performance, space, or construction time, and that spare parts and service are readily available.
- .2 Remove materials not so conforming to the Contract Documents or containing defects deemed irreparable by the Consultant.
- .3 Defective Products, whenever identified prior to completion of the Work, will be rejected, regardless of previous reviews by the Contractor. Reviews by the Consultant do not relieve responsibility but are a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to the quality or fitness of Products, the decision rests strictly with the Consultant based upon requirements of the Contract Documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the Work.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions or when located in mechanical, or electrical room, or fire-resistant ratings on closures, or required by authorities having jurisdiction.
- .7 Provide fastenings and accessories in same material, texture, colour and finish as adjacent materials, unless indicated otherwise. Prevent electrolytic action between dissimilar metals and materials. Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Unless approved, wood or any other organic material plugs are not acceptable. Keep exposed fastenings to a minimum, space evenly and install neatly. Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- .8 The Contractor must accept responsibility for verification of material availability, production schedules and other pertinent data prior to submission of bid and delivery time. It is the Contractor's responsibility to notify the Consultant immediately if items specified are discontinued, replaced or not available for an extended period.
- .9 If delays in the supply of products are foreseeable, the Contractor shall notify the Consultant in order that other remedial action may be authorized in time to prevent delay in performance of the work. In the event of failure to notify the Consultant, the Consultant reserves the right to substitute more readily available products of a similar character at no increase to the Contract Price.

#### **1.24 STORAGE AND HANDLING**

- .1 Conform to the material manufacturer's directions as a minimum for the delivery, storage and handling of Products. Store in original containers with all labels and seals intact. Prevent materials from freezing, excessive heat, moisture, soiling and sunlight as directed by the manufacturer. Store all flammable, corrosive or toxic substances in suitable containers clearly labelled. Store in separate storage sheds and in strict accordance with the manufacturer's directions.
- .2 Storage area for materials on site is limited and is generally restricted to within site areas. Deliver materials to the site consistent with progress schedule and so as to not

unreasonably encumber the premises with materials. Be responsible for the security of products stored on site.

- .3 Arrange for method and routing of site access and distribution and delivery with the Contractor prior to mobilizing on the site. Confirm in writing.
- .4 Store materials in a manner to avoid damage to project and/or landscaped areas.

#### **1.25 SITE INSPECTION**

- .1 Before commencing the Work, visit the site and report to the Consultant any conflicts between existing site conditions and the requirements for the Work.
- .2 Report to the Consultant any defects or conditions in the existing construction which would affect the proper performance of the Work. Commencement of the Work shall imply acceptance of existing conditions and substrates.

#### **1.26 FIELD ENGINEERING**

- .1 The Contractor will provide a qualified registered land surveyor to provide the following:
  - .1 Establish lines and levels, locate and lay out, by instrumentation, including, but not limited to:
    - property lines
    - encumbrances
    - physical features, including storm & sanitary man holes, watermain valves, utility poles, fire hydrants, light standards, electrical boxes, let-downs, edges of pavement, curbs, sidewalks, parking lines
    - outline of existing and new buildings and structures- topographic elevations.
  - .2 Maintain a complete, accurate log of control and survey work as it progresses. On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

#### **1.27 PROGRESSIVE CLEANING**

- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris daily.
- .2 Make arrangements with and obtain and pay for permits from authorities having jurisdiction for the proper disposal, salvage and recycle of construction materials and waste as stated in the Project Waste Management article below.
- .3 Do not dispose of waste or volatile materials such as mineral spirits, solvents, oil, or paint thinner into sewer or drainage systems.

#### **1.28 PROJECT WASTE MANAGEMENT**

- .1 The objective of Construction Waste Management for this project is to efficiently manage waste generated by daily construction activities and reduce the amount of construction waste produced on site by a minimum of 25% by diverting recyclable waste from the landfill disposal to appropriate locations for recycling.
- .2 Employ processes that ensure the generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection, or other factors as well as minimizing over packaging and poor-quality estimating.
- .3 Waste disposal to landfills or incinerators is to be minimized.

- .4 Be responsible to provide and pay for proper disposal and salvage of construction materials and waste on this project. Unless otherwise shown on the drawings or described in the specifications, all salvaged materials become the property of the Contractor.
- .5 Designate someone on site to be responsible for instructing workers and overseeing waste management practices are performed on-site. Provide on-site instructions of appropriate separation, handling, salvage and recycling practices to be used by all parties during construction and final cleaning.
- .6 Provide a location and facilities for separation of materials for waste or potential salvage and recycling. Clearly label containers and with graphics to avoid contamination of materials. Area around separation facilities is to be kept neat and clean.
- .7 Hazardous materials are to be separated, stored and disposed of in accordance with the requirements of the authorities having jurisdiction including the Provincial Waste Management Act and BC Special Waste Regulation.

#### **1.29 LOCAL LABOUR AND SUPPLIERS**

- .1 Wherever possible, use local labour, materials, suppliers and Subcontractors.

#### **1.30 CONSTRUCTION SCHEDULE**

- .1 Submit a construction schedule using Critical Path Method (CPM) clearly showing the project's overall duration, milestones and critical path and float times for review, indicating the sequence of operations proposed for completing the Work within the time stipulated in the Agreement, prior to the first draw.
  - .1 This CPM of the project will include the following:
    - .1 A list of all activities required to complete the project (typically categorized within a work breakdown structure.
    - .2 The start, duration, completion date of all major parts of work by trade and/or area,
    - .3 The time (duration) that each activity will take to complete,
    - .4 The dependencies between the activities and,
    - .5 Logical end points such as milestones or deliverable items.
  - .2 The schedule is to include, but not be limited to:
    - .1 Separate line items for major shop drawing submittals, and product deliverables.
    - .2 Commissioning.
    - .3 Record documents preparation, delivery and review.
    - .4 Maintenance manual preparation, delivery and review.
    - .5 Occupancy by Owner.
    - .6 The schedule is to be updated each month to reflect actual progress to date and is to be submitted with the monthly claim and an accompanying report assessing progress and noting steps to be taken to overcome schedule shortfalls.
    - .7 Include on schedule major unavoidable service disruptions and all major holiday and jobsite closures.
    - .8 Substantial Performance of this Contract is required to be achieved by the date as indicated in the Contract. The Contractor will be responsible for expenses



incurred in relation to any inability to achieve Substantial Performance by this required date, where such inability results from lack of performance of the Contract.

- .3 Prepare the schedule in the form of a horizontal bar Gantt chart including a separate bar for each major event or operation and a horizontal time scale identifying the first workday of each week.
- .4 Submit a schedule for all shop drawings listing the submittal date and approval date and latest date for commencement of fabrication on shop drawing work.

### **1.31 DIVISION OF WORK**

- .1 Division of the Work among Subcontractors and Suppliers is solely Contractor's responsibility. Consultant and Owner assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the Work.

### **1.32 COORDINATION**

- .1 The Contractor will coordinate construction operations with the Subcontractors included in various sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
  - .1 Co-ordinate work in order to produce a first-class job without delay.
  - .2 Co-ordinate the work to ensure the completion of the Contract by the stipulated date and hold periodic trade meetings for this purpose as necessary.
  - .3 Be responsible for expediting work and delivery of materials in order that deliveries are to meet the project schedule. No claims will be allowed for delays or additional expense resulting from failure to place orders in ample time.
  - .4 No claims will be allowed for delays or additional expenses resulting from failure to organize, expedite and attend to ordering and/or placement of contract materials and works.
- .2 The Contractor will coordinate construction operations and direct Subcontractors included in different Sections of the Work, that depend on each other for proper installation, connection, and operation:
  - .1 The Subcontractor shall schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - .2 Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - .3 Make adequate provisions to accommodate items scheduled for later installation.
- .3 The Contractor will prepare memoranda for distribution to each party involved, outlining special procedures required for coordination.
- .4 The Contractor will include such items as required notices, reports, and list of attendees at meetings:
  - .1 The Subcontractor shall prepare similar memoranda for Owner if coordination of their Work is required.

### **1.33 COOPERATION WITH OTHER CONTRACTORS**

- .1 During this Contract, the Contractor will supervise the Subcontractors to carry out Work separate from this Contract.

- .2 Cooperate and coordinate the Work of this Contract with the Subcontractors engaged by the Contractor.
- .3 Other contractors and their scope will include, but not be limited to:
  - .1 Contractor for Burke Mountain Middle / Secondary School, including shared access road
- .4 Receive and incorporate the schedules of these contractors into the construction schedule.

#### **1.34 SITE USE LIMITS**

- .1 Contain operations within area of work as indicated on the drawings and with minimum interference to adjacent areas and access facilities in general.
- .2 Maintain adjacent areas free from materials, debris and equipment at all times.
- .3 Generally, constrain workmen to areas of immediate work.
- .4 Work is to occur beyond the site use limits only as indicated and/or as necessary to carry out the full contract.
- .5 Provide flag persons and safety procedures as required to ensure safe access to site for deliveries or trade access.

#### **1.35 WORK GENERAL**

- .1 Starting work is to imply the acceptance of surfaces and surrounding conditions as being adequate to carry out work to the standard specified.
- .2 Verify critical dimensions by site measurement before any fabrication, and before starting work; any additional cost arising out of any modification required to rectify incorrect work is to be borne by the Contractor.
- .3 Ensure surfaces which are to receive finishing materials are level and free from irregularities.
- .4 Ensure other divisions of work abutting work of any other division are complete and fully cured before proceeding with any installation.
- .5 Ensure all mechanical and electrical systems are installed complete and are operating efficiently prior to concealment by finishing materials.
- .6 Elements of work whose work is related to any others are to designate areas of potential interference between components of one and other prior to starting work.
- .7 Examine supports for fixing on drawings at time of bidding and prior to actual time of fixing on site and ensure that they are satisfactory.
- .8 Interferences arising following the beginning of construction is to be reported by the Subcontractor involved to the Contractor as soon as interferences are observed.
- .9 Resolution of interferences are to be by the Contractor and/or Consultant with assistance of trades involved.
- .10 Where unauthorized modification, inadequate workmanship or materials or damage to work results in unsatisfactory performance, rectification acceptable to Contractor will be made by the Subcontractor at no additional cost to the Owner.
- .11 No cutting or modifications of structural members is permitted without the specific written direction of the Consultant.

### **1.36 PUBLIC UTILITIES**

- .1 Before commencement of the Work, ensure that the area occupied by the public utilities; including but not limited to electricity, gas, water, and telephone, meet the correct requirements of the respective utility company.
- .2 Notify the Consultant immediately in writing if the requirements of the utility companies are not met.
- .3 Make good to the requirements of authorities having jurisdiction all soiled or damaged public roads, walkways, sidewalks, curbs, public utilities, traffic control devices, telephone lines, power cables and supports.

### **1.37 ADMINISTRATIVE PROCEDURES**

- .1 The Contractor will coordinate scheduling and timing of required administrative procedures with construction activities of the Subcontractors and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - .1 Preparation of construction progress schedule.
  - .2 Preparation of the schedule of values.
  - .3 Installation and removal of temporary facilities and controls.
  - .4 Delivery and processing of submittals.
  - .5 Progress meetings.
  - .6 Pre-installation conferences.
  - .7 Project closeout activities.

### **1.38 PROJECT SIGNAGE**

- .1 Provide signage clearly indicating the following:
  - .1 Contractor's name and identification as "Prime Contractor".
  - .2 Contractor's office and first aid station.
  - .3 Construction access, no parking, public access route(s) to facility.
  - .4 No Smoking or vaping or cannabis consumption on the park site. This also includes no smoking or vaping or cannabis consumption in any construction area, in vehicles, or on sidewalks adjacent to the project site.
- .2 No signs other than those provided by or specifically approved by the Owner will be permitted on the park site.

### **1.39 AVAILABILITY OF PRODUCTS**

- .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of materials, equipment or articles are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the Work.
- .2 In the event of failure to notify the Contractor at commencement of Work, and should it subsequently appear that work may be delayed by such reason, the Contractor with the Owner agreement reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.

#### **1.40 FINAL CLEANING**

- .1 Upon completion and prior to Substantial Performance of the Work, perform final cleaning and adjustments.
- .2 Repair, patch and touch-up marred surfaces to match adjacent finishes. Ensure that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned.
- .3 Remove products, tools, construction machinery and equipment, and waste products and debris, prior to application for the final certificate for payment.
- .4 Remove stains, spots, marks and dirt from decorative work, electrical and/or mechanical fixtures, site furnishings, walls and all other exposed surfaces. Remove grease, paint spots, dirt, dust, stains, labels, fingerprints and other foreign matter from surfaces. Clean the plumbing and electrical fixtures and equipment.

#### **1.41 MAINTENANCE MANUALS**

- .1 Submit one preliminary PDF copy of maintenance manual, in final form, 15 days prior to final inspection. Copy will be returned with Consultant's comments.
- .2 Submit two sets maintenance manuals to the Owner prior to application for Certificate of Substantial Performance. Submit this information in matching 3-ring binders and PDF on one (1) USB memory storage device.
- .3 Identify each binder with a title sheet recording the Project name, date, list of contents of binder and Contractor's and Subcontractors' names, addresses and telephone numbers.

#### **1.42 PROJECT RECORD DRAWINGS**

- .1 Each Subcontractor shall keep a set of white prints on site for purpose of maintaining 'as built' drawings. Maintain in new condition and make available for inspection on site by Owner's Representative and on completion of Work and prior to final inspection. Identify drawings as 'as-built'.
- .2 All concealed services: noting size, location and direction are to be recorded on "as built" drawings.
- .3 Record in red ink, in an accurate and neat manner, any deviations from Contract Documents caused by site conditions and changes ordered by the Consultant.
- .4 Record locations of concealed components of mechanical and electrical services. Include co-ordination drawings with colour coded installed piping and wiring diagrams.

#### **1.43 CONTRACT CLOSEOUT**

- .1 Submit the following prior to and as a condition of issuance of the certificate of Substantial Performance of the Work:
  - .1 Reviewed submittals and list of suppliers and manufacturers.
  - .2 Submit material prior to final Application for Payment.
  - .3 Operation and maintenance data.
  - .4 As - Built drawing provided by the General Contractor for preparation of Record Drawings by the Consultant team.
  - .5 Warranties fully executed and notarized.
  - .6 A final statement of account, giving total adjusted Contract Price, previous payments, and remaining moneys due.

- .2 The Contractor will obtain all certificates of approval such as may be issued by Building, Plumbing, Electrical, Health, Fire or Zoning and other departments or by any other inspection authority having jurisdiction over site and project.

- .1 Certificates will include the certificate of indefeasible title dated the day following the date when all lien rights expire, certifying that the property is free of liens.

#### **1.44 SYSTEM DEMONSTRATION AND TRAINING**

- .1 Prior to final inspection, the Contractor shall:
  - .1 Demonstrate operation of each system to Owner or the Owner's Representative.
  - .2 Instruct Owner's personnel in operation, adjustment and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.

#### **1.45 GENERAL COMMISSIONING REQUIREMENTS**

- .1 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete, defects are corrected, and project site is clean and in condition for occupancy. Notify the Owner's representative in writing of satisfactory completion of the Work and request an inspection.
- .2 During Owner's representative's inspection, a list of deficiencies and defects will be tabulated and corrected by the Contractor. When the Owner considers deficiencies and defects have been corrected and it appears requirements of Contract have been performed, the Contractor shall make application for certificate of Substantial Performance.

**END OF SECTION**

## **Section 01 14 00 WORKPLACE RESTRICTIONS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

#### **1.3 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Make arrangements with Consultant to facilitate work as stated.
- .3 Nothing should be left on ground or unsecured.
- .4 Install temporary defined loading zone. Install temp defined path for deliveries, Contractor to advise in advance of deliveries.
- .5 Maintain existing services and provide for personnel and vehicle access.
- .6 Where security is reduced by work provide temporary means to maintain security.
- .7 Contractor to provide temporary sanitary facilities for use by Contractor's personnel. Keep facilities clean.

#### **1.4 EXISTING SERVICES AND PHASED OPERATIONS**

- .1 Notify Owner one week prior to intended interruption of services and obtain required permission.
- .2 Where work involves terminating, breaking into or connecting to existing services, give Owner a minimum of one-week written notice for necessary interruption of mechanical or electrical service throughout course of work.

**END OF SECTION**

## **Section 01 23 00 ALTERNATES**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section includes administrative and procedural requirements for separate prices.

#### **1.2 BASIS OF BID AND AWARD**

- .1 Include all separate prices described in this Section in the bid form. Failure to comply may be cause for rejection. No segregated bids or assignments will be considered. Alternate prices must be submitted at time of bid closing as described in the Bidding Instructions.
- .2 Do not include separate prices in terms of an addition or deletion to the base bid value.

#### **1.3 GENERAL**

- .1 Referenced Specifications contain pertinent requirements for materials and methods to achieve work described herein.
- .2 Co-ordinate pertinent related work and modify surrounding work as required to complete Project under each separate item designated.

#### **1.4 SEPARATE PRICES**

- .1 Addition of 2 bleachers:
  - .1 Product: 5-Row Outdoor Bleachers, BL-5TB-27DR, 27', Aluminum picket guardrail  
Sports System Canada  
877-600-4667 or [www.sportssystemscanada.com](http://www.sportssystemscanada.com)

**END OF SECTION**

## **Section 01 25 00 PRODUCT SUBSTITUTIONS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 No substitutions for products will be approved unless a request for substitution has been submitted. Refer to Section, 01 25 01, Product Substitution Request Form.
- .2 Where substitution of named manufacturer's product is allowed, submit request for substitution 10 days prior to bid closing. Unapproved products included in bid price will not be accepted by Consultant or Owner.
- .3 Where unnamed products are specified, provide request for substitution 10 days prior to bid closing if alternative product(s) is of different materials or material qualities than are specified.
- .4 Substituted materials and products must meet or exceed the requirements indicated.
- .5 Product substitution may be allowed after execution of contract at the discretion of the Consultant where product differences are minor.

#### **1.3 DEFINITIONS**

- .1 Products Not Available: When all listed manufacturers products in the specification section are no longer manufactured.
- .2 Proprietary specification means a specification which includes one or more proprietary names of products or manufacturers, or both, and may also include descriptive, reference standard, or performance requirements, or any combination thereof.
- .3 Non-proprietary specification means a specification which includes descriptive, reference standard or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.
- .4 Substitution means a product or manufacturer not specified by proprietary name, which may be acceptable in place of a product or manufacturer which, is specified by proprietary name.

#### **1.4 PRODUCT OPTIONS**

- .1 For products specified only by referenced standards and performance criteria, select any product that meets or exceeds the standard.
- .2 For products specified by naming "Acceptable Materials", select any product named. If a standard is also referenced, verify that the product selected meets the standard.
  - .1 The term "Acceptable Materials" is used to specify products by trade name, manufacturer, catalogue number, model number, or similar reference.
  - .2 The term "Acceptable Materials" shall be deemed to establish the standard of acceptance that the Consultant will consider appropriate for the Work.



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- .3 Where a list of "Acceptable Materials" exists in the technical specification sections, any one of the specified products may be used to establish the Bid Price.
- .3 Where the specification provides for selection of an option which is not consistent with the drawings and schedules (as in the case of a piece of equipment which differs from the equipment detailed in dimensions, service requirements, loads imposed on structures, etc.), if the Contractor elects to use that option, they then agree to coordinate the installation of the selected option into the Work, making such changes in the Work as may be required to accommodate the option. The Contractor will bear all costs and waives all claims for additional compensation for costs that subsequently become apparent arising out of the option, including costs of re-design, and preparation of drawings and details.
- .4 For products specified by non-proprietary specification:
  - .1 Select any product by any manufacturer, which meets requirements of Contract Documents
- .5 For products specified by proprietary specification:
  - .1 Select any product or manufacturer named, or
  - .2 Substitute an unnamed product or manufacturer in accordance with Article 1.6 of this Section.
- .6 For products specified by proprietary specification and accompanied by words indicating that substitutions will not be accepted:
  - .1 Select any product or manufacturer named; substitutions are not permitted.

#### **1.5 SUBSTITUTIONS - PRODUCTS**

- .1 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by the Consultant, subject to the following:
  - .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the specified product(s). Substitutions shall not require revisions to Contract Documents nor to work of other subcontractors.
- .2 Submit proposals for substitution. Contractor shall prepare a list of proposed substitutions and submit for the Consultants review 10 days prior to Bid closing.
- .3 The Consultant will review the substitute products for acceptability within ten (10) days after receipt of Proposed Substitutions.
- .4 The Consultant is not obliged to accept any or all Proposed Substitutions offered by the Contractor. The Consultant reserves the right to dismiss any or all items with no further explanation.
- .5 The completed list must include statements of respective costs of items originally specified and proposed substitutions.
- .6 Consultant may consider proposal if:
  - .1 Products selected by Contractor from those specified are not available,
  - .2 Delivery date of products selected from those specified would unduly delay completion of Contract,

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- .3 Different products or construction methods to those specified that are considered by the Contractor to meet the standard established or superior to those specified.
- .4 Verification that the substitute products can be obtained, meet the performance required for the project, and meet all requirements of the Building Code.
- .5 Different products or construction methods that will result in credit to Contract Price and maintain the specified performance.
- .6 Products or construction methods that add cost to the Contract Price may be considered where additional value or life cycle cost benefits can be demonstrated for the Owner.
- .7 Include with Proposed Substitutions:
  - .1 Complete data substantiating compliance of the proposed substitute with contract requirements.
  - .2 Substitute Products, provide the following:
    - .1 Product identification, including manufacturer's name and address.
    - .2 Manufacturer's literature, including product description, performance and test data, reference standards, and limitations
    - .3 Comparison of properties to specified products.
    - .4 Samples if appearance is relevant,
    - .5 Names and addresses of similar projects where the product has been used.
  - .3 Substitute Construction Methods, provide the following:
    - .1 Detailed description of the proposed method, and drawings illustrating it.
    - .2 Itemized comparison of proposed substitution with product or method specified.
    - .3 Data relating to changes in schedule.
  - .4 Quotation for change in contract sum if substitution is approved indicated as an addition or deletion from Contract Price.
  - .5 Verification that product complies with the latest versions of the BC Building Code, ULc and CSA.
- .8 Should proposed substitution be found acceptable by the Consultant, in part or in whole, the Contractor shall:
  - .1 Assume full responsibility and costs when substitution affects any other Work.
  - .2 Pay for any drawing changes required as a result of substitution,
  - .3 Ensure that drawings incorporating and coordinating all aspects of affected Work bear the seal and signature of a Consultant registered in province of the work.
- .9 In making a proposal for substitution the Contractor represents:
  - .1 That it has personally investigated the proposal and (unless the proposal explicitly states otherwise) determined that it performs similarly to or superior to the product or method specified.

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- .2 That the same guaranty will be furnished as for the originally specified product or construction method.
- .3 That it will coordinate installation of the accepted substitute into the Work, making such changes in the Work as may be required to accommodate the change.
- .4 That it will bear all costs and waives all claims for additional compensation for costs that subsequently become apparent arising out of the substitution.
- .5 That the quotation is complete and includes all related costs.
- .10 The Consultant reserves the right to disregard any requests for substitutions submitted after the date established for the Project Start-Up Meeting and that are not presented in with the information requested.
- .11 Substitutions will not be considered that are implicit in submitted shop drawings and samples rather than formally presented proposals as described above.
- .12 Substitutions will not be considered which require substantial changes in the Contract Documents.
- .13 No substitutions will be permitted without Consultant's and Owner's written acceptance. Where substitutions are found in the Work that have not been formally accepted by the Consultant, the Contractor will be required to remove such products and replace with specified materials or provide a credit to the value of the contract at the Consultant's discretion.
- .14 Substitutions will not be considered that arise from negligence in ordering specified product in proper advance time considering place of origin of product, normal method of delivery and manufacturers ordering requirement. In the case of the preceding, the Consultant will either select a substitute product or recommend that extraordinary delivery methods be utilized to deliver the specified product at no additional cost to the Owner.

## 1.6 SUBSTITUTIONS - MANUFACTURERS

- .1 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers will be accepted by the Consultant, subject to the following:
  - .1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of the Contractor.
- .2 In making a substitution the Contractor represents that they have:
  - .1 Investigated substitute product or manufacturer, or both, and determined it meets the specified performance criteria; and
  - .2 Will make any changes to the Work necessitated by substitution as required for Work to be complete in all respects, and
  - .3 Waives claims for additional costs and time caused by substitution which may subsequently become apparent.
- .3 Do not order or install requested substitutions without Consultant's acceptance.
- .4 If, in the Consultant's opinion, a substitution does not meet requirements of Contract Documents, the Contractor shall, at no extra cost to the Owner, provide a product which, in Consultant's opinion, does meet requirements of Contract Documents.

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## **1.7 PROPRIETARY SPECIFICATIONS**

- .1 Notwithstanding specified proprietary names of either or both products and manufacturers, products provided shall meet other applicable requirements of Contract Documents. Modify products if necessary, to ensure compliance with all requirements of Contract Documents.

## **1.8 CHANGES TO ACCEPTED PRODUCTS AND MANUFACTURERS**

- .1 Products and manufacturers accepted by Consultant for use in performance of Work of Contract shall not be changed without Consultant's written consent.
- .2 Submit requests to change accepted products and manufacturers to Consultant in writing, including product data indicated in Article 1.9 Product Data below.

## **1.9 PRODUCT DATA**

- .1 When requested by Consultant, submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:
  - .1 Product identification, including manufacturer's name and address.
  - .2 Manufacturer's literature providing product descriptions, applicable reference standards, and performance and test data.
  - .3 Samples, as applicable.
  - .4 Name and address of projects on which product has been used and date of each installation.
  - .5 Itemized comparison of substitution with named product(s). List significant variations.
  - .6 Designation of availability of maintenance services and sources of replacement materials.

## **1.10 CONSULTANT PROCEDURE**

- .1 In reviewing the supporting data submitted for substitutions, Consultant will use, for purposes of comparison, all the characteristics of the specified material or equipment as they appear in the manufacturer's published data even though all the characteristics may not have been particularly mentioned in the Specifications.
- .2 Consultant will review supporting data and will determine that the substitution in the Consultant's opinion is or is not able to meet or exceed the standards of quality, appearance and performance to the material specified.
- .3 Consultant to sign and date the RFS.

## **1.11 OWNER PROCEDURE**

- .1 Owner will review Request for Substitution (RFS) form and accept or reject substitution.
- .2 Owner to sign and date RFS.
- .3 Such acceptance from the Owner shall not relieve the Contractor from complying with the requirements of the Drawings and Specifications.
- .4 The Contractor shall be responsible for costs of changes resulting from Contractor's proposed substitutions which affect other parts of the Work.

**END OF SECTION**

## Section 01 25 01 PRODUCT SUBSTITUTION REQUEST FORM

### Part 1 General

#### 1.1 SUMMARY

- .1 Complete the following for each material proposed:
  - .1 Request for Substitution Number (RFS):
  - .2 Specification Section Number:
  - .3 Specified Product:
    - .1 Manufacturer:
    - .2 Product Name or Material:
  - .4 Proposed Substitute Product:
    - .1 Manufacturer:
    - .2 Product Name or Material:
    - .3 Manufacturer Telephone No:

#### 1.2 REASON FOR SUBSTITUTION

- .1 Specified products (all specified products) are not available (no longer manufactured).  
Were Manufacturers Contacted? Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, provide telephone number and name of contact:
  - .1 Name:
  - .2 Telephone Number:
  - .3 If no, provide reason for not contacting specified manufacturers.
- .2 Less than three (3) manufacturers have been specified. Were Manufacturers Contacted?  
Yes No If yes, provide telephone number and name of contact:
  - .1 Name:
  - .2 Telephone Number:
  - .3 If no, provide reason for not contacting specified manufacturers.

#### 1.3 SUBSTITUTION WOULD BE IN THE BEST INTEREST OF THE OWNER.

- .1 Provide an explanation of how the substitution would be in the best interest of the Owner.
- .2 Time savings to Owner: Project to be complete \_\_\_\_\_ day(s) earlier than Contract date of Substantial Completion.
- .3 Cost savings to Owner: Owner to deduct \$ \_\_\_\_\_ from base bid price.

#### 1.4 CONTRACTOR'S REPRESENTATION

- .1 Contractor: The undersigned acknowledges the following.

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- .1 The above information has been verified by the Subcontractor.
- .2 The above information meets the requirements of Section 01 25 00 Substitution Procedures.
- .3 Supporting data is complete and provided with this Substitution Request Form in compliance with Section 01 25 00 Substitution Procedures.
- .4 The proposed substituted product provides the same warranties and or bonds as specified product.
- .5 The installation of an accepted substitution into the Work will be coordinated with other trades. All changes to the Work as may be required are to be complete in all respects.
- .6 The Contractor waives all claims for additional costs related to the substitution which may subsequently become apparent.
- .7 Provide side by side comparison of product performance data with this form.

## **Part 2 Products**

### **2.1 CONSULTANT'S RECOMMENDATION**

- .1 Consultant's recommendation: The undersigned acknowledges the following.
  - .1 Reason for substitution meets the requirements of the following sections:
    - .1 01 25 00 Substitution Procedures: In Compliance\_\_\_ Not In Compliance\_\_\_
  - .2 Supporting data has been provided with this "Substitution Request Form".
    - .1 Product Data: In Compliance\_\_\_ Not In Compliance\_\_\_ Not Required\_\_\_
    - .2 Shop Drawings: In Compliance\_\_\_ Not In Compliance\_\_\_ Not Required\_\_\_
    - .3 Samples: In Compliance\_\_\_ Not In Compliance\_\_\_ Not Required\_\_\_
    - .4 Other supporting data:
  - .3 Recommendation:
    - .1 Resubmit with additional information.
    - .2 Reviewed equivalent.
    - .3 Reviewed unacceptable.
    - .4 Comments:
- .2 Signature: Date: \_\_\_\_\_

### **2.2 OWNER'S DIRECTIVE**

- .1 Owner's directive: The undersigned acknowledges the following.
  - .1 Provide proposed substitution.
  - .2 Substituted product not acceptable.
- .2 Signature: Date: \_\_\_\_\_

**END OF SECTION**

## **Section 01 26 00**

# **CONTRACT MODIFICATION PROCEDURES**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 This Section is to be read in conjunction with the conditions governing changes in the Work and valuation of changes in the General Conditions of Contract. This section shall be viewed as complementary to the General Conditions of the Contract including City of Coquitlam's Supplemental General Conditions.
- .2 The General Conditions of the Agreement between Owner and the Contractor provide for valuation of changes by three different methods: lump sum, unit price, and cost plus.
- .3 The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or the time required for performance of the Work, an equitable adjustment will be authorized by a Change Order.
- .4 Under no circumstances shall the Owner be liable for any extra Work that has not been authorized by a properly executed Change Order.

#### **1.2 DEFINITIONS**

- .1 Actual Cost of Material and Labour: as used in the valuation of changes article in the General Conditions of Contract, means the sum of costs directly related to or necessarily and properly incurred by Contractor, Subcontractors and Sub-subcontractors in the performance of a Change in the Work. Direct costs shall include:
  - .1 Materials cost.
  - .2 Total actual labour cost / hour.
  - .3 Travel and subsistence cost.
  - .4 Temporary work cost.
  - .5 Construction equipment cost.
  - .6 Shall exclude overhead cost and profit from both the Contractor and any Subcontractor or supplier.
- .2 Material cost: means cost of all materials, including transportation and storage thereof. All rebates, refunds, returns from sale of surplus materials, and trade discounts other than prompt payment discounts, shall be credited to the Contractor.
- .3 Total labour cost means sum of direct labour cost and payroll burden cost, excluding fee and overhead arising from changes to the work.
- .4 Direct labour cost means base wage costs of employees, excluding payroll burden cost.
- .5 Payroll burden cost: means costs statutory charges and fringe benefit costs additional to direct labour cost and includes employment insurance, WorkSafeBC burdens, vacation pay, statutory holiday pay, health and welfare, pension plan, training fund, and other payroll costs which are hourly wage dependent and are paid by the employer.

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- .6 Travel and subsistence cost: means travel and subsistence costs incurred by employees when working beyond a reasonable commuting distance from their normal place of residence.
- .7 Temporary work cost: means cost of temporary structures, facilities, services, controls, and other temporary items used in the performance of a change in the work, including maintenance, dismantling and removal, less any residual value after dismantling and removal.
- .8 Construction Equipment Cost: means the cost of rented or owned equipment, including cost of loading, transportation, unloading, erection, maintenance, dismantling and removal.
- .9 Overhead Cost: means Contractor's, Subcontractors' and Sub-subcontractors' costs related to:
  - .1 Operation and maintenance of head offices, branch offices, and site offices.
  - .2 Administration at head offices, branch offices, and site offices.
  - .3 General management, legal, audit, and accounting services.
  - .4 Buying organization, corporate tax.
  - .5 Financing and other bank charges.
  - .6 Salaries and other compensation of off-site personnel.
  - .7 Estimating of work.
  - .8 All other costs not defined as direct costs.
  - .9 Superintendents and project managers cost to be covered as an overhead cost unless they are required to provide additional work hours outside of the regular work day.

### 1.3 SCHEDULE OF LABOUR RATES

- .1 As part of the RFP procurement process, submit for the Consultant's review a schedule of labour rates for all trades and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the Work. Provide a breakdown of payroll burden component of labour rates. Rates to be fixed for the full contract term.
- .2 Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of the Contractor, Subcontractors, and sub-Subcontractors, stated as hourly rates, that will be used when:
  - .1 Preparing price quotations for Change Orders, and
  - .2 Determining the cost of work attributable to Change Directives.
- .3 Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the Work, during regular working hours. Labour rates shall not include any additional overhead and profit component.
- .4 Where collective agreements apply, the labour rates shall not exceed those established by collective agreement.
- .5 Obtain the Owner's written acceptance of the schedule of labour rates before submitting the first Change Order quotation.



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- .6 Accepted schedule of labour rates will be used solely for evaluating Change Order quotations and cost of performing work attributable to Change Directives.

#### **1.4 SCHEDULE OF EQUIPMENT RATES**

- .1 As part of the RFP procurement process, submit for the Consultant's review a schedule of equipment rates for Contractor owned Construction Equipment.
- .2 Equipment rates shall reflect the rates that will be used when:
  - .1 Preparing price quotations for Change Orders, and
  - .2 Determining the cost of work attributable to Change Directives.
- .3 Equipment rates stated in the schedule shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.
- .4 Obtain the Owner's written acceptance of the schedule of equipment rates before submitting the first Change Order quotation.
- .5 Accepted schedule of equipment rates will be used solely for evaluating Change Order quotations and cost of performing work attributable to Change Directives.

#### **1.5 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE ORDERS**

- .1 Unless otherwise agreed, the adjustment of the Contract Price on account of a proposed change in the Work shall be based on a quotation for a fixed price increase or decrease to the Contract Price regardless of the Contractor's actual expenditures and savings.

#### **1.6 CHANGE ORDER PROCEDURES**

- .1 Upon issuance by the Consultant to the Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:
  - .1 Submit to the Consultant a fixed price quotation for the proposed change in the Work within 5 days after receipt of the proposed change in the Work.
  - .2 If requested in the proposed change, provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
    - .1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
    - .2 Estimated Product costs, including Supplier quotations, estimated quantities and unit prices.
    - .3 Estimated Construction Equipment costs.
    - .4 Enumeration of all other estimated costs included in the price quotation.
    - .5 Estimated credit amounts for labour and Products not required on account of the proposed change.
  - .3 Include in the quotation the increase or decrease to the Contract Time, if any, for the proposed change, stated in number of days. Consultant requires the following to consider a Contract time extension: indication of the change to affect the critical path of the Construction Schedule.
  - .4 Include in the quotation the number of days for which the quotation is valid.

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- .5 The quotation will be evaluated by the Consultant and the Owner and, if accepted by the Owner, be documented in the form of a signed Change Order.

#### 1.7 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS

- .1 Where the Contractor's price quotation for a Change Order result in a net increase to the Contract Price, the Contractor's entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable: (City of Coquitlam Supplementary Conditions GC 6.2 Change Order).
  - .1 For *Change Orders* not covered by allowances, the *Contractor's* overhead and profit and supervision shall be 10% on *Work* performed directly by the *Contractor*, and 5% on work performed by *Subcontractors*;
  - .2 The *Subcontractor's* allowance for overhead and profit and supervision shall be 10% of the actual cost of all Change Orders attributed to the *Subcontractor's Work*, as determined by this paragraph;
  - .3 Where the *Change Order* involves the substitution of one type of *Product* for another the "actual cost" of the *Change Order*, whether credit or extra, shall be the net difference in the "actual cost" defined above.
  - .4 On work deleted from the Contract and not covered by unit prices, the credit to the Owner shall be the full cost of the work.
  - .5 No markup shall be applied to labour rates or unit prices listed in the Contract or otherwise agreed to in writing by the parties for changes to the Work.
  - .6 For a detailed list of what the Contractor may include in the cost of the work before adding mark-ups, refer to GC 6.3 Change Directive, article 6.3.7.
  - .7 The mark-up for overhead and profit includes estimating costs and other office expenses. Claims for additional bonding or insurance costs, related to an increase in contract value, must be submitted with supporting documentation to be considered for approval.
  - .8 Full detailed back-up including sub-trades and supplier detail and work sheets shall be provided with the quotation, including Sub-trades' original quotations.

#### 1.8 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE DIRECTIVES

- .1 Unless the Owner and the Contractor reach an earlier agreement on the adjustment to the Contract Price by means of a Change Order that cancels the Change Directive, the adjustment in the Contract Price for change carried out by way of a Change Directive shall be determined as specified in the General Conditions of Contract after the change in the Work is completed.

#### 1.9 CHANGE DIRECTIVE PROCEDURES

- .1 If a Change Directive is issued for a change in the Work for which a proposed change was previously issued, but no Change Order has yet been signed, the Change Directive shall cancel the proposed change and any Contractor quotations related to that change in the Work.
- .2 When proceeding with a change in the Work under a Change Directive, keep accurate records of daily time sheets for labour and Construction Equipment, and invoices for Product and Construction Equipment costs. Submit such records to the Consultant no

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later than the end of the next business day until the Change Order superseding the Change Directive is issued.

#### **1.10 FEES FOR OVERHEAD AND PROFIT – CHANGE DIRECTIVES**

- .1 The Contractor's entitlement to a fee for overhead and profit on the Contractor's expenditures and savings attributable to a Change Directive shall be as follows, as applicable (refer to City of Coquitlam Supplementary Conditions GC 6.3 Change Directive):
  - .1 On work deleted from the Contract and not covered by unit prices, the credit to the Owner shall be the full cost of the work.
  - .2 No markup shall be applied to labour rates or unit prices listed in the Contract or otherwise agreed to in writing by the parties for changes to the Work.
  - .3 For a detailed list of what the Contractor may include in the cost of the work before adding mark-ups, refer to GC 6.3 Change Directive, article 6.3.7.
  - .4 The mark-up for overhead and profit includes estimating costs and other office expenses. Claims for additional bonding or insurance costs, related to an increase in contract value, must be submitted with supporting documentation to be considered for approval.
  - .5 Full detailed back-up including sub-trades and supplier detail and work sheets shall be provided with the quotation, including Sub-trades' original quotations.

#### **1.11 SUPPLEMENTAL INSTRUCTIONS**

- .1 The Consultant may issue Supplemental Instructions to provide clarifications to the Contract Documents, provide additional information, or make minor variations in the Work not involving adjustment in the Contract Price or Contract Time.
- .2 If the Contractor considers a Supplemental Instruction to require an adjustment in Contract Price or Contract Time, the Contractor shall promptly notify the Consultant and the Owner in writing and shall not proceed with any work related to the Supplemental Instruction pending receipt of a Change Order, a Change Directive, or, in accordance with the dispute resolution provisions of the General Conditions of Contract, a Notice in Writing of a dispute and instructions to proceed

#### **1.12 COST OF THE WORK**

- .1 Cost Adjustment for Change:
  - .1 The term "Cost of the Work" means the sum of all costs necessarily incurred and paid by the Contractor in the proper performance of the Work. Except as otherwise may be agreed to in writing by the Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the items listed below, and shall not include any of the costs itemized in the subsection below entitled "Unallowable Costs":
    - .1 Payroll costs for employees in the direct employ of the Contractor in the performance of the Work under schedules of job classifications agreed upon by the Owner and the Contractor.
    - .2 Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work.

- .3 Payroll costs will include, but not be limited to, salaries and wages plus the cost of fringe benefits, which will include social security contributions, unemployment, excise and payroll taxes, workers or workers ' compensation, health, and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foremen at the site.
- .4 The expenses of performing the Work after regular working hours, on Sunday, or legal holidays shall be included in the above to the extent authorized by the Owner.
- .2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith.
  - .1 All cash discounts shall accrue to the Contractor, unless the Owner deposits funds with the Contractor with which to make payments, in which case the cash discounts shall accrue to the Owner.
  - .2 All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
  - .3 Payments made by the Contractor to the Subcontractor(s) for Work performed.
    - .1 If required by the Owner, the Contractor shall obtain competitive Bids from Subcontractor(s) acceptable to the Contractor and shall deliver such Bids to Owner who will then determine, with the advice of the Engineer and/or Prime Consultant, which Bids will be accepted.
    - .2 If a subcontract provides that the Subcontractor is to be paid based on the cost of the Work plus a fee, the Subcontractor's cost of the work shall be determined in the same manner as Contractor's cost of the work.
    - .3 All subcontracts will be subject to the other provisions of the Contract Documents insofar as applicable.
  - .4 Costs of special outside services (including, but not limited to, engineers, architects, testing laboratories, surveyors, lawyers, and accountants) employed for services specifically related to the Work.
- .2 Supplemental Costs:
  - .1 The portion of necessary transportation and travel expenses of the Contractor's employees incurred in discharge of duties connected with the Work.
  - .2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site, and hand tools not owned by the workers, which are used or consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of the Contractor.
  - .3 Rentals of all construction equipment and machinery and the parts thereof, whether rented from the Contractor or others, in accordance with rental agreements approved by the Owner or the Consultant, not to exceed the costs of

transportation, loading, unloading, installation, dismantling, and removal thereof—all in accordance with terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

- .4 Sales, use, or similar taxes related to the Work, and for which the Contractor is liable, imposed by any governmental authority.
- .5 Deposits lost for causes other than the Contractor's negligence, royalty payments, and fees for permits and licenses.
- .6 Losses and damages (and related expenses), not compensated by insurance or otherwise, to the Work or otherwise sustained by the Contractor in connection with the execution of the Work, provided they have resulted from causes other than the negligence of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of the Owner or the Engineer. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee. If, however, any such loss or damage requires reconstruction and Contractor is placed in charge thereof, the Contractor will be paid for services a fee proportionate to that stated in the subsection below entitled "Contractor's Fee."
- .7 The cost of utilities, fuel, and sanitary facilities at the site.
- .8 Minor expenses such as long-distance telephone calls, telephone service at the site, and similar petty cash items in connection with the Work.
- .9 Cost of premiums for additional Bonds and insurance required because of changes in the Work.

.3 **Unallowable Costs:**

- .1 The Cost of the Work will not include any of the following:
  - .1 Payroll costs and other compensation of the Contractor's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor whether at the site or in the Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in the subsection above entitled "Cost Adjustment for Change" above—all of which are to be considered administrative costs covered by the Contractor's fee.
  - .2 Expenses of the Contractor's principal and branch offices other than the Contractor's office at the site.
  - .3 Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the Work and charges against the Contractor for delinquent payments.
  - .4 **Cost of premiums for all Bond(s) and for all insurance whether or not the Contractor is required by the Contract Documents to purchase and maintain the same (except for additional Bond(s) and insurance required because of changes in the Work).**

- .5 Costs because of negligence of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
  - .6 Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in subsection above entitled "Cost Adjustment for Change."
- .4 Contractor's Fee: Refer to CCDC 2 2008, 6.3.6.3

#### **1.13 CHANGE ORDER PROCESS TIME**

- .1 The Consultant will prepare a Contemplated Change Notice for pricing to be submitted against.
- .2 Time is of the essence on the project and Subcontractors will be allowed (seven) 7 calendar days to price a Contemplated Change Notice (CCN).

#### **1.14 FIELD ORDER**

- .1 The Consultant may at any time issue a Supplemental Instruction to make changes in the details of the Work.
- .2 The Contractor shall proceed with the performance of any changes in the Work so ordered by the Consultant, unless the Contractor believes that such Field Order entitles the Contractor to an increase or decrease in Contract Price or Contract Time, or both, in which event the Contractor shall give the Consultant and the Owner written notice thereof within seven (7) days after the receipt of the field order.
- .3 Thereafter, the Contractor shall document the basis for the change in Contract Price or Contract Time within seven (7) days. The Contractor shall not execute such changes pending receipt of an executed Change Order or further instruction from the Owner.
- .4 If there is a dispute on whether a Supplemental Instruction involves a change to the Contract Sum or Contract Time, the Consultant may decide to issue a directive to proceed with the work under dispute. The Contractor must proceed with the work without delay but reserves the right to dispute the finding of the Consultant at a future time with additional supplemental information or alternatively through the dispute resolution process.

**END OF SECTION**

## Section 01 29 00 PAYMENT PROCEDURES

### Part 1 General

#### 1.1 DOCUMENTS

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

#### 1.2 SUMMARY

- .1 Comply with requirements stated in General and Supplemental Conditions of the Contract and in specifications for administrative payment procedures.
- .2 Coordinate the schedule of values and applications for payment with the Contractor's construction schedule, submittal schedule, and List of Subcontracts.

#### 1.3 DEFINITIONS

- .1 Substantial Completion: The British Columbia *Builders Lien Act* (BLA) imposes "substantial completion" as the statutory milestone that triggers the claim of lien filing period.
  - .1 The substantial completion milestone can be "certified" by issuance of a certificate of completion or be deemed complete in accordance with the BLA.
  - .2 The BLA identifies the "3-2-1 formula" and the "improvement completion" as the two approaches or triggers for determining whether a contract, subcontract, or improvement can be either certified or deemed complete, in fact. Both the 3-2-1 formula and Occupancy for the project must be satisfied in order to achieve "Substantial Completion".
- .2 3-2-1 formula: The 3-2-1 formula is used to certify complete a head contract or subcontract. The formula details are set out in section 1 of the BLA as follows:
  - .1 A head contract, contract or subcontract is substantially performed if the work to be done under that contract is capable of completion or correction at a cost of not more than:
    - .1 3% of the first \$500 000 of the contract price,
    - .2 2% of the next \$500 000 of the contract price, and
    - .3 1% of the balance of the contract price.
  - .2 Note that the 3-2-1 formula cannot be used to certify complete cost-plus or unit-rate contracts or subcontracts that lack guaranteed target contract prices, because there is no final "contract price". For example, where a contractor has billed \$300,000 on account of work completed pursuant to a cost-plus contract with no guaranteed target contract price, but the scope of work remains incomplete, then the 3-1-2 formula is unworkable because there is no "contract price" based on which to calculate the three percent.

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#### **1.4 SCHEDULE OF VALUES**

- .1 Coordinate preparation of the schedule of values with preparation of the Contractor's construction schedule.
- .2 Submit the schedule of values within 10 days of awarded Contract.

#### **1.5 FORMAT AND CONTENT**

- .1 Use the project manual table of contents as a guide to establish the format for the schedule of values. Provide at least one-line item for each specification section.
- .2 Include the following project identification:
  - .1 Project name and location.
  - .2 Name of Consultant.
  - .3 Consultant's project number.
  - .4 Contractor's name and address.
  - .5 Date of submittal.
- .3 Arrange the schedule of values in tabular form (refer to section 01 31 00, Project Management and Coordination, 1.9.3.4) with separate columns to indicate the following for each item listed:
  - .1 Related Specification section or division.
  - .2 Description of work.
  - .3 Scheduled value.
  - .4 Work completed from previous application.
  - .5 Work completed from this period.
  - .6 Materials presently stored not included in work completed.
  - .7 Total completed and stored to date.
  - .8 Percentage of contract price completed to nearest percent.
  - .9 Balance to Finish.
  - .10 Retainage
- .4 Provide a breakdown of the contract price in sufficient detail to facilitate evaluation of Applications for Payment. Break subcontract amounts down into several line items. Round amounts to nearest whole dollar; the total shall equal the contract price.
  - .1 No payment claim may be made for any materials not incorporated in the work, stored on the site or stored in a bonded warehouse.
- .5 Materials inventoried and securely stored on site in a fenced in secure compound with the Owner's prior agreement, may be progress invoiced as delivered. A list of such materials is to be provided with the progress invoice for inclusion under the Owner's insurance policies.
- .6 Provide separate line items for initial cost of the materials, for each subsequent stage of completion, and for total installed value.
- .7 Show line items for indirect costs and margins on costs only when such items are listed individually in applications for payment. Each item in the schedule of values and



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applications for payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

- .8 Temporary facilities and items that are not direct cost of work-in-place may be shown as separate line items or distributed as general overhead expense.
- .9 Update and resubmit the schedule of values when Change Orders or Construction Change Directives change the contract price.
- .10 Change Orders and their percent completion will be evaluated separately for each change.
- .11 General Contractors general conditions line item to follow the same percentage as the overall project completeness.

#### **1.6 APPLICATIONS FOR PAYMENT**

- .1 Applications for payment shall be consistent with previous applications and payments as certified by the Consultant and paid for by the Owner.

#### **1.7 PAYMENT- APPLICATION TIMES**

- .1 A meeting to review percentage of completion will occur near the end of each month to establish the percentage completion at that date.
- .2 The Owner's representative, Consultant, Contractor, Contractor's project manager, and Contractor's superintendent shall attend.

#### **1.8 PAYMENT-APPLICATION FORMS – AS ACCEPTABLE TO OWNER.**

- .1 Application Preparation
  - .1 Complete every entry, including notarization and execution by a person authorized to sign on behalf of the Contractor. The Owner or Consultant will return incomplete applications without action.
  - .2 Entries shall match data on the schedule of values and the contractor's construction schedule. Use updated schedules if revisions were made.
  - .3 Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- .2 Transmittal
  - .1 Application for payment to the Owner within 48 hours of application for payment meeting. One copy shall be complete, including waivers of lien and similar attachments. Electronic copy to be sent to City and Consultant team for review. Once approved it is to be sent electronically to: [APIInvoices@coquitlam.ca](mailto:APIInvoices@coquitlam.ca) for processing.
  - .2 Transmit each copy with a transmittal listing attachments and recording appropriate information related to the application.
- .3 Waivers of Lien
  - .1 With each Application for Payment, submit statutory declaration that all subcontractors have been paid from previous monthly payment.
  - .2 Submit partial waiver for the amount requested, prior to deduction for retainage.
  - .3 When an application shows completion of an item, submit final or full waivers.

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- .4 Submit each application for payment with Contractor's waiver of lien for the period of construction covered by the application.
- .5 Submit final applications for payment with final waivers from every entity involved with performance of the Work covered by the application who may file a lien.
- .6 Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
- .4 Initial application for payment: Administrative actions and submittals that must precede or coincide with submittal of the first application for payment shall comply to the CCDC2 2008 and as follows:
  - .1 List of subcontractors (to date).
  - .2 List of principal suppliers and fabricators.
  - .3 Schedule of Values.
  - .4 Contractor's Construction Schedule (preliminary if not final).
  - .5 Submittal Schedule (preliminary if not final).
  - .6 Copies of permits other than Shoring and Excavation Permit copies of which the Owner will provide to the Contractor.
  - .7 Copies of licenses from governing authorities.
  - .8 Certificates of insurance and insurance policies for the Contractor.
  - .9 Performance and payment bonds.
  - .10 Initial progress report.
  - .11 Initial settlement survey and damage report (if required).

#### **1.9 APPLICATION FOR PAYMENT AT SUBSTANTIAL PERFORMANCE**

- .1 Following issuance of the Certificate of Substantial Performance, submit an application for payment. This application shall reflect Certificates of Partial Substantial Performance issued previously for Owner occupancy of designated portions of the Work. Refer to CCDC 2 2008.
- .2 Process required when Contractor is requesting "Substantial Performance" refer to Appendix A - Station One Architects Project Closeout, for all requirements to be met prior to application.
- .3 Administrative actions and submittals that shall precede or coincide with this application include the following:
  - .1 Refer to Section 01 77 00 Contract Closeout for additional requirements.
  - .2 Warranties and maintenance agreements.
  - .3 Test/adjust/balance records.
  - .4 Approved Maintenance Manuals and Maintenance Instructions.
  - .5 Meter readings.
  - .6 Start-up performance reports.
  - .7 Changeover information related to Owner's occupancy.
  - .8 Final cleaning.

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- .9 Application for reduction of retainage and consent of surety.
- .10 Final progress photographs.
- .11 List of incomplete Work recognized as exceptions to Consultant's Certificate of Substantial Performance.
- .12 Verification of completion of utilities or right-of-way work for which bond is held.
- .4 Progress Claims will not be accepted by the Consultant or Owner for progress of the Project Deficiencies.

#### **1.10 FINAL PAYMENT APPLICATION**

- .1 Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
  - .1 Completion of project closeout requirements. Refer to Section 01 77 00, Closeout Procedures.
  - .2 Completion of items specified for completion after Substantial Performance.
  - .3 Transmittal of project construction records to the Owner.
  - .4 Certified property survey.
  - .5 Proof that taxes, fees, and similar obligations were paid.
  - .6 Removal of temporary facilities and services.
  - .7 Change of door locks to Owner's access.
  - .8 Assurance that unsettled claims will be settled.
  - .9 Assurance that Work not complete and with exceptions will be completed without undue delay.
  - .10 Removal of surplus materials, rubbish and similar elements.

#### **1.11 PROGRESS PAYMENT PROCEDURES**

- .1 Make applications for payment on account in monthly claims as Work progresses.
- .2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- .3 Submit to Consultant at least 15 calendar days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.
- .4 Include statement based on schedule of values with each application for payment.
- .5 Support claims for products delivered to Place of Work but not yet incorporated into Work.
- .6 Submit separate schedule for any of the following Prices, that may be requested in the Bid form for:
  - .1 Unit Prices.
  - .2 Alternative Prices.
  - .3 Cash Allowances.

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- .4 Separate Prices.
- .7 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in price breakout the following:
  - .1 Cost of Material.
  - .2 Delivery and unloading at Site.
  - .3 Sales Taxes.
  - .4 Installation, Overhead and Profit.
- .8 The Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as the Consultant determines to be properly due. If the Consultant amends application, the Consultant will give notification in writing giving reasons for amendment.

#### **1.12 PAYMENT OF LIEN HOLDBACK**

- .1 Refer to Lien Act for required time frame and procedures or payment.

#### **1.13 PRE-SUBSTANTIAL PERFORMANCE**

- .1 Prior to the completion of the work, the Contractor shall notify the Consultant, in writing, of the anticipated Date of Substantial Performance.
- .2 Within five (5) working days of the receipt of such notification, the Consultant and Subconsultants will complete an overview of the work and prepare a general description of deficiencies and requirements to assist the Contractor in achieving Substantial Performance.
- .3 The Contractor remains fully responsible for preparing detailed deficiency lists and for organizing and effecting satisfactory completion of the work of his forces and sub-trades and the provision of required submissions.
- .4 Upon receipt of the Consultants and Subconsultants "General Description of Deficiencies and Substantial Performance Requirements" the Contractor shall assess same and re-confirm to the Consultant, in writing, the Substantial Performance date as agreed with the Consultant.

#### **1.14 SUBSTANTIAL PERFORMANCE**

- .1 The Consultant and Subconsultants will review the work on the agreed date, for the purpose of establishing Substantial Performance.
- .2 Should the work be determined to be Substantially Performed, the Consultant will:
  - .1 Issue a certificate (or letter) of Substantial Performance, setting out the exact date of same.
  - .2 Prepare and issue a list of outstanding incomplete or unsatisfactory work which requires completion and/or correction.
  - .3 Identify a holdback sum, to be deducted from amounts due, representing a minimum of three times the estimated cost of completing all outstanding incomplete and/or unsatisfactory work.
- .3 The Contractor shall complete and/or correct all such listed (and any other) works promptly and no later than thirty (30) days after the date of Substantial Performance or other date, as approved by the Consultant.

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- .4 Should the work be determined to be not Substantially Performed, the Consultant will:
  - .1 Confirm the incomplete state of the work.
  - .2 Prepare and issue a general list of incomplete or unsatisfactory works required to be completed and/or corrected prior to acceptance of Substantial Performance.
- .5 The Contractor shall complete and/or correct the listed work promptly and notify the Consultant, in writing, of such completion and confirm a date for Substantial Performance as agreed with the Consultant.
- .6 All work and deficiencies must be Completed within the 30 days after substantial performance has been granted. No partial progress claims may be made against retained deficiency holdbacks.

#### **1.15 TOTAL PERFORMANCE**

- .1 The Contractor shall complete (or correct) deficient and/or incomplete work remaining (or occurring) after Substantial Performance.
- .2 Within five (5) working days of receiving notice of Total Performance, the Consultant and Subconsultants will review the work for the purpose of establishing Total Performance.
- .3 Should the work be determined to be Totally Performed, the Consultant will:
  - .1 Issue a certificate (or letter) of Total Performance setting out the exact date of same.
- .4 Should the work be determined to be not Totally Performed, the Consultant will:
  - .1 Confirm the incomplete state of the work.
  - .2 Prepare and issue a list of incomplete or unsatisfactory work required to be completed and/or corrected before acceptance and/or Total Performance.
- .5 The Contractor shall provide a schedule for the completion of all deficiencies by the agreed date for total performance, and shall notify the Consultant, in writing, confirming a date for Total Performance as agreed with the Consultant.
- .6 The Consultant and Subconsultants will review the work on the agreed day.

#### **1.16 REVIEW SUMMARY AND COST NOTICE**

- .1 The Substantial/Total Performance procedures require site reviews as follows:
  - .1 Before Substantial Performance.
  - .2 At Substantial Performance.
  - .3 At Total Performance.
- .2 Additional site reviews that are required as a result of Non-Performance of Substantial or Total Performance will be charged and retained from payment to the Contractor and the additional costs incurred therein by the Consultant and Subconsultants will be charged to the Contractor.

**END OF SECTION**

## **Section 01 31 00**

# **PROJECT MANAGEMENT AND COORDINATION**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 This Section includes requirements for coordinating construction operations including, but not necessarily limited to, the following:
  - .1 Preconstruction organization and start-up.
  - .2 Coordination drawings and requirements for coordination of space.
  - .3 Administrative and supervisory personnel.
  - .4 Cleaning and protection.
  - .5 General project coordination procedures.

#### **1.3 PRECONSTRUCTION ORGANIZATION AND START-UP**

- .1 Schedule and administer preconstruction meeting within 15 days after award of Contract to discuss and resolve administrative procedures and responsibilities.
- .2 Attendance:
  - .1 Owner's Representative and/or Owner's project manager.
  - .2 Architect and Engineering Consultants.
  - .3 Contractor's Project Manager and/or Contractor's Superintendent.
- .3 Establish time and location of meeting and notify parties concerned minimum of 5 days before meeting.
- .4 Meetings will be chaired by the Consultant.
- .5 Agenda will be prepared by the Consultant and will include the following:
  - .1 Appointment of official representative of participants in Work.
  - .2 Schedule of Work: Provide progress schedule.
  - .3 Schedule of submissions in accordance with Section 01 33 00 Submittal Procedures.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences, environmental controls, in accordance with Sections 01 51 00 and 01 52 00.
  - .5 Delivery schedule of specified equipment.
  - .6 Site security in accordance with Section 01 52 00 - Construction Facilities.

- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime and administrative requirements in accordance with General Conditions and Supplementary Conditions.
- .8 Owner-provided Products.
- .9 Record drawings in accordance with Section 01 78 39, Project Record Documentation.
- .10 Maintenance in accordance with Section 01 78 23, Operation and Maintenance Data.
- .11 Take-over procedures, acceptance and warranties in accordance with Section 01 77 00, Closeout Procedures and Section 01 78 00, Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs and holdbacks.
- .13 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00, Quality Control.
- .14 Insurances and transcript of policies.
- .15 Site Review, Mock-Ups, Window Testing.
- .16 Other Business.

#### **1.4 COORDINATION**

- .1 Coordinate construction to ensure efficient and orderly installation of each part of the Work. Coordinate operations that depend on each other for proper installation, connection, and operation.
- .2 Schedule operations in the sequence required to obtain the best results where installation of one part depends on installation of other components, before or after its own installation.
- .3 Coordinate installation of different components to use spaces efficiently and assure maximum accessibility for maintenance, service, and repair.
- .4 Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on drawings.
- .5 Follow routing shown for pipes, ducts and conduits as closely as possible.
- .6 Make provisions to accommodate items scheduled for later installation.
- .7 Where necessary, prepare memoranda for Owner and separate subcontractors where coordination of their work is required and distribute to each party involved, outlining procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- .8 Administrative Procedures: Coordinate scheduling and timing of required procedures with other activities to avoid conflicts and assure orderly progress.
- .9 Conservation: Coordinate construction to assure that operations are carried out with consideration for conservation of energy, water, and reduction of waste materials.
- .10 Salvage materials and equipment involved in performance of, but not incorporated in, the Work.

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- .11 Carefully study and compare Contract Documents before proceeding with fabrication and installation of work. Promptly advise Consultant of errors, inconsistencies, omissions, or apparent discrepancies discovered.
- .12 Verify that characteristics of operating equipment are compatible with the project's utilities and services.
- .13 Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various specification sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- .14 In finished areas, except as otherwise indicated, conceal pipes, conduit and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
- .15 Execute cutting and patching to integrate elements of work, uncover ill-timed, defective, and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls and ceilings.
- .16 Coordinate the actual layout of plumbing, electrical and other similar elements as necessary to avoid interference between systems.
- .17 Maintain configurations of architectural elements and minimum ceiling and clearance heights as required by code and Contract Documents.
- .18 Coordination Drawings: Prepare coordination drawings if needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space necessitates maximum utilization of space for efficient installation of different components.
- .19 Show the relationship of components shown on separate shop drawings.
- .20 Indicate required installation sequences.
- .21 Comply with requirements contained in Section 01 33 00, Submittal Procedures.

## **1.5 REQUEST FOR INFORMATION**

- .1 Allot time in construction scheduling for liaison with Consultant and Owner. Allow one week for Consultant/Owner review and routing of submittals and Request for Information (RFI's).
- .2 Submit RFI's to Consultant, on Contractor's standard form, in sequentially numbered requests within consultant's web-based project management software.

## **1.6 EXECUTION**

- .1 Inspection of Conditions: Installers of major components to inspect substrates and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected. Commencement of work immediately confirms acceptance of the substrate.
- .2 Coordinate temporary enclosures with inspections and tests to minimize the need to uncover completed construction.
- .3 Clean and protect construction in progress and adjoining materials, during handling and installation. Apply protective covering to assure protection from damage.
- .4 Clean and maintain completed construction as necessary through the construction period. Adjust and lubricate operable components to assure operability without damaging effects.



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- .5 Limiting Exposures: Supervise construction to assure that no part is subject to harmful, dangerous, or damaging exposure. Such exposures include, but are not limited to:
  - .1 Excessive static or dynamic loading.
  - .2 Excessive internal or external pressures.
  - .3 Excessively high or low temperatures or humidity.
  - .4 Water or ice.
  - .5 Solvents and chemicals.
  - .6 Abrasion.
  - .7 Soiling, staining, and corrosion.
  - .8 Combustion.
  - .9 Air contamination or pollution.
  - .10 Excessive weathering.
  - .11 Unprotected storage.

#### **1.7 REFERENCE STANDARDS**

- .1 Refer to Section 01 42 00, References.
- .2 For products specified by association or trade standards, comply with requirements of the standard except when more rigid requirements are specified or are required by applicable codes.
- .3 The date of the standard is that in effect as of the Proposal closing date, or date of Owner-Contractor Agreement when there are no bids, except when a specific date is specified.
- .4 Obtain copies of standards when required by Contract Documents. Maintain copy at jobsite during progress of the specified work.

#### **1.8 FIELD ENGINEERING**

- .1 Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices.

#### **1.9 APPLICATIONS FOR PAYMENT**

- .1 Refer to Section 01 29 00, Payment Procedures.
- .2 Submit 1 email copy of each application on a form acceptable to the Consultant and Owner by the 25<sup>th</sup> of each month.

#### **1.10 ON-SITE DOCUMENTS**

- .1 Maintain at job site, one copy each of the following:
  - .1 Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings/Product Data.

- .5 Change Orders (CO's), Contemplated Change Notices (CCN's), Supplemental Instructions (SI's).
- .6 Other modifications to Contract.
- .7 Site test reports, Site Review Reports.
- .8 Copy of approved Construction Schedule.
- .9 Manufacturer Installation and Application Instructions.

#### **1.11 CONSTRUCTION SCHEDULES**

- .1 Submit preliminary construction progress schedule to Consultant and Owner's Project Manager.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by the Consultant and/or the Owner.

#### **1.12 SUBMITTALS**

- .1 All submittals including request for information, shop drawings, contemplated change notices, change orders, costing etc. to be processed digitally through the Consultant's indicated web-based project management software.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space and for relation to Work of other contracts. After review, revise and resubmit for transmittal to the Consultant.
- .3 Submit requests for payment for review and for transmittal to the Consultant and the Owner.
- .4 Submit requests for information of Contract Documents and obtain instructions through the Consultant
- .5 Process substitutions through the Consultant.
- .6 Process change orders through the Consultant.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to the Consultant.

#### **1.13 CO-ORDINATION DRAWINGS**

- .1 Provide information required by the Consultant and/or Owner for preparation of co-ordination drawings. Prior to installation of services.
- .2 Revise drawings as required for re-submission to the Consultant and/or Owner.

#### **1.14 CLOSEOUT PROCEDURES**

- .1 Notify the Consultant when Work is considered ready for Substantial Performance.
- .2 Follow procedures outlined in Section 01 77 00 Closeout Procedures.
- .3 Accompany the Consultant and Owner on preliminary inspection to determine items listed for completion or correction.

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- .4 Comply with the Consultant's instructions for correction of items noted on date of Substantial Review. Substantial Review may be granted with a list of items noted for correction. See Section 01 29 00, 1.12.
- .5 Notify the Consultant when all items are corrected.
- .6 The Consultant will issue certificate of Substantial Performance when all corrections are complete. Subsequent Reviews (if required) over an above the initial follow up review after request for Substantial Review may be billed for.

**END OF SECTION**

## **Section 01 31 16 PROJECT MEETINGS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 This Section specifies administrative and procedural requirements by the Contractor for project meetings, including, but not limited to, the following:
  - .1 Progress Report.
  - .2 Preconstruction conferences.
  - .3 Pre-installation conferences.
  - .4 Progress meetings.

#### **1.3 PROGRESS REPORT**

- .1 The Contractor shall keep a permanent written record on site of the progress of work. This record is to be open to inspection of the Owner and copies is to be furnished to the Owner upon request.
- .2 This record is to show dates of commencement and completion of trade and parts of the work. It is to include particulars regarding daily weather conditions various parts of the work such as excavation, erection and removal of forms, placing of concrete.

#### **1.4 PRE-CONSTRUCTION CONFERENCE**

- .1 Within one week after award of the contract, convene a pre-construction conference to discuss and resolve administrative procedures and responsibilities, with General Contractor, Consultant and major Subcontractors.
- .2 The Consultant will establish time and location of meeting and notify all parties concerned to attend.
  - .1 Attendees:
    - .1 Owner's representative, Consultant, Project Manager, Site Superintendent.
    - .2 The Subcontractor and Suppliers agree to attend in person or send their authorized representatives at any such meetings that may be called by the Contractor.
- .3 Agenda: Discuss items that could affect progress, including the following:
  - .1 Tentative construction schedule and critical work sequencing.
  - .2 Submittal of Shop Drawings, product data, and samples, and special submittal procedures.
  - .3 Use of the premises, site mobilization and review of Subcontractor responsibilities and administrative procedures.

- .4 Procedures to follow regarding site security, control of access of the site, emergency response procedures in case of fire or serious injury.
- .5 Project specific concern/issues and strategies to maximize health and safety during the term of the contract.

## 1.5 PRE-INSTALLATION CONFERENCES

- .1 As necessary the Contractor will conduct a conference before each activity that requires coordination with other operations. If requested, Subcontractors are required to attend the conferences.
- .2 Attendees:
  - .1 The Subcontractors and representatives of manufacturers and fabricators involved in or affected by the installation shall attend. As necessary the Contractor will advise Owner and Consultant of scheduled meeting dates.
  - .2 Review the progress of other operations and preparations for the activity under consideration at each pre-installation conference, including requirements for the following:
    - .1 Compatibility problems and acceptability of substrates.
    - .2 Time schedules and deliveries.
    - .3 Manufacturer's recommendations.
    - .4 Warranty requirements.
    - .5 Inspecting and testing requirements.
  - .3 The Contractor will record significant discussions and distribute record of meeting to everyone concerned, including Consultant.
  - .4 Subcontractor is not to proceed with installation if conference cannot be successfully concluded. Subcontractor is responsible for initiating actions necessary to resolve problems and reconvene conference.
  - .5 Unless otherwise required, notify Consultant a minimum of seven calendar days prior to each scheduled meeting.

## 1.6 PROGRESS MEETINGS

- .1 The Consultant shall organize, co-ordinate, attend and record regular site meetings at such intervals as may be deemed necessary for the purpose of co-coordinating and expediting the progress of the work. The Consultant shall record and circulate notes to the satisfaction of the Owner.
- .2 These meetings will be attended by the Owner, Consultant or his authorized representative as and when required; the Contractor shall attend in person or send his authorized representatives to any such meeting which may be called for by the Owner.
  - .1 The Subcontractors and suppliers agree to attend in person or send their authorized representatives at any such meetings that may be called by the Contractor.
- .3 Such formal site meetings are to be held weekly, but at a minimum bi-weekly or as otherwise directed by Owner.
- .4 Purpose: to monitor construction progress and to identify problems and action required for their solution, to expedite the Work.

- .5 Agenda:
  - .1 Review and approval of notes of previous meeting.
  - .2 Review of ESC measure
  - .3 Review of site safety items
  - .4 Review of items of significance that could affect progress.
  - .5 Other topics for discussion as appropriate to current status of the Work.
  - .6 Review progress since the last meeting. Determine where each activity is in relation to the construction schedule. Determine how to expedite construction behind schedule; secure commitments from parties involved to do so. Discuss revisions required to ensure subsequent activities will be completed within Contract Time.
  - .7 Provide RFI log and discuss status of RFI's.
  - .8 Provide change proposal log and discuss status of proposed changes.
  - .9 Provide Site Instruction (SI) log and discuss status of SI's.
  - .10 Provide submittal log and discuss status of submittals.
  - .11 Reporting: Meeting notes will be distributed to each party present and to parties who should have been present.
  - .12 Schedule Updating: Revise Construction Schedule as necessary after each meeting where revisions have been made.
  - .13 Notes: Consultant will record notes and distribute copies to attendees and affected parties not in attendance, within four (4) days after meeting.
- .6 The Consultant shall:
  - .1 Schedule and administer project progress and site meetings throughout the progress of the work.
  - .2 Distribute written notice of each meeting one week in advance of the meeting date to the Owner, Subcontractor and Consultants, unless the meeting has been prescheduled at a previous meeting.
  - .3 Record the meeting. Include significant proceedings and decisions. Identify "action by" parties. Exact format for meeting notes is to be provided by the Consultant and include:
    - .1 Each meeting is to be numbered consecutively.
    - .2 New items arising at a meeting will bear the number of that meeting. (i.e. for meeting #10 - 10.1, 10.2.)
    - .3 This item or issue is to retain this number until it is completed or concluded. Incomplete items are to remain on the "running" meeting notes until completed with new information added to each item and dated.
    - .4 Reproduce and distribute copies of meeting notes within five days after each meeting and transmit to meeting all participants including, Owner, Consultants, and affected parties not in attendance.
    - .5 Advise Consultants, Subcontractors and Owner to attend as required.
- .7 All Parties will:

- .1 Review notes of meetings and advise of any errors or omissions not later than 7 days following receipt of the meeting notes.
- .2 Notify the Contractor not later than 7 days.
- .3 Provide advance notice of items for agenda if possible.

**END OF SECTION**

## **Section 01 33 00 SUBMITTALS PROCEDURES**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 RELATED WORK**

- .1 01 11 00 Summary of Work
- .2 01 45 00 Quality Assurance
- .3 01 71 00 Examination and Preparation
- .4 01 77 00 Closeout Procedures

#### **1.3 SUMMARY**

- .1 This section specifies general requirements and procedures for submissions of shop drawings, product data, samples, and mock-ups. Contractor shall submit required materials to the Consultant for review. Additional specific requirements for submissions are specified in individual sections of Divisions 2 to 32.
- .2 The Contractor shall submit required submittals listed for review by the Consultant. Submit with reasonable promptness and in orderly sequence to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed.
- .3 The Contractor shall review submittals prior to submission to the Consultant for review. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the contract documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and will be considered rejected.
- .4 The Contractor's responsibility for compliance in submission to the requirements of Contract Documents is not relieved by Consultant's review.
- .5 The Contractor shall keep one reviewed copy of each submission on site.
- .6 The Contractor shall provide a list of subtrades employed including contact information to the Contractor and Owner at the start of the project.
- .7 Do not proceed with work until relevant submissions are reviewed by the Consultant and returned to the Contractor. Late or incomplete submissions will not be considered for cause of delivery or installation delays to the work.
- .8 Present shop drawings, product data, samples, and mock-ups in Imperial units.
- .9 Where items or information is not produced in Imperial units converted values are acceptable.
- .10 The Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submissions.



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- .11 Notify in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .12 The Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant's review of submission, unless Consultant gives written acceptance of specific deviations.
- .13 The Contractor shall make any changes in submissions that the Consultant may require that are consistent with the intent of the Contract Documents and resubmit.
- .14 Notify in writing, when resubmitting, of any revisions (highlighting as a bubble) other than those requested by the Consultant.
- .15 All submittals including request for information, shop drawings, contemplated change notices, change orders, costing etc. to be processed digitally through the Consultant's indicated web-based project management software.

#### 1.4 SUBMISSION REQUIREMENTS

- .1 Coordinate each submission with requirements of Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .2 Allow ten 10 business days for the Consultant review of individual submissions. Allow 15 business days where multiple submissions are made at the same time. Where multiple submissions are made, identify which submissions have a higher priority with respect to the progress of the Work.
- .3 Accompany submissions with transmittal letter 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.
- .4 Submissions shall 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.

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- .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.
- .5 After Consultant's review distribute copies.

## 1.5 SHOP DRAWINGS

- .1 Shop drawings: original drawings, or modified standard drawings provided by Contractor, to illustrate details of portions of Work, which are specific to project requirements.
- .2 Cross-reference shop drawing information to applicable portions of Contract Documents.
- .3 Within two (2) weeks of award of this contract, the Contractor shall submit a detailed list of all shop drawings and submittals which he intends to submit for review. This list is to reflect each individual item, the date shop drawings will be submitted, and the date upon which review will be required to comply with the project schedule. Individual shop drawing submissions will be cross-referenced back to this list to assist the Contractor's shop drawing control and expediting procedures.
- .4 The Contractor shall be responsible for submitting and for instructing all Subcontractors and suppliers to submit shop drawings or diagrams in 8 1/2" x 11" or 11" x 17" PDF format via email, if possible, to the Contractor. If electronic versions are not available, the Subcontractor shall submit five (5) hard copies of all shop drawings.
- .5 The shop drawings will be reviewed by the Consultant and checked by the Contractor for conformance with the design concept of the project and compliance with the information given in the Contract Documents and the drawing stamped accordingly, in one of the following ways:
  - .1 'No comment.'
  - .2 'Reviewed'
  - .3 'Reviewed as Noted'.
  - .4 'Revise and Resubmit and returned to the Subcontractor.
- .6 "Revise and Resubmit" drawings are to be corrected by the Contractor and resubmitted to the Consultant.
- .7 Only shop drawings stamped 'No Comment' and 'Reviewed as Noted' are to be used on the site. All other shop drawings are to be considered as being not reviewed.
- .8 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Subcontractor to illustrate details of a portion of the Work.
- .9 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which

- the adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.
- .10 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing prior to proceeding with the Work.
  - .11 Make changes in shop drawings as the Consultant may require, consistent with the Contract Documents. When resubmitting, notify the Contractor in writing of any revisions or bubble changes other than those requested.
  - .12 Submit design criteria notes, where design has been delegated to the Contractor, as shop drawings and provide all information necessary to determine compliance with design intent.
  - .13 Indicate dimensions on shop drawings in metric units. The Contractor shall be responsible for establishing site dimensions prior to submission of shop drawings, as follows:
    - .1 Field Measurements: Where materials are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
    - .2 Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions with Contractor and proceed with fabricating materials without field measurements. Coordinate other construction to ensure that actual dimensions correspond to established dimensions.
  - .14 Do not use the term "by others" on shop drawings or submittals. State the related Subcontractor requiring coordination.
  - .15 Where specifications require shop drawings to bear seal of professional engineer, engineer must be registered in the Province of BC and shall have expertise in area of practice reflected in shop drawings.
  - .16 Submit shop drawings only where specified.
  - .17 Request advance permission from Contractor to submit shop drawings where not specified for materials, products, or systems, for Consultant's review.
  - .18 Provide materials, products, or equipment in compliance with the Contract Documents

## 1.6 MOCK-UPS

- .1 Mock-ups: field-erected example of work complete with specified materials and workmanship.
- .2 Erect mock-ups at locations acceptable to Contractor.
- .3 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be assessed.
- .4 Required mock-ups are listed in the specification sections. Some mock-ups require several sections of work to cooperate and construct a complete assembly. Coordinate the activities of these sections to ensure that required mock-ups are completed.
- .5 All mock-ups that are found acceptable by the Consultant may form a part of the permanent work of the Work. Where modifications are required, they shall be completed and form the standard of acceptance for the remainder of the Work. Where mock-ups are found not acceptable, mock-up shall be repaired or replaced as directed.

## **1.7 SAMPLES**

- .1 The Subcontractor shall furnish, for the Contractor's review, such samples as may be reasonably required. The work is to be in accordance with reviewed samples. Where required by a specification section or by the Contractor, the Subcontractor shall submit samples in duplicate for review and any required testing. Samples to be the materials specified or the properly approved alternatives; no deviation permitted after review of samples.
- .2 Adjustments made on samples by the Contractor are not intended to change the contract price. If adjustments affect the value of Work, state such in writing to the Contractor prior to proceeding with the Work.
- .3 The Contractor shall make changes in samples which may be required, consistent with the Contract Documents.
- .4 Samples: examples of materials, equipment, quality, finishes, workmanship.
- .5 Where colour, pattern, or texture is criterion, submit full range of samples.
- .6 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.
- .7 Submit for Consultant's review, where specified, shown, or considered necessary, duplicate Samples, one for retention by the Consultant, other to be returned to the Contractor marked approved or not approved.
- .8 Identify samples with name and number of projects, date, name of Contractor, name of supplier/manufacturer and intended use of material represented by sample.
- .9 Do not proceed with fabrication or delivery of materials until Samples are approved.
- .10 Review of samples does not imply acceptance of finished Work.
- .11 Work judged by the Consultant to be below the standard set by the sample may be rejected, in which event the Contractor shall replace with acceptable Work, at no additional cost.

## **1.8 PRODUCT DATA**

- .1 Product data: manufacturers catalogue sheets, brochures, literature, performance charts and diagrams, concrete mix designs, used to illustrate standard manufactured products.
- .2 Upon contract award, suppliers, and Subcontractor's must submit product data as required by the respective specification sections to Contractor without conditions.
- .3 Submit 1 copy of product data, dispersal will be similar to Shop Drawings.
- .4 Sheet size: 216 mm (8½") x 279 mm (11"), maximum of 3 modules.
- .5 Delete information not applicable to project.
- .6 Supplement standard information to provide details applicable to project.
- .7 Cross-reference product data information to applicable portions of Contract Documents.

## **1.9 OPERATIONAL AND MAINTENANCE MANUALS**

- .1 Deliver copies of a manual presenting the operation and maintenance of the project and its equipment as specified in Section 01 78 23, Operations and Maintenance Data to the Contractor prior to Substantial Performance of the Work. Failure to submit operations and maintenance data will result in a holdback of 5% of the Contract Price.

**1.10 AS BUILT AND RECORD DRAWINGS**

- .1 Submit As-Built Drawings in accordance with requirements of Section 01 78 39. Failure to submit record documents will result in a holdback.
- .2 Record drawings shall be prepared by the Consultant from As-Built Drawing information in accordance with requirements of Section 01 78 39.

**END OF SECTION**

## **Section 01 41 00 REGULATORY REQUIREMENTS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 REGULATORY REQUIREMENTS**

- .1 Execute the Work in accordance with Municipal, Provincial and Federal Requirements, applicable bylaws, regulations, and building codes; conform to latest published revisions, addenda, supplementary and appropriate current standards presently recognized and enforced by authorities having jurisdiction.
- .2 Execute the Work in accordance with, applicable Bylaws, Building Codes and Standards, including but not limited to:
  - .1 British Columbia Building Code 2024 (BCBC).
  - .2 WorksafeBC Requirements.
  - .3 B.C. Plumbing Code.
  - .4 Canadian Electrical Code adapted to the Province of B.C and all bulletins issued by the Province of B.C. Electrical Safety Branch.
  - .5 National Fire Code of Canada (NFC), 2015.
  - .6 Master Municipal Construction Documents (MMCD)
- .3 Notwithstanding versions of codes noted in each section, the latest current applicable code will always apply.
- .4 Additional requirements and standards as noted in the Mechanical and Electrical sections.
- .5 Should conflicts arise between one document or authority and another, obtain clarification from the Consultant before proceeding with Work. Generally, the most stringent regulation will govern.
- .6 Submit to the Consultant during construction and upon completion of the Work all certificates of inspection provided by authorities having jurisdiction.
- .7 Submit all permits and certificates of inspection provided by authorities having jurisdiction.
- .8 Should hazardous materials including but not limited to spray or trowel-applied asbestos be encountered, stop work and notify Consultant immediately. Do not proceed until written instructions have been received from Owner.

#### **1.3 CERTIFICATES, INSPECTIONS, LICENCES AND PERMITS**

- .1 The Contractor shall obtain and pay for all other services, connection costs, permits, licenses, deposits, certificates and bonding costs as required by authorities having jurisdiction and for the performance of the Work.

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#### **1.4 UTILITIES AND SERVICES CONNECTIONS**

- .1 The Contractor shall be responsible for all utility and service connection costs associated with the Project, regardless of whether the required Work is performed by the Contractor or its Subcontractors, the Municipality or by a utility.

#### **1.5 PERMITS PROVIDED BY CONTRACTOR**

- .1 Pay all fees and obtain all required permits pertaining directly to the Work of the Contract in accordance with the General Conditions and applicable local regulations and bylaws.
- .2 Provide inspection authorities with such plans and information as may be required for the issue of acceptance certificates. Furnish inspection certificates as evidence that the Work performed conforms to the requirements of the authorities having jurisdiction.

**END OF SECTION**

## Section 01 42 00 REFERENCES

### Part 1 General

#### 1.1 DOCUMENTS

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

#### 1.2 SUMMARY

- .1 All references to Codes, Standards and standard Specifications referred to in these Specifications or used on drawings shall mean and intend to be the currently adopted edition, amendment, and revision of such reference standards in effect at the time of Bid closing.
- .2 Referenced Standards and Code requirements shall be considered minimum requirements.
- .3 Applicable portions of Standards used that are not in conflict with the Contract Documents are hereby made a part of the Specifications.
- .4 Modifications or exceptions to Standards shall be considered as amendments, and unmodified portions shall remain in full effect.
- .5 In cases of discrepancies between the Specifications and Standards, the most stringent requirements shall govern.
- .6 In cases of discrepancies between Codes and the Specifications, the Code requirements shall govern.
- .7 Where references to Codes or Standards are used in these Specifications, the Contractor must be familiarized with the applicable portions and shall be governed by them.

#### 1.3 INDUSTRY STANDARDS

- .1 Applicability of Standards:
  - .1 Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- .2 Publication Dates:
  - .1 Comply with standards in effect as of date of the Contract Documents, notwithstanding an earlier date that may be indicated within the specification sections.
- .3 Conflicting Requirements:
  - .1 If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Consultant for a decision before proceeding:



- .1 Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed.
- .2 The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.
- .3 To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.
- .4 Refer uncertainties to the Consultant for a decision before proceeding.
- .2 Copies of Standards: Each entity engaged in construction on project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Document.
  - .1 Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

#### 1.4 DEFINITIONS

- .1 Basic Contract "Definitions" are included in the Conditions of the Contract, the following definitions are in addition to "Definitions", and are intended to define words used in the specifications:
  - .1 Accepted: The term "accepted", when used to convey Consultant's action on Contractor's submittals, applications, and requests, is limited to Consultant's duties and responsibilities as stated in the Conditions of the Contract.
  - .2 Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean directed by the Consultant, requested by Consultant, and similar phrases.
  - .3 Indicated: The term "indicated" refers to graphic representations, notes, or schedules on Drawings or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help the user locate the reference.
  - .4 Regulations: The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
  - .5 Furnish: The term "furnish" means to supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.
  - .6 Install: The term "install" describes operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
  - .7 Provide: The term "provide" means to furnish and install, complete and ready for the intended use.
  - .8 Installer: An installer is the Contractor, or another entity engaged by Contractor as an employee, subcontractor to perform a particular construction operation, including installation, erection, application, and similar operations.
  - .9 Experienced: The term "experienced", when used with an entity, means having successfully completed a minimum of five previous projects similar in size and

scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction:

- .1 Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.
- .10 Project site: Is the space available for performing construction activities. The extent of project site is shown on Drawings and may or may not be identical with the description of the land on which project is to be built.

## 1.5 INDUSTRY ASSOCIATIONS AND CONSENSUS STANDARDS

- .1 Conform to the latest edition of appropriate consensus standards presently being recognized and enforced, in whole or in part, as noted within specification sections, including but not limited to those of the following organizations:
  - .1 Acoustical and Board Products Association (ABPA).
  - .2 American Concrete Institute (ACI).
  - .3 American Institute of Steel Construction (AISC).
  - .4 American National Standards Institute (ANSI).
  - .5 American Society for Testing Materials (ASTM).
  - .6 American Society of Heating, Refrigeration, and Air Conditioning Engineers Inc. (ASHRAE).
  - .7 Architectural Aluminum Manufacturer's Association (AAMA).
  - .8 Canadian Electrical Manufacturers Association (CEMA).
  - .9 Canadian Gas Association (CGA).
  - .10 Canadian General Standards Board (CGSB).
  - .11 Canadian Hardwood Plywood Association (CHPA).
  - .12 Canadian Institute of Steel Construction (CISC).
  - .13 Canadian Lumbermans Association (CLA).
  - .14 Canadian Masonry Contractors Association (CMCA).
  - .15 Canadian Prestressed Concrete Institute (CPCI).
  - .16 Canadian Sheet Steel Building Institute (CSSBI)
  - .17 Canadian Standards Association (CSA).
  - .18 Canadian Steel Door and Frame Manufacturer's Association (CSDFMA).
  - .19 Canadian Welding Bureau (CWB).
  - .20 Cement Association of Canada (CAC).
  - .21 Council of Forest Industries of B.C. (COFI).
  - .22 Insulated Glass Manufacturers Association of Canada (IGMAC).
  - .23 Master Municipal Construction Documents (MMCD)
  - .24 National Association of Architectural Metal Manufacturers (NAAMM).

- .25 National Electrical Manufacturers Association (NEMA).
- .26 National Fire Protection Association (NFPA).
- .27 National Lumber Grades Authority (NLGA).
- .28 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
- .29 Steel Structures Painting Council (SSPC).
- .30 Underwriters Laboratories of Canada (ULC).
- .31 Underwriters Laboratories Inc. (ULI)
- .32 Warnock Hersey International Inc. (WHI).

## **1.6 QUALITY ASSURANCE**

- .1 Unless otherwise noted in specifications, conform to the latest edition of the following technical trade association standards and quality assurance programs where noted:
  - .1 Architectural Painting Specification Manual and Maintenance Repainting Manual as issued by the Master Painter Institute (MPI).
  - .2 B.C. Landscape Standard as jointly published by the B.C. Society of Landscape Architects (BCSLA) and B.C. Nursery Trades Association (BCNTA).
  - .3 Landscape Irrigation Standard of the Irrigation Industry Association of British Columbia (IIABC).
  - .4 Masonry Technical Manual by the Masonry Institute of British Columbia (MIBC).
  - .5 Master Municipal Construction Documents (MMCD) (for civils utilities, paving and related work).
  - .6 Roofing Practices Manual (RPM) of the Roofing Contractors Association of British Columbia (RCABC).
  - .7 Specifiers Guide for Cedar Products by the Western Red Cedar Lumber Association (WRCLA).

**END OF SECTION**

## **Section 01 45 00**

### **QUALITY CONTROL AND ASSURANCE**

#### **Part 1 General**

##### **1.1 DOCUMENTS**

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

##### **1.2 SUMMARY**

- .1 This section includes requirements for quality assurance measures such as requirements for testing agencies, mock-ups, and workmanship.

##### **1.3 GENERAL**

- .1 Quality-control services include inspections, tests, and related actions, including reports performed by the Contractor, by independent agencies and by governing authorities. They do not include contract administration activities performed by Owner, Project Manager or Consultant.
- .2 Contractor Responsibilities: Provide and pay for a commissioning agent regarding electrical operations; also, inspections and tests (not listed above) but specified elsewhere and required by authorities having jurisdiction. Costs for these services are included in the Contract Price. Major Subcontractors shall include the cost of providing testing required by authorities having jurisdiction.
  - .1 The Contractor will be responsible for the coordination of inspection and/or testing for concrete testing and concrete mix design, but the Owner will pay for these inspections and/or testing
  - .2 The Contractor will be responsible for coordination of inspection and/or testing including, but will not necessarily be limited to, the following:
    - .1 Painting inspection.
    - .2 Backfill compaction testing.
    - .3 Soils inspection and testing.
    - .4 Reinforcing steel inspection.
    - .5 Steel Inspections
    - .6 Metal fabrications.
- .3 Notify Consultant, Owner and Testing Laboratory 48 hours prior to expected time for operations requiring inspection and testing. When tests or inspections cannot be performed, through the fault of the Contractor, reimburse the Owner for additional costs incurred.
- .4 If initial tests and inspections indicate deficient work, remove and replace work not complying with Contract Documents. Remedies shall be in accordance with Contract Documents and Code requirements.

- .5 Retesting: Retest until specified standards are met, where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements, regardless of whether the original test was Contractor's responsibility.
- .6 Costs of retesting are the Contractor's responsibility where tests performed indicated noncompliance with requirements.
- .7 Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify the agency in advance of operations to permit assignment of personnel. Auxiliary services include the following:
  - .8 Providing access to the Work.
  - .9 Furnishing incidental labor, tools, samples, test reports, equipment, design mixes and facilities to assist inspections and tests.
  - .10 Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
  - .11 Providing preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  - .12 Providing security and protection of samples and test equipment at the Project Site.
  - .13 Coordination: Coordinate activities with each agency engaged to accommodate services with a minimum of delay. Avoid removing and replacing construction to accommodate inspections and tests.
  - .14 Scheduling inspections, tests, taking samples, and similar activities.
  - .15 Schedule testing and inspection to be as continuous and brief as possible. Utilize lab services efficiently.

#### **1.4 INSPECTIONS, TESTING AND APPROVALS**

- .1 The Contractor shall be responsible for the organization notifications and arrangements as required to assure inspections, tests and related approvals required by authorities and/or the contract documents are sent to the Consultant.
- .2 The Contractor shall ensure reasonable notification of the Consultant in relation to ongoing work and testing. The Consultant will be responsible only for responding to such reasonable notice. The Contractor shall co-operate with the Consultant and organize and schedule such work and provide five (5) working days' notice for review.
- .3 The Contractor shall note that the building code requires the Consultant to review specific code related construction works. A summary of such specific works has been provided by the Consultant.
- .4 The construction administration and site review role of the Consultant is solely on behalf of the Owner and is intended to assist in the provision of construction in compliance with the Contract Documents through intermittent review of portions of the work only. The Consultant is in no way responsible for the Contractor for management, protection, quality control of completeness of the Work.
- .5 When required by the Consultant, the Contractor shall produce reasonable evidence to show that any products, methods or workmanship used conforms to the Contract Documents and Building Code.
- .6 Products are to be delivered, stored, handled and applied in strict accordance with manufacturer's instructions and are to be delivered with type, grade and brand name clearly identifiable and seals intact.

## **1.5 MANDATORY SITE REVIEWS**

- .1 The work that must be reviewed by the Consultant before proceeding further, includes, but is not limited to the following:
  - .1 Backfill materials and compaction.
  - .2 Foundation drains, storm and sanitary sewers prior to backfilling.
  - .3 Service piping, hydrostatic tests prior to covering pipe.
  - .4 Other as set out in Structural, Civil, Landscape and Electrical sections.
  - .5 Notify Consultant minimum five (5) working days prior to above inspections.

## **1.6 INDEPENDENT INSPECTION AGENCIES**

- .1 Independent Inspection/Testing Agencies will be engaged by the Contractor and paid for by the Owner for the purpose of inspecting and/or testing the portions of Work as specified and required by the Authorities Having Jurisdiction.
- .2 The Contractor shall provide access for equipment required for executing inspection and testing by the appointed agencies.
- .3 Employment of inspection/testing agencies does not relieve the Contractor of his responsibility to perform Work in accordance with the Contract Documents, or to maintain his own quality control.
- .4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain the full degree of defect. Correct defects and irregularities as advised by the Consultant at no cost to the Owner. The Contractor shall pay costs for retesting and re-inspection.
- .5 Access to The Work
  - .1 The Contractor shall allow inspection/testing agencies access to the Work, offsite manufacturing and fabrication plants.
  - .2 The Contractor shall co-operate to provide reasonable facilities for such access.
- .6 Procedures
  - .1 The Contractor shall notify the appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.
  - .2 The Contractor shall submit samples and/or materials required for testing, as specifically requested in the specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

## **1.7 MOCK-UPS**

- .1 Provide mock-ups as specified in the individual specification sections and as follows:
- .2 Do not provide additional mock-ups, until approval is provided by Consultant or Owner's representative.
- .3 Do not proceed with subsequent work until approval of the mock-up is obtained.
- .4 Approval of mock-up shall be the standard of workmanship and materials for the remainder of Work similar to the mock-up.
- .5 Maintain mock-up in approved condition, until directed otherwise.

- .6 Unless specified otherwise, remove mock-up at completion, when directed by the Consultant and Owner's representative. Prior to removal photo-document mock-up with prints to the Consultant and Owner.
- .7 Unless specified or approved otherwise, schedule mock-ups a minimum of 5 working days prior to actual installation of the work represented by the mock-up.
- .8 Notify Consultant and Owner a minimum of 5 working days prior to mock-up.
- .9 For each mock-up, provide conditions which will duplicate the conditions of the actual installation, including lighting.
- .10 The Contractor shall prepare mock-ups for work specifically requested in the specifications at his expense. Include for work of all sections required to provide mock-ups.
- .11 The Contractor shall construct mock-ups in locations acceptable to the Consultant and Owner.
- .12 The Contractor shall prepare mock-ups for the Consultant review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.
- .13 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed.
- .14 Remove mock-ups at conclusion of Work or when acceptable to the Consultant.

#### **1.8 CONCRETE TESTING**

- .1 The Owner is to provide a list of pre-approved test agencies or qualifications to the contractor to test materials, review and check the mix designs, check production materials samples, take, test and report on concrete strength, air content and slump.
- .2 If the testing agency finds out-of-specification concrete he has the authority and is expected to reject such concrete. The testing agency is to be responsible for obtaining specification from the Consultant.
- .3 If the testing agency at any time suspects that they are not called every time the Contractor is pouring concrete or if the Contractor does not give sufficient notice, the testing agency will immediately notify the Owner and Consultant.

#### **1.9 TESTING AGENCY DUTIES**

- .1 Testing agencies are to cooperate with Owner, Consultant, and Contractor in performing its duties. Agency shall provide qualified personnel to perform inspections and tests. The agency shall:
- .2 The testing agency shall notify the Owner, Consultant and Contractor of irregularities or deficiencies observed in the Work during performance of its services.
- .3 The testing agency shall not release, revoke, alter or enlarge requirements or approve or accept any portion of the Work.
- .4 The testing agency shall not perform the duties of Contractor.
- .5 Test Agency Submittals:
  - .1 The testing agency shall submit a certified written report of each inspection and test to the Owner. If the Contractor is responsible for the service, the Contractor shall submit a certified written report of each inspection or test.

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- .2 The testing agency shall submit additional copies of each report to the governing authority, when authority so directs.
- .3 Report Data: Reports of each inspection, test, or similar service include, but are not limited to, the following:
  - .1 Date of issue.
  - .2 Project title and number.
  - .3 Name, address, and telephone number of testing agency.
  - .4 Dates and locations of samples and tests or inspections.
  - .5 Names of individuals making the inspection or test.
  - .6 Designation of the Work and test method.
  - .7 Identification of product and Specification Section.
  - .8 Complete inspection or test data.
  - .9 Test results and an interpretation of test results.
  - .10 Ambient conditions at the time of sample taking and testing.
  - .11 Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
  - .12 Name and signature of laboratory inspector.
  - .13 Recommendations on retesting.

#### 1.10 QUALITY ASSURANCE

- .1 Ensure that quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Notify Consultant immediately if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contractor reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of quality of Work in cases of dispute rest solely with the Consultant, whose decision is final.
- .4 Service Agency Qualifications: Engage prequalified Canadian accredited inspection and testing service agencies that specialize in the types of inspections and tests to be performed.
  - .1 Each agency shall be authorized by authorities having jurisdiction to operate in the Province where the Project is located.
- .5 Maintain quality control over suppliers, manufacturers, products, services, site conditions and workmanship, to produce work of specified quality.
- .6 Workmanship:
  - .1 Comply with industry standards, except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
  - .2 Perform Work with persons qualified to produce workmanship of specified quality.



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- .3 Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.
- .7 Manufacturer's Instructions:
  - .1 Unless specified otherwise, comply with instructions in full detail, including each step-in sequence. Should instructions conflict with Contract Documents, request clarification from Consultant before proceeding.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Repair and Protection: Upon completion of inspection, testing, and sample taking, repair damaged construction. Restore substrates and finishes. Comply with Section 01 11 00 Summary of Work.
- .2 Protect construction exposed by or for quality-control service activities and protect repaired construction.
- .3 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for inspection and testing.

**END OF SECTION**

## **Section 01 51 00**

# **TEMPORARY FACILITIES AND CONTROLS**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 Provide temporary facilities and controls specified in this Section and as otherwise required for performance of Work of the Contract.

#### **1.2 TEMPORARY HEATING AND VENTILATING**

- .1 Provide general heating as required to allow work to proceed.

#### **1.3 LAYOUT OF THE WORK**

- .1 Maintain layout and if disturbed, arrange for replacement at no additional cost to the Owner.

#### **1.4 GUARD RAILS AND BARRICADES**

- .1 Provide temporary safeguards and protection, to protect against accident or injury to workers or other personnel on site.
- .2 Provide and maintain guard as required by the authority having jurisdiction.
- .3 Protect project materials in their final position, from freezing.
- .4 Be responsible for safe storage of materials.
- .5 Prevent sprayed materials from contaminating air beyond application area, by providing temporary enclosures.
- .6 Remove temporary barriers and enclosures prior to completion and final acceptance. Patch and repair surfaces to original condition.

#### **1.5 TEMPORARY BARRIERS AND ENCLOSURES**

- .1 Project Site:
  - .1 The Contractor shall be restricted in the use of the premises to inside the project site, which shall be defined by the project's perimeter hoarding.
  - .2 Only commercial vehicles carrying tools or materials for the work are permitted temporarily on site.
- .2 Access to Site
  - .1 The Contractor shall not close or obstruct streets, sidewalks, lanes or other public rights of way without having first obtained required authorization from the Owner and permits from the authorities having jurisdiction.
  - .2 The Contractor shall maintain adequate means of egress from the project and shall not diminish, by his operations, adequate access/egress from the adjacent existing premises of the Owner.
  - .3 The Contractor shall maintain an ongoing fire fighting access to the construction area.

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- .3 Construction Site Hoardings.
  - .1 Perimeter hoarding to be minimum 2400mm high.
- .4 Site Security
  - .1 The Contractor shall be responsible for construction site security.
- .5 Neither the Owner nor the Consultant will be responsible for any loss or damage to materials, property or equipment of the Contractor, Subcontractor, or Subcontractor's workers.

#### **1.6 DESIGN OF TEMPORARY FACILITIES**

- .1 Be responsible for design and safety of temporary facilities. Temporary facilities of such nature that engineering proficiency is required for their design to ensure safety during construction shall be designed by a professional engineer licensed to practice in British Columbia.
- .2 Before the temporary structures are used; the person responsible for the design or their representative shall inspect the structure and issue a certificate stating that it has been constructed according to their design and meets code requirements.

#### **1.7 WEATHER ENCLOSURES**

- .1 Provide protection against weather, rain, wind, storms, to maintain work, materials, apparatus and fixtures free from injury or damage. At end of day's work protect new work likely to be damaged from same.
- .2 Properly protect the Work, and make provision for necessary temporary cold weather heating, during such periods of Work stoppages.

#### **1.8 TEMPORARY PROJECT SIGNAGE**

- .1 Project Site Signage.
  - .1 The Contractor shall, prior to commencing work on the site, install a project identification sign as specified in Section 01 11 00, Summary of Work.

#### **1.9 PUBLIC TRAFFIC FLOW**

- .1 Provide and maintain, traffic signs barricades and lights as required, to protect the public at perimeter of construction site limits.
- .2 Control traffic entering and leaving the site by providing Flagpersons.
- .3 Do not obstruct access or access to adjacent portions of site at any time, except by prior arrangements with the Owner and Authority having Jurisdiction.

#### **1.10 CLEANING DURING CONSTRUCTION**

- .1 Cleanup garbage and debris daily to achieve project's scheduling and safety objectives.
- .2 Clean up site on a regular basis during progress of Work, clean-up premises and site and dispose of waste material, rubbish, and debris.
- .3 Do not allow waste material, rubbish, and debris to accumulate and become an unsightly or hazardous condition. Maintain site in a clean and orderly condition.
- .4 Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

- .5 Sprinkle dusty debris with water as required.
- .6 Lower waste material in a controlled manner; do not drop or throw materials from heights.

#### **1.11 MANAGEMENT AND WASTE DISPOSAL REQUIREMENTS**

- .1 Comply with Section 01 74 19 Waste Management and Disposal.
- .2 Comply with Provincial and Municipal laws, rules and regulations pertaining to disposal operations.
- .3 Collect and dispose of non-hazardous waste material, rubbish and debris from site.
- .4 Do not burn or bury waste material, rubbish and debris on site.
- .5 Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
- .6 Separate hazardous waste from general waste and stored in an area designated by Owner. Ensure waste is promptly and properly removed and disposed of in accordance with regulations. Pay cost associated with debris removal.

#### **1.12 REMOVAL AND RESTORATION**

- .1 Remove temporary facilities specified in this Section, prior to request for inspection for Final Acceptance.
- .2 Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities used during construction to original condition.

#### **1.13 PARKING**

- .1 On-site and immediately adjacent street parking is limited. Ensure that employees and Subcontractor minimize impact of parking on neighboring residents and businesses.

**END OF SECTION**

## **Section 01 52 00 CONSTRUCTION FACILITIES**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 REFERENCES**

- .1 British Columbia Building Code - 2024.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.189, Exterior Alkyd Primer for Wood.
  - .2 CAN/CGSB 1.59, Alkyd Exterior Gloss Enamel.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .2 CSA 0121, Douglas Fir Plywood.
  - .3 CSA S269.2, Access Scaffolding for Construction Purposes.
  - .4 CAN/CSA Z321, Signs and Symbols for the Workplace.
- .4 Worksafe BC OHS Regulations and Guidelines.

#### **1.3 INSTALLATION AND REMOVAL**

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation. Do not proceed with work until this is approved by Consultant.
- .2 Identify areas which must be graveled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

#### **1.4 SITE STORAGE/LOADING**

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

#### **1.5 CONSTRUCTION PARKING**

- .1 Parking to be determined.
- .2 Provide and maintain adequate access to project site.

## **1.6 OFFICES**

- .1 Provide office of sufficient size to accommodate site meetings and furnished with drawing lay down table.
- .2 Provide Digital Display: Consultant projection of drawings, project data and video conferencing during construction meetings.
- .3 Internet: Provide high-speed Internet connection for consultant use at site meetings. Must be of sufficient speed to host hybrid in-person & video conference calls.
- .4 Provide marked and fully stocked first-aid case in a readily available location.
- .5 Subcontractors to provide their own offices as necessary. Direct location of these offices in coordination with the Contractor.

## **1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE**

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

## **1.8 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

## **1.9 CONSTRUCTION SIGNAGE**

- .1 No signs or advertisements, other than warning signs, are permitted on site.

## **1.10 ROADWAYS**

- .1 Verify adequacy of existing roads and allowable load limit on these roads. Repair of damage to roads caused by construction operations.
- .2 Construct access and haul roads necessary.
- .3 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .4 Dust control: adequate to ensure safe operation at all times.
- .5 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Contractor.
- .6 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .7 Provide snow removal during period of work.
- .8 Remove, upon completion of work, haul roads designated by Contractor.

## **1.11 CLEAN-UP**

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

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- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material off site daily.

**END OF SECTION**

## **Section 01 53 00 TEMPORARY CONSTRUCTION**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 Temporary construction required for general prosecution of the work.
- .2 Temporary construction and procedures to accommodate temporary exiting and safety requirements to permit construction to occur without compromising the safety or function of adjacent occupied spaces.

#### **1.3 REGULATORY REQUIREMENTS**

- .1 All temporary construction shall be installed and maintained in compliance with the regulations of appropriate governmental agencies.

#### **1.4 PERMITS**

- .1 Contractor shall acquire all permits required for erection of barriers in public ways.

#### **1.5 BARRIER PERFORMANCE AND MONITORING**

- .1 Barriers shall be erected where isolation of noise, odors, dust, heat or other objectionable effects of construction may compromise the safety, operation or comfort of adjacent occupied spaces.
- .2 Temporary heat, welding or any other operation which could produce objectionable effects on adjacent occupied spaces shall be mitigated using barriers, equipment or other appropriate methods. The Contractor shall provide all such protection whether temporary barriers are indicated in the contract documents.
- .3 The Contractor shall provide all necessary monitoring, including required equipment, to assure compliance with the requirements of this section.

#### **1.6 CONSTRUCTION FENCING**

- .1 The Contractor shall erect and maintain a construction fence throughout the construction period. The construction fence shall enclose an area sufficient to completely enclose all of the Contractor's work area including space for staging, stockpiling of materials, field offices, storage trailers and sheds.
- .2 The construction fence shall be removed at the completion of construction. Damaged or disturbed soils shall be regraded and compacted as specified.
- .3 Existing construction fencing, as part of the Burke Mountain Middle / Secondary School project, may be utilized, upon approval in writing by the school district and the school Contractor.



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## **1.7 PROTECTIVE BARRIERS**

- .1 The Contractor shall erect suitable barriers for the protection of workers and the general public from construction hazards.
- .2 Barriers shall be accompanied by appropriate signs and/or markings for the identification of hazards.
- .3 Barriers requiring engineering (i.e. protection from overhead falling objects, etc.) shall be designed by a registered engineer of BC and will follow the guidelines of the Authority having Jurisdiction.
  - .1 Engineering of barriers:
    - .1 The Contractor will pay for the engineering of all barriers.
    - .2 A stamped submittal of all engineered barriers shall be submitted to the Consultant for review.

## **1.8 DUST, NOISE AND ENVIRONMENTAL HAZARD CONTAINMENT BARRIERS**

- .1 The Contractor shall erect barriers suitable for the containment of environmental hazards. Environmental hazard containment barriers shall be constructed and maintained in compliance with the requirements and regulations of local, state and federal regulatory agencies.

## **1.9 TRAFFIC ROUTING**

- .1 Pedestrian and/or vehicular traffic shall not be impeded by operations conducted in the execution of this Contract, except as permitted in writing prior to construction.
- .2 Closures and alternate routing of traffic shall be performed in full compliance with the laws, regulations, and procedures of governing authorities, applicable codes, and regulations.

## **1.10 MAINTENANCE OF BARRIERS**

- .1 Barriers shall be maintained in place for the duration of need.
- .2 Barriers shall be maintained by the Contractor so that their functions are not compromised at any time.
- .3 Contractor shall obtain approval in writing from the Owner prior to removal of any temporary barriers.
- .4 When temporary barriers are removed, the Contractor shall repair any damage to the surrounding construction with no noticeable differences in appearance.

## **1.11 SHORING AND BRACING**

- .1 Where construction requires temporary shoring or bracing of excavations, beams, columns, etc. during erection, demolition, cutting, etc., the Contractor shall provide such temporary construction of type and configuration appropriate for the task.
- .2 Should engineering be required for temporary shoring or bracing, the Contractor shall acquire and pay for such engineering.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Construction fencing:
  - .1 The construction fence shall be 2,400mm in height (minimum).
  - .2 Fence construction and materials shall be adequate to prevent unauthorized entry into the contract area.
  - .3 Plastic snow fencing or warning tape are not acceptable materials.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Contractor shall install and maintain barriers to provide continuous effective hazard protection. Minimum standards of governing agencies shall be followed.

### **3.2 BARRIER PERFORMANCE AND MONITORING**

- .1 Barriers shall be erected wherever isolation of noise, odors, dust, heat or other objectionable effects of construction may compromise the safety, operation or comfort of adjacent occupied spaces.
- .2 Temporary heat, welding or any other operation which could produce objectionable effects on adjacent occupied spaces shall be mitigated using barriers, equipment or other appropriate methods. The Contractor shall provide all such protection whether temporary barriers are indicated in the Contract Documents.
- .3 The Contractor shall provide all necessary monitoring, including required equipment, to assure compliance with the requirements of this section.

**END OF SECTION**

## **Section 01 57 13**

# **TEMPORARY EROSION AND SEDIMENT CONTROLS**

### **Part 1 General**

#### **1.1 TEMPORARY EROSION AND SEDIMENTATION CONTROLS**

- .1 The erosion and sedimentation control strategy must be developed in accordance with the Authority having Jurisdiction requirements.
- .2 The contractor shall be fully responsible for implementing, maintaining, and monitoring all Erosion and Sediment Control (ESC) measures in compliance with applicable laws, regulations, and project specifications.
- .3 Erosion and sedimentation controls to be considered as part of the erosion and sedimentation control strategy include but are not limited to the following:
  - .1 A phased construction schedule that limits the extent of tree or vegetation removal and soil disturbance to those areas immediately required for site construction.
  - .2 A plan to divert runoff from entering the construction site and from cleared areas, while preventing untreated stormwater runoff from leaving the project boundary, using berms or swales.
  - .3 Details showing site access and a wheel wash system if access pad cannot be maintained to limit sediment trackout onto City roads.
  - .4 Plans, specifications and design calculations necessary to describe any works required to convey, control and treat total suspended solids and / or PH anomalies in run-off water from the construction site and the location of the discharge to the City sewer system.
  - .5 The stabilization of all exposed soil areas by either mulching, seeding or covering with plastic. From October 1 to April 30, soils must be stabilized within two days of being exposed. From May 1 to September 30, soils must be stabilized within seven days.
  - .6 A program to remove mud dirt and debris from City property.
  - .7 Storm drain inlet protection.
  - .8 Sampling and analyses may be required to demonstrate compliance with the applicable By-laws.

#### **1.2 EROSION AND SEDIMENTATION CONTROL PLAN**

- .1 The Contractor shall submit and adhere to an erosion and sedimentation control plan in accordance the local applicable codes and standards to include a monthly updating to the Consultant as to the status of the project's sedimentation management.
  - .1 Within fifteen (15) days of Notice of Award of Contract, provide confirmation that the provided erosion and sedimentation control (ESC) Plan has been reviewed against construction staging and methodology and that the required ESC measures are suitable and can be generally implemented as shown; submit any

proposed revisions / alternations to the provided plan to the Consultant for approval. Provide the approved ESC Plan to all Subcontractors.

- .2 Within ten (10) days of contract award, the Subcontractors shall review project erosion and sedimentation control plan.
- .2 The Subcontractor is responsible for ensuring that the plan requirements are met during their own activities. The Contractor may require the Subcontractor's presence at an erosion and sedimentation control training session and will undertake disciplinary action if the plan is not being followed.
- .3 Organize and send monthly progress updates to the Consultant including photographs of each erosion and sedimentation control measure as required.
- .4 Manage steep slopes within the project site in support of erosion and sedimentation requirements. erosion and sedimentation plan shall include special measures to protect steep slopes.
- .5 Any deficiencies must be corrected immediately at the contractor's expense.6. The contractor shall be responsible for all costs associated with ESC failures and any fines or penalties resulting from non-compliance.
- .6 The contractor shall be responsible for all costs associated with ESC failures and any fines or penalties resulting from non-compliance.

**END OF SECTION**

## **Section 01 60 00 PRODUCT REQUIREMENTS**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 Provide the guidelines and information for the product requirements based upon the design and intent of the project and its systems, including but not limited to the following:
  - .1 Product Quality.
  - .2 Availability.
  - .3 Manufacturer's Instructions.
  - .4 Delivery and Handling.
  - .5 Storage and Protection.
  - .6 Product Options.
  - .7 Substitutions.

#### **1.2 RELATED SECTIONS**

- .1 01 25 00 Product Substitutions.
- .2 01 33 00 Submittal Procedures.
- .3 01 45 00 Quality Control and Assurance.

#### **1.3 REFERENCES**

- .1 This Section applies to Technical Specification sections, and supplements the General and Supplemental Conditions, and General Subcontractor Agreement.

#### **1.4 GENERAL**

- .1 Products include material, equipment and systems.
- .2 Comply with size, make, type and quality specified, unless otherwise approved in writing by the Consultant. Specifications and referenced standards are minimum requirements.
- .3 A required component to be supplied in quantity shall be the same and shall be interchangeable. This requirement applied to items furnished under one or several sections of the specifications.
- .4 Unless specified or indicated otherwise, materials employed for construction purposes, such as formwork, scaffolding, and temporary lighting, shall not be incorporated into work.
- .5 Unless indicated or specified otherwise, products incorporated into the work shall be new, and of the most suitable grade of their respected kinds for the intended use.

#### **1.5 PRODUCT QUALITY**

- .1 Products, materials, equipment, and articles (referred to as products throughout specifications) incorporated in work shall be new, not damaged or defective, and of best

quality (compatible with Specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

- .2 Defective products, whenever identified prior to completion of work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with the Consultant based upon requirements of contract documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any or like item throughout the project.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

#### **1.6 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work might be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.7 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Consultant, in writing, of conflicts between specifications and manufacturer's instructions, so that a course of action may be established.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, will require removal and re-installation at no increase in Contract Price or Contract Time.
- .4 Obtain and distribute copies of manufacturer's instructions to parties involved in the installation, including two copies to the Consultant.

#### **1.8 DELIVERY AND HANDLING**

- .1 Transport products by methods to avoid product damage.
- .2 Deliver products in manufacturer's original containers or packaging, with identifying labels intact and legible.
- .3 Furnish equipment and personnel to handle products by methods to prevent soiling or damage.
- .4 Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- .5 Immediately replace non-conforming products with new conforming products, at no additional cost to Owner.

## **1.9 STORAGE AND PROTECTION**

- .1 Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- .2 Store sensitive products in weather-tight enclosures. Maintain within temperature and humidity ranges required by manufacturer's instructions, and as otherwise required to prevent damage.
- .3 For exterior storage of fabricated products, place on sloped supports above ground. Protect from soiling or staining through ground contact. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- .4 Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- .5 Arrange storage of products to furnish convenient access for inspection and inventory.

## **1.10 PRODUCT OPTIONS**

- .1 Product specified by reference standards or by description only: Provide product meeting those standards.
- .2 Product specified by naming one or more manufacturers with an "or approved" provision: Use specified product or submit a request for substitution in accordance with the specified substitution requirements. When approved a substitute product may be used.
- .3 Product specified by naming one or more manufacturers, without a provision for substitution: No substitution will be allowed.

## **1.11 SUBSTITUTIONS**

- .1 Refer to Section 01 25 00 Product Substitution.

**END OF SECTION**

## **Section 01 71 00 EXAMINATION AND PREPARATION**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 This section includes requirements for quality assurance measures such as requirements for testing agencies, mock-ups, and workmanship.

#### **1.3 GENERAL**

- .1 The Contractor shall lay out his work and be responsible for the correctness and location of the structures and improvements for lines, elevations, measurements, grading, paving, utilities and other work, executed by him under this Contract.
- .2 Exercise proper precautions to verify and co-ordinate figures shown on the drawings, before layout of work and be responsible for any errors resulting from failure to exercise such precaution.
- .3 Quality-control services include inspections, tests, site reviews. Investigations of subsurface conditions and related actions, including reports performed by the Contractor, by independent agencies, and by governing authorities. They do not include contract administration activities performed by Owner or Consultant.
- .4 Survey services to establish necessary lines and levels and provide batter boards and other means to control the accurate positioning of all project elements as well as establish elevations and confirm invert measurements for Work.
- .5 Provision of site survey on completion indicating that structures or improvements are correctly located and constructed to grades, lines, levels and overall dimensions required in the contract documents subject to noted deviations.

#### **1.4 QUALITY ASSURANCE**

- .1 Surveyor used on site shall be a qualified registered Land Surveyor licensed to practice in the Province of British Columbia, acceptable to Owner.
- .2 Submit documentation to verify accuracy of field engineering work.

#### **1.5 SUBMITTALS**

- .1 All submittals shall be in accordance with requirements of Section 01 33 00.
- .2 Submit signed certificates certifying that elevations and locations of completed work are in conformance or non-conformance with Contract Documents.

#### **1.6 SURVEY CERTIFICATE OF NON-ENCROACHMENT**

- .1 Survey Reference Points:
  - .1 Existing property line markers and vertical control points are provided onsite.



- .2 Locate, confirm and protect control points prior to starting the work. Preserve permanent reference points during construction.
- .3 Report to the Contractor when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations and retain a qualified registered B.C. Land Surveyor to replace control points in accordance with the original survey control, at the Contractor's expense.
- .2 Upon completion of footing and foundation forms, submit to the Consultant and Owner, three (3) certified original copies of the survey certificate by a B.C. Registered Land Surveyor verifying non-encroachment of foundation locations and dimensions.
- .3 Proceed with foundation work only after validation of location and dimensions.

#### **1.7 SURVEY REQUIREMENTS**

- .1 Existing grades, lines, and site conditions shown on drawings were taken from survey information established by persons engaged directly by the Owner. The accuracy of survey information is not the Consultant's responsibility.
- .2 Verify property line locations and dimensions and establish necessary lines and levels and provide batter boards and other means to control the accurate positioning of all structure elements from legal survey provided by the Owner.
- .3 Establish a permanent site benchmark or markers as widely separated as possible and ensure that they are compatible with the benchmark provided by the Owner's Survey.
- .4 Establish structure lines and levels by instrumentation and provide batter boards and stake for grading and fill placement
- .5 Verify elevations of floor levels as construction proceeds and relate to bench-mark datum.
- .6 Correlate geodetic elevation of benchmark datum with elevations in use by public utilities adjacent to Project and establish lines and levels for onsite services. Verify final locations and elevations of all buried storm, sanitary, and water services and electrical duct banks on site.
- .7 Prepare grade sheets in a form satisfactory to the Consultant and submit to the Consultant (and authorities having jurisdiction if requested). Review of grade sheets by the Consultant or authorities having jurisdiction does not release the Contractor from any responsibility for correctness of layout of work under this contract.
- .8 Take every precaution to prevent disturbance of official survey monuments or pins marking property lines and other permanent reference points during construction. Make no changes or relocations without prior written notice to the Consultant.
- .9 Report to Contractor when a reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.
- .10 Replace control points if disturbed by Contractor during performance of the Work in accordance with original survey control.
- .11 Any deviation from drawings by the Contractor or Subcontractor which cause the Owner to incur extra costs at a later date will be the Contractor's responsibility to rectify or pay for rectification which the Owner undertakes.

## **1.8 EXISTING CONDITIONS AND SERVICES**

- .1 Before commencing work adjacent to public property, verify that no plans for altering clearances, set-backs, easements, grades or otherwise have been made by local authorities, after their approval of Contract Documents which would affect the original intent.
- .2 Before commencing work establish location and extent of service lines in area of Work and notify Contractor and Consultant of findings.
- .3 Cap, plug, disconnect, relocate or divert services interfering with construction operations; report unidentified services discovered in course of operations to the Consultant. Take such action as is necessary or as required to prevent damage to existing utilities or make good such damage incurred at no extra costs to Contract.
- .4 Establish locations of recorded concealed services prior to commencement of work.
- .5 Take proper measures to maintain access to existing manholes, catch basins, electrical pull boxes, fire hydrants, valve boxes and allied services underground and on the surface.
- .6 Abandoned service lines shall be removed to within 1000 mm of structure and be capped or sealed at cut-off points as directed by the Consultant, and as otherwise noted on drawings.

## **1.9 DRAINAGE**

- .1 Ensure that positive drainage is provided to site drains and catch basins, as set in their final positions. Provide constant slopes for drained surfaces to drains and drainage courses.
- .2 Ensure that allowable construction tolerances and structural tolerances do not permit ponding of water.
- .3 Verify the extent of each area served by a drain, or drainage course, to eliminate possible un-drained surfaces. Co-ordinate the work of involved sections before each proceeds

## **1.10 SUBSURFACE CONDITIONS**

- .1 Notify Consultant in writing promptly if subsurface conditions at Place of Work differ materially from those indicated in the geotechnical report (when applicable), or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should the Consultant determine that conditions do differ materially, instructions will be issued for changes in Work.

## **1.11 FIELD DRAWINGS**

- .1 Prepare interference and equipment placing drawings to scale to ensure that all components will be properly accommodated within the spaces provided.
- .2 Ensure that clearances required by jurisdictional authorities and/or for easy maintenance of equipment will be shown on the above drawings
- .3 Interference drawings shall be prepared before any orders for equipment and/or materials are released to suppliers.

## **1.12 RECORDS**

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

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- .2 Provide a certified survey on completion of foundation work and major site improvements showing dimensions, locations, angles, and elevations of the Work
- .3 Provide a certified survey of vertical and horizontal locations of new and existing underground services and connections into existing underground services.

**END OF SECTION**

## **Section 01 73 00 EXECUTION REQUIREMENTS**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - .1 Construction layout.
  - .2 Field engineering and surveying.
  - .3 General installation of products.
  - .4 Coordination of Owner installed products.
  - .5 Progress cleaning.
  - .6 Starting and adjusting.
  - .7 Protection of installed construction.
  - .8 Correction of the Work.
- .2 See Section 01 77 00 Closeout Procedures for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### **1.2 SUBMITTALS**

- .1 Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- .2 Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- .3 Certified Surveys: Submit two copies signed by land surveyor.
- .4 Final Property Survey: Submit 5 copies showing the Work performed and record survey data.

#### **1.3 QUALITY ASSURANCE**

- .1 Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of mechanical and electrical systems and other construction affecting the Work.
  - .1 Before construction, verify location and points of connection of utility services.
  - .2 Verify with authorities having jurisdiction and utility companies.
- .2 Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - .1 Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - .2 Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - .3 Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- .1 Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- .2 Coordinate with requirements specified in Section 01 51 00 Temporary Facilities and Controls for temporary utilities.
- .3 Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services:
  - .4 Notify Owner not less than 7 days in advance of proposed utility interruptions.
  - .5 Do not proceed with utility interruptions without Owner's written permission.
- .6 Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .7 Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- .8 Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents, submit a request for information to Consultant. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### **3.3 CONSTRUCTION LAYOUT**

- .1 Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to property survey and existing benchmarks. If discrepancies are discovered, notify Consultant promptly.
- .2 General: Engage a land surveyor to lay out the Work using accepted surveying practices.
- .3 Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
- .4 Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
- .5 Inform installers of lines and levels to which they must comply.
- .6 Check the location, level and plumb, of every major element as the Work progresses.
- .7 Notify Consultant when deviations from required lines and levels exceed allowable tolerances.
- .8 Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- .9 Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- .10 Structure Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- .11 Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Consultant.

### **3.4 FIELD ENGINEERING**

- .1 Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- .2 Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
- .3 Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- .4 Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.
- .5 Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
- .6 Recording: At Substantial Performance, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### **3.5 INSTALLATION**

- .1 General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- .2 Make vertical work plumb and make horizontal work level.
- .3 Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- .4 Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- .5 Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Performance.
- .6 Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- .7 Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
- .8 Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Consultant.
- .9 Allow for structure movement, including thermal expansion and contraction.
- .10 Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- .11 Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### **3.6 PROGRESS CLEANING**

- .1 General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
- .2 Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
- .3 Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80°F (27°C).
- .4 Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- .5 Site: Maintain project site free of waste materials and debris.
- .6 Work Areas: Clean areas where work is in progress to level of cleanliness necessary for proper execution of the Work.
- .7 Remove liquid spills promptly.
- .8 Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

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- .9 Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- .10 Exposed Surfaces: Contractor shall clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Performance.
- .11 Cutting and Patching: Contractor shall clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials:
- .12 Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- .13 Recycling and Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted. Recycle products identified in Construction Waste Management Plan.
- .14 During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Performance.
- .15 Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- .16 Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.7 PROTECTION OF INSTALLED CONSTRUCTION**

- .1 Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Performance.
- .2 Comply with manufacturer's written instructions for temperature and relative humidity.

### **3.8 CORRECTION OF THE WORK**

- .1 Repair and replace defective construction. Restore damaged substrates and finishes.
- .2 Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- .3 Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- .4 Repair components that do not operate properly. Remove and replace operating components.
- .5 Remove and replace chipped, scratched, and broken glass or reflective surfaces.

**END OF SECTION**



## **Section 01 74 00 FINAL CLEANING**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 Provide a final cleaning process for the entire construction project site after all systems and products have been installed and are functioning completely as specified and designed.

#### **1.2 QUALITY CONTROL**

- .1 Ensure that cleaning agents and methods do not remove finishes and permanent protective coatings on surfaces being cleaned.
- .2 Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in an average institutional building cleaning and maintenance program.
- .3 Comply with manufacturer's written cleaning instructions.

#### **1.3 COORDINATION**

- .1 Coordinate repair or replacement of broken or damaged materials with original installing Subcontractors.

### **Part 2 Products**

#### **2.1 CLEANING MATERIAL**

- .1 Use only cleaning materials recommended by manufacturer of material to be cleaned.
- .2 Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

### **Part 3 Execution**

#### **3.1 ONGOING CLEANING**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from site at regularly scheduled times.
- .3 Clear snow and ice where required to allow access to the site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site sufficient quantities of hinged lid steel industrial waste containers for collection of waste materials and debris. Place containers in locations acceptable to Owner.
- .6 Provide and use clearly marked separate bins for recycling. Direct as much waste as practical into recycling in order to reduce landfill dependency. Refer to Section 01 74 19 Construction Waste Management and Disposal for additional recycling requirements.
- .7 Remove waste material and debris from site and deposit into waste containers at end of each working day.

- .8 Dispose of waste materials and debris off site.
- .9 Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .11 Provide adequate ventilation during use of volatile or noxious substances.
- .12 Use only cleaning materials recommended by manufacturer of surface to be cleaned and as recommended by cleaning material manufacturer. High quality, non-toxic cleaning products are to be used in all areas.
- .13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces.

### **3.2 FINAL CLEANING**

- .1 Conduct cleaning and waste removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- .2 Complete the following cleaning operations before requesting final review for acceptance of Declaration of Substantial Completion in accordance with Section 01 77 00, Closeout Procedures:
  - .1 Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - .2 Sweep paved areas broom clean
  - .3 Rake grounds that are not planted or paved to a smooth, even textured surface.
  - .4 Remove tools, construction equipment, machinery, and surplus material from project site.
  - .5 Clean exposed exterior hard surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces.
  - .6 Remove labels that are not permanent.
  - .7 Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
  - .8 Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - .9 Leave project clean and ready for use.
- .3 Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from work site and dispose of lawfully.

**END OF SECTION**

## **Section 01 74 19**

# **WASTE MANAGEMENT AND DISPOSAL**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 The purpose of the Construction Waste Management Plan is to efficiently manage the waste generated by daily construction activities. The intent of the Waste Management Plan is to provide the Contractor and Subcontractor with guidelines for onsite construction waste management.
- .2 The minimum recycled waste for this project will include:
  - .1 Cardboard and Paper products.
  - .2 Recyclable Containers, Beverage Containers and Glass.
  - .3 Concrete/Brick/Concrete Block/Asphalt Debris.
  - .4 Land clearing waste (excluding excavated material).
  - .5 Metals including rebar, aluminum, metal studs, nails, screws, and scrap metal.
  - .6 Wood, palette wood, dimensional wood.

#### **1.2 WASTE MANAGEMENT - GOALS**

- .1 Employ processes to ensure generation of as little waste as possible including prevention of damage due to mishandling, improper storage, contamination, inadequate protection or other factors as well as minimizing over packaging and poor quantity estimating.

#### **1.3 WASTE MANAGEMENT - DEFINITIONS**

- .1 Alternative daily cover is material (other than earthen material) that is placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control fires, odours, blowing litter, and scavenging.
- .2 Construction and demolition debris includes waste and recyclables generated from construction and from the renovation, demolition or deconstruction of pre-existing structures. It does not include land-clearing debris, such as soil, vegetation, and rocks.
- .3 Construction waste calculation is used to determine the percentage of waste diverted from landfill and incineration facilities.
- .4 Incineration facilities are waste management operations that use combustion as a means of reducing the volume of waste materials and/or producing heat or energy.
- .5 Recycling is the collection, reprocessing, marketing, and use of materials that were diverted or recovered from the solid waste stream.
- .6 Reuse returns materials to active use in the same or a related capacity as their original use, thus extending the lifetime of materials that would otherwise be discarded.
- .7 Tipping fees are charged by a landfill for disposal of waste, typically quoted per tonne.
- .8 Separate condition refers to waste sorted into individual types.
- .9 Source separation acts of keeping different types of waste materials separate beginning from first time they became waste.

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- .10 Waste: any material that is no longer used for its original purpose and that is intended for recycling, treatment, or disposal.
- .11 Waste Management Co-ordinator: Contractor's representative responsible for supervising waste management activities as well as co-ordinating related required submittal and reporting requirements.
- .12 Waste Management - Plan (WM-P): consists of a series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

#### **1.4 REGULATORY REQUIREMENTS**

- .1 Conform to applicable codes and regulations for disposal and removal of common and hazardous waste.
- .2 Handle and dispose of hazardous and banned materials in accordance with the BC Waste Management Act and Special Waste Regulation, and regional and municipal regulations.
- .3 Only licensed brokerage, storage, transfer and disposal facilities which comply with the requirements of local municipal bylaws, or those licensed or regulated by other jurisdictions shall be used by the Contractor for the recycling and disposal of waste materials.
- .4 Hazardous and banned materials include but are not limited to asbestos, drywall (banned from disposal), underground storage tanks, Polychlorinated Biphenyls (PCBs), abandoned chemicals (gasoline, pesticides, herbicides, flammable and combustible substances), Freon from cooling equipment, lead-based paints, smoke detectors, and mercury containing switches.

#### **1.5 IMPLEMENTATION AND EXECUTION**

- .1 New Construction:
  - .1 Processes shall be employed to limit construction generated waste, including that caused by damage due to mishandling, improper storage or inadequate protection. Special provisions shall also aim to minimize over-packaging and excessive quantity estimating.
- .2 Deconstruction or Renovations
  - .1 Complete deconstruction, or partial in the case of renovation projects, shall be carried out in such a way as to salvage for reuse and recycling the largest amount of materials possible.

#### **1.6 PROJECT WASTE MANAGEMENT PROVISIONS**

- .1 The Contractor's submittals to the Owner and the Consultant shall include a Construction Waste Management Plan (WMP).
- .2 Project Update
  - .1 Provide a monthly update of actual deconstruction and construction job site generated waste materials. Indicate whether these materials were salvaged, recycled, or disposed of, and the receiving facility.
- .3 Project Waste Management Implementation Meetings
  - .1 The Contractor shall coordinate and conduct Project Waste Management meetings. Meetings shall include Subcontractor and suppliers affected by the

WMP. Review of the WMP and each subsequent update of the plan shall be a regular meeting agenda item. At a minimum, waste management goals and issues shall be discussed at the following meetings:

- .1 Pre-bid meeting.
- .2 Pre-construction meeting.
- .3 Regular job site meetings.
- .4 Project Waste Management Implementation Administration:
  - .1 Contractor:
    - .1 The Contractor shall designate an on-site representative responsible for instructing workers and overseeing, documenting, and updating the WMP.
  - .2 Distribution:
    - .1 The Contractor shall distribute copies of the WMP to all Subcontractor and suppliers.
  - .3 Instruction:
    - .1 The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling procedures to be used by all parties at the appropriate stages of the project.
    - .2 For deconstruction projects the Contractor shall provide on-site direction to identify materials intended for salvage, outline procedures for removal, storage and handling, and confirm requirements for reusing salvaged materials within the project.
  - .4 Separation Facilities:
    - .1 The Contractor shall establish and label a specific area to facilitate separation of materials for recycling and salvage. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
- .5 Application for Progress Payments:
  - .1 The Contractor shall submit with each application for progress payment an updated WMP with the "*Part 2 – Project Update*" section completed for the invoicing term. Failure to submit this information shall render the *Application for Payment* incomplete and shall delay progress payment.
  - .2 Submit to the Consultant and/or Owner waybills, invoices and other documentation confirming that all materials have been delivered to the required locations.
  - .3 Any materials salvaged by the Contractor, Subcontractor, employees or agents for their own re-use elsewhere, or any items gifted to a third party for re-use must be accounted for. In these situations where waybills, invoices or other documentation are not available, the Contractor shall still declare the materials, submit a written declaration that such materials have been, or are intended to be salvaged. It is important that the overall quantities of all waste materials are inventoried within the WMP to verify the Owner's minimum 75% waste diversion goals.
- .6 Project Waste Summary:

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- .1 The Contractor shall submit with the final Application for Payment, a summary WMP for the project. The submission shall generally be a summation of the monthly WMP submissions which will provide an overall synopsis of the total project waste management performance. Failure to submit this information will render the application incomplete and will result in holdback of the final payment.

## **1.7 OFFSITE SORTING**

- .1 Offsite sorting of construction and demolition debris at a regional sorting facility can substitute for onsite sorting, as follows:
  - .1 The applicant must provide actual weights and volumes of the construction waste and estimates of the materials composition by weight or volume.
  - .2 The recycler must confirm the destination and end use for each material diverted from landfill. Separate reports from end-use facilities are not required.
  - .3 The project diversion rate is based on the confirmed weight/volumes and the actual products diverted from landfill.
- .2 Also note that where the estimates are based on volume and the diversion rate is based on weight the applicant will need to confirm that the volumes were converted to weight using the appropriate density figures.

## **Part 2 Products**

### **2.1 DIVERSION OF MATERIALS**

- .1 Refer to following list of materials to be separated from general waste stream for recycling, wherever respective recycling facilities exist.
  - .1 Construction Waste: including but not limited to following types, as applicable to Project.
    - .1 Uncontaminated packaging (wood, metal banding, cardboard, paper, plastic wrappings, polystyrene).
    - .2 Wood pallets (recycle or return to shipper).
    - .3 Wood (uncontaminated).
    - .4 Paint, solvent, oil.
    - .5 Concrete.
    - .6 Crushed Asphalt.
  - .2 Administration/worker waste (uncontaminated): including but not limited to following types.
    - .1 Paper, cardboard.
    - .2 Plastic containers and lids marked Types 1 through 6.
    - .3 Glass and aluminum drink containers (recycle or return to vendor).
- .3 On-site sale and advertising of salvaged/recovered material not permitted.

**END OF SECTION**

## Section 01 77 00 CLOSEOUT PROCEDURES

### Part 1 General

#### 1.1 DOCUMENTS

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

#### 1.2 SUMMARY

- .1 Comply with requirements stated in conditions of the Contract and in Specifications for administrative procedures in closing out the Work. The closeout process is summarized as follows:
  - .1 Substantial Performance of the Work:
    - .1 Fulfillment of prerequisites to Substantial Performance as defined in the Builder's Lien Act of BC.
    - .2 Deficiency lists prepared by Consultant, Contractor and Owner.
    - .3 Inspection for Substantial Performance.
    - .4 Issuance ratification of the certificate of Substantial Performance.
  - .2 Facility Takeover:
  - .3 Facility takeover by the Owner will occur at Issuance of Letter of Substantial Performance and when occupancy permit has been granted by the Authority Having Jurisdiction. Currently, the following occurs:
    - .1 Facility or portion thereof is handed over to Owner.
    - .2 Warranty for systems and products supplied by Subcontractors commences.
    - .3 Payment of utilities taken over by Owner.
  - .4 Total Performance of the Work:
    - .1 All construction deficiencies repaired

#### 1.3 DEFINITIONS

- .1 Substantial completion: The British Columbia *Builders Lien Act* (BLA) imposes "substantial completion" as the statutory milestone that triggers the claim of lien filing period.
  - .1 The substantial completion milestone can be "certified" by issuance of a certificate of completion or be deemed complete in accordance with the BLA.
  - .2 The BLA identifies the "3-2-1 formula" and the "improvement completion" as the two approaches or triggers for determining whether a contract, subcontract, or improvement can be either certified or deemed complete, in fact.
- .2 3-2-1 formula: The 3-2-1 formula is used to certify complete a head contract or subcontract. The formula details are set out in section 1 of the BLA as follows:

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- .1 A head contract, contract or subcontract is substantially performed if the work to be done under that contract is capable of completion or correction at a cost of not more than:
  - .1 3% of the first \$500 000 of the contract price,
  - .2 2% of the next \$500 000 of the contract price, and
  - .3 1% of the balance of the contract price.
- .2 Note that the 3-2-1 formula cannot be used to certify complete cost-plus or unit-rate contracts or subcontracts that lack guaranteed target contract prices, because there is no final "contract price". For example, where a contractor has billed \$300,000 on account of work completed pursuant to a cost-plus contract with no guaranteed target contract price, but the scope of work remains incomplete, then the 3-2-1 formula is unworkable because there is no "contract price" based on which to calculate the three percent.
- .3 Improvement completion:
  - .1 When the 3-2-1 formula is unworkable or a certificate of completion is not requested or issued, the BLA provides for an "improvement completion" approach, which allows for an improvement to be *deemed* completed "if the improvement or a substantial part of it is ready for use or is being used for the purpose intended."
  - .2 The BLA does not define the phrase "substantial part" or when an improvement is "ready for use". Therefore, in contrast to the 3-2-1 formula, the improvement completion approach is a principally subjective exercise.
  - .3 Note the improvement completion approach must only be employed if the owner did not engage a head contractor. For example, when the owner contracts directly with various trade contractors there are *multiple* "head contracts" and no *one* head contractor can be said to have been "engaged to do substantially all of the work" with respect to an improvement.

#### 1.4 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 1.5 PARTIAL ACCEPTANCE OF WORK

- .1 When partial utilization of the Work is required and Substantial Performance of part(s) of the Work is a condition of such partial utilization, the applicable requirements specified in this Section shall apply to the part(s) of the Work to be utilized.

#### 1.6 PREREQUISITE TO SUBSTANTIAL PERFORMANCE

- .1 Prior to requesting Contractor's inspection for Substantial Performance, Contractor shall do the following as applicable to their scope of work, not necessarily in order listed:
  - .1 Submit operation and maintenance data as specified in Section 01 78 23.
  - .2 Submit product warranties as specified in Section 01 78 36.
  - .3 Provide spare parts and maintenance materials.
  - .4 Make final change-over of locks and transmit keys to Owner as specified.



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- .5 Ensure that all contract deficiencies which may affect operation of systems have been corrected.
- .6 Ensure that the Work is complete and ready for take over for the purpose intended with an occupancy permit.
- .7 Review Contract Documents and inspect Work to confirm that prerequisites to Substantial Performance of Work have been fulfilled and that Work is ready for inspection for Substantial Performance.
- .8 Provide request for substantial performance and progress claim indicating satisfaction to 3-2-1 formula in writing.
- .9 Submit As-Built Drawings to Consultant for production of Record Drawings, refer to Section 01 78 39, Project Record Documents.

#### 1.7 INSPECTION AND DECLARATION

- .1 Contractor 's inspection: Contractor and all Subcontractors will perform an inspection of Work, identify deficiencies and defects and repair as required to conform to Contract Documents.
  - .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request in writing Consultants 'Pre-Substantial Review'.
- .2 Consultant's Pre-Substantial Review: Consultants and Contractor will perform review of Work to identify obvious defects or deficiencies.
  - .1 These deficiencies are to be corrected prior to request for 'Substantial Performance' of the Contract.
- .3 Prior to requesting Substantial Performance (min 45 days prior to anticipated date by written request): Contractor to submit written confirmation that following have been achieved/submitted to the Consultant:
  - .1 Operation of systems has been demonstrated to Owner's personnel.
  - .2 All Inspection Final Reports and Certificates, Bonds, and Guarantees have been received.
  - .3 Operating and Maintenance Manuals have been submitted (including applicable items listed above as well as requirements for O & M Manuals listed in Section 01 78 00 Close out Submittals).
- .4 The Contractor is responsible to collect all documents listed in Appendix A - Station One Architects Project Closeout check list.
- .5 Request Substantial Review, only when all of the items listed above have been achieved.
- .6 Consultant to request and have in place the following documentation, prior to conducting a Substantial Review - Note that all schedules must be sent as a complete package to the Consultant:
  - .1 Civil Schedule C-B
  - .2 Geotechnical Schedule C-B
  - .3 Electrical Schedule C-B.
  - .4 Landscape Schedule C-L

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- .7 Commencement of Lien and Warranty Periods: date of Substantial Performance (if achieved per Terms of the Lien Act) will be date for commencement for Warranty period and commencement of Lien period, unless required otherwise by Lien statute of Place of Work.
- .8 If it is deemed by the Consultant that 'Substantial Performance' per terms of the Lien Act has been achieved, the Consultant shall post on the date of Declaration of Substantial the following:
  - .1 Builders Lien Act (Section 7 (4)) – Notice of Certification of Completion.
  - .2 Builders Lien Act (Section 7 (10)) – Certification of Completion.

#### **1.8 INSPECTION FOR WARRANTY PERFORMANCE**

- .1 The Consultant, Contractor and Owner will conduct inspections for Warranty Performance during the one-year warranty period at the 4 month, 9 month and 11 month dates. One-year warranty commences on Substantial Performance.

#### **1.9 WARRANTY PERFORMANCE OF THE WORK**

- .1 Following inspection, Contractor will:
  - .1 Advise Subcontractor(s) of items which must be corrected prior to issuance of Letter of Warranty Performance.

#### **1.10 CONTRACT ACCEPTANCE PROCEDURES**

- .1 Once Substantial Request is made, the Consultant will review the work and generate a list of deficiencies and associated values of deficient or incomplete work. This value will be used in the BLA following the 3,2,1 calculations to determine Substantial Completion.
  - .1 The Consultant will not preform a deficiency review prior to request for substantial.
- .2 Prior to requesting Contractor's inspection for Substantial Performance:
  - .1 Ensure Work is ready for use for purpose intended.
  - .2 Review Contract Documents and inspect Work to confirm prerequisites to Substantial Performance of Work have been fulfilled and that Work is ready for inspection for Substantial Performance.
  - .3 Submit written request to the Consultant for inspection for Substantial Performance of the Work, certifying prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed, corrected or submitted and date which items on list will be complete.
- .3 Results of Contractor 's inspection for Substantial Performance will form initial contract deficiency list.
- .4 Prior to requesting inspection for Substantial Performance, Subcontractor shall do the following:
  - .1 Ensure that Work, except those items arising from the warranty provisions of Contract Documents, has been performed to the requirements of Contract Documents.
  - .2 Review Contract Documents and inspect Work to confirm that prerequisites for Substantial Performance of Work have been met and that Work is ready for inspection for Substantial Performance.

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- .3 Submit written request to the Consultant for inspection for Substantial Performance of Work, including copy of Contactor's most recent contract deficiency list, and certifying that each Contract Deficiency has been corrected or otherwise resolved in a manner agreed to between Contactors and Subcontractor. List known exceptions, if any, in request.
- .5 Following inspection, the Consultant and the Contractor will:
  - .1 Issue a Letter of Substantial Performance stating effective date of Substantial Performance of Work, with a copy of the Contract Deficiency list attached thereto;
- .6 Requirements to obtain Occupancy from the Authority Having Jurisdiction refer to Station One Architects Appendix A - Project Closeout checklist.

### **Part 3 Execution**

#### **3.1 FINAL CLEANING**

- .1 Refer to Section, 01 74 00, Final Cleaning.

#### **3.2 PROJECT RECORD DOCUMENTS**

- .1 Provide one set of prints for record drawing purposes. Store record documents in site office apart from documents used for construction.
- .2 Submit completed project record documents before, or with, application for Substantial Performance of the Work as specified in Section 01 78 39, Project Record Documents.
- .3 Submit with each submission a covering letter including Date of Submission, Trade Contractor's name, address and telephone number.

#### **3.3 OPERATION AND MAINTENANCE DATA**

- .1 Refer to Section 01 78 23, Operation and Maintenance Data.

#### **3.4 MAINTENANCE MATERIALS**

- .1 Deliver maintenance materials before request for inspection for Substantial Performance, as identified in each relevant specification section.
- .2 Provide maintenance materials identical to those installed.
- .3 Prior to requesting Consultant's inspection for Substantial Performance, do the following:
  - .1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.
  - .2 Verify that items listed on inventory list are in their designated storage locations.
  - .3 Inspect items to verify that they meet specified requirements and are in serviceable condition.
  - .4 Arrange for delivery of any missing items.
  - .5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.
  - .6 Review inventory list with Consultant during Sub Contractor's inspection for Substantial Performance.

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- .4 For items not delivered prior to Substantial Performance of the Work, provide a duplicate copy delivery slip and obtain Owner signature upon delivery. Owner will only accept responsibility for care, custody, and control of items properly received and signed for.

**END OF SECTION**

## **Section 01 78 00 CLOSEOUT SUBMITTALS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 Comply with requirements stated in conditions of the Contract and in Specifications for administrative procedures in closing out the Work.
- .2 This section includes the following:
  - .1 As-built, samples, and specifications.
  - .2 Equipment and systems.
  - .3 Product data, materials and finishes, and related information.
  - .4 Operation and maintenance data.
  - .5 Spare parts, special tools and maintenance materials.
  - .6 Warranties and bonds.
  - .7 Final site survey.

#### **1.3 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 77 00 – Closeout Procedures.

#### **1.4 SUBMISSION**

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Submit one copy of completed volumes in final form 15 days prior to final inspection.
- .3 Copy will be returned after final inspection, with Owner's Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Owner's Representative, two final copies of operating and maintenance manuals.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 If requested, furnish evidence as to type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

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## **1.5 FORMAT**

- .1 Organize data in the form of an 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. 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 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. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide CAD files in DWG format on USB Drive. Also provide electronic files in PDF format.

## **1.6 TABLE OF CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of Subcontractor and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly 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. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

## **1.7 AS-BUILTS AND SAMPLES**

- .1 In addition to requirements in General Conditions, maintain at the site for Owner's Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to the Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.

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- .7 Inspection certificates.
- .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. 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. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Owner's Representative.

#### **1.8 RECORDING ACTUAL SITE CONDITIONS**

- .1 Provide felt tip marking pens, maintaining red color pens for recording information.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly 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 References to related shop drawings and modifications.
- .4 Specifications: legibly 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.
- .5 Other Documents: submit manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .6 At completion of project provide all recorded information on print drawings or alternatively transfer to CAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

#### **1.9 FINAL SURVEY**

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

## **1.10 EQUIPMENT AND SYSTEMS**

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. 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 sequence of operation by controls manufacturer.
- .4 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .5 Provide installed control diagrams by controls manufacturer.
- .6 Provide Consultant's coordination drawings, with installed colour coded piping diagrams.
- .7 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .8 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .9 Include test reports
- .10 Additional requirements: As specified in individual specification sections.

## **1.11 MATERIALS AND FINISHES**

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

## **1.12 MAINTENANCE 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 location as directed, place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Owner's Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

## **1.13 SPECIAL TOOLS**

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.



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- .3 Deliver to project site place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Owner's Representative. Include approved listings in Maintenance Manual.

#### **1.14 STORAGE, HANDLING AND PROTECTION**

- .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 to satisfaction of Owner's Representative.

#### **1.15 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan to Owner's Representative's approval.
- .3 Warranty management plan to include required actions and documents to assure that Owner 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 and submit (2) two copies upon acceptance of work. 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 principals.
  - .3 Obtain warranties and bonds, executed in duplicate by Subcontractor, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
  - .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
  - .5 Verify that documents are in proper form, contain full information, and are notarized.
  - .6 Co-execute submittals when required.
  - .7 Retain warranties and bonds until time specified for submittal.
- .6 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 Contractor, Subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, motors, transformers, and commissioned systems such as alarm systems, sprinkler systems, lighting protection systems.

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- .3 Provide list for each warranted equipment, item, feature 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.
- .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.
- .7 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .8 Written verification will follow oral instructions. Failure to respond will be cause for the Owner's Representative to proceed with action against Contractor.

#### **1.16 PRE-WARRANTY CONFERENCE**

- .1 Meet with Owner's Representative to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Owner's Representative.
- .2 Owner's Representative will establish communication procedures for:
  - .1 Notification of construction warranty defects.
  - .2 Determine priorities for type of defect.
  - .3 Determine reasonable time for response.

#### **1.17 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Owner's Representative.
- .2 Leave date of acceptance until project is accepted for occupancy.

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.3 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 Contractor.

**END OF SECTION**

## **Section 01 78 23**

### **OPERATION AND MAINTENANCE DATA**

#### **Part 1 General**

##### **1.1 DOCUMENTS**

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

##### **1.2 SUMMARY**

- .1 Provide operation and maintenance manuals for this project and turn over to commissioning agent, which the Contractor is responsible for retaining.
- .2 The Manual will include a chapter of written descriptions for daily, weekly, monthly and emergency procedures for general operation and maintenance. The descriptions will include procedures for mechanical, electrical, and architectural equipment expected to be performed by the maintenance staff, written using simple, non-technical terms so they may be clearly understood.

##### **1.3 DESCRIPTION**

- .1 Submit one (1) digital version (PDF copy) on a USB Flash Storage for each submission and of the same manuals with bookmarks mirroring the indexing structure of the hard copy manuals to make the two versions identical. Include all reports, certificates, shop drawings and manufacturer's instructions that are included in the hard copy as scanned/PDF documents. Submit two (2) hard copies of maintenance, operating and instruction manuals in addition to their digital copies when the manuals are over 75 pages.
- .2 Submit, where possible, original digital documents and not scanned files.
- .3 Submit a draft copy of the tables of contents for the manuals prior to final payment certificate and for review by the Consultant. Submit completed maintenance manuals with application for Substantial Performance, for review by the Consultant
- .4 Submit manuals containing descriptions of the systems to be maintained; at what frequency of time such maintenance will done; a suppliers list of parts; as well as providing information regarding aspects of pertinent care, maintenance, operation, installation and warranty issues. Instructions in the manuals to be in plain language so as to guide the Owner in the proper operation and maintenance of building materials, finishes, components, equipment and systems.
- .5 The Contractor is responsible for maintenance issues and warranty items during the first year of service. Refer to individual warranties.
- .6 Include all items covered by Change Orders.
- .7 Include equipment supplied by the Owner.
- .8 Bind manual contents into hard plastic coated three-ring binders, complete with coloured plastic tabs organizing contents into applicable categories of Work, based on the specifications for the project. Label the cover and spine of the manuals with the name of the project and manual contents.
- .9 Format: Digital

- .1 Digital Documents, Descriptions and Lists are to be created so as to fit legibly on 8 1/2" x 11" (216 mm x 280 mm) heavy bond paper when printed.
- .2 The maximum paper size for schedules and diagrams is (11" x 17" (279 mm x 432 mm). Larger paper sizes will be accepted for diagrams only if a reduction to 11" x 17" is also provided.
- .3 Index tab separators are to be used in each manual to identify each information "Section".

#### 1.4 ORGANIZATION OF MANUALS

##### .1 SECTION 1.0 - DIRECTORY

- .1 Provide a directory listing the names, addresses, telephone and facsimile numbers of Consultant, Contractor, Subcontractor and major equipment, product suppliers and service contract providers (e.g., alarm system, elevator). Include emergency contact names.

##### .2 SECTION 2.0 - LIST OF DRAWINGS AND SPECIFICATIONS

- .1 Provide a complete index of drawings, specifications. Provide index of shop drawings and test reports in their own sections.

##### .3 SECTION 3.0 - ARCHITECTURAL

- .1 Provide care, cleaning and recommended maintenance instructions for finishes and materials as specified.
- .2 Provide operation and maintenance instructions for equipment such as overhead doors, landscape irrigation systems and elevators. Provide descriptive and technical data, maintenance and operating procedures, as-built wiring diagrams, spare parts lists, name of service representative, suppliers for replacement parts, trouble shooting data and preventive maintenance program.
- .3 Submit a backup copy of the elevator control system software on CD-ROM placed in pocket in Manual. Provide access order to Owner.
- .4 Provide copy of finish hardware schedule and paint schedules, complete with the manufacturer, supplier and identification names and numbers.
- .5 Provide inspection and approval certificates from authorities having jurisdiction.
- .6 Provide a copy of warranty and guarantee certificates as specified.
- .7 ☐ Provide a complete set of reviewed shop drawings.
- .8 Submit a list of chattels, if any, including make, model and serial number provided by the Contractor for the project.

##### .4 SECTION 5.0 - ELECTRICAL

- .1 Provide an index with the following headings:
  - .1 General (Permit, Schedules, Testing, etc.)
  - .2 Electric Kiosk
  - .3 Sportfield Lighting
  - .4 Non-Sportfield Lighting
- .2 Under each of the above headings, provide the following information, arranged under separate tabs, for each system and major piece of equipment:

- .1 Descriptive and Technical Data
- .2 Maintenance and Operating Procedures
- .3 Wiring Diagrams
- .4 Spare Parts List
- .5 Service Representatives
- .6 Suppliers for Replacement Parts
- .7 Test Results
- .8 Certifications and warranties
- .9 Trouble Shooting Data
- .10 Preventive Maintenance Program Complete with Checklists

#### **1.5 SCHEDULE OF MAINTENANCE MANUALS SUBMITTALS**

- .1 Provide a complete Schedule of Maintenance Manual Submittals.
- .2 Include a copy of all reviewed shop drawings as noted in the Schedule of Maintenance Manual Submittals, or as requested by the Consultant.
- .3 Provide Manufacturer product information required to maintain the project.
- .4 Specification Divisions: 0-32 Notes:
  - .1 Trade listing.
  - .2 Submit Subcontractor or Supplier's name, address, telephone number and emergency contact.
  - .3 Submit copy of reviewed shop drawings or Product data as specified. Submit engineered shop drawings where specified.
  - .4 Submit installation instructions for products.
  - .5 Submit warranties and guarantees as called for in the specifications. Warranties and guarantees to be signed by an authorized signing authority.
  - .6 Submit list of recommended maintenance intervals for materials covered under warranties and guarantees.
  - .7 Submit manufacturer's instructions covering the care, cleaning, and maintenance of specified finishes.
  - .8 Submit a complete copy of the hardware schedule in accordance with the specifications.
  - .9 Submit complete listing of paint products, colours, gloss levels and locations.
  - .10 Submit descriptions and operation of major components and systems, including seasonal variations, interface with other components, and operation of controls.
  - .11 Submit a detailed preventative maintenance schedule, operating instructions, and complete trouble shooting checklists. Include schedules of tasks, frequency, tools required and task time.
  - .12 Submit testing, adjusting and balancing reports as specified

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- .13 Submit inspection and test certificates issued by authorities having jurisdiction and equipment manufacturers. Submit performance data sheets after commissioning is complete.
- .14 Submit wiring diagrams and schematics as specified.
- .15 Submit a complete list of equipment and fixtures installed as part of the Work complete with make and model numbers.
- .16 Submit a complete list of spare parts for equipment, and source.
- .5 Maintenance schedule including the following elements:
  - .1 11"x17" format table with project element to be maintained or replaced along with a description of the task to be carried out including architectural, mechanical and electrical elements
  - .2 Note frequency of maintenance listing the specific year of maintenance over a minimum 20-year span along with the associated cost of maintenance
  - .3 Note key dates from the warranties for manufactured items and the level of expertise required for each inspection
- .6 The following completed project documents shall be included:
  - .1 Substantial Completion Certificate
  - .2 Letters of Assurance
  - .3 Copy of Performance Bond

**END OF SECTION**

## **Section 01 78 36 WARRANTIES**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 Provide extended warranties as required where noted in the technical sections.

#### **1.3 RELATED SECTIONS**

- .1 01 78 00 - Closeout Submittals.
- .2 01 78 39 – Project Record Documents.

#### **1.4 WARRANTY**

- .1 Submit warranty in individual specification Sections in accordance with Section 01 77 00, Closeout Procedures.
- .2 The Warranty shall be submitted with the Operations and Maintenance Manual.
- .3 Date warranty from date of Substantial Performance as determined by the Consultant, Owner and Contractor.
- .4 Sign warranty.
- .5 Warranty shall include:
  - .1 Owner Name.
  - .2 Project Name.
  - .3 Project Address.
  - .4 Name of company providing warranty.
  - .5 Contact name.
  - .6 Contact address.
  - .7 Date warranty starts.
  - .8 Date warranty expires.
- .6 Provide duplicate notarized copies.
- .7 Provide table of contents and assemble in three D side ring binder with durable plastic or cloth cover.
- .8 Submit prior to final application for payment.
- .9 For items of work delayed beyond date of Substantial Performance, provide updated submittal within 10 days after Owner's acceptance, listing date of acceptance as start of warranty period.



**Part 2 Products**

**2.1 NOT USED**

.1 Not Used.

**Part 3 Execution**

**3.1 PREPARATION**

.1 Execute and assemble transferable warranty documents from Subcontractor, suppliers, and manufactures.

**END OF SECTION**

## **Section 01 78 39 PROJECT RECORD DOCUMENTS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 SUMMARY**

- .1 Provide 'As Built' and 'Project Record' Documents.
- .2 Final Project Record Documents will be provided by each of the Project Consultants responsible for the work of this contract.
- .3 Provide both hard copy and digital versions of project completion documents within 45 days prior to substantial performance.
- .4 The Contractor shall deliver to the Owner all service contracts, manufacturer's inspections, certifications, guarantees and warranties, and assignments of all guarantees and warranties required by the Contract Documents.
- .5 Engage the Consultant to prepare Record Prints as outlined below, including the following:
  - .1 Record Drawings.
  - .2 Record Specifications.
  - .3 Record Product Data.
  - .4 Operations and Maintenance Manuals.
  - .5 Spare Parts and Maintenance Materials.
  - .6 Miscellaneous Submittals.

#### **1.3 DEFINITION**

- .1 "As-Built Drawings" - set of Drawings and Specifications marked-up by Contractor, in erasable red pencil, on-site during construction.
- .2 "Project Record Drawings" – the changing of the electronic file drawings and specifications with the changes marked on the As-Built Drawings from the site.

#### **1.4 RELATED WORK**

- .1 01 77 00 - Closeout Procedures.
- .2 01 78 00 – Closeout Submittals.
- .3 01 78 23 - Operation and Maintenance Data.
- .4 01 91 13 - General Commissioning Requirements.

#### **1.5 SUBMITTALS**

- .1 Record Drawings: Provide the following:

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- .1 Initial Submittal: Submit one set of marked-up Record Prints to Consultant.
- .2 Consultant will initial and date each print and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Should information submitted require clarification or reorganization, Consultant will return to Contractor for additional information and additional organization.
- .3 Consultant team will produce record drawings for Contractor and return electronic copies of record drawings and record specifications to Contractor so Contractor can submit to Owner.
- .4 Number of copies of final submittal: Submit two (2) sets of marked-up record prints, one (1) hard copy and 2 sets of record CAD drawing files.
- .5 Electronic Media: Flash drive, memory stick
- .2 Record Specifications:
  - .1 Initial Submittal: Submit one set of marked-up Record Specifications to Consultant. Include addenda and changes made through contract modifications via site instructions and change orders.
  - .2 Consultant team will produce record specifications for Contractor and return electronic copies of same to Contractor so Contractor can submit to Owner.
- .3 Record Project Data:
  - .1 Submit two (2) copies of each Product Data submittal.
  - .2 Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- .4 Operations and Maintenance Manuals:
  - .1 Submit two (2) hard copies and one electronic copy.

## **Part 2 Products**

### **2.1 RECORD DRAWINGS**

- .1 As Built Record Drawings:
  - .1 Obtain one (1) set of white prints of the Contract Drawings necessary for the sole purpose of documenting with red pencil "as built conditions" of deviations from the Contract Documents.
  - .2 Clearly identify these drawings as "As Built Record Drawings in letters at least 12 mm high and include Sub Contractor's name and contact information. Have them available at all times and at each regular project progress meeting for inspection or as required by the Consultant.
- .2 Preparation:
  - .1 As Work progresses, document clearly and indelibly in red pencil "as built conditions" deviating from the Contract Documents as a result caused by site conditions or various directives by addenda, correspondence, clarifications, instructions, change orders, shop drawings and authorities having jurisdiction.
  - .2 Deviations include in general, but are not limited to things hidden from view, things of major importance to future operations, maintenance and alterations and additional work, detailed requirements in connection with various systems,

- landscaping, food service equipment, plumbing, mechanical and electrical as set out in accordance with various sections of the Specifications.
- .3 Record dimensions in measure shown on the drawings.
- .4 Mark Record Prints to show the actual installation where installation varies significantly from that shown originally.
- .5 Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
- .6 Accurately record information in an understandable drawing technique.
- .7 Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
- .3 Content: Types of items requiring marking include, but are not limited to, the following:
  - .1 Dimensional changes to Drawings.
  - .2 Revisions to details shown on Drawings.
  - .3 Locations and depths of underground utilities.
  - .4 Changes made by Change Order or Change Directive.
  - .5 Changes made following Consultant's written orders.
  - .6 Details not on the original Contract Drawings.
  - .7 Field records for variable and concealed conditions.
  - .8 Record information on the Work that is shown only schematically.
  - .9 Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  - .10 Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - .11 Mark important additional information that was either shown schematically or omitted from original Drawings.
  - .12 Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- .4 Project Record Drawings:
  - .1 The Contractor shall engage the Consultant to produce the Project Record Drawings and provide the As Built drawings as outlined above.
  - .2 The Consultant shall prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
    - .1 Format: Same CAD program, version, and operating system as the original Contract Drawings
    - .2 Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable. Record changes in a manner consistent with original Drawings. Remove outline clouds and notations from Drawings.

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- .3 Consult with Contractor in instances of uncertainty for resolution.
- .4 Incorporate the mark-ups from the AS Built Drawings provided by the Subcontractor.
- .3 Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location in letters at least 1/2" (12 mm) high.
  - .1 CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
  - .2 Record PDF Drawings: from the Record CAD Drawings, prepare a PDF of each one and name each PDF file the same name as the corresponding CAD file.
  - .3 Submit CAD and PDF drawings on a high-quality electronic CD format to Owner or Owner's Representative for review before final submission.
  - .4 Incorporating any review comments made by Owner or Owner's Representative and resubmit final reviewed set in following format:
    - .1 One set on electronic disc in CAD and PDF formats.
- .4 Identification: As follows:
  - .1 Project name.
  - .2 Date.
  - .3 Designation "PROJECT RECORD DRAWINGS."
  - .4 Name of Owner
  - .5 Names of all Consultants.
  - .6 Name of Contractor.

## 2.2 FORMAT

- .1 Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  - .1 Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - .2 Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
  - .3 Identification: As follows:
    - .1 Project name.
    - .2 Date.
    - .3 Designation "PROJECT RECORD DRAWINGS."
    - .4 Name of Owner and Consultant.
    - .5 Name of Contractor.

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## **2.3 SPARE PARTS AND MAINTENANCE MATERIALS**

- .1 Deliver specified spare parts, extra material and maintenance materials before request for inspection for Substantial Performance, as identified in each relevant Specification Section.
  - .1 Provide spare parts manufactured by original equipment manufacturer,
  - .2 Provide maintenance materials identical to those installed.
  - .3 Use unbroken cartons, or if not supplied in cartons, they shall be securely packaged. Identify, on carton or package, name of item, colour or part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.
  - .4 Stored items shall remain in Contractor's care, custody, and control until Substantial Performance of the Work. Protect stored items against theft or damage.
  - .5 Prior to requesting Owner's inspection for Substantial Performance, do the following:
    - .1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.
    - .2 Verify that items listed on inventory list are in their designated storage locations.
    - .3 Inspect items to verify that they meet specified requirements and are in serviceable condition.
    - .4 Arrange for delivery of any missing items.
    - .5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.
    - .6 Provide Owner with copy of inventory list indicating status of all required items.
  - .6 Review inventory list with Owner during Owner's inspection for Substantial Performance.
  - .7 For items not delivered prior to Substantial Performance of the Work, provide a duplicate copy delivery slip and obtain Owner's signature upon delivery. Owner will only accept responsibility for care, custody, and control of items properly received and signed for.

## **2.4 RECORD PRODUCT DATA**

- .1 Preparation: Mark product data to indicate the actual product installation where installation varies substantially from that indicated in product data submittal.
  - .1 Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - .2 Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - .3 If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.

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- .4 Note related Change Orders, Record Specifications, and Record Drawings where applicable.

## **2.5 MISCELLANEOUS RECORD SUBMITTALS**

- .1 Assemble miscellaneous records required by other specification sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## **Part 3 Execution**

### **3.1 RECORDING AND MAINTENANCE**

- .1 Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- .2 Maintenance of record documents and samples: Store record documents and samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Consultant's and Owner's reference during normal working hours.

**END OF SECTION**

## **Section 03 00 50**

# **TESTING OF CONCRETE AND REINFORCEMENT**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide all labour, materials, equipment, access, cooperation, coordination and services to allow the testing of concrete reinforcement to be carried out by a Testing Agency responsible to the Owner.
- .2 The scope of the required quality assurance testing is described in this section to inform the Contractor of the type and scope of testing on the project and to allow the Contractor to make appropriate allowances. The costs for the testing described in this section is not the responsibility of the Contractor. It will be paid for by the Owner. It is the responsibility of the Contractor to schedule the testing described, to coordinate construction schedules with the Testing Agency, and to cooperate with the Testing Agency in the execution of this work.
- .3 The scope of the required quality assurance testing is described in this section to inform the Contractor of the type and scope of testing on the project and allow the Contractor to make appropriate allowances. Refer to Section 01 45 00, Quality Control and Assurance.
- .4 Testing required by the Contractor for his own quality control will be paid for by the Contractor.

#### **1.3 RELATED WORK**

- .1 03 11 00 – Concrete Forming.
- .2 03 15 00 – Concrete Accessories.
- .3 03 20 00 - Concrete Reinforcing.
- .4 03 25 00 – Concrete Composite Reinforcing
- .5 03 31 00 - Structural Cast-in-Place Concrete
- .6 03 33 00 – Architectural Concrete.
- .7 03 54 15 – Cementitious Underlayment.

#### **1.4 REFERENCES**

- .1 Where the Standard is referenced in this specification it shall mean the documents specified in this clause, and their referenced Standards.
- .2 Testing of concrete and reinforcement shall conform to the requirements of the following Standards unless otherwise required by this specification:
- .3 ASTM A706 / A706M –16, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- .4 British Columbia Building Code - 2024.



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- .5 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
- .6 CSA A23.3-14 - Design of Concrete Structures.
- .7 CAN/CSA A23.4-A251:0, Precast Concrete - Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.
- .8 CSA-S413-14 (R2019) - Parking Structures.
- .9 CSA G30.18-2009 (R2014), Carbon Steel Bars for Concrete Reinforcement.
- .10 A copy of A23.1 and A23.2 shall be kept on site by the Contractor for the duration of the work and be made available for reference.

## **1.5 DEFINITIONS**

- .1 "Owner", "Contractor", "Consultant", as per the General Conditions and Definitions.
- .2 "Specialty Engineer" is a Professional Engineer registered in B.C. responsible for components designed by the Contractor and who seals and signs shop drawings.
- .3 "Testing Agency" shall mean the testing agency responsible to the Owner.
- .4 "Standard" and "Standards" shall mean the reference standards listed under "Reference Standards" in this section.

## **1.6 APPOINTMENT OF TESTING AGENCY**

- .1 The Owner shall hire a CSA-approved Testing Agency who shall test concrete, reinforcement and grout as per this specification.
- .2 Testing paid for by the Owner.
  - .1 Refer to Section 01 45 00, Quality Control and Assurance.
  - .2 Testing as outlined in Section 3.0, except for testing required by the Contractor for stripping of formwork.
- .3 Testing paid for by the Contractor.
  - .1 Review of Contractor-requested mix design changes.
  - .2 Any waiting time incurred by the Testing Agency in excess of 1/2 an hour.
  - .3 Any additional costs due to overtime, shift work, holiday or weekend work, except that the Owner will pay for holiday or weekend pickup when the concrete was placed on a regular workday.
  - .4 Costs for testing required by the Contractor for stripping of formwork, such as field cure cylinders etc.
  - .5 Cost for retesting or additional testing of concrete or reinforcement where tests have failed to meet the specified requirements.

## **1.7 RESPONSIBILITY OF THE CONTRACTOR**

- .1 The Contractor shall cooperate fully with the Testing Agency.
- .2 The Contractor shall give the Testing Agency at least four (4) hours prior notice of concrete placement.
- .3 It is the Contractor's responsibility to provide a finished product that meets the specification. If initial tests indicate that the concrete failed to meet the specification, the

Consultant shall decide if any additional testing is necessary. This testing shall be done by a CSA-approved Testing Agency but need not be the Owner's agency. The proposed additional testing shall have prior approval of the Consultants.

- .4 Strengths of cored samples must equal the specified strength if tested dry or 85% of specified if tested wet, with wet or dry tests as per the Standard.

#### **1.8 RESPONSIBILITY AND DUTIES OF THE TESTING AGENCY**

- .1 The Testing Agency is responsible to the Owner and has the authority to, and is expected to, reject any concrete not meeting the specifications.
- .2 If the Testing Agency becomes aware that concrete is being placed without their notification, or if insufficient notice is received, then the Testing Agency shall notify the Consultant immediately.
- .3 Low 7-day, 28-day, and 56-day strength tests shall be brought immediately to the attention of the Consultant and the Contractor.

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used

### **Part 3 Execution**

#### **3.1 TESTING - CONCRETE AND REINFORCEMENT**

- .1 All strength tests shall be numbered consecutively and the cylinders marked as follows:
  - .1 7-Day Test: Marked "A".
  - .2 28-Day Test: Two (2) cylinders marked "B" and "C".
  - .3 56-Day Test: Where these are required by the drawings and specifications, two (2) cylinders marked "D" and "E".
- .2 All tests reports shall record:
  - .1 Name of Project
  - .2 Date and time of sampling
  - .3 Name of supplier
  - .4 Delivery truck number
  - .5 Batch time and discharge time
  - .6 Identification of sampling and testing technicians
  - .7 Exact location in the structure of the concrete sampled
  - .8 Design strength of concrete sampled
  - .9 Admixtures, cement type, maximum aggregate size
  - .10 Air and concrete temperature
  - .11 Slump, and air content
- .3 All field cured cylinders shall be marked "F".
- .4 Slump tests shall be performed prior to the addition of superplasticizers.

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- .5 Tests for slump and air content shall be taken with each strength test and as required by the specifications and drawings.

### **3.2 REGULAR TESTING - CONCRETE**

- .1 To conform to the Standard, except each test shall consist of three (3) cylinders - one (1) for 7-day strength, one (1) for 28-day strength, and one (1) for 56-day strength.
- .2 Testing for concrete with SCM's to reduce the cement content (greater than 30% cement reduction as defined in Section 03 31 00 Structural Cast-in-Place Concrete) to conform to the Standard, except each test shall consist of four (1) cylinders – one (1) for 7-day strength, one (1) for 28-day strength, and two (2) for 56-day strength
- .3 Regular testing applied to all elements not listed in Clause 3.3 - Full Time Testing.

### **3.3 FULL-TIME TESTING - CONCRETE**

- .1 Full time testing shall apply to:
  - .1 Concrete above 40 MPa specified strength.
  - .2 Parking slab concrete in suspended slabs.
- .2 Shall conform to the Standard and regular testing except:
  - .1 The Testing Agency shall have a representative on the job site at all times that the concrete requiring full time testing is being placed.
  - .2 Test the slump and air content from every truck and reject any concrete not within specification.

### **3.4 FIELD CURED CYLINDERS**

- .1 Field cure cylinders shall be protected against wind and be stored on the floor immediately below the slab they represent unless the floor below is heated. In that case they shall be stored on top of the slab but covered with a plywood box. The cylinders are to be undisturbed at this location until picked up by the Testing Agency. Field core cylinders are not to be stored in temperature controlled containers.

### **3.5 TESTING REINFORCEMENT**

- .1 The Testing Agency shall, over the duration of the project, perform at least one (1) tensile and bend test for each bar size and mill stamp used on the project. Such testing shall comply with the applicable CSA documents. Further testing may be requested at the Consultant's discretion.
- .2 The Testing Agency will select the bars to be tested from the reinforcing supplied to the construction site, not from the suppliers' yard. The Contractor shall cut the bars to the required length and replace the shortened bars without cost to the Owner.
- .3 The Contractor shall supply mill certificates of chemical analysis in accordance with CAN/CSA G30.18R and G30.18W for all bar supplied to site.
- .4 For epoxy coated reinforcing steel, the Testing Agency will visit the epoxy coating fabrication site, as required, to satisfy themselves that the fabrications and quality control process is in accordance with ASTM A775M. They shall report their findings to the Consultant.

**END OF SECTION**

## **Section 03 10 00 CONCRETE FORMING & ACCESSORIES**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 RELATED WORK**

- .1 Concrete Reinforcement: Section 03 20 00
- .2 Cast-In-Place Concrete: Section 03 30 00
- .3 Concrete Finishing: Section 03 35 00
- .4 Shotcrete: Section 03 37 13
- .5 Construction Waste Management and Disposal: Section 01 74 19
- .6 Sustainable Design Reporting Section 01 33 29

#### **1.3 1.3 REFERENCES**

- .1 Do concrete formwork in accordance with CSA-A23.1:19 and CSA O86:19, except where specified otherwise.
- .2 Do falsework in accordance with CSA S269.1-16 except where specified otherwise.

#### **1.4 SHOP DRAWINGS**

- .1 Comply with CSA S269.1-16 and the Worksafe BC regulations for falsework drawings.
- .2 Where formwork requires review by a professional engineer the shop drawings for such work shall bear the stamp and signature of a qualified Professional Engineer registered in the Province of British Columbia.
- .3 A copy of the falsework and formwork drawings shall be kept at the job site while the temporary supporting structure is under construction or use.
- .4 Prepare fully dimensioned shop drawings for all exposed concrete walls showing form tie locations, embedded plates, reglets, and reveals.

#### **1.5 SITE MOCK-UPS**

- .1 Erect formwork for exposed concrete walls, rectangular and circular concrete column full-size mock-ups as directed at permanent locations designated by the Consultant within the project for examination and acceptance of appearance of surface finish, form tie locations, details, jointing, assembly and alignment.
- .2 The mock-ups required shall include the following,
  - .1 A sample retaining wall representing Class 3 finish, of a size designated by the Consultant
  - .2 A cold joint between two pours using standard fibreglass column forms.

- .3 A sample wall representing Class 1 Architectural Concrete finish of size designated by the Consultant.
- .4 A sample wall representing Class 2 Smooth Form finish of a size designated by the Consultant.
- .3 Adjust formwork for mock-up installations at no extra cost to the Owner as required to meet requirements indicated on the drawings. Accepted mock-ups shall become part of permanent work and shall be minimum standard to which balance of concrete shall match, subject to passing of tests.

## 1.6 SAMPLES & PROTOTYPES

- .1 Material samples: if applicable submit the following samples of materials for approval to the Consultant. Approved samples shall be used as the acceptable standard for all materials used on the project.
  - .1 Forming materials, including Class 1 Architectural Concrete finish materials.
  - .2 Gaskets, sealing materials, and form jointing system (as applicable).
  - .3 Ties, cones, and recessed precast concrete plugs, where specified.
  - .4 Rustication strips, reveals, and reglet forming material.
  - .5 Form release agent.
  - .6 Expansion and isolation joints.

## Part 2 Products

### 2.1 MATERIALS

- .1 Formwork lumber: plywood and wood formwork materials to CSA O86 and CSA A23.1.
- .2 Falsework materials: to CSA S269.1.
- .3 Class 1 - Architectural Concrete Finish: all exposed exterior and interior concrete surfaces—high density overlay plywood similar to Simpson's Multipour HDO plywood, or steel forms, for Architectural Concrete finish in accordance with CSA A23.1, Clause 8.3.4 Formwork for Special Architectural Features. Minimum thickness of plywood 20mm. Forms shall not have patches, broken edges, or joint widths greater than 2mm.
- .4 Class 2 – Smooth Form Finish: all exposed interior concrete surfaces, including slab soffits – plywood with non-absorptive liner such as urethane coating or medium density overlay plywood for Smooth Form finish in accordance with CSA A23.1, Clause 7.10.2.6. Forms shall not have patches, broken edges, or joint widths greater than 2mm.
- .5 Class 3 - Rough Form Finish: all concealed concrete surfaces - plywood or shiplap, for Rough Form finish in accordance with CSA A23.1, Clause 7.10.2.5.
- .6 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface. The portion remaining in the concrete shall not be less than 25mm from the surface of the concrete. All exposed concrete formwork shall use coil ties with 63.5mm recessed cones and a black plastic filler plug recessed 25mm as per architectural details.
- .7 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

## Part 3 Execution

### 3.1 ERECTION

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Obtain Consultant's approval for use of earth forms.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Construct falsework in accordance with CSA S269.1.
- .5 Prior to constructing formwork for architectural concrete (formed surfaces prominently exposed to view), submit shop drawings for review showing all details of formwork including panel sizes, joint locations, tie spacing and location, joint sealing, and other formwork details with the Architect and obtain written approval to proceed. This clause applies to Class 1 Architectural Concrete only.
- .6 Construct forms to produce finished concrete conforming to shape, dimensions, locations, and levels indicated within the following tolerances. Tolerances shall not be cumulative.
  - .1 Deviation from vertical line - 6mm in 3000mm, 10mm in 6000mm, and 20mm in 12000mm or more.
  - .2 Deviation from flat surface for walls, slabs, and roof slabs- 8mm in 3000mm.
  - .3 Deviation from horizontal - 6mm in 3000mm.
  - .4 Deviation of linear structure lines from established position in plans and related position of columns, walls, and partitions plus or minus 8mm.
  - .5 Deviation in cross sectional dimensions of columns or beams, or in thickness of slabs and wall plus or minus 6mm.
- .7 Obtain Consultant's permission before framing openings not indicated in concrete beams or columns. Obtain Consultant's permission before framing openings in walls greater than 300mm x 300mm.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Clean formwork in accordance with CSA A23.1 before placing concrete.
- .10 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 1 day for walls and sides of beams or in accordance with Section 03 35 00 Concrete Finishing.
  - .2 1 day for columns or in accordance with Section 03 35 00 Concrete Finishing.
  - .3 28 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
  - .4 1 day for footings and abutments.
- .11 Wall, column and beam side forms shall not be removed until concrete has achieved 10 MPa minimum strength and form removal will not damage concrete.
- .12 Beam and suspended slab soffit formwork shall not be removed until concrete has achieved 22 MPa minimum strength. Re-shore as per Clause 3.2.

- .13 Re-use of formwork and falsework subject to the requirements of CSA A23.1.

### **3.2 CONCRETE FINISH**

- .1 In addition to the requirements specified herein, and in Clause 8.3.4 of CSA A23.1, formwork for concrete shall also comply with the following:
- .1 Ensure that formwork is constructed so that finished concrete surfaces will be free from any imperfections as a result of, but not limited to, misalignment or warping of forms, misalignment or warping of plywood or steel elements, inadequate tightness of forms, mortar leakage and any texture imparted by formwork.
  - .2 Establish pattern for form ties and reveals in accordance with pattern for form ties and reveals indicated on the drawings.
  - .3 Back all edges of forms and brace to assure that mortar leakage is eliminated. Carefully inspect forms prior to erecting to ensure debris has not entered formwork voids.
- .2 Maintain true right-angled corners for all exposed edges of concrete, unless otherwise indicated.
- .3 Joint widths shall be no greater than 2mm.

**END OF SECTION**

## **Section 03 20 00 CONCRETE REINFORCEMENT**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 RELATED WORK**

- .1 Concrete Forming & Accessories: Section 03 10 00
- .2 Cast-in-Place Concrete: Section 03 30 00
- .3 Concrete Unit Masonry: Section 04 22 00
- .4 Shotcrete: Section 03 37 13
- .5 Construction Waste Management and Disposal: Section 01 74 19
- .6 Sustainable Design Reporting Section 01 33 29

#### **1.3 REFERENCES**

- .1 Do reinforcing work in accordance with CSA A23.1:19.
- .2 Do welding of reinforcement in accordance with CSA W186:21, except where specified otherwise.

#### **1.4 SOURCE QUALITY**

- .1 Provide Consultant with certified copy of mill test reports of reinforcing steel, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcing work.
- .2 Inform Consultant of proposed source of material to be supplied.
- .3 Testing of the reinforcement will be at the discretion of the Consultant. As a minimum, there will be one tensile and one bend test for each bar size used on the project.

#### **1.5 QUALITY CONTROL**

- .1 Submit proposed quality control procedures for Consultant's review. See Section 03 30 00.
- .2 Provide completed Pre-Pour Quality Control Checklist for Consultant's information prior to each concrete placement.
- .3 The Consultant shall be notified when the reinforcing steel is in place and with sufficient time to permit an observation of same prior to concrete placement. Minimum of 48 hours' notice. Contractor to allow sufficient time to allow for correction of deficiencies prior to concrete placement.
- .4 Provide documentation of corrected deficiencies for Consultant's review prior to concrete placement.



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## **1.6 SUBSTITUTES**

- .1 Substitution of different size bars permitted only upon the written approval of the Consultant.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Reinforcing steel: billet steel, Grade 400W, deformed bars to CSA G30.18 unless indicated otherwise.
- .2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
- .3 Chairs, bolsters, bar supports, spacers: to CSA A23.1 (non-metallic).
- .4 Mechanical splices: to develop the full capacity of the bar size being spliced, as manufactured by Dayton Superior (DBR) or Lenton or alternate pre-approved by the Consultant subject to the approval of the Consultant.
- .5 Dowel Bars: to develop full capacity of the bar size being spliced, as manufactured by Dayton Superior or alternate pre-approved by the consultant.
- .6 Weldable rebar dowels as noted on the drawings. Field welding by others.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing in accordance with CSA A23.1 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures
- .2 Obtain Consultant's approval for locations of reinforcement splices other than shown on drawings. Stagger splices in adjacent bars.
- .3 Horizontal reinforcement to be made continuous around corners by use of corner bars of same size and strength as horizontal bars and as indicated on the drawings.
- .4 Bars noted as continuous to be spliced in accordance with structural drawings, staggered where possible.
- .5 Provide standard hook length for all bars noted "H1E", unless noted otherwise.
- .6 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and list.

## **Part 3 Execution**

### **3.1 FIELD BENDING**

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

### **3.2 PLACING**

- .1 Place reinforcing steel as indicated on drawings and in accordance with CSA-A23.1.
- .2 Metal reinforcement shall be protected by thickness of concrete indicated on drawings or as specified in CSA-A23.1.

- .3 Clean reinforcing steel of excess rust and previously deposited concrete prior to placing concrete.
- .4 Use non-metallic chairs and bolsters to support all reinforcement. Reinforcement shall be accurately placed and secured against displacement. Chairs in exposed concrete beam, slab band, and slab soffits shall be placed in a regular pattern. Randomly placed strips of "caterpillar" chairs shall be avoided.
- .5 Anchor bolts, dowels, and steel embedment's shall be set before concrete placement and shall not be inserted into placed concrete.
- .6 The Consultant shall be notified when the reinforcing steel is in place and in sufficient time to permit an inspection of same prior to concrete placement.
- .7 Cooperate with trades placing in-slab electrical services and radiant heating piping. Do not damage or displace items placed by other trades.
- .8 Drilled dowels to existing concrete shall be Hilti HIT-RE 500 V3 to the standard embedment specified by Hilti or as shown on the drawings.
- .9 Reinforcement shall be spliced only in locations shown on the drawings or as approved in writing by the Consultant.
- .10 Where reinforcing bars are interrupted by formwork, provide threaded couplers that develop the full capacity of the bar being spliced or dowels with lap lengths specified on the drawings.

**END OF SECTION**

## **Section 03 30 00 CAST IN PLACE CONCRETE**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 RELATED WORK**

- .1 Concrete Forming & Accessories: Section 03 10 00
- .2 Concrete Reinforcement: Section 03 20 00
- .3 Concrete Finishes: Section 03 35 00
- .4 Construction Waste Management and Disposal: Section 01 74 19

#### **1.3 REFERENCES**

- .1 Do work in accordance with CSA A23.1:19 and CSA A23.2:19 except where specified otherwise.

#### **1.4 CERTIFICATES**

- .1 Provide certification that plant, equipment, and materials to be used in concrete comply with the requirements of CSA A23.1.
- .2 Provide certification that mix proportions selected will produce concrete of specified quality and yield, and that strength will comply with CSA A23.1.

#### **1.5 QUALITY CONTROL**

- .1 Submit proposed quality control procedures for Consultant's review. The quality control procedures must include a Pre-Pour Quality Control Checklist that includes the following:
  - .1 Concrete Requirements
    - .1 Concrete mix confirmed
    - .2 Concrete finish confirmed and coordinated
  - .2 Formwork Check
    - .1 Survey completed
    - .2 Dimensions checked
    - .3 Pour height elevation checked
    - .4 Formwork sealed
    - .5 Debris cleaned out of formwork
    - .6 Recesses and reveals checked
  - .3 Reinforcing Steel Check

- .1 Reinforcement size, quantity, spacing and layout checked
  - .2 Concrete cover and chairing checked
  - .3 Vertical reinforcement layout surveyed and checked
  - .4 Vertical reinforcement plumb and square
- .4 Misc Hardware
  - .1 Embeds and anchor rods properly located and checked
  - .2 Studrails installed and checked
- .5 Curing Procedures
- .2 Do not place concrete until quality control procedures have been completed. Provide completed Pre-Pour Quality Control Checklist to Consultant upon request.

## 1.6 SAMPLES AND PROTOTYPES

- .1 Material samples: submit the following samples of materials for approval to the Consultant. Approved samples shall be used as the acceptable standard for all materials used on the project.
  - .1 Forming materials, including Class 1 Architectural Concrete finish materials.
  - .2 Gaskets, sealing materials, and form jointing system (as applicable).
  - .3 Ties, cones, and recessed precast concrete plugs, where specified.
  - .4 Rustication strips, reveals, and reglet forming material.
  - .5 Form release agent.
  - .6 Expansion and isolation joints.
- .2 At least two (2) weeks before beginning work, construct samples of select concrete works for each type of finish. Confirm with Owner's Representative for the location and size prior to constructing samples. Construct additional samples as necessary until a sample is approved by the Owner's Representative. Samples to be provided include:
  - .1 2m x 2m of flat work
  - .2 1m x 1m of retaining wall
  - .3 1 lineal meter of runnel
- .3 Samples shall be reviewed and approved by the Owner's Representative prior to commencing concrete work. Any concrete placed prior to sample approval may be rejected.
- .4 Protect approved samples until acceptance of all concrete paving. Approved samples shall be the basis for evaluation of finish and installation quality.

## Part 2 Products

### 2.1 MATERIALS

- .1 Portland cement: Type GU or Type HS, as required to CSA A3000:23.
- .2 Cementitious hydraulic slag: to CSA A3000:23.
- .3 Water: to CSA A23.1.

- .4 Aggregates: to CSA A23.1. Coarse aggregates to be normal density.
- .5 Air entraining admixture: to ASTM C260.
- .6 Chemical admixtures: to ASTM C494 and CSA S413:21. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Super-plasticizer: to CAN3-A266.5 "Guidelines for the use of Super-plasticizing Admixtures in Concrete".
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents of pouring consistency, capable of developing a compressive strength of 50 MPa at 28 days.
- .9 Concrete curing and sealing compound: Where slabs are to receive resilient flooring or carpeting, use curing compounds compatible with flooring adhesive. Do not use where bond required for additional concrete or surface coating. Acceptable products are as specified in Section 03 35 00.
- .10 Bonding agent: formulated for bonding new concrete to cured concrete. Acceptable products are as specified in Section 03 35 00.
- .11 Waterstops: extruded PVC with factory welded corner and intersecting pieces.
- .12 Pre-moulded joint fillers, expansion and isolation joints: Bituminous impregnated fibre board conforming to ASTM D1751.
- .13 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .14 Underslab dampproof membrane: Polyethylene film to CGSB 51-GP-51M.
- .15 Control joints: All areas of slab-on-grade concrete require saw-cut joints. See structural and architectural drawings for layout pattern and depth of cut. Joint pattern to match architectural finish patterns. Depth of cut to be 30mm minimum unless noted otherwise. Cuts to be done within 24 hours of pour but after such time that cutting will not damage the slab edges at the cuts.
- .16 Waterproofing admixture: in elevator walls below grade as manufactured by Xypex or Kryton International Inc. or approved equal, in strict accordance with the manufacturer's written instructions.
- .17 Waterstop slurry: in elevator walls below grade, Krystol Waterstop Treatment as manufactured by Kryton International Inc. or approved equal, in strict accordance with the manufacturer's written instructions for either the internal or external grout method.
- .18 Waterstop grout: in elevator walls below grade Krystol Waterstop Grout as manufactured by Kryton International Inc. or approved equal, in strict accordance with the manufacturer's written instructions for either the internal or external grout method.

## 2.2 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CSA A23.1, clause 4.1.2.1, Alternative 1, to give the properties shown on the structural drawings.
- .2 Mix designs are to be established in accordance with CSA A23.1, clause 4.3.5.1 or Clause 4.3.5.2.
- .3 Concrete mix designs to be submitted to the consultants for review prior to commencing work.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Do cast-in-place concrete work in accordance with CSA A23.1.

### **3.2 WORKMANSHIP**

- .1 Obtain the Structural Consultant's approval before placing concrete. Provide 24 hours notice, minimum, prior to placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment and mix design.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing. Provide minimum of 3 days of moist curing for all slabs with an exposure class of N and 7 day moist cure for all other exposure classes.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .6 Concrete shall not be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, construction joints shall be located as permitted by the Consultant. All pour and construction joints shall be formed with a straight-edge fixed to formwork. Placing shall be carried out at such a rate that concrete which is being integrated with fresh concrete is still plastic.
- .7 Compact concrete with high-frequency vibrators applied directly to concrete by experienced personnel. Do not over-vibrate.
- .8 In locations where new concrete is dowelled to already completed work, drill holes in existing concrete. Attach steel dowels of deformed steel reinforcing bars with Hilti HIT RE 500V3 epoxy adhesive to the depths shown on the drawings or specified by the manufacturer. Intentionally roughen interface between existing and new concrete to 6mm amplitude.
- .9 Take every precaution to protect finished surfaces from stains and abrasions. Surfaces and edges likely to be damaged during the construction period, such as corners of columns, walls, and stair nosings, shall be especially protected with wood furring. All exposed concrete floor surfaces shall be protected from staining and damage by suitable means
- .10 Do not place load upon new suspended concrete until the concrete has reached the design 28-day strength or has been suitably shored for the anticipated loads and/or as authorized by the structural consultant.

### **3.3 INSERTS**

- .1 Set sleeves, ties, pipe hangers, brace bay base hardware, embed plates, and other inserts and openings as indicated or specified elsewhere. NOTE: braced frame hardware to be set accurately, especially in alignment and plumbness to allow successful installation of braced frame members.
- .2 Sleeves and openings in slabs and walls greater than 300mm x 300mm not indicated on structural drawings must be approved by the Consultant.

- .3 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where expressly detailed on structural drawings or approved by the Consultant.
- .4 Electrical conduit shall not be larger in outside diameter than one-third the thickness of the slab or wall in which they are embedded nor spaced closer than three diameters on centre.
- .5 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Consultant before placing of concrete.
- .6 Check locations and sizes of sleeves and openings shown on structural drawings with architectural, mechanical, and electrical drawings.
- .7 Set special inserts for strength testing as indicated and as required by Non-Destructive Method of Testing Concrete.
- .8 Anchor bolts: Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
- .9 Dovetail Anchor Slots: Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.

### **3.4 PLACING GROUT**

- .1 Grout underside of steel column and beam bearing plates with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.

### **3.5 TOLERANCES**

- .1 Concrete tolerances to be in accordance with CSA A23.1, or as noted in Sub-section 3.1.6 of Section 03 10 00, Concrete Forming & Accessories.

### **3.6 PATCHING**

- .1 General:
  - .1 Areas to be repaired shall be determined by the Consultant and shall not exceed 0.2m<sup>2</sup> for each 100m<sup>2</sup> of surface area and shall be widely dispersed. Repairs shall match the surrounding area. Patching of horizontal paving will not be accepted.
  - .2 Before commencing any repair work, the Contractor shall confirm repair procedures with the Consultant and establish by trial mix the formula required. The Contractor shall demonstrate his repair techniques on a prototype sample panel.
- .2 The following are key steps to making a repair to architectural concrete:
  - .1 Prepare the area to be repaired. This should include achieving the desired finish in the surrounding area. Remove loose particles and chip out part of the sound concrete to avoid feather edge repairs.
  - .2 Proportion the repair mix by weight according to the same proportions as used in the concrete mix but substituting a portion of white cement for grey cement. This should be based on tests to determine what is required to match the finished surface.
  - .3 Apply a coat of bonding material to the root of the areas to be repaired, being careful to avoid dripping on any surface to be exposed.

- .4 Fill in the area to be repaired with mortar of the stiffest consistency that will permit placing. Consolidate in place and strike off to leave the repaired area slightly higher than the surrounding surface to permit initial shrinkage. The repair shall be left undisturbed for at least one hour before being textured.
- .5 The repaired area shall be cured by suitable means to minimize shrinkage and cracking and provide a durable finish.
- .6 Clean the repaired area to remove laitance and match the surrounding area.
- .3 Repair of cracks in concrete slabs and slabs-on-grade shall be the sole responsibility of the Contractor to satisfy the requirements of the floor finishes.

### 3.7 FINISHING

- .1 Formed surface: The finishes to be provided for the various formed surfaces shall be:
  - .1 Class 1 – Architectural Concrete Finish:
    - .1 This finish shall apply to formed exterior architectural concrete surfaces which are exposed to view, in accordance with Section 03 35 00 - Concrete Finishing.
  - .2 Class 2 – Smooth Form Finish:
    - .1 This finish shall apply to formed exposed interior Class 2 concrete surfaces in accordance with Section 03 35 00 - Concrete Finishing.
  - .3 Class 3 – Rough Form Finish:
    - .1 This finish shall apply to formed surfaces which are not exposed to view and where roughness is not objectionable.
    - .2 The surface, in general, shall not require any treatment after form removal, other than repair of defective concrete, snap-tie holes, and the removal of ridges and surface irregularities.
- .2 Unformed surface: The finish to be provided for the various unformed surfaces shall be:
  - .1 Plastic Concrete Surfaces:
    - .1 Working of the concrete surface shall take place while it is sufficiently plastic to achieve the desired shape, plane, and texture. Screeding shall be followed by one or more of the operations of darbying, floating, trowelling, and tooling of edges and joints, in that order, to provide the surface finish specified in the drawings or by the Consultant.
    - .2 Initial finishing shall be accomplished by screeding, darbying, or bull floating and shall be performed in accordance with the requirements of CSA A23.1, Clause 7.7.3.
    - .3 Initial finishing operations shall be completed before any bleed or free water appears on the concrete surface. Overworking, which can bring excessive fines to the concrete surface, shall not be permitted.
    - .4 Final finishing shall be accomplished by mechanical floating, mechanical trowelling, creation of the specified surface finish, and tooling of edges and joints, in that order. Exposed edges and corners shall be as detailed. Surfaces at tooled edges shall be trowelled and sand-blasted to remove tool edge marks. Hand floating



and trowelling shall only be permitted in small areas of restricted access. All final finishing procedures shall conform to the requirements of CSA A23.1, Clause 7.7.4.

- .5 Final finishing shall commence after bleed water has disappeared from the surface and when the concrete has stiffened sufficiently to prevent the working of excess water to the surface. No additional dry cement or water shall be used to facilitate finishing.
- .6 The final finish to be provided shall be as specified on the drawings and in accordance with Section 03 35 00 Concrete Finishing for floor finishes. All concrete floors receiving flooring shall conform to ASTM F-710 and the flooring manufacturer's recommendations.
- .7 It is the General Contractor's responsibility to determine concrete surface profile (CSP) that is appropriate for different types of flooring specified on this project. The General contractor shall coordinate with the flooring contractor and flooring supplier before concrete floors are poured. Any potential flooring system failure stemming from general contractor's failure to determine/implement CSP, concrete pH, concrete relative humidity, concrete vapour emission rate and other flooring installation criteria recommended by the flooring manufacturer(s) (for each type of flooring specified for this project) shall be corrected by the General Contractor at no additional cost to the Owner. Refer to Architectural resilient flooring specifications for additional information.

### 3.8 WATERSTOPS

- .1 Install waterstops at all joints in all foundation walls surrounding below-grade occupied spaces to provide continuous water seal. Do not distort or pierce waterstop to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
- .2 Use only straight heat-sealed butt joints in field. Use factory welded corners at intersections.

### 3.9 JOINT FILLERS

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .2 Locate and form isolation joints as indicated. Install joint filler.
- .3 Use joint filler to separate slabs on grade from all vertical surfaces and extend joint filler from bottom of slab to within 12mm of finished slab surface unless indicated otherwise.

### 3.10 CONTROL JOINTS

- .1 Provide control joints in foundation walls in accordance with the details on the drawings at maximum 6m on centre. Align joints to suit architectural features.
- .2 Provide saw-cut joints in all slabs-on-grade and concrete paving in accordance with the details on the drawings and to suit Architectural finishes. Review locations with the Consultant.

### **3.11 HOUSEKEEPING AND EQUIPMENT PADS**

- .1 Provide concrete pads and curbs under equipment where indicated on drawings and as specified in Division 22, Division 23, Division 26, any other applicable division, and to approved shop drawings. Dowel pads and curbs to base slab in accordance with details on the drawings.

### **3.12 QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Owner in accordance with CSA A23.1. Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2.
- .2 Testing Laboratory will take additional test cylinders during cold weather concreting, where temperatures are below freezing. Cure cylinders on job site under the same conditions as concrete which they represent.
- .3 If results of tests show concrete to be less than specified in quality or strength, the Consultant shall have the right to have the mix designs altered for the remainder of the work at no cost to the Owner. Further testing and remedial measures required by CSA A23.1 shall be done, the costs of this work paid for by the Contractor.
- .4 Inspection or testing by Owner will not augment or replace Contractor quality control nor relieve them of their contractual responsibilities.

**END OF SECTION**

## **Section 03 35 00 CONCRETE FINISHING**

### **Part 1 General**

#### **1.1 DOCUMENTS**

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

#### **1.2 RELATED WORK**

- .1 Concrete Forming: Section 03 10 00
- .2 Concrete Reinforcement: Section 03 20 00
- .3 Cast-in-Place Concrete: Section 03 30 00
- .4 Shotcrete: Section 03 37 13
- .5 Construction Waste Management and Disposal: Section 01 74 19
- .6 Sustainable Design Reporting Section 01 33 29

#### **1.3 REFERENCES**

- .1 Do concrete finishing work in accordance with CSA A23.1:19, except where specified otherwise.

#### **1.4 JOB CONDITIONS**

- .1 Meet the requirements of CSA A23.1 for curing and protection including hot weather and cold weather protection.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Formwork materials: to Section 03 10 00.
- .2 Concrete materials: to Section 03 30 00.
- .3 Clear sealer (for general application): for exposed concrete floors and stairs, as indicated shall be, Sika Florseal WB-18 & 25, Eucosil liquid densifier for concrete by Euclid chemical, Websen Acrylene sealer, Sonneborn Sonocrete Lapidolith; W.R. Meadows HIAC Acrylic Sealer; Kyrton Kyrstol Floor Hardener; or preapproved equal.
- .4 Premoulded joint fillers: Bituminous impregnated fibre board conforming to ASTM D1751.
- .5 Joint sealant: to be self-levelling two-part polyurethane type, conforming to CGSB 19.24-M90, Type 1, Class B. Approved types are Sikaflex-2C NS/SL; Isoflex 880 6B (self-levelling) Sealant; Master Seal SL2; Vulkem 4455SL, or other approved sealant. Colour as selected by Consultant from standard range. Primers, bond breakers, and backer rods as required to install the perimeter joint sealant system shall be provided in strict accordance with sealant manufacturer's recommendations.
- .6 Slab-on-Grade Joint Sealer: to be semi-rigid, self-levelling, two-part epoxy urethane. Approved type is Sika Loadflex or equivalent sealant.

## Part 3 Execution

### 3.1 FINISHING OF FORMED SURFACES

- .1 Formed surfaces shall be:
  - .1 Class 1 - Architectural Concrete Finish for exposed exterior concrete surfaces: to conform to CSA A23.1, clause 7.10.2.6 Smooth Form Finish and in accordance with procedures under Section 8.3 Architectural Concrete with patching to be done in accordance with clause 7.9.3 Patching.
  - .2 Class 2 - Smooth Form Finish for exposed interior concrete surfaces, including exposed concrete columns: to conform to CSA A23.1 Clause 7.10.2.6 with patching to be done in accordance with clause 7.10.3 Patching.
  - .3 Class 3 - Rough Form Finish for all concealed concrete surfaces, including exposed surfaces of elevator pits, and trenches: to conform to CSA A23.1 clause 7.10.2.5 Rough Form Finish.

### 3.2 FLOOR AND SLAB FINISHING

- .1 Deviation from flat surface, slabs, and roof slabs – 8 mm in 3000mm.
- .2 All concrete floors receiving flooring shall conform to ASTM F-710 and flooring manufacturer's recommendations.

It is the General Contractor's responsibility to determine concrete surface profile (CSP) that is appropriate for different types of flooring specified on this project. The General contractor shall coordinate with the flooring contractor and flooring supplier before concrete floors are poured. Any potential flooring system failure stemming from general contractor's failure to determine/implement CSP, concrete pH, concrete relative humidity, concrete vapour emission rate and other flooring installation criteria recommended by the flooring manufacturer(s) (for each type of flooring specified for this project) shall be corrected by the General Contractor at no additional cost to the Owner. Refer to Architectural resilient flooring specifications for additional information.
- .3 Finish concrete in accordance with CSA A23.1 Section 7.7. Finishing of concrete floor surfaced, and as follows:
  - .1 Steel trowelled finish for exposed concrete floors as indicated, for concrete slabs to receive roof membranes and waterproofing membranes, and for concrete slabs-on-grade:
    - .1 After the concrete has been properly placed, struck off and darried or bull-floated, it shall not be worked until ready for trowelling. The lapse of time between darrying and power trowelling may vary from two to eight hours or more, depending on the weather conditions, concrete temperature and the concrete admixture.
    - .2 Trowelling shall begin when the water sheen has disappeared and/or the mix has stiffened sufficiently that the weight of a man standing on it leaves only a slight imprint on the surface.
    - .3 Trowelling shall be continued until the surface is dense, smooth and free of all minor blemishes such as trowel marks.
    - .4 Final hand trowelling shall be required to remove slight imperfections left by trowelling machines and to bring the surface to a dense, smooth, polished finish. It shall be continued until a ringing sound is heard as the trowel passes over the surface.

- .2 Non-slip finish for exposed concrete stair treads and landings: finish as for steel trowel finish and immediately after first trowelling provide a nonslip surface by light brushing or surface to texture approved by the Consultant followed by two (2) coat application of specified clear liquid sealer in accordance with manufacturer's printed directions. At all floor level stair landings, as required by BCBC, provide heavy tooled finish tactile area to conform to requirements for handicapped and to Consultant's approval.
- .3 Light brush finish for concrete floor to receive thin-set ceramic and porcelain ceramic floor tile: finish as for steel trowel finish and after first trowelling provide a light brushing of surface to texture approved by the Consultant.
- .4 Float finish for suspended concrete floor slabs in accordance with CSA A23.1
- .4 Tool all crack control joints and construction joints as indicated on the drawings. Tooling shall be coordinated with concrete finishing. If necessary, re-tool joints at completion of finishing to give full-size joint with clean and sound substrate ready for sealant.

### **3.3 CURING**

- .1 Cure and protect the surface of finishes and slabs in accordance with CSA A23.1 and/or as specified.
- .2 See Section 03 30 00 for general curing and protection requirements including cold weather requirements.

### **3.4 PROTECTION OF FINISHED SURFACES**

- .1 Keep traffic which would affect and otherwise disturb the curing procedures as required.
- .2 Protect exposed concrete finishes against damage until the project is accepted by the Owner.
- .3 Protect concrete finishes against contamination by paint, oil, or other deleterious materials.

### **3.5 JOINT FILLERS AND SEALERS**

- .1 Provide joint fillers and sealers at interior slabs-on-grade at junction with vertical surfaces and where required.
- .2 Particular care shall be taken to construct clean joints free from any foreign material which will impair the proper function of the joint.
- .3 Joint filler material shall be anchored to the previously poured concrete surface.
- .4 Unless shown otherwise, joint filler shall extend for the full depth of the joint and shall terminate 13mm below the top of the joint. The 13mm space shall be filled joint sealer. Apply bond breaker tape before applying sealant if impregnated fibreboard is used.

**END OF SECTION**

## Section 03 37 13 SHOTCRETE

### Part 1 General

#### 1.1 REFERENCES

- .1 American Concrete Institute (ACI).
  - .1 ACI 506R, Guide to Shotcrete.
  - .2 ACI 506.2, Specification for Shotcrete.
  - .3 ACI 506.3R, Guide to Certification of Shotcrete Nozzlemen.
- .2 American Society for Testing and Materials (ASTM).
  - .1 ASTM C 42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  - .2 ASTM C1140 Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels
- .3 Canadian Standards Association (CSA).
  - .1 CSA A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2 CSA A23.2, Test Methods and Standard Practices for Concrete.
  - .3 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

#### 1.2 DEFINITIONS

- .1 There are two basic shotcreting processes defined as:
  - .1 Dry mix process where mix water is added at nozzle.
  - .2 Wet mix process where mix water is added before concrete enters delivery hose, and compressed air is added at nozzle.
- .2 Rebound is material which bounces off surface being shotcreted. It consists primarily of coarse particles and contains a lower proportion of cement than shotcrete mix.
- .3 Overspray is shotcrete material deposited away from intended receiving surface.

#### 1.3 QUALIFICATIONS

- .1 Use operators of equipment for mixing and application of shotcrete experienced in process to be used.
- .2 Operators: qualified to perform work to ACI 506.3R.
- .3 Foremen: minimum 2 years experience as shotcrete nozzlemen.
- .4 Nozzlemen: minimum 1 year experience on similar applications.
- .5 Provide documentation attesting to satisfactory experience.

### Part 2 Products

#### 2.1 MATERIALS

- .1 Concrete mixes and materials: as specified below.

- .1 Shotcrete aggregate gradation: to CSA A23.2 and all applicable limits.
- .2 Silica fume: to be from production of silicon or ferro-silicon alloys containing at least 75% silicon.
- .3 Other supplemental cementing materials subject to approval of Engineer.
- .4 Shrinkage reducing admixture: SikaControl-75 or approved alternate. Dosage to be appropriate for all applicable crack control requirements (including shrinkage cracking and thermal cracking) and architectural visual requirements for the specified exposed rockscape finish.
- .5 Use of other admixtures subject to approval of Engineer.
- .6 Do not use calcium chloride or compounds containing calcium chloride.
- .7 Water: to CSA A23.1.
- .2 Steel anchors, supports and spacers: galvanized to CAN/CSA G164.
- .3 Bonding agent: Sikadur 32 Hi-Mod, By Sika

## **2.2 COMPATIBILITY**

- .1 Ensure that all materials used are compatible. Provide written proof of compatibility.

## **2.3 EQUIPMENT**

- .1 Shotcrete equipment for dry or wet mix process to ACI 506R.
- .2 Batching equipment to proportion aggregate and cement mixtures on a mass basis, or by integral cement bag count and sand measured on a volume basis.
- .3 Use an air supply system that delivers air uncontaminated by oil and that is capable of maintaining constant air pressure.
- .4 Provide a separate air hose and blow pipe, capable of simultaneous operation with shotcreting operation, for removal of rebound and dust.
- .5 Equipment will be subject to approval of Engineer. Maintain equipment in proper working order. Provide additional test panels and test cores as required by Engineer to demonstrate that equipment is functioning properly during shotcreting operation.

## **2.4 MIXES**

- .1 Proportion concrete for dry or wet process shotcrete in accordance with CSA A23.1, Alternative 1, to give following properties:
- .2 Use Type GU, CSA A23.1 normal Portland Cement
- .3 Silica fume: content maximum 10% by mass of cement content.
- .4 Exposure class: Minimum requirement of F1.
- .5 Minimum compressive strength in place as determined from cores taken from test panels to ASTM C 42:
  - .1 28 MPa at 7 days.
  - .2 35 MPa at 28 days.
- .6 Minimum cement content: ratio of cement to aggregate to be 1 to 4 by mass.
- .7 Maximum water/cementing materials ratio: 0.38.
- .8 Air content of wet mix concrete as shot: to CSA A23.2, -5 - 8%.

- .9 Slump of wet mix shotcrete at discharge into pump: to CSA A23.2, 40 mm.
- .10 Submit full mix design, signed and sealed by a Professional Engineer registered in the Province of British Columbia, for review.

## **2.5 TESTS/INSPECTION**

- .1 Pre-construction testing procedures to ACI 506.2.
- .2 Make one test panel for each shooting position for each mix being considered for use on project. Repeat for each nozzleman to be employed on project.
- .3 Provide six (6) cores from each test panel to certified testing laboratory retained by Contractor.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Prepare surfaces for shotcreting in accordance with ACI 506R.
- .2 Remove unsound concrete and repair cracks with equipment and method approved by Engineer. Remove only in areas and to depths as directed by Engineer.
- .3 After acceptance of surface by Engineer, sandblast surfaces. Remove all dirt, grease, oil or other substances which would interfere with bond of newly placed shotcrete in accordance with SSPC-SP13/NACE No.6.
- .4 Install anchors and reinforcing as indicated on drawing.
- .5 Clean, wet and damp dry surfaces just prior to application of shotcrete.

### **3.2 APPLICATION**

- .1 Apply shotcrete to prepared surfaces in accordance with ACI 506R, and as noted in 3.1.1.
- .2 Do not apply shotcrete to a surface on which there is running or free standing water.
- .3 Do not apply shotcrete when temperature is below 5°C.
- .4 Where applicable, apply bonding agent prior to application of shotcrete.
- .5 Apply shotcrete to build concrete surface to finished lines. Acceptable minus tolerance of finished surfaces is 3 mm. Provide minimum cover of 50 mm over steel reinforcement.
- .6 Use depth probes in accordance with ACI 506R as guide to obtain correct thickness of shotcrete.
- .7 Provide a flash coat and steel trowel the interior (exposed to water) surface to provide a smooth sealed finish. Follow with second steel trowelling.
- .8 Protect adjacent surfaces from shotcrete and rebound during operations and clean up material deposited.
- .9 During application continuously remove rebound from surfaces.
- .10 Do not reuse rebound or overspray material. Dispose of surplus material off site.
- .11 Cure and protect finished surfaces for a minimum period of seven (7) days and in accordance with ACI 506.2.



### **3.3 SITE TESTS**

- .1 Construction testing and acceptance of results in accordance with ACI 506.2, and as specified herein.
- .2 Demonstrate shotcreting technique to ensure reinforcing steel is encapsulated and fully bonded with concrete.
- .3 Test panels in accordance with ACI 506.2.
- .4 Field cure panels in same manner as work in accordance with ACI 506.2.
- .5 Remove and replace shotcrete in areas where hollow spots, segregation, honeycombing, laminations, dry patches, slugs, voids or sand pockets occur, as directed by Engineer.

**END OF SECTION**

## **Section 05 50 00 METAL FABRICATIONS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This Section of the Specifications forms part of the contract and is to be read, interpreted, and coordinated with all other parts including Division 1 General Requirements.

#### **1.2 SUMMARY**

- .1 This section covers the fabrication and installation of miscellaneous bars, post elements, post anchors and handrails etc. submitted from suppliers and as per drawings.
- .2 Provide shop fabricated ferrous metal items.
- .3 Provide shop fabricated aluminum items.
- .4 Provide shop fabricated stainless steel items.
- .5 Coordinate with work of Section 09 90 00 Painting and Coating to ensure compatibility of finish systems. Refer to Interior Design Specifications.
- .6 Player shelter fabrication.
- .7 Tennis court fencing base plates and supports.

#### **1.3 RELATED SECTIONS**

- .1 03 15 00 - Concrete Accessories
- .2 03 31 00 - Cast in Place Concrete.
- .3 09 90 00 - Painting and Coating.

#### **1.4 REFERENCES**

- .1 AAMA 611 - Specifications for Anodized Architectural Aluminum.
- .2 AAMA 2603 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- .3 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .4 ANSI A14.3 - Ladders, Fixed, Safety Requirements.
- .5 ASTM A53/A53M-07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .6 ASTM A123/A123M-08 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .7 ASTM A153/A153M-05 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .8 ASTM A283/A283M-03 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- .9 ASTM A307-07 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

- .10 ASTM A500-M07a Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- .11 ASTM A653/A653M-08a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .12 ASTM B209/B209M-07 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .13 ASTM B210-04 Standard Specification for Aluminum and Aluminum -Alloy Drawn Seamless Tubes.
- .14 ASTM B211-03 Standard Specification for Aluminum and Aluminum -Alloy Bar, Rod, and Wire.
- .15 ASTM B221/B221-08a Standard Specification for Aluminum and Aluminum -Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .16 British Columbia Building Code 2024.
- .17 CAN/CSA G40.21-04 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel (ASTM A36/A36M-05 Standard Specification for Carbon Structural Steel).
- .18 CSA W59-03, Welded Steel Construction (Metal Arc Welding), Edition: 8.
- .19 CAN/CSA-S16-01, Limit States Design of Steel Structures.
- .20 CSA S157-05/S157.1-05, Strength Design in Aluminum / Commentary on CSA S157.05 Strength Design in Aluminum.
- .21 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel Structures.
- .22 [CSA W47.2-M1987\(R1998\)](#), Certification of Companies for Fusion Welding of Aluminum .
- .23 CSA W55.3-2008, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .24 CSA W59-M-03 Welded Steel Construction (Metal Arc Welding)
- .25 CSA W59.2-M1991(R2003), Welded Aluminum Construction.
- .26 SSPC Steel Structures Painting Manual, The Society for Protective Coatings, (formerly SSPC - Steel Structures Painting Council).

## 1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting a min. of 5 business days prior to beginning on-site installation, with contractor's representative, and Consultant in accordance with Section 01 32 16.07 – Construction Progress Schedule – Bar (GANTT) Chart to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Coordination with other subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## 1.6 SUBMITTALS

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Shop Drawings:

- .1 Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
  - .2 Include erection drawings, elevations, and details where applicable.
  - .3 Indicate welded connections using standard welding symbols. Indicate net weld lengths.
  - .4 Shop Drawings: Shall bear the seal and stamp of a Professional Engineer experienced in design of this work and licensed in the Province of British Columbia.
- .3 Letters of Assurance: At completion of installation submit Engineering Letters of Assurance Schedule S-B and S-C to be submitted to Project Coordinating Registered Professional (CRP); in accordance with the requirements of the British Columbia Building Code.

#### **1.7 SITE MOCK UPS**

- .1 Provide mock-ups of the guardrail systems - refer to Section 01 45 00 Quality Control & Assurance 1.7 Mock ups

#### **1.8 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Architectural Signage Manufacturer:
  - .1 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal lettering and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Metal Shop / Fabricator:
  - .1 Shop Drawings:
    - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
    - .2 Indicate materials, thicknesses, finishes and hardware.
- .4 Samples:
  - .1 Sample of fabricated work and finishes is to be submitted for approval as per Section 01 33 00 – Submittal Procedures.
  - .2 Allow 5 business days for inspection of samples by Consultant before proceeding with Work.
  - .3 When accepted, samples will demonstrate minimum standard for Work.
  - .4 Do not proceed with work prior to receipt of written acceptance of sample by Consultant.
  - .5 Accepted samples shall be retained by Owner for reuse, as needed.

#### **1.9 INFORMATIONAL SUBMITTALS**

- .1 Product Data:

- .1 Submit manufacturer's printed product literature panel signage or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

#### **1.10 QUALITY ASSURANCE**

- .1 Do steel welding to CSA W59 by fabricators certified by the Canadian Welding Bureau - CSA W47.1.
- .2 Do steel resistance welding to CSA W55.3 by fabricators certified by the Canadian Welding Bureau - CSA W47.1.
- .3 Do aluminum welding to CSA W59.2 by fabricators certified by the Canadian Welding Bureau to CSA W47.2.
- .4 Submit Welders Certificates for welders employed on the Work, to verify qualification within the previous 12 months.
- .5 Electrodes to conform to CSA Standard W48.
- .6 Mock-ups: Provide the following system mock-ups complete with accessories and in conjunction with related work.
  - .1 One full-height, full width panel of guardrail system with glazing, anchorage and sealants.
- .7 Finishes: Material finish as specified on drawings or approved equal.

#### **1.11 DELIVERY**

- .1 All miscellaneous metal items delivered to the site shall be tagged and supplied with sufficient information for identification and fixing in correct location.
- .2 Arrange delivery in such sequence and manner to permit the most efficient and economical performance of this section of work as per Section 01 32 16.07 – Construction Progress Schedule – Bar (GANTT) Chart.

#### **1.12 PROTECTION**

- .1 Protect miscellaneous metal before, during, and after installation until Final Acceptance.
- .2 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Consultant and City Representative at the Contractor's cost.

#### **1.13 COOPERATION**

- .1 Cooperate with all other trades and subconsultants in the installation of the work of this section.

### **Part 2 Products**

#### **2.1 MATERIALS - STEEL**

- .1 All materials shall be new, best quality, clean to dimensions indicated and free from distortions and defects.
- .2 Handrail fittings for pipe railings shall be prefabricated bends, corner and flanges as manufactured by Wagner, to suit details and dimensions or approved equals.

- .3 Screws shall be countersunk socket head, or Phillips type, machine screws, same as parent metal, galvanized for exterior plated for interior, of adequate size.
- .4 Fasteners, expansion shields, etc., shall be of proper type, size and location for purpose intended.
- .5 Ferrous surface paint primer shall be red lead alkyd, oil pint or zinc chromate.
- .6 Zinc Rich paint shall be "Galvicon" or approved equal.
- .7 Grating shall be 1 ¼" x 3/16 type W. A-4 galvanized grating with bearing bars at 1 3/16" o/c and cross bars at 4" o/c. Stair treads shall be fabricated with same grating material and checker plate nosing.
- .8 All balustrades, guards, handrails & guardrails are to be designed to withstand all applicable loads in accordance with N.B.C.C. 2015 edition.
- .9 Horizontal Bars:
  - .1 Metal:
    - .1 Stainless Steel (Grade 304 or 316).
    - .2 1 ½" Diameter, 1.9" O.D.
    - .3 Iron Pipe Size XS, Schedule 80S
- .10 Vertical Posts:
  - .1 Metal:
    - .1 Stainless Steel (Grade 304 or 316).
    - .2 4.5" Diameter
    - .3 Iron Pipe Size STD
    - .4 Schedule 40S
    - .5 Wall Thickness 0.237"
- .11 Diagonal Stabilizing Bar:
  - .1 Metal:
    - .1 Stainless Steel (Grade 304 or 316).
    - .2 1 ¼" Diameter, 1.66" O.D.
    - .3 Iron Pipe Size XS
    - .4 Schedule 40S
- .12 Plate Steel:
  - .1 Metal:
    - .1 Stainless Steel (Grade 304 or 316)
    - .2 Thickness: As per drawing details
- .13 Stainless steel sheet to be 316, brushed finish.
- .14 Steel Sections: ASTM A36.
- .15 Steel Tubing: ASTM A500, Grade B.
- .16 Steel Angles and Plates: ASTM A283.

- .17 Pipe: ASTM A53, Grade B Schedule 40.
- .18 Bolts, Nuts, and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components.
- .19 Welding Materials: Type required for materials being welded.
- .20 Shop and Touch-Up Primer: PCC 15, Type 1, red oxide.
- .21 Touch-Up Primer for Galvanized Surfaces: SPCC 20 Type II Organic zinc rich.

## **2.2 MATERIALS - ALUMINUM**

- .1 Extruded Aluminum: ASTM B221/B221M, Aluminum Association AA6063-T5 alloy and temper.
- .2 Sheet Aluminum: ASTM B209/B209M.
- .3 Aluminum -Alloy Drawn Seamless Tubes: ASTM B210, Aluminum Association AA6063-T6 alloy and temper.
- .4 Aluminum -Alloy Bars: ASTM B211, Aluminum Association AA6063-T6 alloy and temper.
- .5 Bolts, Nuts, and Washers: Stainless steel.
- .6 Welding Materials: Type required for materials being welded.

## **2.3 ALUMINUM HANDRAILS AND GUARDRAILS**

- .1 Aluminum Rails and Posts: 38 x 38 mm (1-1/2 x 1-1/2 in.) OD extruded tubing.
- .2 Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast aluminum.
- .3 Mounting: As indicated. Where indicated, prepare plates for wall mounting.
- .4 Splice Connectors: Concealed spigot or welding collars; cast aluminum.
- .5 Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- .6 Finish: As indicated.

## **2.4 FASTENERS**

- .1 General: Provide zinc plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- .2 For aluminum fabrications provide Type 304 stainless steel fasteners.
- .3 Bolts and Nuts: Stainless steel hexagon-head bolts, ASTM A307, with hex nuts, ASTM A563, and, where indicated, flat washers and neoprene gaskets.
- .4 Machine Screws: ANSI B18.6.3.
- .5 Lag Bolts: ANSI B18.2.1.
- .6 Plain Washers: Round, carbon steel, ANSI B18.22.1.
- .7 Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- .8 Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

- .1 Material: Carbon steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
- .2 Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F593 and ASTM F594.

## **2.5 GROUT**

- .1 Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107, specifically recommended by manufacturer for heavy-duty loading applications.
- .2 Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## **2.6 CONCRETE FILL**

- .1 Comply with requirements in Section 03 31 00 Cast-in-Place Concrete – Refer to Structural Specifications, for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

## **2.7 STEEL HANDRAILS AND GUARDRAILS**

- .1 Design and fabricate handrails, guardrails, railings and balusters to provide load capacity as required by BC Building Code and authorities having jurisdiction.
  - .1 Provide members of type, style and profile indicated and provide cold-rolled steel handrails in patterns indicated.
  - .2 Provide fully welded construction, using internal slip connectors. Grind joints flush and smooth so that joints are invisible after painting and hot-dipped galvanizing.
  - .3 Provide mitered joints at square turns.
  - .4 Provide smooth radiuses at bends and maintain uniform cross-section throughout with no kinks, buckling or twisting.
  - .5 Return ends to walls with fully concealed anchors, except where detailed not to return to wall.
  - .6 Provide steel plate toe boards where indicated and where required by authorities having jurisdiction.
  - .7 Provide brackets, flanges, fittings and anchors for connecting railing to railing and railing to floors, landings, stringers and walls.
- .2 For railing posts set in concrete, fabricate sleeves from steel pipe not less than 150mm (6 in.) long, and with an inside diameter not less than 12.7mm (1/2 in.) greater than outside diameter of post with a steel plate closure welded to bottom of sleeve. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 12.7mm (1/2 in.) below finished surface of concrete.
- .3 Removable Safety Guardrail for Mechanical Room:
  - .1 2438mm long removal safety railing as supplied by Uline Canada or approved equal. Model: H-4978. Colour: Yellow.
  - .2 Provide 2 floor mounted sockets as supplied by Uline Canada or approved equal. Model: H-4979



## 2.8 STEEL FINISHES

- .1 Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- .2 Coordinate with Section 09 90 00 Painting and Coating prior to application of primers to ensure compatibility with finish coats. Unless otherwise noted paint items to be welded
  - .1 After erection and connections are completed, touch up steel in exterior exposures, steel which is to have a finish paint coat, and steel with no paint shop coat that has been chipped or scraped, with a coat of Galvicon.
  - .2 Galvanized Items: All exposed exterior steel is to be galvanized, sandblasted and primed with zinc-rich primer after fabrication is completed.
  - .3 Hot-dip galvanize items indicated to be galvanized to comply with ASTM A123 or ASTM A153/A153M as applicable.
  - .4 Coverage: Provide 56.7g/093sq m (2.0 oz./sq.ft.) zinc coverage minimum, and not less than the coverage required by referenced standards.
  - .5 Touch Up: Touch-up damaged or abraded galvanized surfaces with ZRC Cold Galvanizing Compound, Duncan ZiRP or Consultant approved equal in compliance with ASTM A 780.
  - .6 Structural Steel Members: Galvanize after fabrication to ASTM A123. Provide minimum 380 g/sq m (1.2 oz / sq ft) galvanized coating.
  - .7 Non-structural Items: Galvanized after fabrication to ASTM A123. Provide minimum 380 g/sq m (1.2 oz / sq ft) galvanized coating.
  - .8 Exterior Items: Hot-dipped galvanized to ASTM A123 - Z275.
- .3 Colours: As Selected by Consultant.

## 2.9 STAINLESS STEEL FABRICATIONS

- .1 Assemble all stainless-steel fabrications at the shop and deliver in sections to pass through all access openings.
- .2 Deliver stainless steel fabrications to site only after structure and / or project is in proper condition and suitable arrangements have been made to properly handle, store and protect the item.
- .3 Fabricate stainless steel items as detailed. Perform work in accordance with the Architectural Sheet Metal Manual, as published by the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA). Finish all exposed edges. All corners and edges to be rounded, no sharp edges or fastenings. Hem exposed edges a minimum of 12 mm. Generally run grain vertically and in same direction between adjacent pieces. Form sections square, true and accurate to size, free from distortion, waves, buckling, oil-canning, or other defects detrimental to appearance.
- .4 All fastenings and fittings, such as bolts, metal screws, lock-washers, nuts and mounting brackets shall be stainless steel with polished heads where exposed. Wherever possible conceal fastenings, but, where necessary at exposed or inaccessible surfaces, use countersunk flat heads.
- .5 Corners shall be welded, ground, polished and crevice-free. All joints and welds shall be polished to a uniform #4 satin finish. No filler or solders shall be used.

- .6 Stainless steel surround at drinking fountains: 1.51 mm Type 316 stainless steel #4 finish with all exposed edges hemmed.
- .7 Stainless steel mesh: Columbia Shoals by The Western Group complete with stainless steel u-channel frames. Mechanically fastened to structure as detailed.
- .8 Clean all stainless steel surfaces to remove all traces of ferrous deposits. Use a chemical cleaner in accordance with manufacturer's directions.

## **2.10 STAINLESS STEEL HANDRAILS AND STEEL GUARDS**

- .1 All handrails are to be stainless steel. Handrails shall be fixed to guard rail pipes with brackets formed of 19 mm diameter bar stock. Handrails fixed to wall shall be fixed with brackets fabricated of 19 mm diameter round bar stock welded to rail and to flat base pipe flanges, complete with 3 counter sunk screw holes. Wagner # 611A, or approved equal.
- .2 Guards to be welded to steel stair stringer or curb as required.
- .3 Woven Flat Bar Mesh: Columbia Bar Stainless Steel, Flat Bar 2 x8 mm 27 mm weave size, 59.7% open. Woven mesh insert for guardrail located on level 2 outdoor learning space.
- .4 All exterior stairs, supports, grates, perforated metal, handrails, guards and miscellaneous parts to be galvanized. Exterior stair safety tread to be AMICO – ISG Safety Tread channel product specs ASTM-A-526G 90 (Z-275) pre-galvanized 11 gauge steel c/w 1/4" dia. Drainage holes.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Examine all details of the work as related to this section and other sections. Ensure that all conditions are suitable to provide a complete and satisfactory installation or be responsible for any additional costs involved.
- .2 Carefully inspect all surfaces and the work of other trades as it relates to the work of this Section for defects and discrepancies and report same to the Consultant and City representative.
- .3 Verify that field conditions are acceptable and are ready to receive work with installer present.
- .4 Correct unsatisfactory conditions.

### **3.2 PREPARATION**

- .1 Clean and strip primed steel items to bare metal and aluminum where site welding is required.
- .2 Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

### **3.3 FABRICATION**

- .1 Verify all dimensions on site prior to proceeding with shop fabrication.
- .2 Fabricate all work in accordance with details shown on drawings and reviewed/stamped shop drawings.
- .3 Fabricate items from steel unless otherwise noted.

- .4 Where possible, fit and shop assemble work, ready for erection. This includes the exterior site furnishings. Due to overall dimensions some on-site welding may be required.
- .5 Fabricate and assemble miscellaneous metal items true, square, and free from warpage or other defects.
- .6 Items to be fixed to or set in concrete as per plans unless approved otherwise.
- .7 Design, fabrication, and workmanship shall conform to CAN3-S16.1-M94.
- .8 Welding shall conform to CSA W59-M89.
- .9 Grind smooth all exposed welds, sharp edges, angles, and corners.
- .10 Ensure exposed welds are continuous for length of each joint.
- .11 Provide smooth exposed surfaces with all fastenings and connections hidden where possible.
- .12 Curved work shall be true to radii shown.
- .13 All welding to occur in a controlled environment.

### **3.4 ERECTION**

- .1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .2 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor chips, bar anchors, expansion bolts and shields, and toggles. Ensure that items cast into concrete or built into masonry are given to the appropriate trades together with setting templates.
- .3 Execute all metal work in a thorough manner according to best shop practices. Material cut from stock to be sheared or parted straight and all debarred. Where cuts are burned, grind off clean and true to line. Exposed welding or welding in fitted surfaces to be ground smooth or fileted as required. Fabricate all items accurately, true to line and dimension.
- .4 Make field connections with bolts to CAN3-S16.1-M84, or weld.
- .5 Hand items over for casting into concrete or into masonry to appropriate trades together with setting templates.
- .6 Fastenings shall be concealed where possible, sizes and spacing as indicated on the drawings, and shall conform to local municipal requirements, CSA Specifications, and best trade practices to give permanent stability and good appearance. Avoid staining, scratches, damage, and distortion of materials.
- .7 Fix in place with epoxy grout where applicable. Remove excess epoxy grout by approved means, leaving the surface around each handrail base smooth and clean.

### **3.5 INSTALLATION**

- .1 Install items plumb and level, accurately fitted, free from distortion or defects.
- .2 Bolt holes and penetrations through fascia and/or walls to be injected with sealant to prevent water penetration.
- .3 Horizontal and Vertical Bars: Set in concrete as per plans and details.
- .4 Handrails. Surface mount to concrete as per plans.
- .5 Bollards:

- .1 Anchor in concrete with pipe sleeves preset and anchored into concrete. Fill space between bollard and sleeve solidly with nonshrink, nonmetallic grout.
- .2 Anchor in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.
- .3 Anchor to existing construction with post-installed anchors and bolts. Provide four (4) 19 mm (3/4 in.) anchors at each bollard, embedded at least 100 mm (4 in.) in existing concrete.
- .4 Fill bollards with concrete. Mound top surface.
- .5 Hot-dipped-galvanize bollards.
- .6 Guardrails:
  - .1 Anchor railings to structure in accordance with reviewed Shop Drawings.
  - .2 Install railings to manufacturer's instructions. Install components plumb and level, accurately fitted, free from distortion or defects.
  - .3 Field weld anchors as indicated on Shop Drawings. Touch-up welds with primer. Grind welds smooth.
  - .4 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
  - .5 Assemble with spigots and sleeves to accommodate tight joints and secure installation.
  - .6 Glaze in accordance with manufacturer's instructions.
- .7 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- .8 Field weld components indicated on shop drawings.
- .9 Perform field welding in accordance with CSA requirements.
- .10 Obtain approval prior to site cutting or adjusting not scheduled.
- .11 After erection, prime welds, abrasions, and surfaces (not shop primed or galvanized), except surfaces to be in contact with concrete.
- .12 All bolt holes and penetrations through fascia and / or walls shall be injected with sealant to prevent water penetration.

### 3.6 SCHEDULE – STEEL

- .1 The following Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
  - .1 All handrails to be Stainless Steel.
  - .2 Exterior metal handrails.
  - .3 Stair handrails & guardrails.
  - .4 Steel handrails and guardrails.
  - .5 Bollards: Schedule 40 Steel pipe, concrete filled, crowned cap, as indicated. Hot-dipped-galvanize, and paint to Section 09 99 00: Colour to be selected by Consultant.
  - .6 Pipe Guards: 75mm x 75mm x 8mm (3 in. x 3 in. x 5/16 in.) steel angles, extending from floor to 1100mm (42 in.) above floor, with 10mm (3/8 in.) steel

base plates for bolting to floor. Provide at least two vertical angles at each location. Connect tops of angles and anchor to wall or column with 6mm x 50mm (1/4 in. x 2 in.) steel strap braces welded to angles and bolted to wall.

### **3.7 SITE MAINTENANCE / CLEAN UP**

- .1 The job site shall be kept in a neat, clean, and orderly condition at all times during the installation process.
- .2 Erection/installation of all miscellaneous metal shall be continuous so that the amount of exposed/unprotected/incomplete work at the end of each workday is minimized. Any unsafe conditions created by work of this Section shall be barricaded and marked with high visibility marking tape to current Worker's Compensation Board requirements.
- .3 Any damage to paving, planting or any other site element due to work of this Section shall be immediately repaired at the Contractor's expense to satisfaction of Consultant.
- .4 Remove and dispose of all surplus material, excess excavated materials, trash, debris, residue, and waste material from the work of this Section as per Section 01 35 43 – Environmental Procedures and local code.

**END OF SECTION**

## **Section 07 46 19 CORRUGATED METAL**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide labour and materials for corrugated profile metal cladding, sub girts and accessories as indicated in Drawings and as specified.

#### **1.3 RELATED SECTIONS**

- .1 05 50 00 – Metal Fabrications
- .2 07 62 00 – Sheet Metal Flashing and Trim.

#### **1.4 REFERENCES**

- .1 AAMA 2605-05 - Voluntary Specification, Performance requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .2 AAMA 2604 - Voluntary Specification, Performance requirements and Test Procedures for High Performing Organic Coatings on Aluminum Extrusions and Panels.
- .3 AAMA 2603 - Voluntary Specification, Performance requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- .4 ASME B18.6.3, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .5 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .6 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .7 ASTM D2369-10, Test Method for Volatile Content of Coatings.
- .8 ASTM D2832, Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .9 CSA B111, Wire Nails, Spikes and Staples.
- .10 CAN/ULC S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .11 CAN/ULC S114, Standard Test Method for determination of non-combustibility in building materials
- .12 UL 2761 Sealants and Caulking Compounds
- .13 British Columbia Building Code – 2024.

## **1.5 PERFORMANCE REQUIREMENTS**

- .1 Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
- .2 Movement: Accommodate movement within system without damage to components or movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- .3 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

## **1.6 DESIGN REQUIREMENTS**

- .1 Deflection of the wall system is not to exceed 1/180th of the span for the wind load based on serviceability limit states.
- .2 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
- .3 Design expansion joints to accommodate movement in cladding and between cladding and structure to prevent permanent distortion or damage to the cladding.
- .4 Maximum variation from plane or location shown on shop drawings: 20 mm/10 m (3/4 inch/30 feet).
- .5 Maximum offset from true alignment between two adjacent members abutting end to end in line: 1 mm (0.04 inches).

## **1.7 SUBMITTALS**

- .1 Submittals to be in accordance with Section 01 33 00, Submittal Procedures.
- .2 Product Data: Manufacturer's data sheets on each product to be used, including:
  - .1 Preparation instructions and recommendations.
  - .2 Storage and handling requirements and recommendations.
  - .3 Installation methods.
- .3 Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- .4 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- .5 Verification Samples: For each finish product specified, two samples, minimum size 2 inches (51 mm) by 3-1/2 inches (89 mm), representing actual product, color, and gloss.
- .6 Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- .7 Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic cleaning and maintenance of components.

## **1.8 QUALITY ASSURANCE**

- .1 Manufacturer of wall system, and installer shall demonstrate at least five-years' experience in projects similar in scope.

- .2 This section establishes the standard of quality required for the complete metal wall system. Proposed substitutions must meet this standard, and will be considered as follows:
  - .1 A written request for approval of a substitution is received at least ten (10) days prior to tender closing.
  - .2 The request includes a complete item-by-item description comparing the proposed substitution to the specified system, together with manufacturer's literature, samples, test data, engineering standards and performance evaluation indicating comparable standards to those specified.

## **1.9 STORAGE AND HANDLING**

- .1 Package and store products under cover in manufacturer's unopened packaging until ready for transport and installation.
- .2 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- .3 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- .4 Prevent contact with materials capable of causing discoloration or staining.

## **1.10 WARRANTY**

- .1 Provide a manufacturer's written warranty: Furnish panel manufacturer's written warranty covering failure of factory-applied exterior finish within the warranty period. Warranty period for finish 20 years after the date of Substantial Completion. The values below are based on normal environments and exclude any aggressive atmospheric conditions.

## **Part 2 Products**

### **2.1 COLOUR**

- .1 Prefinished cladding colour as per finish schedule from the manufacturer's entire colour range. Contractor to include for 2 colours as per exterior finish schedule.

### **2.2 ACCESSORIES**

- .1 Flashing: In accordance with Section 07 62 00 – Sheet Metal Flashing and Trim. Material to match cladding in exposed locations, galvanized material in concealed locations. Custom fabricated to suit architectural details, as required. Use preformed corner pieces only. Double back exposed edges.
- .2 Closures: Metal closures to suit profiles selected, to manufacturer's recommendations.
- .3 Sealants:
  - .1 Concealed: Tape or compound, non-skinning, non-drying, butyl rubber.
  - .2 Exposed: One part silicone to CGSB CAN2-19.13

### **2.3 FABRICATION**

- .1 Fabricate all components of the system in the factory, ready for field installation.
- .2 Provide metal liner and cladding and all accessories in longest practicable length to minimize field lapping of joints.



## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Examine work of other Sections upon which work of this Section depends.
- .2 Report all discrepancies to consultant before beginning work on the roof system.

### **3.2 INSTALLATION**

- .1 Metal Roofing System
  - .1 Standing seams shall incorporate a continuous engineered interlocking connection with concealed anchor clips that prevents the entrance of water passage (select for engineered snap-together panels). Or, standing seams shall incorporate a continuous mechanically seamed connection with concealed anchor clips that prevents the entrance of water passage (select for mechanically seamed panels).
  - .2 Standing seams shall contain factory injected non-curing sealant that runs continuously throughout the panel length as job conditions dictate.
  - .3 Panel clips shall be as recommended by the manufacturer to meet the performance criteria of this specification.
  - .4 All exposed adjacent flashing shall be of the same material and finish as the roof panels.
  - .5 Fasteners:
    - .1 Exposed screw fasteners shall be 300 series alloy stainless steel with integrally bonded neoprene washers or Zinc Aluminum Cast head covers with integral neoprene gaskets.
    - .2 Exposed pop rivets shall be stainless steel, rivet and mandrel, self plugging type #44 - 1/8" diameter 1/4" grip range minimum. Exposed pop rivets shall be painted to match the metal roof system.
    - .3 Concealed fasteners for anchor clips shall be # 10-13- 1ll or # 10-16 – 1ll long pancake head #2 Phillips drive screw as required to meet the performance criteria in this specification.
    - .4 Concealed fasteners for flashing attachment shall be # 10-13- 1ll or # 10-16- 1ll long truss head #2 Phillips drive screw as required to meet the performance criteria in this specification.
    - .5 There shall be no exposed fasteners except to fasten flashing at fixing points, or for panel attachment as dictated by warranty requirements for longitudinal thermal expansion and contraction, or as indicated on the shop drawings.
  - .6 Closures:
    - .1 Hip and ridge closures shall be factory fabricated from similar material to the roof panels. Hip and ridge closures shall be field cut to fit properly between the panel seams.
  - .7 Sealant:
    - .1 Factory-applied seam sealant shall be non-curing butyl designed for metal to metal connection in concealed joints, if specified.

- .2 Field applied sealant and/or butyl tape shall be as recommended by the manufacturer of the metal roof system.
- .8 Underlayment:
  - .1 Install approved polypropylene sheet material in 10 square rolls equal to the product listed, applied in shingle-like application in continuous coverage from eave to ridge per roof area with approved mechanical attachment procedures. See —Part 3—Execution.
  - .2 Consult DMI for self-adhering ice and water underlayment approval for use in critical areas such as valleys, aprons, rakes, rake walls, and penetrations, particularly as they apply to watertight warranty requirements. See —Part 3-- Execution
- .2 Flashing:
  - .1 Install starter flashing, drip and other flashing, and corners, edgings, window and door flashing as shown on the drawings.
- .3 Exterior Cladding:
  - .1 Install exterior cladding {and soffit} in accordance with manufacturer's standard installation procedures, providing proper laps and detailing to ensure a weathertight face.
  - .2 Install finishing flashing and cap flashing.
- .4 Sealants:
  - .1 Install sealants at junctions with adjoining work, and where shown on the drawings, in accordance with Section 07 92 00.

### **3.3 FABRICATION**

.1

### **3.4 CLEAN-UP**

- .1 Clean exposed panel surfaces in accordance with manufacturer's instructions.
- .2 Repair and touch up with colour matching high grade enamel minor surface damage, only where permitted by the Consultant and only where appearance after touch-up is acceptable to Consultant.
- .3 Replace damaged panels and components that, in opinion of the Architect, cannot be satisfactorily repaired.

**END OF SECTION**

## **Section 07 62 00**

### **SHEET METAL FLASHING AND TRIM**

#### **Part 1 General**

##### **1.1 DOCUMENTS**

- .1 This Section of the specifications forms part of the contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

##### **1.2 SUMMARY**

- .1 Provide flashing, counter flashings and sheet metal work as indicated and as specified.
- .2 Provide flashings at vertical and horizontal junctions and perimeters to ensure integrity of building materials.
- .3 Provide prefinished aluminum flashing and sheet metal work as indicated and as specified.
- .4 Provide flashing for roofing work including fascias and parapet copings.
- .5 Provide windclips under cap flashings.
- .6 Provide rainwater leaders and overflow scuppers as indicated and specified.
- .7 Provide flashing and trim not supplied by other trades.

##### **1.3 RELATED WORK**

- .1 07 46 00 - Corrugated Metal Cladding
- .2 07 71 23 – Manufactured Gutters and Downspouts.
- .3 09 90 00 - Painting and Coating.

##### **1.4 REFERENCES**

- .1 Refer to latest edition at time of tender unless otherwise specified.
- .2 ASTM A653/A653M-19a Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed by the Hot Dip Process.)
- .3 ASTM A792/A792M-10(2015) Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .4 ASTM B32-08(2014) Standard Specification for Solder Metal.
- .5 ASTM B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .6 ASTM B370-12(2019) Standard Specification for Copper Sheet and Strip for Building Construction.
- .7 ASTM D1187-97(2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- .8 ASTM D3019-17 Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered.
- .9 Roofing Contractors Association of British Columbia (RCABC) Roofing Manual

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- .10 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Inc., Architectural Sheet Metal Manual.
- .11 British Columbia Building Code - 2024.

## 1.5 SUBMITTALS

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Submit shop drawings for metal flashings and soffits to clearly indicate bending, folding, jointing, fastening and installation details.

## 1.6 QUALITY ASSURANCE

- .1 Conform to SMACNA requirements specified and detailed in Architectural Sheet Metal Manual for all other flashing and sheet metal requirements.
- .2 Use experienced installers.

## 1.7 DESIGN REQUIREMENTS

- .1 Minimum material gauges and weights shall be in accordance with British Columbia Building Code, RCABC and SMACNA requirements.
- .2 Ensure minimum size for overflow scuppers is in accordance with local Building and Plumbing Code requirements for local rain load and maximum permitted hydraulic loads.

## 1.8 DELIVERY/STORAGE

- .1 Store off ground and under cover in a dry, well-ventilated enclosure.
- .2 Stack pre-formed material in manner to prevent twisting, bending and rubbing.
- .3 Provide protection for pre-coated surfaces.
- .4 Prevent contact of dissimilar metals during storage. Protect from acids, flux, and other corrosive materials and elements.

## Part 2 Products

### 2.1 MATERIALS

- .1 Metal products shall have a minimum 80% recycled content, minimum 15% post-consumer recycled content.
- .2 Aluminum/Zinc Prefinished Stock: AZM150 (AZ50) medium duty aluminum zinc (Galvalume) coating to ASTM A792/A792M SS Grade 33, clean of mill oils, chemicals and residue.
  - .1 Surface: Smooth, flat.
  - .2 General Flashing: 0.64mm (0.0252in./ 24 ga) minimum thick. Thickness tolerance as per ASTM A924/924M +/- 0.08mm (0.003") for sheet widths not exceeding 1500mm (60").
  - .3 Exposed Finish: pre-painted with a two coat thermoset system (primer and topcoat) of silicone modified polyester (SMP) with nominal dry film thickness of 1.0 + 0.2 mil, colour as selected by Consultant.
  - .4 Concealed Sheet Finish: baked on neutral coloured primer coat having a minimum dry film thickness of 0.06mm (0.25 mil)

- .3 Prefinished Aluminum: to ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required. Max. sheet length 3.04m (10 ft.) x 1200mm (48 in.).
  - .1 Surface: Smooth, flat.
  - .2 General Flashing: 1.27mm (0.050 in.) minimum thick
  - .3 Base Flashing: Aluminum: 1.02mm (0.040 in.) minimum thick.
  - .4 Counterflashing: Aluminum: 0.81mm (0.032 in.) minimum thick.
  - .5 Flashing Receivers: Aluminum: 0.81mm (0.032 in.) minimum thick.
  - .6 Exposed Finish: Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Colours to match adjacent metal panel construction where applicable.
  - .7 Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013mm).
- .4 Galvanized Steel Sheet: commercial quality sheet to ASTM A653/A653M, with Z275 or G90 designation zinc coating.
  - .1 General: 0.64mm (0.0252in./ 24 ga) minimum thick. Thickness tolerance as per ASTM A924/924M +/- 0.08mm (0.003") for sheet widths not exceeding 1500mm (60").
- .5 Pre-painted Galvanized Steel: commercial quality to ASTM A653/A653M with Z275 zinc coating pre-painted with baked on enamel with colours of proven durability for exterior exposure, to CSSBI Technical Bulletin No. 7, 5000 series.
- .6 Overflow Scuppers: 0.55 mm thick specified by mechanical engineer. Weld apron to down pipe in perfectly watertight seam. Solder in conformance with ASTM B32 and ASTM B370.
  - .1 Clamping Ring: Stainless steel or cast aluminum, with mechanically-adjustable screws to ensure secure contact with down pipe.
- .7 Material Gauges: SMACNA and design criteria requirements to gauges indicated. Provide heavier gauge where oil canning may occur.

## 2.2 ACCESSORIES

- .1 Clips: Continuous concealed clips, 2 ga thicker than flashings.
- .2 Fasteners: corrosion resistant to CSA B111 (hot dipped galvanized or aluminum), same as substrate sheet metal and compatible with material being fastened with respect to galvanic reaction. Length and thickness to meet British Columbia Building Code requirements and reference standards.
- .3 Washers: of same material as sheet metal with resilient (rubber) packings as required.
- .4 Plastic Cement: compatible with roofing membranes.
- .5 Isolation Coating: alkali resistant bituminous paint to ASTM D1187.
- .6 Sealants: Provide sealants in accordance with Section 07 92 00 Joint Sealants.

- .7 Cleats: minimum 50mm (2 in.) wide of same material temper and thickness as sheet metal being secured.
- .8 Solder: to ASTM B370 and ASTM B32
- .9 Flux: commercial quality as recommended by sheet metal manufacturer.
- .10 Flashing Nails: #12 hot dipped zinc coated, annular ringed.
- .11 Sheet Metal Screws: Cadmium plated, self tapping, pan head.
- .12 Lap Cement: to ASTM D3019.
- .13 Sealing Compound: Refer to Section 07 92 00.
- .14 Flashing Anchor Clips: 0.80 mm thick galvanized steel.
- .15 Material Gauges: SMACNA and design criteria requirements except minimum gauge shall be 0.45mm (0.018 in. / 26 gauge) unless indicated otherwise. Provide heavier gauge where oil canning may occur.
- .16 Flashing Nails: to match material to be fastened, annular ringed.
- .17 Sheet Metal Screws: Cadmium plated, self tapping, pan head. Paint heads to match flashing where exposed.
- .18 Sealants: Type 1, neutral cure silicone base, as specified in Section 07 92 00 Joint Sealants.
- .19 Isolation coating: alkali resistant bituminous paint.
- .20 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .21 Drainage Chain: heavy galvanized 38mm to 50mm chain link anchored to scupper and loosely at grade.

## **2.3 FABRICATION**

- .1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .2 Back paint sheet metal with bituminous paint on surface in contact with concrete, masonry, cementitious materials or dissimilar metal.

## **2.4 FABRICATION, FLASHING**

- .1 Maximum Joint Spacing:
  - .1 Parapet Face Flashings: 1200 mm.
  - .2 Cap Flashing 300 mm and Greater in Width: 1200 mm.
  - .3 All Other Flashings: 2400 mm.
- .2 Construct flashing joints to allow for flashing movement, using flat "S" lock seams.
- .3 Maintain minimum of 22 mm lap at all joints. Provide 25 mm anchor projection of "S" locks.
- .4 At inside and outside corners, mitre the joint, and use upstanding seams, 25 mm minimum height and 22 mm minimum lap.
- .5 Maintain minimum 1:5 slope on horizontal surfaces of flashings, parapets and control joints.

- .6 Hem exposed edges on underside of all flashings.
- .7 Fabricate cap flashing to have a drip leg minimum 110 mm high.
- .8 Fabricate cap and counter flashings to lap 100 mm over base flashings.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Examine areas to receive sheet metal, flashing and trim with Installer present.
- .2 Correct unsatisfactory conditions.
- .3 Start of work indicates acceptance of substrates as suitable for satisfactory installation.

#### **3.2 INSTALLATION OF FLASHINGS**

- .1 Provide high temp underlayment under sheet metal in accordance with SMACNA requirements, secured in place with joints lapped a minimum of 100mm (4 in.).
- .2 Install flashing and sheet metal in accordance with SMACNA requirements.
- .3 All metal flashings incorporated into the roofing must be installed to RCABC guarantee standards and standard RCABC flashing details. Form flashings square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance. Ensure that wide girth flashings are adequately sloped to the inside of the roof area and do not pond water.
- .4 Use concealed in-seam or clip-type fasteners unless indicated otherwise.
- .5 Do not fasten metal flashings through top surfaces. Where top fastening is required due to specific job site conditions use high temp self-adhering membrane on underside of flashing and appropriate colour matched screw type fasteners with neoprene washers. Nails are not acceptable.
- .6 Join flashing using standing seam on "S" lock along continuous lengths, and standing seams with corners mitred and end joints locked at corners. Joints to be caulked watertight. Lap seams are not acceptable.
- .7 Counterflash bituminous flashings at intersections of roof and vertical surfaces and curbs.
- .8 Install surface mounted reglets as indicated, true and level and caulk joint.
- .9 Insert metal flashing into reglets or under cap flashing as detailed to form a weathertight junction.
- .10 Turn top edge of flashing into recessed reglet a minimum of 25mm (1 in.), wedge securely into joint and caulk.
- .11 On cant and parapet wall details, where roofing membrane is extended over to exterior finish, completely cover with metal flashing. High parapet wall that are completely flashed with metal on interior side are to be under flashed with membrane. Refer to Section 07 25 00 Weather Barriers.
- .12 Install membrane flashing, sloped to drain, at base of cavity walls and where cavity is interrupted by horizontal members or supports. Turn flashing up the backup wall a minimum of 203 mm (8"). Form flashing "dams" at lintels, sills and at wall ends to prevent water from travelling horizontally past the flashing ends. Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall. Install a width of sheet metal flashing in horizontal joints to extend sufficiently

beyond the outer face of the wall to prevent staining from drainage. Membrane flashing must lap over top of metal flashing within mortar joint.

**END OF SECTION**



## **Section 07 71 23 MANUFACTURED GUTTERS & DOWNSPOUTS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide manufactured gutters and downspouts with accessories for a complete installation as indicated on the drawings and as specified.
- .2 Downspouts that terminate at sloped roofs shall have the downspouts continued down and over the roof to drain directly into the eaves trough/gutters.
- .3 Downspouts shall be capped where they enter the storm drain, at grade level, with a metal cap finished to match downspouts. Secure the cap to the drain with sheet metal screws. Where storm drains do not exist, terminate downspouts on a dedicated splash pad.

#### **1.3 RELATED SECTIONS**

- .1 07 46 19 - Corrugated Metal Cladding
- .2 07 62 00 - Sheet Metal Flashing and Trim.
- .3 09 90 00 – Painting.

#### **1.4 REFERENCES**

- .1 Refer to latest edition at time of tender unless otherwise specified.
- .2 ASTM A370-19e1 Test Methods and Definitions for Mechanical Testing of Steel Products.
- .3 ASTM A568/A568M-19a Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements.
- .4 ASTM A635/A635M-15 Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements.
- .5 ASTM A653/A653M-19a Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed by the Hot Dip Process.)
- .6 ASTM A792/A792M-10(2015) Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .7 ASTM A924-19 Standard Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
- .8 ASTM A941-18 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys.

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- .9 ASTM B370-12(2019) Standard Specification for Copper Sheet and Strip for Building Construction.
- .10 ASTM E18-19 Test Methods for Rockwell Hardness of Metallic Materials.
- .11 ANSI/SPRI ES-1-2017 Wind Design Standard for Edge Systems Used with Low-Slope Roofing Systems.
- .12 Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Inc., Architectural Sheet Metal Manual.
- .13 British Columbia Building Code – 2024.

## **1.5 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedure.
- .2 Product Data: Provide data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.
- .3 Samples: Provide nominal 3 x 5 inch sample of each color indicated for gutters, downspouts and accessories.
- .4 Submit manufacturer's installation instructions including special installation criteria, interface with adjacent components.

## **1.6 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: Manufacturer shall have a minimum of five (5) years experience in the production of sheet metal gutters and downspouts.
- .2 Fabricator Qualifications: Shall be approved by manufacturer for fabrication of gutters and downspouts.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- .2 Storage: Store materials in clean, dry area in accordance with manufacturer's instructions.
- .3 Handling: Protect materials during handling and installation to prevent damage.

## **1.8 WARRANTY**

- .1 Manufacturing Defects: Standard form in which manufacturer agrees to repair or replace items that fail by blistering, checks, crazes, flakes, peels or weathers unevenly due to a defect in manufacturing within two (2) warranty period from date of original installation.
- .2 Installer to provide two (2) year warranty covering installation and workmanship.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Downspouts:
  - .1 Zinc Coated Steel with painted finish.
  - .1 Downspouts shall be a maximum section of 10'.

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- .2 Downspouts shall be round in shape and have a min 5" diameter with a connect via male-to-female friction.

- .2 Custom Gutters:

- .1 Custom steel gutters as indicated & detailed on drawings.

## 2.2 ACCESSORIES

- .1 Custom Gutters:

- .1 Custom steel gutters as indicated & detailed on drawings.

- .2 Downspouts:

- .1 Downspout Support:

- .1 Exposed strap.
    - .2 Color: As selected from manufacturer's full color line.

- .2 Miscellaneous downspout components:

- .1 Provide all necessary elbows, downspout offset sections, and pop rivets as required for a complete installation. All miscellaneous components shall match downspouts.

- .3 Fasteners:

- .1 Fasteners of sufficient length to penetrate minimum 1 inch into substrate.

- .3 Flashing:

- .1 Flashing: Provide flashing complying with Section 07 62 00, Sheet Metal Flashing and Trim at roof apron, fascia apron, and where indicated.

- .4 Sealants: Tripolymer, single component sealant as recommended by manufacturer at gutter joints.

- .5 Downspout Strainer: Aluminum wire-ball downspout strainer.

- .6 Splash Pans: Fabricate from the following. Size and shape as indicated on Drawings.

- .1 Aluminum: 0.040 inch thick.

## 2.3 FINISH

- .1 Exterior Coating:

- .1 Standard Coating; Kynar 500 or Hylar 5000 applied to exposed side.
  - .2 Color: As selected from manufacturer's standard color line.

- .2 Interior coating: Manufacturer's standard primer wash coat.

## 2.4 FABRICATION

- .1 Gutters shall be minimum 0.6mm thickness for all 5" and 6" gutters and 0.7mm for 7.5" gutters.

- .2 The gutter shall have a rolled front bead of not less than 0.67 mm for 5" and 6" gutters and 0.87" for 7.5" gutters.

- .3 Downspouts shall have a minimum thickness of 0.6mm.

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- .4 Hangers shall be 5mm in thickness and minimum 25mm wide for 5" and 6" and 5mm thick and 30mm wide for 7.5" gutters with a profile to match gutter.
- .5 All gutters, downspouts and accessories shall be constructed from steel sheet containing a layer of G90 galvanization, a passivation layer, a primer coating and a top coating on both sides.
- .6 Gutter connectors shall have a factory installed watertight EPDM seal allowing for thermal movement of the gutter.
- .7 End caps for 5" and 6" gutters shall have a factory installed watertight EPDM seal and attach using friction.
- .8 Inside and outside corner miters will be stamped out of a single piece of metal with finish and profile compatible with the gutter. Manufacturer's gutter hanger's type shall be chosen from by the Consultant.
- .9 Downspouts and elbows shall be seamed.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 All areas of rain drainage system installation shall be examined for any conditions that may be detrimental to proper installation.
- .2 Start of installation means acceptance of existing conditions.

#### **3.2 INSTALLATION**

- .1 Refer to Manufacturer's Guide for proper installation methods.
- .2 Gutters shall be installed in maximum lengths as possible.
- .3 Gutters shall have a slope to downspout of 1" per 32' of run.
- .4 Downspouts shall be installed plum and in accordance to SMACNA's "Architectural Sheet Metal Manual".
- .5 Do not perforate downspout or connectors or elbow with screws, excluding ribbed elbow at foot of downspout.
- .6 Gutters and downspouts shall be cut by either hacksaw or approved low frequency method.
- .7 Connections and fittings shall be snug and watertight.

#### **3.3 CLEANUP**

- .1 Packing material and debris shall be removed and recycled.
- .2 Any damage to gutters or downspouts shall be repaired, including touch up paint to small scratches to finish coat.

#### **3.4 PROTECTION**

- .1 The installer shall be responsible for protecting materials and work before and during the installation process.
- .2 Upon completion of installation the general contractor shall be responsible for protecting the work from damage during the remaining construction.

**END OF SECTION**

## **Section 09 90 00 PAINTING AND COATING**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide labor, materials, tools and other equipment, services and supervision required to complete all interior and exterior (including above roof) painting and decorating work as indicated and to the full extent of the drawings and specifications.
- .2 Work under this contract shall also include, but not necessarily be limited to:
  - .1 Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to the limits defined under MPI preparation requirements.
  - .2 Specific pre-treatments noted herein or specified in the MPI Architectural Painting Specification Manual
  - .3 Painting of all semi-concealed areas.
  - .4 Provision of safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile / flammable materials are being used.
- .3 Provide a non-slip painted surface on exterior stairway landings and treads in accordance with the British Columbia Building Code. Ensure stair nosings are of a contrasting colour to the remainder of the stair tread.
- .4 Prepare surface of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, making good surfaces and areas, pre-treatment, priming and back priming to the extent / limits defined under MPI preparation requirements.
- .5 Surface preparation to receive painting and finishing is not included under this section of Work, except for priming and back-priming and specific pre-treatments noted herein or specified in the Master Painters Institute (MPI) Painting Specification Manual.
- .6 Refer to drawings and Schedules for type, location and extent of finishes required, and include all touch-ups and field painting necessary to complete Work shown, scheduled or specified. In general, provide complete painting systems for exterior and public interior spaces.
- .7 Coordinate the work of this section closely with the work of Section 05 50 00 Metal Fabrications to ensure compatibility of primers and finish systems.

#### **1.3 REFERENCE STANDARDS**

- .1 Master Painters Institute (MPI) Architectural Painting Specification Manual.

#### 1.4 SYSTEM DESCRIPTION

- .1 Paint exposed surfaces in new construction wherein colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural.
  - .1 Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.
  - .2 If color or finish is not designated, Consultant will select from standard colors or finishes available.
  - .3 Painting includes field painting exposed bare and covered, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
  - .4 The following items are not to be painted: finished metal surfaces, concealed surfaces, operating parts, and labels.
- .2 Labels: Do not paint over CSA, Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- .3 Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- .4 Notify Consultant of problems anticipated using the materials specified.

#### 1.5 SUBMITTALS

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Product Data:
  - .1 Provide an itemized list complete with manufacturer, paint type and colour coding for all colours used for Owner's later use in maintenance.
  - .2 Submit two (2) sets of Material Safety Data Sheets (MSDS) prior to commencement of Work for review and for posting at job site as required.
- .3 Submit consent of surety with Bid Submission as proof of ability to supply a 100% two (2) year Maintenance Bond, if an **MPI** Accredited Quality Assurance Association's guarantee option is not used.
- .4 Manufacturer's Certification: Submit written confirmation from the product manufacturer, that product is approved for use in proposed application as well as laboratory tests or data verifying product compliance with criteria specified.
- .5 If requested, submit an invoice list of all painting materials ordered for project work to Paint Inspection Agency indicating manufacturer, types and quantities for verification and compliance with specification and design requirements.
- .6 Provide written confirmation from steel fabricators / suppliers of specific surface preparation procedures and primers used for fabricated steel items to ascertain compatible finish coat materials to be used before painting any such work.
- .7 Samples and Mock-Ups:
  - .1 When requested by the Consultant or Paint Inspection Agency, provide duplicate minimum 300 mm (12") square samples of surfaces or acceptable facsimiles requested painted with specified paint or coating in colors, gloss / sheen and textures required to MPI Painting Manual standards for review and approval.

When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

- .2 When requested by the Consultant or Paint Inspection Agency, prepare and paint designated surface, area, room or item (in each color scheme) to requirements specified herein, with specified paint or coating showing selected colors, gloss / sheen, textures and workmanship to MPI Painting Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

## 1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: A firm experienced in successfully producing work similar to that indicated for this Project, with a record of successful in-service performance, and with sufficient production capacity to produce required units without causing delay in the Work.
- .2 Installer Qualifications: Paint Contractor shall have a minimum of five (5) years proven satisfactory experience. Paint Contractor shall maintain a qualified crew of painters throughout duration of the work who shall be qualified to fully satisfy the requirements of this specification.
- .3 Only qualified journeypersons who have a "Tradesperson Qualification Certificate of Proficiency" shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .4 Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual (hereafter referred to as MPI Painting Specification Manual).
- .5 All paint manufacturers and products used shall be as listed under the "Approved Products" section of the MPI Architectural Painting Specification Manual. Refer to Approved products List on line at [www.paintinfo.com](http://www.paintinfo.com), and paint E (VOC) rating.
- .6 Materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .7 Painting and decorating work will be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. Notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .8 Surfaces requiring painting will be inspected by the Paint Inspection Agency who will notify Consultant and General Contractor in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.
- .9 Provide written confirmation of the specific surface preparation procedures and primers used for fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

## 1.7 REGULATORY REQUIREMENTS

- .1 Conform to the latest edition of Industrial Health and Safety Regulations issued by applicable authorities having jurisdiction in regard to site safety (ladders, scaffolding, ventilation, etc.).

- .2 Conform to requirements of local authorities having jurisdiction in regard to the storage, mixing, application and disposal of all paint and related waste materials. Refer to Waste Management and Disposal.
- .3 Notify the Paint Inspection Agency on award of contract and make application for assignment of an Inspector using appropriate forms supplied by the Agency as well as provide a copy of the project painting specification, drawings, color schedule and list of proposed materials for review purposes prior to commencement of work.
- .4 Fully cooperate at all times with the requirements of the Paint Inspection Agency in the performance of their duties, including providing access and assistance as required to complete inspection work.

## **1.8 PROJECT REQUIREMENTS**

- .1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting or decorating work when the ambient air and substrate temperatures are below 50°F (10°C).
- .2 Perform no exterior painting work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided. Where required, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
- .3 Do not perform painting or decorating work when the relative humidity is above 85% or when the dew point is less than 5°F (3°C) variance between the air / surface temperature.
- .4 Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
- .5 Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
  - .1 12% for concrete and masonry (clay and concrete brick/block).
- .6 Conduct all moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
- .7 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .8 Recycle and dispose of paint and painting products to regulations of applicable authorities having jurisdiction in accordance with requirements stated in Section 01 74 19 Construction Waste Management.

## **1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver all painting materials in sealed, original labeled containers bearing manufacturer's name, brand name, type of paint or coating and color designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.
- .2 Store all paint materials in original labeled containers in a secure (lockable), dry, heated and well ventilated single designated area meeting the minimum requirements of both paint manufacturer and authorities having jurisdiction and at a minimum ambient temperature of 45-degree F (7 degree C). Only material used on this project to be stored on site.



- .3 Where toxic and/or volatile / explosive / flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings (e.g. no smoking) as required.
- .4 Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect the environment from hazard spills. Materials that constitute a fire hazard (paints, solvents, drop clothes, etc.) shall be stored in suitable closed and rated containers and removed from the site on a daily basis.
- .5 Comply with requirements of authorities having jurisdiction, in regard to the use, handling, storage and disposal of hazardous materials.

#### **1.10 SCHEDULING**

- .1 Schedule painting operations to prevent disruption of and by other trades.

#### **1.11 MAINTENANCE MATERIALS**

- .1 At project completion provide 4 liters (1 gallon) of each type and color of paint from same production run (batch mix) used in unopened cans, properly labeled and identified for Owner's later use in maintenance. Store where directed.

#### **1.12 WASTE MANAGEMENT AND DISPOSAL**

- .1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Obtain information on these controls from applicable Provincial and Local government departments having jurisdiction.
- .2 All waste materials shall be separated and recycled. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
  - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
  - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - .3 Return solvent and oil-soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
  - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
  - .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .5 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

- .6 No paint, sundries or other debris caused during painting operations shall be disposed into City of Coquitlam disposal units.

### 1.13 GUARANTEE

- .1 Furnish either the local MPI Accredited Quality Assurance Association's two (2) year guarantee, or, alternatively, a 100% two (2) year Maintenance Bond - both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements.
- .2 All painting and decorating work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the local MPI Accredited Quality Assurance Association's Paint Inspection Agency (inspector), whether using either the MPI Accredited Quality Assurance Association's guarantee, or the Maintenance Bond option. The cost for such inspections, and for either the local MPI Accredited Quality Assurance Association's Guarantee, or the Maintenance Bond, shall be included in the Base Bid Price.
- .3 Painting and decorating Subcontractors choosing the Maintenance Bond option shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified check are not acceptable in lieu of surety consent.

## Part 2 Products

### 2.1 MATERIALS

- .1 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the MPI Painting Specification Manual. "Approved Product" listing and shall be from a single manufacturer for each system used.
- .2 Other paint materials such as linseed oil, shellac, etc. shall be the highest quality product of an approved manufacturer listed in the MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.
- .4 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc. Refer to 3.7, Field Quality Control / Standard of Acceptance requirements.
- .5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.
- .6 Slip Resistant Additive (SRA): rubber aggregate, clean/washed silica sand or ground walnut chips (interior dry areas only) for use with or as a component part of paint (usually floor / porch / stair enamel) on horizontal surfaces as required to provide slip resistance. Where site applied, material to either mixed into paint (and mixed constantly to keep material in suspension) or broadcast into first or prime coat as required.

### 2.2 EQUIPMENT

- .1 Painting and Decorating Equipment: to best trade standards for type of product and application.
- .2 Spray Painting Equipment: of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times

## 2.3 MIXING AND TINTING

- .1 Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 If required, thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

## 2.4 FINISH AND COLOURS

- .1 Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements.
- .2 Colours shall be as selected by the Consultant from a manufacturer's full range of colours. [Refer to Finish Schedule for identification and location of colors.
- .3 Where other methods are not specified (i.e. applied material or nosing) and/or in accordance with the requirements or authorities having jurisdiction at stairs providing access and exit for persons with visual impairment, slip resistant paint shall be applied to handrails and treads. Slip resistant paint shall be of a contrasting colour at tactile warning strips at stair treads and landings.

## 2.5 ENVIRONMENTALLY FRIENDLY PRODUCTS

- .1 Refer to the MPI Manual and Approved Products List. Visit [www.specifygreen.com](http://www.specifygreen.com) and [www.paintinfo.com](http://www.paintinfo.com) and select to view the products list by MPI Number or alphabetically.
- .2 The following are quoted from Master Painters Institute Inc.
  - .1 MPI Finish System: Refer to the MPI Painting Specification Manual
  - .2 MPI gloss: The gloss of a finish suggests a level of gloss (reflection of light from the surface that is independent of color) from flat to gloss or 'glossy'
    - .1 Gloss Level 1 – Matte or Flat finish.
    - .2 Gloss Level 2 – Velvet finish.
    - .3 Gloss Level 3 - Eggshell finish.
    - .4 Gloss Level 4 – Satin finish.
    - .5 Gloss Level 5 – Semi-gloss finish.
    - .6 Gloss Level 6 - Gloss finish.
    - .7 Gloss Level 7 – High Gloss finish.
  - .3 E-Range:
    - .1 These VOC (Volatile Organic Compounds) ranges are now identified numerically under the heading of "E", as these are easily converted to a specification. The options now are E3, E2, E1, E0 (outside range) or n/a (not available or verified in time for printing). E3 is the lowest VOC range, E2 the next lowest, and E1 the next lowest.

- .2 This information is only presented for comparative informational purposes. While efforts are made to ensure its accuracy, the VOC levels listed are those supplied by the manufacturer. The method of calculation is as requested under EPA Method 24.
- .4 GPS-1 and GPS-2 - MPI Green Performance™ Standards: (previously shown as an "L")
  - .1 " The MPI Green Performance™ Standard (GPS-1) requires that the manufacturer demonstrate that VOC concentrations of the product shall not exceed those listed below as determined by US Environmental Protections Agency (EPA) Reference Test Method 24 (Determination of Volatile Matter Content, Water Content, Density Volume Solids and Weight Solids of Surface Coatings) Code of Federal Regulations Title 40 Part 60, Appendix A.
  - .2 "MPI Green Performance™ Standard (GPS-2) provides for a maximum allowable limit of 50 g/L of VOCs.
  - .3 "VOCs shall be listed as g/L (grams per litre). The calculation of VOC shall exclude water and tinting colour added at point of sale.
- .3 Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

## 2.6 ALTERNATIVE AND EQUIVALENT PRODUCTS

- .1 Only products and methods specified shall be used, or such products and methods approved as equivalent. Alternative or equivalent products and methods may be used only where approved in writing by Consultant.
- .2 Submit request for approval, in duplicate, to Consultant. List specification section or drawing number and page, brand, model, and manufacturer of specified product and proposed product, with full supporting technical specifications, data, and samples and any other special requirements listed in the section.

## Part 3 Execution

### 3.1 CONDITION OF SURFACES

- .1 Prior to commencement of work of this section, thoroughly examine (and test as required) all conditions and surfaces scheduled to be painted and report in writing to the Owner any conditions or surfaces that will adversely affect work of this section.
- .2 No painting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency.
- .3 The Painting Subcontractor shall not be responsible for the condition of the substrate or for correcting defects and deficiencies in the substrate which may adversely affect the painting work except for minimal work normally performed by the Painting Subcontractor and as indicated herein. It shall always, however, be the responsibility of the Painting Subcontractor to see that surfaces are properly prepared before any paint or coating is applied.

### **3.2 PREPARATION OF SURFACES**

- .1 Prepare all surfaces in accordance with MPI Painting Specification Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.
- .2 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.
- .3 Solvent wash (SSPC SP 1) all concrete floors scheduled for coating application to remove all surface contaminants such as grease, oils and other contaminants, acid etch floor surfaces to attain a roughened surface profile.
- .4 Substrate defects shall be made good and sanded by others ready for painting particularly after the first coat of paint to include gypsum wallboard and concrete surfaces, no intermediate finish coat applications shall commence until such work has been certified as complete by the Consultant or Owners.
- .5 Confirm preparation and primer used with fabricator of structural steel items. Refer to Quality Assurance.
- .6 Galvanized surfaces shall be prepared using MPI #25 Cleaner, etching in strict accordance with manufacturers Technical data sheet.
- .7 All concrete surfaces to receive opaque coating system are to be sandblasted to achieve refer to Section 09 97 00, to include exterior and interior surface.

### **3.3 APPLICATION**

- .1 Do not paint unless substrates are acceptable and until environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.
- .2 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.
- .3 Apply paint and decorating material in a workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.
- .4 Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- .5 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .6 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .7 Unless otherwise approved by the painting inspection agency, apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results.
- .8 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .9 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.

### **3.4 FIELD QUALITY CONTROL / STANDARD OF ACCEPTANCE**

- .1 All surfaces, preparation and paint applications shall be inspected.

- .2 Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:
  - .1 Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
  - .4 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  - .5 Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- .3 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
  - .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
  - .2 Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
  - .3 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
  - .4 When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- .4 Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

### **3.5 PROTECTION**

- .1 Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .2 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

### **3.6 CLEAN-UP**

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

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- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers / strippers in accordance with the safety requirements of authorities having jurisdiction.

## **Clauses**

### **4.1 EXTERIOR SURFACES**

- .1 Paint exterior surfaces in accordance with the following MPI Painting Manual Premium Grade requirements:
  - .1 Systems modified to W.B. Alkyd shall use Cloverdale Renaissance
- .2 Asphalt Surfaces (zone/traffic marking for drive and parking areas, game lines etc)  
EXT 2.1A Latex Zone/Traffic Marking (DFT minimum 7 mil)
- .3 Concrete Vertical Surfaces: (including horizontal soffits)  
EXT 3.1A Exterior Latex (over alkali resistant primer) G3/4 Satin
- .4 Concrete Horizontal Surfaces:  
EXT 3.2 Exterior Heavy Duty Traffic Coating (BASF Sonoguard)
- .5 Structural Steel and Metal Fabrications exposed:  
EXT 5.1R W.B. Light Industrial (over high build epoxy) G5 Semi-Gloss
- .6 Galvanized Metal: (not chromate passivated)  
EXT 5.3J W.B. Light Industrial (over w.b. primer) G5 Semi-Gloss

### **4.2 FINISH / COATING SYSTEMS**

- .1 Mechanical / Electrical Equipment and Related Surfaces:
  - .1 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with color and texture to match adjacent surfaces, in the following areas:
    - .1 where exposed-to-view in all exterior areas.

**END OF SECTION**

## **Section 09 96 10 GRAFFITI RESISTANT COATINGS**

### **Part 1 General**

#### **1.1 RELATED DOCUMENTS**

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this section.

#### **1.2 SUMMARY**

- .1 Tennis Court walls exceeding a height of 0.6 metres shall be protected by an Anti-Graffiti coating.

#### **1.3 RELATED SECTIONS**

- .1 03 30 00 - Cast in Place Concrete
- .2 03 33 00 - Architectural Concrete

#### **1.4 REFERENCES**

- .1 ASTM D523 Standard Test Method for Specular Gloss.
- .2 ASTM D6578 Standard Practice for Determination of Graffiti Resistance.
- .3 ASTM D7089 Standard Practice for Determination of the Effectiveness of Anti-Graffiti Coating for Use on Concrete, Masonry and Natural Stone Surfaces by Pressure Washing.

#### **1.5 SUBMITTALS**

- .1 Submittals in accordance with 01 33 00, Submittal Procedures.
- .2 Product Data: For each coating system indicated. Include block fillers and primers.
  - .1 Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - .2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
- .3 Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.
  - .1 Architect will furnish color chips for surfaces to be color coated (if applicable).
- .4 Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
- .5 Qualification Data: For Firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owner, and other information specified.



- .6 Additional Materials: Provide sacrificial coating replacement material in quantities that will permit two additional instances of removal and reapplication of the anti-graffiti coating Product.

#### **1.6 QUALITY ASSURANCE**

- .1 Applicator Qualifications: Engage Manufacturer to provide a manufacturer-certified applicator who has completed anti-graffiti coating system applications similar in material and extent to those indicated for Project, and whose work has a record of successful in-service performance.
- .2 Source Limitations: Obtain base coatings, top coatings, and removal agents from the same manufacturer.
- .3 Mock-up: Apply alkyd-based graffiti to a 600 mm x 600 mm treated area selected by the Consultant. Demonstrate complete removal of the graffiti in the presence of the Consultant a minimum of five (5) days minimum after application. Reapply product as required to mockup location after acceptance of demonstration to achieve finished condition of this work result.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
  - .1 Name or title of material.
  - .2 Product description (generic classification or binder type).
  - .3 Manufacturer's stock number and date of manufacture.
  - .4 Contents by volume, for pigment and vehicle constituents.
  - .5 Thinning instructions.
  - .6 Application instructions.
  - .7 Color name and number.
  - .8 Handling instructions and precautions.
- .2 Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
- .3 Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

#### **1.8 PROJECT CONDITIONS**

- .1 Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 40 and 100 deg F.
- .2 Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - .1 Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

## **Part 2 Products**

### **2.1 SACRIFICIAL COATING**

- .1 Provide a waterbased, clear, non-yellowing matte finish sacrificial coating to create a protective shield against damage caused by graffiti, that can be removed with low-pressure hot water with optional cleaning solvents, and then reapplied in order to reinstate graffiti protection:
  - .1 Solids Content: minimum 30% by Volume to ASTM D2697
  - .2 Gloss Level: Level 1 (matte) to MPI Paint Standards, and to ASTM D523
  - .3 Thickness: Minimum 2 mils DFT and as recommended by Manufacturer.
  - .4 Graffiti Resistances: Cleanability Level 1 to ASTM D6578
  - .5 Colour: Clear, non-yellowing.
  - .6 Shall allow moisture vapour transmission.
  - .7 Additional Materials: Provide additional coating materials for 5 full reapplication cycles for a 36 month period after Substantial Completion.
  - .8 Acceptable suppliers and proprietary products include:
    - .1 CBR 501-AG Anti-Graffiti Coating by Broda Stains and Coatings, as supplied by CBR Products, Cordova, Vancouver BC. (604-254-3325).
    - .2 Or approved alternative.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Coordination of Work: Review other sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
- .2 If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding.
  - .1 Confirmation of the primer's suitability for expected service conditions.
  - .2 Confirmation of primer's ability to be top coated with materials specified.
- .3 Notify Consultant of anticipated problems before using the coatings specified over substrates primed by others.

### **3.2 PREPARATION**

- .1 General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of the size or weight of item, provide surface-applied protection before surface preparation and coating.
  - .1 After completing coating operation, reinstall items that were removed; use workers skilled in the trades involved.
- .2 Cleaning: Clean substrates of substances that could impair bond of coatings. Remove dirt, dust, chalking paint, mortar spatter, all loose rust, all loose mill scale, old caulking, grease, oil, release agents, curing compounds, laitance and other foreign matter including frost.

- .1 Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- .3 Surface preparation: Clean and prepare surfaces to be coated according to manufacturers written instructions for each substrate condition and as specified.
- .4 Material Preparation: Carefully mix and prepare coating materials according to the manufacturers written instructions.
  - .1 Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
  - .2 Stir materials before applying to produce a mixture of uniform density. Stir as required during application.

### 3.3 APPLICATION

- .1 General: Apply coatings according to manufacturer's written instructions.
  - .1 Use applicators and techniques best suited for the material being applied.
    - .1 Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
    - .2 Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
- .2 Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

### 3.4 FIELD QUALITY CONTROL

- .1 Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
  - .1 Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of the Construction Manager.
  - .2 Testing agency will perform appropriate tests for the following characteristics as required by Owner:
    - .1 Quantitative materials analysis.
    - .2 Absorption
    - .3 Accelerated weathering.
    - .4 Accelerated yellowness.
    - .5 Alkali and mildew resistance.
    - .6 Abrasion resistance.
    - .7 Wash ability.
  - .3 Consultant may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be

required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

- .2 Demonstration: Apply alkyd-based graffiti to a 2 ft. sq. treated area selected by the Consultant. Five (5) days minimum after application, demonstrate complete removal of the graffiti in the presence of the Consultant.

### **3.5 CLEANING**

- .1 Cleanup: At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - .1 After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

### **3.6 PROTECTION**

- .1 Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- .2 Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
- .3 At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

**END OF SECTION**

## **Section 12 93 00 SITE FURNISHINGS**

### **Part 1 General**

#### **1.1 DESCRIPTION**

- .1 Work included: Furnish all labour and materials and equipment necessary for supply and installation of benches, bike racks, trash receptacles, picnic tables.

#### **1.2 RELATED WORK**

- .1 Cast-In-Place Concrete - Section 03 30 00

#### **1.3 DELIVERY AND HANDLING**

- .1 Provide adequate protection to prevent damage of all site furnishings during delivery. Protect with manufacturer's standard protective packaging.
- .2 Provide protected storage prior to installation.
- .3 Provide all necessary facilities for handling and lifting into final location.

#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings for all items prior to manufacture, clearly showing dimensions, finishes, base details and anchor supports.

#### **1.5 TEMPLATES**

- .1 Provide all templates as required for location of fixing devices.

### **Part 2 Products**

#### **2.1 METALS**

- .1 Nails, spikes, bolts, lagscrews, nuts, and washers shall be hot-dipped galvanized or shall be an approved nonferrous type.
- .2 All connecting steel shall be medium structural steel conforming to CSA-G40.4. All connecting steel shall be hot-dipped galvanized after fabrication.
- .3 All painted metals shall be prime coated and then finished with a minimum of two (2) coats of paint.

#### **2.2 BOOT BRUSH STATION**

- .1 Supplier: Tomko Sports Systems
- .2 Product Name: Scrusher
- .3 Model: TS-SCSC
- .4 Mount: Surface Quantity: 4

#### **2.3 SPORTS BENCHES**

- .1 Supplier: Sports Systems Canada
- .2 Product Name: Permanent Inground Players Bench

- .3 Product Number: BL-IGB-21-BR
- .4 Size: 21'
- .5 Backrest: Yes
- .6 Quantity: 2

#### **2.4 SCORER'S TABLE**

- .1 Supplier: Sports Systems Canada
- .2 Product Name: Outdoor Scoring Tables
- .3 Product Number: BL-TIMERTABLE-6
- .4 Size: 6'
- .5 Quantity: 1

#### **2.5 BLEACHERS**

- .1 Supplier: Sports Systems Canada
- .2 Product Name: 5-Row Outdoor Bleachers
- .3 Product Number: BL-5TB-27DR
- .4 Size: 27'
- .5 Guardrail: Aluminum Picket Guardrail: Refer to product specifications from supplier
- .6 Quantity: 2

#### **2.6 SOCCER GOAL FULL SIZE**

- .1 Supplier: Habitat Systems
- .2 Manufacturer: Score Master
- .3 Product Number: SM-DM2400
- .4 Size: 8' x 24'
- .5 Net: Heavy Duty, 4mm, braided, 5" square mesh, white
- .6 Anchor/Teacher: Yes
- .7 Wheels: Yes, 4 Wheels per goal
- .8 Powder Coat: White
- .9 Quantity: 2

#### **2.7 FIELD HOCKEY GOAL**

- .1 Supplier: Habitat Systems
- .2 Manufacturer: Score Master
- .3 Product Number: SM-FH1200
- .4 Net: HD-NET-FH 12 Field Hockey Net, 3mm, braided, black
- .5 Anchor/Tether: Yes
- .6 Wheels: Yes – SM-FH1200-Wheels
- .7 Powder Coat: White

.8 Quantity: 2

## **2.8 LACROSSE GOAL**

.1 Supplier: Habitat Systems  
.2 Manufacturer: Score Master  
.3 Product Number: SM-L1000  
.4 Net: SM-HD-NET-L10 Heavy Duty Net, 3mm, braided, black  
.5 Powder Coat: Orange  
.6 Quantity: 2

## **2.9 WATER FOUNTAIN**

.1 Manufacturer: Elkay  
.2 Product Name: Elkay Outdoor ezH2O Bottle Filling Station Bi-Level Pedestal with Pet Station Non-Filtered Non-Refrigerated Freeze Resistant  
.3 Model: LK4420BF1UDBFRK  
.4 Optional Accessories: No  
.5 Colour: Black (BLK)  
.6 Quantity: 2

## **2.10 WASTE RECEPTACLES**

.1 Manufacturer: Wishbone  
.2 Product Name: Freedom 55  
.3 Product Number: HF-55C/HF1701 (Recycled Plastic Siding Bear Resistant)  
.4 Metal Colour: Black  
.5 Plastic Lumber: Walnut  
.6 Quantity: 3

## **2.11 TENNIS POSTS**

.1 Manufacturer: Douglas Sports  
.2 Supplier: Sports Systems Canada  
.3 Product Name: Douglas® Premier™ XS Tennis Posts, 2-7/8" OD  
.4 Product Number: 63034SS  
.5 Colour: Black  
.6 Gears: Stainless Steel  
.7 Height: 60" in length and sit 42" above court surface  
.8 Quantity: 4

## **2.12 TENNIS SLEEVES**

.1 Manufacturer: Douglas Sports  
.2 Supplier: Sports Systems Canada

- .3 Product Name: GS-24RD/AL Aluminum Ground Sleeves 24" Long for 2-7/8" OD Posts
- .4 Product Number: 63171
- .5 Quantity: 4

#### **2.13 TENNIS NET**

- .1 Manufacturer: Douglas Sports
- .2 Supplier: Sports Systems Canada
- .3 Product Name: Douglas® TN-28DM Tennis Net, 3.5mm Double Mesh Tapered
- .4 Product Number: 30060
- .5 Size: 42"x42"
- .6 Quantity: 4

#### **2.14 BOLLARD**

- .1 Manufacturer: Reliance Foundry
- .2 Product Name: Bollard Post
- .3 Product Model: R-7901
- .4 Colour: Polyester Powder coated black
- .5 Additional Item: Include two bands of white reflective tape between top ridges.
- .6 Mount Option: Removeable Receiver with Lid
- .7 Quantity: 3

#### **2.15 GOAL ANCHORS**

- .1 Supplier: KWIK GOAL
- .2 Product Name: Goal Secure Turf Anchors
- .3 Product Number: 10B5301
- .4 Quantity: 4 anchors (for 2 goals)

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 All materials and components will be subject to inspection upon arrival on site. Materials and/or components which do not meet the requirements stated herein shall be rejected and shall be removed from the site and replaced.
- .2 All materials and components shall be stored adequately and protected from damage.

#### **3.2 INSTALLATION**

- .1 All work shall be carried out in accordance with the drawings, or reviewed shop drawings, and requirements stated herein and as per manufacturer's directions.
- .2 The work shall be laid out true to line and level, plumb and true. Structural supports and members shall be accurately placed in position and securely braced to remain plumb and true until permanently fixed.



- .3 Fastening shall be done with nails, spikes, bolts, or framing anchors, as detailed. Bolt holes shall be bored 1.5 mm larger than the diameter of the bolt.
- .4 All cutting and framing where required for the installation of the work of others shall be executed as shown on the drawings.
- .5 Waste Receptacle installation: Locate as per drawings and as approved by Consultant. Install securely to concrete, as per manufacturer's specifications.

**END OF SECTION**

## **Section 31 11 00 CLEARING AND GRUBBING**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 GENERAL REQUIREMENTS**

- .1 Section 31 11 01 refers to those portions of the Works that are unique to clearing and grubbing. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the Works described herein.
- .2 The Contractor shall visit the site and establish a full understanding of the site conditions, including the types and sizes of the items to be cleared, grubbed, and stripped.
- .3 Clearing, grubbing and stripping shall consist of clearing the surface of the ground, in the designated areas, of all trees, snags, identified stumps including attached root wads, shrubs, brush, down timber, logs, vines, undergrowth, hedging, vegetative growth, heavy growth of grass and/or weeds, fences, structures, pavement, woody debris, rocks over 0.3m<sup>3</sup> in size, debris and rubbish of any nature, natural obstructions or such material which, in the opinion of the City Representative/Consultant, is unsuitable for the foundations of the structures designated to be placed over top. Clearing and Grubbing shall occur within the limits designated on the Contract drawings or as required, leaving the affected area in an appropriate condition for immediate site grading operations and shall be accomplished to the complete satisfaction of the City Representative/Consultant.

#### **1.3 RELATED SECTIONS**

- .1 31 22 00 - Rough Grading
- .2 31 22 01 - Grading & Finish Grading
- .3 31 23 00 - Excavation and Fill.

#### **1.4 REFERENCES**

- .1 Master Municipal Construction Documents (MMCD) Volume II (2019)
- .2 British Columbia Landscape Standards (current edition)
- .3 Canadian System of Soil Classification (current edition)
- .4 Canada Water Act.

#### **1.5 INTERPRETATION OF THE WORK**

- .1 The Contractor shall be fully acquainted with the existing site and shall fully understand the difficulties and restrictions attending the execution of the work under this contract. Any 'interpretations' by the Contractor of the meaning of any section of the contract drawings and specifications herein prior to submitting a tendered price shall not remove the responsibility of completing the Works as per the directions of the City Representative/Consultant, including all costs associated with the Works, should the Contractor's 'interpretation' be incorrect. To avoid Contractor 'interpretations' prior to

submitting a tendered price for the Works, the Contractor must seek clarification from the City Representative/Consultant for any items within the contract drawings and specifications that may appear to be unclear or conflicting.

## **1.6 DEFINITIONS**

- .1 Clearing consists of cutting off trees, brush, and heavy vegetative growth to a height of no more than 300mm above ground and off-site disposal of felled trees, brush and heavy vegetative growth including, all underbrush, deadwood, and surface debris.
- .2 Grubbing consists of off-site disposal all trees, snags, stumps including attached root wads, shrubs, brush, down timber, logs, vines, undergrowth, hedging, vegetative growth, heavy growth of grass and/or weeds, fences, structures, pavement, woody debris, rocks over 0.3m<sup>3</sup> in size debris and rubbish of any nature, natural obstructions, or such material to a depth of 450mm below ground level.
- .3 Rock consists of off-site disposal all individual boulders, rocks and rock fragments including igneous rock of any sort, granite, conglomerate, sandstone, or shale over 0.3m<sup>3</sup> in size that are deemed to not be retained and re-used on site.

## **1.7 SUBMITTALS**

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

## **1.8 STORAGE AND PROTECTION**

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench-marks, existing pavement, utility lines, water courses, ditches and root systems of trees, which are to remain.
  - .1 Repair damaged items to approval of City Representative / Consultant.
  - .2 Replace any trees designated to remain, if damaged, as directed by City Representative / Consultant.
- .2 Compensate the Owner for property damage, where repair or equivalent replacement is considered by the Contract Administrator to be impractical.
- .3 Valuation for damage and replacement shall be at the sole discretion of SD43 and the City Representative/Consultant. Valuation of tree damage will be based on the methods prescribed by the Council of Tree and Landscape Appraisers. The Contractor shall be responsible for the cost of this valuation, including the City Representative/Consultant and their sub-Consultants cost in preparing the valuation.
- .4 Stockpiled woody debris to be protected from fire hazards.
- .5 No blasting of rock is to proceed without written approval of the City Representative/Consultant.

## **1.9 MEASUREMENT AND PAYMENT**

- .1 Payment for all Work performed in this section will be included under payment for work involving Clearing and Grubbing and includes removal and off-site disposal of all vegetation remains, rock, boulders and rock fragments unless specifically shown otherwise as separate pay item.
- .2 Payment for all clearing and grubbing items will be based on area cleared and grubbed as shown on the Contract Drawings.

- .3 Unauthorized rock removal (i.e., rock removed prior to examination and measurement by the City Representative/Consultant) will not be classified as rock excavation
- .4 No payment will be made for removal of rock, including all subsequent remedial backfilling, in excess of limits as specified herein and limits shown on the Contract Drawings unless authorized by the City Representative/Consultant.
- .5 Payment for removal of individual boulders and rock will be made in this section for boulders or rock fragments which can be lifted by equipment available on site.
- .6 Individual boulders, rock, and rock fragments larger that can not be lifted by equipment available on site and any rock that requires breaking by drilling or blasting will be treated as 'mass rock' and will be paid for as a separate pay item.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.

## **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 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 or designated hard surfaces have been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 PREPARATION**

- .1 Inspect the Work Site and confirm with the City Representative/Consultant items designated to remain and any restrictions within or adjacent to the specified limits of Work prior to clearing and grubbing.
- .2 Locate and protect designated trees, trees adjacent to the Work, utility lines, underground services and structures as directed by the City Representative/Consultant. Preserve in operating condition active utilities traversing Work Site.
- .3 Notify utility authorities before starting clearing and grubbing operation.
- .4 The Contractor shall notify the City Representative/Consultant of any hazard trees which the City Representative/Consultant will determine removal requirements.
- .5 Commence clearing and grubbing Work in accordance with the construction schedule approved by the City Representative/Consultant.
- .6 Provide snow fencing at the Tree Boundaries and in all areas where embankment fill is to be placed adjacent to clearing as directed by the Contract Administrator.

### **3.3 TREE PROTECTION AND ACCESS RESTRICTION**

- .1 None of the following activities shall be permitted within 1.0mm of the treed area.

- .1 Passage of vehicular traffic including tracks, excavators, backhoes, forklifts, and similar vehicles including the use of grubbing buckets or blades to remove vegetation.
- .2 Storage or piling of construction material such as sand, aggregates, lumber, formwork, pipes, or similar items.
- .3 Disposal of waste materials or the piling of waste construction materials.
- .4 The location of portable toilets, generators, ancillary service machines, portable sheds and other storage units shall be set back at least 10m from all tree protection area boundaries.
- .2 The tree shall not be used to support signs, fencing, lights, cables, hoarding or any other equipment or structure.
- .3 No pruning or other treatment shall be performed to retain trees except as directed by the City Representative/Consultant.
- .4 No excavation of soils or depositing of fill soil on land within the tree protection fence shall occur.
- .5 Maintain snow fencing and gates in good condition for the duration of the Work. Replace snow fencing and gates as directed by the City Representative/Consultant.

### **3.4 CLEARING**

- .1 Clearing includes felling, trimming, and cutting of trees and existing landscaping into sections and satisfactory disposal of trees and other vegetation designated for removal by the Consultant, including trees, landscape bushes, and rubbish occurring within work area.
- .2 Grub out tree stumps.
- .3 Prune individual trees as required for completion of the work, as indicated, and only after approval by the Consultant.
- .4 Trim trees designated to be left standing shall be protected from damage as indicated on the contract documents.
- .5 Paint cuts more than 3 cm in diameter with approved tree wound paint.
- .6 Do not clear or grub existing trees, landscape plant beds, stumps, miscellaneous plant material and their associated root areas that have been identified on the Contract Drawings or marked in the field by the City Representative/Consultant or Contractor to remain.

### **3.5 GRUBBING**

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 300 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m<sup>3</sup>.
- .4 Fill depressions made by grubbing with approved material and to make new surface conform with existing adjacent surface of ground.
- .5 Do not clear or grub existing trees, landscape plant beds, stumps, miscellaneous plant material and their associated root areas that have been identified on the Contract

Drawings or marked in the field by the City Representative/Consultant or Contractor to remain.

### **3.6 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials and debris (including branches and limbs) to approved disposal sites off-site.
- .2 Fires and burning Fires and burning rubbish on Works Site are not permitted.
- .3 Stockpiled cleared and grubbed material shall be protected from fire hazards.

### **3.7 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of the City Representative / Consultant.

### **3.8 CLEANING**

- .1 On completion and verification of performance of installation, remove surplus.

**END OF SECTION**

## **Section 31 22 00 ROUGH GRADING**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide rough grading to the site in preparation for surface improvements as required to grade the site to design sub-grade elevation.

#### **1.3 RELATED SECTIONS**

- .1 32 11 00 - Clearing and Grubbing.
- .2 32 23 00 - Excavation and Fill.
- .3 Landscape Specifications.

#### **1.4 REFERENCES**

- .1 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .2 ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .3 ASTM C117 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- .4 ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- .5 British Columbia Building Code - 2024.
- .6 Master Municipal Construction Document – 2009 Edition (Platinum Book)
- .7 Authority Having Jurisdiction – Supplementary Specifications Master Municipal Construction Documents
- .8 Authority Having Jurisdiction Subdivision and Development Servicing Bylaw No. 3558

#### **1.5 QUALITY ASSURANCE**

- .1 Subcontractor to have a minimum of 5 years proven experience in related work.

#### **1.6 PROTECTION**

- .1 Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage.
- .2 Use means necessary to control dust on and near the Work, and on and near all off-site borrow areas, if such dust is caused by the Contractor's operations during performance of the Work, or is resulting from the condition in which the Contractor leaves the site.
- .3 Use means necessary to protect materials of this section before, during and after installation, and to protect objects designated to remain. In the event of damage,

immediately make repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

- .4 Protect existing fencing, trees, landscaping, natural features, benchmarks, pavement, surface or underground utility lines which are to remain as shown on the drawings. If damaged, restore to original or better condition unless directed otherwise.
- .5 Maintain access roads to prevent accumulation of construction related debris on roads.

## **Part 2 Products**

### **2.1 MATERIALS AND COMPONENTS**

- .1 Fill material: in accordance with of Section 31 23 00 - Excavation and Fill.
  - .1 Type 3 fill: 75mm Select Granular Sub-base
  - .2 Type 4 fill: 75mm Crushed Granular Sub-base
- .2 Excavated or graded granular material existing on site may be suitable to use as fill for grading work if approved by Consultant, prior to use.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify site conditions.
- .2 Verify that survey benchmark and intended elevations for the Work are as indicated.

### **3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum.
- .2 Stake and flag locations of known utilities.
- .3 Protect above and below grade utilities that remain.
- .4 Protect plant life, lawns, and other features that are to remain, in addition to those features specifically noted be protected for the duration of the work.

### **3.3 EXCAVATION**

- .1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- .2 Rough grade site under concrete paving, asphalt paving and other areas to final sub-grade for finished surfaces.
- .3 Provide uniform slopes between noted elevations.
- .4 When excavating through roots, perform work by hand.
- .5 Remove subsoil unsuitable for use as fill from site
- .6 Replace damaged or displaced subsoil to same requirements as for specified fill.

### **3.4 FILLING AND GRADING**

- .1 Fill areas to contours and elevations as indicated on drawings.
- .2 Place fill material in continuous layers with a maximum loose lift thickness of 300 mm. Lift thickness shall be adjusted to achieve the required compaction with the available equipment.



- .3 Do not place fill on frozen or snow-covered subgrade and do not place frozen fill or fill susceptible to freezing during construction.
- .4 Adjacent areas of fill shall not exceed a difference in surface elevation of 1 m.
- .5 Compact subgrade and fill material to 95% of the corrected modified Proctor maximum dry density (MPMMD) determined per ASTM D1557
- .6 Maintain optimum moisture content of fill materials to attain required compaction density.
- .7 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
  - .1 Grade ditches and swales to depth as indicated.
- .8 Make grade changes gradual. Blend slope into level areas.
- .9 Ensure fill and grading does not bury or otherwise obscure existing utility service covers, valveboxes, manholes, catchbasins, or the like. Should a circumstance arise where a service will fall below proposed finish grades, halt work and contact the Consultant immediately before proceeding.

### 3.5 TESTING

- .1 The contractor shall obtain a qualified testing agency to complete the following testing at the specified frequencies during construction. Copies of the lab and field testing reports shall be submitted to the Owner and Consultant.
  - .1 Modified Proctor Moisture-Density Relationship Test (ASTM D1557)
    - .1 Minimum 1 test per every 500 m<sup>3</sup> of material placed.
  - .2 Gradation Analysis Tests (ASTM C136 & C117)
    - .1 Minimum 1 test per every 250 m<sup>3</sup> of material placed.
  - .3 Density Test with Nuclear Densometer (ASTM D6938)
    - .1 Minimum 1 test for every 250 m<sup>2</sup> of material placed
    - .2 Minimum 1 test for every 100 m<sup>2</sup> of material placed
    - .3 Minimum 1 test per lift

### 3.6 REVIEW

- .1 Notify Consultant at least 48 hours in advance of any necessary reviews of the work.
- .2 The Consultant shall be given the opportunity to review the existing subgrade and/or native material before placement of fill

### 3.7 CLEANING

- .1 Clean up in accordance with Section 01 74 11 Cleaning.
- .2 Dispose of unused topsoil as directed by Consultant.

### 3.8 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

**END OF SECTION**

## **Section 31 22 01**

### **GRADING AND FINISH GRADING**

#### **Part 1 General**

##### **1.1 DOCUMENTS**

- .1 This Section of the specifications forms part of the contract and is to be read, interpreted, and coordinated with all other parts including Division 1 General Requirements.

##### **1.2 GENERAL REQUIREMENTS**

- .1 Section 31 22 01 is a 'Landscaping' Section and refers to those portions of the Works that are unique to the preparation of sub grade, by rough grading and filling to provide a base that will allow placing of growing medium (topsoil) to specified depths. This Section does not apply to grading prior to placement of paved or concreted surfaces. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the Works described herein.
- .2 This section is based upon the 'British Columbia Landscape Standard' published by the B.C. Society of landscape Architects and the Nursery Trades Association.

##### **1.3 SUMMARY**

- .1 Provide grading and finish grading as indicated on drawings and specified in this section.
- .2 Provide granular fill and soil grading for areas to receive concrete, asphalt, landscaping and other site elements and features.

##### **1.4 RELATED SECTIONS**

- .1 31 11 11 - Clearing and Grubbing
- .2 31 23 00 - Excavation and Fill
- .3 32 11 23 - Aggregate Base Courses
- .4 32 15 40 - Landscape Aggregates
- .5 Landscape Specifications.

##### **1.5 REFERENCES**

- .1 ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .2 ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .3 ASTM C117 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- .4 ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- .5 ASTM D4695 General Pavement Deflection Measurements
- .6 British Columbia Building Code - 2024.
- .7 Master Municipal Construction Document – 2019 Edition

- .8 Authority Having Jurisdiction – Supplementary Specifications Master Municipal Construction Documents
- .9 Authority Having Jurisdiction Subdivision and Development Servicing Bylaw
- .10 British Columbia Landscape Standards (current edition)
- .11 Canadian System of Soil Classification (current edition)

## **1.6 INTERPRETATION OF THE WORK**

- .1 The Contractor shall be fully acquainted with the existing site and shall fully understand the difficulties and restrictions attending the execution of the work under this contract. Any 'interpretations' by the Contractor of the meaning of any section of the contract drawings and specifications herein prior to submitting a tendered price shall not remove the responsibility of completing the Works as per the directions of the City Representative/Consultant, including all costs associated with the Works, should the Contractor's 'interpretation' be incorrect. Prior to submitting a tendered price for the Works, the Contractor must seek clarification from the City Representative/Consultant for any items within the contract drawings and specifications that may appear to be unclear or conflicting.

## **1.7 QUALITY ASSURANCE**

- .1 Subcontractor to have a minimum of 5 years proven experience in related work.
- .2 The City Representative/Consultant is to inspect and approve all stages of the work.
  - .1 Provide forty-eight (48) hours notice to the City Representative/Consultant when inspection is required.
- .3 At the City Representative/Consultant discretion, a licensed testing agency will be retained by the Contractor to perform periodic testing of the sub grade preparation to demonstrate proctor density has been achieved at no extra cost to the Owner.
- .4 Remove any base materials which are unacceptable for required sub-grade bearing capacities or Corrected Modified Proctor Density (MPD) as specified.

## **1.8 COORDINATION**

- .1 The work shall include:
  - .1 Stripping and stockpiling of approved onsite fill material
  - .2 Importing and placement of fill material in place of unsuitable sub grade material.
  - .3 Grading operation to attain sub grade design grades.
  - .4 Compaction of fill materials.
  - .5 Removal and off-site disposal of unsuitable material.
- .2 If sub grade non-structural, or structural, fills are required to meet design sub grades, use granular material as per MMCD Section 31 05 17 - Aggregate and Granular Materials.
- .3 Over Excavation
  - .1 Based on the Geotechnical Report prepared by the Consultant, the City Representative/Consultant does not anticipate need for over excavation unless it is discovered that conditions differ from those encountered at test hole locations. These changes or variations may be one of the following:

- .1 Organics or topsoil encountered below the anticipated design sub grade elevations for:
  - .1 Footings.
  - .2 Soft or wet, silty with clay soils within the sub grade.
  - .3 Buried concrete, wood debris or old foundations.
- .2 If these conditions are encountered the contractor must notify the City Representative/Consultant, prior to over excavation.
- .3 If unsuitable bearing materials are encountered at indicated elevations, carry excavation deeper and replace excavated material with suitable materials as directed by the City Representative/Consultant.
- .4 Perform over excavation only by written authorization of the City Representative/Consultant. If additional over excavation is required, City Representative/Consultant shall be notified so that exact quantities can be measured.
- .4 Unauthorized Excavation
  - .1 Unauthorized excavation shall be any excavation beyond elevations and dimensions indicated, without specific direction by the City Representative/Consultant.
  - .2 The Landscape Contractor shall fill unauthorized excavation with approved fill material, to elevations and dimensions indicated, to the requirements of this section.
  - .3 Unauthorized excavation and remedial work shall be at Landscape Contractor's expense.

## 1.9 PROTECTION

- .1 Examine site with City Representative/Consultant and obtain approval of previous work prior to commencing Site Grading.
- .2 Comply with MMCD General Conditions, MM 4 - Protection of Work, Property and the Public and, MMCD General Conditions, MM5 - Errors, Inconsistencies or Omissions in the Contract Documents.
- .3 Protect existing fencing, natural features, benchmarks, existing pavement, sub surface and surface utility lines, and water courses and miscellaneous items noted on contract drawings as to remain.
- .4 Protect all existing trees, landscape plant beds, miscellaneous plant material and their associated root areas within the area to be rough graded that have been identified to remain on the contract drawings.
- .5 Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage.
- .6 Notify the Consultant immediately if any damage occurs.
- .7 Use means necessary to control dust on and near the Work, and on and near all off-site borrow areas, if such dust is caused by the Contractor's operations during performance of the Work, or is resulting from the condition in which the Contractor leaves the site.
- .8 Use means necessary to protect materials of this section before, during and after installation, and to protect objects designated to remain. In the event of damage,

immediately make repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

- .9 Protect and/or transplant existing fencing trees, landscaping, natural features, bench marks, pavement, surface or underground utility lines which are to remain as directed by Owner's Representative. If damaged, restore to original or better condition unless directed otherwise.
- .10 Maintain access roads to prevent accumulation of construction related debris on roads. all means necessary to control dust on and near the work caused by operations.
- .11 The Contractor, at no cost to the Owner shall make good all damages incurred during the rough grading operation.

#### **1.10 MEASUREMENT AND PAYMENT**

- .1 Measurement and payment for topsoil stripping including, stockpiling for re-use will be made before and after cross sections of stripped area as determined by field measurements on site by the City Representative/Consultant.
- .2 Measurement and payment for rough site grading shall be by the square meter of area rough grading and, shall include cut and fill excavation and its on-site redistribution and compaction to design elevations and grades for the entire area graded.
- .3 Measurement and payment for excavation and offsite disposal of unsuitable materials, as determined by the City Representative/Consultant, will be by loose truck box volume.
- .4 Measurement and payment for removal and off-site disposal of soft or unsuitable material revealed during proof-rolling include all remedial work, equipment, materials and requirements for over excavation (over the sub grade design elevations) shall be made by loose truck box volume as determined by City Representative/Consultant.
- .5 Measurement and payment for topsoil stripping including, stockpiling for re-use then, placement and spreading of native topsoil previously stockpiled on-site will be made before and after cross sections of stripped area as determined by field measurements on site by the City Representative/Consultant.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Fill Material
  - .1 Soft Landscape Areas: Loose, friable, well drained, native on-site fill or imported fill shall be free of rocks and boulders in excess of 100 mm (4") in size. Provide sample for review and approval by the City Representative/Consultant prior to use or import to site. Use suitable existing inorganic material and compact to at least 80% Standard Proctor maximum dry density.
- .2 Type
  - .1 Granular and fill material shall be as identified in:
    - .1 Section 31 23 01 – Excavating, Trenching and Backfilling
    - .2 Section 31 05 17 – Aggregate and Granular Materials
    - .3 Excavated or graded material conforming to the backfill specification may be used as site fill or for grading work after approval by the City Representative/Consultant.

- .4 The City Representative/Consultant reserves the right to approve which of the excavated material is to be reused, and which is to be disposed offsite, based upon material quality and suitability for its intended purpose.
- .5 Protect approved material from contamination.
- .6 Pit Run Gravel
  - .1 To be well graded granular material, substantially free from clay clumps, organic material and other extraneous material, screened to remove all stones in excess of 75mm. Material to compact to specified density and conform to the following gradations:

Sieve Size (mm)	Percent passing (%)
75	100
50	70-100
25	50-100
4.75	22-100
2.36	10-85
0.075	2-8

- .7 Recycled concrete free from contaminated and other extraneous materials conforming to the specified gradations may be used as pit run gravel.

### Part 3 Execution

#### 3.1 EXAMINATION

- .1 Verify site conditions.
- .2 Verify that survey benchmark and intended elevations for the Work are as indicated.

#### 3.2 PREPARATION

- .1 Identify required lines, levels, contours, and datum.
- .2 Stake and flag locations of known utilities.
- .3 Protect above and below grade utilities that remain.
- .4 Protect plant life, lawns, and other features that are to remain, in addition to those features specifically noted be protected for the duration of the work.

#### 3.3 ROUGH GRADE OPERATIONS

- .1 Rough grade site to contours, lines, grades, elevations, and dimensions to the following minimum sub grade depths allowing for depths of finished surface treatment as indicated on contract drawings and to accommodate planting areas shall be as follows:

Depths	Areas
150mm (6")	Lawn
300mm (12")	Perennials, Grasses and Groundcovers
450mm (18")	Shrub Planting
900mm (36")	Tree Planting

- .2 Remove and dispose all deleterious material, grass sod, organic material, roots, branches, stones, concrete, asphalt waste, building materials or any other elements which may interfere with the installation of proposed hard landscape components noted on contract drawings. All material shall be disposed of in an approved off-site disposal area.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub grade surface. Finished sub grade shall have no irregularities exceed 15mm (5/8") when checked with a 3.0 metre (10'-0") straight edge placed in any direction.
- .4 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction.
- .5 Compaction Densities:
  - .1 Ensure that all rough grade sub grade areas are compacted to the following Modified Proctor Densities (MPD):
    - .1 Soft Landscape Areas - 80% MPD in compliance with ASTM D1557
    - .2 Hard Landscape Areas - 95% MPD in accordance with ASTM D1557
- .6 All landscape areas to be scarified to a depth of 200 mm (8") after compaction to ensure proper drainage.
- .7 Remove and dispose offsite all obstructions or debris encountered during excavation before any construction procedures commence to avoid contamination of sub grade.
- .8 Ensure the sub grade has a minimum gradient for positive subsurface drainage.
- .9 Re-usable common excavation may be stockpiled but must not cover any on-site stockpiled topsoil or grassed areas.
- .10 Do not disturb soil or rock below bearing surfaces.
- .11 Notify City Representative/Consultant when excavations are complete.
- .12 Do not disturb soil or rock below bearing surfaces.
- .13 Excavation taken below depths shown on the Contract Drawings without the written authorization of the City Representative/Consultant must be filled at Landscape Contractor's expense.
- .14 If bearings are unsatisfactory, additional excavation will be authorized by City Representative/Consultant in writing and paid for as per the contract unit price for common excavation.
- .15 Dispose of surplus and unsuitable excavated material offsite at an approved disposal area.
- .16 Do not obstruct flow of surface drainage or water courses.

- .17 Obtain City Representative/Consultant approval of completed excavation, backfilling and rough grading.
- .18 Hand trim tree exposed roots, remove and make firm areas of loose materials and debris from excavations.

### **3.4 SHORTAGE AND SURPLUS**

- .1 Supply all necessary fill to meet backfilling and grading requirements.
- .2 Remove surplus material unsuitable for fill, grading or landscaping from site and dispose at an approved disposal area.

### **3.5 DEWATERING**

- .1 Keep excavations and construction site area free of water while work is in progress and protect against surface runoff.
- .2 Provide pumps, piping, temporary drains, trenches, sumps, and related equipment to remove water.
- .3 Provide settling basins, siltation fences, and or other siltation control facilities to remove suspended solids or other materials before discharging to storm sewers or water courses.
- .4 Submit for City Representative/Consultant review details of proposed dewatering methods. Maintain groundwater table a minimum of 300mm below elevations for sub grade.
- .5 Do not use sanitary sewers or private property for discharge of water.
- .6 Dispose of water in a manner not detrimental to the environment, public and private property, or any portion of work completed or under construction.

### **3.6 GRADING TOLERANCES**

- .1 General: Uniformly grade site, including adjacent transition areas. Smooth finish surface within specified tolerances of plus/minus 25mm; compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- .2 Grade Control: During construction, maintain lines and grades including crown and cross-slope of sub grade course. Grading outside of the line defining the work of this contract shall consist of rough grading to grades indicated.
- .3 Grading Surface of Fill: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of  $\pm 15$  mm when tested with a 3-meter straight edge.
- .4 Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.
- .5 Stripped grade below slabs shall be brought up to required elevation using free draining material in maximum 300 mm lifts and compacted to a minimum 98% Standard Proctor dry density.

### **3.7 ROUGH FILL OPERATIONS**

- .1 Fill Placement – Soft Landscape: Place fill materials over acceptable sub grade to elevations and sections shown on contract drawings. Place in maximum 200 mm (8") lifts, compacting each lift to 80% Modified Proctor Density.



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- .2 Fill Placement – Hard Landscape Areas: Place fill materials over acceptable sub grade to elevations and sections shown on contract drawings. Place in maximum 150mm (6") lifts. Each lift to be compacted to 95% MPD.
- .3 Ensure gradients conform to slopes and grades indicated on the contract drawings. Contractor shall inform the Consultant if the following grading guidelines cannot be attained:

Location	Minimum	Maximum
Lawn and Grass	50:1(2%)	3:1(33%)
Grass Swales	0:1(2%)	10:1(10%)
Slope along inverts	6:1(16%)	3:1(33%)
Side Slopes - Planted areas	50:1(2%)*	2.5:1(40%)*

\*Unless directed otherwise by City Representative/Consultant

- .4 Ensure grade transitions are smooth and even and carried out such that ponding will not occur on sub grade surface.

### 3.8 PROTECTION

- .1 Maintain finished surfaces in condition conforming to this section until acceptable by Contract Administrator.
- .2 Polyethylene sheets shall be placed on stockpiled re-usable native material to protect against erosion and contamination.
- .3 Polyethylene sheets shall be placed on all exposed surfaces to protect against erosion.
  - .1 Polyethylene sheets shall be pinned to prevent displacement by the wind.

### 3.9 EQUIPMENT

- .1 Excavation shall be carried out using an excavator equipped with a clean-up/landscape bucket to minimize disturbance to the sub grade.
- .2 Compaction equipment must be capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.

### 3.10 TESTING

- .1 The contractor shall obtain a qualified testing agency to complete the following testing at the specified frequencies during construction. Copies of the lab and field testing reports shall be submitted to the Owner and Consultant
  - .1 Modified Proctor Moisture-Density Relationship Test (ASTM D1557)
    - .1 Minimum 1 test per every 250 m<sup>3</sup> of material placed.
  - .2 Gradation Analysis Tests (ASTM C136 & C117)
    - .1 Minimum 1 test per every 100 m<sup>3</sup> of material placed.
  - .3 Density Test with Nuclear Densometer (ASTM D6938)
    - .1 Minimum 1 test for every 250 m<sup>2</sup> of granular base and subbase material. Minimum 1 test per lift.

- .2 Minimum 1 test for every 100 m<sup>2</sup> of granular base and subbase material placed. Minimum 1 test per lift.
- .3 Minimum 1 test for every 50 lineal meters of curb base.
- .4 Minimum 1 test for every 75 m<sup>2</sup> of sidewalk base.
- .4 Benkelman Beam Test (ASTM D4695)
  - .1 Prior to paving roads with asphalt concrete, the granular base surface shall be checked for deflections utilizing a Benkelman Beam. A representative from the City shall be present for the test.
  - .2 Results of the test shall conform with the requirements in the Authority Having Jurisdiction Supplementary Specifications Master Municipal Construction Documents.

### **3.11 FINISH GRADING**

- .1 See Section 2921 – Growing Medium Placement and Finish Grading for placement and finish grading of growing medium (topsoil).

### **3.12 REVIEW**

- .1 Notify Consultant at least 48 hours in advance of any necessary reviews of the work.

### **3.13 CLEANING**

- .1 Clean up in accordance with Section 01 74 11 Cleaning.
- .2 Dispose of unused topsoil as directed by Consultant.

**END OF SECTION**

## **Section 31 23 00 EXCAVATION AND FILL**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements.

#### **1.2 SUMMARY**

- .1 Provide trench and backfilling for foundation footings and walls.
- .2 Provide trenching for mechanical and electrical services and variations in slab heights.
- .3 Provide backfilling below slab, at foundation walls and to service trenches, as indicated.
- .4 Provide poly vapour barrier below interior spaces under slab on grade.

#### **1.3 RELATED WORK**

- .1 03 11 00 - Concrete Forming.
- .2 03 31 00 - Cast In Place Concrete.
- .3 03 35 00 - Concrete Finishing.
- .4 32 12 16 - Asphalt Paving.
- .5 32 13 13 - Curbs and Sidewalks.

#### **1.4 REFERENCES**

- .1 ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .2 ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .3 ASTM C117 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- .4 ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- .5 British Columbia Building Code 2024.
- .6 Master Municipal Construction Document – 2009 Edition (Platinum Book)
- .7 Authority Having Jurisdiction – Supplementary Specifications Master Municipal Construction Documents
- .8 Authority Having Jurisdiction Subdivision and Development Servicing Bylaw

#### **1.5 SUBMITTALS**

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Submit methods, procedures, sequence and equipment used to provide finish specified.
- .3 Submit the results of the following lab testing for approval of each planned fill material:
  - .1 Modified Proctor Moisture-Density Relationship Test (ASTM D1557)

- .1 Minimum 1 test per material source.
- .2 Gradation Analysis Tests (ASTM C136 & C117)
  - .1 Minimum 1 test per material source.
- .4 Submit batching slips for fill material delivered to site.

## **1.6 QUALITY ASSURANCE**

- .1 Complete excavation and fill in accordance with Consultant reports, specifications and drawings.

## **1.7 PROTECTION**

- .1 Protect bench marks and existing structures, roads, sidewalks, paving and curbs against damage.
- .2 Protect excavations by shoring, bracing, sheet piling, underpinning or other methods, as required to prevent cave-ins and to prevent loose dirt falling into the excavations, and to prevent damage to improvements and structures on adjacent properties.
- .3 Protect the bottoms of excavations and soils around and beneath footings from frost and ingress of surface water.
- .4 Use means necessary to control dust on and near the Work, and on and near all off-site borrow areas, if such dust is caused by the Contractor's operations during performance of the Work, or is resulting from the condition in which the Contractor leaves the site.
- .5 Use means necessary to protect materials of this section before, during and after installation, and to protect objects designated to remain. In the event of damage, immediately make repairs and replacements necessary to the approval of the Consultant and at no additional cost to the Owner.

## **Part 2 Products**

### **2.1 FILL MATERIALS**

- .1 Sieve sizes to CAN/CGSB-8.1-87
- .2 Crushed gravel, when tested according to ASTM C-136, to have a generally uniform gradation and conform to the following gradation limits and 60% of the material passing each sieve must have one or more fractured faces.
- .3 Type 1 fill: 19mm GRANULAR BASE
  - .1 Clean, hard, durable crushed gravel, free from shale, clay, friable materials, organic matter and other deleterious substances and graded within the following limits:

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

.4 Type 2 fill: 25mm GRANULAR BASE

- .1 Clean, hard, durable crushed gravel, free from shale, clay, friable materials, organic matter and other deleterious substances and graded within the following limits

Sieve Designation	% Passing
25mm	100
19mm	80-100
12.5mm	75-90
4.75mm	35-70
2.36mm	25-50
1.18mm	15-35
0.30mm	5-20
0.075mm	0-5

.5 Type 3 fill: 75 mm SELECT GRANULAR SUBBASE

- .1 To be well graded granular material, substantially free from lumps and organic matter, screened if required to conform to the following gradation:

Sieve Designation	% Passing
75mm	100
25mm	50-85
0.150mm	0-15
0.075mm	0-8

.6 Type 4 fill: 75 mm CRUSHED GRANULAR SUBBASE

- .1 To be 75 mm crushed gravel conforming to the following gradation:

Sieve Designation	% Passing
75mm	100
38mm	60-100
19mm	35-80
9.5mm	26-60
4.75mm	20-40
2.36mm	15-30
1.18mm	10-20
0.60mm	5-15
0.30mm	3-10
0.075mm	0-5

.7 Type 5 fill: SAND

.1 River sand to be free of organic material and conform to the following gradation:

Sieve Designation	% Passing
19mm	100
4.75mm	80-100
0.60mm	20-100
0.42mm	10-100
0.25mm	0-80
0.15mm	0-50
0.075mm	0-4

.8 Type 6 fill: 19mm CLEAR CRUSHED GRAVEL (DRAIN ROCK)

.1 To consist of clean crushed rock conforming to the following gradation:

Sieve Designation	% Passing
19mm	100
9.5mm	0-5
4.75mm	0

## 2.2 MEMBRANE AND FILTER MATERIALS

.1 Underslab Vapour Barrier: 10 mil thick vapour barrier conforming to ASTM E1745 to be submitted for review and approval

.2 Non-Woven Geotextile / Filter Cloth: Layfield LP6, Nilex 4551, or approved equivalent.

## 2.3 BACKFILLING

.1 Backfill to Footings, Foundations, and Perimeter Foundation Walls:

.1 Type 3 fill: 75 mm Select Granular Subbase (Free-draining) placed in maximum 300 mm thick loose lifts and compacted to 95% MPMDD.

.2 Backfill to Underside of Interior Slab-on-Grade:

.1 Type 6 fill: 19 mm Clear Crushed Gravel compacted to an unyielding state.

.2 Place vapour barrier conforming to ASTM E1745 between the clear crushed gravel drainage layer and the slab-on-grade.

- .3 Backfill to Trenches:
  - .1 Trench backfill materials shall follow the drawings and applicable standard detail drawings
  - .2 Trench backfill not specified in the drawings or standard sections shall be well-graded granular import placed in maximum 300 mm thick loose lifts and compacted to 95% MPMDD.
  - .3 Excavated granular materials existing on site may be suitable to use as trench backfill, subject to approval of the Consultant

## 2.4 TESTING

- .1 The contractor shall obtain a qualified testing agency to complete the following testing at the specified frequencies during construction. Copies of the lab and field testing reports shall be submitted to the Owner and Consultant
  - .1 Modified Proctor Moisture-Density Relationship Test (ASTM D1557)
    - .1 Minimum 1 test per every 250 m<sup>3</sup> of material placed.
  - .2 Gradation Analysis Tests (ASTM C136 & C117)
    - .1 Minimum 1 test per every 100 m<sup>3</sup> of material placed.
  - .3 Density Test with Nuclear Densometer (ASTM D6938)
    - .1 Minimum 1 test for every 100 m<sup>2</sup> of material placed for backfill to footings, foundations and perimeter walls. Minimum 1 test per lift.
    - .2 Minimum 1 test per 50 lineal meters of trench backfill. Minimum 1 test per lift.

## 2.5 OTHER MATERIALS

- .1 All other materials, not specifically described but required for a complete and proper installation, shall be as selected by the Contractor subject to the approval of the Consultant.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Prior to work of this Section, become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this Section.

### 3.2 BACKFILLING PRIOR TO APPROVAL

- .1 Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.
- .2 Should any of the work be so enclosed or covered up before it has been approved, uncover such work at no additional cost to the Owner.
- .3 After the work has been completely tested, inspected, and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.
- .4 General Contractor shall adhere to local regulations, carry out work in safe manner, and be responsible for any related disturbance to proximate facilities.

### **3.3 FINISH ELEVATIONS AND LINES**

- .1 For setting and establishing finish elevations and lines, secure the services of a B.C. Land Surveyor acceptable to the Consultant. Carefully preserve data and monuments set by the Surveyor and, if displaced or lost, immediately replace to the approval of the Consultant and at no additional cost to the Owner.

### **3.4 SITE PREPARATION**

- .1 Remove obstructions, branches, dirt and other organic materials and ice and snow, from work area.
- .2 Inspect project area to locate soil depressions and other anomalies that may need repair prior to commencement of the work of this contract.

### **3.5 STOCKPILING**

- .1 Stockpile fill materials in areas as appropriate on-site. Stockpile granular materials in manner to prevent segregation and protect from contamination.
- .2 Remove excavated materials from site.

### **3.6 EXCAVATING**

- .1 Excavate to the elevations shown on the drawings to facilitate construction of the footings, foundations, walls, utilities and other infrastructure. Where excavation elevations are not shown on the drawings, excavate as required to accommodate the installation or construction.
- .2 The excavations shall follow the appropriate safety regulations for sloping and benching. The contractor shall be prepared for the use of shoring or other ground control methods where the required slopes or benching cannot be achieved.
- .3 Over-excavation may be required if the subgrade is considered unsuitable by the Consultant. Backfill and compact over-excavated areas with well graded granular fill to the required subgrade.
- .4 Excavating for footings, foundations and perimeter foundation walls:
  - .1 Subgrade upon which footings will be placed must be compacted to the approval of the Consultant and in accordance with the compaction requirements established in this Section of these Specifications.
  - .2 Verify that compaction is complete and approved prior to excavating for footings.
  - .3 Excavate to the established lines and grades. Cut the bottom of the excavation level, and remove loose or water-softened soil. Where soft spots are encountered, remove defective material and replace with lean concrete at no additional cost to the Owner.

### **3.7 TRENCHING**

- .1 Perform trenching required for the installation of items where the trenching is not specifically described in other Sections of these Specifications.
- .2 Make trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting. Provide minimum horizontal to vertical excavation cut slopes as recommended by the Geotechnical Engineer or consistent with the recommendations of Work Safe BC.



- .3 Trench as required to provide the elevations shown on the Drawings. Where elevations are not shown on the Drawings, the depth of the trench will be per the minimum cover and bedding requirements defined by the appropriate Consultant.
- .4 Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the Consultant, and then compact to provide a firm and unyielding subgrade and/or foundation to the approval of the Consultant and at no additional cost to the Owner.

### **3.8 PREPARATION OF SUBGRADE**

- .1 Any existing topsoil, organics and/or unsuitable fill materials must be stripped from excavated or new fill areas prior to fill placement.
- .2 Remove all ruts, hummocks, and other uneven surfaces by surface grading prior to placement of fill.
- .3 If the exposed subgrade for footings, foundations, and perimeter foundation walls is susceptible to water-softening or disturbance, and the integrity of the subgrade cannot be maintained prior to pouring of the concrete, a blinding layer comprising compacted granular fill or lean mix concrete shall be installed.

### **3.9 EXCESS WATER CONTROL**

- .1 Do not place, spread or compact fill material during unfavourable weather conditions if the quality/performance of the fill is compromised and/or the stability of the excavation can not be maintained. Do not resume operations until moisture content and fill density are satisfactory to the Consultant.
- .2 Provide berms or channels to prevent flooding of subgrade. Promptly remove water collecting in depressions or the bottom of the excavations.
- .3 Where soil has been softened or eroded by flooding, construction disturbance, or placement during unfavourable weather, remove damaged areas and re-compact as specified for fill and compaction below.

### **3.10 DEWATERING**

- .1 Provide and maintain at all times during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the Work.
- .2 Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of the bottoms of excavations.

### **3.11 FILL AND COMPACTION**

- .1 Prior to placement of backfill, geotextiles, membranes or blinding layers, the Consultant shall be given the opportunity to review the subgrade.
- .2 Place membranes or geotextiles are required per the project drawings.
- .3 Backfill material in maximum 300 mm thick loose lifts (unless specified otherwise) and compact with appropriate equipment to achieve the required compaction. Lighter compaction equipment shall be used within 1 m of walls and foundation elements or in areas inaccessible by larger equipment.
- .4 Maintain optimum moisture content of fill materials to attain required compaction density.
- .5 If installed, remove shoring in a manner that allows for proper compaction and prevent the trench or excavation walls from collapsing.

### **3.12 GRADING**

- .1 Except as otherwise directed by the Consultant, perform rough and final grading required to attain the elevations shown on the Drawings. Verify finished grades by B.C. Land Surveyor.

### **3.13 TREATMENT AFTER COMPLETION OF GRADING**

- .1 After grading is completed and Consultant has finished his inspection, permit no further excavating, filling, or grading except with the approval of and inspection by the Consultant.
- .2 Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

### **3.14 EXCAVATING FOR FOOTINGS**

- .1 Preparation: To minimize differential settlement, it is essential that earth surfaces upon which footings will be placed be compacted to the approval of the Consultant and in accordance with the compaction requirements established in this Section of these Specifications.
- .2 Verify that compaction is complete and approved prior to excavating for footings.
- .3 Excavating: Excavate to the established lines and grades. Cut off bottom of trenches level, and remove loose soil. Where soft spots are encountered, remove defective material and replace with lean concrete at no additional cost to the Owner.

### **3.15 PIPE BEDDING REQUIREMENTS**

- .1 Grade the trench bottoms to provide a smooth, firm, and stable foundation free from rock points throughout the length of the pipe.
- .2 Refer to the drawings and standard detail drawings for the specified pipe foundation materials
- .3 Subsurface conditions:
  - .1 In areas where soft, unstable materials are encountered at the surface upon which cohesionless material is to be placed, remove the unstable material and replace it with material approved by the Consultant. Make sufficient depth to develop a firm foundation for the item being installed.
  - .2 If the need for over-excavation is due to an act or failure to act on the part of the Contractor, make the over-excavation and replacement at no additional cost to the Owner.
- .4 Pipe bedding details, including granular surround (pipe cushion) and material specifications to be as shown on Contract Drawings. Pipe installation to be per typical x-section in contract drawings and MMCD.
- .5 Place the specified granular material in the trench, simultaneously on each side of the pipe for the full width of the trench, to a maximum depth of 900 mm and a minimum depth of 300 mm above the outside diameter of the pipe barrel.
- .6 Contractor shall compact material to densities as specified in previous Items of this Section.
- .7 Other bedding procedures and materials may be used if prior written approval has been obtained from the Consultant.

### **3.16 PLACING BASE COURSES**

- .1 Spread base course aggregate in 75 to 100 mm (3" to 4") layers and shape accurately finish by blading, and roll to cross-section and profile required by Drawings and Specifications. Use 10 ton steel-wheeled roller where possible. Sprinkle water on base course ahead of compacting machine to aid compaction or reduce dust nuisance, or both. Use hand compactor in areas inaccessible by roller.
- .2 Slope the base course of parking areas to catch basins for proper drainage.
- .3 Specified base course thicknesses shall be the thickness after compaction to density of 95% Standard Proctor.

### **3.17 FIELD QUALITY CONTROL**

- .1 Notify Consultant at least 48 hours in advance of any necessary reviews of the work.
- .2 The Consultant shall be given the opportunity to review the existing subgrade and/or native material before placement of fill, membranes, geotextiles or blinding layers.

**END OF SECTION**

## **Section 32 11 23 AGGREGATE BASE COURSES**

### **Part 1 General**

#### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 74 21 - Waste Management and Disposal
- .2 Section [31 05 16 - Aggregate Materials].

#### **1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117 - 04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131 - 06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136 - 06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .5 ASTM D1557 - 09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883 - 07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318 - 10, 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.

#### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

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

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 - Product Requirements
- .2 Storage and Handling Requirements:
  - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
  - .2 Replace defective or damaged materials with new.
  - .3 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

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## Part 2 Products

### 2.1 MATERIALS

.1 Native Fill Material

- .1 Will be considered but must be reviewed and approved by either the project Geotechnical Engineer or should a Geotechnical Engineer not be part of the project team a Geotechnical Engineer engaged by the Contractor at no cost to the Owner.

.2 Pit Run Gravel

- .1 As per MMCD

.3 Granular Base:

- .1 The 19 mm crushed granular base shall consist of sound, durable particles, free from clay, organic material or other deleterious matter, and be evenly graded.
- .2 The granular base shall conform to MMCD gradation limits.

.4 Granular Subbase

- .1 Shall be 75 mm minus, clean, granular material free of organic material.
- .2 The granular subbase shall conform to MMCD gradation limits:

Sieve Size (mm)	Percent Passing
75	100
37.5	60-100
19	35-80
9.5	26-60
4.75	20-40
2.36	15-30
1.18	10-20
0.6	5-15
0.3	3-10
0.075	0-5

.5 River Sand

- .1 River sand to be free of organic material, salt, and foreign objects.
- .2 River sand shall conform to the following gradation standards:

Sieve Size (mm)	Percent Passing
19	100
4.75	80-100
0.6	20-100
0.425	10-100
0.15	0-50
0.075	0-4

.6 Filter Fabric

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- .1 Needle-punched, non-woven filter fabric, Nilex 4551 as manufactured by Nilex, or pre-approved equivalent.
- .2 Fabric to be 100% Polypropylene, non-woven, needle-punched engineering fabric. Material to be AMOCO 4546 or approved equal.
- .3 Fabric to have the following hydraulic properties:
  - .1 Apparent size opening US SIEVE (ASTM-D4751) 70.
  - .2 Permittivity Sec-1 (ASTM-D4491) 2.0.
  - .3 Flow rate gal/min/sq.ft. (ASTM-D4491) 145.
  - .4 Fabric to have the following physical properties:
    - .5 Grab Tensile Strength lbs. (ASTM-D4632) 100.
    - .6 Grab Tensile Elongation % (ASTM-D4632) 50.
    - .7 Mullen Burst PSI (ASTM-D3786) 225.
    - .8 Puncture lb. (ASTM-D4833) 65.
    - .9 Trapezoid Tear lb. (ASTM-D4533) 45.
    - .10 UV Resistance % (ASTM-D4355 – 500 hours)70.
- .4 Fabric to be placed with a minimum width of 4.0 metres and a minimum continuous length of 50 metres. When a length of fabric is not continuous, the lateral seam shall have a minimum overlap of 0.6 metres. The fabric shall not be folded or turned up along the edges.
- .7 Permeable Aggregates
  - .1 Permeable aggregates shall be a product manufactured by using clean crushed rock (less than 2% fines) and washed concrete sand (less than 2% fines). Bank sand is not an acceptable component for use in the mixture.
  - .2 Field Surface Drain Rock
    - .1 To be clean, washed, uniformly graded torpedo gravel conforming to the following gradations:

Sieve Size (mm)	Percent Passing
19	100
15.8	85-100
12.5	60-100
9.5	40-90
4.75	0-5
2.36	0-4
1.18	0-2

- .3 Field Course Permeable Aggregate
  - .1 To be open-graded, fractured, and conforming to the following gradations:

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Sieve Size (mm)	Percent Passing
32	100
25	90-1000
19	80-100
12.5	50-80
9.5	40-60
4.75	20-40
2.36	13-30
0.60	10-20
0.15	2-10
0.075	0.2

.4 Field Top Course Permeable Aggregate

.1 To be open-graded, fractured and conforming to the following gradations:

Sieve Size (mm)	Percent Passing
19	100
12.5	60-100
9.5	40-90
4.75	30-80
2.36	10-60
0.60	10-20
0.15	2.5
0.075	0-2

- .5 Aggregate to be a minimum of 75% fractured with at least one fractured face by mechanical means on each individual particle larger than 6.4mm.
- .6 Aggregate to be clean and shall have a minimum infiltration rate of 250mm per hour in accordance with the test procedure set out in Section 1.12.4 of this document.
- .7 Compact to 95% of maximum dry density as per ASTM D698.

### 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 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 City Representative/Consultant.
- .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 City Representative/Consultant 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 can obtain required material densities.
  - .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from City Representative/Consultant before use.
  - .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compacting:
  - .1 Compact to density not less than 95% MPD.
  - .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 Consultant.
  - .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 Consultant to use nonstandard proof rolling equipment.
- .3 Proof roll at level in granular base as indicated.
  - .1 If use of nonstandard proof rolling equipment is approved, Consultant 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 Consultant.
  - .2 Backfill excavated subgrade with [common material and compact in accordance with Section [31 22 14 - Airfield Grading]] [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 Consultant and replace with new materials in accordance with Section [32 11 16.01 - Granular Sub-base] and this section at no extra cost.
- .6 Handling of Base and Top Course Permeable Aggregates
  - .1 Subgrade and drain trenches must be accepted by the consultant prior to placement of any permeable aggregates. Remove any contamination from the drain rock trenches before placing base aggregates.
  - .2 Place geosynthetic fabric and cover immediately with base course aggregate. Do not allow equipment on fabric.
  - .3 No trucks or equipment to drive over drain rock trenches until after a minimum of 200 millimetres of compacted base aggregate is covering the drain rock.
  - .4 Keep moisture content of permeable aggregates at 3% to 5% in the stockpile and add water at site as required to achieve same moisture content.
  - .5 When material is dumped on-site minimize distance material is pushed. After material is dumped from the truck, mix material with excavator bucket to eliminate segregation as directed by the Consultant.
  - .6 Place base aggregate in one lift of specified thickness.
  - .7 Do not place base aggregate if water is ponded on subgrade.
  - .8 Remove and dispose of material which becomes segregated because of construction process. This applies both during placement of material and surface segregation after final grading.
- .7 Dewatering
  - .1 Pump or otherwise continuously remove all water that has accumulated in excavation during the progress of the Work.

- .2 Do not divert water onto adjacent property.
- .3 Ensure that sediment control devices are in place as per municipal or provincial regulations prior to the start of dewatering operations. Do not divert dewatering effluent to natural water bodies.

### **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.
- .2 Finished tolerances for permeable aggregate.
  - .1 Field course plus or minus 3 millimetres from specified grade but not uniformly high or low. No irregularities exceeding 6 millimetres when checked with a 3-metre straight edge placed in any direction.
  - .2 All grading of subgrade and field aggregates to be controlled using laser survey equipment.

### **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].

### **3.5 PROTECTION**

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

**END OF SECTION**

## **Section 32 12 16 COC ASPHALT PAVING**

### **Part 1 General**

#### **1.1 SECTION INCLUDES**

- .1 Hot-mix asphalt patching.
- .2 Hot-mix asphalt paving.
- .3 Hot-mix asphalt overlay.

#### **1.2 RELATED REQUIREMENTS**

- .1 Section 312301 Excavation and backfill for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
- .2 Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

#### **1.3 PREINSTALLATION MEETINGS**

- .1 Preinstallation Conference: Conduct conference at Burke Mountain Athletic Park or via phone/online if appropriate. To be decided by City of Coquitlam and according to their health and safety measures.

#### **1.4 ACTION SUBMITTALS**

- .1 Product Data: Contractor is to submit a Design Mix of each mix-type for City Representative/Consultant to review and approve prior to ordering and/or placing on site.

#### **1.5 INFORMATIONAL SUBMITTALS**

- .1 Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

#### **1.6 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction.

### **Part 2 Products**

#### **2.1 AGGREGATES**

- .1 Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- .2 Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- .3 Mineral Filler: ASTM D 242/D 242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.
- .4 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.

Sieve Designation	Percent Passing				
	*Lower Course #1	*Lower Course #2	*Upper Course #1	*Upper Course #2	*Fine Mix
25.0 mm	100	--	--	--	--
19.0 mm	--	100	100	--	--
12.5 mm	70-85	84-99	84-99	100	--
9.5 mm	--	73-88	73-88	--	100
4.75 mm	40-65	50-68	50-68	55-75	80-100
2.36 mm	32-53	35-55	35-55	38-58	64-89
1.18 mm	26-44	27-46	27-46	28-47	48-76
0.600 mm	18-36	18-36	18-36	20-36	32-60
0.300 mm	10-26	10-26	10-26	10-26	16-42
0.150 mm	4-17	4-17	4-17	4-17	6-23
0.075 mm	3-8	3-8	3-8	3-8	4-10

**\*Footnote to asphalt mix-type selection:** Lower Course #1: Arterial and collector, lower course only.

Lower Course #2 Local, Lower course only.

Upper Course #1 Arterial and collector, upper course only.

Upper Course #2: Local, surface course only.

Fine Mix: Skim patch on existing asphalt surface.

## 2.2 ASPHALT MATERIALS

- .1 Asphalt Binder: AASHTO M 320, PG 64-22.

## 2.3 MIXES

- .1 Surface Course Limit: Recycled content no more than 10 percent by weight.
- .2 Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
  - .1 Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - .2 Base Course: Lower Course #2 (Refer to table 2.1.4)
  - .3 Surface Course: Upper Course #2. (Refer to table 2.1.4)

## Part 3 Execution

### 3.1 PATCHING

- .1 Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- .2 Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

### **3.2 SURFACE PREPARATION**

- .1 General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- .2 Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

### **3.3 PLACING HOT-MIX ASPHALT**

- .1 Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - .1 Spread mix at a minimum temperature of 250 deg F (121 deg C).
  - .2 Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- .2 Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
- .3 Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### **3.4 JOINTS**

- .1 Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - .1 Clean contact surfaces and apply tack coat to joints.
  - .2 Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
  - .3 Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
  - .4 Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

### **3.5 COMPACTION**

- .1 General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - .1 Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- .2 Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

- .3 Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - .1 Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- .4 Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- .5 Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- .6 Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- .7 Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.6 INSTALLATION TOLERANCES

- .1 Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - .1 Base Course: Plus or minus 1/2 inch (13 mm).
  - .2 Surface Course: Plus 1/4 inch (6 mm), no minus.
- .2 Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
  - .1 Base Course: 1/4 inch (6 mm).
  - .2 Surface Course: 1/8 inch (3 mm).
- .3 Tennis Court Tolerance:
  - .1 In the presence of the Consultant, the Contractor is to confirm that the planarity requirements for the asphalt meets the requirements of 4mm or less of deformity under a 4000mm straight edge in any direction, and 2mm or less of deformity under a 1000mm straight edge in any direction, at all tested locations. In addition, no areas may contain bird baths greater than 2mm in depth and all areas must have positive drainage off all asphalt surface. All out of tolerance areas are to be identified by the contractor and each out of tolerance area is to be noted as to how to bring the area back into the required tolerances. A flood test is to be conducted by the Contractor to identify the above conditions. The Contractor is to supply the hoses and the water from a water truck for the flood tests if there is no close by water source. A second flood test must be conducted after the adjustments to the asphalt surface's planarity have been made.

### 3.7 FIELD QUALITY CONTROL

- .1 Replace and compact hot-mix asphalt where core tests were taken. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.8 ENVIRONMENTAL CONDITIONS

- .1 Do not install hot-mix asphalt concrete pavement, base, or sub-base during heavy rain or snowfall, cool temperatures, or other unsuitable conditions as determined by Staff. Place paving under favourable weather conditions; with temperatures exceeding 4 degrees Cel-

sus. Base and sub-base surface should be dry and stable. Air temperature must be at least 5 degrees Celsius to place asphalt mixtures. (Air temperature must be 10 de-grees and rising for tennis and sport courts)

- .2 Do not install asphalt concrete paving on frozen, wet, muddy, or rutted base(s).

**END OF SECTION**

## **Section 32 12 16.2**

# **ASPHALT PAVING FOR SYNTHETIC TRACK SURFACING**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 This section includes provisions for hot-mixed asphalt paving over prepared subbase.
- .2 This section includes provisions for replacing pavement removed during the Work or damaged resulting from Contractor's operations.

#### **1.3 RELATED WORK**

- .1 Synthetic track surveying Section 32 18 23.38
- .2 Synthetic track surfacing Section 32 18 23.39

#### **1.4 REFERENCE STANDARDS**

- .1 American Standard Testing Materials (ASTM)
- .2 Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
- .3 Applicable Provincial Department of Transportation Standard Specifications.
- .4 Master Municipal Construction Documents (MMCD)

#### **1.5 INSPECTION**

- .1 The Contractor shall notify the Owner's Representative and Consultant at least 48 hours before any inspection.

#### **1.6 SUBMITTALS AND TESTING**

- .1 Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.
- .2 Field Test Reports: Submit results of Marshal density field testing directly to the EOR.
- .3 The GC shall submit asphalt concrete design mix to the Consultant and City for review and approval. Submit test certificates showing suitability of materials at least 1 week prior to commencing work. The mix design is to include at a minimum Marshall Stability (at 60°C). flow value, air voids, aggregate voids, and index of retained stability.
  - .1 Physical Characteristics Design Mix Table to be as per MMCD hot mix asphalt concrete paving
- .4 Track Paving Experience:
  - .1 Track Paving Contractor Qualifications:



- .1 Track Paving Contractor shall provide a list of personnel and completed facilities (minimum of 2 running tracks in past ten years).
- .2 Track Paving Contractor shall provide an experienced on-site supervisor (minimum of 2 running tracks, in past ten years) to direct the Work at the site. The Supervisor must be on the site for the duration of the Work once the material has been delivered to the site, and is ready for installation, until the completion of the entire installation including rolling and compaction.
- .5 The GC shall engage a certified professional third-party geotechnical testing agency for Quality Control testing and reporting. Reports to be forwarded to the Civil Consultant and City.
- .6 The GC shall submit granular base compaction tests results, to the Consultant and City for review and approval that are a representative sample from all areas that will be receiving running track asphalt concrete paving proving that the granular base meets the specified compaction.
- .7 The cost of all submittals, testing and reporting shall be at the GC's expense.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Products shall satisfy the requirements of the standard unless otherwise specified herein or on the drawings.

### **2.2 MATERIALS**

- .1 Fill:
  - .1 Refer to Section 31 23 01 - Excavating and Backfilling
- .2 Granular Base:
  - .1 Refer to Section 31 05 17 - Aggregate and Granular Materials
- .3 Hot Mix Asphalt:
  - .1 Hot mix asphalt for surface courses shall consist of coarse and fine aggregates and mineral filler plant-mixed with bitumen binder.
  - .2 All hot mix asphalt shall be in accordance with applicable provisions of State or Provincial Department of Transportation "Standard Specifications for Road and Bridge Construction", except as herein modified.
  - .3 The hot mix asphalt shall be plant-mixed and the bituminous material for mixture shall be AC-1, 85 - 100 penetration grade or 60 - 70 penetration grade where required in warm climates. The asphaltic cement (AC-1) content shall be 4.0 % - 6.0% (by weight) of the total composite mixture.
  - .4 Coarse aggregate (material retained on the 4.75mm sieve) shall be sound, angular crushed stone or gravel (shale is not recommended).
  - .5 Fine aggregate (material passing the 4.75mm sieve and retained on the # 200 (0.075mm) sieve) shall be sand, stone sand and stone screening Class B quality or better and gradation FA - 3.

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- .6 Mineral filler (Material passing the # 200 (0.075mm) sieve) shall be dry limestone or dust.
- .7 The aggregate shall have the following maximum limits of detrimental substances:
  - .1 Soft fragments, AASHTO T189: 2.00%
  - .2 Coal and lignite, AASHTO T113: 0.25%
  - .3 Clay lumps, GHD 1: 0.25%
  - .4 Flat or elongated pieces (length greater than five times average thickness): 10.00%
  - .5 Sulfur content computed as sulfide sulfur, ASTM E30: 0.01%
  - .6 Other local detrimental Substances: 2.00%
- .8 The gradation of the composite aggregate for the Asphalt Bottom Course shall conform to MMCD Lower course #2

Sieve	Total % Passing
3/4" (19mm)	100
1/2" (12.5mm)	90-100
3/8" (9.5mm)	78-82 (80)
#4 (4.75mm)	45-75
#8 (2.36mm)	25-55
#30 (0.60mm)	5-20 (12)
#50 (0.30mm)	5-16 (6.5)
#100 (0.15mm)	2-9 (3)
#200 (0.075mm)	0-5 (3)

- .9 The gradation of the composite aggregate for the Asphalt Top Course shall conform to MMCD Upper course #2

Sieve	Total % Passing
1/2" (12.5mm)	100
3/8" (9.5mm)	90-100 (100)
#4 (4.75 mm)	60-90 (70)
#8 (2.36mm)	35-65 (49)
#30 (0.60mm)	20-25 (22)
#50 (0.30mm)	6-25 (14)
#100 (0.15mm)	(8)
#200 (0.075mm)	0-5 (3)

- .10 The asphalt "Bottom Course" and "Top Course" mixtures are the type IV mixes recommended by the Asphalt Institute. Hot mix asphalt mixtures may differ from the above provided specifications, meet or exceed the present specifications. Determination of the job mix formula shall be based on attaining a mix having a Marshall Stability (ASTM D1559, 75 blows each Side) of 750 lbs. or greater.
- .11 Samples of the job mix from the asphalt plant shall be laboratory tested for Marshall Stability. A compacted specimen shall be retained for density (ASTM D2726) comparison with core samples from the installed pavement.

- .4 Prime coats and tack coats
  - .1 The primer for application on aggregate base (prime coat) MMCD Asphalt Prime (32 12 13.2).
  - .2 The primer for application on asphalt surfaces (tack coat) shall be MMCD Asphalt Tack Coat (32 12 13.1).

### Part 3 Execution

#### 3.1 SUB-GRADE

- .1 Surface shape of the sub-grade shall comply with the tolerances itemized in the following table:

Item	Characteristic	Tolerance
Sub-grade	Level	+20mm / -20mm
	Thickness	Unspecified

- .2 Should a section of the work not be acceptable based on level, high areas shall be graded off, low areas shall be corrected by adding and compacting material similar to that already in place.
- .3 The placement of the sub-base layer shall not be commenced until the sub-grade has been approved following inspection and/or testing.

#### 3.2 SUB-BASE AND BASE

- .1 Pavement base courses shall comply with the tolerances itemized in the following table:

Item	Characteristics	Tolerance
Base	Level	+5mm / -5mm
	Straightness	6 mm maximum deviation from 4m straight-edge in all directions
	Thickness	+15mm / -15mm
Sub-base	Level	+10mm / -10mm
	Thickness	+30mm / -30mm

- .2 Should a section of the work not be acceptable based on elevation, planarity or depth, high areas shall be graded off, low areas shall be scarified to the full layer depth, built up as necessary and re-compacted as specified.
- .3 Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.

#### 3.3 HOT MIX ASPHALT PAVEMENT

- .1 Mixing of hot mix asphalt should be undertaken in a mixing plant capable of effectively drying and heating the aggregate to the specified temperature, accurately proportioning and uniformly mixing coarse and fine aggregate, filler and binder to always meet the specified requirements. For all types of mixing facilities:
  - .1 Asphalt, which has been stored for more than twenty-four hours or produced at temperatures not in accordance with those specified, shall not be used.
  - .2 The mix shall leave the mixing facility at a temperature between 285°F (140°C) and 320°F (160°C).

- .2 The hot mix asphalt must be kept clean during hauling and covered if necessary, during transit with canvas or other material that will retain the desired pavement temperatures. The mixtures must not be hauled in such a manner that segregation of the ingredients takes place or that a crust is formed on the surface, or that mixture will crumble or flatten out when dumped.
- .3 The hot mix asphalt shall be spread by running two(2) self-propelled machine spreaders 'in tandem' to ensure a hot seam is created at the joint. The self-propelled machine spreaders shall have a floating screed assembly.
- .4 Self-propelled rollers are required as compaction equipment. Towed-type rollers should not be used. Hand-held or vibrating plate compactors can be used in small, inaccessible areas. Steel-wheeled non-vibrating rollers shall have a mass of 10 tons (9 metric tons). Steel wheeled vibrating rollers shall have a mass of 5 tons (4.5 metric tons). Pneumatic tired multi-wheeled rollers shall not be used.
- .5 The hot mix asphalt shall be placed with a minimum delay after delivery.
- .6 The day's work shall be organized so that each layer spread covers the full width of the pavement.
- .7 Hot mix asphalt shall be spread to a depth consistent with the specified compacted thickness. Each layer shall be completed to a surface parallel to the finished surface of the pavement and at a depth below it equal to the compacted thickness of the subsequent layer or layers specified.
- .8 Hot mix asphalt shall not be placed during rain, or when the air temperature in the shade and away from artificial heat is 50°F (10°C) or less, or while the surface is wet or when the pavement temperature does not comply with the Table below:

Pavement surface temperature in shade	Minimum Laying Temperatures Bottom Course	Minimum Laying Temperatures Top Course
40°F - 50°F (5°C - 10°C)	302°F (150°C)	293°F (145°C)
50°F - 60°F (10°C - 15°C)	293°F (145°C)	284°F (140°C)
60°F - 77°F (15°C - 25°C)	284°F (140°C)	275°F (135°C)
Over 77°F (Over 25°C)	275°F (135°C)	266°F (130°C)

- .9 Maximum laying temperature of the mixture shall be 320°F (160°C)
- .10 The temperature of the mix shall be measured in the truck just prior to discharging into the paver hopper. A suitable stem type thermometer shall be used. The stem shall be inserted into the mix to a depth of approximately 8" (200mm) at a location at least 12" (300mm) from the side of the truck body. An average of at least two readings shall be adopted as the temperature of the mix.
- .11 There are three acceptable types of sensing devices used with the automatic screed control system:
  - .1 The Wand Sensor
  - .2 The Ultra Sonic Sensor
  - .3 The Laser Sensor
- .12 The grade reference used with the above listed sensing devices can be either a fixed string line tied between graded iron pins or on an existing surface, a previously placed surface, a curb line, etc. A string line can be erected that will include roll down factors for true grade. The roll down is estimated to be about 25% of the non-compacted mat

thickness. To calculate the exact position of the string line, a survey crew is used to determine the existing grade at approximate intervals of 9 meters (30 feet). The existing grade is subtracted from the theoretical grade for calculation of lift thickness. A roll down factor of 25% of this thickness is added for the string line grade. Once the string line is erected, intermediate points of support may be placed under the string line, especially on curves or in sudden changes of grade. Graded iron pins and intermediate supports should be placed so that they will not interfere with the travel of the machine spreader, but close enough to each other and to the path of the machine spreader that they can hold the string in a convenient position to be reached by the electronic sensors and by a short straight edge placed on the newly laid pavement to visual check on its level.

- .13 The area to be surfaced with hot mix asphalt shall be cleared of all foreign or loose material with power blowers, power brooms or hand brooms.
- .14 Crushed stone or asphalt surfaces shall be primed prior to the installation of the bottom course and top course. Prime crushed stone surfaces at the rate of 0.3 gallons per square yard. Prime asphalt surfaces at the rate of 0.05 gallons per square yard. Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application. Each sprayer shall be fitted with a hand lance. Tack Coat shall be applied, not less than thirty (30) minutes nor more than two (2) hours before hot mix asphalt is placed. When spraying the tack coat, shields shall be used and all necessary precautions taken to protect curbs, gutters, channels, adjoining structures, surfaces and grassed areas. Any pools of tack coat which may form in small depressions or surface irregularities shall be brushed out over the adjacent area with brooms or rubber squeegees before the emulsion breaks. In dusty conditions, every precaution shall be taken to prevent freshly coated surfaces from being contaminated by dust or other foreign material.
- .15 Starting blocks equal to 1.25 times the thickness of the non-compacted mat are required to set the thickness and to null the screed.
- .16 Blocks equal to 25% of the non-compacted thickness are used to start from a joint.
- .17 The screed must be initially heated at the start of each new paving operation.
- .18 Hot mix asphalt shall be spread in such a manner as to minimize the number of transverse and longitudinal joints in the pavement.
- .19 Transverse joints shall be constructed where the spreading operation is stopped for longer than 20 minutes. Transverse joints in adjoining spreader runs shall be offset by not less than 8 feet (2.44m). Transverse joints shall be offset from layer to layer by not less than 8 feet (2.44m). Transverse joints shall be constructed at right angles to the direction of spreading and be cut to a straight vertical face for the full depth of the layer.
- .20 When the construction is ready to stop for the end of the day or for a period longer than 20 minutes, the following procedure is used to form a suitable transverse joint:
  - .1 As the hopper empties and the amount of material in the screed chamber decreases below normal operating level, the paver is stopped.
  - .2 The screed is raised and the paver moved out of the way.
  - .3 The mix is then removed from the end of the mat to form a clean, vertical edge.
  - .4 Heavy wrapping paper is placed on the existing surface along the edge of the joint.

- .5 New material is finally placed on top of the paper and used to form a ramp, from the new surface to the existing surface.
- .21 When construction is ready to resume, the following procedure is used to form a suitable transverse joint:
  - .1 The ramp of material is removed along with the board or paper.
  - .2 A straightedge is used to check the longitudinal grade of the mat. If it is not level, a new transverse edge must be cut behind the point where the taper begins.
  - .3 The vertical face of the mat is tack-coated.
  - .4 The paver is backed up to the edge of the mat and the screed rested on the mat surface.
  - .5 The screed is heated while it rests on the mat.
  - .6 The heated screed is raised and shims as thick as the difference between the compacted and the non-compacted mat (approximately 25% of the compacted thickness) are positioned under its ends.
  - .7 The truck with the first load of HMA is backed carefully to the hopper. During discharge of the mix from the truck bed to the paver, it is essential that the truck not bump the paver and cause it to move.
  - .8 The paver starts forward.
  - .9 Once the paver has moved away, excess asphalt is cleaned off the surface of the mat and the smoothness of the joint is checked with a straightedge.
  - .10 If the joint is satisfactory, a 6" (150mm) width of the fresh mix is rolled transversely and the joint checked for smoothness. If the joint is satisfactory, transverse rolling is continued in 6" to 12" (150 to 300mm.) increments until the entire width of the roller is on the new HMA. If straight edging shows an uneven joint, the surface of the new mat must be scarified while still warm and workable. Scarification is done with the fine side of the lute. Excess material can then be removed or additional material added, and the joint rolled. During rolling, timbers should be placed along the edges of the mat to prevent the roller from driving off the longitudinal edge and distorting it.
- .22 The hot mix asphalt shall be spread by running two(2) self-propelled machine spreaders 'in tandem' to ensure a hot seam is created at the joint. Longitudinal joints shall be offset from layer to layer by not less than 6" (150 mm) Longitudinal joints shall be parallel to the center line of the pavement.
- .23 The following procedure is used to form a suitable longitudinal joint:
  - .1 The exposed edge of the first lane shall be formed while hot to a straight line with a dense face, which shall lie between vertical and 45° to the vertical for the full depth of the layer.
  - .2 The unsupported longitudinal edges of spread material should be side tamped to raise the level of the hot mix asphalt slightly to secure maximum edge compaction from subsequent rolling.
  - .3 While placing the companion lane, the paver screed should be set to overlap the first mat by 1" to 2" (25 to 50 mm).

- .4 The elevation of the screed above the surface of the first mat should be equal to the amount of roll-down expected during compaction of the new mat.
- .5 The coarse aggregate in the material overlapping the cold joint should be carefully removed and wasted. This leaves only the finer portion of the mixture to be pressed into the compacted lane at the time the joint is rolled.
- .24 The placing of hot mix asphalt against abutting structures such as curbs, gutter, manhole or adjoining pavement shall be carried out in the same manner as for longitudinal and transverse joints. Any spaces left unfilled between the spreader run and abutting edges shall be filled with sufficient material to the proper height prior to compaction.
- .25 After the paving mixture has been properly spread, it shall be thoroughly and uniformly compressed by rolling with power rollers.
- .26 Hot mix asphalt shall be compacted uniformly to the standard specified as soon as it will support rollers without undue displacement. All rolling shall be completed while the mix is at a temperature above 185°F (85°C).
- .27 The pavement shall be compacted to 97% or more of the density (ASTM F2726) obtained on a retained job mix specimen by the seventy-five blow Marshall procedure (ASTM D1559), Marshall stability (ASTM D1559) shall be 750 lbs. or greater.
- .28 The exact number of passes of a roller that will be required to obtain adequate density will be determined on a test strip using a nuclear density gauge to measure the density of the mat after each pass, until maximum achievable density is indicated by the test results. The rolling pattern used on the test strip should be the same that will be used on the remainder of the job. The number of rollers and/or the rate of production will be adjusted accordingly.
- .29 The speed of rollers shall be slow enough to avoid displacement of the mix.
- .30 Steel wheel rollers shall be operated with minimum wetting of rollers.
- .31 Vibratory mechanisms shall be disengaged before stopping or reversing direction.
- .32 Rollers shall not remain stationary on hot mix asphalt while it is still warm. Roller wheels shall be kept free from any build-up.
- .33 The roller shall pass over the unprotected end of the freshly laid mixture only when a transverse joint must be made.
- .34 Initial (breakdown) rolling shall be performed with a static steel-wheeled roller. Transverse joints shall be rolled first, then the longitudinal joint and the outside edge. Breakdown rolling shall continue longitudinally, commencing on the lower side and proceeding to the higher side of the spreader run. The roller shall overhang the unsupported edges of the run by about 4-inch (100mm). Each longitudinal pass shall overlap the previous pass by about 4-inch (100mm) and adjacent passes of the roller shall be of different lengths.
- .35 Secondary rolling to obtain required density before the mixture cools to 185°F (85°C) shall be performed as soon as possible after initial rolling and shall be performed with a static or a vibratory steel wheeled roller. Rolling shall be carried out longitudinally commencing on the lower side and proceeding to the higher side of the spreader run. Each roller pass shall overlap the previous pass, and adjacent passes shall be of different lengths.
- .36 Final rolling for the improvement of the surface while the mixture is still warm enough to permit removal of any roller marks shall be performed with static steel wheeled roller.

- .37 When paving in echelon, the edge of the run common to adjacent spreaders shall be left unrolled for a width of 8 inch (200mm) until the longitudinal joint has been constructed. This strip shall be rolled together with the edge of the adjacent spreader run. Rolling shall commence before the temperature of the material along the edge of the first spreader run has fallen below 95°C (203°F).

### 3.4 ACCEPTANCE AND REMEDY WORK

- .1 Each successive layer shall not be commenced until the underlying layer has been approved following inspection and/or testing.
- .2 Acceptance of paving work as far as compaction and Marshall Stability specifications is concerned will be based on tests to be performed on core samples taken from each layer shortly after application.
- .3 Should a section of the work be not acceptable based on inadequate compaction and/or the mixture became loose and broken, mixed with dirt or in any way defective, it shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.
- .4 On completion of placement and compaction, pavement courses shall comply with the tolerances itemized in the following table:

Item	Characteristic	Tolerance
Top Course	Level	+2mm / -2mm from design levels
	Thickness	+5mm / -0 mm from design thickness
	Planarity	3mm maximum departure from a 3m straight-edge in all directions
Bottom Course	Level	+4mm / -4mm from design levels
	Thickness	+5mm / -0mm from design thickness
	Planarity	4mm maximum departure from a 3m straight-edge in all directions

- .1 Note: The hot mix asphalt top course must meet flush with the concrete curbs on the inside and outside edge of the track. The adjacent concrete will be used in the planarity calculations.
- .5 Surface shape of each layer of pavement shall be such that water cannot accumulate at any point and the surface shall free drain to drainage channels.
- .6 The whole surface of each layer of pavement should be checked for levels by a local surveyor, and for planarity with a 3m straightedge in all directions; the surface shall also be flooded and inspected for ponding, "bird baths", ridges, etc. After testing, all high and low areas shall be marked on the leveling course surface.
- .7 Areas of one (1) square inch or more showing excess of bitumen shall be removed and replaced.
- .8 Asphalt infrared repair techniques: high and low asphalt sections can be remedied using infrared asphalt heaters that allow continuous, uniform re-heating of the asphalt to the same temperature that new asphalt is manufactured at the plant. The softened asphalt can be scarified to mix in fresh hot mixture, or to remove and dispose of the excess. The repaired area shall be thoroughly compacted to the specified tolerance.
- .9 Asphalt removal and replacement: high and low asphalt sections, sections that became loose and broken because of localized cohesive failure, or mixed with dirt or mud, or



showing excess of bitumen, or contaminated by oil spills that penetrated deep into the asphalt can be remedied by cutting out the top course to full depth - or to a minimum depth of 1" - and replacing with new hot mixture at the correct elevation. First the area must be tack coated. The repaired area shall be thoroughly compacted to the specified tolerance. Areas affected by cracks and fissures generated by instability of the subbase shall be cut out to the full depth of the stone base and replaced. First the defective subbase shall be remedied or replaced.

- .10 Additional finish rolling of asphalt in warm weather, when pavement temperature is equal to or above 85°C (185°F), can be performed to remedy minor profile deficiencies and to remove tire marks and roller marks. Additional finish rolling shall be immediately interrupted in the event of over-compaction.
- .11 All contaminants must be removed from the base via mechanical abatement such as power washing, sanding, wet grinding, scarifying or shot-blasting. The degree of aggressivity required will vary with the type and depth of penetration of the compound on the surface.
- .12 Never use chemical abatement methods as residual chemicals on or penetrating the surface of the base.
- .13 No open flames shall be applied to soften the asphalt since open flames would burn bitumen and reduce the internal cohesion of the mixture.
- .14 No filling of low spots with sand mixes shall be allowed. Sand mixes lack sufficient internal cohesion.
- .15 No tar emulsions shall be applied to the surface. Nor shall any other type of asphalt or tar leveling or sealing product (hot or cold) be coated on the surface.
- .16 No asphalt milling shall be performed to remedy profile deficiencies.

### **3.5 SEQUENCING AND SCHEDULING**

- .1 Coordinate the placement of hot mix asphalt pavement with the completion of underground work by other trades.
- .2 The asphalt top course shall be allowed to cure for 28 days prior to application of track surfacing.

### **3.6 CERTIFICATION OF ASPHALT BASE**

- .1 The installer responsible for the synthetic running track surfacing shall perform an inspection of the asphalt and in conjunction with test results, submit written certification of acceptance of the asphalt base for the installation of the synthetic track surfacing. The inspection and certification shall be completed at least two working days prior to synthetic track surfacing installation.
- .2 The synthetic track surfacing contractor shall notify the General Contractor and Engineer if there is any evidence of defect or installation conditions which could result in unsatisfactory performance.

### **3.7 WORLD ATHLETICS CERTIFICATION**

- .1 The following criteria must be followed. The track surface i.e., asphalt substrate, shall not exceed the following gradients:
  - .1 0.1% downward in the direction of running. This applies to the oval as well as the event areas i.e., long jump, triple jump, javelin and pole vault.

- .2      1% across the width of the track towards the inside lane and across the width of any event runway i.e., long jump, triple jump, javelin and pole vault.

**END OF SECTION**

## **Section 32 13 13 CURBS AND SIDEWALKS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This Section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements

#### **1.2 SUMMARY**

- .1 .1 Provide Portland cement concrete sidewalks, curbs and wheel stops where indicated and specified.

#### **1.3 RELATED SECTIONS**

- .1 31 23 00 - Excavations and Fill
- .2 32 12 16 - Asphalt Paving

#### **1.4 REFERENCES**

- .1 ASTM C94, Ready Mix Concrete.
- .2 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
- .4 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .5 ASTM D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .6 ASTM D3405, Specification for Joint Sealants, Hot Poured, for Concrete and Asphalt Pavements.
- .7 British Columbia Building Code 2024.
- .8 CAN/CSA-A5, Portland Cement.
- .9 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
- .10 CAN/CSA-A23.2, Methods of Test for Concrete.

#### **1.5 PERFORMANCE REQUIREMENTS**

- .1 Sidewalks and Paving: Designed for medium duty commercial vehicles, and pedestrian traffic.
- .2 Perform perimeter sidewalk on-site and off-site work to municipal standards.

#### **1.6 SUBMITTALS**

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Product Data: Provide data on joint filler, admixtures and curing compounds.

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- .3 Inform Consultant of proposed source of materials and provide access for sampling at least 4 weeks prior to commencing work.
- .4 Submit the proposed mix design of each class of concrete to Consultant for review prior to commencement of work.
- .5 If materials have been tested by an accredited testing laboratory within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

#### **1.7 ALLOWABLE TOLERANCES**

- .1 Establish and grade base courses with surfaces within 6mm (1/4") of established elevations and within a tolerance of 6mm (1/4") under a 3m (10'-0") long straightedge as per MMCD.

#### **1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Do not place concrete when base surface temperature is less than 4degC, or surface is wet or frozen.

#### **1.9 PROTECTION**

- .1 Prevent vehicle or foot traffic to occur over freshly laid concrete for at least 24 hours following completion. Barricade the areas as required.
- .2 Work only in areas where no Project earthwork or trucking is taking place.
- .3 Take necessary measures to ensure that dust from work of this Section is not spread over adjacent areas.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Formwork Materials: Conform to CAN/CSA-A23.1M.
- .2 Non-staining mineral type form release agent: chemically active release agent containing compounds that react with free lime to provide water soluble soap.
- .3 Granular base: specified in Section 31 23 00
- .4 Portland Cement Concrete: as specified in Structural Specifications or on drawings, complete with air entraining agents for exterior work.
- .5 Air entraining admixture: to ASTM C260, 5% to 7% air entrained
- .6 Preformed joint fillers: Bituminous impregnated fibre board: to ASTM D1751.
- .7 Exterior grade concrete curing compound: to ASTM C309.
- .8 Hot poured Joint Sealants are to conform ASTM D3405.
- .9 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.

#### **2.2 DESIGN**

- .1 Cast-in-place concrete sidewalks and formed concrete curbs and precast parking wheel stops.
- .2 Concrete: 32 MPa at 28 day, Minimum 150mm thick, grey colour Portland cement.

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- .3 Concrete finishes: washed aggregate and broom finish sidewalks as shown on drawings; smooth sack rubbed for curbs and wheel stops.
- .4 Finish all concrete to required levels with no irregularities exceeding 5mm in 2 m.
- .5 Wheel Stops: pre-cast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, or high-density plastic, approximately 150 mm high, 225 mm wide, by 2130 mm long. Provide chamfered corners and drainage slots on underside, and provide holes and galvanized steel dowels for anchoring to substrate.

## **2.3 DESIGN**

- .1 Cast-in-place concrete sidewalks and formed concrete curbs and precast parking wheel stops.
- .2 Concrete: 32 MPa at 28 day, Minimum 150mm thick, grey colour Portland cement.
- .3 Concrete finishes: washed aggregate and broom finish sidewalks as shown on drawings; smooth sack rubbed for curbs and wheel stops.
- .4 Finish all concrete to required levels with no irregularities exceeding 5mm in 2 m.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify compacted sub-grade, granular base, stabilized soil is ready to support paving and imposed loads.
- .2 Verify gradients and elevations of base are correct.
- .3 Fill Aggregate with fines base course forms the base construction for work of this Section. See geotechnical report.

### **3.2 PREPARATION**

- .1 Moisten the base to minimize absorption of water from fresh concrete.
- .2 Notify the Consultant minimum 24 hours prior to commencement of concreting operations.

### **3.3 FORMING**

- .1 Place and secure the forms to correct location, dimension, and profile.
- .2 Assemble form-work to permit easy stripping and dismantling without damaging concrete.

### **3.4 JOINTS**

- .1 Place sidewalk crack control sawcuts at maximum 3 m (or as indicated) and place expansion and contraction joints at maximum 9 m intervals conforming to MMCD standards.
- .2 Align sidewalk joints with patio, curbs, gutter joints and landscape hard surface joints where possible.
- .3 Place joint filler between sidewalk or paving components or other appurtenances where applicable. Recess top of filler 1/2" for sealant placement by Section 07 92 00 Joint Sealants.
- .4 Place joint filler vertical in position, in straight lines. Secure to form-work during concrete placement.

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- .5 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, or permanent structure.

### **3.5 PLACING CONCRETE**

- .1 Place concrete in accordance with CAN/CSA-A23.1M and as specified in Structural Section.
- .2 Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### **3.6 FIELD QUALITY CONTROL**

- .1 Perform field inspection and testing under provisions for concrete in Structural Specifications.
- .2 Testing firm will take cylinders and perform slump and air entrainment Tests in accordance with CAN/CSA-A23.1M.
- .3 One slump test will be taken for each set of test cylinders taken.
- .4 Maintain the records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

### **3.7 PROTECTION**

- .1 Keep traffic off newly paved areas until paving has properly cured and joints have been sealed.
- .2 Promptly remove from the job site all concrete droppings and debris resulting from the work of this section.

**END OF SECTION**

## **Section 32 13 13 CONCRETE PAVING**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 Section Includes Concrete Paving. Including the Following:
  - .1 Walks and player shelter areas.

#### **1.2 ACTION SUBMITTALS**

- .1 Product Data: For each type of product.
- .2 Samples: For each type of product, ingredient, or admixture requiring color selection.
- .3 Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### **1.3 QUALITY ASSURANCE**

- .1 Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

#### **1.4 PRECONSTRUCTION TESTING**

- .1 Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures. Testing agency to be approved by City Representative and Consultant.

### **Part 2 Products**

#### **2.1 CONCRETE, GENERAL**

- .1 ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

#### **2.2 STEEL REINFORCEMENT**

- .1 Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
- .2 Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- .3 Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.
- .4 Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

#### **2.3 CONCRETE MATERIALS**

- .1 Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - .1 Portland Cement: ASTM C 150/C 150M, portland cement Type I.

- .2 Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4M.
- .3 Air-Entraining Admixture: ASTM C 260/C 260M.
- .4 Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- .5 Water: Potable and complying with ASTM C 94/C 94M.

## **2.4 FIBER REINFORCEMENT**

## **2.5 CURING MATERIALS**

- .1 Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.
- .2 Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- .3 Water: Potable.

## **2.6 RELATED MATERIALS**

- .1 Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.
- .2 Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

## **2.7 CONCRETE MIXTURES**

- .1 Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
- .2 Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - .1 Air Content: 5-1/2 percent plus or minus 1-1/2 percent.
- .3 Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- .4 Concrete Mixtures: Normal-weight concrete.
  - .1 Compressive Strength (28 Days): 4640 psi (32 MPa).
  - .2 Maximum W/C Ratio at Point of Placement: [0.45]
  - .3 Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).

## **2.8 CONCRETE MIXING**

- .1 Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.



## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

### **3.2 PREPARATION**

- .1 Remove loose material from compacted subbase surface immediately before placing concrete.

### **3.3 EDGE FORMS AND SCREED CONSTRUCTION**

- .1 Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- .2 Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### **3.4 STEEL REINFORCEMENT INSTALLATION**

- .1 Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

### **3.5 JOINTS**

- .1 General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
- .2 Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
- .3 Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
- .4 Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.
- .5 Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### **3.6 CONCRETE PLACEMENT**

- .1 Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- .2 Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- .3 Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- .4 Screed paving surface with a straightedge and strike off.

- .5 Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

### 3.7 FLOAT FINISHING

- .1 General: Do not add water to concrete surfaces during finishing operations.
- .2 Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - .1 Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

### 3.8 CONCRETE PROTECTION AND CURING

- .1 General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- .2 Comply with ACI 306.1 for cold-weather protection.
- .3 Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- .4 Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- .5 Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these.

### 3.9 PAVING TOLERANCES

- .1 Comply with tolerances in ACI 117 (ACI 117M) and as follows:
  - .1 Elevation: 3/4 inch (19 mm).
  - .2 Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  - .3 Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).
  - .4 Joint Spacing: 3 inches (75 mm).
  - .5 Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
  - .6 Joint Width: Plus 1/8 inch (3 mm), no minus.

### 3.10 REPAIR AND PROTECTION

- .1 Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Consultant / City Representative.
- .2 Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- .3 Maintain concrete paving free of stains, discoloration, dirt, and other foreign material.  
Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

**END OF SECTION**

## **Section 32 13 73 CONCRETE PAVING JOINT SEALANTS**

### **Part 1 General**

#### **1.1 SUMMARY**

- .1 Section Includes:
  - .1 Cold-applied joint sealants.
  - .2 Hot-applied joint sealants.
  - .3 Joint-sealant backer materials.
  - .4 Primers.

#### **1.2 PREINSTALLATION MEETINGS**

- .1 Preinstallation Conference: Conduct conference at **Burke Mountain Athletic Park** or via phone/online if appropriate. To be decided by City of Coquitlam and according to their health and safety measures.

#### **1.3 ACTION SUBMITTALS**

- .1 Product Data: For each type of product.
- .2 Samples: For each kind and color of joint sealant required.
- .3 Paving-Joint-Sealant Schedule: Include the following information:
  - .1 Joint-sealant application, joint location, and designation.
  - .2 Joint-sealant manufacturer and product name.
  - .3 Joint-sealant formulation.
  - .4 Joint-sealant color.

#### **1.4 INFORMATIONAL SUBMITTALS**

- .1 Product certificates.

### **Part 2 Products**

#### **2.1 MATERIALS, GENERAL**

- .1 Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

#### **2.2 COLD-APPLIED JOINT SEALANTS**

- .1 Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.
- .2 Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

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- .3 Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
- .4 Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
- .5 Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

## **2.3 HOT-APPLIED JOINT SEALANTS**

- .1 Classifications of sealants in this article are based on ASTM D 6690. Type I is for moderate climates and tested down to zero deg F (minus 18 deg C) with 50 percent extension. Type II and Type III are for most climates and tested down to minus 20 deg F (minus 29 deg C) with 50 percent extension. Type IV is for very cold climates and tested down to minus 20 deg F (minus 29 deg C) with 200 percent extension.
- .2 Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I.

## **2.4 JOINT-SEALANT BACKER MATERIALS**

- .1 Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- .2 Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- .3 Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

## **2.5 PRIMERS**

- .1 Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

# **Part 3 Execution**

## **3.1 INSTALLATION OF JOINT SEALANTS**

- .1 Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- .2 Cleaning of Joints: Clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
- .3 Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer.
- .4 Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- .5 Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - .1 Do not leave gaps between ends of joint-sealant backings.
  - .2 Do not stretch, twist, puncture, or tear joint-sealant backings.

- .3 Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- .6 Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
  - .1 Place joint sealants so they fully contact joint substrates.
  - .2 Completely fill recesses in each joint configuration.
  - .3 Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- .7 Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
  - .1 Remove excess joint sealant from surfaces adjacent to joints.
  - .2 Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- .8 Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- .9 Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

**END OF SECTION**

## **Section 32 17 23 PAVEMENT MARKINGS**

### **Part 1 General**

#### **1.1 DOCUMENTS**

- .1 This Section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division, 1 General Requirements.

#### **1.2 SUMMARY**

- .1 Provide painted site pavement traffic and lane markings as indicated.
- .2 Provide parking bay striping, lane divider stripes, and directional arrows.
- .3 Provide lettering and graphic symbols.
- .4 Provide crosswalks, paint curbs and safety zone striping as indicated.
- .5 Provide painted markings for playground including but not limited to basketball courts.

#### **1.3 RELATED SECTIONS**

- .1 03 11 00 - Concrete Forming.
- .2 03 31 00 - Cast In Place Concrete.
- .3 09 90 00 - Painting and Coating.

#### **1.4 SUBMITTALS**

- .1 Submittals to be in accordance with 01 33 00, Submittal Procedures.
- .2 Product Data:
  - .1 Provide product data and MSDS sheets for each product used.
  - .2 Provide manufacturer's installation instructions. Indicate special installation instructions.

#### **1.5 PROJECT CONDITIONS**

- .1 Coordinate this work with the work of other Sections to avoid delays or interference with other work.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Pavement Marking Paint: Refer to Section 09 90 00 Painting and Coating.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Examine substrates with installer present to ensure conditions are suitable for intended applications. Correct unsatisfactory conditions. Starting work constitutes acceptance of the existing conditions.

### **3.2 PREPARATION**

- .1 Allow concrete to be fully cured before application of marking paint. Remove dirt, oil, grease and foreign material from areas of pavement and curbs to be marked.
- .2 Apply paint only on thoroughly dry surfaces, when atmospheric temperature is above 10 deg C (50 deg F), when relative humidity is below 85 percent, and for exterior work, when weather is favorable.

### **3.3 INSTALLATION**

- .1 Apply pavement-marking paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Provide templates for all other work.
- .2 Apply at manufacturer's recommended rates to provide a minimum dry film thickness of 8mils.
- .3 Layout and review with Consultant and Owner before paint application. Apply respective markings in colors shown. Use white unless noted otherwise.
- .4 Do not permit traffic on pavement until markings are thoroughly dry.

**END OF SECTION**



## **Section 32 17 23.13 SPORT COURT SURFACING**

### **Part 1 General**

#### **1.1 SECTION INCLUDES**

- .1 Asphalt sport court surface colour coating system.

#### **1.2 RELATED WORK**

- .1 32 12 16 Hot Mix Asphalt Paving

#### **1.3 REFERENCE STANDARDS**

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
  - .1 Tennis Canada.

#### **1.4 SUBMITTALS**

- .1 Product Data: Submit manufacturer's product data, including surface and crack preparation and application instructions.
- .2 Samples: Submit manufacturer's color samples of color coating.
- .3 Test Reports:
  - .1 Submit independent test results for solar reflectance index.
  - .2 Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
  - .3 Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.
- .4 Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- .5 Manufacturer's Project References: Submit manufacturer's list of successfully completed asphalt tennis court or sport court surface color coating system projects, including project name, location, and date of application.
- .6 Applicator's Project References: Submit applicator's list of successfully completed asphalt tennis court or sport court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.
- .7 Warranty Documentation: Submit manufacturer's standard warranty.

#### **1.5 QUALITY ASSURANCE**

- .1 Manufacturer's Qualifications:
  - .1 Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt tennis court or sport court surface color coating systems of similar type to that specified.

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.2 Applicator's Qualifications:

- .1 Applicator regularly engaged, for past 3 years, in application of tennis court or sport court surface color coating systems of similar type to that specified.
- .2 Employ persons trained for application of tennis court or sport court surface color coating systems.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- .2 Storage and Handling Requirements:
  - .1 Store and handle materials in accordance with manufacturer's instructions.
  - .2 Keep materials in manufacturer's original, unopened containers and packaging until application.
  - .3 Store materials in clean, dry area indoors.
  - .4 Store materials out of direct sunlight.
  - .5 Keep materials from freezing.
  - .6 Protect materials during storage, handling, and application to prevent contamination or damage.
  - .7 Close containers when not in use.

**1.7 AMBIENT CONDITIONS**

- .1 Do not apply asphalt sport court surface color coating system when air or surface temperatures are below 10 degrees F during application or within 24 hours after application.
- .2 Do not apply asphalt tennis court surface color coating system when rain is expected during application or within 24 hours after application.

**Part 2 Products**

**2.1 MANUFACTURER**

- .1 Ocean Marker Sport Surfaces:  
4481 232st Langley BC  
604 530 6430  
Or Approved Equal
- .2 Plexipave Tomko Sports Systems, Inc.  
165 - 6660 Graybar Road  
Richmond, BC  
604-273-0257

**2.2 MATERIALS**

- .1 Asphalt Sport Court Surface Color Coating System: SportMaster, Colour Concentrate
- .2 Crack Sealant:
  - .1 100 percent acrylic emulsion elastomeric crack sealant.

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- .2 Seals cracks up to 1/2 inch wide in asphalt pavement.
- .3 Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- .4 Non-Volatile Material: 61 percent, plus or minus 5 percent.
- .5 Color: [Green] [Blue].
- .3 Crack Filler:
  - .1 100 percent acrylic emulsion trowel-grade crack filler.
  - .2 Fills cracks in asphalt pavement up to 1 inch wide.
  - .3 Chemical Characteristics, by Weight, Minimum:
    - .1 Acrylic Emulsion: 10.0 percent.
    - .2 Hiding Pigment: 0.2 percent.
    - .3 Mineral Inert Fillers: 78.0 percent.
    - .4 Film Formers, Additives: 1.8 percent.
    - .5 Water: 8.5 percent.
  - .4 Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
  - .5 Non-Volatile Material: 80 percent, plus or minus 5 percent.
  - .6 Color: [Green] [Neutral] [Red].
- .4 Patch Binder:
  - .1 100 percent acrylic emulsion liquid binder.
  - .2 Mix on-site with sand and cement.
  - .3 Levels and repairs low spots and depressions up to 3/4 inch deep in asphalt pavement.
  - .4 Fills Cracks in Asphalt up to 1" in width.
  - .5 Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- .5 Filler Course:
  - .1 100 percent acrylic emulsion resurfacer.
  - .2 Mix on-site with silica sand.
  - .3 Apply to asphalt surfaces or previously colored acrylic surfaces in preparation of color coating system.
  - .4 Chemical Characteristics, by Weight, Minimum:
    - .1 Acrylic Emulsion: 44.0 percent.
    - .2 Hiding Pigment: 2.0 percent.
    - .3 Mineral Inert Fillers: 5.0 percent.
    - .4 Film Formers, Additives: 0.2 percent.
    - .5 Water: 45.0 percent.
  - .5 Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
  - .6 Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.

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- .7 Color: [Black] or [Neutral].
- .6 Color Coating:
  - .1 100 percent acrylic emulsion coating.
  - .2 Mix on-site with silica sand and water.
  - .3 Color coats multipurpose courts.
  - .4 Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs.
  - .5 Color: [Blue] [Green] [Light Blue] [White].
- .7 Line Markings Primer:
  - .1 100 percent acrylic emulsion primer, clear drying.
  - .2 Primes line markings and prevents bleed-under for sharp lines.
  - .3 Chemical Characteristics, by Weight, Nominal:
    - .1 Acrylic Emulsion: 38.0 percent.
    - .2 Hiding Pigment: 0.0 percent.
    - .3 Mineral Inert Fillers: 7.0 percent.
    - .4 Film Formers, Additives: 1.5 percent.
    - .5 Water: 50.0 percent.
  - .4 Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
  - .5 Non-Volatile Material: 29 percent, plus or minus 5 percent.
- .8 Line Paint:
  - .1 Pigmented, 100 percent acrylic emulsion line paint.
  - .2 Line marking on asphalt sport courts.
  - .3 Chemical Characteristics, by Weight, Nominal:
    - .1 Acrylic Emulsion: 25.89 percent.
    - .2 Pigment: 14.90 percent.
    - .3 Mineral Inert Fillers: 13.12 percent.
    - .4 Additives: 4.73 percent.
    - .5 Water: 41.36 percent.
  - .4 Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
  - .5 Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
  - .6 Color: As per drawings.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Examine asphalt sport court surfaces to receive color coating system.
- .2 Verify asphalt sport courts meet Basketball Canada requirements.

- .3 Notify Landscape Architect of conditions that would adversely affect application or subsequent use.
- .4 Do not begin surface preparation or application until unacceptable conditions are corrected.

### **3.2 SURFACE PREPARATION**

- .1 Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt sport court surface color coating system.
- .2 Prepare surfaces in accordance with manufacturer's instructions.
- .3 Cure new asphalt surfaces a minimum of 14 to 30 days before application of asphalt sport court surface color coating system.
- .4 Remove dirt, dust, debris, oil, grease, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt sport court surface color coating system. Pressure wash entire surface.
- .5 Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.
- .6 Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.
- .7 Apply 1 or 2 coats of filler course as required by surface roughness and porosity to provide smooth underlayment for application of color coating.
- .8 Ensure surface repairs are flush and smooth to adjoining surfaces.

### **3.3 APPLICATION**

- .1 Apply asphalt sport court surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- .2 Mix materials in accordance with manufacturer's instructions.
- .3 Apply Filler Course and Color Coating with a 50-60 durometer, soft rubber squeegee.
- .4 Filler Course:
  - .1 Apply 2 coats on new asphalt or existing acrylic surfaces with extensive cracks or low spot repair.
  - .2 Apply 1 coat on existing acrylic surfaces with minimal repairs.
- .5 Color Coating: Apply a minimum of 2 coats of color coating to prepared surfaces in accordance with manufacturer's instructions.
- .6 Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

### **3.4 LINE MARKINGS**

- .1 Lay out court line markings as per plans.
- .2 Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and sport court surface to prevent bleed-under when line paint is applied.
- .3 Apply a minimum of 1 coat of line paint in accordance with manufacturer's instructions.

### **3.5 PROTECTION**

- .1 Allow a minimum of 24 hours curing time before opening sport courts for play.
- .2 Protect applied asphalt sport court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

## **Section 32 17 26**

### **EXTERIOR TACTILE WARNING SURFACE**

#### **Part 1 General**

##### **1.1 DOCUMENTS**

- .1 This Section of the Specifications forms part of the Contract and is to be read, interpreted, and coordinated with all other parts including Division 1, General Requirements

##### **1.2 SUMMARY**

- .1 .1 Provide tactile warning surfacing where indicated and specified.

##### **1.3 RELATED SECTIONS**

- .1 Section 31 23 00 - Excavation and Fill.

##### **1.4 REFERENCES**

- .1 Building Code In Force: Refer to Section 01 41 00, Regulatory Requirements.
- .2 ASTM B117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus.
- .3 ASTM C501-84(2009), Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
- .4 ASTM C1026-13, Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling.
- .5 ASTM C1028-07, Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
- .6 ASTM D543-06, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- .7 ASTM D570-98(2010)e1, Standard Test Method for Water Absorption of Plastics.
- .8 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.
- .9 ASTM D695-10, Standard Test Method for Compressive Properties of Rigid Plastics.
- .10 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- .11 ASTM E84-13a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .12 ASTM G151-10, Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources.
- .13 ASTM G155-13, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

##### **1.5 SUBMITTALS**

- .1 Product Data:

- .1 Submit manufacturer's literature describing products, installation procedures and maintenance instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Indicate all characteristics of the composite cast-in-place Tactile Warning Indicator, including material, profile, thicknesses, and installation methods.
- .3 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit two (2) Tactile Warning Surface samples, minimum 200 x 200, complete with fasteners. Samples shall be properly.
- .4 Material Test Results:
  - .1 Submit current test reports from qualified, accredited independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and meet the properties indicated. All test reports submitted shall be representative.
- .5 Closeout Submittals:
  - .1 Provide manufacturer's operation and maintenance data for each type of Tactile Warning Indicator and accessories.

## 1.6 QUALITY ASSURANCE

- .1 Provide composite cast-in-place Tactile Warning Indicator as produced by a single manufacturer with a minimum of five years' experience in manufacturing Tactile Warning Indicator.
- .2 Installer's Qualifications: Engage an experienced installer certified in writing by the Tactile Warning Indicator manufacturer, who has successfully completed Tactile Warning Surface installations similar in material, design, and extent to that indicated for the Contract.
- .3 Cast-in-place Tactile Warning Indicators must be compliant with ADAAG, PROWAG, and CA Title 24 requirements. Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11). IR 11B-4 (1/01/11) removed the requirement for a "staggered" pattern and now calls for the "square grid" (in-line) pattern.
- .4 Cast-in-place Tactile Warning Indicators shall meet or exceed the following test criteria using the most current test methods:
  - .1 Compressive Strength: 28,000 psi minimum, when tested in accordance with ASTM D695.
  - .2 Flexural Strength: 29,000 psi minimum, when tested in accordance with ASTM D790.
  - .3 Water Absorption: Not to exceed 0.10%, when tested in accordance with ASTM-D570.
  - .4 Slip Resistance: 1.00 minimum wet/dry static coefficient of friction when tested in accordance with ASTM C1028.



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- .5 Flame Spread: 25 maximum, when tested in accordance with ASTM E84.
- .6 Salt and Spray Performance of Tactile Warning Indicator: No deterioration or other defects after 200 hours of exposure, when tested in accordance with ASTM B117.
- .7 Chemical Stain Resistance: No reaction to 1% hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, and antifreeze, when tested in accordance with ASTM D543.
- .8 Abrasion Resistance: 500 minimum, when tested in accordance with ASTM C501.
- .9 Accelerated Weathering of Tactile Warning Indicator when tested by ASTM G155 or ASTM G151 shall exhibit the following result:  $\Delta E < 5.0$  at 2,000 hours minimum exposure.
- .10 Tensile Strength: 11,000 psi minimum, when tested in accordance with ASTM D638.
- .11 Freeze/Thaw/Heat: No deterioration when tested in accordance with ASTM C1026.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Cast-in-place Tactile Warning Indicators shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings.
- .2 Store Tactile Warning Indicators in an area that is within an acceptable temperature range (4-32 degrees C). In particular, protect sealants from freezing.
- .3 Maintain storage facility in a clean dry condition to prevent contamination or damage to Tactile Warning Surfaces.

#### 1.8 GUARANTEE

- .1 Tactile Warning Indicators shall be guaranteed in writing for a period of five (5) years from date of Contract's final completion. The guarantee includes manufacturing defects, breakage, and deformation.

### Part 2 Products

#### 2.1 MATERIALS

- .1 Composition: Tactile Warning Indicator shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based sheet molding compound (SMC) composite material. Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the Tactile Warning Indicator for superior slip resistance performance superior to that offered by a gloss finish.
- .2 Color: As selected by Consultant from Manufacturer's line.
  - .1 Color shall be homogeneous throughout Tactile Warning Indicator.
- .3 Domes: Square grid pattern of raised truncated domes of 5 mm nominal height, base diameter of 23 mm and top diameter of 11 mm. Truncated dome spacing range of 40 mm- 61 mm is acceptable. The preferred truncated dome spacing shall have a center-to-

- center (horizontally and vertically) spacing of 60 mm, measured between the most adjacent domes on square grid.
- .4 Configuration: The Warning Indicators shall feature a minimum of eight (8) embedded corrosion resistant 38 mm zinc inserts with 13 mm diameter bolts. Bolts must be covered with a structural water tight cap. Bolts must be located between the truncated domes (in the field) for maximum protection of the Bolt integrity. Do not locate bolts in the truncated dome.
- .1 The field area shall consist of a non-slip textured surface with a minimum static coefficient of friction of 0.80, wet and dry.
- .2 At a minimum, Warning Indicator thickness shall measure 6 mm nominal exclusive of the perimeter minimum 19 mm thick (nominal) by 25 mm wide flange structure. The body of the Tactile Warning Indicator must consist of a solid body for maximum strength and to eliminate the possibility of air entrapment and cracking. "Hollow back," "honeycomb," or "waffle tiles" are not acceptable for use on this Project.
- .5 Truncated Dome Surface of Warning Indicator shall be protected with factory installed plastic sheeting for cleanliness during the installation process. Installation guidelines shall be printed on the plastic sheeting in both English and French for customer convenience.
- .6 Dimensions:
- .1 100mm wide x maximum practical length.
- .2 Cleaning materials used on site shall have low VOC solvent content and low flammability.
- .7 The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.
- .8 Approved Product:
- .1 Armor-Tile by Kinesik Engineered Products.
- .2 Or approved alternative.

### **Part 3 Execution**

#### **3.1 EQUIPMENT REQUIREMENTS**

- .1 Provide all tools, equipment and services required for satisfactory installation per manufacturer's instruction.

#### **3.2 PREPARATION**

- .1 During all concrete pouring and Warning Indicators installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- .2 The physical characteristics of the concrete shall be consistent with the Contract Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Warning Indicator. An overly wet mix will cause the Warning Indicator to float. Under these conditions suitable weights such as 2 concrete blocks or sandbags (11 kg) shall be placed on each Warning Indicator.
- .3 The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to Warning Indicator placement.

### **3.3 INSTALLATION**

- .1 Tactile Warning Indicator will not be allowed to be installed until all submittals have been reviewed and approved by the Departmental Representative.
- .2 Warning Indicators shall be installed as per manufacturer' s written instructions.
- .3 To the maximum extent possible, the Warning Indicators shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple Warning Indicators regardless of size are used, the truncated domes shall be aligned between the tactile warning surface tiles and throughout the entire Tactile Warning surface installation.
- .4 The Warning Indicators shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Tactile Warning Indicator is flush to the adjacent concrete surface to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
- .5 On Continuous Runs: leave a 3mm nominal gap between successive Tactile Warning Indicators. As part of the concrete finishing operation, apply 3 mm - 6 mm edge treatment around the perimeter of the Tactile Warning Indicators to facilitate future replacement of the Warning Indicator. A Urethane Sealant such as Sikaflex 1a, BASF NP1, or approved alternate shall be applied to the edge treatment for a watertight installation.

### **3.4 CLEANING AND PROTECTION**

- .1 Protect Warning Indicators against damage during construction period to comply with manufacturer's written specifications.
- .2 During and after the Warning Indicator installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the Warning Indicators to rock the Warning Indicator, causing a void between the underside of the Warning Indicator and the concrete substrate.
- .3 Remove Protective Plastic Sheeting from Warning Indicator within 24 hours of installation. Particularly under hot weather conditions (27degrees C or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to Tactile Warning Indicator when not removed quickly.
- .4 Clean Warning Indicators not more than four (4) days prior to date of substantial completion in each area of project. Clean Warning Indicators by method specified by Tactile Warning Indicators manufacturer.

**END OF SECTION**

## **Section 32 18 23.29**

### **SYNTHETIC TURF SPORTS FIELD SURFACE**

#### **Part 1 General**

##### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

##### **1.2 DESCRIPTION**

- .1 Supply all products, labor, equipment, and services necessary to install synthetic turf sports field surface as indicated in the contract documents.
  - 1. The supply and installation of the synthetic turf field is to include all infill, game lines, and event markings. The synthetic turf surface is to be installed over a shock pad.
- .2 Accurate surveying and layout of the specified work program, including game lines and event markings as per the specifications and drawings herein. Verify field dimensions on site prior to shipping materials.
- .3 The provision of all Samples and Submittals as described herein.
- .4 The provision of all required testing as described herein.
- .5 The supply to the Owner, for post-installation maintenance use, the following items.
  - .1 100 m2 of material in same 4.5m / 15' widths.
  - .2 One (1) 20-liter pail of turf adhesive.
  - .3 One (1) super-sack of rubber infill material.
- .6 The Contractor must conduct an on-site one-hour maintenance seminar with the Owner's maintenance staff demonstrating maintenance and repair procedures and maintenance machine operations using the Owner's maintenance machinery.
- .7 Prior to Substantial Performance being granted the Contractor is to provide a warranty and separate product warranty as part of the required project binder as per the requirements herein.

##### **1.3 RELATED WORK**

- .1 Synthetic Turf Sports Field Shock Pad Section 32 18 23.31

##### **1.4 REFERENCE STANDARDS**

- .1 Standard specifications for rules:
  - .1 FIFA Laws of the Game (most current edition).
  - .2 FIH Rules for Field Hockey (most current edition).
  - .3 WL Rules for Field Lacrosse (most current edition).

- .2 Standard specifications for testing materials:
  - .1 American Standard Testing Materials (ASTM)
  - .2 Synthetic Turf Council - Suggested Guidelines for the Essential Elements of Synthetic Turf Systems
  - .3 European Standards/European Norms (EN)
  - .4 FIFA - Quality Programme for Football Turf - Test Manual I & II (2015 Editions)

## 1.5 INSPECTION

- .1 The Contractor shall notify the Owner's Representative at least 48 hours before any requested inspection.

## 1.6 TESTING AND APPROVALS

- .1 The Contractor must accept the use of the Owner's selected testing agencies for all testing noted herein. The test results of the samples must meet or exceed the test results that were supplied in the tender. The Turf Contractor is to instruct the testing agency to deliver the testing results directly to the Consultant. Accepted testing agencies are as follows:
  - .1 Labosport Canada, 5661, Rue de Lanaudiere, suite 100, QC H2G 3A5, Tel: 1.514.386.7077, Contact: Luc Poirier.
  - .2 Testing Services Inc., 817 Showalter Avenue, Dalton, Georgia, USA, 30721, Tel: 706.226.1400, Contact: Melissa Schultz.
  - .3 Sports Labs, 4295 Cromwell Road, Suite 204, Chattanooga, TN, USA, 37421, Tel: 423.541.5526, Contact: Kieran O'Donnell.
  - .4 Firefly Sports Testing, 78 Londonderry Turnpike, UNIT D5, Hooksett, NH, USA, 03106, Tel: 603.715.5453, Contact: Michael Gentile.
- .2 The Contractor is responsible for all testing costs.
- .3 After Manufacturing
  - .1 Prior to shipment of the synthetic turf material for the field, to the job site, synthetic turf material from every tenth roll should be randomly sampled and then tested by an independent testing laboratory noted above. Official test results shall be forwarded to the City and Consultant from the testing laboratory.
  - .2 The tests that must be performed on the samples from each roll are as follows:
    - .1 Pile Height - ASTM D5823-13
    - .2 Turf Bind (without infill) - ASTM D1335
    - .3 Grab/Tear Strength - ASTM D5034-09
    - .4 Shock Attenuation - ASTM D355-A
    - .5 Infiltration Rate through turf materials - ASTM WK22081 (or approved in-lab test)
    - .6 Yarn Denier - ASTM D1577
    - .7 Yarn Break Strength - ASTM D2256
    - .8 Yarn Melting Point - ASTM D789

- .9 Pile Yarn Type - FTIR Spectrograph
- .10 Pile Weight - ASTM D5848
- .11 Total Weight - ASTM D5848
- .12 Pill Burn Test - ASTM D2859
- .13 Fiber Thickness - ASTM D3218
- .14 Fiber Tensile Strength - ASTM D2256-15
- .15 Lisport XL test to - 6000 cycles
- .16 Total lead Content - ASTM F2765-09
- .4 After Delivery
  - .1 From two (2) randomly selected rolls of synthetic turf material, which have been delivered to the site, samples shall be removed, prepared, and shipped for testing. These samples will be removed in the presence of the Consultant. To accommodate the removal of material for testing, the Turf Contractor must be able to accommodate the removal of a 1000 mm x the width of the roll sample from any roll without affecting the installation of the product. The labour and materials and associated costs for the patching of the removed portion is the sole responsibility of the Turf Contractor. The samples from each roll must be sent to one of the above testing laboratories. Where required, the testing agency is to be provided with a portion of the selected shock pad. Infill (with infilling instructions) are to be included with the samples as required and at the Turf Contractor's cost.
    - .1 The tests that must be performed on the samples from each roll are as follows.
      - .1 Turf Bind (without infill) - ASTM D1335
      - .2 Grab/Tear Strength - ASTM D5034-09
      - .3 Pile Weight - ASTM D5848
      - .4 Total Weight - ASTM D5848
      - .5 Grab/Tear Strength - ASTM D5034-09
    - .2 In the presence of the Consultant, remove two samples of the new infill sand from two different sacks, and remove two samples of the new infill material from two different sacks. Send sand samples to a professional geotechnical engineering firm to have a sieve test completed on each sample. Sieves must meet the specifications herein. Send the two infill samples to one of the approved testing agencies to have the tests EN 15330-5 annex internal method, Friability – Roller Infill, and PAT EN 15330-5 annex internal method, Permanent Agglomeration Temperature completed. Perform 71-3 toxicological test results. A passing result must be achieved.
- .5 After Installation
  - .1 Before Substantial Completion, the synthetic turf system is to be tested as per ASTM F1936-98 and ASTM F355-A. The impact attenuation of the synthetic turf system must maintain an average G-Max of less than 100 over three randomly located test drops, with no individual test exceeding 100 at any location, and

shall maintain a G-Max value of no more than 130 throughout the warranty period.

- .2 Provide an in-situ ASTM F2898 infiltration test on the completed synthetic turf surface. Testing to be completed by an independent geotechnical engineering firm. The tests results from four locations must show a permeability of 500 mm per hour.
- .3 Third party test results demonstrating compliance with the field test requirements for FIFA Quality Pro as indicated in FIFE quality programme for football turf – test manual I & II – 2015 edition.

## 1.7 SUBMITTALS

- .1 Provide with the proposal the complete product specifications, which include:
  - .1 Product cut sheets.
  - .2 Manufacturer's standard specification for material construction and installation.
  - .3 Manufacturer's maintenance instructions.
  - .4 Warranty.
  - .5 Third party test results demonstrating compliance with the specifications for the products used on this project including a test report from an independent lab showing the product passed the requirements for FIFA Quality Pro as indicated in FIFE quality programme for football turf – test manual I & II – 2015 edition.
  - .6 FIFA Lisport XL test (meeting or exceeding 6,000 cycles). Test to include a pre and post Lisport XL shock attenuation test, and the results must meet the FIFA Quality Pro requirements.
  - .7 Key personnel of the project team, including the project manager and project superintendent. Include the credentials and experience of each person.
- .2 Within fourteen (14) days after contract execution, submit to the Consultant shop drawings, which include:
  - .1 Total infill depth.
  - .2 Seam details and layout.
  - .3 Gluing patterns.
  - .4 Roll layout plans.
  - .5 Attachment details showing edge conditions consistent with design documents.
  - .6 Dimensional shop drawings showing the layout of game lines, numbers, letters, and logos. Indicate application method of each line and marking.
- .3 Within fourteen (14) days after contract execution, submit to the Consultant samples for each type of synthetic grass surfacing.
- .4 Within fourteen (14) days after contract execution, submit to the Consultant the Safety Data Sheets for all products to be used for the installation.
- .5 At the time of completion of the field's granular base, review the granular base in the presence of the Consultant and submit to the Owner a letter of acceptance of the granular base.

- .6 Within fourteen (14) days of the Notice of Substantial Performance being granted, submit to the Consultant for review a set of marked-up drawings noted as, "Project Record Copy," showing all changes made to the work during the installation period.
- .7 Within fourteen (14) days of the Notice of Substantial Performance being granted, submit one electronic copy of a Project Manual. The manual is to include a cover page indicating the project, date of Substantial Performance, and company contact information, as well as a table of contents. Organize contents into applicable categories, including:
  - .1 Maintenance manual (with detailed maintenance methods, maintenance schedules, product repair materials, and methods of repair, referencing any equipment required to carry out maintenance and repairs).
  - .2 Shop drawings.
  - .3 Reduced size marked-up record drawings.
  - .4 The product Safety Data Sheets.
  - .5 The company and product warranty for the turf.

#### **1.8 QUALIFICATIONS**

- .1 Approved preferred Provider for the synthetic turf system shall be manufactured, sold and warrantied by a single manufacturer. Manufacture of the synthetic turf system shall include, at a minimum, assembly of the constituent components.
- .2 The synthetic turf manufacture shall provide written documentation, in the form of a signed affidavit, certifying the source of the fiber used in the manufacturing of the synthetic turf system, including any other fiber colors used for lines and/or markings sewn in during or added after manufacturing of the synthetic turf system.
- .3 The manufacture of the synthetic turf system must have produced a minimum of five (5) successful full sized, outdoor, mono-filament or hybrid system, sand & rubber in-filled fields within the past two (2) years.

#### **1.9 TURF SYSTEM HOLD HARMLESS**

- .1 The synthetic turf manufacturer and installer shall not infringe upon any current or pending patents held by other synthetic turf manufacturers or installers or infill material suppliers.
- .2 The Contractor shall hold the Owner and the Consultant harmless from infringement of any current or future patent issued for the synthetic turf system, pad system, installation methods and vertical draining characteristics.

#### **1.10 WARRANTIES**

- .1 Refer to the "Form of warranty of synthetic turf" for more information on warranty requirements.

#### **1.11 DELIVERY AND STORAGE**

- .1 The Contractor is to pack, deliver, and store all materials in accordance with the manufacturer's requirements. Products shall not be opened prior to arriving at the project site.



## **Part 2 Products**

### **2.1 GENERAL**

- .1 Products shall satisfy the requirements of the standard unless otherwise specified herein or on the drawings.
- .2 The complete synthetic turf installation shall be a vertical-draining permeable synthetic turf system. The turf shall consist of a synthetic grass-like surface pile, which shall be tufted into a synthetic backing.
- .3 All backing layers and coating shall be firmly bonded together. Coating materials must be completely cured and bonded to the other backing layers. Synthetic turf panels or rolls that do not meet this requirement will be rejected.
- .4 The entire synthetic turf installation shall be resistant to moisture, rot, mildew, bacteria, fungus growth and ultraviolet ray degradation at all field locations. It should resist damage from wear and tear during athletic and recreational usage. All components should be non-toxic and not cause commonly known allergic reactions.
- .5 Deliver and store the products in the original manufacturer's packaging with labels intact and store the products where they will be protected from damage, theft, and vandalism. All materials must be kept dry prior to installation. Infill containers that are damaged must be repaired to protect the infill from getting wet.

### **2.2 MATERIALS**

- .1 The area of synthetic surfacing is approximately 9,747m<sup>2</sup>.
- .2 The product incorporates 100% true hybrid system fibers and has a pile height of 50mm.
- .3 The product must meet the most current FIFA Quality Pro requirements, except for the Lisport XL test whereas the product must have successfully completed 6,000 cycles, including passing a pre and post Lisport XL shock attenuation test, as verified by test results from a qualified independent testing laboratory.
  - .1 The product must meet the following minimum ASTM test results. No plus or minus ranges are allowed for these test results.
    - .1 ASTM D5823, min. pile height – 50 mm.
    - .2 ASTM D1335, tuft bind, excluding in-fill - 8 lbs.
    - .3 ASTM D5848, pile face weight – 42 oz/yd<sup>2</sup>.
    - .4 ASTM D3218, Tape Thickness - 300 microns.
    - .5 ASTM D2256–15, Avg. Yarn Breaking Strength, Elongation – 15 lbs.
    - .6 ASTM F2898 – 500 mm/hr.
  - .2 The synthetic turf playing field surface system must be the standard product manufactured by the supplier and that was the product that passed the FIFA Quality Pro testing requirements. The product cannot be altered specifically for this project unless the alteration is required for the product to meet the minimum specifications as prescribed herein, where the standard product has characteristics lower than what is specified. Alterations to the standard product to meet the minimum specifications herein, where the supplier's standard product normally exceeds the minimum specifications subscribed herein, will not be accepted.

- .4 The complete synthetic turf installation (turf, pad, and infill) shall drain vertically at a minimum of 500 mm precipitation per hour without visible surface ponding.
- .5 All rolls of material must exhibit uniform characteristics, including, but not limited to, colour, roll width, pile direction, and pile height. Any roll that does not meet this standard will be rejected for use. Any material that has permanent wrinkles will be rejected for use. Rolls shall be at least 4.57m in width.
- .6 All materials, such as turf, scrim, glue, seaming tape, infill rubber, etc. that are employed in the Work and which become a permanent part of the synthetic turf system, are to be resistant to weather, insects, rot and mildew, fungus, and be non-toxic and resist ultraviolet degradation.
- .7 Manufacturer shall guarantee that synthetic turf is adaptable to painted lines in the event painting is utilized in the future.
- .8 Wherever possible, all lines and event markings are to be inlaid during manufacturing. All other lines are to be glued-in on site during the synthetic turf installation. The shave and glue method will not be allowed for line installation unless the line material has a pile height that is minimally 6mm shorter than the pile height of the turf panels. The pile direction of the lines must match the pile direction of the field wherever possible.
- .9 No fitted or fill pieces are allowed. Over-cuts or over-shaving by more than the stitch row spacing, non-true edge cuts, non-true shaving, and other errors in the cutting or shaving of the line position are to be repaired by cutting out a section of turf 500mm wider than the line and replacing both the line and the surrounding turf in the repair area with new material.
- .10 The colours for the line markings shall be as selected by the Consultant from the standard range of colours.
  - .1 White for Soccer lines.
  - .2 Yellow for Field hockey lines.
  - .3 Blue for Field lacrosse lines.
- .11 The colours for the field shall be as selected by the Consultant from the standard range of colours.
  - .1 Green.
- .12 This project has no logos or lettering as part of the work.
- .13 Fasteners that are to be employed in fastening the edges of the turf must be manufactured as to prevent corrosion while in use over the life of the Warranty period.
- .14 Infill material to be composed of a combination of rubber and sand.
  - .1 Any sand used in the infill must meet the following sieve criteria, as well as having a turbidity of less than 100, be of non-crushed, sub-round to round (roundness = 0.6 to 0.7, sphericity = 0.65 to 0.85) silica sand only and have a hardness (Moh) of 7. Product size must meet the following sieve specifications:

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MILLIMETERS	MESH SIZE	% RETAINED
1.180mm	16	0%
0.850 mm	20	0-20%
0.600 mm	30	45-45%
0.425 mm	40	20-30%
0.300 mm	50	5-15%
0.075mm	200	0-3%

- .2 The rubber granules are to be processed, sulfur cured SBR (Styrene Buterdyne Rubber) rubber granules that are predominantly black in colour. The product must be made from recycled tires. The rubber granules are to be cleaned as to ensure that the granules contain no traces of steel, fabric, rubber dust, stones, sand, and other foreign material. The rubber granules may be ambient or cryogenically chipped and must be graduated to the gradations noted in the table below:

MILLIMETERS	MESH SIZE	% RETAINED
2.000 mm	10	0-15%
1.700 mm	12	0-30%
1.180 mm	16	40-70%
0.850 mm	20	15-35%
0.600 mm	30	0-15%
0.425mm	40	0-1%
PAN	PAN	0-1%

- .3 Crumb rubber infill shall:
- .1 Be derived from used whole vulcanized truck tires produced in compliance with North American tire manufacturing specifications.
  - .2 Have a specific gravity greater than 1.1 and less than 1.2 as per ASTM D297.
  - .3 Have an ash content of between 5% and 15% as determined by ASTM D297.
  - .4 Not contain more than 0.01% liberated fiber (no more than 0.2 lbs per ton) tested per ASTM D5603. The liberated fiber remaining in the CRI shall be free flowing and not agglomerated into clumps of fiber as received at the job site.
  - .5 Be dry and free flowing.
  - .6 Be produced cryogenically or ambiently.
  - .7 All infill and sand blended fields to have silica sand (silt free). Contractor to provide sieve sample for all proposed sand and ratio of sand to rubber infill.
  - .8 Infill material shall be clean and not include any metal or fibre glass.
- .15 Synthetic turf with tufted fibres and a coated backing must include perforations in the backing for vertical drainage. The minimum infiltration rate is stated above.
- .16 Perforations in turf backing to be a minimum of 5mm diameter clear opening and shall be a maximum of 100mm uniformly on centre.

- .17 If a permeable backing is utilized, perforations are not required. Certified independent test results indicating a minimum drainage rate of 500 mm per hour must be provided for the permeable backing and infill material.
- .18 The synthetic turf backing shall be perforated with a minimum of 95% integrity over the entire surface. Holes must be full diameter, completely through the underside of the turf backing with no material residue or fragmented fibres remaining.
- .19 Non-permeable backing material shall not exceed 300mm in width. If overlapping backing materials are utilized (including inlaid lines and markings) resulting in a non-permeable surface more than 200mm wide, then the backing material shall be manually perforated using a hot iron or drill with a minimum of 5mm diameter clear opening and shall be spaced a maximum of 100 mm uniformly on centre. Perforations shall be drilled from the surface after the adhesive has set, but prior to installation of the infill material.
- .20 The Consultant shall approve the turf perforations prior to shipment, upon shipment on-site, or during on-site perforation operations as applicable.
- .21 Any rolls delivered to the site that lack sufficient perforations or have incomplete perforations shall be remediated or replaced with a roll that meets the requirements. Replacement will be of full rolls only (not partial rolls or sections of turf). Remediation measures include on-site manual perforations using a drill or hot iron capable of producing a 5 mm diameter clear opening at a maximum spacing of 100 mm uniformly on centre.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 All phases of synthetic turf installation work shall be in accordance with the standard unless otherwise specified herein or on the drawings. Workers who are skilled and experienced in their trade shall do the work.

#### **3.2 GRANULAR BASE PLANARITY ACCEPTANCE**

- .1 All grading of permeable base course and top course aggregates to be controlled using laser survey equipment.
- .2 The contractor is to hire an independent 3rd party to perform a planarity review of the permeable top course in the presence of the consultant. The planarity review shall verify that the surface meets the planarity requirements herein.
- .3 The planarity requirements for the permeable granular base are to be 4mm or less of deformity under a 4-meter straight edge and 10mm or less of deformity under a 20-meter string line, and neither uniformly high nor low, at all tested locations.
- .4 The costs associated with this review are the responsibility of the Contractor.
- .5 The synthetic turf installation cannot commence until all of the above requirements have been confirmed and the granular base is accepted in writing by Notarized Letter from the Contractor as meeting the specifications and as being suitable for the successful installation of the synthetic turf system as per the specifications herein.

#### **3.3 INSPECTION OF MATERIALS**

- .1 Prior to installation, and immediately upon delivery of synthetic turf system materials to the project site, the Contractor shall inspect the materials as follows:

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- .1 For damaged or defective items.
- .2 Measure turf pile height and thickness of each roll.
- .3 Measure backing perforation diameter and spacing.
- .4 Reject damaged materials and all materials out of tolerance with this specification.

### **3.4 PROTECTION**

- .1 If equipment is to be used in the installation that must remain stationary on the synthetic turf for over 30 minutes, or if equipment is to be used in the installation that generates heat, a sheet of 19mm plywood must be placed under such equipment.
- .2 Acceptance of the repair work is at the sole discretion of the Consultant. All repairs must be completed and accepted prior to Substantial Performance of the Work being granted and before the release of any deficiency holdback amount.

### **3.5 PREPARATION**

- .1 Accurately survey and layout the specified work program according to the specifications and drawings herein.
- .2 The game lines are to be centered across the width of the field.
- .3 Clean off dirt, oils, and other debris that may inhibit the application, adherence, and surface texture of the synthetic turf system and the on-site line and event marking installation.
- .4 The installation procedures for all materials must be in strict accordance with the manufacturer's specifications, meet the requirement of this specification, and provide for a long-term successful installation of all materials.

### **3.6 SYNTHETIC TURF INSTALLATION**

- .1 Care should be taken during installation to account for rapid fluctuations in temperature to avoid expansion and/or contraction which can affect the final installation. Temperature extremes should be carefully monitored. The carpet should never be rolled or unrolled when frozen. Adhesive materials should not be used during the rain or when the ambient air temperature or the material temperature is less than 5 °C. The turf shall be installed in appropriate moisture conditions as stated by the manufacturer.
- .2 Immediately prior to application of synthetic turf, the base shall be thoroughly cleaned of all foreign material, soil, or any other substances that may be detrimental to permeability and the installation of the turf system.
- .3 The fabric surface shall be constructed and installed in 4.57m minimum widths with no longitudinal or transverse seams, except for head or tee seams at field boundaries and inlaid lines within a finished roll assembly. The seams should be spaced at 4.57m.
- .4 Rolls that do not lay evenly and with full dimension width will be rejected.
- .5 The bonding or fastening of all system material components shall provide a permanent, tight, secure, and hazard-free athletic playing surface.
- .6 Turf shall be fastened to the perimeter with 50mm galvanized steel nails at 300mm on center. Contractor to ensure all nails are removed from site if not used as fasteners for the perimeter board.

.7      Seams:

- .1      All turf seams shall be sewn with high strength polyester fiber cord or nylon.
- .2      Backing layers must lie flat on the field base to provide a uniform pile surface.
- .3      The width between fiber rows at the seam locations shall not exceed 12.5mm.
- .4      All sewn seams shall be brushed to free any trapped fibers and provide full coverage over the thread.
- .5      All cemented seams shall be brushed to remove any adhesive material from the fibers.

**3.7      PLACING OF LINES AND EVENT MARKINGS ONTO SYNTHETIC TURF**

- .1      All lines and event markings all shall be accurately positioned and marked as prescribed by the contract drawings and shall be straight and true without distortions. In the case of curved lines they are to follow a consistent radius without distortions. No line shall vary from the specified layout dimensions by more than 9 mm over the total length of the line and by no more than 6 mm over a 1000 mm length.
- .2      The pile direction of the lines must to match the pile direction of the field wherever possible.
- .3      No fitted or fill pieces are allowed. Over-cuts or over-shaving by more than the stitch row width, non-true edge cuts, non-true shaving, and other errors in the cutting or shaving of the line position are to be repaired by cutting out a section of turf 500 mm wider than the line and replacing both the line and the surrounding turf in the repair area with new material.

**3.8      INFILL INSTALLATION**

- .1      The infill material shall be applied in a dry condition and when the synthetic turf is dry.
- .2      The sand and rubber infill system shall be installed with a minimum of 6 applications.
- .3      The infill installation shall not result in fiber material trapped below the surface of the infill material. If fiber is trapped below the surface, a portion or all the infill material must be removed and reinstalled.
- .4      The infill material shall be installed at a uniform depth across the entire field area. Infill depths shall not vary more than 5mm across each field area.

**3.9      OWNER'S TEST**

- .1      The Owner may have samples of the turf submitted and tested for verification of conformance to specifications in addition to the required testing to be completed by the Contractor. The Synthetic Turf acceptance is subject to the result of these tests.
- .2      Any material tested and found not conforming to the specifications will be rejected and replaced with material conforming to the specification at the Contractor's expense. Re-submittal shall be required.

**3.10      CLEANING**

- .1      Remove all excess materials of all types, equipment, debris, etc., from the site immediately after completion of the work. Remove all stains and other blemishes from all finished surfaces. Leave work in clean, new appearing condition, ready for use by the Owner.

- .2 The Contractor shall inspect the entire field area with a hand-held metal detector to identify any construction materials or tools left on the field. All such materials shall be removed prior to Owner occupancy of the field.
- .3 Upon completion of the Work the Contractor is to ensure the project site is free of loose material around the site. Loose material is to include infill materials, turf fibers, or any other materials related to the work. The Contractor is to ensure all equipment is removed from the site upon completion of the work.

**END OF SECTION**

## Section 32 18 23.30 FORM OF WARRANTY OF SYNTHETIC TURF

### Part 1 General

#### 1.1 FORM OF WARRANTY OF SYNTHETIC TURF

.1 Warranty jointly provided by:

Synthetic Turf Contractor:	Turf Manufacturer (if not Contractor):
Name:	Name:
Address:	Address:
Contact:	Contact:
Tel:	Tel:
Fax:	Fax:
Email:	Email:

.2 Warranty provided to:

Owner:	Location of Installation:
Name:	Facility:
Address:	Address:
Contact:	
Tel:	
Fax:	
Email:	

#### 1.2 GENERAL

.1 The Warranty shall cover, in general, the usability of the turf surface, accessories, use characteristics, and suitability of the installation. The field is to perform as a high capacity, multiuse sports field accommodating in the order of 3,000 [BL1]hours of physical education and organized sport related use per year. All items covered by the Warranty are to be replaced or repaired with new materials, including installation at the sole expense of the warranting Contractor for the period of eight (8) years. The designated uses are enumerated as follows:

- .1 Soccer
- .2 Football
- .3 Lacrosse
- .4 Ultimate (Frisbee)
- .5 Field Hockey
- .6 Rugby
- .7 Baseball
- .8 Softball
- .9 Marching Band
- .10 Physical exercises



- .11 Physical education activities
- .12 Field cover for special events
- .13 Pedestrian traffic and similar uses
- .14 Pneumatic rubber-tired maintenance and service vehicles
- .15 Other miscellaneous community, sport and recreation activities
- .2 The Warranty shall cover other additional physical education, sport, and training related activities, including new sports that are developed, except where the Contractor, acting reasonably, has provided written notice to the Owner prohibiting any such activity.
- .3 The Warranty shall be signed by a principal of the applicable firm(s), duly authorized to make contracts.
- .4 The term "Contractor" contained in the Warranty means the firm furnishing the Warranty. "Owner" is the government body, individual, corporation or other entity indicated on the first page of this document. Warranty period shall commence from date of acceptance of the installed system by the Owner.
- .5 If the firm manufacturing and supplying the synthetic turf system is not the same entity as the Contractor, the Warranty shall be co-signed by the turf manufacturer/supplier. Should the Warranty be co-signed by the turf manufacturer/supplier, both the Contractor and the turf manufacturer/supplier will be jointly and equally liable for all commitments made under the Warranty.
- .6 All claims by the Owner under this Warranty must be made in writing to Contractor's address within 60 days after the Owner learns of the defect giving rise to the claim. This Warranty shall constitute a Contract made in the Province of British Columbia and shall be governed by the laws thereof.

## Part 2 Products

### 2.1 FORM OF WARRANTY

- .1 Contractor hereby warrants to the Owner, subject to the limitations and conditions set forth below, that its synthetic turf system consisting of synthetic turf described as \_\_\_\_\_, and the adhesives and underlying shock pad (if applicable) described as \_\_\_\_\_ used in the installation, are free from defects in material and workmanship and shall, for a period of eight (8) years from the date of acceptance by the Owner, remain serviceable for multiple sports activities.
- .2 Contractor warrants to the Owner that its synthetic turf materials shall not fade, fail, shrink, wrinkle, or reflect excessive wear. Contractor shall, at the Contractor's sole expense and cost, repair or replace such areas of the synthetic turf system not performing to these standards for the life of the Warranty.
- .3 Definitions
  - .1 The term "not fade" in the context of this Warranty shall mean that the synthetic turf material(s) shall remain a uniform shade of green, or other colors installed, with no significant loss of color.
  - .2 The term "not fail" or "excessive wear" as used in the context of this Warranty shall mean that the length and weight of the face yarn or pile material in the synthetic turf surface(s) above the infill materials shall not have been decreased by more than 10% per year according to ASTM D418, D1335 for tuft withdrawal

- and D5848 for pile weight, nor exceed 50% during the Warranty period. If the synthetic turf system does not retain its fiber volume, pile height, pile weight, fiber height and shock absorbency and is consequently no longer serviceable during the Warranty period, the Contractor shall, at the Contractor's sole expense, replace such portion of the system that is(are) no longer serviceable.
- .3 The term "serviceable" in the context of this Warranty shall mean that the synthetic turf system shall have a maximum "G" value according to ASTM F1936-98 and Procedure A, ASTM F355, not to exceed 100G's at any location upon installation and shall not exceed 130G's throughout life of the Warranty period.
- .4 Where applicable, the fabric seams shall remain attached to the underlying surface over the Warranty period and shall not separate or become unglued or unattached, as applicable.
- .5 Contractor warrants to the Owner that the permeable synthetic system shall drain vertically a minimum of 500 mm of precipitation per hour without visible surface ponding or saturation of the infill material.
- .6 Contractor warrants to the Owner that the synthetic turf system (synthetic turf fiber, backing, infill, shock pad (if applicable), adhesives and all other components) will meet all Canadian environmental regulations (for public sports field/playground use) with respect to contaminants such as lead and other hazardous materials upon installation and throughout the life of the Warranty.
- .7 Contractor shall replace with new materials, at their sole expense, any damage to the synthetic turf system(s) that extends more than 1 meter beyond the location of foreign combustibles, which may ignite and fire-damage the synthetic turf system.
- .8 The Contractor shall not be held liable for any incidental or consequential damages. These warranties and the Contractor's obligations here-under are expressly conditioned upon:
- .1 The Owner making all minor repairs to the synthetic turf system upon the discovery of the need for such repairs;
- .2 The Owner maintaining and properly caring for the synthetic turf system in accordance with the Contractor's maintenance manual and instructions;
- .3 The Owner complying with the dynamic and static load specifications established by the Contractor.
- .9 The Warranty is not to cover any defect, failure, damage, or undue wear in or to, the synthetic turf system caused by, or connected with, abuse, neglect, deliberate acts, act of God, casualty, static or dynamic loads exceeding Contractor's recommendations, footwear having metal spikes, or similar projections other than conventional sport shoes, or use of improper cleaning methods.
- .10 The Contractor shall be allowed to examine the synthetic turf system regarding any claim that the Owner makes, to be present at any time, to analyze the results of all tests conducted by the Owner or others, and to conduct such tests of their own. Except where expressly provided for in the Warranty, the Contract or other binding agreement between the Contractor and the Owner, the Contractor shall not be responsible for any costs or expenses incurred by the Owner or others with respect to such tests, except the Contractor shall pay for costs of all tests and analysis conducted or directed by their representative.

- .11 In the event the Contractor does not respond to the Owner's written notice within 10 days of receipt of notice or does not submit, schedule and execute corrective work within 30 days of receipt of notice, the Owner has the option of having the Work performed at the expense of the Contractor. The work will not unreasonably affect the original warranty of the overall synthetic surface due to the Owner undertaking the work.
- .12 The Warranty included herein is the form to be used by the Contractor. Manufacturer's standard form of Warranty will not be acceptable. Any amendments, exclusions or additional conditions proposed to the form of Warranty by the Contractor must be submitted in writing for the Owner's consideration and approved by the Owner in writing within seven (7) days of being notified of the Owner's intent to award the Contract.

### **Part 3 Execution**

#### **3.1 WARRANTY TESTING**

- .1 The turf is to be tested, at the Contractor's expense, for dynamic cushioning ("G" Test), infiltration, and field test requirements as indicated in FIFA quality program for football turf – 2015 edition by an experienced independent licensed testing laboratory acceptable to the Consultant or Owner at the completion of the installation, prior to acceptance of the Work by the Owner/Consultant.
- .2 The Owner may choose to complete additional dynamic cushioning tests at the Owner's expense.
- .3 If test results from the Warranty tests or any additional tests completed by the Owner indicate that the conditions of the Warranty are not met, the Contractor has the option of corrective work or replacement. In the event corrective work does not meet the requirements of the Warranty after a second attempt to bring the system within these limits, then the Contractor is to replace nonconforming areas or sections, solely at the Owner's discretion and direction.
- .4 Dynamic cushioning tests shall be performed in accordance with ASTM F-1936-98 and F355. Test locations as designated in F-1936-98, Paragraph 8.1. Included in the report shall be the measured depth of the infill material at all test locations.
- .5 Infiltration tests shall be performed to ASTM F2898.
- .6 All costs for testing shall be paid by the Contractor unless otherwise stated. All re-testing as a result of non-conformity shall be paid by the Contractor.
- .7 After the completion of corrective work arising out of failed testing, the Contractor shall re-test the field in the area of the corrective work within 10 days of the corrective work being completed. The re- testing shall be completed to the same standards as the Warranty testing requirements. All costs for re-testing shall be paid for by the Contractor.
- .8 If the Contractor does not have the tests performed within 10 days of specified time(s) listed, the Owner has the option of ordering the testing work at the expense of the Contractor.

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**3.2 AS EVIDENCED WHEREOF, THE CONTRACTOR HAS EXECUTED THIS WARRANTY:**

<b>For the Contractor</b>
Signature of the Contractor (Signing Officer)
Date
Name and Title (please print)

<b>For the Turf Manufacturer/Supplier:</b>
Signature of the Contractor (Signing Officer)
Date
Name and Title (please print)

**END OF SECTION**

## **Section 32 18 23.31 SYNTHETIC TURF SPORTSFIELD SHOCK PAD**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 Supply all products, labor, equipment, and services necessary to install synthetic turf sports field shockpad as indicated in the contract documents.
- .2 The supply and installation of all new material of approximately 9,747m2 of a drainage & shock pad over a granular surface as per the drawings and specifications.
- .3 Attend the site to review and accept in writing, in the presence of the Consultant, the synthetic turf surfacing granular base and nailing strip.
- .4 Accurate surveying and layout of the specified work program, as per the specifications and drawings herein. Verify field dimensions on site prior to shipping materials.
- .5 The modifying of the shock and drainage pad as necessary to conform to the field dimensions and required footings.
- .6 The provision of all Samples and Submittals as described herein.
- .7 The supply to the Owner, for post-installation maintenance use all remaining remnants of shock & drainage pad as selected by the Owner. Remnants that are rejected by the Owner are to be disposed of as waste material as directed by this specification.
- .8 Complete site clean-up is required daily and upon Work completion.
- .9 Prior to Substantial Performance being granted the Contractor is to provide a company warranty and separate product warranty as per the requirements herein.

#### **1.3 RELATED WORK**

- .1 Synthetic Turf Sports Field Surface Section 32 18 23.29

#### **1.4 REFERENCE STANDARDS**

- .1 American Standard Testing Materials (ASTM)
- .2 Synthetic Turf Council - Suggested Guidelines for the Essential Elements of Synthetic Turf Systems
- .3 European Standards/European Norms (EN)
- .4 FIFA - Quality Programme for Football Turf - Test Manual I & II (2024 Editions)

## **1.5 INSPECTION**

- .1 The Contractor shall notify the Owner's Representative at least 48 hours before any concrete is placed.

## **1.6 TESTING AND APPROVALS**

- .1 Provide shock and drainage pad material for the Lisport XL testing as required in Specification Section 32 18 23.29, Synthetic Turf Sports Field Surface.

## **1.7 SUBMITTALS**

- .1 Provide with the Proposal the complete product specifications which include:
  - .1 Product cut sheets.
  - .2 Manufacturer's standard specification for material construction and installation.
  - .3 Manufacturer's maintenance instructions.
  - .4 Warranty.
- .2 Within fourteen (14) days after contract execution, submit to the Consultant the Safety Data Sheets for all products to be used for the installation.
- .3 Within fourteen (14) days after contract execution, submit to the Consultant shop drawings for the proposed product showing a typical layout pattern.
- .4 Send samples of the product the same size as the turf sample being sent for the required tests.

## **1.8 WARRANTIES**

- .1 Provide an installation company non-pro-rated warranty covering the shock and drainage pad installation that shall endure for eight years starting from the date of Substantial Performance of the Work that covers quality of workmanship, delamination of glued seams, separation of sewn seams, and any other installation feature that is deemed to not be caused by ordinary wear on a synthetic turf playing field surface. The Warranty must specifically state that all seams that come apart will be repaired within 10 working days of being notified by the Owner. The installation company is responsible for all costs associated with ensuring a successful repair, even under inclement weather conditions. The Owner's testing agency shall be accepted for any materials testing related to the repairs and all costs related to that testing. The warranty must specifically state that the Contractor shall pay for the removal and disposal of any materials that are to be removed to complete the warranty work.
- .2 Provide a shock and drainage pad manufacturer's non-pro-rated warranty covering the proposed product that shall endure for 25 years starting from the date of Substantial Performance of the Work that covers defects in materials, excessive loss of porosity, loss of product thickness greater than 3mm (only if the pad has not been subjected to stress loads in excess of 35 psi), warping, cracking, shattering, splitting, and any other feature that is deemed to not be ordinary wear for a shock and drainage pad. The warranty cannot restrict the number of hours per year or per warranty period that can be played on the field that is installed over the shock and drainage pad.
- .3 The installation company, and the shock and drainage pad manufacturer must provide that their warranties accept the use of the field for the following activities: soccer, lacrosse, football, rugby, baseball, softball, marching band, physical exercises, physical education activities, pedestrian traffic, ceremonial and entertainment events with portable

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floor coverings, pneumatic rubber-tired maintenance and service vehicles as normally required for the above uses and to conduct normal maintenance of the synthetic surfaces. The warranties must accept the use of athletic shoes with spikes or other protrusions that are intended for use on synthetic turf fields.

- .4 The product manufacturers and installation company shall promptly replace or repair, to the specifications herein, any areas of the shock and drainage pad that are not performing to the standards of the specifications and warranty at the sole expense of the Contractor and the product manufacturers.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Products shall satisfy the requirements of the standard unless otherwise specified herein or on the drawings.

### **2.2 MATERIALS**

- .1 Provide 9,747m<sup>2</sup> of a porous, resilient, drainage and shock pad designed specifically for use with synthetic turf. The material must have both impact absorption and drainage properties that meet the following performance requirements:
  - .1 Shock Absorption – in combination with the infilled synthetic turf to be used on the project provide an average G-Max of less than 100 over three randomly located test drops following Substantial Completion, with no individual test exceeding 100 at any location, and shall maintain a G-Max value of no more than 130 G's throughout the warranty period as per ASTM F1936-98 and ASTM F355-A testing methods.
  - .2 Shock pad must maintain a minimum infiltration rate of 500mm of precipitation per hour without visible surface ponding throughout the warranty period.
  - .3 All materials that are employed in the installation and which become a permanent part of the drainage mat system are to be resistant to weather, insects, rot and mildew, fungus, and be non-toxic and resist ultraviolet degradation.
  - .4 All materials that are employed in the installation and which become a permanent part of the drainage mat system must exhibit uniform characteristics, including, but not limited to, color, panel width, and thickness. Any panel that does not meet this standard will be rejected for use.
- .2 Product shall be installed using interlocking panels.
- .3 Thickness: 23 to 25 mm. The product must exhibit complete uniformity of thickness (within plus or minus 1 mm) for all product supplied and installed.  
Density: The product must exhibit complete uniformity of density in all areas for all product supplied and installed.  
Expansion/Contraction Properties: The product must have expansion and contraction characteristics that will keep the product lying flat under the synthetic turf in temperatures ranging for minus 20 degrees Celsius to +40 degrees Celsius.
- .4 The Contractor is responsible for ensuring that the drainage and shock pad supplier provides the correct product type that meets all specifications herein.
- .5 The product must have expansion and contraction characteristics that will keep the product laying flat under the synthetic turf in temperatures ranging from minus 20 degree Celsius to plus 40 degrees Celsius.

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## **Part 3 Execution**

### **3.1 GENERAL**

- .1 All phases of shock pad installation work shall be in accordance with the standard unless otherwise specified herein or on the drawings. Workers who are skilled and experienced in their trade shall do the work.

### **3.2 GRANULAR BASE PLANARITY ACCEPTANCE**

- .1 As per Specification Section 32 18 23.29, Synthetic Turf Sports Field Surface, attend the site to review in the presence of the Consultant and accept in writing the field's granular base at the time of their completion. All costs for attending this review are the responsibility of the Contractor.

### **3.3 INSPECTION OF MATERIALS**

- .1 Prior to installation, and immediately upon delivery of shock pad to the project site, the Contractor shall inspect the materials as follows:
  - .1 For damaged or defective items.
  - .2 Measure the thickness of materials from each pallet.
  - .3 Reject damaged materials and all materials out of tolerance with this specification.

### **3.4 PROTECTION**

- .1 The Contractor is responsible for the protection of all new and existing facilities from damage and/or disfiguration from the processes of the Work AND from vandalism. Any damage or disfiguration must be repaired promptly and to the original condition of the facility prior to the damage.
- .2 If equipment is to be used in the installation that must remain stationary on the pad for over 30 minutes, or if equipment is to be used in the installation that generates heat, a sheet of 19mm plywood must be placed under such equipment.
- .3 Acceptance of the repair work is at the sole discretion of the Consultant. All repairs must be completed and accepted prior to Substantial Performance of the Work being granted and before the release of any deficiency holdback amount.

### **3.5 PREPARATION**

- .1 Ensure that all application surfaces are clean and free of debris.
- .2 Accurately survey and layout the specified work program according to the specifications and drawings herein.
- .3 The installation procedures for all materials must be in strict accordance with the manufacturer's specifications, meet the requirement of this specification, and provide for a long-term successful installation of all materials.

### **3.6 PLACEMENT**

- .1 Place individual sheets directly onto granular field surface and interlock adjacent panels. Complete installation of the material under the direction of the installation superintendent and, where not specified herein, according to the manufacturer's installation instructions. Allow enough material to overlap the edges of the field such that if any shrinkage occurs



- the product remains overlapping the edges of the field. Trim excess pad material after laying out turf panels.
- .2 Do not exceed the manufacturer's recommendations for the acceptable loads for on-pad vehicle operation prior to installation.
  - .3 The product shall be placed as to ensure a smooth surface that meets the tolerances of a maximum deviation from a level plane of 8mm under a 4000mm straight edge and 13mm under a 20,000mm string line.
  - .4 There are to be no gaps between panels that exceed 6mm. Adjacent panels must have their top surfaces level with each other, with no adjacent panels being more than 1mm higher or lower than an adjacent surface of the same material.
  - .5 Cut and otherwise modify the material to conform to the edge of the synthetic turf nailing strip/field perimeter edges and the goal post footing covers. Ensure that cuts and modifications form a straight and true edge or radius.

**END OF SECTION**

## **Section 32 18 23.38 SYNTHETIC TRACK SURVEYING**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 This section covers all labor and materials required to provide survey of key construction elements and the final track and field facility. The Contractor is responsible for completing all survey work.

#### **1.3 RELATED WORK**

- .1 Cast in Place Concrete Section 03 30 00

#### **1.4 REFERENCE STANDARDS**

- .1 The survey work must be completed by a licensed BCLS surveyor. Surveyor must have previous experience with track and field layout survey.
- .2 Codes and standards follow the latest Class III guidelines set forth by World Athletics.

#### **1.5 INSPECTION**

- .1 The Contractor shall notify the Owner's Representative and Consultant at least 48 hours before any survey work is to take place. It is at the Consultant's discretion if they wish to be present during the survey.

#### **1.6 SUBMITTALS**

- .1 The following information must be submitted by the Contractor in PDF and CAD format:
  - .1 The surveyor's instrument calibration certificate from the manufacturer.
  - .2 After installation of channel drain:
    - .1 Survey the new channel drain location with elevations at:
      - .1 10-meter intervals starting at the middle point on the curvature of the track.
      - .2 At each interval, measure the outsides edges, where they meet the adjacent asphalt and concrete curb.
  - .3 After installation of monument, channel drain, and perimeter concrete curb:
    - .1 Survey the new monuments and the start, middle, and end of the curvature of the track at both ends.
  - .4 After installation of perimeter concrete curb:
    - .1 Survey the new perimeter concrete curb location with elevations at:

- .1 Intervals parallel to the two points taken from the channel drain.
  - .2 At each interval, measure both edges of the curb.
  - .3 All corners.
- .2 If the Owner's Representative's deems the survey information provided by the contractor is insufficient to confirm that the installation will meet Class III World Athletics standards, the Owner's Representative's may request additional survey information at no additional cost to the Owner and with no time extension granted to the contractor.

**Part 2 Products - Not Used**

**Part 3 Execution**

**3.1 APPROVAL**

- .1 The contractor may not begin synthetic surfacing install work until the Owner's Representative's has approved the survey information specified herein. The Owner's Representative's has 5 working days to review and approve the survey information. If the Owner's Representative's requests more survey information, an additional 5 working days will be required for each subsequent review.
- .2 If the measurements provided in the survey indicate that the curb and channel drain have not been installed in a manner that will allow the track installer to meet Class III World Athletics standards, then remedial work will be required at the Owner's Representative's discretion.

**END OF SECTION**

## **Section 32 18 23.39 SYNTHETIC TRACK SURFACING**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 This section covers all labor and materials required to install a track surface. The Track Synthetic Surfacing Contractor is responsible for installing all track synthetic surfacing materials and line markings as designated in these specifications.

#### **1.3 RELATED WORK**

- .1 Cast in Place Concrete Section 03 30 00
- .2 Asphalt Paving for Synthetic Track Surfacing Section 32 12 16.2
- .3 Synthetic Track Line Marking Section 32 18 23.40

#### **1.4 REFERENCE STANDARDS**

- .1 Codes and standards follow the current guidelines set forth by World Athletics (WA)

#### **1.5 SUBMITTALS**

- .1 Provide with the proposal the complete product specifications, which include:
  - .1 Product cut sheets.
  - .2 Manufacturer's standard specification for material construction and installation.
  - .3 Manufacturer's maintenance instructions.
  - .4 Warranty
- .2 Provide with the proposal, the following:
  - .1 Contractor to submit a current valid Product Certificate for the facility synthetic surfacing material.
  - .2 Test results, from a WA certified laboratory, verifying manufacturer's Track Synthetic Surfacing product meets the WA Performance Specifications for Synthetic Surfaces.
    - .1 The same components from the test sample must be used in the installed surface. No substitutions will be allowed.
    - .2 TRL Pendulum test results for slip resistance must be greater than 47.
  - .3 Surfacing Contractor On-site Project Manager/Superintendent Qualifications:

- .1 The project manager/superintendent for the surfacing contractor will be on-site during all surfacing operations. Substitution of project manager/superintendent shall not be permitted.
- .2 A list of completed facilities, minimum of 3, in the past 5 years utilizing the product specified in these specifications. Bidder to highlight any WA certified facilities their project manager has installed.
- .4 Installation process and requirements for subbase (stone, asphalt, and concrete) and any conditions that may limit the track synthetic surface installation or affect quality of installation.
- .5 Temperature/climatic conditions limiting quality of installation.
- .6 Standard specification and application for recommended subbase primers, crack filler, patching and leveling material.
- .7 Provide a letter stating the Track Synthetic Surfacing Contractor reviewed the asphalt specification and are accepting the specification as correct.
- .8 Letter from synthetic surfacing manufacturer approving the installer/applicator of the synthetic surface listed in these specifications.
- .3 Within fourteen (14) days after contract execution, submit to the Consultant the following:
  - .1 Three product samples, a minimum of 6" x 6" in size, the same color, texture, thickness, etc. of the same type of surfacing to be installed for this project. This must be a representative sample of the product. This sample must be submitted and approved by the Owner prior to installation. At completion of the project this sample may be used as a comparison to judge the quality of the installed product.
  - .2 Material safety data sheets on all individual components of the product being installed.
- .4 The following information must be submitted by the Track Synthetic Surfacing Contractor prior to installation.
  - .1 Upon completion of the Asphalt paving and prior to installation of the track synthetic surface, the Track Synthetic Surfacing sub-contractor will provide a letter accepting the installed asphalt and stating it is suitable to receive the track synthetic surface.
  - .2 Provide a Care and Maintenance manual for the Owner's use in maintaining the synthetic surfacing.

## 1.6 QUALITY ASSURANCE

- .1 Prior to installation, or during installation or at completion of installation of the synthetic surfacing, if the Owner has any question or doubt about the quality or formulation of the material, the Track Synthetic Surfacing Contractor shall have the product tested. If the product meets these specifications, then the Owner shall pay for the cost of the testing; if the product does not meet these specifications, then the Track Synthetic Surfacing Contractor shall pay for the testing. Any material failing to meet specifications will be replaced with new material at the Track Synthetic Surfacing Contractor's expense.
- .2 Slopes and Tolerances (WA):
  - .1 The lateral inclination of tracks towards the inside edge should not exceed 1:100 (1%).

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- .2 the overall downward inclination in the running direction shall not exceed 1:1000 (0.1%) between any start and finish line.
- .3 The completed synthetic running track surface shall be reviewed for planarity by the GC in the presence of the Installer, Consultant and City. Evenness to match world athletics requirements. Tolerances to be measured using WA methods. The organization, implementation, and cost of the planarity, flood, repairs and any re-flood testing are the responsibility of the GC.

#### **1.7 SPECIAL PROJECT CONDITIONS**

- .1 The Track Synthetic Surfacing Contractor will provide a project manager/superintendent on-site daily through the completion of the Track Synthetic Surfacing Contractor's portion of the contract.
  - .1 The on-site project manager/superintendent shall remain on site through the completion of the project. Substitution of project manager/superintendent shall not be permitted.
- .2 Prior to installing any concrete, the Contractor must verify with the Track Synthetic Surface manufacturer if any curing compounds or agents are allowed or acceptable.

#### **1.8 SCOPE OF WORK**

- .1 The Track Synthetic Surfacing Contractor shall provide all labor, materials and equipment to perform the following work:
  - .1 The Track Synthetic Surfacing Contractor is responsible for installing all track synthetic surfacing materials and line markings as designated in these specifications.
  - .2 Review Bidding documents and specifications, provide technical assistance, and approve Asphalt Paving work as required in the specifications.
  - .3 Brush and wash down all areas to be surfaced, as often as necessary during the installation of the track synthetic surface.
  - .4 Install material in trench drain opening to prevent surfacing material from entering the storm system, in keeping with ESC measures.
  - .5 Repair all damaged areas, clean-up all glue, and remove excess polyurethane, primers and similar products. All trim cuts shall be neat and clean; on all curves the trim-out shall follow a radius line for accuracy and neatness.
  - .6 Three separate top coat colours are required of an evenly distributed mix for each separately colored lanes of Green, Blue and Grey. EPDM granule colours will be chosen from the Manufacturer's full range of colours which matches most closely to the RAL No. 6021, 5015 & 7038 specified herein.

#### **1.9 WARRANTY**

- .1 Refer to the "Form of warranty of synthetic track surfacing" for more information on warranty requirements.

## **Part 2 Products**

### **2.1 TRACK SYNTHETIC SURFACE**

- .1 The track synthetic surface shall be as per the manufacturer's specifications, plus the following requirements and where discrepancies exist, they shall be brought to the attention of the Owner or Owner's representative prior to Bidding or Installation.
- .2 Colors: Green, Blue, Grey. RAL 6021, 5015, 7038. Or approved Equal.
- .3 The following Products are approved for bidding:
  - .1 Beynon Sports Surfaces:
    - .1 Product: Sandwich System: BSS 300.
  - .2 Stockmeier Urethanes:
    - .1 Product: Sandwich System: Stobitan SW.
  - .3 Polytan GmbH
    - .1 Product: Sandwich System: Rekortan M
- .4 Synthetic Track Surfacing shall be the Class III World Athletics approved thickness unless otherwise specified.
- .5 Patching Material: All materials must be approved materials and compatible with the synthetic surface.
- .6 Synthetic Track Surfacing shall be a World Athletics certified product.

## **Part 3 Execution**

### **3.1 INSPECTION AND ACCEPTANCE**

- .1 Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation.
- .2 Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.

### **3.2 INSTALLATION REQUIREMENTS**

- .1 The following installation requirements must be met by the Track Synthetic Surfacing Contractor:
  - .1 Installation by synthetic surface manufacturer approved project manager/ superintendent applicators and technicians.
  - .2 Priming - The primer shall be spray-applied in accordance with the manufacturer's specifications. Only those areas which can be installed on the same day should be primed. All concrete areas to be surfaced shall receive manufacturer's approved primer.

### **3.3 INSTALLATION OF THE CAST-IN-PLACE POLYURETHANE**

- .1 General:
  - .1 The one component moisture-cured polyurethane to be in a pure form and not contain any foreign substances.

- .2 The mixing of the two-component polyurethane must be completed in a purpose suited, machine controlled, continuous mixing machine. Hand mixing with an egg beater type of tool is not allowed.
- .2 Base Mat:
  - .1 Prior to the application of the base mat a primer is to be applied to the asphalt base surface according to the manufacturer's recommended rate of application, as required to ensure a long-term successful bond that completely resists delamination.
  - .2 The base mat shall consist of a mixture of one-component polyurethane binder and 1 – 4 mm SBR granules
  - .3 The mixing ratio for the base mat components shall be to the manufacturer's strict instructions.
  - .4 Quantities of materials as specified shall be thoroughly mixed in a mechanical mixer specially constructed for this procedure to produce a homogeneous blend.
  - .5 The base mat shall be placed as to ensure a smooth surface that meets the tolerances described herein.
  - .6 The base mat surface shall have a seal coat applied to it that is a mixture of one component polyurethane and rubber dust to create a completely nonporous base mat.
- .3 Top Coat:
  - .1 Prior to the application of the top coat a primer is to be applied to the seal coat according to the manufacturer's recommended rate of application, as required to ensure a long-term successful bond that completely resists delamination.
  - .2 The top coat shall be applied according to the manufacturer's recommended time frame to ensure a long-term successful bond that completely resists delamination.
  - .3 The top coat shall be a self-leveling, two-component, polyurethane wet-pour coating and shall be coloured using extended range of the manufacturer's colours, as described herein this specification, and as selected by the City and located as per the drawing
  - .4 The top coat shall be applied as a liquid which is spread using a triangular notched trowel. This surface coat shall have 1 – 3 mm EPDM rubber granules broadcasted onto it and embedded evenly and uniformly over the entire surface to give a system which conforms to the overall thickness requirements herein. Ensure no bare areas or shiny spots remain. Ensure that all areas of the track match in texture. The thickness of the system will be determined from samples cut out of the installed surface, with the measurement being made from the bottom of the sample to a point that represents the average of the peaks and valleys of the top coat granules.
  - .5 The granules are to be applied as environmental conditions dictate and according to the manufacturer's recommended time frame to ensure a long term successful bond that ensures the proper adhesion of granules. The contractor is to carefully monitor the polyurethane setting conditions. No bare or shiny spots will be accepted. No areas that differ in appearance and texture from the majority of the running track will be accepted.



- .6 The final surface coat shall be completed so that the finish is even in colour and texture with no bare areas or shiny spots and which has a minimum of seams. Seams shall be finished as to be virtually invisible.

### **3.4 INSTALLATION OF TRACK SYNTHETIC SURFACE**

- .1 Sandwich System:
  - .1 Thickness to match sample submitted to WA certified testing laboratory.
  - .2 Base Course:
    - .1 The SBR granules and two component polyurethane shall be mixed on site to regulate the ratio/quantity of SBR, not to exceed 82% in the base mat portion of the system. The two-component polyurethane shall be mixed with the SBR rubber so that a minimum of 20%, by weight, exists in the final mixture. This mixture is then mechanically installed using the paver.
  - .3 Seal Coat:
    - .1 The two polyurethane components are mixed at the prescribed ratio homogeneously with a suitable mixing device. The coating is squeegee applied to the base mat, making it impermeable.
  - .4 Wearing Course:
    - .1 The 1 to 3mm EPDM granules shall be integrated into the two-component polyurethane to achieve the full depth of the 5 mm wearing course. The resilient embedded textured finish shall be a dense matrix of exposed EPDM granules. The homogeneous wearing course shall be applied in situ with the base course.
  - .5 Planarity:
    - .1 Planarity shall be no more than 6mm over a 4m straight edge or 3mm over a 1m straight edge.

### **3.5 TIMING, LIMITATIONS, AND CONDITIONS AFFECTING INSTALLATION**

- .1 The track surfacing material shall be applied no sooner than 28 days after placement of the asphalt top course.
- .2 Weather and Climate: If in the opinion of the synthetic track surfacing manufacturer or the Owner, weather and climatic conditions are having or will have an adverse effect on installation; work shall be delayed until the adverse condition has passed.
- .3 Adjacent and Concurrent Construction: Installation shall not take place until the completion of the adjacent or concurrent construction operations which generate dust, airborne abrasives, or any other by-product that, in the opinion of the Owner or synthetic track surfacing manufacturer, would be harmful to the track material. Under specific direction of the Owner, the Track Synthetic Surfacing Contractor may be allowed to cover the track material with an approved covering if such harmful construction operations must occur after the track material has been installed.

**END OF SECTION**

## **Section 32 18 23.40 SYNTHETIC TRACK LINE MARKING**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 This section covers all labor and materials required to install the track & field line markings.

#### **1.3 RELATED WORK**

- .1 Synthetic Track Surfacing Section 32 18 23.39

#### **1.4 REFERENCE STANDARDS**

- .1 Codes and standards follow the current Class III guidelines set forth by World Athletics (WA)

#### **1.5 SUBMITTALS**

- .1 The following information shall be submitted prior to installation of specified work:
  - .1 Submit a detailed drawing showing the location and color of all lane lines, start, finishes and all related markings for the owner to review at least four weeks prior to their application. Colours according to World Athletics standard 400 meter track marking plan.
  - .2 All line markings must be reviewed and verified by the Owner's representative prior to installation.
  - .3 Installation process and requirements for line markings and any conditions that may limit the installation or affect quality of installation.
  - .4 Material safety data sheets on all products.
  - .5 Provide samples of each combination of line marking color and surface color.
  - .6 Paint product submittal.
- .2 The following information shall be submitted at the completion of the specified work:
  - .1 The owner shall be supplied with a Measurement Report in accordance with the requirements of World Athletics.

#### **1.6 WARRANTY**

- .1 A two (2) Year Warranty shall be provided for the line markings.
- .2 Contractor warrants to the Owner that the line markings shall not fade, delaminate, or wear excessively. Contractor shall, at the Contractor's sole expense and cost, repair or

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replace such areas of the line markings not performing to these standards for the life of the Warranty.

- .3 The term "not fade" in the context of this Warranty shall mean that the line marking material(s) shall remain a uniform shade, with no significant loss of color.
- .4 The term "wear excessively" in this context of this Warrant shall mean that the color of the rubber underneath shall not be visible through the line markings.
- .5 Any products replaced or repaired under warranty shall have the warranty period renewed, starting from the date that the warranty works have been tested and are accepted by the Owner.

## **Part 2 Products**

### **2.1 PAINT**

- .1 All line marking paint is to be approved by the synthetic surfacing manufacturer.

### **2.2 TEMPORARY REFERENCE MARKINGS**

- .1 These markings shall be removed at the completion of the project.

## **Part 3 Execution**

### **3.1 SUMMARY**

- .1 All markings shall be in accordance with the latest World Athletics standards.
- .2 Line markings shall be installed only if the weather permits as specified by the product manufacturer.

### **3.2 LINE MARKINGS**

- .1 Paint:
  - .1 All line markings to receive adequate paint to completely cover the track & field synthetic surface.
  - .2 Paint product submittal required to the Consultant, application rates to match that in the paint product submittal.
- .2 Measure Line (Theoretical – not painted):
  - .1 Track oval will utilize a regulation curb.
  - .2 The distance to right hand edge of the inside lane line of Lane 1 to be 30 centimeters from the measure line.
- .3 Line Precedence:
  - .1 Lane lines to take precedence over other markings.
  - .2 Waterfall starting lines take precedence over straight starting lines.
- .4 Linework, with colours according to the World Athletics standard 400m track marking plan.
  - .1 Break Lines
  - .2 Finish Line
  - .3 Lane numbers

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.4 Interval Marks

TRACK EVENT	IN LANE START	GROUP LANE	START 1-8	GROUP LANE	START 5-8	FINISH LINE NORTH
100 M	X					X
150 M	X					X
200 M	X					X
400 M	X					X
800 M	X					X
800M, 1200M, 2000M, 10000M,		X				X
600M, 1000M, 3000M, 5000M		X				X
1500M		X				X
MILE		X				X
<b>HURDLES (SPACING)</b>						
60MH (11.00, 6.50, 16.50)	X					X
80MH (12.00, 7.00, 19.00)	X					X
80MH (12.00, 7.50, 15.50)	X					X
80MH (12.00, 8.00, 12.00)	X					X
100MH (13.00, 8.50, 10.50)	X					X
110MH (13.72, 9.14, 14.02)	X					X
400MH (45.00, 35.00, 40.00)	X					X
<b>RELAYS</b>						
4X100M	X					X
4X400M	X					X
50M	X					
60M	X					
80M	X					
300M	X					
80M, 1200M, 2000M, 10000M		X		X		X
600M, 1000M, 3000M, 5000M		X		X		X
<b>HURDLES (SPACING)</b>						
200MH (20.00, 3500, 40.00)	X					
300MH (50.00, 35.00, 40.00)	X					

END OF SECTION

## Section 32 18 23.41 FORM OF WARRANTY OF SYNTHETIC TRACK SURFACING

### Part 1 General

#### 1.1 FORM OF WARRANTY OF SYNTHETIC TURF

.1 Warranty jointly provided by:

Synthetic Track Surfacing Contractor:	Track Manufacturer (if not Contractor):
Name:	Name:
Address:	Address:
Contact:	Contact:
Tel:	Tel:
Fax:	Fax:
Email:	Email:

.2 Warranty provided to:

Owner:	Location of Installation:
Name:	Facility:
Address:	Address:
Contact:	
Tel:	
Fax:	
Email:	

#### 1.2 GENERAL

.1 The Warranty shall cover, in general, the usability of the track surface, accessories, use characteristics, and suitability of the installation. Track is to perform as a high capacity, multi-use track accommodating in the order of 3,000 [BL1]hours of physical education and organized sport related use per year. All items covered by the Warranty are to be replaced or repaired with new materials, including installation at the sole expense of the warranting Contractor for the period of minimum eight (8) years to the Owner, for the designated uses enumerated as follows:

- .1 Track and field activities
- .2 Running
- .3 Walking
- .4 Regular pedestrian traffic and similar uses
- .5 Marching band
- .6 Physical exercises
- .7 Physical education activities
- .8 Field cover for special events, equipment access to the infield

- .9 Pneumatic rubber-tired maintenance and service vehicles
- .10 Other miscellaneous community, sport and recreational activities
- .2 The Warranty shall cover other additional physical education, sport, and training related activities, including new sports that are developed, except where the Contractor, acting reasonably, has provided written notice to the Owner prohibiting any such activity.
- .3 The Warranty shall cover sports footwear having metal spikes, cleats, or similar projections.
- .4 The Warranty shall be signed by a principal of the applicable firm(s), duly authorized to make contracts.
- .5 The term "Contractor" contained in the Warranty means the firm furnishing the Warranty. "Owner" is the government body, individual, corporation or other entity indicated on the first page of this document. Warranty period shall be a minimum of five years from date of acceptance of the installed system by the Owner.
- .6 If the firm manufacturing and supplying the synthetic track system is not the same entity as the Contractor, the Warranty shall be co-signed by the track manufacturer/supplier. Should the Warranty be co-signed by the track manufacturer/supplier, both the Contractor and the track manufacturer/supplier will be jointly and equally liable for all commitments made under the Warranty.
- .7 All claims by the Owner under this Warranty must be made in writing to Contractor's address within 60 days after the Owner learns of the defect giving rise to the claim. This Warranty shall constitute a Contract made in the Province of British Columbia and shall be governed by the laws thereof.

## Part 2 Products

### 2.1 FORM OF WARRANTY

- .1 Contractor hereby warrants to the Owner, subject to the limitations and conditions set forth below, that its synthetic track system consisting of synthetic track described as \_\_\_\_\_, are free from defects in material and workmanship and shall remain serviceable for multiple sports activities.
- .2 Contractor warrants to the Owner that its synthetic track materials shall not fade, fail, bubble, blister, crack, or reflect excessive wear. Contractor shall, at the Contractor's sole expense and cost, replace such areas of the synthetic track system not performing to these standards for the life of the Warranty.
- .3 Definitions
  - .1 The term "not fade" in the context of this Warranty shall mean that the synthetic track materials shall remain a uniform shade of the colors installed, with no significant loss of color.
  - .2 The term "not fail" as used in the context of this Warranty shall mean that the properties of the synthetic track surface adhere to the following requirements during the Warranty period:
    - .1 The shock absorption of the synthetic track shall be between 35-50%, at any surface temperature between 10°C and 40°C.
    - .2 The vertical deformation of the synthetic track shall be between 0.6-2.5mm, at any surface temperature between 10°C and 40°C.

- .3 The slip resistance of the synthetic track shall not be less than 47 on a TRRL Pendulum Test.  
\*\*If the synthetic track system no longer meets the requirements above during the Warranty period, the Contractor shall, at the Contractor's sole expense, replace such portion of the system.\*\*
- .4 Where applicable, the surfacing will hold fast and/or adhere to the primer, asphalt, concrete, edging, filler, patches, or overlay materials.
- .5 Contractor warrants to the Owner that the synthetic track system shall drain excess water so that when completely covered with water and allowed to drain for 20 minutes, there shall be no area of synthetic surface where the depth of residual water exceeds the depth of texture of the surface.
- .6 Contractor warrants to the Owner that the synthetic track system, adhesives and all other components will meet all Canadian environmental regulations (for public sports field/playground use) with respect to contaminants such as lead and other hazardous materials upon installation and throughout the life of the Warranty.
- .7 The Contractor shall not be held liable for any incidental or consequential damages. These warranties and the Contractor's obligations here-under are expressly conditioned upon:
  - .1 The Owner making all minor repairs to the synthetic track system upon the discovery of the need for such repairs;
  - .2 The Owner maintaining and properly caring for the synthetic track system in accordance with the Contractor's maintenance manual and instructions;
  - .3 The Owner complying with the dynamic and static load specifications established by the Contractor.
- .8 The Warranty is not to cover any defect, failure, damage, or undue wear in or to, the synthetic track system caused by, or connected with, abuse, neglect, deliberate acts, act of God, casualty, static or dynamic loads exceeding Contractor's recommendations, or use of improper cleaning methods.
- .9 Contractor shall be allowed to examine the synthetic track system regarding any claim that the Owner makes, to be present at any time, to analyze the results of all tests conducted by the Owner or others, and to conduct such tests of their own. Except where expressly provided for in the Warranty, the Contract or other binding agreement between the Contractor and the Owner, the Contractor shall not be responsible for any costs or expenses incurred by the Owner or others with respect to such tests, except the Contractor shall pay for costs of all tests and analysis conducted or directed by their representative.
- .10 In the event the Contractor does not respond to the Owner's written notice within 10 days of receipt of notice or does not submit, schedule and execute corrective work within 30 days of receipt of notice, the Owner has the option of having the Work performed at the expense of the Contractor.
- .11 The Warranty included herein is the form to be used by the Contractor. Manufacturer's standard form of Warranty will not be acceptable. Any amendments, exclusions or additional conditions proposed to the form of Warranty by the Contractor must be submitted in writing for the Owner's consideration within seven (7) days of being notified of the Owner's intent to award the Contract.

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### Part 3 Execution

#### 3.1 WARRANTY TESTING

- .1 The track is to be tested to meet the slopes and tolerances as outlined by World athletics.
- .2 The Contractor shall, in the presence of the Owner, inspect the track synthetic surfacing each year until the end of the warranty period, or at any time requested by the Owner.
- .3 The Owner may choose to complete additional testing at the Owner's own cost.
- .4 If test results from the Warranty tests or any additional tests completed by the Owner indicate that the conditions of the Warranty are not met, the Contractor has the option of corrective work or replacement. In the event corrective work does not meet the requirements of the Warranty after a second attempt to bring the system within these limits, then the Contractor is to replace nonconforming areas or sections, solely at the Owner's discretion and direction.
- .5 Tests shall be performed in accordance with the World Athletics Track and Runway Synthetic Surface Testing Specifications.
- .6 Test locations as designated in the World Athletics Track and Runway Synthetic Surface Testing Specifications.
- .7 All costs for the stated testing shall be paid by the Contractor unless specifically noted otherwise.
- .8 After the completion of corrective work arising out of failed testing, the Contractor shall re-test the track in the area of the corrective work within 10 days of the corrective work being completed. The re- testing shall be completed to the same standards as the Warranty testing requirements. All costs for re-testing shall be paid for by the Contractor.
- .9 If the Contractor does not have the tests performed within 10 days of specified time(s) listed, the Owner has the option of ordering the testing work at the expense of the Contractor.

#### 3.2 AS EVIDENCED WHEREOF, THE CONTRACTOR HAS EXECUTED THIS WARRANTY:

<b>For the Contractor</b>
Signature of the Contractor (Signing Officer)
Date
Name and Title (please print)

<b>For the Track Manufacturer/Supplier:</b>
Signature of the Contractor (Signing Officer)
Date
Name and Title (please print)

**END OF SECTION**



## **Section 32 18 23.53 SPORT COURT SURFACING**

### **Part 1 General**

#### **1.1 SECTION INCLUDES**

- .1 Asphalt sport court surface colour coating system.

#### **1.2 RELATED WORK**

- .1 Hot Mix Asphalt Paving

#### **1.3 REFERENCE STANDARDS**

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
  - .1 Tennis Canada.

#### **1.4 SUBMITTALS**

- .1 Product Data: Submit manufacturer's product data, including surface and crack preparation and application instructions.
- .2 Samples: Submit manufacturer's color samples of color coating.
- .3 Test Reports:
  - .1 Submit independent test results for solar reflectance index.
  - .2 Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
  - .3 Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.
- .4 Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- .5 Manufacturer's Project References: Submit manufacturer's list of successfully completed asphalt tennis court or sport court surface color coating system projects, including project name, location, and date of application.
- .6 Applicator's Project References: Submit applicator's list of successfully completed asphalt tennis court or sport court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.
- .7 Warranty Documentation: Submit manufacturer's standard warranty.

#### **1.5 QUALITY ASSURANCE**

- .1 Manufacturer's Qualifications:
  - .1 Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt tennis court or sport court surface color coating systems of similar type to that specified.

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.2 Applicator's Qualifications:

- .1 Applicator regularly engaged, for past 3 years, in application of tennis court or sport court surface color coating systems of similar type to that specified.
- .2 Employ persons trained for application of tennis court or sport court surface color coating systems.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. store products and materials where they will be protected from damage, theft and vandalism.
- .2 Storage and Handling Requirements:
  - .1 Store and handle materials in accordance with manufacturer's instructions.
  - .2 Keep materials in manufacturer's original, unopened containers and packaging until application.
  - .3 Store materials in clean, dry area indoors.
  - .4 Store materials out of direct sunlight.
  - .5 Keep materials from freezing.
  - .6 Protect materials during storage, handling, and application to prevent contamination or damage.
  - .7 Close containers when not in use.

**1.7 AMBIENT CONDITIONS**

- .1 Do not apply asphalt sport court surface color coating system when air or surface temperatures are below 10 degrees F during application or within 24 hours after application.
- .2 Do not apply asphalt tennis court surface color coating system when rain is expected during application or within 24 hours after application.

**Part 2 Products**

**2.1 MANUFACTURER AND APPLICATOR**

- .1 Asphalt Sports Court Surface Colour Coating System: SportMaster, Clour Concentrate
- .2 Or Approved Equal
- .3 Ocean Marker Sport Surfaces: 4481 232st Langley BC 604 530 6430
- .4 Or Approved Equal

**2.2 MATERIALS**

- .1 Asphalt Sport Court Surface Color Coating System: SportMaster, Colour Concentrate
- .2 Crack Sealant:
  - .1 percent acrylic emulsion elastomeric crack sealant.
  - .2 Seals cracks up to 1/2 inch wide in asphalt pavement.

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- .3 Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- .4 Non-Volatile Material: 61 percent, plus or minus 5 percent.
- .5 Color: [Green] [Blue].
- .3 Crack Filler:
  - .1 percent acrylic emulsion trowel-grade crack filler.
  - .2 Fills cracks in asphalt pavement up to 1 inch wide.
  - .3 Chemical Characteristics, by Weight, Minimum:
    - .1 Acrylic Emulsion: 10.0 percent.
    - .2 Hiding Pigment: 0.2 percent.
    - .3 Mineral Inert Fillers: 78.0 percent.
    - .4 Film Formers, Additives: 1.8 percent.
    - .5 Water: 8.5 percent.
  - .4 Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
  - .5 Non-Volatile Material: 80 percent, plus or minus 5 percent.
  - .6 Color: [Green] [Neutral] [Red].
- .4 Patch Binder:
  - .1 percent acrylic emulsion liquid binder.
  - .2 Mix on-site with sand and cement.
  - .3 Levels and repairs low spots and depressions up to 3/4 inch deep in asphalt pavement.
  - .4 Fills Cracks in Asphalt up to 1" in width.
  - .5 Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- .5 Filler Course:
  - .1 percent acrylic emulsion resurfacer.
  - .2 Mix on-site with silica sand.
  - .3 Apply to asphalt surfaces or previously colored acrylic surfaces in preparation of color coating system.
  - .4 Chemical Characteristics, by Weight, Minimum:
    - .1 Acrylic Emulsion: 44.0 percent.
    - .2 Hiding Pigment: 2.0 percent.
    - .3 Mineral Inert Fillers: 5.0 percent.
    - .4 Film Formers, Additives: 0.2 percent.
    - .5 Water: 45.0 percent.
  - .5 Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
  - .6 Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.
  - .7 Color: [Black] or [Neutral].

- .6 Color Coating:
  - .1 percent acrylic emulsion coating.
  - .2 Mix on-site with silica sand and water.
  - .3 Color coats multipurpose courts.
  - .4 Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs.
  - .5 Color: [Blue] [Green] [Light Blue] [White].
- .7 Line Markings Primer:
  - .1 percent acrylic emulsion primer, clear drying.
  - .2 Primes line markings and prevents bleed-under for sharp lines.
  - .3 Chemical Characteristics, by Weight, Nominal:
    - .1 Acrylic Emulsion: 38.0 percent.
    - .2 Hiding Pigment: 0.0 percent.
    - .3 Mineral Inert Fillers: 7.0 percent.
    - .4 Film Formers, Additives: 1.5 percent.
    - .5 Water: 50.0 percent.
  - .4 Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
  - .5 Non-Volatile Material: 29 percent, plus or minus 5 percent.
- .8 Line Paint:
  - .1 Pigmented, 100 percent acrylic emulsion line paint.
  - .2 Line marking on asphalt sport courts.
  - .3 Chemical Characteristics, by Weight, Nominal:
    - .1 Acrylic Emulsion: 25.89 percent.
    - .2 Pigment: 14.90 percent.
    - .3 Mineral Inert Fillers: 13.12 percent.
    - .4 Additives: 4.73 percent.
    - .5 Water: 41.36 percent.
  - .4 Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
  - .5 Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
  - .6 Color: As per drawings.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Examine asphalt sport court surfaces to receive color coating system.
- .2 Verify asphalt sport courts meet Basketball Canada requirements.
- .3 Notify Landscape Architect of conditions that would adversely affect application or subsequent use.

- .4 Do not begin surface preparation or application until unacceptable conditions are corrected.

### **3.2 SURFACE PREPARATION**

- .1 Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt sport court surface color coating system.
- .2 Prepare surfaces in accordance with manufacturer's instructions.
- .3 Cure new asphalt surfaces a minimum of 14 to 30 days before application of asphalt sport court surface color coating system.
- .4 Remove dirt, dust, debris, oil, grease, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt sport court surface color coating system. Pressure wash entire surface.
- .5 Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.
- .6 Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.
- .7 The Contractor shall apply two(2) to three(3) coats of acrylic filler course to the entire court surface as per manufacturer's directions and as required by surface roughness and porosity to provide a smooth underlayment for application of colour coating. Each coat is to be applied at a 45 degree angle to the previous coat. When the final coat has cured the surface is to be scraped to remove any ridges and then the entire surface is to be blown clean to remove all debris. The entire surface is to be scraped and blown again until the surface meets the manufacturer's requirement for the application of the coloured filler base.
- .8 Once the last filler course has cured, the Contractor shall apply two coats of acrylic coloured filler emulsion as per the manufacturer's specifications. The surface will then be scraped and blown as previously described blown clean to remove all debris. The entire surface is to be scraped and blown again between each coat and after the last coat until the surface meets the manufacturer's requirement for the application of the fortified acrylic coloured emulsion.
- .9 The Contractor shall finish the surface by applying one coat of fortified highly pigmented acrylic as per the manufacturer's specifications.
- .10 Ensure surface repairs are flush and smooth to adjoining surfaces.

### **3.3 APPLICATION**

- .1 Apply asphalt sport court surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- .2 Mix materials in accordance with manufacturer's instructions.
- .3 Apply Filler Course and Color Coating with a 50-60 durometer, soft rubber squeegee.
- .4 The installation procedures for all materials, where not specified herein, must be in strict accordance with the manufacturer's specifications and provide for a long-term successful installation of all materials. The bonding method for materials employed in the system must provide for a permanent hazard free synthetic tennis court surface.
- .5 Prior to the application of the Acrylic Filler Course, the Contractor shall correct any depressions, including where the tennis net posts were removed, with High Strength

Acrylic Bonding Liquid Patching Mixture, as per manufacturer's specifications. After curing of the filler, the court surface area must again be flooded to ensure that all depressions have been filled. If it is determined that more filling is required, filling will be done as described above. The use of Asphaltic type emulsions or Hot mix asphalt to fill depressions is prohibited.

- .6 Prior to the application of the Acrylic Filler Course, the Contractor is to fill all minor cracks with the tennis court surfacing product manufacturer's recommended products and procedures. For all cracks identified by the Owner for the application of the Armor Tennis Court Crack Repair System, use the Armor Tennis Court Crack Repair System products and procedures to repair those cracks, strictly according to the Armor Tennis Court Crack Repair System recommended installation procedures.
- .7 Allow material drying times in accordance with manufacture's instructions before applying other materials or opening completed surface to foot traffic.
- .8 The surfacing is to extend to the perimeter edge of the asphalt, past the line of fence posts.

### **3.4 LINE MARKINGS**

- .1 Lay out court line markings as per plans.
- .2 All lines and event markings all shall be accurately positioned and marked as prescribed by the contract document drawings and shall be straight and true without distortions. The lines will then be taped out with 25mm wide purpose-suited masking tape. No line shall vary from the specified layout dimensions by more than 3mm over the total length of the line. All lines are to have sharp edges.
- .3 All lines are to have two (2) applications of 100% acrylic emulsion line paint and applied in accordance with manufacturer's instructions. The first application must be completely dry prior to the second coat being applied. The finished painted lines and event markings must be opaque and must not have visible brush or spray strokes.
- .4 After the lines are installed, the surface shall be allowed to cure for a minimum of forty-eight (48) hours, or in accordance with manufacturer's instructions, prior to usage.

### **3.5 PROTECTION**

- .1 Allow a minimum of 24 hours curing time before opening sport courts for play.
- .2 Protect applied asphalt sport court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

### **END OF SECTION**

## **Section 32 31 13 CHAIN LINK FENCE AND GATES**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Section 32 31 13 refers to those portions of the Works that are unique to the supply and installation of chain link fences and gates. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the Works described herein.
- .2 General Contractor responsible for the supply and installation of fencing. Existing fencing still in good condition can be repurposed upon approval of consultant. Remaining fencing material to be removed and disposed of during demobilization.
- .3 Industry standards to apply where details and procedures not specified.

#### **1.2 RELATED WORK**

- .1 Section 03 30 00 Cast-in-Place Concrete.

#### **1.3 REFERENCES**

- .1 Master Municipal Construction Documents (MMCD) Volume II 2009 Edition
- .2 CAN/CGSB-138.1-M80, Fence, Chain Link Fabric.
- .3 CAN/CGSB-138.2-M80, Fence, Chain Link, Framework, Zinc-Coated, Steel.
- .4 CAN/CGSB-138.3-M80, Fence, Chain Link Installation.
- .5 CAN/CGSB-138.4-M82, Fence, Chain Link, Gates.
- .6 CSA G164-M1981, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .7 ASTM A90-81, Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- .8 ASTM A53-88a, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .9 CGSB 1-GP-181M-77, Coating, Zinc-Rich, Organic, Ready Mixed.

#### **1.4 INTERPRETATION OF THE WORK**

- .1 The Fencing Contractor shall be fully acquainted with the existing site and shall fully understand the difficulties and restrictions attending the execution of the work under this contract. Interpretations by the Fencing Contractor of the meaning of any section of the contract drawings and specifications herein prior to submitting a proposal shall not remove the responsibility of completing the Work as per the directions of the City Representative/Consultant, including all costs associated with that Work, should the Fencing Contractor's interpretation be incorrect. Prior to submitting a proposal for the Work, the Fencing Contractor must seek clarification from the City Representative/Consultant for any items within the contract drawings and specifications that may appear to be unclear or conflicting.

## **1.5 SAMPLES AND SUBMITTALS**

- .1 Prior to the start of the work, submit a 300mm long powder-coated pipe sample that will be representative of the quality of the powder-coating for all powder-coated fencing materials installed as part of the Works.

## **1.6 QUALIFICATIONS**

- .1 Execute work in this Section only by a Fencing Contractor who has adequate equipment, skilled tradesmen, and materials to perform it expeditiously and to the specifications and who has at least two similar successful installations to that specified over the previous three years. Previous installations must have been installed under the same company ownership and with the same project supervisor proposed for this project.

## **1.7 QUALITY ASSURANCE**

- .1 Provide Engineer Schedule SB & SC for all fences being used as guard rails and at the tennis courts.

## **1.8 SUPERVISOR**

- .1 The Fencing Contractor must provide an experienced on-site supervisor to direct the Works at the site.

## **1.9 TESTING**

- .1 Refer to MMCD General Conditions, Clause 4.12, Tests and Inspections
- .2 The surface of the posts and rails will be scratch tested to ensure the finish does not flake. Finishes that flake when scratched will be rejected.

## **1.10 BONDS, WARRANTIES, AND INSURANCE**

- .1 Provide a company warranty covering products and installation that shall endure for one (1) year starting from the date of Substantial Completion.
- .2 The company warranty shall cover workmanship, defects in materials, and any other feature that is deemed to be not ordinary wear for chain link fencing.
- .3 The Contractor shall promptly replace or repair, to the specifications herein, any portions of the chain link fencing that are not performing to the standards of the company warranty within 30 days of being notified by the Owner of the defect(s). All direct and associated costs of the repair work shall be at the sole expense of the Contractor.

## **1.11 MEASUREMENT AND PAYMENT**

- .1 Payment for chain link fences shall be made by separate items for each height and type of fence as detailed on the Contract Drawings & Details and as listed in the Schedule of Quantities and Prices.
- .2 Payment to include post hole digging, offsite disposal of hole digging spoil, concrete supply and installation, chain link fence supply and installation, including, equipment, labour, and materials, and all incidentals required to complete the chain link fence installation work as outlined herein and in the Contract Drawings and Details.
- .3 Measurement will be made along the surface of the ground for the length of each item of fence installed.
- .4 Payment for chain link gates shall be made by separate items of each height and type of gate as detailed on the Contract Drawings & Details and as listed in the Schedule of



Quantities and Prices. No additional price will be paid for fence gates in the chain link fencing section.

- .5 Payment for chain link fencing using existing onsite re-usable materials will be the same as for chain link fencing using new materials.
- .6 Payment to remove and reinstate fencing will only be made for approved sections of fence which, as decide by the City Representative, are re-useable. Payment of these sections shall include careful removal of existing fence, including gates, posts, mesh and associated hardware, cleaning and storing fence, gates, post, mesh, and associated hardware removed and reinstating to same details as before removal and all necessary new materials to complete reinstatement.

## **Part 2 Products**

### **2.1 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver and store the products in the original manufacturer's packaging with labels intact and store the products where they will be protected from damage. Determine a suitable, City Representative approved, on-site location for products.

### **2.2 MATERIALS**

- .1 All concrete work to Contract Drawings and Specification Section 03 30 00.
  - .1 Nominal coarse aggregate size: 19mm.
  - .2 Compressive strength: 20 MPa minimum at 28 days.
- .2 Fencing, posts, rails, and fabric is to be constructed as indicated on the Contract Drawings and Specifications herein.
- .3 Chain-link fence fabric: to CAN/CGSB-138.1.
  - .1 All chain link fabric is to be galvanized, vinyl coated, black, commercial, and heavy grade with 50mm openings unless otherwise specified on drawings. The widest rolls of fabric are to be employed in the construction of the appropriate fence type (i.e., 1200mm wide rolls for 1200mm high fencing and 2400mm wide rolls for 2400mm high fencing, etc.).
  - .2 Fabric gauges, fabric opening sizes, fence heights, and post spacing are to be as follows unless otherwise specified on drawings:
    - .1 For passive and low activity City and Park areas the chain link fence is to be:
      - .1 mm high with the post spacing 2400mm o.c. and,
      - .2 Chain link fabric to be 9 gauge (3.55mm diameter) galvanized, vinyl coated, black, commercial grade with 50mm openings.
    - .2 For high activity City and Park areas the chain link fence is to be:
      - .1 mm high with the post spacing 2400mm o.c. and,
      - .2 Chain link fabric to be 6 gauge(4.50mm) galvanized, vinyl coated, black, commercial, and heavy grade with 50mm openings.
    - .3 For the soccer playing field backstop fences the chain link fence is to be:

- .1 mm and higher with the post spacing 2400mm o.c. (unless otherwise specified on drawings) and,
- .2 Chain link fabric to be 6 gauge(4.50mm) 6 gauge galvanized, vinyl coated, black, commercial, and heavy grade with 38mm openings.
- .3 Posts and rails for all fencing locations are to CAN/CGSB-138.2, schedule 40 galvanized steel pipe and are to be powder-coated black steel pipe. No short lengths, tubing, conduit or open seam material will be permitted.
  - .1 Post and rail sizes are to be as follows unless otherwise specified on drawings:
    - .1 For passive/active public/non-public areas which are 1200mm or 2400mm and higher:
      - .1 Corner and gate posts are to be 76mm nominal outside diameter, standard continuous weld Schedule 40 powder-coated black steel pipe.
      - .2 Line posts are to be 60mm nominal outside diameter, standard continuous weld Schedule 40 powder-coated black steel pipe.
      - .3 Top and bottom rails and horizontal braces are to be 48mm nominal outside diameter, plain ends, continuous lengths, standard continuous weld Schedule 40 powder-coated black steel pipe.
      - .4 Bottom tension wire to be single strand, 6 gauge (4.50mm diameter) black vinyl coated, galvanized steel wire.
    - .2 Soccer playing field backstop which are 8400mm high:
      - .1 Corner and line posts to be 168.3mm (6 5/8") nominal outside diameter, standard continuous weld Schedule 40, 50ksi (345MPa) ASTM F1083 steel pipe, powder-coated black.
      - .2 Bottom and horizontal bracing rails to be 48mm nominal outside diameter, plain ends, continuous lengths, standard continuous weld Schedule 40 powder-coated black steel pipe.
      - .3 Top bracing rails to be 60mm nominal outside diameter, plain ends, continuous lengths, standard continuous weld Schedule 40 powder-coated black steel pipe.
- .4 Tie wire fasteners are to be single strand, black vinyl coated galvanized aluminium or steel wire conforming to requirements of fence fabric.
- .5 All fence connections to be cove fitted and welded construction. Chain link and steel picket fence connections to be all welded construction
- .6 Tension bars: 4.76 x 19mm minimum galvanized black power coated steel.
- .7 Tension bar bands: 3 x 20 mm galvanized black powder coated steel or 5x20mm minimum black powder coated aluminium.

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- .8 All fastenings and fittings to be hot dip galvanized
- .9 All caps to be powder coated black and welded in place.
- .10 Install the chain link fence person gates and vehicle gates as indicated on the Contract Drawings.
  - .1 Chain Link Vehicle Gates.
    - .1 The vehicle gates are not to use a centre post. The closure device is to operate by securing the gates together when in the closed position. The closure device is to operate independent of the locking pins. Closure device must accept a standard padlock.
    - .2 The vehicle gate is to have locking pins with locking pin aluminum sleeves recessed 25mm into the concrete walkway to secure the gates in the open and closed positions. The top of the sleeve is to be flush with the surrounding concrete surface. The locking pin rod is to be spring-loaded so that the pin is always in the raised position unless pushed and turn locked into place, as per the drawings herein.
    - .3 The vehicle gate is to be to be 3.65 metres high to be bridged with a top rail over it, as per detail.
    - .4 The vehicle gate is to operate on wheels which fully support the weight of the gate. The wheels must be suitable for use on concrete surfaces and must not mark the concrete surface.
    - .5 Vehicle gates are not to have signage inserts.
    - .6 All hinges are to be heavy duty and welded into place.
  - .2 Chain Link Person Gates.
    - .1 The person gates are to have clear openings of as shown on plans to accommodate handicapped accessible for sports wheelchairs.
    - .2 The person gates are to use a closure device operated by securing the gate to the gate post when in the closed position. Closure device must accept a standard padlock.
    - .3 The Dog Park gates are to be able to swing 90 degrees if they will hit the adjacent fence and 135 degrees if they open into the dog park area.
    - .4 For soccer playing field entry gates, the gates are not to have locking pins for the open positions. Field entry gates are to be able to swing 180 degrees wide and lock open by attaching to main fence line.
    - .5 The person gates are to be to the full height of the fence and are not to be bridged with a top rail over them as to eliminate any restrictions on the height of objects passing through the gate.
    - .6 All hinges are to be welded into place.

## 2.3 FINISHES

- .1 Galvanizing:
  - .1 For chain link fabric: to CAN/CGSB-138.1.
  - .2 For pipe: 550 g/m2 minimum to ASTM A90.
  - .3 For other fittings: to CSA G164.

- .4 For vinyl coating: 0.045mm minimum dry film thickness
- .2 Powdercoating:
  - .1 Powdercoat all exposed surfaces. Powder coating to use powdercoat paint on acid washed surfaces. Wash and coating to be completed on a conveyor system. Dipping is not acceptable. Finish must be baked dry. Colour to be black except for backstop signage and signage inserts which are to have Owner selected custom colours.
  - .2 The powder-coat finish must not crack or chip when scratched tested.
- .3 Organic zinc rich Galvicon paint coating: to CGSB 1\_GP-181M is to be applied to all joints, welds, and damaged areas. Two coats are required. Paint to have a high gloss finish. Use black or a custom colour as necessary to match the surrounding powder-coating.

### **Part 3 Execution**

#### **3.1 ENVIRONMENTAL CONDITIONS**

- .1 Work is to commence and continue only if the environmental and site conditions are in accordance with the manufacturer's recommendations for product placement.

#### **3.2 PROTECTION**

- .1 The Contractor is responsible for the protection of all new and existing facilities from damage and/or disfiguration from the processes of the Work and from vandalism. Any damage or disfiguration must be repaired promptly and to the original condition of the facility prior to the damage.
- .2 Acceptance of the repair work is at the sole discretion of the Consultant. All repairs must be completed and accepted prior to Total Performance of the Work being granted and the release of any deficiency holdback amount.
- .3 Any deficiency holdback amount will be calculated at two times greater than the actual value of the labour and materials required to correct the deficiencies. The value of the labour and materials required to correct the deficiencies will be determined by the Consultant.

#### **3.3 PREPARATION**

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
- .2 Clean off dirt, oils, and other debris that may inhibit the application of the product. Ensure that all areas and surfaces are clean and free of debris.
- .3 Accurately survey and layout the specified work according to the Contract Drawings and Specifications herein.
- .4 The installation procedures for all materials must be in strict accordance with the manufacturer's specifications and provide for a long-term successful installation of all materials.

#### **3.4 ERECTION OF FENCE**

- .1 Erect fences along lines as indicated on the Contract Drawings and in accordance with CAN/CSG-138.3.

- .2 Space straining posts at equal intervals not exceeding 150 metres if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 metres.
- .3 Install end posts at end of fence and at changes in fence alignment. Install gate posts on both sides of gate openings.
- .4 Embed posts into concrete to depths indicated. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .5 Do not install fence fabric or pickets until concrete has cured a minimum of 5 days.
- .6 Install intermediate rail between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install intermediate rails on both sides of corner and straining posts in similar manner.
- .7 Install and weld overhang tops and caps.
- .8 Install rails between posts and weld securely to terminal posts and secure waterproof caps and overhang tops.
- .9 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate, and straining posts with tension bar secured to post with tension bar bands spaced at 300mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.
- .10 Provide a clearance between bottom of fence and finished grade of 50mm. The clearance under all rails is to be consistent.
- .11 Secure fabric to rails and posts with tie wires as follows. Give tie wires a minimum of two twists.
  - .1 At every knuckle for 50mm opening mesh.
  - .2 At every second knuckle for 38mm opening mesh.
  - .3 At every fourth knuckle for 25mm opening mesh.

### **3.5 REMOVAL AND RE-USE OF USEABLE EXISTING CHAIN LINK FABRIC**

- .1 Cut tie wires and remove existing fabric. Take care not to stretch or otherwise damage the fabric. Do not re-use damage portions of existing fabric.
- .2 Cut fabric to length and height as required. Ensure cut edges are properly and securely tied. Attach fabric as per the specifications herein.
- .3 All surplus fabric is to be rolled up into roll sizes that are manageable by one person and handed over to the City Representative if, requested to do so. Damaged fabric to be disposed of off-site.

### **3.6 REMOVAL AND RE-USE OF USEABLE EXISTING CHAIN LINK POSTS AND RAILS**

- .1 Cut existing posts and rails taking care to maximize the usable length of the existing post or rail. Do not re-use damage posts or rails.
- .2 Cut posts and rails as required. Prepare surfaces and powder-coat as per the specifications herein. Install posts and rails as per the specifications herein. 2400mm post spacing can be adjusted to accommodate re-used rails. Ensure that where spacing is adjusted it is consistent and in one section of fence.
- .3 Dispose of damaged or surplus posts, rails, and mesh off-site

### **3.7 TOUCH UPS**

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of black high gloss organic zinc rich Galvicon paint to damaged areas, allowing the manufacturer's recommended drying time between coats. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.
- .2 Wire brush, clean, and paint all welds with two coats of high gloss zinc rich Galvicon paint, allowing the manufacturer's recommended drying time between coats. Use paint colour that matches surrounding powder-coated surfaces.

### **3.8 SITE CLEAN-UP**

- .1 Upon completion of the work remove all containers, surplus materials, and installation debris, etc. Project area must be left in a clean and orderly condition.

### **3.9 MAINTENANCE SUPPLIES**

- .1 Upon completion of the work, the Contractor shall provide the Owner with maintenance materials consisting of the following.
  - .1 Two (2) 500 ml cans of black high gloss organic zinc-rich paint.
  - .2 One (1) 500 ml can of high gloss organic zinc-rich paint of each custom colour.
  - .3 Four (4) packages of 50 tie wires.

**END OF SECTION**

## **Section 32 84 23 IRRIGATION**

### **Part 1 General**

#### **1.1 SECTION INCLUDES**

- .1 Design, labour, Products, equipment and services necessary for irrigation work in accordance with the Contract Documents.

#### **1.2 REFERENCES**

- .1 CSA B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications (Withdrawn, No Replacement).
- .2 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- .3 ASTM D2466, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- .4 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

#### **1.3 CODES AND PERMITS**

- .1 All work shall be installed in accordance with the requirements of local and applicable provincial and federal regulations. Any work shown on the drawings or described in the specifications which is at variance with the regulations shall be changed to comply with the requisite authority at no cost to the City.
- .2 WorkSafe BC regulations shall be followed.
- .3 The Subcontractor shall be responsible for obtaining all permits and licenses required to undertake and complete the work. Include costs for required permits and approvals in tendered prices.
- .4 Provide the Consultant with signed and approved copies of all required permits, including the following:
  - .1 Backflow test report.
  - .2 Technical Safety BC Electrical Contractor Authorization and Declaration of Compliance Electrical Inspection Request Form.

#### **1.4 SUBMITTALS**

- .1 Provide a Certified Irrigation Contractor certificate and proof of good standing with the Irrigation Industry Association of BC or the Irrigation Association within 5 days of receipt of the Notice to Proceed.
- .2 Provide FSR C-R Low Energy field safety representative certificate of qualification and Electrical Contractor License within 5 days of receipt of Notice to Proceed.
- .3 Provide Backflow Assembly tester certificate within 5 days of receipt of Notice to Proceed.

- .4 If required, the Subcontractor shall submit evidence of project personnel having certification in High-Density Polyethylene Butt-Fusion within 5 days of the Notice to Proceed.
- .5 The Subcontractor shall submit Shop Drawings for approval by the Consultant prior to construction. Shop Drawings of the irrigation system are required for all aspects of the irrigation system not included in the Drawings. This includes but is not limited to:
  - .1 Revisions to irrigation system design not previously addressed in Contract Documents, including revisions to irrigation system design which markedly alter the original design, as determined by the Consultant.
  - .2 Installation details for irrigation components are not addressed in the Contract Documents.
  - .3 Details are required by the consultant for the review of proposed substitutes.
  - .4 Tasks identified in project specifications as requiring a Shop Drawing.
  - .5 Submit shop drawings to the consultant for review, comment, approval, or rejection.
- .6 The Subcontractor shall submit product literature for approval by the Consultant prior to the start of construction.
- .7 Provide Electrical Installation Permit and Electrical Contractor Authorization and Declaration of Compliance Electrical Inspection Request upon permit issuance.
- .8 Submit a complete set of Record Drawings to the Consultant prior to the issuance of a Certificate of Substantial Performance. Submit a digital copy in .pdf and .dwg format, hard copies in full and half-sized, and a half-sized laminated copy in the controller cabinet.
- .9 Submit the complete Operating Manual to the Consultant prior to issuance of Substantial Performance. Provide one (1) hard copy in a binder and one (1) digital copy.
- .10 Submit a written guarantee to the Consultant prior to issuance of Substantial Performance.

#### **1.5 IRRIGATION RECORD DRAWINGS**

- .1 Maintain accurate scaled records of the installed irrigation system and its components on a marked-up set of Contract Documents daily during Construction. Show all deviations from the Contract Drawings. Make marked-up Contract Drawings available to the Consultant upon request.
- .2 For sports fields and large parks, retain a qualified survey instrument operator to record the exact locations of all installed irrigation components, including changes of pipe direction.
- .3 The Record Drawings shall be submitted within 14-days of issuance of Substantial Performance. Submit one (1) full-sized copy, one (1) half-sized copy, and one (1) half-sized laminated copy. Submit digital copies in .pdf and .dwg format with the digital submission of the Operating Manual.
- .4 The Record Drawings must clearly and legibly show all components of the irrigation system as installed, including wire splices. The Record Drawings must include the following:
  - .1 Identify each zone numerically, complete with precipitation rate and GPMs per zone.



- .2 Scale and north arrow.
- .3 Legend of all equipment installed, complete with make and model of each product.
- .4 Date of installation.
- .5 Irrigation watering schedule.
- .5 The Subcontractor shall maintain the as-built record drawing throughout the maintenance and warranty period and issue a revised as-built Irrigation Drawing at Final Acceptance if any changes are made. The as-built drawings shall be certified by the landscaping subcontractor as being an accurate record of the installation.

#### **1.6 OPERATING MANUAL**

- .1 Prepare a complete Operating Manual for the installed irrigation system. The Operating Manual shall be submitted within 14-days of issuance of Substantial Completion. The content of the Operating Manual must include:
  - .1 Product literature and warranty documentation
  - .2 Equipment operating instructions.
  - .3 Maintenance instructions, including spring start-up and winterization procedures.
  - .4 Copies of all irrigation inspection reports and test results.
  - .5 Copies of the backflow test report and Electrical Permit.
- .2 A written guarantee statement covering workmanship and materials shall be provided to the City for at least one (1) year from the date of Substantial Performance. The Subcontractor shall warranty maintenance on the system for at least one (1) year, including but not limited to spring start-up, adjustments and maintenance operations as required, and winterization. The Subcontractor will also attend a warranty inspection before handover.

#### **1.7 QUALITY ASSURANCE**

- .1 The Subcontractor performing this work shall be a "Certified Irrigation Contractor," having met the certification standards established by the Irrigation Industry Association of British Columbia or the Irrigation Association and having experienced, trained, and insured personnel qualified for the scope of work.
- .2 Be certified as a Class C-R Low Energy field safety representative (FSR) registered with Technical Safety BC as an Electrical Contractor.
- .3 If the design involves High-Density Polyethylene Pipe (HDPE), the Subcontractor shall be certified in High-Density Polyethylene Butt-Fusion as certified by the British Columbia Institute of Technology or approved equivalent.
- .4 Manufactured products, including but not limited to irrigation heads, quick couplers, controllers, valve boxes and valves, will be warranted as per the manufacturer's standard warranty period or a minimum of one (1) year, whichever is greater.
- .5 The double-check valve assembly and meter shall be installed and tested by a certified and licensed backflow tester with B.C.W.W.A.
- .6 All electrical components or products specified or used in the construction of the proposed irrigation system must be CSA-approved and installed in accordance with all local, provincial, and national electrical codes.
- .7 All materials are to be new and without flaws.

- .8 The completed irrigation system is to efficiently and uniformly irrigate all areas and perform as required by these specifications.
- .9 A written guarantee of the installed irrigation system shall be provided to the City covering workmanship and materials for at least one (1) year from the date of substantial completion. The Subcontractor shall warranty maintenance on the system for at least one (1) year, including but not limited to spring start-up, adjustments and maintenance operations as required, and winterization.

## 1.8 TESTS AND INSPECTIONS

- .1 Inspection and testing of components will be required at various milestones during construction to ensure the irrigation system's performance meets expected standards.
- .2 Provide equipment and personnel necessary for the performance of inspections and tests.
- .3 The Subcontractor shall provide a minimum of 3-days' notice to the Consultant of required inspections.
- .4 Conduct all inspections and tests in the presence of the Consultant and request the Consultant issue a signed report to the Subcontractor within three days regarding each test result.
- .5 Keep work uncovered and accessible until successful completion of inspection or test.
- .6 As a condition of issuance of a Certificate of Substantial Performance, confirm in writing to the Consultant the following inspections and successful tests:
  - .1 Backflow prevention test.
  - .2 Point of Connection Inspection.
  - .3 Mainline Inspection.
  - .4 Mainline pressure test.
  - .5 Mainline pressure test.
  - .6 HDPE pipe strap test.
- .7 System installation inspections shall be held regularly.
- .8 Backflow Assembly Test:
  - .1 Conduct backflow prevention assembly test as per BC Water Works Association standards using qualified personnel.
  - .2 Conduct backflow upon backflow assembly installation and submit the report to the Consultant.
- .9 POC Inspection:
  - .1 Inspect the point of connection. Inspect all components, connections, wire splices, supports, and sizing.
  - .2 Call for inspection upon completing the installation of the point of connection.
- .10 Mainline Inspection:
  - .1 Inspect the mainline trench, depth, sand bedding, welds, connections, caution tape, and wire.
  - .2 Call for inspection once 50% of the mainline is installed.
- .11 Mainline Pressure Test:

- .1 Perform mainline pressure test to identify potential leaks and ensure mainline can operate at design pressure and maintain pressure.
- .2 Conduct mainline pressure test before backfilling of mainline.
- .3 Fill the mainline with water and expel all air from the pipe. Maintain water in the pipe for 3 hours.
- .4 Subject mainline to hydrostatic pressure of 120psi or twice the optimum design pressure of the mainline and not to exceed 160psi.
- .5 Stop the make-up water supply from going to the mainline and record hydrostatic pressure.
- .6 Visually inspect mainline and fittings for leaks.
- .7 Record hydrostatic pressure in the mainline 3 hours after the supply of make-up water stopped.
- .8 The test result is determined based on the difference in recorded pressures at the beginning and end of the test. A 5% difference or less is considered a pass.
- .9 Identify the source of the leak and replace all defective material and workmanship as necessary to eliminate the leak.
- .10 Repeat the mainline pressure test and make replacements as necessary until a passed result is achieved.
- .12 System Coverage and Operation Test:
  - .1 Conduct coverage and operation tests after installation and operation of the complete irrigation system. Conduct inspection to confirm that:
    - .1 Head spacing does not exceed the distances shown on Contract Drawings, and head-to-head coverage is achieved.
    - .2 Where applicable, irrigation piping should be installed to follow the contours of the land to minimize low-head drainage situations.
    - .3 Heads, boxes, vaults, and trenches are at a specified elevation relevant to the finished grade and are not subject to settlement or lifting.
    - .4 Valves are installed with the required clearances, materials, products, and connections.
    - .5 All irrigation components are installed with all required clearances, materials, products, and connections.
  - .2 Conduct operational tests to verify that:
    - .1 The controller can be programmed manually and remotely via the City's central control system.
    - .2 The controller can send and receive communication with the City's central control system 10 consecutive times without a missed communication.
    - .3 The controller responds to the flow sensor.
    - .4 Operating pressure is within design parameters.
    - .5 Each zone can be operated automatically and in succession via the programmed controller.

- .6 There is no overspray onto different control zones, hard surfaces, or other improvements.
- .13 Dripline Emitter Test:
  - .1 Perform inspection and testing of the dripline/emitter manifold and lines to identify potential leaks and confirm that the manifold, driplines, and emitters can operate at design pressure. Conduct inspection and testing prior to backfilling the manifold, driplines, or emitters.
  - .2 Fill the manifold and lines with water at operating pressure and maintain pressure for 15 minutes. Visually inspect the manifold, driplines, and fittings for leaks. Confirm that emitters are functioning correctly. Identify sources of leaks and replace all defective materials and workmanship as necessary to eliminate the leak.
  - .3 Repeat inspection and testing and make replacements as necessary until no further leaks are identified.
- .14 HDPE Pipe Strap Test:
  - .1 Conduct an HDPE pipe strap test at least 1 hour after the fusion weld has been made before backfilling of HDPE pipe on those fusion welds where, upon visual or tactile inspection, the bead does not roll back properly or is inconsistent in height or width.
  - .2 HDPE pipe strap consists of:
    - .1 Cut fusion weld from pipe, allowing 200mm on either side of weld to work with.
    - .2 Cut pipe lengthways through fusion weld to create a strap 25mm wide.
  - .3 Bend strap back on itself.
  - .4 If weld breaks repeat test on another fusion weld, chosen by the Consultant. If second fusion weld fails, then all welds become suspect, and the HDPE pipe cannot be installed until the reason for the fusion joint failures is determined.
  - .5 If the fusion weld does not break, then the weld is acceptable, and no further testing of similar welds is required.
  - .6 Replace or repair the tested pipe strap.
- .15 Vault Drainage Test:
  - .1 Conduct vault drainage test when the vault is installed and backfilled.
  - .2 Plug the drain, fill the vault with water to a depth of 300mm, and leave the water to drain.
  - .3 Determine the test result based on the time required for the water to drain. To pass this test, the water must drain in 60 minutes or less.

## 1.9 SUBSTITUTIONS

- .1 Where materials are specified by brand name and model number, such specifications shall be deemed to facilitate a description of the materials and material quality and shall establish a standard for performance and quality against which proposed substitutes shall be evaluated.
- .2 Substitution requests shall not be considered unless submitted in writing with sufficient descriptive literature and product samples to permit product comparison.

- .3 All product substitutions shall be equal to or greater than the original design in performance, value, and water efficiency. All proposed sprinkler substitutions must be accompanied by verifiable water efficiency performance data provided by the manufacturer or an independent industry source such as the Centre for Irrigation Technology (CIT), Fresno.
- .4 Alternate materials shall match the specified materials in performance, flow, and pressure loss so as not to compromise the intent of the design.
- .5 The consultant's written approval is required for the use of materials different from those shown in the design. Materials installed that have not been preapproved by the Consultant are subject to removal and replacement with approved materials at the Subcontractor's expense.
- .6 Substitution requests by the Subcontractor shall have no impact on Milestone Dates.

#### **1.10 SITE CONDITIONS**

- .1 Verify the existence and location of all underground utilities and services before the commencement of the work.
- .2 Consult with the Consultant to adjust the design, if necessary, to suit existing site conditions and grades before the work commences.
- .3 Ensure that sequencing of irrigation work is carried out in coordination with the work of other trades and that sleeves, wire, pipes, valves, and other equipment are installed when appropriate.
- .4 Plan, schedule and execute work to ensure a water supply is available for landscape establishment and maintenance purposes at the appropriate time, in adequate amounts, and operating at design pressures to ensure satisfactory irrigation of all landscaped areas.
- .5 Report to the Consultant in writing any conditions or defects encountered on the site during or before construction upon which the work of this section depends and which may adversely affect its performance.
- .6 Protect existing landscape features, plant material, structures, irrigation work in progress, and the work of other trades from damage.

### **Part 2 Products**

#### **2.1 ELECTRICAL PRODUCTS**

- .1 All electrical products shall be CSA-approved and bear the CSA label. Alternatively, where a product does not bear the required CSA label, it shall be approved in writing by the authority having jurisdiction.
- .2 The wiring conduit shall be a Grey PVC DB2 non-metallic electric conduit, as shown on the drawings, with a minimum diameter of 50 mm.

#### **2.2 ELECTRICAL SERVICE AND METER**

- .1 Unless already installed or otherwise required by the electrical utility having jurisdiction over the site, provide a metered electrical service, including but not limited to:
  - .1 Electrical permit.
  - .2 Electrical meter.
  - .3 Establish and verify the electrical account with the appropriate utility provider.

- .2 The type and size of electrical service are to be specified in the contract drawings.
- .3 Unless specified otherwise, an electric meter is to be supplied and installed according to the electrical utility's standards and specifications.

## **2.3 IRRIGATION CONTROLLER**

- .1 Acceptable controllers are the Toro DXi Central Control Assemblies series. Refer to the design for specific models.
- .2 The controller must include a Toro M8C cellular Kit with an antenna.
- .3 Where power is not available, acceptable battery-operated controllers are:
  - .1 Rain Bird ESP-BAT-BT
  - .2 Toro Tempus DC Series

## **2.4 CONTROLLER CABINET**

- .1 Acceptable controller cabinets include the following:
  - .1 DXi Stainless Steel Wall Mount Cabinet.
  - .2 DXi Stainless Steel Pedestal Type 1.
  - .3 Or as shown on the Contract Drawings.

## **2.5 CONTROL WIRE**

- .1 The control wire from the irrigation controller to the electric control valve is to be a minimum of #14-gauge, with direct burial and type TWU-40 wire. It may be any colour other than white, blue, purple, or red.
- .2 The common wire from the irrigation controller to the electric control valve must be a minimum #14-gauge direct burial, type TWU-40 wire, and white in colour.
- .3 The master valve wire from the controller to the valve must be a minimum #14-gauge direct burial, type TWU-40 wire, and it must be red in colour.
- .4 The spare control wire is to be blue in colour.
- .5 Spare common wire to be white in colour.
- .6 All connectors will be new, two-step, CSA-approved for watertight applications and assembled according to the manufacturer's recommendations.

## **2.6 TWO-WIRE CONDUCTOR**

- .1 The Paige Electric P7350D shall be used to communicate between the controller and the field decoders at the electric control valves.
- .2 Single conductor spare decoder wire shall be CSA-approved #14 AWG Blue.
- .3 All control wires installed shall use a Polyethylene outer jacket.
- .4 All connectors are to be new, two-step, CSA-approved for watertight applications and assembled according to the manufacturer's recommendations.

## **2.7 GROUNDING AND BONDING**

- .1 Ground assembly consists of CSA and BC Electrical Code-endorsed products per the irrigation controller manufacturer's recommendations for grounding.

## **2.8 WIRE SPLICE BOXES**

- .1 The wire splice box, matching lid, and extensions are to be commercial grade and grey in colour. The wire splice box is to have a locking overlapping lid with a stainless steel bolt locking device and appropriate washers.

## **2.9 WATER SERVICE AND METER**

- .1 Unless already installed or otherwise required by the water utility having jurisdiction over the site, provide a metered water service, including but not limited to:
  - .1 Permit.
  - .2 Backflow prevention assembly.
  - .3 Establish and verify water accounts with the appropriate utility provider.
- .2 Supply and install a water meter in accordance with the requirements of the water utility.
- .3 Conform water meter size to mainline diameter and allow for minimal pressure losses.

## **2.10 VAULT AND LID**

- .1 Refer to Contract Drawings for acceptable vaults and lids for point-of-connection components.
- .2 Lids to have recessed hinges and locking hardware.

## **2.11 VAULT DRAIN**

- .1 Perforated Schedule 40 PVC pipe, 100mm diameter with threaded inlet cover having 13mm grated openings.

## **2.12 BACKFLOW PREVENTION ASSEMBLY**

- .1 Acceptable double-check valve assemblies are:
  - .1 Watts Series 007 Double Check Valve Assembly.
  - .2 Apollo 4A-100 Double Check Valve Assembly.

## **2.13 FLOW SENSORS**

- .1 Flow sensors are to be PVC, sized to match system low and high flows. Acceptable flow sensors are:
  - .1 Toro TFS-050.
  - .2 Toro TFS-075.
  - .3 Toro TFS-100.
  - .4 Toro TFS-150.
  - .5 Toro TFS-200.
  - .6 Toro TFS-300.
  - .7 Toro TFS-400.
- .2 Acceptable wires for the flow sensor shall be shielded, direct burial communication cable and include the following:
  - .1 Regency Wire PE-39 Communication Cable.
  - .2 Paige Electric P71R2D.

- .3 Approved equal.

#### **2.14 MASTER VALVE**

- .1 Acceptable master valves are as follows:
  - .1 Rain Bird PEB Series.
  - .2 Toro P220 Series.
- .2 Master valve to be sized to maximum and minimum flow parameters as shown on Contract Drawings.

#### **2.15 PRESSURE REDUCING VALVE**

- .1 Acceptable water pressure-reducing valves are Watts Series 25AUB-Z3.

#### **2.16 BLOW-OUT ASSEMBLY**

- .1 Blowout assembly to consist of a tee with a 25 mm ball valve with a plug.

#### **2.17 QUICK-COUPLING VALVE**

- .1 Acceptable quick coupling-valves are as follows:
  - .1 19mm Rain Bird 3-RC.
  - .2 25mm Rain Bird 5-RC.

#### **2.18 GATE VALVE**

- .1 For gate valves sized up to 50mm, acceptable gate valves include the following:
  - .1 Red White #280.
  - .2 Toyo #206A.
- .2 Acceptable gate valves that are sized greater than 50 mm are as shown on Contract Drawings.

#### **2.19 POLYVINYL CHLORIDE (PVC) PIPE**

- .1 Conform to CSA B137.3.
- .2 New condition, extruded from virgin, high impact materials, solvent weldable with belled ends, continually and permanently marked showing manufacturer's name, material, size, and pressure rating.
- .3 Acceptable PVC pipe to be as follows:
  - .1 Class 200 PVC.
  - .2 Schedule 40 PVC.

#### **2.20 POLYETHYLENE (PE) PIPE**

- .1 New condition Series 100, in new condition, extruded from virgin materials, continually and permanently marked showing manufacturer name, material, size, and pressure rating.

#### **2.21 HIGH DENSITY POLYETHYLENE (HDPE) PIPE**

- .1 New condition CSA Approved, extruded from virgin materials, continually and permanently marked showing manufacturer's name, materials, size, and pressure rating.



- .2 Material to be listed by the Canadian Standards Association (CSA) and Plastic Pipe Institute (PPI) as a PE-3408 resin with a hydrostatic design basis (HDB) of 1600 psi for water at 23C. Material to comply with ASTM D1248 as a Type III Class C, Category 5, Grade P34 material and with ASTM D3350 as a 345434C cell material.
- .3 Acceptable HDPE pipe is dependent on operating pressure and to have Standard Density Ratios (SDR) as follows:
  - .1 Max. pressure up to 100psi: SDR 17.0.
  - .2 Max. pressure exceeding 100psi: SDR 11.0.

## **2.22 SLEEVING**

- .1 Schedule 40 PVC for irrigation sleeve in a bored hole or under the hard surface.
- .2 Irrigation sleeve diameter is to be a minimum of 50mm or twice the diameter of the pipe running through it, whichever is greater.
- .3 Control wire conduit to be a minimum of 50mm diameter CSA Approved electrical conduit.

## **2.23 FITTINGS**

- .1 New condition Schedule 40 PVC is conforming to ASTM D2466 standards and is of the same material as the pipe. Fittings are to be designed for solvent welding to PVC pipe except where valves and risers require threaded joints.
- .2 Nipples are to be threaded Schedule 80 PVC and manufactured from the same material as pipe.
- .3 At the point where the supply source changes from metal to PVC pipe, the metal end of the pipe must be an FIPT (female) adapter and the PVC fitting a MIPT (male) adapter.
- .4 Flange couplers may be used upon approval of the Consultant.
- .5 The fittings for the LDPE pipe are to be Spears insert fittings complete with stainless steel gear clamps.
- .6 Fittings for HDPE pipe to be butt fusion type for end-to-end joints.
- .7 The SDR rating of HDPE fittings must match the SDR rating of the HDPE pipe specified.
- .8 HDPE pipe fittings are to be moulded or fabricated by the pipe manufacturer. HDPE pipe fittings and flange adapters made by contractors or distributors are prohibited.
- .9 Fittings for dripline and drip emitters to be compatible with specified dripline or emitter and as recommended by the manufacturer.
- .10 All pipes and fittings installed in the irrigation vault are to be Schedule 80 per Drawings.

## **2.24 PIPE SOLVENT AND PRIMER**

- .1 PVC pipe solvent and primer combinations are recommended by the manufacturer and suitable for use with specified materials and applications.
- .2 Use solvent and primer as directed by the manufacturer. Use only solvent and primer that meets local codes.
- .3 The use of wet and dry solvents and primers is prohibited.

## **2.25 VALVE BOXES**

- .1 Acceptable irrigation valve boxes are:

- .1 Rain Bird VB Series Valve Boxes.
- .2 NDS Pro-Spec Series.
- .2 Valve box and matching T Cover Lid and extensions to be commercial grade and green in colour.
- .3 The valve box is to have a locking lid with a stainless steel bolt locking device and appropriate washers.

## **2.26 ELECTRICAL CONTROL VALVE**

- .1 Acceptable electric control valves are:
  - .1 Rain Bird PEB Series.
  - .2 Toro P-220 Series.
- .2 Size the electric control valve in accordance with the valve manufacturer's recommendations for the design flow.

## **2.27 SWING JOINT ASSEMBLY**

- .1 Acceptable swing joint assemblies for sprinklers flowing up to 8 gpm:
  - .1 Rain Bird SA Series Swing Assembly.
- .2 For sprinklers flowing greater than 8gpm, use swing joints with three (3) threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.
- .3 The length of the nipple shall be such a length to permit the installed head or valve to be set as specified.
- .4 The diameter of the nipple to match the inlet for the valve or head is shown on the Contract Drawings.

## **2.28 SPRINKLERS - SPRAYHEADS**

- .1 Acceptable sprayhead sprinklers are as follows:
  - .1 Rain Bird 1806-SAM-PRS, 1806-SAM-P45, 1812-SAM-PRS, 1812-SAM-P45 Series.
  - .2 Rain Bird RD1800 Series Spray Heads.
- .2 Acceptable nozzles are Rain Bird MPR fixed arc nozzles. Where fixed arc nozzles do not fit the desired irrigated area, use Rain Bird HE-VANs.

## **2.29 SPRINKLERS - ROTORS**

- .1 Acceptable rotors are as follows:
  - .1 Rain Bird 5004-+-SAM-R Series.
  - .2 Rain Bird Falcon 6504 Series.
  - .3 Rain Bird 8005-SS Series for sports field applications.
  - .4 Rain Bird 8005.

## **2.30 ROOT WATERING SYSTEM**

- .1 Acceptable root watering systems are Rain Bird RWS Series, and the size and depth are specified on the contract drawings.
- .2 Root watering systems shall be outfitted with a Rain Bird RWS-SOCK when installed.

### **2.31 DRIP ZONE KITS**

- .1 Acceptable drip zone kits are as follows:
  - .1 0.3 to 20 GPM: Rain Bird X CZ-100-PRB-COM.
  - .2 15 to 40 GPM: Rain Bird X CZ-150-LCS.

### **2.32 FILTERS**

- .1 Acceptable filters are as shown on the Contract Drawings.
- .2 Filter to be commercial grade appropriate for designed flow rates and manufactured by Rain Bird.

### **2.33 LANDSCAPE DRIPLINE**

- .1 Acceptable driplines are as follows:
  - .1 Rain Bird XFD On-Surface Dripline.
  - .2 Rain Bird XFS Sub-Surface Dripline.
  - .3 Rain Bird XFS-CV Dripline.

### **2.34 DRIP EMITTERS**

- .1 Acceptable emitters are Rain Bird Xeri bugs, sized as shown on Contract Drawing.

### **2.35 LATERAL FLUSH ASSEMBLY**

- .1 Ball valve with a street elbow on swing joint assembly complete with Rain Bird VB10RND valve box.

### **2.36 AIR RELIEF VALVES**

- .1 Acceptable air relief valves are Rain Bird ARV050 Air/Vacuum relief valves.

### **2.37 THRUST BLOCK**

- .1 Thrust blocks to be 20MPa at 28-day strength. Thrust blocks can be either:
  - .1 Poured in place concrete.
  - .2 Pre-cast concrete block.

### **2.38 BACKFILL MATERIAL**

- .1 Native excavated material shall be clean excavated soil, free from organic matter, stones larger than 25mm, building debris, and other foreign substances.
- .2 Sand: pit run sand.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Report existing conditions at variance with Contract Drawings to the Consultant.
- .2 Verify locations of underground utilities before commencing excavation and conduct work to prevent interruption and damage to services and utilities. Make good all damages to same at Subcontractor's cost.
- .3 Protect existing conditions and complete work from disturbance during work. Make good all damages to same at Subcontractor's cost.

- .4 Adjustments to the irrigation system installation to avoid existing conditions, completed work, and utilities will be permitted subject to prior approval by the Consultant.

### **3.2 LAYOUT**

- .1 Locations of irrigation components shown on plans are schematic in nature. Coordinate the actual location of irrigation components with landscaping and physical features of the site. Confirm proposed changes to the location of irrigation components in writing with the Consultant before installation. Changes that markedly alter the irrigation design, in the consultant's opinion, require the submission of Shop Drawings and an updated Design Report to the Consultant for their permission to proceed. Record all approved revisions on a marked-up set of Contract Drawings.
- .2 Layout and stake irrigation system per Contract Drawings to confirm:
  - .1 The layout is within the project boundary and property lines.
  - .2 Site grades are consistent with Contract Drawings.
  - .3 Damage to the root system of existing trees is minimized.
  - .4 Installation of irrigation components to be a minimum of 1 meter outside the dripline of existing trees.
  - .5 Minimum horizontal and vertical clearances from electrical and other utilities are met.
  - .6 Location of all sleeving, mainlines, pedestals, vaults, valve boxes, and splice boxes.

### **3.3 EXCAVATION**

- .1 Excavate to ensure depth and bedding requirements are met.
- .2 All excavation is unclassified. Report any material or site condition that cannot be excavated by normal mechanical or normal means, or that may affect excavation to the required depth to the Consultant before excavation.
- .3 Identify and recycle all suitable materials recovered during construction.
- .4 Remove and dispose of buried debris exposed during excavation, including decommissioned irrigation materials and underground utilities, which may impede the proper installation and operation of the irrigation system.

### **3.4 IRRIGATION CONTROLLER**

- .1 Install irrigation controller in the cabinet as per Contract Drawings.
- .2 Coordinate controller installation with other electrical components.
- .3 Install controller and wiring in accordance with local, provincial, and national electrical codes.
- .4 Install communication components per the manufacturer's recommendations and establish communication between the controller and the City's Central Control System, including relays or boosters as necessary.
- .5 Before issuance of Certificate of Substantial Performance, request irrigation program from the Consultant and set controller program accordingly.

### **3.5 CONTROLLER CABINET**

- .1 Install the controller cabinet in the location shown on Contract Drawings or in an alternate location approved or directed by the Consultant.
- .2 Orient alignment of the controller cabinet as approved by the Consultant, to provide optimal observation of the irrigation system in operation.
- .3 Install the controller cabinet using a poured-in-place concrete pad mount.
- .4 Provide electrical service to controller cabinet as shown in Contract Drawings.

### **3.6 CONTROL WIRE**

- .1 Install control wire per code by qualified personnel employed by the company holding the electrical permit.
- .2 Bury control wire per applicable code and in no case above the bottom side of the parallel pipe.
- .3 Bed control wire in sand with a minimum of 50 mm sand around the control wire. Where the control wire is in the same trench as the pipe, place the wire beside the pipe with a horizontal clearance of a minimum of 50 mm and in accordance with BC Electrical Code depth.
- .4 Bundle multiple lengths of wire in the same trench or conduit with ties at a maximum of 3.0m intervals.
- .5 Install wire with 600 mm length of coiled slack at all direction changes, in wire splice boxes and at connections to controlled components.
- .6 Identify all control wires entering the controller cabinet with a permanent label or tag indicating the zone number of the valve operated by each control wire.
- .7 Maintain consistent wire colour through wire splice box.
- .8 Minimize wire splices. Where wire splices are unavoidable, make splices only in the wire splice box using a specified connector.
- .9 Identify spliced wire with permanent label or tag indicating zone number of the spliced control valve.
- .10 Where specified on Contract Drawings, install extra control wire to wire splice box. Provide 600 mm of coiled slack of each wire end in the wire splice box. Identify extra control wire as 'extra' wire with a permanent label or tag.

### **3.7 GROUNDING AND BONDING**

- .1 Install ground assembly in the location shown on Contract Drawings or the revised location approved by the Consultant.
- .2 Use the rod, plate and wire configuration as recommended by the manufacturer of the irrigation controller and per BC Electrical Code.

### **3.8 WIRE SPLICE BOX**

- .1 Where possible, locate the wire splice box in the planting bed for ease of access, maintenance, and testing.
- .2 Install the wire splice box per the drawings and arrange it neatly and in an orderly manner.
- .3 Do not install valves in the wire splice box.

- .4 The wire splice box is to be a Rain Bird VB10RND valve box.

### **3.9 WATER SERVICE AND ACCOUNT**

- .1 Establish a water utility account and obtain permits and approvals necessary to install and operate irrigation systems.
- .2 Review regulations and restrictions imposed by applicable water utility with a Certified Irrigation Designer and advise the Consultant of any regulations or restrictions that will affect the operation of the proposed irrigation system. Provide the Consultant with the options necessary to respond to any regulations or restrictions affecting the operation of the proposed irrigation system.
- .3 Coordinate with water utility as required to confirm availability, suitability, and location of an acceptable service connection.
- .4 Isolate water service before installation of any irrigation components.
- .5 Install water service to the point of connection. Refer to City requirements for irrigation water service.

### **3.10 VAULT AND LID**

- .1 Install vault in location on Contract Drawings or in an alternate location approved or directed by the Consultant.
- .2 Support and brace point of connection components, piping and valves within the vault using adjustable aluminum pipe stands complete with riser, pipe clamps, base plate, and stainless-steel fittings in the quantity per service size indicated as follows:
  - .1 19 mm: 2 supports.
  - .2 50 mm: 3 supports.
  - .3 64 mm and greater: 3 supports per vault.
- .3 Use Schedule 80 Pipe and fittings for inside vault and extend outside the vault a minimum of 300mm beyond the vault.
- .4 Connect PVC and metal pipes using male threads on PVC and female threads on metal pipes.
- .5 Install vault drain and connect to drain pit, dry well, manhole or catch basin.

### **3.11 VAULT DRAIN**

- .1 The vault drain consists of a minimum of 2m<sup>3</sup> of 25mm drain rock wrapped in landscape fabric.
- .2 The pipe from the vault shall have a minimum of 0.5% slope from the vault to the drain pit.

### **3.12 BACKFLOW PREVENTION DEVICE**

- .1 Install the Double Check Valve Assembly (DCVA) in a lockable concrete vault or a locked mechanical room, per the Contract Drawings.
- .2 Install the backflow prevention assembly in accordance with all applicable codes and bylaws and the current Cross Connection Control Manual Accepted Procedure and Practice (BCWWA).
- .3 Support backflow prevention assembly with specified supports per the manufacturer's recommendations for locations of the support points.

### **3.13 FLOW SENSOR**

- .1 Install flow sensor in the location specified by Drawings.
- .2 The flow sensor wire is to run continuously, with no splices, between the flow sensor and irrigation controller.
- .3 There must be an unrestricted pipe for at least 10x the pipe's diameter upstream and 5x the pipe's diameter downstream of the tee.
- .4 Follow the manufacturer's recommendations for the installation of a flow sensor and wiring.

### **3.14 MASTER VALVE**

- .1 Install master valve per Contract Drawings.

### **3.15 PRESSURE REDUCING VALVE**

- .1 Install a pressure-reducing valve as shown on Contract Drawings.

### **3.16 BLOW-OUT ASSEMBLY**

- .1 Install the blow-out assembly immediately in a vault at the point of connection.

### **3.17 QUICK COUPLERS**

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.

### **3.18 GATE VALVE**

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.

### **3.19 PIPES AND FITTINGS**

- .1 Verify that all pipes, fittings, primer, and cement are compatible for proper installation.
- .2 Do not locate the open side of the trench any closer than 300 mm from the hard surface or feature.
- .3 Keep the inside and outside of the pipe and its ends clean at all times. Cap or plug open pipe ends to keep out dirt and debris.
- .4 Cut PVC pipe ends at a right angle to pipe length, and clean burrs before joining pipe and fittings.
- .5 Immediately before joining pipe and fittings, wipe contact surfaces clean with primer.
- .6 Apply a light coat pipe of cement on the inside of the fitting and a heavier coat on the outside of the pipe. Insert the pipe into the fitting and give a quarter turn to seat cement. Wipe excess cement from outside of the pipe.
- .7 Consultant reserves the right to request that the Contract remove and replace any solvent weld joints that are
- .8 Wrap male threads of threaded fittings with a minimum of 3 wraps of Teflon tape immediately prior to making a connection.
- .9 Flush all irrigation pipes fully to remove accumulation of dirt and debris before installation of heads, dripline, emitters, and filters. Flush all laterals in a manner approved by the manufacturer to prevent clogging of screens, nozzles, and emitters.
- .10 Conduct mainline pressure test and HDPE pipe strap test and obtain approval from the consultant before backfilling lines.

- .11 Sidewall fusion of HDPE is not acceptable.
- .12 Set mainlines and laterals on and backfill them with sand to the clearance limit shown on the drawings.
- .13 Install thrust blocks at all changes in the direction of PVC pipe 64mm in diameter or greater and for any change in the direction of gasketed pipe.
- .14 Install lateral piping at a depth of 300 mm to 600 mm (12" to 24").
- .15 Install mainline piping at a depth of 450 mm to 800 mm (18" to 32").

### **3.20 SLEEVING**

- .1 Install irrigation sleeves in locations shown on Contract Drawings.
- .2 Install irrigation sleeve to depth as follows:
  - .1 Mainline Piping:
    - .1 600 mm below walkways
    - .2 900 mm below driveways, roads and plazas
  - .2 Lateral Piping:
    - .1 300 mm below walkways
    - .2 600 mm below driveways, roads and plazas
- .3 Install sleeves to extend 1.0 m past the edge of the hard surface into the soft landscape surface.
- .4 Cap sleeve with removable plug or cover. Maintain plug in sleeve until the pipe or wire is ready to be installed.
- .5 Bed sleeves as follows:
  - .1 Under walkways, 100 mm of sand is placed all around.
  - .2 Under driveways, roads, and plazas, compacted base aggregate all around per materials shown on Drawings.
- .6 Bury a piece of detectable metal on top of each end of the sleeve to enable the location of the sleeve end by a metal detector after burial.
- .7 Stake location of each end of the sleeve prior to backfilling such that the top of the stake is 300 mm above finished grade and maintained. Label the exposed end of the stake with the word "sleeve".
- .8 Record the location of sleeve ends and label the size of the sleeve on record drawings.
- .9 Remove the sleeve stake after submitting the Record Drawings.

### **3.21 VALVE BOXES**

- .1 Install manual and electric control valves, control zone kits, and quick coupler valves in valve boxes or concrete vaults, as shown on the Drawings.
- .2 Except as shown otherwise on Contract Drawings or approved otherwise by the Consultant, locate valve boxes in planting beds and locate for ease of access, maintenance, and testing.
- .3 Install the valve box flush with the finish grade and arrange it in a neat and orderly manner.



- .4 Provide a minimum 50 mm clearance between the valve box and all components within.
- .5 The valve box must not contact the irrigation pipe. Use 300mm height-matching valve box extensions as required.
- .6 Up to three (3) 25 mm control valves or two (2) 38 mm control valves may be contained within a single valve box provided 100mm of clearance between valves. Install valves 50 mm and larger in their own valve box.
- .7 Install a minimum of four (4) bricks below all corners of the valve box. The bricks shall not intrude into the valve box's space.
- .8 Wrap all valve boxes in landscape fabric before burial to prevent material from sloughing into the valve box.

### **3.22 ELECTRICAL CONTROL VALVE**

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify the electric control valve with a permanent label or tag indicating the zone number of the valve.
- .3 Install a 25 mm Schedule 40 PVC ball valve upstream of each 25mm; for larger valves, install a gate valve sized to match the valve.
- .4 Ensure a 50 mm gap between the bottom of the valve and the top of the drain rock.
- .5 Install valve box on bed 150mm depth of 25mm drain rock that extends 100mm past all edges of the valve box.

### **3.23 SWING JOINT ASSEMBLY**

- .1 Fabricate the assembly of a triple swing joint using three threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple for sprinklers flowing more than 8gpm and preassembled Rain Bird swing joint assemblies for sprinklers flowing up to 8gpm.
- .2 Install swing joint assembly to rotate counterclockwise when depressed.
- .3 Tape threads of PVC fittings with Teflon tape and make hand tight.
- .4 Install pre-fabricated swing joints per the manufacturer's recommendations.

### **3.24 SPRINKLERS**

- .1 Install per manufacturer's recommendations and in the location shown on Contract Drawings.
- .2 The location of heads, as illustrated on the Contract Drawings, is intended as a guide to the layout of heads. Establish actual head locations in the field to ensure complete and adequate coverage of all areas to be irrigated and no overspray onto adjacent surfaces and improvements. Do not exceed the head spacing shown on the Contract Drawings.
- .3 Where obstructions or site improvements hinder or block head-to-head coverage, advise the Consultant and determine the best method to maximize coverage.
- .4 For flat surfaces, install head plumb to finished grade. For sloped surfaces, install a head perpendicular to half the grade of the slope.
- .5 Mount pop-up heads on the triple swing joint assembly. Connect the sprinkler's bottom inlet to the swing joint assembly, not the side inlet. Adjust the swing joint assembly to set the head flush with the finish grade. Tape the threads of the PVC fittings with Teflon tape and make the hand tight.

- .6 Adjust arc, the radius of coverage and flow at each sprinkler to achieve even head-to-head coverage of the area to be irrigated, with minimum over-spray onto other surfaces.

### **3.25 ROOT WATERING SYSTEM**

- .1 Install root watering system as follows:
  - .1 Install sock over the canister.
  - .2 Position units evenly spaced around the root ball and adjacent to the root zone within the tree canopy.
  - .3 Fill the canister with pea gravel to 50mm below the bubbler.
  - .4 Connect to lateral pipe with Rain Bird SPX Series Swing Pipe and Rain Bird SB Series Spiral Barb fittings.
  - .5 Cover the grate with duct tape or landscape fabric to prevent the ingress of foreign material during construction. Remove it prior to Substantial Performance.

### **3.26 DRIP ZONE KITS**

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify the electric control valve with a permanent label or tag indicating the zone number of the valve.
- .3 Drip zone kits shall include one (1) schedule 40 PVC ball valve and filter.
- .4 Drip zone kits are to include a ball valve, filter, and pressure regulating module.
- .5 Ensure a 50mm gap between the bottom of the valve and the top of the drain rock.
- .6 Install valve box on bed 150mm depth of 25mm drain rock that extends 100mm past all edges of the valve box.

### **3.27 FILTERS**

- .1 Install the filter in the same valve box as a valve, per the manufacturer's recommendations and Contract Drawings.

### **3.28 LANDSCAPE DRIPLINE**

- .1 Do not install driplines or emitters of different flow lengths or spacing on the same zone.
- .2 Place the dripline on the prepared surface. The surface must be free of sharp rocks or other objects that may damage it. It must also be at the grade necessary for the dripline to be at the specified depth after the remainder of the topsoil or growing medium is placed.
- .3 Placement of dripline by trenching using hand or mechanical methods permitted only if specified as such on Contract Drawings or upon written approval of the Consultant.
- .4 Thoroughly flush each zone after installation and before beginning regular operation of the drip zone.
- .5 Stake dripline in beds every 450 mm on centre.
- .6 Make all zone connections and test the manifold, lines, and fittings for leaks prior to placing topsoil or growing medium over the manifold, headers, dripline, and emitters.

### **3.29 DRIP EMITTERS**

- .1 Install per manufacturer's recommendations and as shown on Contract Drawings.

### **3.30 LATERAL FLUSH ASSEMBLY**

- .1 Install flush assembly on the swing joint in the valve box.
- .2 Install flush valve assembly at the end of each leg or section of drip line and at the end of each leg of lateral on a root watering system zone.

### **3.31 AIR RELIEF VALVE**

- .1 Install an air relief valve at the highest point in the zone or bed.

### **3.32 THRUST BLOCK**

- .1 Place a thrust block to support the pipe joints from separating, not to prevent the pipe from heaving. Do not cover the top of the pipe with concrete thrust blocking at change from a horizontal alignment to a vertical alignment.
- .2 For thrust blocks installed in disturbed soils, increase the thrust block area by 50%.
- .3 Place 2 ply of 6 mil polyethylene between the pipe and thrust block.
- .4 Allow the concrete to set before backfilling the trench or pressurizing the line.
- .5 Obtain approval from the Consultant before backfilling the thrust block.

### **3.33 CLEAN-UP AND RESTORATION**

- .1 Remove all waste and debris from the site resulting from irrigation installation.
- .2 Restore all disturbed surfaces to original condition or better, and repair all trench settlements.

### **3.34 INSTRUCTIONS TO CITY (OWNER)**

- .1 Instruct the City in complete operating and maintenance procedures for the irrigation system, including start-up, winterization, and programming.
- .2 Review Record Drawings and Operating Manual with the City on site.

### **3.35 GENERAL MAINTENANCE**

- .1 Inspect, operate, maintain, and adjust the irrigation system through the Landscape Maintenance Period until issuance of Certificate of Acceptance to ensure it operates as intended, including but not limited to:
  - .1 Adjust irrigation schedule to ensure survival, health and growth of plant material and respond to soil conditions, and climate.
  - .2 Clean sprinkler heads and adjust coverage to eliminate over watering, under watering and overspray onto adjacent surfaces.
  - .3 Monitor and clean filtration equipment.
  - .4 Restore grass areas, planting beds, and hard surfaces, as well as improvements affected by trench settlement and erosion.
  - .5 Respond to requests from the Consultant for program adjustments, servicing, adjustments, and repairs.

### **3.36 WINTERIZATION MAINTENANCE**

- .1 During the Maintenance Period, be responsible for the winterization of the irrigation system at the end of the growing season and before the onset of air temperatures below 0 Celsius. Be liable for any damage resulting from late or improper winterization.

- .2 Request the presence of the City at winterization at least 5 days prior to the proposed winterization date.
- .3 Winterization includes but is not limited to:
  - .1 Deactivation of controller
  - .2 Drainage and blow-out assembly of the entire irrigation system.

### **3.37 MAINTENANCE SPRING START-UP**

- .1 During the Maintenance Period, be responsible for the spring start-up of the irrigation system at the beginning of the growing season or within 10 days of the request for start-up from the City. Be liable for any damage resulting from late or improper start-up.
- .2 Ensure the City is present for spring start-up. Request the city's presence at least five (5) days before the proposed start-up.
- .3 Spring start-up includes but is not limited to:
  - .1 Checking and testing for leaks.
  - .2 Cycling irrigation control program through all zones to ensure proper function and performance.
  - .3 Checking and adjusting heads and emitters to achieve even coverage with minimum overspray onto other surfaces.
  - .4 Test backflow prevention assembly. Submit test results to the Consultant.
  - .5 Saturation of soil with water to a depth of 300 mm to provide deep watering of all lawn areas, planting beds and tree pits

### **3.38 GUARANTEE**

- .1 Submit a written guarantee, in approved form, stating that all work showing defects in materials, workmanship or operation will be repaired or replaced at no cost to the City for a period of one (1) year from the date of Substantial Performance.
- .2 Guarantee includes the supply of labour, materials and equipment necessary for the repair and replacement of damaged or defective materials and workmanship. Guarantee also includes spring start-up, winterization, maintenance, necessary testing, program corrections or adjustments and restoration of settled trenches.
- .3 Guarantee will not apply to materials or workmanship damaged after Substantial Performance by causes beyond the Subcontractor's control, such as vandalism or abuse.

### **END OF SECTION**

## **Section 32 91 13 GROWING MEDIUM**

### **Part 1 General**

#### **1.1 GENERAL REQUIREMENTS**

- .1 Refer to Division 1, General Requirements.
- .2 This section of the specification forms an integral part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

#### **1.2 DESCRIPTION**

- .1 Supply all products, labour, equipment and services necessary to install growing medium and mulch as indicated in the contract documents

#### **1.3 RELATED WORK**

- .1 Section 32 93 10 - Plants and Planting
- .2 Section 32 92 21 - Hydraulic Seeding
- .3 Section 32 92 23 - Sodding

#### **1.4 REFERENCE STANDARDS**

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
  - .1 Canadian Landscape Standard, Current Edition
  - .2 Environmental Management Act and Public Health Act of British Columbia
  - .3 Canadian Systems of Soil Classification, Methods of Soil Analysis
  - .4 Society for Testing and Materials (ASTM)

#### **1.5 DEFINITIONS**

- .1 **GROWING MEDIUM:** A mixture of mineral particulates, microorganisms and organic matter which provides a suitable medium capable of supporting the intended plant growth.
- .2 **SOIL:** A biologically active, porous, growing medium composed of profiles and built of a combination of materials; Sand, Silt, Clay, Organic Matter and chemical inputs, either through natural formation or engineered processes. Soil taxonomy is graded mainly by particle size.
- .3 **OWNER'S REPRESENTATIVE:** The person or entity, employed by the Owner to represent their interest in the review of the work.

#### **1.6 TESTING**

- .1 Provide a 3.79L sample of materials delivered to site to laboratory approved by Owner's Representative. At the discretion of Owner's Representative, submit two additional samples at directed intervals.
  - .1 Approved laboratory: Pacific Soil Analysis Inc. Suite 5-11720 Voyageur Way, Richmond, BC, V6X 3G9 Tel: 604 273 8226

- .2 Or approved equal testing centre
- .2 The analysis shall outline the testing laboratory's recommendations for amendments, fertilizer and other modifications to make the proposed growing medium meet the requirements of this specification.
- .3 Samples of existing site soil that are under existing pavement to be removed should be submitted as soon as possible after the paving is removed.
- .4 Native Soil samples to be taken from depth of established root mass.
- .5 All samples to represent characteristics of the final delivered soil.
- .6 Soils containing biosolids shall be submitted to demonstrate the finished product meets the BC Organic Matter Recycling Regulation's (OMRR) "Biosolids Growing Medium" standards.
- .7 Failure to submit soils analysis is cause for immediate rejection and possible removal of any placed growing medium at their expense.
- .8 Soil that has sat three months or longer on site is subject to further testing.

#### **1.7 SUBMITTALS AND EVALUATION**

- .1 Action Submittals: Submit analysis to Owner's Representative for review and acceptance not less than forty-five (45) days prior to start of installation of materials and products specified in this Section, to allow time for adjustments to mix design and supplier.
- .2 Analysis must Include:
  - .1 PH
  - .2 Soluble salt by electrical conductivity of a 1:2 soil water sample.
  - .3 Percent Organic Content
  - .4 Cation Exchange Capacity in Meg / g
  - .5 Nutrient levels by parts per million including: Phosphorus, Potassium, Magnesium, Manganese, Iron, Zinc and Calcium.
  - .6 Texture Analysis and distribution of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.
- .3 Soil shall be free from crabgrass, couch grass, Equisetum, convolvulus or other weeds or seeds or parts thereof. Substantially free from roots, sticks, building materials, wood chips, chemical pollutants, and other extraneous materials.
- .4 All similar materials supplied to the site shall be of similar nature and from a single source.
- .5 Costs of imported materials shall include cost of modifications from source to ensure that these materials meet specifications.
- .6 Acceptance of material at source does not preclude future rejection if material fails to conform to requirements specified following onsite analysis, or if its field performance is found to be unsatisfactory.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Weather: Do not mix or deliver soil when frozen or saturated with water following period of rainfall or heavy irrigation.

- .2 Protect soil and soil stockpiles, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Confine delivered materials to neat piles in areas coordinated with the site supervisor. Cover stockpiles with plastic sheeting when not in use.
- .3 Soils with high electrical Conductivity (2.5+) can be uncovered to correct salt concentrations through rainfall exposure or irrigation based on Owner's Representative approval and directions.
- .4 All soil to be stripped and stockpiled on site in an approved location. Stripping and stockpiling work shall be such that the soil is not damaged or contaminated
- .5 All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations.
- .6 Biological and Chemical additives shall be protected from extreme humidity, cold or heat. All products shall be freshly manufactured and dated for the year in which the products are to be used. Chemical amendments shall have original labels intact and legible.

#### **1.9 CONTAMINATED ONSITE SOIL**

- .1 Soil containing invasive species to undergo further assessment by a Qualified Professional such as a registered Biologist or Agrologist - prior to further distribution throughout site or removal of materials from site.
- .2 If soils are suspected as being contaminated, then further testing is required from an international standard ISO/IEC 17025 approved laboratory. A third-party accredited Biologist or Environmental Engineer must review findings to confirm presence and to give recommendations for amendment.

#### **1.10 SCHEDULING**

- .1 All delivery notification of approved material to include and be given with no less than seven (7) days notice.

### **Part 2 Products**

#### **2.1 AT GRADE SOIL FOR BEDS**

- .1 On site or imported soil shall be friable "A Horizon" topsoil to the requirements of the Canadian Landscape Standard Level 2P in addition to this.
- .2 Soil shall be suitable for modification by screening and additives to meet the requirements within this specification, except where specified and approved for use "as is".
- .3 Soil shall be of a sandy loam or loamy sand texture as specified by Owner's Representative.
- .4 Containing between 10% and 20% organic matter (dry weight basis), organic matter not to contain large quantities of Mushroom Manure or Yard Waste.
- .5 Salinity: Maximum saturation extract conductivity of 2.5 mmho/cm.
- .6 PH: 4.5-6.5 – unless planting is noted as specified for a PH 6.5-8.5.
- .7 Approved product:  
"Plant Zone" from Denbow, Chilliwack, BC

"Garden Blend" from West Creek Farms, Fort Langley, BC  
Or pre-approved equal

## **2.2 LAWN AREA SOILS**

- .1 On site or imported soil shall be friable "A Horizon" topsoil to the requirements of the Canadian Landscape Standard Level 2L in addition to this:
- .2 Soil shall be suitable for modification by screening and additives to meet the requirements within this specification, except where specified and approved for use "as is".
- .3 Containing between 3% and 10% organic matter (dry weight basis), organic matter not to contain large quantities of Mushroom Manure or Yard Waste.
- .4 Containing min 70% Coarse Sand.
- .5 Salinity: Maximum saturation extract conductivity of 2.5 mmho/cm.
- .6 PH: 6.0-7.0 – unless planting is noted as specified for a PH 7.0-8.5
- .7 .1 Approved product:  
"Turf Zone" from Denbow, Chilliwack, BC  
"Lawn Blend (80-20)" from West Creek Farms, Fort Langley  
Or pre-approved equal

## **2.3 BIO-RETENTION / RAIN GARDEN SOILS**

- .1 Specified in applications where a soil with high sand content is required to create a structure which retains moisture to prolong drainage, conserve water and act as a screen to filter runoff. Sites with in-situ soil infiltration rates of 5cm per hour or greater immediately prior to the initial placement of the media, bio-retention media is recommended.
- .2 Imported soil shall be friable "A Horizon" topsoil to the requirements of the Canadian Landscape Standard, used at grade and off-site - as per Level 2P in addition to this:
- .3 Soil texture to be sandy clay loam with 5-15% Silt content, 2-5% Clay and 70-90% Coarse Sand of particle size 0.002-0.05mm.
- .4 Containing between 10% and 15% organic matter (dry weight basis), organic matter not to contain large quantities of Mushroom Manure or Yard Waste.
- .5 Salinity: Maximum saturation extract conductivity of 2.5 mmho/cm.
- .6 PH: 6.0-7.0 – unless planting is noted as specified for a PH 7.5-8.0.
- .7 Fertilizers should not be added to Bio-retention soils.
- .8 .1 Approved product:  
"ecoMedia" from Veratec, Chilliwack, BC  
Or pre-approved equal

## **2.4 MULCH**

- .1 Refer to Section 32 93 10 Plants and Planting

## **2.5 AMENDMENTS**

- .1 All growing medium is to arrive pre-mixed with the exception of addition of the following components that are to be applied at rates indicated in the growing medium analysis recommendations and using:



- .2 Manure: Not to be used in the amendment of soils.
- .3 Organic Matter: Owner's Representative does not allow use of any paper fibre amended compost products. Shall be derived from organic source free of sewage biowaste, heavy metals, contaminants, animal or plant chemical additives or supplements.
- .4 Sand: Coarse, well washed and free of contaminants, chemical and organic matter. Gradation of particle sizes shall fall within the Canadian Landscape Standard recommendations. Must have saturated hydraulic conductivity between 100-300mm.
- .5 Peat moss: Not to be used.
- .6 Wood Residuals: Content of wood residuals such as fir or hemlock sawdust shall not cause a Carbon to Nitrogen ratio higher than 25:1. Cedar or redwood sawdust shall not be present in the growing medium mix with the exception of Cedar bark that has had Thujone extracted.
- .7 Dolomite Lime: Approved commercial brands for horticultural purposes, coarsely ground; containing not less than 20% calcium by weight.
- .8 Thoroughly mix using mechanical mixing/screening equipment the constituent growing medium components and recommended additives. Resulting mixture must have a particle size class and properties that match the requirements of this specification.

## **2.6 FERTILIZERS**

- .1 Standard commercial brands, meeting the requirements of the Canada Fertilizer Act, packed in waterproof containers, clearly marked with the name of the manufacturer, weight and analysis. Granular slow release fertilizers only.
- .2 Fertilizers must be those specified in the soil analysis or by Owner's Representative. Contractor shall not make any substitutions without prior written approval.

## **2.7 DRAINAGE MEDIUM**

- .1 Drain Rock: Shall consist of clean round stone or crushed rock. Acceptable material includes 19 mm (3/4") drain rock or torpedo gravel.
- .2 Drain Mat: Light duty, UV stable, impermeable cusped core bonded to a layer of non-woven filter fabric with the following minimum properties
  - .1 Compressive Strength -718 kN/m<sup>2</sup> as per ASTM D-1621
  - .2 Flow Rate – 188 l/min/Metre as per ASTM D-4716
  - .3 Approximate profile thickness of 10mm (3/8"). Acceptable products include J-DRain 200 manufactured by JDR Enterprises (1.800.843.7569); Nudrain WD/15 manufactured by Nilex Geotechnical Products Inc., Burnaby, BC or pre-approved equal.

## **2.8 FILTER FABRIC**

- .1 Needled, non-woven polypropylene mat. Nilex 4545 by Nilex Geotechnical Products Inc., Burnaby, BC or pre-approved equal.

### **Part 3 Execution**

#### **3.1 SUBGRADE PREPARATION**

- .1 Verify the size, location and depth of all existing site services and sub-surface utilities prior to commencement of the work. Repair all damage as result of failure to perform adequate review at no cost to the Owner.
- .2 Notify Owner's Representative when the site is prepared for growing medium placement. Do not place growing medium until subgrades have been reviewed and approved.
- .3 Provide at least two days (48 hours) notice in advance of each required review.
- .4 All excavation shall be undertaken in accordance with Municipal Rules and Regulations.
- .5 On Grade Planting Area:
  - .1 Scarify compacted subgrade to a minimum depth of 200mm (8") immediately before placing growing medium.
  - .2 Verify that subgrades are at the proper elevations before placing growing medium
  - .3 Remove debris, roots, branches stones in excess of 50mm dia. and other deleterious materials as directed by Owner's Representative.
  - .4 Remove any soil contaminated with calcium chloride, toxic materials or petroleum products.
  - .5 Remove any materials that protrude 25mm (1") above the surface.
  - .6 Dispose of removed material off site.
  - .7 Review sub grade conditions to ensure that there is proper drainage in all planting areas and tree pits. Perform a percolation test as needed to confirm proper drainage.

#### **3.2 PLACING GROWING MEDIUM**

- .1 Do not place growing medium until Owner's Representative has reviewed all planters or sub grades.
- .2 Ensure that root barrier and irrigation lines to be installed have been reviewed by Owner's Representative prior to the placing of growing medium.
- .3 Growing medium shall be moist but not wet when placed (25% of field capacity). It shall not be handled in anyway if it is wet or frozen.
- .4 Except where Contract Drawings show otherwise, place to the following min. / max. depths and levels (measured after initial settling of growing medium):
  - .1 Tree Planting Areas on grade or on slab min 900mm (36") and shall conform to the following additional parameters
    - .1 Planting hole shall be minimum 300mm (12") wider than rootball on all sides.
    - .2 Planting hole shall be minimum depth of root ball.
    - .3 Each tree shall have access to minimum 10m<sup>3</sup> growing medium volume per street trees and minimum 10m<sup>3</sup> growing medium volume per on-site tree within connected volumes. Soil volume of street trees may vary per Municipal Bylaws.

- .4 The required growing medium volume may be accommodated with varying soil depths between 900mm (36") and 250mm (10") outside the area defined by the planting hole. Volume must have a direct relationship to the mature drip line with outward adjustment for columnar species.
- .2 Shrub and Groundcover Areas on grade or on slab 450mm (18") minimum depth.
- .3 Low or High Traffic Lawn Areas on grade or on slab 150mm (6") minimum depth.
- .4 Wildflower/Perennial mix on grade 300mm (12") minimum depth.
- .5 Crown or slope for positive surface drainage as shown on the drawings.

### 3.3 APPLICATION OF AMENDMENTS

- .1 Ensure minimum seven (7) days separation time between the application of any lime treatment or fertilizers and plant material installation. All granular applications to be irrigated with sufficient water to dissolve amendments into soil.
- .2 Addition of amendment components shall be at the rates indicated in the growing medium analysis recommendations via the following methods:
- .3 Fertilizers
  - .1 This material shall be applied with mechanical spreaders over the entire planting area
  - .2 Rake fertilizers into top 50mm (2") minimum of the placed growing medium.
- .4 Lime
  - .1 This material shall be applied with mechanical spreaders over the entire planting area and mixed thoroughly into the top 100mm (4") of the growing medium prior to fine grading.
  - .2 Do not apply by hand.
  - .3 Ensure lime does not come in contact with the nitrogen - phosphate - potash fertilizers during amending process.
- .5 Organic Matter
  - .1 Organic matter shall be top-dressed and cultivated into the top 150 -200mm (6"-8") of the growing medium prior to fine grading.

### 3.4 FINE GRADING

- .1 Manually fine grade growing medium installation to contours and elevations shown on Contract Drawings or as directed by Owner's Representative. Tolerance for finish grading to be 13mm (1/2").
- .2 Eliminate rough spots and low areas to ensure positive drainage.
- .3 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.
- .4 In the event of heavy foot traffic compacting the soil grade, Contractor will need to cultivate the soil prior to finish grading to allow for absorption of water and oxygen into soil media.
- .5 Limit foot traffic through soil grade to prevent plating and compaction. Use plywood to create temporary paths where soil grade is exposed to frequent traffic.

### **3.5 WEED CONTROL**

- .1 Ensure all weeds and weed roots that have germinated during the course of work of this Section have been eliminated from growing medium.
- .2 Provide Owner's Representative with a written methodology outlining of weed removal for approval seven (7) days prior to starting weed removal operations.

### **3.6 MULCHING**

- .1 Place mulch over all growing medium except grass areas. Moisten uniformly and spread to a consistent settled depth of 50mm (2") in tree and shrub planting areas, 25mm (1") in ground cover areas. Mulch to not cover root flare of any tree or shrub.

### **3.7 CLEANING**

- .1 All excess materials and other debris resulting from growing medium preparation and placement operations shall be disposed off site.
- .2 Ensure all discoloration of adjacent surfaces caused by growing medium placement have been removed. Ensure all paved areas, tops of planters, and adjacent surfaces have been thoroughly cleaned to the satisfaction of Owner's Representative.

**END OF SECTION**

## Section 32 92 23 SODDING

### Part 1 General

#### 1.1 GENERAL REQUIREMENTS

- .1 Section 32 92 23 refers to those portions of the *Works* that are unique to the supply and placement of grass sod. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Works* described herein.
- .2 Furnish all labour, materials, equipment, and services necessary for the supply and placement of grass sod to areas indicated on drawings.
- .3 The work of this section shall include, but shall not necessarily be limited to the supply, installation, and maintenance of the following:
  - .1 Finish grade growing medium.
  - .2 Sodding
  - .3 Maintenance of sodded areas until Total Performance
- .4 This section is based on the "British Columbia Landscape Standards and the B.C. Nursery Trades Association. This standard is intended to set a level of quality which is equaled or bettered in the construction documents.

#### 1.2 RELATED WORK

- .1 Section 31 22 01 - Site Grading
- .2 Section 32 91 21 - Growing Medium Preparation and Placement
- .3 Section 32 92 19 - Mechanical seeding
- .4 Section 32 93 01 - Planting of Trees, Shrubs and Groundcovers
- .5 Section 32 84 23 – Irrigation

#### 1.3 REFERENCES

- .1 Master Municipal Construction Documents (Mmcd) Volume Ii 2009 Platinum Edition
- .2 British Columbia Landscape Standards (Current Edition)
- .3 Canadian System Of Soil Classification (Current Edition)

#### 1.4 INTERPRETATION OF THE WORK

- .1 The Contractor shall be fully acquainted with the existing site and shall fully understand the difficulties and restrictions attending the execution of the work under this contract. Any 'interpretations' by the Contractor of the meaning of any section of the contract drawings and specifications herein prior to submitting a tendered price shall not remove the responsibility of completing the *Works* as per the directions of the City Representative/Consultant, including all costs associated with the *Works*, should the Contractor's 'interpretation' be incorrect. To avoid Contractor 'interpretations' prior to submitting a tendered price for the *Works*, the Contractor must seek clarification from the City Representative/Consultant for any items within the contract drawings and specifications that may appear to be unclear or conflicting.

## **1.5 QUALITY ASSURANCE**

- .1 City Representative/Consultant shall review sod sample for approval prior to installation. The sample accepted by the review will form the standard by which the project will be supplied.
- .2 Should the Contractor require the source of sod supply to change during the construction a written request must be provided to the City Representative/Consultant 48 hours in advance. The request is to be followed up by submission of proposed sod substitution sample and include the name of sod farm, base soil type, seed mix percentage for City Representative/Consultants review prior to the start of supply to the site.
- .3 Sod shall be cut by machine designed for that purpose, and by acceptable methods to an industry standard length of 457mm wide by 2.19m long (1m<sup>2</sup>), plus or minus two (2) percent in width and five (5) percent in length. Small, irregular, or broken pieces of sod delivered to the site will be rejected.
- .4 Sod to be cut to a uniform soil thickness of 16mm (0.7 inches) excluding top growth or thatch, lifted in such a manner to prevent tearing, and breaking and rolled for shipment.
- .5 Grass height at time of sod cutting shall be 40mm and 60mm (1 1/2" – 2").
- .6 All sod shall be completely free of invasive and/or noxious broadleaf weeds, grasses including but not limited to poa annua, disease, fungi, detrimental nematodes, and detrimental insects.
- .7 Broken, dry, or discoloured sod is unacceptable and will be rejected.

## **1.6 SCHEDULING**

- .1 Schedule all operations to ensure optimum environmental protection, grading, growing medium placement, planting, seeding or sodding operations as outlined in the contract specifications.
- .2 Schedule seeding to coincide with preparation of soil surface and as designated by the City Representative/Consultant.
- .3 Organize scheduling to ensure a minimum of on-site storage of seed and fertilizer material, minimum movement, and compaction of growing medium, and prompt watering operations. Coordinate work schedule with scheduling of other trades on site.
- .4 Plan, schedule and execute the work to ensure a supply of water for landscape purposes in adequate amounts and at adequate pressures for satisfactory irrigation of all seeded areas.

## **1.7 DELIVERY STORAGE AND PROTECTION**

- .1 Schedule sod deliveries such that sod installation occurs within twenty-four (24) hours of being lifted from the source sod farm.
- .2 Sod is to be neatly stacked or rolled at the source sod farm, delivered, and unloaded on sturdy pallets which are no more than 3 pallets high.
- .3 Protect sod during transport to the site to prevent excessive drying. Sod to arrive at site green in colour, fresh and healthy condition.

## **1.8 SAMPLES**

- .1 Submit one (1) square metre (1 square yard) of sod to City Representative/Consultant for review. Ensure sample is complete with name of sod farm, base soil type, seed mix percentage.

- .2 The City Representative/Consultant requires a sample which has been handled and shipped in such a manner as to be representative of product supplied and placed.

## **1.9 DRAINAGE CONTROL**

- .1 Provide for proper water management and drainage of site during work of this section. Water management shall include silt traps, erosion control measures, temporary water collection ditches, as well as their adequate maintenance to ensure that storm water which may become laden with soil, growing medium or hydraulic seed is detained and cleaned prior to discharge from site.

## **1.10 SITE EXAMINATION**

- .1 Examine site prior to the commencement of work to verify surface preparation is complete and has been accepted by the City Representative/Consultant.

## **1.11 GUARANTEE**

- .1 The Contractor hereby guarantees that the sod will remain free of weeds and defects for a period of one (1) year from the date of Substantial Performance. The contractor shall make all corrections, adjustments and replacements required because of failure of all products in this section.
- .2 The Owner reserves the right to extend the Contractor's guarantee period and responsibilities for one (1) additional year if, at end of the initial guarantee period if the development and growth of the sod is not sufficient to ensure future survival.

## **1.12 INSPECTION AND TESTING**

- .1 Refer to MMCD General Conditions, Clause 4.12, Tests and Inspections

## **1.13 MEASUREMENT AND PAYMENT**

- .1 Payment for sodding includes the necessary equipment to supply, place and maintenance of the sod to meet conditions of Total Performance.
- .2 Measurement for payment will only be made for surfaces actually sodded. Areas of blending into existing grass or sod and areas of overlaying onto existing grass or sod will not be measured for payment.
- .3 No additional payment will be made for pegging of sod over sloped areas.
- .4 Measurement and payment for this item shall be by the square meter of sod supplied, placed, and maintained, as determined by field measurements by the City Representative/Consultant. Tender unit price to include full compensation for all labour, materials and equipment required to complete the work as specified.
- .5 Payment for all *Work* performed in this section will include supply, application of grass seed and maintenance to meet conditions of Total Performance as specified in Section 32 92 23 – 3.6 and 3.7.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Sod to be approved by the City Representative/Consultant and to be nursery grown, true to type, conforming to standards of nursery Sod Growers' Association and their Nursery Sod Specifications. Sod to be quality, cultured turf grass grown from seed approved by Canada Department of Agriculture, free of disease, clovers, stones, pests, and debris.
- .2 Nursery sod:

- .1 Shall be No. 1 Premium grade and contain only species of grass indicated on the supplier's certificate.
- .2 Sod is to be 'non-netted.'
- .3 Standard grass mixture requirements for general purpose areas shall be in the following approximate proportions:
  - .4 Kentucky Bluegrass max. 50%
  - .5 Perennial Turf Type Ryegrass min. 50%
  - .6 For Chafer Beetle sensitive area:
    - .1 Boss Sod "Chafer Beetle Resistant Sod"
    - .2 Or any sod with a mixture of the following approximate proportions:
      - .1 Kentucky Bluegrass + Perennial Turf Type Ryegrass 30% - 40%
      - .2 Tall Turf-type Fescue 60% - 70%
- .7 Water:
  - .1 Potable, free of impurities that would inhibit seed germination. Contractor to ensure adequate water is available to maintain seeded areas during germination and in a vigorously growing, healthy state until Total Performance of work of this section.
- .8 Fertilizer: complete synthetic slow-release fertilizer. Type and application shall be as required by the growing medium analysis report.
- .9 Wooden Pegs: 19mm x19mm x 150mm long (3/4"x3/4" x 6") No. 1 grade or better Hem/fir.
- .10 Binder Twine: Hemp based multiple strand string.
- .11 Flagging Tape: 30mm wide (1.875"), biodegradable ribbon tape made of nonwoven cellulosic material, colour: red, or an approved equal.

### **Part 3 Execution**

#### **3.1 FINISH GRADE PREPARATION**

- .1 Do not perform work under adverse field conditions such as frozen soils, excessively wet or dry soils or soils covered with snow, ice or standing water.
- .2 Loosen existing sub grade by means of thorough scarification, discing or harrowing to minimum 150mm (6") depth over entire area to receive growing medium and seed.
- .3 Fine grade scarified sub grade. Fine grading process shall ensure area to receive growing medium and seed provides slopes (2% minimum - 33% maximum) for positive drainage, is free of humps and hollows, deleterious material, sticks and stones over 50 mm (2") in size (dimensions relates to length, width and height).
- .4 Place growing medium to a depth of 150mm (6") when compacted to 80%MPD. Compaction of growing medium to 80% MPD will not leave deep foot impressions when walked on.
- .5 Fine grade growing medium to lines and levels indicated on construction documents. Ensure that all low spots, humps, and irregularities are eliminated prior to review by City Representative/Consultant.



- .6 Finish grade growing medium smooth to extent required for class of sodding to be carried out, firm against footprints, loose textured and free of all stones, roots, branches, etc. larger than 25mm (1") or required for removal for class of sodding to be carried out.
- .7 Prior to the placement of sod City Representative/Consultant to review and direct minor adjustments and refinements of finish grades prior to the Contractor proceeding. Review includes grades, growing medium depth and condition of finished surface. Subsequent to the City Representative/Consultant review and at no cost to the Owner the Contractor shall re-grade, add growing medium and adjust as directed by City Representative/Consultant.
- .8 Remove and dispose of weeds, soils contaminated by oil, gasoline, and any other deleterious materials to an approved off-site disposal area.

### 3.2 LAYING OF SOD

- .1 Placement of sod during hot dry summer periods, at freezing temperatures, or over frozen growing medium is not acceptable. Sod placed in these conditions will be rejected.
- .2 Allow sod to dry sufficiently during wet weather to prevent tearing during lifting and handling.
- .3 Handle sod carefully to minimize tearing and dropping of soil.
- .4 Placement of Sod:
  - .1 Lay sod in rows smooth and flush to adjoining grass areas and paving and top surfaces of curbs unless shown otherwise on Contract Drawings. Ensure there is a full roll width between the new sod and any adjoining surfaces. Small cut pieces from a full roll will not be accepted.
  - .2 Stagger joints and ensure that sod sections are butted closely together without overlapping or leaving gaps between sections.
  - .3 Cut out irregular or thin sections with a sharp knife.
  - .4 Cut sod to fit tight around landscape elements.
  - .5 Cut sod to create clean, smooth lines along all plant beds.
- .5 Placement of Sod on Slopes:
  - .1 Lay sod with the length of each sod section parallel to slope taking extra care to ensure that sod sections are butt tight and each sod section is set in a staggered formation.
  - .2 On slopes exceeding 3:1 gradient ensure sod is secured with wooden pegs at intervals of not more than 450mm (18") along the center of each section. Ensure wooden pegs are driven flush with the sod.
  - .3 Prior to acceptance of sod areas that have been secured with wooden pegs either remove the wooden pegs or drive each wooden peg at least 50mm (2") below finished grade.
  - .4 Where required, place erosion control mesh or netting and secure with stakes or staples sunk firmly into ground to a minimum depth of 150 mm at maximum intervals of 4 meters along pitch of slope. Place stakes or staples horizontally across slope at intervals equal to width of mesh or netting minus 150mm and drive flush with top of sod.
- .6 Use a light roller to ensure that there is full, close contact between sod and growing medium. Use of a heavy roller to correct irregularities in grade is not permitted.

- .7 Ensure all sodded areas are watered immediately after installation. Verify that water applied to has penetrated through sod into top 100 mm (4") of growing medium. Continue watering operations as needed to ensure that adequate moisture content is maintained to encourage deep root growth and healthy, vigorous leaf growth.
- .8 Sod that has been damaged by construction operation, construction/ site personnel or construction traffic shall be replaced at no cost to the Owners. Replacement shall include removal of growing medium, regarding of sub grade, replacing growing medium and sod as required.

### **3.3 PROTECTION**

- .1 Protect all sodded areas against trespassing and from damage at all times clearly marked, staked, string and flagging tape.
- .2 Perimeter Protection: All sodded areas shall be surrounded by a 900 mm high barrier made up of the following components:
  - .1 Wood posts placed at 1.8 metres (6'-0") on centre.
  - .2 Wood Posts to be driven to a depth of 300mm (12").
  - .3 String two (2) strands of hemp-based binder twine (or equal product) between posts. Insure one full wrap of twine around each post.
  - .4 Tie 300 mm (12") strands of 'red' flagging tape at 450 mm (18") intervals along the entire length of both strands of twine.
  - .5 Maintain perimeter protection until Total Performance of seeded area by City Representative/Consultant. Upon acceptance, remove perimeter fence and dispose of off-site.
- .3 Protect newly placed sod from heavy foot traffic during installation and until acceptance by the City Representative/Consultant. Protection shall include but is not limited to placement of wood planks or plywood of sufficient thickness to bear the imposed weight and prevent damage to sod or displacement and/or compaction of sod/growing medium.

### **3.4 CLEAN UP:**

- .1 Remove from the Work Site all surplus material and other debris resulting from sodding operations.
- .2 Immediately flush all walkways and paved areas where growing medium or debris has been spilled onto surfaces and clean to the satisfaction of the City Representative/Consultant.

### **3.5 MAINTENANCE**

- .1 Maintenance of sodded areas shall begin immediately after sodded operation and shall continue until all deficiencies noted in the Substantial Performance review have been rectified to the satisfaction of the City Representative/Consultant and conditions for Total Performance been achieved. The Contractor is to notify the City Representative/Consultant in writing forty-eight hours (48) prior to stopping maintenance operations.
- .2 Sod Cutting: After the 'first' cut of sodded lawn areas cutting operations shall be carried out on a weekly (seven day) basis until Total Performance by City Representative/Consultant:
  - .1 First cut of sodded lawn areas shall occur when a uniform grass height of 75mm (3") has been attained. First cut shall be to a height of 65 mm (2.5").

- .2 Continue regular weekly cutting at a height of 65mm (2") until Total Performance.
- .3 Cutting operations shall be such that each cut is at right angles to the previous cut.
- .4 Contractor to remove grass clippings after each cut and dispose of off site.
- .5 Roll when required to remove any minor depressions or irregularities.
- .6 Immediately repair seeded areas that show deterioration or bare spots. Top-dress all areas showing shrinkage due to lack of watering and seed with seed mix that matches the original seed mix.
- .3 Fertilizer analysis shall conform to recommendations provided with growing medium analysis. Application of fertilizer shall follow manufacturers' recommendations noting that after October 1 lawn areas shall not be fertilized until April 15th of the following spring.
- .4 Sodded lawn areas are to be kept free of invasive and/or noxious broadleaf weeds, grasses including but not limited to poa annua, disease, fungi, detrimental nematodes, and detrimental insects.
- .5 All maintenance equipment and practices are to conform to the BC Landscape Standard Level 2 'Groomed'.

### **3.6 CONDITIONS FOR TOTAL PERFORMANCE**

- .1 Conditions for Total Performance of Sodded areas:
  - .1 Sodded areas exhibit fully established root systems.
  - .2 No seams are visible between sod sections.
  - .3 Sod areas are smooth and evenly graded. No depressions, foot marks or vehicle tracks.
  - .4 Sod is free of bare and dead spots and does not have any broadleaf weeds, noxious grasses including but not limited to poa annua.
  - .5 No surface growing medium is visible when grass has been cut to height of 65 mm (2 1/2").
  - .6 Sodded areas have been cut a minimum of two (2) times, at seven (7) day intervals.
  - .7 Sodded areas are a uniform green colour with no discoloured sections or patches.
  - .8 Sodded areas exhibit a thick, dense, uniform, and healthy appearance.
- .2 Lawns sodded after September 30 will be not be reviewed for Total Performance until April 30<sup>th</sup> the next year.

### **3.7 GUARANTEE/MAINTENANCE**

- .1 One (1) year guarantee period will apply as standard for hydraulic seeded work. Contractor to guarantee all materials and workmanship for a period of one full year from the date of Total Performance, unless specified otherwise in contract documents.
- .2 One (1) year guarantee period includes replacing all hydraulic seeded areas determined by City Representative/Consultant to be dead or failing at the end of the guarantee period. Replacements to be made at next appropriate season and, conditions of guarantee will apply to all replacement seeding for one full growing season.

- .3 Contractor is responsible for materials and workmanship until Total Performance. After Total performance Owner is responsible for work and maintenance.

**END OF SECTION**

## **Section 32 93 01SS**

### **PLANTING OF TREES, SHRUBS AND GROUNDCOVERS**

#### **Part 1 General**

##### **1.1 GENERAL REQUIREMENTS**

- .1 Section 32 93 01 refers to those portions of the *Works* that are unique to the sourcing, supplying, placing, and maintaining the plant material indicated on the Contract Drawings and the Plant List(s). This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Works* described herein.

##### **1.2 RELATED WORK**

- .1 Section 31 22 01 - Site Grading
- .2 Section 32 91 21 - Topsoil and Finish Grading
- .3 Section 32 92 19 - Hydraulic Seeding
- .4 Section 32 92 23 - Sodding
- .5 Section 32 84 23 - Irrigation

##### **1.3 REFERENCES**

- .1 Master Municipal Construction Documents (MMCD) Volume II 2009 Platinum edition
- .2 British Columbia Landscape Standards (current edition)
- .3 Canadian System of Soil Classification (current edition)
- .4 Canadian Nursery & Landscape Association (CNLA) Standard for Nursery Stock (current edition).
- .5 The British Columbia Landscape & Nursery Association (BCLNA).
- .6 ANSI A-300 Tree Pruning Guidelines

##### **1.4 SOURCE QUALITY CONTROL**

- .1 Seven (7) days prior to the City Representative/Consultant review of plant material at source the Contractor shall confirm in writing availability of plant material noted on Plant List.
- .2 Plant material will be supplied from nurseries who are certified by the Clean Plants program, Canadian Nursery Certification Institute (CNCI), current certification standard <http://cleanplants.ca/>. The certification shall include but is not limited to the requirements of the current active module(s), e.g., *P. Ramorum* module. *The certification must extend to all fields and allied nursery operations where plant material is sourced.* Only nurseries, *fields and allied nursery operations* that are certified will be permitted to supply plant material for this project.
  - .1 Prior to the review of plant material by the City Representative/Consultant the Contractor shall submit written documentation with CNCI certification stamp stating that the nursery has undergone all components of a certification program and has been audited to verify that all components are properly implemented.

- .2 The documentation submitted shall include but is not limited to the nurseries CNCI Clean Plants certification number.
- .3 Plant Material Review at the source nursery
  - .1 Contractor request for review of the plant material at source nursery to be a minimum of seven (7) days prior to scheduled review.
  - .2 Shipping of plant material to project site shall not proceed until City Representative/Consultant has reviewed the plant material at the source nursery.
  - .3 City Representative/Consultant shall make one (1) visit to source nursery for review of plant material for entire project.
  - .4 All plant material, including substitutions shall be gathered at one location for review.
  - .5 Contractor shall accompany City Representative/Consultant during plant material review at the source nursery.
- .4 Plant Material Review at Project Site
  - .1 All plant material shall be reviewed at the project site by the City Representative/Consultant prior to planting.
  - .2 Plant material that is rejected by the City Representative/Consultant shall be immediately removed from the site and replaced at the Contractors expense.
- .5 Imported Plant Material
  - .1 Plant material imported from out of province and out of country shall be accompanied with necessary federal and provincial permits and import licenses.
  - .2 The contractor shall conform to all federal and provincial laws and regulations with regard to horticultural inspection of domestic and imported plant material.
- .6 Condition of Plant Material
  - .1 Plant rootballs and containers shall be completely free of noxious weeds and volunteer plants including Horsetail and Morning Glory.
  - .2 Plant materials grown or supplied in Fabric Containers are not acceptable.
- .7 Quality Assurance
  - .1 All materials and execution to conform to the latest edition of the BCNTA Guide Specifications for Nursery Stock and the BCNTA Guide Specifications for Landscape Construction.

## 1.5 SUBMITTALS

- .1 Certificates
  - .1 Submit inspection certificates as required by law for each shipment of plant material.
- .2 Confirmation Plant List
  - .1 Contractor shall provide in writing to the City Representative/Consultant a minimum of seven (7) days prior to review of plant material at the source nursery a plant list confirming the quantity, botanical name, common name, and size of plants specified.

- .3 Substitutions
  - .1 Contractor shall provide in writing to the City Representative/Consultant a minimum of seven (7) days prior to review of plant material at the source nursery a list of proposed substitutions for review.
  - .2 Plant substitutions shall be of similar genus and species and of equal or greater size as those originally specified. The list shall contain the following information:
    - .1 Botanical name, common name of the specified plant
    - .2 Botanical name, common name of the proposed substitute plant
    - .3 Pot size and plant size in the nursery
- .4 Planting Schedule
  - .1 Contractor shall provide in writing to the City Representative/Consultant upon award of the Contract a detailed Planting Schedule outlining dates and duration of planting operations.
  - .2 Revisions to the Planting Schedule because of delays of any kind shall be submitted to the City Representative/Consultant in a timely manner prior to the start of planting operations.
  - .3 Schedule all planting to ensure optimum environmental protection, grading, growing medium placement, planting, seeding, or sodding operations as outlined in these Specifications. Organize scheduling to ensure a minimum duration of on-site storage of plant material, minimum movement, and compaction of growing medium, and prompt mulching and watering operations. Coordinate works schedule with schedule of other trades on-site.
  - .4 Coordinate and schedule plating such that no damage occurs to plant material before and after placement. In particular, meet requirements of living plant material.
- .5 Product Data
  - .1 Composted Mulch
    - .1 Contractor to submit a one (1) litre sample of Composted Mulch to the City Representative/Consultant for review prior to shipment to the site.
  - .2 Prepared Growing Medium
    - .1 Contractor to submit a one (1) litre sample of the Prepared Growing Medium to the City Representative/Consultant for review prior to shipment to the site.
  - .3 Anti-desiccant
    - .1 Contractor to submit three (3) copies of manufacturer product data and specification for City Representative/Consultant review.
  - .4 Fertilizer
    - .1 Contractor to submit three (3) copies of manufacturer product data and specification for City Representative/Consultant review.
  - .5 Guying assembly including clamps, collar, guying wire, anchors, and wire tighteners.

- .1 Contractor to submit three (3) copies of manufacturer product data and specification for City Representative/Consultant review.

## **1.6 SUBSTITUTIONS**

- .1 If it is impossible to obtain the particular plant material listed on the Landscape Drawing, the Landscape Contractor may be permitted to suggest substitutions with types and variations possessing the same characteristics. The Landscape Contractor must request any substitutions of trees in writing at least one (1) months and shrubs and groundcover at least one (1) month prior to planting. Substitutions must be approved by the City Representative/Consultant.

## **1.7 PLANT MATERIAL SUPPLY AND SEARCH AREA**

- .1 Before substitutions of plant material are proposed, documented proof that materials are not available through search on the west coast of Canada and United States must be provided. Area of supply shall include, but not be limited to, all of Western North America.

## **1.8 SHIPMENT AND PRE-PLANTING CARE**

- .1 Coordinate shipping of plant material and excavation of planting pits to ensure minimum time lapse between nursery digging and on-site planting.
- .2 Ensure branches of trees and shrubs are bound securely into a confined mass during handling and transport.
- .3 Do not bind planting stock with rope or wire that would damage bark, break or damage branches or damage the natural shape of the plant.
- .4 Protect plant material against abrasion, and exposure to extreme temperature change during transit.
- .5 Cover plant foliage and branches with tarpaulin to prevent loss of moisture during transit.
- .6 Fully support root ball of large trees during all lifting operations.
- .7 Do not lift trees or shrub by the trunk or branches. Plant material to be moved by lifting the root ball or container.
- .8 Remove broken and damaged roots with clean cuts using sharp pruning shears.
- .9 Temporary Storage/ Heel-In of Plant Material on Site:
  - .1 Temporarily store trees, shrubs and miscellaneous plant material that can not be planted immediately by heeling-in. Acceptable heel-in material includes approved growing medium or sawdust.
  - .2 Ensure temporary storage/heel-in area is shaded and protected from the wind.
  - .3 Provide sufficient water at regular intervals to ensure health of plant material in the temporary storage/heel-in area.
  - .4 Plant material that has not been properly maintained in the storage/heel-in area and illustrates signs of degradation or stress will be rejected by the City Representative/Consultant. Rejected plant material shall be replaced at by the Contractor at no cost to the Owner.



## **1.9 PLANT MATERIAL IDENTIFICATION**

- .1 Plant material that has been located by the City Representative/Consultant and tagged for the project is to have the identification tags removed only after inspection and instruction by the City Representative/Consultant after delivery to the site.

## **1.10 PLANT MATERIAL REPLACEMENT**

- .1 The contractor shall remove from the site and immediately replace any plant material that has been determined by the City Representative/Consultant to have died or failed to grow in a satisfactory manner during the guarantee or maintenance period.
- .2 The Contractor shall extend the guarantee on this replacement plant material for one (1) year from the date of removal.
- .3 The Contractor shall continue such replacement and guarantee of plant material until the City Representative/Consultant has determined that the 'Conditions for Final Acceptance' have been met.
- .4 All required replacements shall be plants of the same size and species as specified on the plant list and shall be supplied and planted in accordance with the drawings, specifications and change orders thereto.
- .5 The cost of replacements resulting from theft, accidental damage, vandalism, carelessness, neglect on the part of others, shall be borne by the Landscape Contractor until the certified date of Substantial Performance.

## **1.11 MAINTENANCE**

- .1 The maintenance period begins at the time each plant is planted and continues for one (1) year from the certified date of Substantial Performance. In cases where one (1) year maintenance is not required, the maintenance period shall begin at the time each plant is planted and continues for forty-five (45) days from the certified date of Substantial Performance.
- .2 Maintenance includes necessary watering, cultivation, weeding, pruning, mowing, aerating, disease and insect control, protective spraying, replacement of unacceptable material, straightening plants which lean or sag, adjustment of plants which settle or are planted too low, and any other procedures consistent with good horticultural practice necessary to insure normal, vigorous, and healthy growth of all work under this contract.
- .3 Maintain all accessories such as tree stakes, etc., in good condition including adjustment to keep tree stakes tight and repair or replace all such accessories when required.

## **1.12 GUARANTEE/WARRANTY**

- .1 The Contractor hereby guarantees/warrants that the plant material will remain free of defects in accordance the General Conditions for a period of one (1) year from the date of Substantial Performance. The contractor shall make all corrections, adjustments and replacements required because of failure of all plant material in this section.
- .2 The Owner reserves the right to extend Contractor's guarantees/warrants period and responsibilities for one (1) additional year if, at end of the initial guarantee/warranty period the leaf development and growth of the plant material is not sufficient to ensure future survival.

- .3 The Consultant reserves the right to reject plant materials at any time during installation, for which the Landscape Contractor shall be responsible for replacing to the satisfaction of the Consultant.
- .4 End of warranty inspection will be conducted by City Representative/Consultant.

#### **1.13 INTERPRETATION OF THE WORK**

- .1 The Landscape Contractor shall be fully acquainted with the existing site and shall fully understand the difficulties and restrictions attending the execution of the work under this contract. Interpretations by the Landscape Contractor of the meaning of any section of the contract drawings and specifications herein prior to submitting a tendered price shall not remove the responsibility of completing the Work as per the directions of the City Representative/Consultant, including all costs associated with that Work, should the Landscape Contractor's interpretation be incorrect. Prior to submitting a tendered price for the Work, the Landscape Contractor must seek clarification from the City Representative/Consultant for any items within the contract drawings and specifications that may appear to be unclear or conflicting.

#### **1.14 MEASUREMENT AND PAYMENT**

- .1 Payment for trees shrubs and groundcovers will include all preparatory work, supply, planting guying and mulching of the trees, shrubs and groundcovers as applicable and other incidental work specified herein including maintenance to meet Conditions of Total Performance.
- .2 The Contractor shall furnish all services, labour, materials, equipment, plant, and operations to supply and install all items based upon respective unit prices in the *Schedule of Quantities and Prices*.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Water
  - .1 Potable and free of minerals that are detrimental to plant growth.
- .2 Composted Mulch
  - .1 mm (3/8") Composted Mulch, black/brown in colour with no cedar or redwood bark or wood material manufactured by Yard Works, Richmond, BC, Eco-Soil, Langley BC Fraser Richmond Bio-Cycle, Richmond, B.C. or pre-approved equal.
- .3 Anti-desiccant
  - .1 Wax-like emulsion that will provide a transpiration reducing film over the plant surface. Moisturin by GSI Horticultural, Bend, Oregon, (541) 383-0222 or approved equal.
- .4 Tree Trunk Protection
  - .1 Extrusion mold process, polyethylene with UV protectors: "Arborgard" manufactured by DeepRoot products Canada, Inc., Vancouver, B.C., or pre-approved equal.
- .5 Burlap

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- .1 Shall be untreated, free from toxic contaminants and of sufficient strength to hold the root ball in a compact, stable mass that does not move relative to the main stem(s) of the tree or shrub.
- .6 Wire Baskets
  - .1 Non-galvanized metal basket designed and manufactured for the purpose of tree moving. Basket shall be shaped to ensure that the root ball will allow a stable planting condition in accordance with standards noted.
- .7 Tree Ties
  - .1 Flat woven polypropylene material. Submit sample for approval to protect bark or other types approved by the Owner Representative. Generally, they shall be of a material that will not damage the bark. Tree tie material shall be at least 50mm (2") in width and shall remain pliable in all weather conditions. They shall permit a reasonable degree of movement by the tree under normal loading conditions/forces such as wind without detrimental effects. Rubber tree buckles, or galvanized wire with rubber hose will not be accepted.
  - .2 Arbor Tie by Deep Root, Vancouver, BC; Fabritech Manufacturing Ltd, Langley, BC; Northwest Landscape Stone & Supply, Burnaby, BC; or pre-approved equal
- .8 Tree Guy Anchors/ Tree Guy System
  - .1 Direct burial or screw type disc guy anchor and guy system. The Arrow Anchor by Tree-Guy/ Tree Guy System, Santa Anna, California (800) 624-1116, or approved equal.
- .9 Stakes and Stake Fasteners
  - .1 ACQ pressure treated Hem/Fir, 75 mm dia. (3") round, 2500 mm (8'-0") long. Stake fasteners shall be hot dipped galvanized or stainless steel.
- .10 Flagging Tape
  - .1 mm (13/16") wide 'Red' PVC flagging tape by Identi-Tape, Boulder, CO or approved equal.
- .11 Planting Fertilizer Tablets
  - .1 Prolonged-release fertilizer tablets containing a minimum of 20% nitrogen, 10% phosphoric acid, and 5% potash (20-10-5). Evergro Tabs as supplied by Agrico or pre-approved equivalent. Store in weatherproof storage space.

## 2.2 PLANT MATERIAL

- .1 Plant Material Size
  - .1 Overall plant spread to be measured when branches are in their natural position.
  - .2 Height and spread dimensions refer to main body of plant and not from branch tip to branch tip.
- .2 Grade
  - .1 Plant material to be No. 1 grade or better.
- .3 Plant material obtained from areas with milder climatic conditions from those of site is acceptable provided:

- .1 Plant material is moved to the site prior to the breaking of buds at their original climatic zone.
- .2 Plant material is heeled-in at a protected area until the climatic conditions are suitable for planting.
- .4 Plant material shall have structurally sound, strong fibrous root system free of disease, insects, defects, or injuries. All plants, typical of their species or variety, have a normal habit of growth and shall be first quality, sound, healthy, vigorous, well branched, and densely foliated, free of disease, insect pests, eggs, or larvae.
- .5 Root Pruning at Source Nursery
  - .1 Plant material shall have been root pruned on a regular basis at the source nursery.
  - .2 Plant material shall be root pruned at least one growing season prior to digging and shipment to the project site.
  - .3 Large trees shall be half root pruned during each of two successive growing seasons. The second root pruning shall have carried out a minimum of one growing season prior to shipment to the site.
- .6 Shade, Ornamental and Evergreen Trees:
  - .1 Trees shall have straight trunks and a well-formed branch system which is characteristic of the species.
  - .2 Trees shall exhibit clear signs of vigorous growth.
  - .3 Trees shall have good twig extension growth, branch spacing and trunk taper.
  - .4 Tree foliage shall be evenly distributed on upper 2/3 of the tree.
  - .5 Trees shall not have upright branches other than leaders.
  - .6 Trees will have spreading branches with a single trunk and a single leader and, unless otherwise noted on plans or plant list.
  - .7 Tree trunks and branches shall not have any mechanical damage.
  - .8 Trees shall be in good health with no presence of insects or disease.
  - .9 Trees shall not have been 'headed back'.
  - .10 Tree root balls shall be solid, always kept moist and/or protected from drying.
  - .11 Trees shall not exhibit symptoms of root circling or girdling.
- .7 Container Grown Plant Material:
  - .1 Root ball to container relationship shall be of sufficient ratio to ensure room for healthy, vigorous root development.
  - .2 Plant material shall have been container grown for a minimum of one (1) growing season but not longer than two (2) growing seasons.
  - .3 The plant root systems that do not have the ability to "hold" growing medium when removed from the container will be rejected.
  - .4 Root bound plant material will be rejected.
- .8 Balled and Burlapped Plant Material:

- .1 Coniferous and broadleafed evergreens over 2.4 metre (7'-8") tall shall be dug with firm soil root ball.
- .2 Deciduous trees more than 3.0 metre (10'-0") height shall be dug with firm soil root ball.
- .3 Root ball diameter shall be a minimum of 230 mm (9") for each 25 mm (1") caliper size.
- .4 Secure root-balls with burlap, heavy twine, and rope.
- .5 Large tree root balls shall be double layer burlap wrapped. Burlap to be secured with drum laces made up of 10 mm (3/8") (minimum) diameter rope.
- .9 Tree Spade Dug Plant Material
  - .1 Plant material shall be dug with mechanized hydraulic spade or clamshell type digging equipment.
  - .2 Root ball diameter shall be a minimum of 230 mm (9") for each 25 mm (1") caliper size.
  - .3 Wire basket shall be lined with burlap. Root ball shall be laced and tied to wire basket with heavy rope.
  - .4 Ensure trunk of tree is not damaged by wire basket, ties, or rope.

### **Part 3 Execution**

#### **3.1 PRE-PLANTING OPERATIONS**

- .1 Place stakes on site to identify location trees, shrubs, and plant beds in accordance with the Landscape Plans.
- .2 City Representative/Consultant to review all tree locations and plant bed layout prior to start of plant bed preparation and planting operation.
- .3 Anti-desiccant shall be applied only as directed by the City Representative/Consultant. Application of anti-desiccant shall be in accordance with manufacturer's instructions.
- .4 Coordinate planting operations with other trades and project schedule.

#### **3.2 PLANTING SEASON**

- .1 Plant only during the season or seasons that are normal for such work, as determined by weather conditions and as approved by Owner's Representative. Plants planted before or after any stipulated dates will be rejected.
- .2 Do not plant during freezing, abnormally hot, dry or wet weather or when damaging climatic conditions can be anticipated.
- .3 The Contractor will be responsible for death or deterioration of plants caused by exposure to damaging climatic conditions, planting under conditions itemized above or inadequate acclimatization of plant material.

#### **3.3 PLANTING SCHEDULE**

- .1 All planting operations shall be done in a timely manner in accordance with the 'Planting Schedule'.

- .2 'Planting Schedule' shall be updated as required by the Contractor to coincide with status of site and coordination with other trades. Provide the City Representative/Consultant with updates to the schedule as required throughout the planting process.

### 3.4 EXCAVATION

- .1 Existing Utilities
  - .1 The contractor is responsible for confirming the location and extent of existing utilities prior to the start of all planting operations. All attempts should be made to ensure that utility services are maintained to all on and off-site parties throughout the entire planting operation.
- .2 Tree Pits
  - .1 Tree Pit Depth 900mm (3'-0") minimum.
  - .2 Width of tree pit shall be a minimum of 450 mm to 600 mm (1'-6" to 2'-0") greater than diameter of the root ball.
  - .3 Prior to the placement of growing medium scarify the sides and bottom of tree pits created with a tree spade to eliminate glazed surface.
- .3 Ensure tree pits dug in heavy or compacted soils exhibit the ability to drain freely by filling each tree pit with a minimum of 20 litres (5 gallon) of water. Water should freely drain through subsoil within ten (10) minutes.
  - .1 Notify City Representative/Consultant if tree pits in any soil condition do not drain freely or if tree pit fills with ground water.
  - .2 There shall be no standing water in the bottom of tree pit at time of planting.
- .4 Protect bottom of tree pit(s) against freezing.
- .5 Ensure tree pits and plant beds are kept well drained and free of contaminants and construction debris.
- .6 Planting Areas:
  - .1 Excavate planting areas to accommodate the following depths.

### 3.5 PLANTING

- .1 Planting operations shall be carried out under conditions that are conducive to healthy, vigorous growth of plant material.
- .2 Plant material shall be planted vertical, straight and plumb at locations staked in field and or noted on landscape plans.
- .3 Ensure orientation of plant material will give best appearance in relation to views from adjacent roads, walks or use areas.
- .4 Ensure planting depth of root ball is equal to the depth of root ball originally established in the nursery. The top of root ball shall be level with adjacent growing medium.
- .5 Ball and Burlap Plant Material: After plant has been lowered into plant bed or tree pit cut away all root ball ties from around trunk. Loosen burlap from around trunk and cut away minimum top 1/3 without disturbing root ball.

- .6 Container Grown Plant Material: Remove entire container (including biodegradable containers) without disturbing root ball. Score root ball vertically at six (6) locations evenly spaced around entire root ball to minimize girdling of roots.
- .7 Tree Spade Dug Root Balls: Cut wire basket around entire perimeter of root ball. Bend down top 2/3 of wire basket without disturbing root ball. Cut away all root ball ties from around trunk. Loosen burlap from around trunk and cut away minimum top 1/3 without disturbing root ball.
- .8 Backfill planting areas in 150 mm (6") lifts to 2/3 of the depth tamping each lift of growing medium around root system to eliminate air voids. Do not use frozen or saturated growing medium for backfill operation.
- .9 .9 Prior to placing remaining growing medium, thoroughly water planting areas, fill tree pits with water. Complete backfill operation only after water has completely penetrated into growing medium.
- .10 Build 100 mm high by 150 mm wide (4" high by 6" wide) saucer around outer edge of tree pit to assist with maintenance watering.
- .11 Tree Stabilization
  - .1 Guy or stake trees as directed by City Representative/Consultant.
  - .2 Ensure guy pins and stakes are not placed through the root ball.
  - .3 Trees that have had root balls penetrated by guy pins and stakes will be rejected.
  - .4 Tie one (1) to two (2) flagging tape flags to all guy wires at a height that is clearly visible.
- .12 Place Tree Trunk Protection around base of tree trunk as per manufacturer instructions.
  - .1 Trees 100 mm (4") caliper or less shall have one protector. Do not interlock ends of tree protector.
  - .2 Trees greater than 100 mm (4") caliper shall have a minimum of two interlocked protectors. Do not interlock outside ends.

### 3.6 PRUNING

- .1 All pruning cuts shall be made with pruning saws or hook and blade pruning tools designed and manufactured for pruning operations. Anvil-type pruning tools shall not be used in any pruning operations.
- .2 Prune trees and shrubs after planting operation as directed by City Representative/Consultant.
- .3 Prune each tree and shrub planted to preserve the natural character of the plant and in a manner appropriate to its requirement in the landscape design. Pruning in general shall be heavier on collected than on nursery-grown plants. Remove all soft wood sucker growth and all broken or badly bruised branches with a clean cut.
- .4 Employ clean sharp tools and make cuts without damaging the branch collar.
- .5 Do not damage the leader or lead branches. Plants which have had the main leader or lead branches damaged or removed will be rejected and replaced by the Contractor at no cost to the Owner.
- .6 Do not remove minor twig branches along the main structural branches.

### **3.7 FERTILIZER APPLICATION**

- .1 Fertilize as per recommendations based on soil testing and place planting tablets at the following rates in prepared planting holes. Spread the tablets in each hole before planting.
- .2 Other sizes as per fertilizer manufacturer's recommendations.

### **3.8 GUYING AND STAKING**

- .1 Guy and stake all trees immediately after planting. Plant material not guyed or staked immediately shall be replaced if damaged.
- .2 Drive one (1) stake per tree vertically into the ground to a depth of 750-1000mm (30"-42"), in such a manner so as not to injure the root or root ball.
- .3 Fasten tree to the crotch and midway between the crotch and the ground with galvanized wire protected by hose.
- .4 Trees to stand plumb upon completion of this operation.

### **3.9 APPLICATION OF COMPOSTED MULCH**

- .1 Prior to the application of composted mulch;
  - .1 Manually remove all weeds and weed roots from root balls and adjacent growing medium.
  - .2 Remove all deleterious material and debris from planting areas.
  - .3 All fine grading is complete, the growing medium is loose and friable
  - .4 The City Representative/Consultant has reviewed of all planting areas.
- .2 Spread composted mulch to minimum depth of 50 mm (2").
  - .1 Ensure finish composted mulch layer is a minimum of 12mm (1/2") below adjacent hard landscape surfaces and edges.
  - .2 Ensure mulch is kept 125 mm (5") away from tree trunks and 75 mm (3") away from stems of shrubs.

### **3.10 MAINTENANCE**

- .1 Maintenance of plants shall begin immediately after planting operation and shall continue in an uninterrupted fashion until all deficiencies noted in the Substantial Performance review have been rectified and the City Representative/Consultant has provided to the Contractor in writing confirmation of the date of Installation Total Performance.
- .2 If for any reason The Contractor elects, on his own without the written consent of the City Representative/Consultant to suspend maintenance operations he is to provide the City Representative/Consultant written notice of such action. Any damages or requirement for the replacement of plant material that because of the suspension of maintenance operations shall be the borne by the Contractor at no cost to the Owner.
- .3 Maintenance of plant material includes but is not limited to watering at intervals sufficient to maintain healthy, vigorous growth, weeding of plant beds and tree pits, cultivating of growing medium, pruning, treatment of insects, molds, fungi, or disease to the Level 2 "Groomed" as per the BCNLA Landscape Standard, Current Edition or as directed by consultant.



- .4 Plant material shall be deep watered at least once per day when temperatures exceed 25 degrees Celsius (77 degrees F).
- .5 Water sufficiently to maintain soil moisture conditions for optimum establishment, growth, and health of plant material without causing erosion.
- .6 Supply equipment such as pumps, portable sprinklers systems, tank trucks, hose and sprinklers required for watering operations. Water trucks, if used for watering operations, must service the site from adjacent roads until irrigation system is operational.
- .7 Contractor to ensure adequate moisture in plant root zone prior to winter freeze-up.
- .8 Reset all plants that have settled to plant depths approved by the City Representative/Consultant prior to the placement of composted mulch.
- .9 Ensure tree guards, stakes, flagging tape on tree guy wire and tree ties are kept secure, taught and in proper repair.

### 3.11 INSTALLATION TOTAL PERFORMANCE

- .1 Conditions for Installation Total Performance:
  - .1 Substantial Performance shall have been granted by the City Representative/Consultant and, Final Acceptance at the end of the guarantee/warranty period.
  - .2 All plant material is healthy; exhibiting signs of vigorous growth and meets the requirements of this specification.
  - .3 Plant material installed less than ninety (90) days prior to frost will be accepted in following spring, thirty (30) days after start of growing season provided that final acceptance conditions are fulfilled.
  - .4 Unless otherwise indicated in the contract drawings the original shape and form of the plant as reviewed by the Consultant has been maintained, leaders are intact, there are no wounds or abrasions on trunks or branches.
  - .5 Mulch has been maintained to specified depths.
  - .6 All planting areas continue to be free draining with no signs of standing water.
  - .7 All plant beds are completely free of weeds and noxious grasses.
- .2 The Contractor shall continue to maintain the work of this section until the City Representative/Consultant provides written confirmation that Installation Total Performance conditions have been met.

### 3.12 CLEAN-UP

- .1 Ensure growing medium spilled onto pavement and growing medium stains on pavement or adjacent hard surfaces is cleaned up immediately.
- .2 Remove from the site all pots, cans, surplus materials, and other debris resulting from planting operations.
- .3 Ensure complete removal of planting tags, labels, strings, or other materials prior to substantial completion.
- .4 Neatly dress and finish all planting areas and flush all walks and paved areas clean to the satisfaction of the Consultant and Owner.

**END OF SECTION**

## **Section 50 APPENDIX A**

### **Part 1 General**

#### **1.1 SECTION INCLUDES**

- .1 SOA Close-Out Procedures - 5 Pages
- .2 Asphalt Pavement Recommendations - Dated 2023.09.01 Thurber Engineering (2 pages)
- .3 Geotechnical Recommendations - Rev 4 Dated 2025.03.24 Thurber Engineering Ltd. (158 pages).
- .4 Geotechnical Recommendation - Rev 3 Dated 2025.01.17 Thurber Engineering Ltd. (67 pages)
- .5 Topographic Site Survey - Dated 2025.01 Target Land Surveying (1 page)

**END OF SECTION**

## Close-out Procedures

Address: \_\_\_\_\_  
Date: \_\_\_\_\_  
Project #: \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Reviewer: \_\_\_\_\_

circulated to:

Organization      Name

[email](#)

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### PROJECT CLOSEOUT

#### Documents

- ☐ Schedule C-A (architectural)
- ☐ Schedule C-B's:
  - Architectural
  - Structural
  - Mechanical
  - Plumbing
  - Civil
  - Electrical
  - Fire suppression
  - Geotechnical (temporary)
  - Geotechnical (permanent)
- ☐ Schedule C-L (landscape)
- ☐ Schedule S-C's, if required (these are submitted to the architect of record not the AHJ):
  - Guardrails
  - Handrails
  - Brick veneer
  - Glazed aluminum curtain wall
  - Mechanical seismic
  - Plumbing seismic
  - Electrical seismic
  - T-bar seismic
  - Commercial kitchen hood
  - Structural: steel stud/bulkhead framing
  - Structural steel
  - Note: submitted to the architect of record, not the AHJ
- ☐ Schedule C-D (building envelope)
  - Note: submitted to the architect of record, not the AHJ
- ☐ Letter of Compliance for Alternate Solution(s) by the building code consultant
- ☐ Fire Alarm Monitoring Certificate
- ☐ Fire Alarm Verification
- ☐ Health authority approval documents, if applicable



- ☐ Fire sprinklers:
  - Contractor's material test certificate for above ground piping
- ☐ Fire department connection
  - Contractor's material and test certificate for above ground piping and/or underground pipe
- ☐ Fire main from the property line into the building
  - Contractor's material and test certificate for underground piping
- ☐ Backflow test reports
- ☐ Sanitary test reports for civil files
- ☐ Water main chlorination and bug tests for civil files
- ☐ Well water potability test report, if applicable
- ☐ Septic certification from the health authority, if applicable
- ☐ Legal site survey
- ☐ Civic unit numbers and strata lot numbers form, if applicable
- ☐ ASRAE compliance letter from energy modeling consultant
- ☐ E-Comm commissioning report, if applicable (fire fighting radio enhancement)
- ☐ Elevating devices certificate of inspection
- ☐ Parkade CO detectors calibration certificate
- ☐ HVAC balancing report (life safety fans)
- ☐ Emergency generator verification report, if applicable

#### **Inspections and Declarations**

1. Declaration of Substantial Performance: when the Consultant considers deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, after Submittals of Maintenance and Record Drawings, make an application for Substantial Performance of the Work.
2. Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
3. Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.
4. Final Payment: When the Consultant considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been completed, make an application for final payment. Multiple releases of deficiency holdback will not be entertained.
5. Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

#### **Closeout Submittals**



1. Prepare instructions and data using personnel experienced in the maintenance and operation of described products.
2. Copy will be returned after final inspection, with Consultant's comments.
3. Revise the content of documents as required prior to final submittal.
4. Two weeks prior to the Substantial Performance of the Work, submit to the Consultant, one copy of operating and maintenance manuals, one copy of laboratory drawings, shop drawings in Canadian English for review by the Consultant, and one electronic copy.
5. Ensure spare parts, maintenance materials and special tools provided are new, undamaged, or defective, and of the same quality and manufacture as products provided in Work.
6. If requested, furnish evidence as to the type, source and quality of products provided.
7. Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
8. Pay costs of transportation.

**Operation and Maintenance Manual Format**

1. Organize data in the form of an instructional manual.
2. Binders: vinyl, black, hard covered with titles, post bound, loose leaf 8.5"x11" with spine and face pockets.
3. When multiple binders are used, correlate data into related consistent groupings. 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 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. Bind in with text; fold larger drawings to size of text pages.
9. Contents for each volume:
  - a. Table of Contents
  - b. Title of project
  - c. Date of submission
  - d. Names, addresses, and telephone numbers of the Consultant, Contractor, and of every party providing products with a contact name and information for each.
  - e. Schedule of products and systems, indexed to the content of the volume.
  - f. For each product or system, list names, addresses, and telephone numbers of subcontractors and suppliers, including local sources of supplies and replacement parts.
  - g. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide a logical sequence of instructions for each procedure, incorporating the manufacturer's instructions.
  - h. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
  - i. Training: Coordinate training sessions with the owner and operating staff.
  - j. Copy of every Reviewed Shop Drawing issued.

**Record Drawings and Samples**

1. In addition to requirements in General Conditions, maintain at the site for Consultant and Owner one record copy of:
  - a. Contract drawings



- b. Specifications.
  - c. Addenda.
  - d. Change Orders and other modifications to the Contract.
  - e. Reviewed shop drawings, product data, and samples.
  - f. Field test records.
  - g. Inspection certificates.
  - h. Manufacturer's certificates.
2. Annotate with coloured felt tip marking pens on the drawings, maintaining separate colours for each major system, for recording changed information.
3. Record information concurrently with construction progress. Do not conceal the work of the Project until the required information is accurately recorded.
4. Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
  - a. Measured depths of elements of the foundation in relation to the finished first floor datum.
  - b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - c. Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - d. Field changes of dimension and detail.
  - e. Changes made by change orders.
  - f. Details not on original Contract Drawings.
  - g. References to related shop drawings and modifications.
5. Project Manual: legibly mark each item to record actual construction, including:
  - a. Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - b. Changes made by Addenda and change orders.
  - c. Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
6. Store record documents and samples in the field office apart from documents used for construction. Provide files, racks, and secure storage.
7. Label record documents and file in accordance with section number listings in the List of Contents of the Project Manual. Label each document "RECORD DOCUMENTS" in neat, large, printed letters.
8. Maintain record documents in clean, dry, and legible condition. Do not use record documents for construction purposes.
9. Keep record documents and samples available for inspection by the Consultant.

#### **Final Survey**

1. Submit a final site survey certificate in accordance with Section 01 70 00, certifying that elevations and locations of completed Work are in conformance or non-conformance with Contract Documents. Inaccurate or neglectful information shall become a liability of the Contractor.

#### **Warranties and Bonds**

1. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. List the subcontractor, supplier, and manufacturer, with the name, address, and telephone number of the responsible principal.
2. Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work. Except for



items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

3. Verify that documents are in proper form, contain full information, and are notarized. Co-execute submittals when required.
4. Retain warranties and bonds until time specified for submittals.



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To:	School District #43	Date:	September 1, 2023
Attn:	Meighan Scott, Architect AIBC	File:	35998
From	Kurt Baia, M.Eng., P.Eng.		
Reviewer:	Steven Coulter, M.Sc., P.Eng.		

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**BURKE MOUNTAIN SECONDARY SCHOOL  
ASPHALT PAVEMENT RECOMMENDATION**

Dear Meighan,

The City of Coquitlam requires a statement of acknowledgement that the recommended asphalt pavement can support fire truck access. It is a condition of this memorandum that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

We recommend the pavement design for onsite roads and parking areas comprise the following:

- Minimum 35 mm thick asphalt surface course
- Minimum 40 mm thick asphalt base course
- Minimum 200 mm thick 19 mm minus Crushed Granular Base, as defined by MMCD, compacted to at least 95% modified Proctor maximum dry density (MPMDD)
- Minimum 300 mm thick 75 mm minus Select Granular Subbase, as defined by MMCD, compacted to at least 95% MPMDD
- Competent subgrade consisting of either the very dense glacial till-like soil or adequately placed and compacted backfill soils (imported structural fill or glacial till-like fill). The subgrade should be reviewed by Thurber before placement of Select Granular Subbase.

The recommended pavement design is considered sufficient to support the infrequent loading of a fire truck weighing 85,200 lbs. If any further clarification is required, please contact us at your convenience.

Thurber Engineering Ltd. Permit to Practice #1001319
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## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



March 24, 2025

File No.: 35998 (BM-AP)

City of Coquitlam – Parks, Recreation, Culture &  
Facilities – Capital Construction  
3000 Guildford Way  
Coquitlam, BC  
V3B 7N2

Attention: Rajinder Singh | Park Planning Project Manager

**BURKE MOUNTAIN PROJECT, COQUITLAM, B.C.  
BURKE ATHLETIC PARK (BM-AP) CONTRACT  
GEOTECHNICAL RECOMMENDATIONS – Rev. 4**

Dear Rajinder,

Thurber has prepared this letter to summary our geotechnical input as required by the design team for the Burke Athletic Park project. This memo contains our recommendations for seismic design, input for wall design and pavement structure. This memo has been revised to incorporate changes to the project made since the memo was first issued on December 6, 2024.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

**1. SEISMIC HAZARD VALUES FOR USE WITH BCBC 2024**

Cast-in-place concrete retaining walls are to be constructed on the east and west sides of the proposed tennis courts. We understand that the structural design of these walls will be in accordance with the 2024 BCBC which, until May 2025, still uses the seismic model from the 2018 BCBC/2015 NBCC.

Based on the results of Thurber's geotechnical investigation completed on March 13, 2023, the site is underlain by very dense, glacial till-like soils with an average shear wave velocity in the top 30 m ( $V_{s30}$ ) of 550 m/s. In accordance with Table 4.1.8.4.-A of the 2015 NBCC, the project site is considered Site Class C.

The 2018 BCBC seismic hazard for the project site is provided in Table 1-1. These spectral accelerations were obtained from the City of Coquitlam Environmental Loads for use with the BCBC 2018 (Permits Bulletin No. 14-003) dated June 2019.

**Table 1-1:  $S_a(T)$ , PGA, and PGV for Site Class C for 5% Damping (2,475-Year Return Period)**

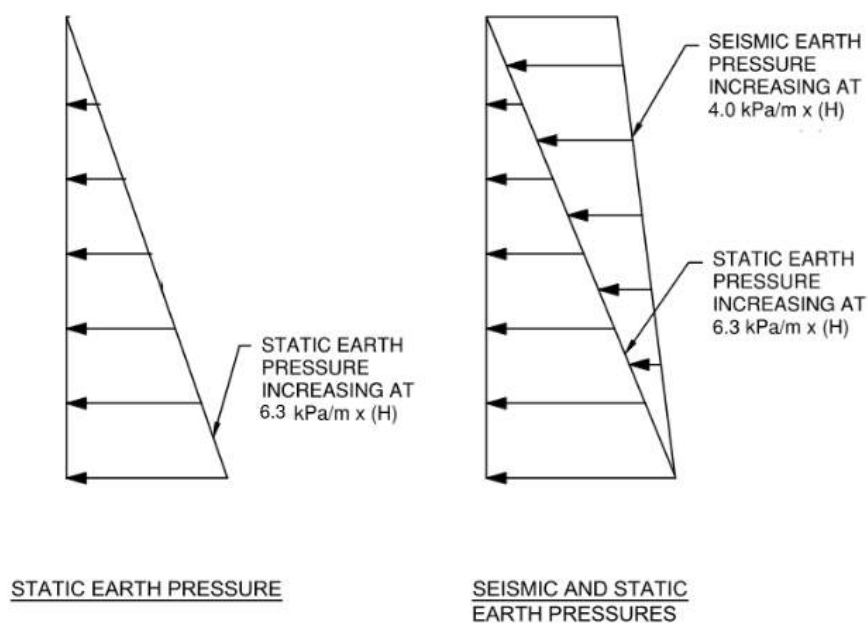
<b><math>S_a</math> (0.2)</b>	<b><math>S_a</math> (0.5)</b>	<b><math>S_a</math> (1.0)</b>	<b><math>S_a</math> (2.0)</b>	<b><math>S_a</math> (5.0)</b>	<b><math>S_a</math> (10.0)</b>	<b>PGA</b>	<b>PGV</b>
<b>(g)</b>							<b>(m/s)</b>
<b>0.784</b>	<b>0.691</b>	<b>0.393</b>	<b>0.24</b>	<b>0.077</b>	<b>0.027</b>	<b>0.399</b>	<b>0.511</b>

## 2. WALL DESIGN INPUT

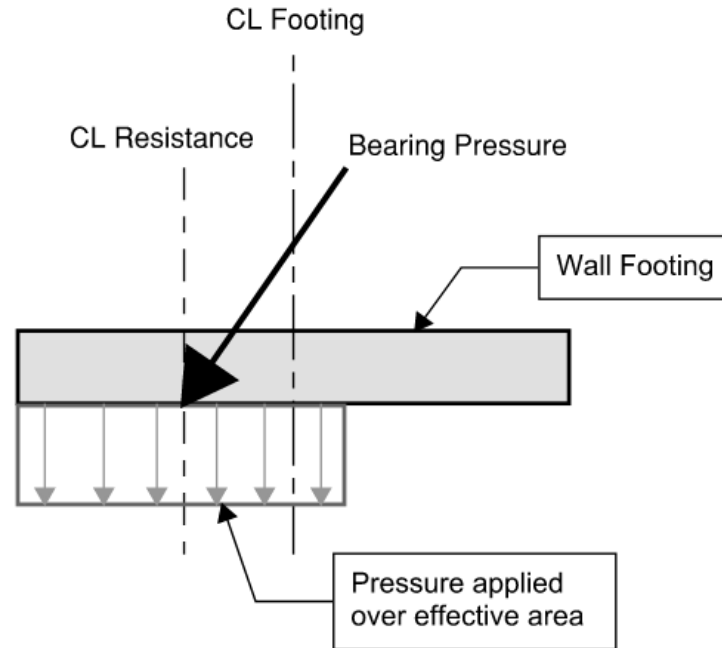
The cast-in-place retaining walls on the east and west sides of the tennis courts are expected to be founded on engineered fill or dense till-like soils. The zone behind the wall will be backfilled with well-graded granular fill and drainage will include either a perforated drainpipe near the base of the wall or regularly spaced weep holes through the face of the wall.

The design of the cast-in-place walls is being completed by others. For assessment of the external stability of the wall and the structural design, the following geotechnical inputs are recommended for Allowable Stress Design (ASD) or Working Stress Design (WSD):

- Ultimate (Unfactored) Bearing Resistance: 500 kPa
- Coefficient of Friction (Unfactored) (Within 6.5 m of the SP3 Retaining Wall): 0.5
- Coefficient of Friction (Unfactored) (All Other Locations): 0.4
- Lateral earth pressure distribution as shown in Figure 1.
- The bearing pressure of the wall should be applied as an equivalent uniform pressure (i.e., not trapezoidal) applied over the effective area as shown in Figure 2.



**Figure 1: Lateral earth pressure distribution where  $H$  is equal to the height of the wall.**



**Figure 2: Bearing pressure distribution adapted from the Canadian Highway Bridge Design Code (CSA S6:19)**

### 3. PAVEMENT DESIGN

For all drivable asphalt areas, we recommend use of the pavement section as follows:

- Minimum 35 mm thick asphalt surface course
- Minimum 40 mm thick asphalt base course
- Minimum 200 mm thick 19 mm minus Crushed Granular Base, as defined by MMCD, compacted to at least 95% modified Proctor maximum dry density (MPMDD)
- Minimum 300 mm thick 75 mm minus Select Granular Subbase, as defined by MMCD, compacted to at least 95% MPMDD. If 75 mm minus fill is already present on the surface of the site, the thickness of that fill can be counted towards this layer where present within the elevation range of the proposed subbase layer. However, test pits approximately 300 mm deep should be undertaken to demonstrate the thickness of the existing 75 mm before it is relied upon by the contractor.
- Competent subgrade consisting of either the very dense glacial till-like soil or adequately placed and compacted backfill soils (imported structural fill or glacial till-like fill). The subgrade should be reviewed by Thurber before placement of Select Granular Subbase.

These recommendations should be applied to the pavement sections in both vehicle traffic areas and non-traffic areas. Note that where the tennis or track designer requires thicker asphalt or base and subbase layers, those thicker layers should take precedent over the pavement section recommended in this memo.

#### **4. LIGHT POLE FOUNDATIONS**

We understand that the light pole foundations have been designed by Musco Lighting. On their design drawings, they listed their design assumes “IBC class 5 soils.” We confirm the soils on site are class 5 or better.

#### **5. EXPECTED SOIL CONDITIONS**

The expected soil conditions for the general site area are provided in the attached geotechnical report from the adjacent Burke Mountain Secondary School project. At the time of our geotechnical investigation, the majority of the site soils consisted of very-dense till-like soils potentially containing boulders. These boulders resulted in difficulty with the installation of some of the existing secant piles. Since the initial geotechnical investigation, some portions of the site have been cut, and others have been filled with 75 mm minus or reused till-fill.

#### **6. REUSE OF NATIVE TILL-LIKE SOILS**

The existing till-like soils on site are moisture sensitive and are difficult to work with in wet weather conditions. We do not recommend that this material be reused as part of this project. If construction occurs during long periods of dry weather, reuse of this material at select locations can be discussed between the contractor, the owner and Thurber. However, reuse of this material should not be relied upon.

#### **7. SECANT PILE WALL CONSIDERATIONS**

##### **7.1 Permanent Drainage and Shotcrete**

Additional drainage is needed for portions of walls without anchors, and where no weep holes are present within 1.5 m of existing grade. At these locations an additional 75 mm diameter weep hole is to be drilled at a height of 0.5 m above existing grade.

To establish permanent drainage, a minimum 1 m wide drainage mat should be placed over the drain holes in the secant walls. The drainage mat should extend from the top drainage hole to a minimum depth of 150 mm below final grade and extend laterally out from the wall by 600 mm. They should be hydraulically connected by permeable fill or PVC pipe to the drainage shown on the civil drainage plan. The below grade portion of the drainage mat should be fully covered with

backfill prior to construction of the structural shotcrete wall detailed on the attached structural shotcrete wall detail.

The attached drawings illustrate the drainage details. They also detail the structural shotcrete wall to be constructed.

## **7.2 Existing Till-Like Slope at West End of SP5**

Site grading at the west end of SP5 incorporates an existing slope comprising native till-like soils. This slope is currently covered with 150 mm or more of 75 mm minus gravel and poly sheeting and could potentially be mistaken for a material stockpile placed up against the secant pile wall. However, the secant piles which extend into this existing slope rely on the dense till-like soil slope for lateral resistance. Disturbance to this material may result in movement or failure of the existing secant pile walls. This material must not be excavated nor disturbed except as discussed in Section 7.3.

## **7.3 Staircase Adjacent Tennis Courts**

The project incorporates a retaining wall and staircase located at the northeast corner of the tennis courts, near the intersection of the SP3 and SP5 retaining walls. The secant piles of SP3 are designed with embedment based on the tennis court elevation. However, as discussed in Section 7.2, the secant piles in the adjacent SP5 wall are founded at a higher elevation and rely on the existing till-like slope for support.

Based on discussions with the structural engineer and review of available drawings, we understand that the excavation for the staircase will be located in front of the SP3 wall. The east edge of the wall's foundation will be located at approximately 1.6 m away from the west edge of the SP5 wall. A sloped excavation in this area will extend to the east and will remove soil support from in front of the SP5 wall. In order to make sure that soil support is maintained in front of the SP5 wall, restrictions must be placed on the extent of the excavation. The excavation slope should rise immediately from the edge of the proposed foundation at a slope no steeper than 1 Horizontal to 2 Vertical (1H:2V) in dense till-like soils. This slope may be vertical where the height of excavation is 1.2 m or less. This slope should then be flattened to 1.5H:1V in the 75 mm minus gravel slope cover that was placed on the till-like soils. If sloughing and stability problems are encountered with the gravel slope cover, then the cover can be entirely removed from the slope within the area of excavation. The surface of the exposed till should then be covered with poly sheeting pinned to the slope to protect the surface from weathering.

Thurber must be on site during excavation to confirm that the intended soil support for the secant pile walls remains in place. Thurber must review this slope before and issue a signed and sealed memo confirming that workers may enter within a horizontal distance of the base of this excavation equal to its height.

## **7.4 Utility Trench Excavations**

Utility trench excavations within 4 m of the existing secant piles should not extend deeper than 0.6 m below final grade without excavation specific review from Thurber and possibly an excavation shoring design from the contractor.

## **8. LOCK-BLOCK WALL CONSIDERATIONS**

### **8.1 Lock-Block Wall Connections**

Where half-height Lock-Blocks are present on the top tier of the Lock-Block wall (such as at discrete locations on the LB1 wall) these Lock-Blocks must be structurally connected to the underlying row of full-sized Lock-Blocks per the attached detail from Associated Engineering. This connection is required to prevent overturning of the blocks under the railing loads discussed in Section 8.2.

### **8.2 Railing/Fence**

The attached structural drawings detail guard rail height and support spacing for cases where the Lock-Block Wall has where the top tier consists only of full sized Lock-Blocks or where half-sized Lock-Blocks are structurally connected to full-sized blocks beneath as discussed in Section 8.1. We understand that the City of Coquitlam no longer wishes to install the cast-in-place concrete cap on the wall. Guard rail height and support spacing is limited by the overturning resistance of each block. Where attached to the top or side of a full height block, the guard rail can be no more than 1.2 m high with supports spaced no greater than 1.5 m horizontally for a 2024 BCBC lateral load of 0.75 kN/m with a load factor of 1.5.

### **8.3 Lift Point Infill**

The top row of the Lock-Block walls is generally flat except for a depressed lift point. These lift points are to be cleaned of soil and water and then infilled with concrete cement as appropriate.

## **8.4 Utility Trench Excavations**

Utility trench excavations will encounter different challenges depending on if they are at the toe of or top of a Lock-Block Wall. Excavations at the toe of the Lock-Block wall within 4 m of the Lock-Block facing should not extend deeper than 0.6 m below existing grade. Deeper excavations in this area will require excavation-specific written design input and field review from Thurber and possibly an excavation shoring design from the contractor.

Excavations at the top of a Lock-Block wall within a horizontal distance 7 m the Lock-Block facing should not extend deeper than 0.6 m below the top of the Lock-Block wall. Geogrid is present at a depth of approximately 0.75 m below the top block of the Lock-Block wall and could be damaged by excavation and removal of soil. Hand excavation should be used to establish the depth of the geogrid. Further machine excavation must not expose or damage the geogrid. Any damage to the geogrid will require that the contractor replace the entire sheet that was damaged, and reset the facing blocks as part of the repair all at their own expense. Thurber should be present during excavation to confirm that the geogrid is not damaged during trenching.

## **9. RETAINING WALLS LESS THAN 1.2 M TALL**

Retaining walls that are less than 1.2 m tall are considered landscape walls and geotechnical input is not required. However, we recommend that any drains associated with landscape walls be wrapped in filter cloth to prevent soil migration and internal erosion.

## **10. EXISTING CONDITIONS**

Numerous components of the proposed project will interact with the secant pile and Lock-Block retaining walls constructed recently. We recommend a copy of the August 2024 Issued for Construction Drawings for the retaining walls be included in the tender package. These drawings should be provided for reference only and may vary from the as-built condition of the wall.



## 11. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact us at your convenience.

Yours truly,  
Thurber Engineering Ltd.  
Steven Coulter, M.Sc., P.Eng.  
Review Engineer

Ryan W.J. Mills, M.Eng., P.Eng.  
Geotechnical Engineer

Thurber Engineering Ltd. Permit to Practice #1001319
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### Attachment

- Statement of Limitations and Conditions
- Drawing – Geotechnical Details for SP3, SP5, LB2 and LB1
- Drawings – Structural Shotcrete Facing Details
- Geotechnical Report for Burke Mountain Secondary School (May 5, 2023)
- Past Geotechnical Reports

## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

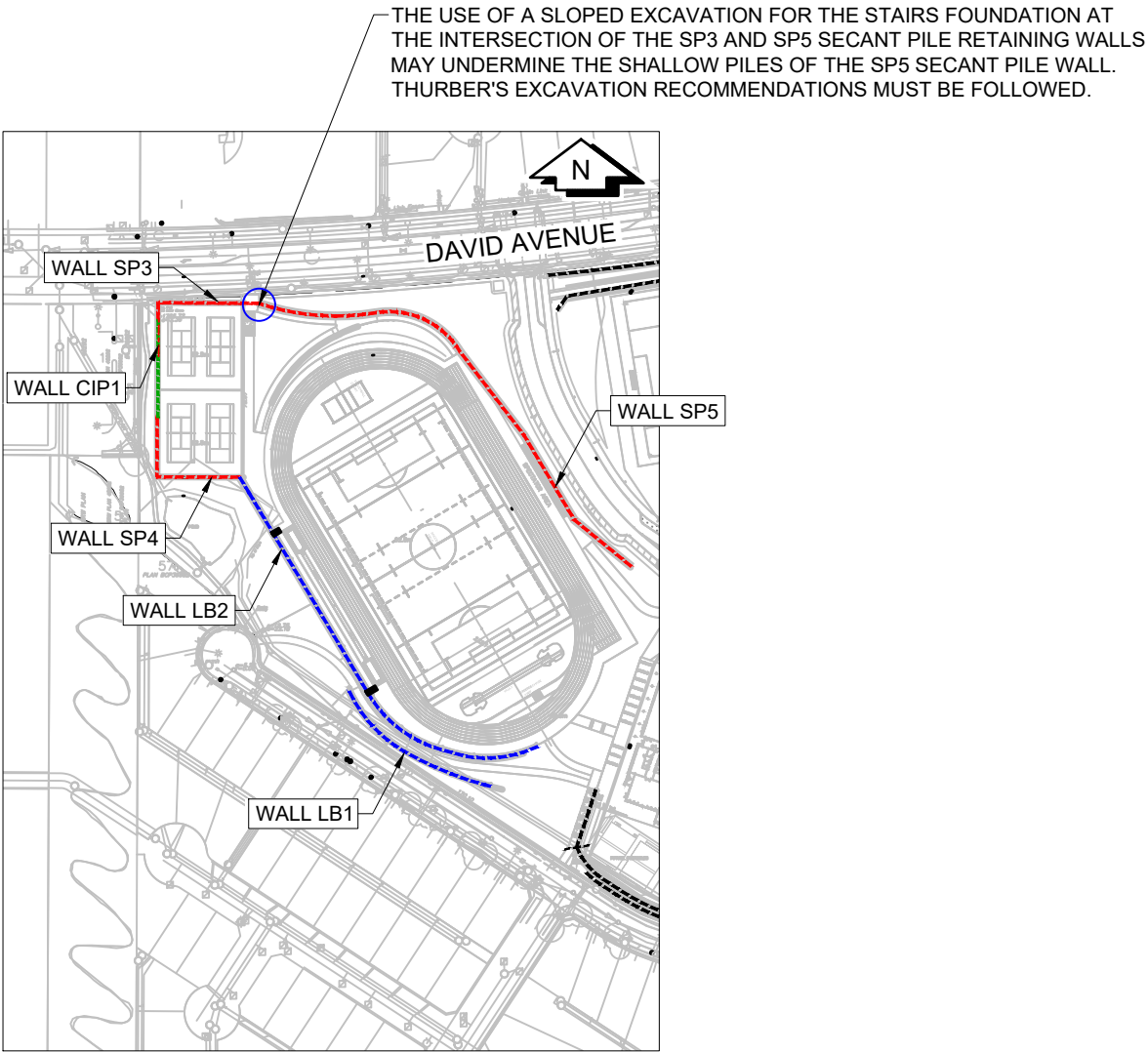
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

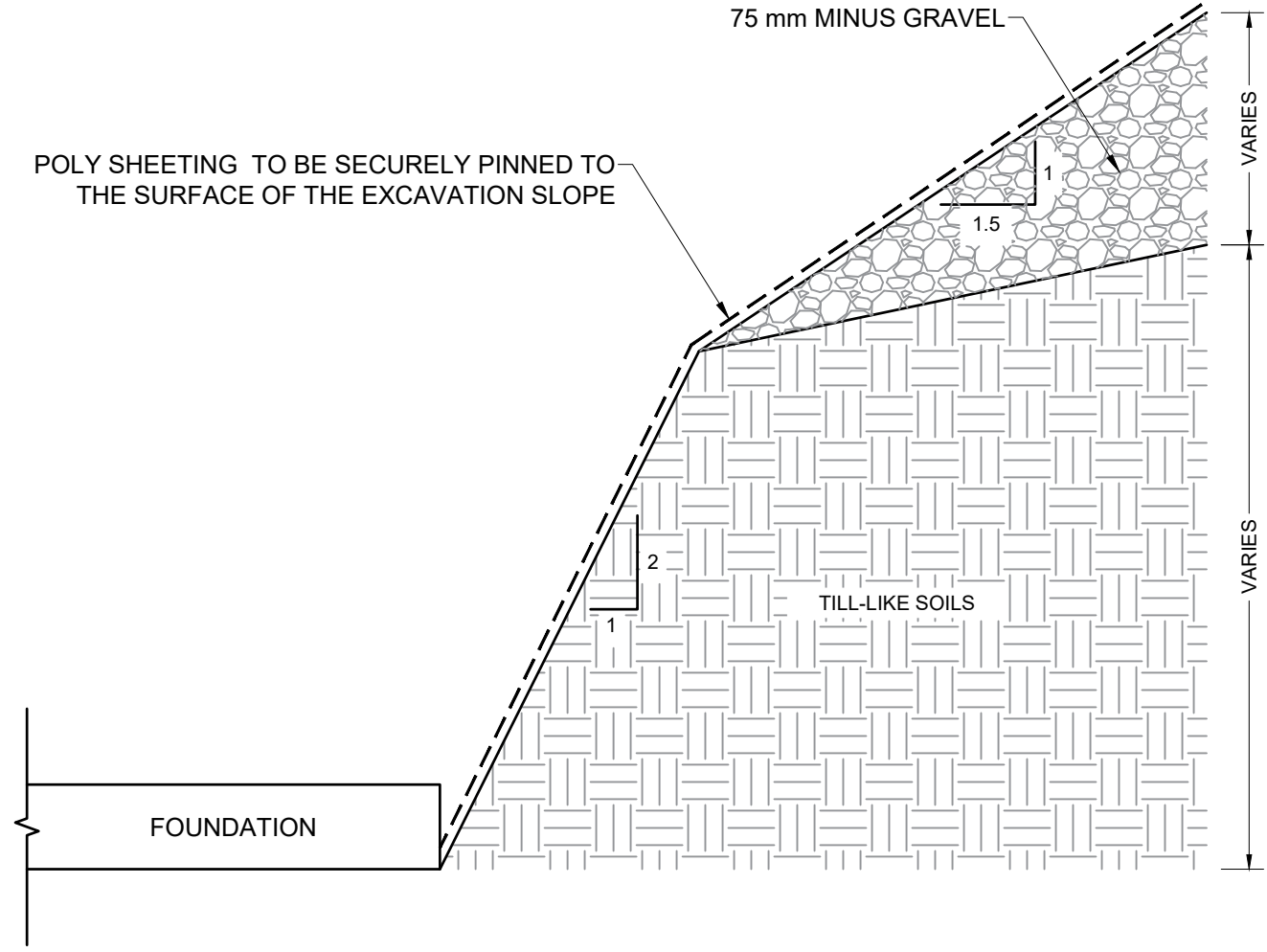
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



SITE PLAN

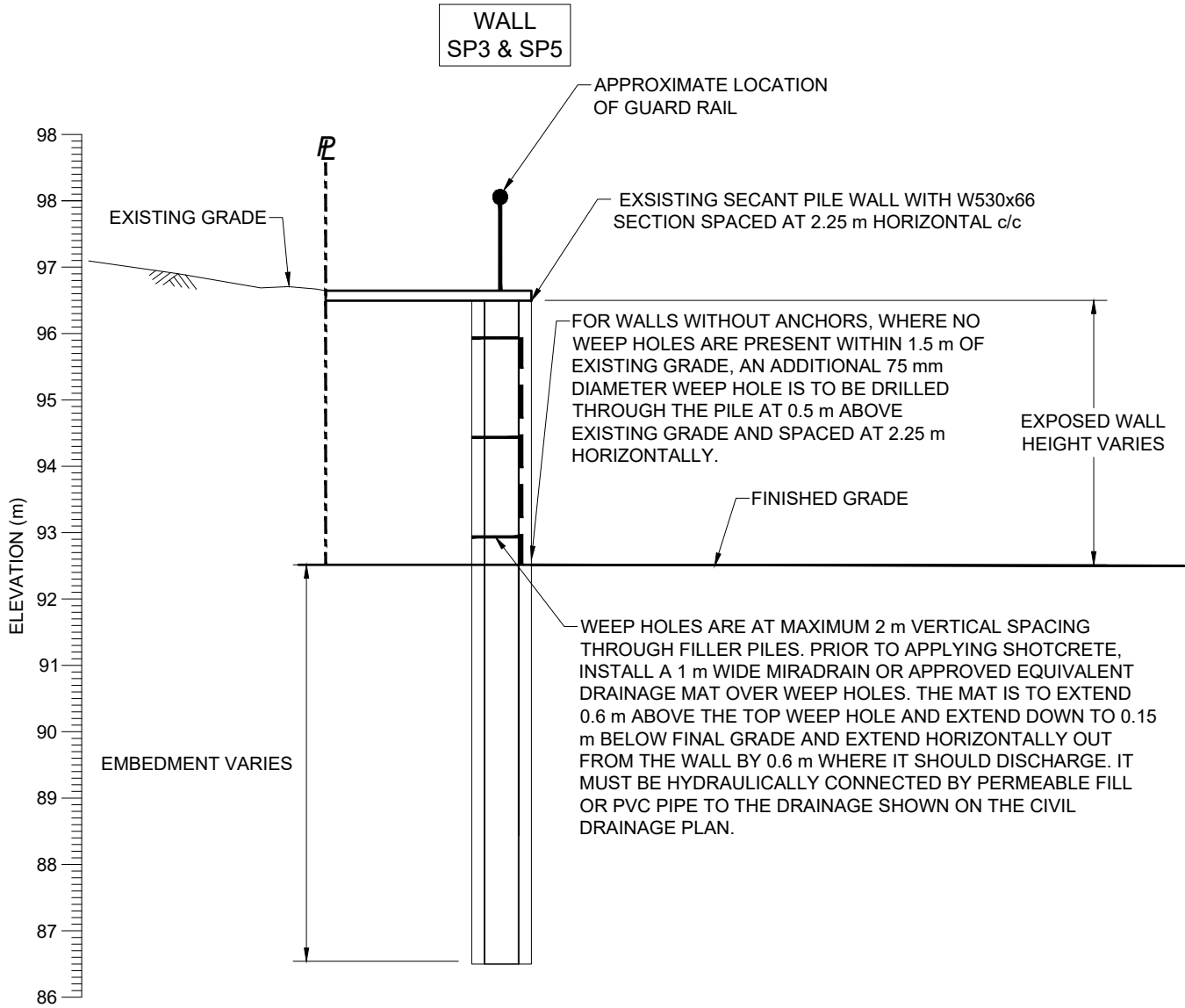


EXCAVATION PLAN FOR TENNIS COURT STAIRS  
NEAR INTERSECTION BETWEEN SP3 AND SP5 WALLS

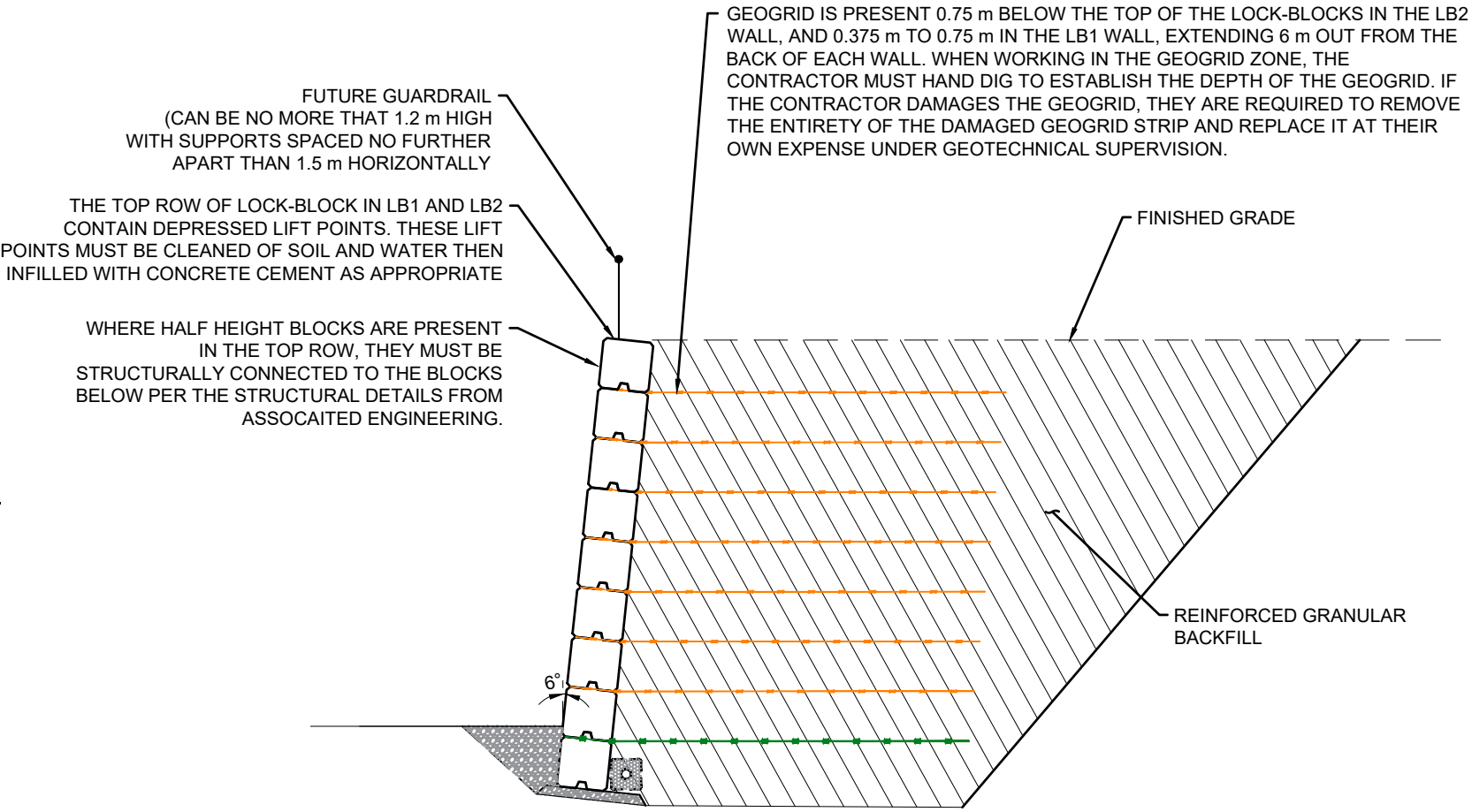
0	2025-03-20	RWJM	ISSUED FOR TENDER
REV.No.	DATE (Y,MTH., D.)	BY	DESCRIPTION

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SEAL		CITY OF COQUITLAM						
		GEOTECHNICAL DETAILS FOR SP3, SP5, LB1 AND LB2						
		BURKE MOUNTAIN ATHLETIC PARK COQUITLAM, BC						
		DESIGNED RWJM	DRAWN MOM	APPROVED SC	DATE MAR. 20, 2025	SCALE N.T.S.	PROJECT No.	DWG. NO. 35998 - G01



SECANT PILES (TYP.)



LOCK-BLOCK WALLS (TYP.)

0	2025-03-20	RWJM	ISSUED FOR TENDER
REV.No.	DATE (Y,MTH., D)	BY	DESCRIPTION

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SEAL



CITY OF COQUITLAM							
GEOTECHNICAL DETAILS FOR SP3, SP5, LB1 AND LB2							
BURKE MOUNTAIN ATHLETIC PARK				COQUITLAM, BC			
DESIGNED RWJM	DRAWN MOM	APPROVED SC	DATE MAR. 20, 2025	SCALE N.T.S.	PROJECT No.	DWG. NO. 35998 - G02	REV. 0



IF NOT 50 mm ADJUST SCALES

50 mm

SCALE(S) SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS. TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALE(S) SHOWN UNLESS NOTED OTHERWISE

CONSTRUCTION:

1. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE, AND EXCEPT WHERE SPECIFICALLY SHOWN, DO NOT INDICATE THE MEANS OR METHODS OF CONSTRUCTION. THE CONTRACTOR AND THEIR SUB-CONTRACTORS SHALL SUPERVISE AND DIRECT THE WORK AND SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, PROCEDURES, TECHNIQUES, QUALITY CONTROL, AND SAFETY MEASURES INCLUDING, BUT NOT LIMITED TO, ADHERENCES TO ALL WORKPLACE HEALTH AND SAFETY GUIDELINES. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR, CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES, FOR SAFETY PRECAUTIONS AND PROGRAMMES IN CONNECTION WITH THE WORK, FOR THE ACTS OR OMISSIONS OF THE CONTRACTOR, SUBCONTRACTORS, OR ANY OTHER PERSON PERFORMING ANY OF THE WORK, OR FOR FAILURE OF ANY OF THESE PERSONS TO CARRY OUT THE WORK IN ACCORDANCE WITH THE STRUCTURAL CONTRACT DOCUMENTS.

2. ALL STRUCTURAL ELEMENTS OF THE PROJECT HAVE BEEN DESIGNED BY THE ENGINEER TO RESIST THE REQUIRED CODE VERTICAL AND LATERAL FORCES THAT COULD OCCUR IN THE FINAL COMPLETED STRUCTURE ONLY. CONTRACTOR IS RESPONSIBLE FOR DESIGNING AND PROVIDING ALL TEMPORARY WORKS INCLUDING, BUT NOT LIMITED TO, BRACING, FALSEWORK, SHORING, AND TEMPORARY SUPPORTS TO MAINTAIN THE DEFLECTION LIMIT, STABILITY AND SAFETY OF ALL STRUCTURAL ELEMENTS DURING THE CONSTRUCTION PROCESS. TEMPORARY WORKS MUST BE CAPABLE OF TRANSFERRING ALL LOADS WITHOUT EXCEEDING SPECIFIED DESIGN LOADS TO THE STRUCTURE. THE ENGINEER IS NOT RESPONSIBLE FOR DESIGN OR FIELD REVIEW OF TEMPORARY AND ANCILLARY WORK.

3. THE DRAWINGS DO NOT SHOW COMPONENTS THAT MAY BE NECESSARY FOR CONSTRUCTION SAFETY. THE CONTRACTOR ASSUMES SOLE RESPONSIBILITY FOR SAFETY IN AND AROUND THE JOBSITE FOR ALL PERSONS AND PROPERTY. PROPER AND SAFE METHODS OF CONSTRUCTION SHALL BE USED AT ALL TIMES. TEMPORARY WORKS TO BE DESIGNED BY CONTRACTOR IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY STANDARDS AND LOCAL RULES AND REGULATIONS.

4. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL UNDERGROUND AND SUB-GRADE SERVICES PRIOR TO COMMENCING SITE WORK.

5. ALL DIMENSIONS, ELEVATIONS AND SLOPES SHALL BE CHECKED AND VERIFIED WITH THE DRAWINGS & EXISTING SITE CONDITIONS PRIOR TO CONSTRUCTION, FABRICATION, AND PREPARATION OF SHOP DRAWINGS. DIFFERENCES BETWEEN CONSTRUCTION AND THAT SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE REFERRED TO THE ENGINEER AND ARCHITECT.

6. PRIOR TO THE SUBMISSION OF SHOP DRAWINGS AND DATA SHEETS, THE CONTRACTOR SHALL VERIFY THE COMPATIBILITY FOR ELEMENTS SUPPORTED BY STRUCTURAL COMPONENTS. THE ELEMENT SHALL BE VERIFIED FOR SIZE, DIMENSIONS, CLEARANCES, ACCESSIBILITY, WEIGHTS, AND WHETHER THE REACTIONS ONTO THE PRIMARY STRUCTURE MATCH WITH THE ORIGINAL DESIGN INTENT. DIFFERENCES SHALL BE CLOUDED ON THE SUBMITTALS.

7. CONTRACTOR SHALL PROVIDE MEANS OF PROTECTING EXISTING WORK (EQUIPMENT, STRUCTURE, FINISHES ETC.) IN EXISTING AREAS NOT DESIGNATED FOR DEMOLITION OR NEW CONSTRUCTION. ALL WORK AT/OR NEAR EXISTING AREAS SHOULD MINIMISE IMPACTS AND DISRUPTIONS TO THE ONGOING OPERATION OF THE EXISTING COMPONENTS AND SYSTEMS. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR AND REPLACEMENT OF ANY EXISTING WORK DAMAGED DURING CONSTRUCTION.

8. WHERE A CONTRACTOR, SUB-CONTRACTOR, OR OTHER (INCLUDING ANOTHER CONSULTANT) PROVIDES WORK, MATERIALS, OR SPECIFICATIONS THAT RELY UPON THE STRUCTURE IN ANY WAY, THEY SHALL INSPECT THE STRUCTURE IN DRAWING FORM AND AS CONSTRUCTED TO DETERMINE WHETHER THE STRUCTURE MEETS THEIR REQUIREMENTS. THE CONTRACTOR MUST NOTIFY THE ENGINEER OF ALL LOCATIONS WHERE THE STRUCTURE MIGHT ADVERSELY AFFECT OR BE ADVERSELY AFFECTED BY CONSTRUCTION. THE CONTRACTOR IS TO THEN PROVIDE THE ACTIONS NECESSARY TO RESOLVE THE ISSUE. EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO, USING THE STRUCTURE TO SUPPORT EQUIPMENT LOADS, STORAGE LOADS, TEMPORARY WORKS, AND DRILLING OR CUTTING INTO THE STRUCTURE FOR CONNECTING OR ATTACHING TEMPORARY WORKS.

9. WORK FOUND DEFECTIVE AFTER COMPLETION OF THE WORK OR PROJECT SHALL REMAIN THE RESPONSIBILITY OF THE CONTRACTOR TO RECTIFY. THIS OBLIGATION IS APPLICABLE AT ANY STAGE OF WORK - REGARDLESS OF PRIOR ACCEPTANCE OR APPROVAL - AND CONTINUES BEYOND SUBSTANTIAL COMPLETION OF THE PROJECT.

10. THE CONTRACTOR IS TO PROVIDE ENGINEER WITH A SET OF MARKED UP STRUCTURAL DRAWINGS, WITH DETAILED DIMENSIONS AND SKETCHES, INCORPORATING ALL MODIFICATIONS MADE TO THE STRUCTURE AS A RESULT OF FIELD CONDITIONS AND CONSTRUCTION PROCEDURES THAT WERE NOT PREDICTED AT THE TIME OF DESIGN AND/OR TENDER.

11. THE ENGINEER MUST BE IMMEDIATELY NOTIFIED OF ANY CHARGES FOR EXTRAS TO THE CONTRACT BEFORE WORK CAN PROCEED. SUFFICIENT TIME MUST THEN BE ALLOWED FOR REVIEW AND APPROVAL OF EXTRAS BY ENGINEER AND/OR THE ARCHITECT AND/OR THE OWNER. PAYMENT MAY NOT BE GRANTED FOR WORK WHICH PROCEEDS PRIOR TO APPROVAL.

12. REQUESTS FOR INFORMATION (RFIs) MUST BE FORMALLY SUBMITTED WITH ADEQUATE TIME FOR REVIEW AND RESPONSE, INCLUDING CONSIDERATION OF THE COMPLEXITY OF THE QUESTION. EACH SUBMISSION OF EACH RFI MUST BE ALLOWED AT LEAST ONE CALENDAR WEEK RESPONSE TIME BY ENGINEER.

EXCAVATION & BACKFILL:

1. REFER TO GEOTECHNICAL REPORT AND GEOTECHNICAL DRAWINGS FOR ALL REQUIREMENTS.

2. ENSURE THE BOTTOM OF EXCAVATION IS UNDISTURBED SOIL, LEVEL AND FREE OF ALL LOOSE, SOFT OR ORGANIC MATTER AND IS PROTECTED AND KEPT DRY DURING EXCAVATION AND DURING CONCRETE PLACEMENT. THOROUGHLY COMPACT THE BASE OF THE EXCAVATION PRIOR TO FOUNDATION CONSTRUCTION IN ORDER TO DENSIFY THE SOIL LOOSENED BY THE EXCAVATION EQUIPMENT.

3. ENSURE THAT THE SOIL BELOW A FOUNDATION IS NOT ALLOWED TO FREEZE, EITHER DURING OR AFTER CONSTRUCTION. UNDER NO CIRCUMSTANCES SHALL CONCRETE BE PLACED ON FROZEN SOIL.

4. USE HAND-OPERATED COMPACTION EQUIPMENT WITHIN 1m OF WALLS AND FOOTINGS.

5. BACKFILL AGAINST GRADE BEAMS AND FOUNDATIONS AS SPECIFIED AFTER CONCRETE HAS ACHIEVED MINIMUM 20 MPa STRENGTH, AND AFTER APPROVAL FROM THE ENGINEER.

6. THE GEOTECHNICAL ENGINEER SHALL BE NOTIFIED A MINIMUM OF 24 HRS. BEFORE COMMENCEMENT OF EXCAVATION. SOIL CONDITIONS SHALL BE INSPECTED BY THE GEOTECHNICAL ENGINEER DURING EXCAVATION AND PRIOR TO CONSTRUCTION OF FORMWORK FOR FOUNDATIONS.

FIELD REVIEW BY AE:

1. THE ENGINEER PROVIDES FIELD REVIEW ONLY FOR THE WORK SHOWN ON THESE STRUCTURAL DRAWINGS. FIELD REVIEWS ARE TO ASCERTAIN GENERAL CONFORMANCE WITH THE STRUCTURAL PLANS AND SUPPORTING DOCUMENTS FOR THE INTEGRITY OF THE PRIMARY STRUCTURAL COMPONENTS ONLY. THE FIELD REVIEWS ARE CARRIED OUT AT THE PROFESSIONAL DISCRETION OF THE ENGINEER. RESPONSIBILITY FOR THE DESIGN, DETAILS, AND DIMENSIONS SHOWN IN THE SHOP DRAWINGS REMAINS WITH THE CONTRACTOR OR SUBCONTRACTOR SUBMITTING THEM.

2. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE FIELD REVIEWS IN A TIMELY MANNER SUITABLE TO THE TIMELINE AND STAGE OF CONSTRUCTION. THE CONTRACTOR MUST GIVE THE ENGINEER A MINIMUM 48 HOURS NOTICE OF WHEN THE STRUCTURAL WORK WILL BE GENERALLY COMPLETED AND READY FOR REVIEW. FIELD REVIEWS SHOULD BE DURING NORMAL WORKING HOURS ONLY. FIELD REVIEWS REQUIRING SUBSTANTIAL TRAVEL TIME MUST BE GIVEN ADEQUATE NOTICE.

3. AT THE TIME OF THE FIELD REVIEW THE STRUCTURAL WORK MUST BE SUBSTANTIALLY COMPLETE AND CANNOT BE CONCEALED BY FINISHES OR OTHER MEANS. WORK COVERED BY FINISHES PRIOR TO THE FIELD REVIEW (INCLUDING CONCRETE CAST AROUND REBAR) MAY NEED TO BE REMOVED AT THE EXPENSE OF THE CONTRACTOR. INSTRUCTIONS FOR REMOVAL OF FINISHES OR CONCRETE ARE AT THE SOLE DISCRETION OF THE ENGINEER. ADDITIONAL FIELD REVIEWS BY THE ENGINEER OR ADDITIONAL MATERIAL TESTING MAY BE REQUIRED IF ANY WORK IS FOUND TO BE INCOMPLETE OR DEFICIENT AT THE TIME OF REVIEW AND SHALL BE DONE AT THE EXPENSE OF THE CONTRACTOR.

4. FIELD REVIEWS DO NOT RELIEVE THE CONTRACTOR/SUBCONTRACTOR OF THEIR RESPONSIBILITY FOR ANY ERRORS, AND FOR MEETING ANY AND ALL REQUIREMENTS LAID OUT IN THE CONTRACT DOCUMENTS. INSTRUCTIONS GIVEN AS A RESULT OF FIELD REVIEW SHALL NOT BE CAUSE FOR EXTRA CHARGE TO THE CONTRACT.

5. FIELD REVIEW IS NOT FOR THE BENEFIT OF THE CONTRACTOR AND MAY NOT FORM PART OF THE CONTRACTORS CONSTRUCTION QUALITY CONTROL.

SUBMITTALS:

1. SHOP DRAWINGS ARE REVIEWED FOR THE SOLE PURPOSE OF ENSURING GENERAL CONFORMANCE TO THE DESIGN INTENT. THE ENGINEER DOES NOT WARRANT OR REPRESENT THAT THE INFORMATION CONTAINED ON THE SHOP DRAWINGS IS EITHER ACCURATE OR COMPLETE. SOLE RESPONSIBILITY FOR CORRECT DESIGN, DETAILS, QUANTITIES, DIMENSIONS, METHOD OF CONSTRUCTION, AND SAFETY MEASURES SHALL REMAIN WITH THE PARTIES SUBMITTING THE DRAWING. THE CONTRACTOR IS RESPONSIBLE FOR ANY ERRORS/AND OR OMISSIONS IN THE SHOP DRAWINGS AND MEETING THE REQUIREMENTS OF THE CONSTRUCTION AND CONTRACT DOCUMENTS.

2. PRIOR TO ENGINEER REVIEW, THE CONTRACTOR IS RESPONSIBLE FOR REVIEWING THE SHOP DRAWINGS TO ENSURE CONFORMANCE TO DRAWINGS, CONTRACT DOCUMENTS, AND SITE CONDITIONS. THE CONTRACTOR SHALL CERTIFY THEIR REVIEW WITH A DATED STAMP BEARING THE SIGNATURE OF AN AUTHORIZED REPRESENTATIVE OF THE CONTRACTOR NOTING THAT THE DRAWINGS HAVE BEEN 'APPROVED'. SUBMITTALS WHICH DO NOT REFLECT THE CONTRACTOR'S APPROVAL, SIGNATURE AND DATE WILL BE RETURNED WITHOUT REVIEW.

3. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING SHOP DRAWINGS OF ALL SUBCONTRACTORS, SUPPLIERS AND SUPPORTING REGISTERED PROFESSIONALS. SUBCONTRACTORS/SUPPLIERS SHALL SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION. FOLLOWING THE ENGINEER'S REVIEW, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING AND DISTRIBUTING ENGINEER'S COMMENTS TO THEIR SUBCONTRACTORS/SUPPLIERS.

4. SHOP DRAWINGS SHALL BE PREPARED FOR ALL STRUCTURAL ITEMS AND SUBMITTED FOR REVIEW TO THE ENGINEER. STRUCTURAL DRAWINGS SHALL NOT BE REPRODUCED AND USED AS SHOP DRAWINGS.

5. ALL ITEMS DEVIATING FROM THE STRUCTURAL DRAWINGS OR FROM PREVIOUSLY SUBMITTED SHOP DRAWINGS SHALL BE CLOUDED.

6. THE ENGINEER WILL REVIEW SHOP DRAWINGS PERTAINING ONLY TO WORK SHOWN ON THE ENGINEER'S DRAWINGS.

7. THE CONTRACTOR SHALL NOT PURCHASE ANY MATERIAL, FABRICATE OR INSTALL ANY ELEMENT PRIOR TO OBTAINING THE ENGINEER REVIEW OF SHOP DRAWINGS. CONTRACTOR SHALL BE RESPONSIBLE FOR DELAYS CAUSED BY REJECTION OF INADEQUATE SHOP DRAWINGS.

8. REFER TO INDIVIDUAL NOTES SECTIONS AND OTHER DISCIPLINES FOR SPECIFIC SUBMITTAL REQUIREMENTS.

9. WHERE REVIEW AND RETURN OF SHOP DRAWINGS IS REQUIRED, THE ENGINEER WILL REVIEW EACH SUBMITTAL AND, WHERE POSSIBLE, RETURN WITHIN TWO WEEKS OF RECEIPT.

10. CONTRACTOR TO SUBMIT ALL SHOP DRAWINGS ELECTRONICALLY FOR REVIEW. ELECTRONIC SHOP DRAWINGS (SEALED WHERE REQUIRED) ARE TO BE SUBMITTED AS A PDF DOCUMENT ONLY.

DESIGN DATA:

1. SEISMIC DESIGN ASSUMPTIONS:

1.1. SITE CLASS C

1.2. DESIGN OF THE SHOTCRETE WALLS WAS PER THE BC BUILDING CODE 2024. SEISMIC DESIGN OF THE SHOTCRETE WALLS WAS COMPLETED USING SEISMIC HAZARD VALUES TO ACCOMMODATE THE CITY OF COQUITLAM ENVIRONMENTAL LOADS FOR USE WITH THE BC BUILDING CODE 2018 (PERMITS BULLETIN NO. 14-003) WHICH ARE IN EFFECT UNTIL MAY 2025. THE UNIFORM HAZARD RESPONSE SPECTRUM IS PROVIDED BELOW.

Sa(0.2)

0.784g

Sa(0.5)

0.691g

Sa(1.0)

0.393g

Sa(2.0)

0.240g

Sa(5.0)

0.077g

Sa(10.0)

0.027g

PGA

0.399g

PGV

0.511 m/s

CONCRETE:

1. PERFORM CONCRETING WORK TO CAN/CSA A23.1.

2. TEST CONCRETE IN ACCORDANCE WITH CAN/CSA A23.2.

3. CONCRETE MIXES SHALL BE PROPORTIONED IN ACCORDANCE WITH CAN/CSA A23.2 TO MEET THE FOLLOWING REQUIREMENTS:

LOCATION

28 DAY COMPRESSIVE STRENGTH (MPa)

CEMENT TYPE

AIR %

SLUMP mm

NOMINAL COARSE SIZE AGG. mm

EXP. COND.

BUTTRESS WALLS, FOOTINGS, AND WALL TOP CAPS

30

GU

5-8

60-100

20

F-1

3.1 STRUCTURAL CONCRETE SUCH AS CONCRETE CURB, RETAINING WALLS AND FOUNDATIONS.

3.2 WATER/CEMENT RATIO FOR EXPOSURE CLASSES AS PER CAN/CSA A23.1

3.3 MAX W/C = 0.5 MIN.

3.4 FLYASH 30% MAX.

3.5 LOWER SLUMP MAY BE REQUIRED FOR BENCHING

3.6 WHERE SPECIFIED STRENGTH EXCEEDS THOSE IMPLIED BY EXPOSURE CLASS, SPECIFIED STRENGTH GOVERNS.

3.7 ALL CONCRETE TO BE NORMAL WEIGHT 2400 kg/m³

3.8 MIX DESIGNS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW

3.9 SUPPLEMENTAL FLYASH TO A MAXIMUM OF 20% MAY BE PERMITTED AT THE DISCRETION OF THE ENGINEER.

3.10 SEE SPECIFICATIONS FOR OTHER TYPES OF CONCRETE REQUIREMENTS

4. ALL CONCRETE AND MATERIALS THAT MAY COME IN CONTACT WITH POTABLE WATER MUST BE CERTIFIED TO NSF/ANSI 61. CONTRACTOR TO PAY FOR FOR NSF/ANSI 61 TESTING OF PRODUCTS THAT HAVE NOT BEEN PRE-CERTIFIED. ALL WATERTIGHT CONCRETE AS DEFINED ABOVE SHALL BE NSF CERTIFIED, EXCLUDING THE RESIDUAL TANK AND TRENCHES.

5. STRENGTH OF CONCRETE TO BE DETERMINED BY FIELD-CURED CYLINDERS. ALTERNATE METHODS, IF ACCEPTABLE TO THE ENGINEER, MAY BE USED.

6. LOCATIONS & DETAILS OF CONSTRUCTION JOINTS NOT SHOWN ON DRAWINGS ARE TO BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

7. BEFORE CONCRETE PLACEMENT, ENSURE THAT ALL EMBEDDED ITEMS SUCH AS ANCHOR BOLTS, SLEEVES, AND WATER STOPS ARE IN POSITION AND SECURELY FASTENED IN PLACE TO THE SATISFACTION OF THE ENGINEER.

8. ANCHOR BOLTS AND DOWELS SHALL BE PLACED BEFORE CONCRETE IS POURED. TEMPLATES SHALL BE USED TO ENSURE CORRECT PLACEMENT OF ANCHOR BOLTS AND DOWELS. DOWELS TO MATCH VERTICAL BARS IN SIZE AND SPACING.

9. BEFORE PLACING CONCRETE, ENSURE THAT THE REINFORCING STEEL AND FORMS ARE CLEAN, FREE OF LOOSE SCALE, DIRT AND OTHER FOREIGN MATERIALS WHICH WOULD REDUCE THE BOND BETWEEN THE REINFORCING STEEL AND THE CONCRETE.

10. ALL EXPOSED CONCRETE CORNERS TO HAVE 20x20 CHAMFER.

11. SAWCUT OR HAND-TOOL CONTROL JOINTS IN THE SEQUENCE THE CONCRETE SLAB IS CAST WITH AT LEAST A MINIMUM JOINT DEPTH OF ¼ THE SLAB THICKNESS.

11.1 SUBMIT TO THE ENGINEER FOR REVIEW AND APPROVAL:

11.2 CONCRETE MIX DESIGN

11.3 DETAIL AND LOCATION OF CONSTRUCTION JOINTS

11.4 CONCRETE TEST RESULTS

11.5 REBAR SHOP DRAWINGS, METRIC

SHOTCRETE:

1. REFER TO SPECIFICATION SECTION 03371.

REINFORCEMENT:

1. REINFORCING STEEL: NEW DEFORMED BARS TO CSA G30.18. "BILLET" STEEL BARS FOR CONCRETE REINFORCEMENT, WITH MIN. YIELD STRENGTH OF 400MPa. WELDED WIRE FABRIC CONFORM TO CSA G30.5 WITH MIN. YIELD STRENGTH OF 450MPa. PLACE REBAR TO CSA/CAN A23.1. REINFORCEMENT REQUIREMENTS ARE SHOWN ON DETAIL DRAWINGS. WHERE DETAILS OF BAR SIZING AND SPACING ARE NOT SHOWN, ALLOW FOR MINIMUM REINFORCEMENT IN ACCORDANCE WITH CSA/CAN A23.1

2. PROVIDE CLEAR CONCRETE COVER OVER REBAR AS FOLLOWS UNO:

2.1 CONCRETE PLACED DIRECTLY ON GROUND

75 mm

2.2 FORMED SURFACES EXPOSED TO WEATHER & SEWAGE

2.2.1 WALLS AND SLABS

50 mm

2.2.2 BEAM PRINCIPAL REINFORCING

50 mm

2.2.3 BEAM STIRRUPS

40 mm

2.3 TOP SLAB REINF. & BEAM STIRRUPS IN BUILDING

40 mm

2.4 BOTTOM SLAB REINFORCING IN BUILDING

25 mm

2.5 FORMED SURFACES EXPOSED TO EARTH

50 mm

3. REBAR SPLICE LENGTHS (UNLESS NOTED OTHERWISE): LENGTHS SHOWN ARE IN mm

REBARS

10M

15M

20M

25M

30M

35M

WALLS

HORIZONTAL

500

650

800

1300

1700

2000

VERTICAL

400

600

700

1100

1300

1500

SLABS

TOP

500

700

900

1400

1700

2000

BOTTOM

400

600

750

1100

1300

1500

4. LAP WIRE MESH REINFORCING 200mm AND MINIMUM 2 LONGITUDINAL MESH BARS.

5. UNLESS OTHERWISE NOTED, EDGE OF ALL SLABS SHALL HAVE 2-15M CONTINUOUS LAPPED 600mm.

6. UNLESS NOTED OTHERWISE, ALL OPENINGS IN SLAB SHALL HAVE 2-15M BARS PARALLEL TO ALL EDGES EXTENDING BEYOND CORNERS 600mm.

7. ALL REINFORCEMENT REQUIRED TO BE WELDED SHALL BE GRADE 400W (WELDABLE).

8. PLACE ADDITIONAL REINFORCEMENT AT ALL OPENINGS FOR PIPING, MECHANICAL AND ELECTRICAL EQUIPMENT, DOORS AND OTHER OPENINGS UNLESS NOTED OTHERWISE.

9. PLACE REINFORCING BARS SYMMETRICALLY OVER SUPPORTS AND SYMMETRICALLY IN SPANS UNLESS NOTED OTHERWISE.

10. UNLESS NOTED OTHERWISE, SLAB REINFORCING SHALL NOT BE CUT AT OPENINGS. SPREAD REINFORCING AROUND OPENINGS.

11. PROVIDE SUFFICIENT CHAIRS AND SUPPORT BARS TO MAINTAIN SPECIFIED CONCRETE COVER AND TO SECURE REINFORCING STEEL IN PLACE DURING CONCRETE PLACEMENT.

12. RESERVE MINIMUM OF 1% TOTAL VOLUME OF REINFORCEMENT TO BE USED AS DIRECTED BY THE ENGINEER FOR FIELD ADJUSTMENT.

13. SUBMIT TO THE ENGINEER FOR REVIEW AND APPROVAL:

• SHOP DRAWING DETAILING ALL REINFORCEMENT (METRIC).

14. REINFORCEMENT REQUIREMENTS ARE SHOWN ON DETAIL DRAWINGS. WHERE DETAILS OF BAR SIZING AND SPACING ARE NOT SHOWN, ALLOW FOR A MINIMUM 0.5% REINFORCING IN EACH DIRECTION, EACH FACE.

15. IF LAP SPLICES ARE NOT SPECIFICALLY INDICATED, LAP SPLICES SHOULD BE LOCATED AT POINTS OF MINIMUM STRESS AND SHOULD BE OUTSIDE OF HIGH STRESS REGIONS AND REBAR CONGESTED AREAS. THE NUMBER OF SPLICES SHOULD BE KEPT AS A MINIMUM AND THE SPLICES SHOULD STAGGER AND ALTERNATE.

Associated Engineering

Platinum member

PERMIT TO PRACTICE ASSOCIATED ENGINEERING (B.C.) LTD. PERMIT NUMBER: 1000163 Engineers & Geoscientists BC

THURBER ENGINEERING LTD

BURKE ATHLETIC PARK RETAINING WALLS

20222774-00

SCALE: AS SHOWN

THURBER ENGINEERING LTD.

STRUCTURAL GENERAL NOTES

DRAWING

REVISION

SHEET

2774-00-S-001

1

1

1

2025MAR20

J. WONG

K. CHAU

ISSUED FOR TENDER

0

2024DEC13

J. WONG

K. CHAU

ISSUED FOR 100% DESIGN

REV

DATE

DESIGN

DRAWN

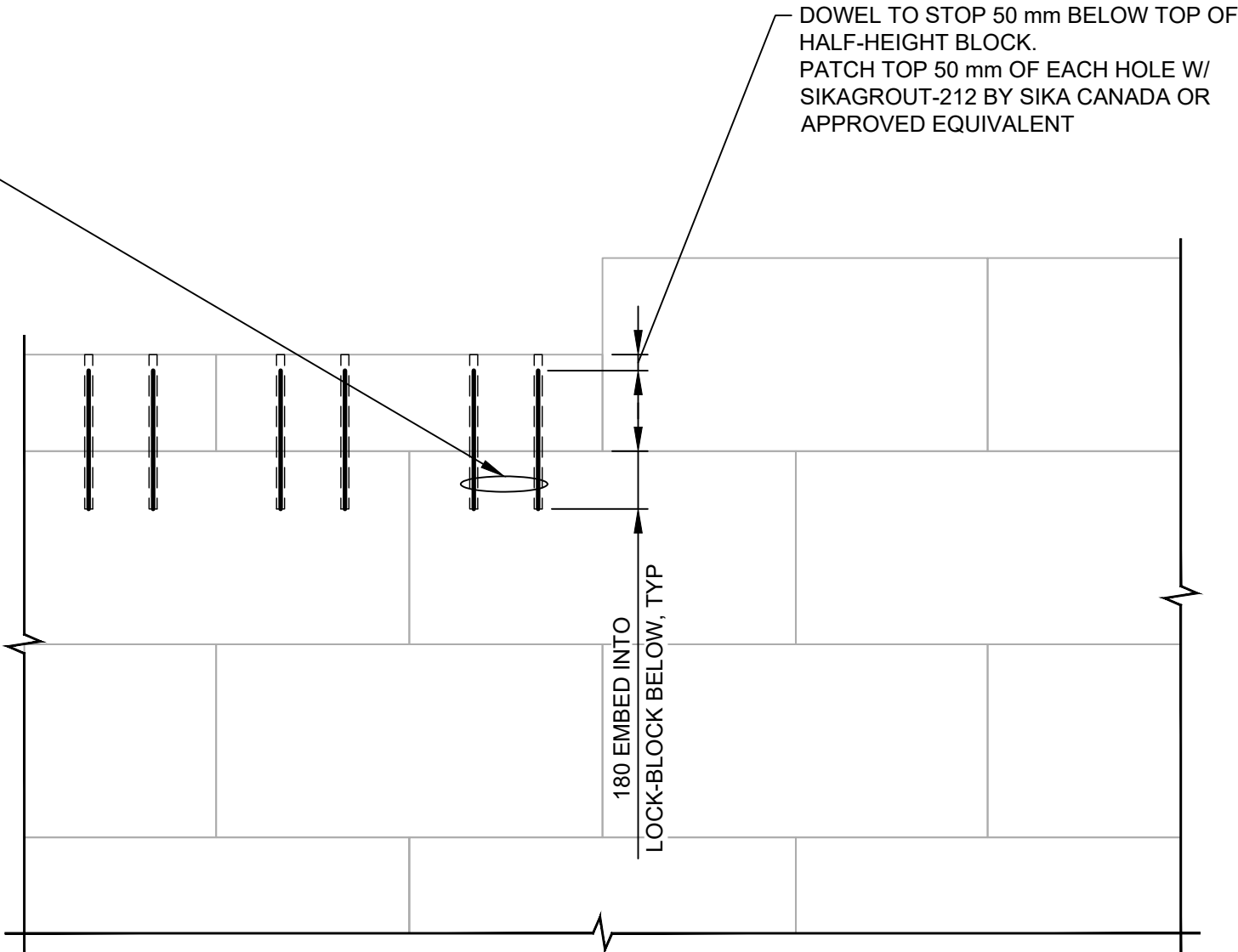
DESCRIPTION



4-10M REBAR DOWELS EMBEDDED W/ HILTI HY200 OR RE500 ADHESIVE. THE FOUR DOWELS TO BE CENTERED AROUND EACH CROSS-SHAPED SHEAR KEY TYP, SPACED 420 mm APART EA WAY (TOTAL OF 8 DOWELS PER HALF-HEIGHT LOCK-BLOCK TYP).

DRILLED HOLES TO BE ALIGNED W/ AND PARALLEL TO THE SLOPE OF THE WALL. HOLE SIZE, CLEANING, AND PREPARATION AS PER MANUFACTURER INSTRUCTIONS. USE SLOW CURE ADHESIVE AND PISTON PLUG AS APPROPRIATE, IN ACCORDANCE W/ MANUFACTURER'S MPI.

ANY ADHESIVE LEAKAGE AT HORIZ JOINT TO BE CLEANED PER ARCHITECTURAL REQUIREMENTS.



NOTE:  
RAILING/FENCES TO BE DESIGNED BY FABRICATOR.  
FABRICATOR'S DESIGN SHALL INCLUDE REACTION LOADS AT THE BASE. STRUCTURAL AND GEOTECHNICAL ENGINEERS TO REVIEW THE BASE CONNECTION DETAIL, REACTION LOADS, AND THE RESULTING EFFECTS ON THE WALL

1 DETAIL 1:20  
REMEDIAL DETAIL FOR  
CONNECTING HALF-HEIGHT  
BLOCKS TO BLOCKS BELOW

PLOT DATE: 3/19/2025 4:12:07 PM  
SAVE DATE: 3/19/2025 4:06:41 PM SAVED BY: CHAIK  
DWG PATH: G:\2025\2774-00\Burke\2774-00-S-511.dwg



PERMIT TO PRACTICE  
ASSOCIATED ENGINEERING (B.C.) LTD.  
PERMIT NUMBER: 1000163  
Engineers & Geoscientists BC

1	2025MAR20	J. WONG	K. CHAU	ISSUED FOR TENDER
0	2024DEC13	J. WONG	K. CHAU	ISSUED FOR 100% DESIGN
REV	DATE	DESIGN	DRAWN	DESCRIPTION

THURBER ENGINEERING LTD

BURKE ATHLETIC PARK  
RETAINING WALLS

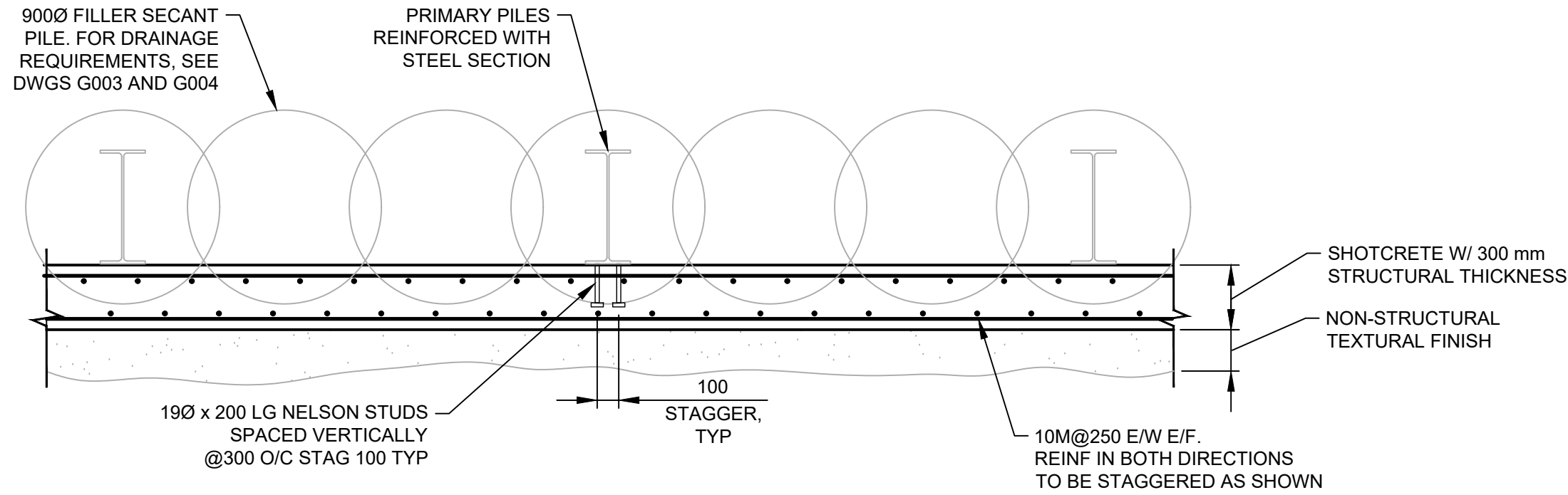
20222774-00

SCALE: AS SHOWN

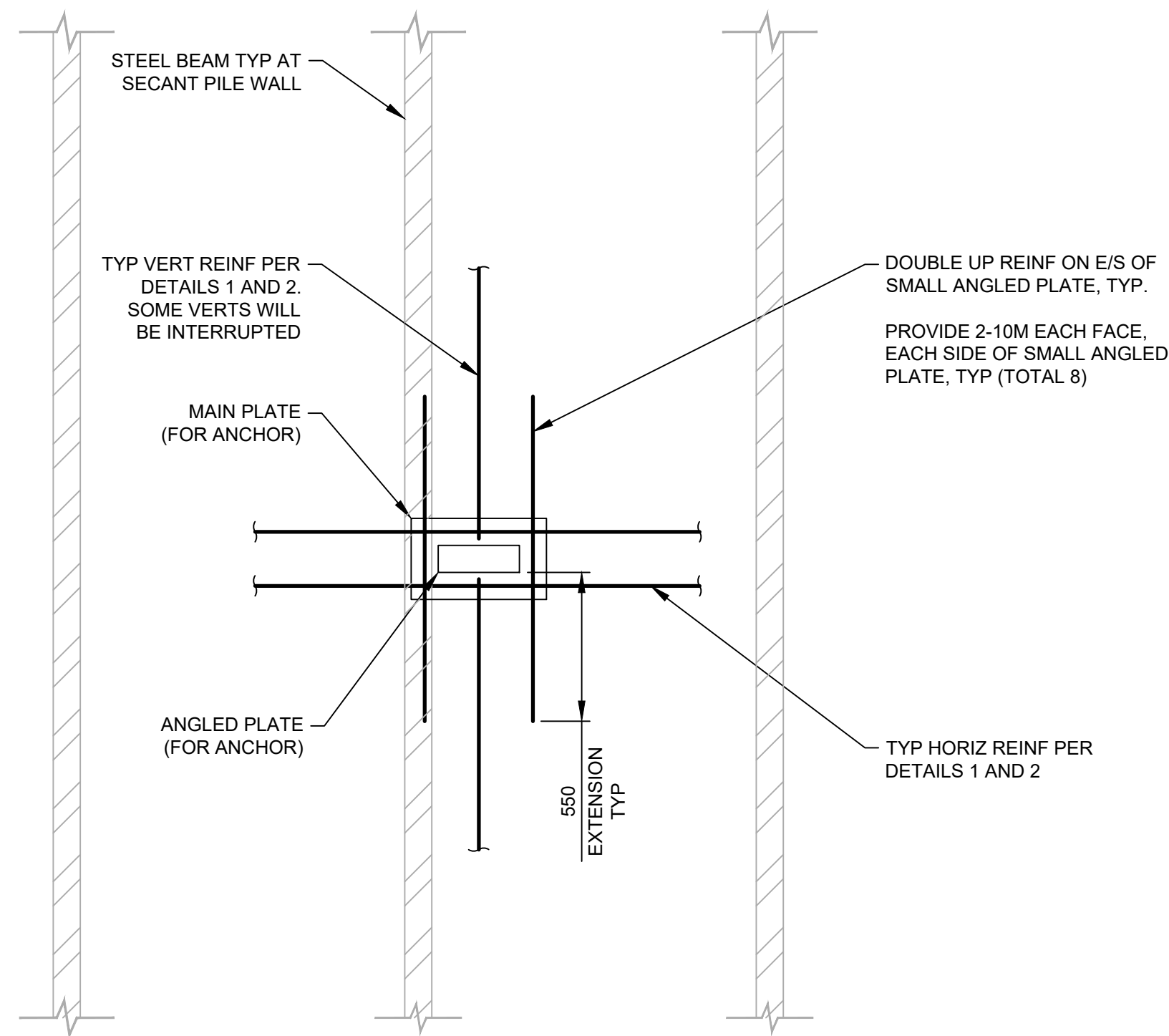


THURBER ENGINEERING LTD.  
STRUCTURAL  
SHOTCRETE FACING AT LOCKBLOCK WALLS  
DETAIL

DRAWING	REVISION	SHEET
2774-00-S-503	1	2

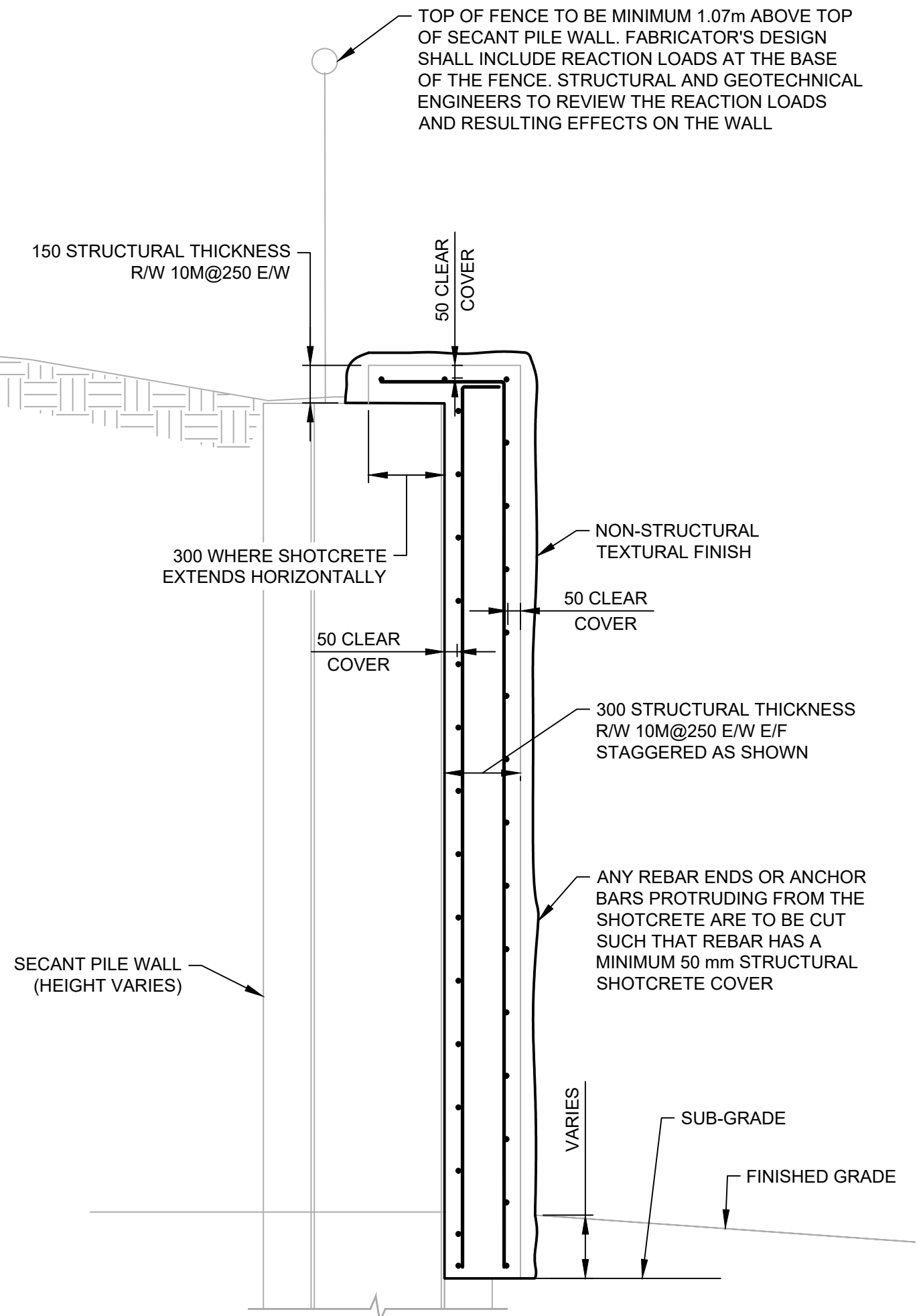
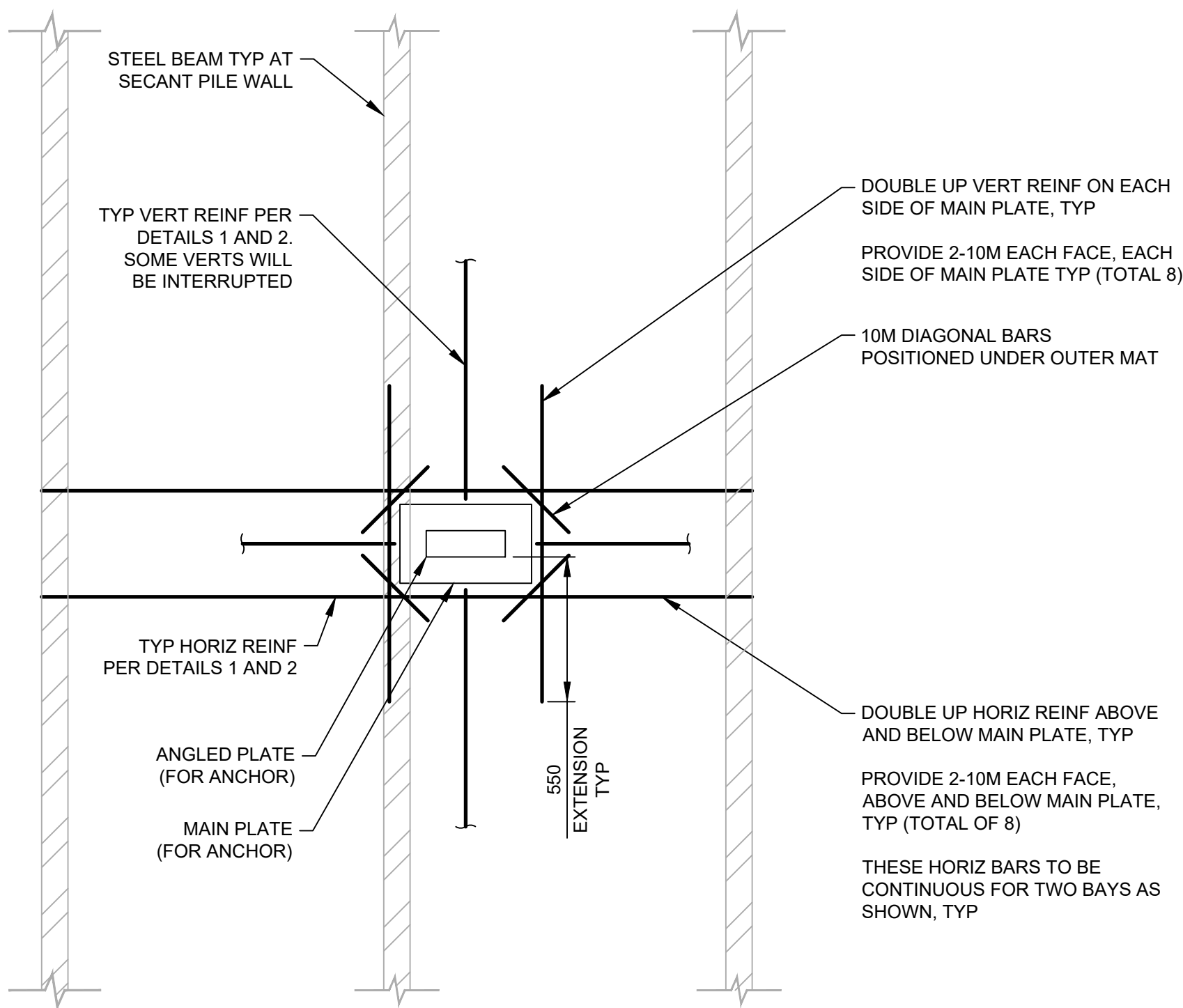


1 DETAIL 1:25  
PARTIAL PLAN SECTION VIEW  
OF SHOTCRETE FACING ON  
SECANT PILE WALL



CASE A - MAIN PLATE IS PERPENDICULAR (i.e. PARALLEL TO SHOTCRETE). SUPPLEMENTAL REINFORCING ONLY REQUIRED AROUND THE SMALLER ANGLED PLATE

3 DETAIL NTS  
SUPPLEMENTAL REINFORCING  
FOR SHOTCRETE AT ANCHOR  
PLATE LOCATIONS



- NOTES:
- FOR PORTIONS OF THE SECANT PILE FACING THAT ARE CUT FURTHER BACK THAN THE STEEL BEAMS (i.e. NOT FLUSH WITH THE REST OF THE WALL SURFACE) AFTER EXCAVATION, ADDITIONAL SHOTCRETE MAY BE NEEDED TO INFILL THESE 'RECESSED' AREAS. THE ACTUAL 'RECESSES' ARE TO BE FURTHER REVIEWED TO DETERMINE THE ACCEPTABLE PROCEDURE.
  - IF THE AS-INSTALLED TOPS OF THE SECANT PILES ARE UNEVEN, THE CONTRACTOR SHALL BE PREPARED TO CUT DOWN SECANT PILES WHICH ARE TOO HIGH TO ACCOMMODATE THE CAP AND TO PATCH PILES WHICH ARE TOO LOW. CONTRACTOR TO SUBMIT REPAIR PROCEDURE FOR REVIEW PRIOR TO PERFORMING THE REMEDIAL WORK.

2 DETAIL 1:20  
SECTION VIEW OF  
SHOTCRETE FACING  
ON SECANT PILE WALL

PERMIT TO PRACTICE  
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PERMIT NUMBER: 1000163  
Engineers & Geoscientists BC



1	2025MAR20	J. WONG	K. CHAU	ISSUED FOR TENDER
0	2024DEC13	J. WONG	K. CHAU	ISSUED FOR 100% DESIGN
REV	DATE	DESIGN	DRAWN	DESCRIPTION

THURBER ENGINEERING LTD

BURKE ATHLETIC PARK  
RETAINING WALLS

20222774-00

SCALE: AS SHOWN



THURBER ENGINEERING LTD.  
STRUCTURAL  
SHOTCRETE FACING AT SECANT PILE WALLS  
DETAIL

DRAWING	REVISION	SHEET
2774-00-S-504	1	3



May 5, 2023

File No.: 35998

The Board of Education of School District 43 (Coquitlam)  
1080 Winslow Avenue  
Coquitlam, BC V3J 0M6  
V3J 2G2

Attention: Meighan Scott, Architect AIBC, MRAIC, LEED AP BD + C – Senior Manager

and

City of Coquitlam  
3000 Guildford Way

Coquitlam, BC V3B 7N2

Attention: Ted Uhrich, MBCSLA – Acting Manager Parks and Facility Planning | Parks, Recreation, Cultures & Facilities

## **BURKE MOUNTAIN SECONDARY/MIDDLE SCHOOL PROJECT GEOTECHNICAL BASE REPORT**

Dear Meighan / Ted,

Thurber Engineering Ltd. (Thurber) has prepared this report to provide preliminary geotechnical recommendations and comments for the proposed development of the Secondary/Middle School located at 3390 and 3400 David Avenue in Coquitlam, BC. We understand that this project is a joint project between the Board of Education of School District 43 (the Board) and the City of Coquitlam (the City). The project includes a new school along with sports fields and running track, tennis court area, and multiple asphalt surface parking areas with access roads and drive aisles.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

### **1. SITE AND PROJECT DESCRIPTION**

The site is bordered by David Avenue to the north, Soball Street to the east, and Don Moore Drive to the south and southwest. The site is irregularly shaped, with maximum dimensions of about 400 m (east-west) and about 250 m (north-south) with a total area of 93,520 m<sup>2</sup>. The site is currently two separate legal properties, namely 3390 and 3400 David Avenue that will be realigned and subdivided. After subdivision, the eastern 57,510 m<sup>2</sup> will be owned by the Board and the western 36,010 m<sup>2</sup> will be owned by the City.



The existing site topography generally slopes downward from the northeast to the southwest at gradients ranging from about 8% to 12%. The overall elevation change along Soball Street and along David Avenue is 35 m and 25 m, respectively. The site was previously unoccupied and heavily forested with a water retention pond on the west side of site, which we understand is part of the local stormwater management system. At the time this report was prepared, the site had been cleared of trees.

This report and accompanying design work are based on the site grading plan by the Civil Engineer (Aplin & Martin Consultants Ltd.). At the time this report was prepared, the site grading plan is being developed and is not complete and may change after this report is written. If the design substantively changes, Thurber should be contacted to revise our report, if necessary.

The general site layout of the project includes the construction of a two-storey school building (initially operated as two schools), an artificial turf sports field, a new grass sports field, tennis court area, asphalt driveway with roundabout connected to access points off David Avenue and Soball Street, and asphalt parking areas. The site layout also includes a future portable construction area and the location of a future middle school. Refer to drawing Appendix A for the site location plan.

Given the site topography and the site grading plan, significant site earthworks along with permanent retaining walls and fill slopes will be required. The site grading plan indicates the following design elements will be required:

- A permanent vertical retaining wall with a maximum overall total height of about 15 m along the northern and eastern sides of the Board's grass sports field (adjacent to David Avenue). This wall will consist of tiered, permanent cantilevered and tieback anchored continuous secant pile walls.
- The southernmost portion of the site, near the southern end of the west side of Soball Street and along the entire north side of Don Moore Drive will require tiered retaining walls to support the placement of as much as 12 m of fill material. This wall will consist of geogrid reinforced, mechanically stabilized earth (MSE) modular block walls.
- Around the running track and tennis court areas, permanent retaining walls and / or excavation slopes will be required to facilitate a grade change of up to 4 m on the north side (cut into the slope) and up to 7 m high fill slopes on the south side. We understand that where walls are required, they will be constructed with a combination of cantilevered secant piles, MSE modular blocks, and cast-in-place concrete.

- The northern side of the school will be required to retain as much as 7 m of soil while the southern side of the school will be constructed over as much of 8 m of fill. The fill placement will require retaining walls to achieve the site grades.

## **2. BUILDING CODE CONSIDERATIONS**

We understand from discussions with the project team that although the building permit will be submitted while the current 2018 British Columbia Building Code (BCBC) governs, this project will be designed and constructed under the upcoming 2023 BCBC, which will be adopted from the recently released 2020 National Building Code of Canada (NBCC). The 2020 NBCC includes several changes, including those to seismic design that are more onerous than the 2018 BCBC. The recommendations provided in this report are based on the 2020 NBCC.

## **3. SUBSURFACE CONDITIONS**

### **3.1 Surficial Geology**

According to the Geological Survey of Canada Surficial Geology Map 1484A, the subsurface soils of the site comprise Vashon drift soils, including lodgement and minor flow till, with lenses and interbeds of substratified glaciofluvial sand and gravel, and lenses and interbeds of glaciolacustrine laminated stony till.

### **3.2 Previous Geotechnical Reports**

We were provided with three geotechnical reports (Golder Associates Ltd., 2004; Centennial Geotechnical Engineers Ltd., 2011, and GeoPacific Consultants Ltd., 2020) that include the results of a total of 10 solid-stem auger test holes and 41 excavator-dug test pits. The solid-stem auger test holes were advanced to depths ranging from 1.5 m to 6.1 m below ground surface and the test pit investigations were advanced to depths ranging from 0.7 m to 2.3 m below ground surface. The approximate locations of the solid-stem auger test holes and excavator dug test pits as well as the associated test hole logs and test pit logs have been extracted from the reports and are attached to this report.

We note that we have used the extracted pages for information only and have not relied on the recommendations provided in the individual reports in any way.

### **3.3 Thurber Geotechnical Investigation and Testing**

Thurber completed a geotechnical investigation on March 14, 2023, within the proposed school footprint that consisted of a sonic-drilled test hole advanced to a depth of 30.5 m below existing site grade. A downhole seismic casing was installed within the test hole and a vibrating wire piezometer was installed at a depth of 10 m. Downhole seismic testing was completed to determine the shear wave velocity profile and calculate the  $V_{s30}$  at the test hole location, which is a required for structural design purposes.

Thurber also coordinated the installation and testing of three sacrificial anchors (labelled SA-1, SA-2, and SA-3) that were installed vertically and incrementally loaded to failure. The purpose of the sacrificial anchors was to evaluate the site-specific soil bond capacity for the permanent tieback anchors required for the northern wall adjacent to David Avenue. Anchors SA-1 and SA-2 were both installed to a total depth of 8.2 m below existing site grade while anchor SA-3 was installed to a total depth of 6.2 m below existing site grade. The anchors were installed with 2.1 m long bond lengths.

The approximate locations of the sonic-drilled test hole and sacrificial anchor test are shown on Appendix A.

## **4. SUBSURFACE CONDITIONS AND TEST RESULTS**

### **4.1 Soil Conditions**

Based on our knowledge of the soil conditions on previous nearby projects, published surficial geology mapping and water well logs, the geotechnical reports by others, and the results of our investigation, the subsurface conditions generally consist of the following:

- Organic topsoil, typically very soft to soft, with trace to some gravel with a thickness ranging from 0.2 m to 1.2 m; over
- Loose to compact sand and gravel with a thickness ranging from 0.4 m to 1.0 m; over
- Very dense silty sand and gravel (glacial till-like) anticipated to be encountered at a depth of about 0.5 m to 1.2 m below existing site grades. We note that all the solid-stem auger test holes and excavator dug test pits encountered the very dense glacial till-like deposit. The glacial till-like soils are expected to extend to depths greater than 40 m below existing site grades. The permeability of the glacial till-like material is very low, with a hydraulic conductivity in the order of  $1 \times 10^{-8}$  m/s, but could vary by an order of magnitude higher or lower; over

- Sandstone / Siltstone bedrock. We note that the bedrock was not encountered in any of the on-site investigations completed; however, the bedrock is known to be present at a depth of about 100 m to 150 m below existing site grades based on regional geology mapping.

## **4.2 Groundwater Conditions**

The vibrating wire piezometer installed in Thurber's test hole SH23-01 indicates that the groundwater table is at a depth of about 5 m below existing site grades (within the glacial till-like soils). The depth to the static groundwater is expected to vary somewhat across the site but will generally follow the existing topography. Although the water level was measured at a depth of about 5 m, the seepage of groundwater into excavations is anticipated to be very low based on the hydraulic conductivity of the glacial till-like soil, even where the excavations will advance deeper than the groundwater level.

Intermittent perched groundwater is expected to be encountered on the surface of the low-permeability glacial till-like soils (within 1 m below the original grade), particularly during extended periods of wet weather.

## **4.3 Downhole Seismic Test Results**

Thurber completed downhole seismic testing at SH23-01. The testing included collecting shear wave velocity measurements at 1 m depth increments. The downhole shear wave velocity profile is shown on Appendix B.

The resulting  $V_{s30}$  of the soils at the school location is 550 m/s.

## **4.4 Sacrificial Anchor Test Results**

Thurber completed sacrificial testing of the three sacrificial anchors at the north end of the site. The results of the test loading of the sacrificial anchors indicate that the ultimate bond capacity of the glacial till-like soil to anchor grout is 270 kN/m at SA-1, 223 kN/m at SA-2, and 53 kN/m at SA-3.

Based on our experience with anchor testing within this deposit, the test results at SA-1 and SA-2 are in line with our expectations. Since SA-3 was installed 2 m shallower than SA-1 and SA-2, the lower bond strength value obtained is likely due to the weaker upper layer of glacial till. We will utilize a conservative bond capacity for initial design of permanent tieback anchors and will revise the design if future test results of production anchors indicate a higher capacity is available.

## 5. GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Based on our understanding of the project and the subsurface conditions we consider that the subsurface soils are favorable to complete the site grading and construct the associated permanent retaining walls as well as support the new school on conventional pad/strip footings and large mat foundations to support seismic elements.

The key geotechnical consideration for this project is the significant extent of site grading, including the excavation of a maximum 15 m high cut that requires a permanent wall and the construction of maximum 10 m high permanent MSE walls.

Furthermore, it is our opinion that the management of the soil to maximize reuse of excavated material to reduce costs will be the most important aspect of construction. To allow for the highest volume of reused materials while maintaining the static and seismic performance of the new school, the school foundations are expected to be constructed directly on undisturbed very dense glacial till-like soils. Furthermore, site services (water, storm sewer, sanitary sewer, gas, etc.) should also be coordinated to avoid, where possible, the geotextile / geogrid required for the MSE walls.

### 5.1 Seismic Design

In accordance with table 4.1.8.4.A of the 2020 NBCC (which will be adopted by the upcoming 2023 BCBC) the subject site should be classified based on the  $V_{s30}$  calculated from in situ measurements of shear wave velocity. As noted, the  $V_{s30}$  at the school location is 550 m/s.

The 2020 NBCC seismic hazard values for the 2,475-year return period earthquake obtained from GSC's website are provided in Table 5-1.

**Table 5-1:  $S_a(T)$ , PGA, and PGV for Site Designation  $X_{550}$  for 5% Damping and 2% / 50 Years Probability for the 2,475 Year Return Period Design Earthquake – 2023 BCBC (2020 NBCC)**

<b><math>S_a</math> (0.2, <math>X_{550}</math>)</b>	<b><math>S_a</math> (0.5, <math>X_{550}</math>)</b>	<b><math>S_a</math> (1.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (2.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (5.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (10.0, <math>X_{550}</math>)</b>	<b>PGA (0.05, <math>X_{550}</math>)</b>	<b>PGV (0.05, <math>X_{550}</math>)</b>
<b>(g)</b>							<b>(m/s)</b>
0.834	0.551	0.318	0.199	0.057	0.026	0.361	0.348

We understand that since the new school is considered a “high importance” structure, the Structural Engineer will require the 475-year return period earthquake seismic hazard values as part of their design, which are provided in Table 5-2.

**Table 5-2:  $S_a(T)$ , PGA, and PGV for Site Designation  $X_{550}$  for 5% Damping and 10% / 50 Years Probability for the 2,475 Year Return Period Design Earthquake – 2023 BCBC (2020 NBCC)**

<b><math>S_a</math> (0.2, <math>X_{550}</math>)</b>	<b><math>S_a</math> (0.5, <math>X_{550}</math>)</b>	<b><math>S_a</math> (1.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (2.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (5.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (10.0, <math>X_{550}</math>)</b>	<b>PGA (0.05, <math>X_{550}</math>)</b>	<b>PGV (0.05, <math>X_{550}</math>)</b>
<b>(g)</b>							<b>(m/s)</b>
0.411	0.0270	0.146	0.078	0.020	0.008	0.180	0.156

Since the site is underlain by very dense glacial till-like soils, the site is not expected to liquefy when subjected to the 2020 NBCC (2023 BCBC) 2,475-year return period design earthquake.

## 5.2 Site Preparation

The areas where the building foundations, retaining walls, roads, and parking will be constructed should be stripped of any loose, organic, and/or soft material to expose the very dense glacial till-like soils. From the subsurface information we have to date, we expect the depth of stripping required to be in the order of 0.8 m to 1.2 m from the existing ground surface.

Occasional cobbles and boulders are expected to be encountered during excavation, which will likely require special measures to remove. The excavation contractor should be made aware of this potential and will need to develop an excavation plan to remove these obstructions or to crush them on site for use as backfill materials.

We note that the exposed glacial till-like soil is susceptible to disturbance by construction equipment, especially during wet weather. To reduce the potential for disturbance, we recommend that the earthworks contractor account for the placement of at least 150 mm of 19 mm minus crushed gravel working surface in the overall excavation volume calculation. The working surface should be placed in relatively small sections as the excavation progresses to limit the duration that the till-like surface is exposed. The actual size of the sections will depend on weather conditions and the contractor's excavation methodology.

## 5.3 Backfill Materials and Compaction

The site grading for this project will involve significant volumes of cut and fill. To reduce costs, we recommend that the site fills consist of a combination of imported structural fill and reused excavated glacial till-like soils. We note that glacial till-like soils are difficult to work with and control water content, particularly during periods of wet weather. As such, the volume of reused till-like soil suitable for reuse will depend on the earthworks construction schedule and the methodology to protect the soil from water.

### **5.3.1 Imported Structural Fill**

Imported granular structural fill will be required to be placed and compacted throughout the site to achieve the grade to the design elevation. Any imported fill should consist of inert, durable, free-draining, well-graded granular material comprised of either pit run or crushed 75 mm minus sand and gravel conforming with the MMCD gradation requirements for subbase. The structural fill should be placed in maximum 300 mm thick lifts that are compacted to 95% of the material's modified Proctor maximum dry density (MPMDD) prior to placing subsequent lifts.

### **5.3.2 Potential Reuse of Glacial Till-Like Soil**

The reuse of glacial till-like fill may be considered throughout the project site except within the MSE wall geogrid reinforcement zone and where drainage is required.

- Where suitable, the placement and compaction of the glacial till-like fill will be subject to the following conditions:
- Any proposed glacial till-like fill should be free of pockets of high plasticity clay, organics, debris, cobbles larger than 100 mm in diameter, and boulders. These undesirable materials should be removed and exported from site.
- The material should be used during periods of dry weather and should not be used while raining.
- Proposed glacial till-like fill material should be stockpiled and covered with tarps to protect it from rain.
- The material must be placed at a water content within 1% of its optimum water content. If the material becomes too wet, it will likely need to be exported from site. If the material is too dry, it will be difficult to add water since the material is highly water sensitive and may also need to be removed from site.
- The material will need to be placed in relatively thin lifts in the order of 100 mm to 150 mm thick to achieve adequate compaction of 95% of the material's MPMDD.
- Thurber must review the placement and test the compaction of each lift of material; any material that does not achieve the required compaction must be removed and replaced.
- The prepared surface must be protected from rain and surface runoff during construction. This may require that tarps, cut off ditches, and placing structural fill over the prepared glacial till-like surface may be necessary. Any areas that become softened or disturbed will need to be excavated and replaced.

## **5.4 Permanent Retaining Walls**

As previously noted, to achieve the desired design grades, several permanent secant pile, MSE, and cast-in-place retaining walls will be required. The following sections provide a brief description of the secant pile and MSE wall designs; the cast-in-place wall designs will be provided by the Structural Engineer.

The permanent secant pile wall design will be provided on stand-alone Thurber design drawings; however, the permanent MSE wall design will be provided on the Civil Engineer's site grading drawings with Thurber providing input on the design details, sections, and notes.

### **5.4.1 Permanent Secant Pile Walls**

To accommodate for the excavation along the northeast corner property line, an approximately 300 m long retaining wall with exposed height up to approximately 15 m will be required. To satisfy the geometry constraints, the wall will be constructed as a tiered secant pile wall with the upper tier constructed as a cantilever wall with an exposed height of about 4 m and the lower tier constructed as an anchor tieback reinforced wall with a maximum 11 m exposed height. The finished face of these walls will be completed with a faux-bedrock shotcrete facing to satisfy aesthetic requirements.

### **5.4.2 Permanent MSE Walls**

Where the exposed height of the retaining wall exceeds 2.0 m and there is sufficient room behind the proposed wall for reinforcement and temporary excavation, geogrid reinforced MSE walls with modular block facing constructed with a 6-degree batter will be used. Walls up to about 6 m high will be constructed as a single wall and walls up to 10 m will be constructed as a tiered wall with minimum 2.5 m wide benches.

All MSE walls should be equipped with drainage tile connected to positive outlet to prevent any softening of foundation soils or water pressure build up in the reinforced backfill. The backfill within the geogrid reinforcement zone is expected to consist of imported structural fill.

## **5.5 Foundation Design**

Based on the subsurface conditions, and provided that the site is prepared in accordance with our recommendations, the school foundations may be supported on exposed very dense glacial till-like soil or engineered fill. However, for long-term performance under static and seismic performance, we strongly recommend that the school foundations be lowered such that they are founded on the glacial till-like soils.



The foundations can be designed using the Serviceability Limit State (SLS) bearing pressure, factored Ultimate Limit State (ULS) bearing resistance, and modulus of subgrade reaction presented in Table 5-2.

**Table 5-3: Foundation Design Parameters**

Foundation Soil	SLS Bearing Pressure		Factored ULS Bearing Resistance** (kPa)	Modulus of Subgrade Reaction*** (MPa/m)
	Footing Width	Bearing Resistance* (kPa)		
Engineered Fill Either Structural Fill or Reused Glacial Till-Like Fill	< 3.5 m	150	250	10
	3.5 m to 4.5 m	125		
	> 4.5 m	Thurber to be contacted to review.		
Glacial Till-Like Soil Very Dense / Hard Sandy SILT to SAND AND SILT	< 3.5 m	1,000	1,000	150
	3.5 m to 4.5 m	800		
	Up to 6.0 m	700		
	> 6.0 m	Thurber to be contacted to review.		

\* SLS Bearing Pressure based on limiting total post-construction settlement to 25 mm and differential settlement to 20 mm over a horizontal distance of 10 m.

\*\* Geotechnical resistance factor of 0.5 used per Canadian Foundation Engineering Manual, 2006

\*\*\* Modulus of subgrade reaction is to be applied to raft foundations and large pad footings based on a grid spacing of 0.3 m by 0.3 m. Thurber must be contacted if alternative spacing is required.

We note that the modulus of subgrade reaction is not a real soil parameter; it is a response of a soil system to load application and is dependent on several factors, including the size of the loaded area, the layering of the subgrade soils, the shear modulus (which is strain dependent), the direction of loading, the type of loading, rigidity of the foundation, and other factors. It is a calculation used by structural engineers to estimate shear force and bending moments in raft slabs and large footings but is not rigorously correct. For design expediency, we suggest that the stresses and moments in the footings and larger mat footings be estimated using the modulus of subgrade reaction values provided. Within about 1 m of the edges of the slab, the modulus should be doubled. According to the American Concrete Institute suggested procedures for design, the sensitivity of the design should be checked by using moduli of subgrade reaction equal to one-half and five times the estimates provided.

The sliding of foundations can be resisted by friction at the interface between concrete and the foundation soils. A factored coefficient of friction of 0.40, based on a resistance factor of 0.5 per the Canadian Foundation Engineering Manual, 2006, can be used for design.

The building foundations should be designed with a minimum dimension of 600 mm for pad footings and 500 mm for strip footings for confinement and frost protection purposes.

## **5.6 Drainage and Backfill Considerations**

The slab-on-grade of the new school should be underlain with an underslab drainage layer consisting of at least 150 mm of 19 mm clear crushed gravel to provide a capillary break and prevent water from contacting the underside of the slab-on-grade. In addition, an underslab and perimeter drainage system should be placed to collect and discharge stormwater into a suitable municipal drainage system that meets the City's bylaws and guidelines. We note that the subsurface conditions consist of low-permeability glacial till-like soils that are not suitable for infiltration of stormwater.

The underslab and perimeter drains should consist of minimum 100 mm diameter perforated PVC pipe surrounded with at least 150 mm of 19 mm clear crushed gravel that is either wrapped in filter cloth or covered with a minimum of 150 mm of birds-eye gravel. The underslab drain should be placed at a maximum 12 m horizontal centre-to centre (c/c) spacing configured to fit between footings, sumps, and elevator cores/stair cores, preferably in straight lines to reduce elbows in the pipe. We expect that the perimeter drain will be constructed on the outside of the building. To hydraulically connect the interior drains to the perimeter drain, weep holes should be installed through the foundation wall at approximately 2 m c/c horizontal spacing. Alternatively, the drainage discharge for the perimeter drain and interior drains may be separated.

Backfill to achieve finished grade elevation around the school should consist of free-draining 75 mm minus sand and gravel that are placed and compacted in discrete lifts to at least 95% MPMDD.

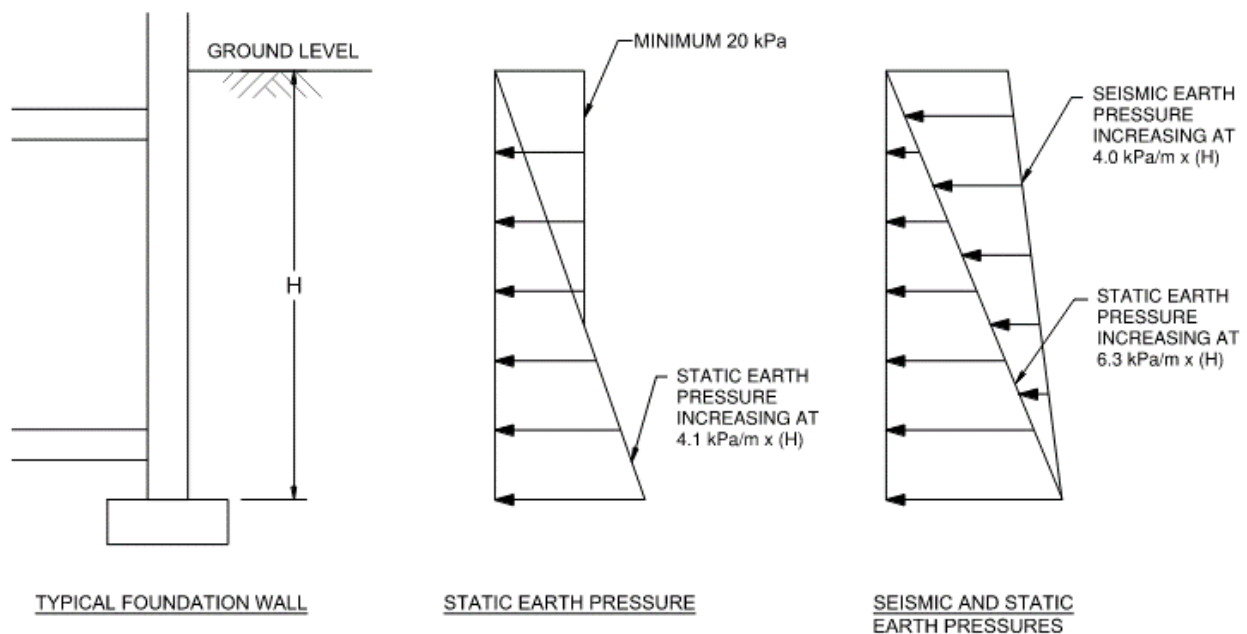
The finished grade around the building should be sloped such that surface runoff is carried away from the building and subsequently collected and discharged into the City drainage system. Where practical, the finished surface should also consist of impermeable materials to limit infiltration of stormwater into the ground.

The purpose of the drainage and backfill provisions in this section is to prevent the build-up of hydrostatic pressures against the underside of the slab-on-grade and foundation walls. The requirement for water-proofing and/or damp-proofing are the responsibility of the Architect or Building Envelope consultant.

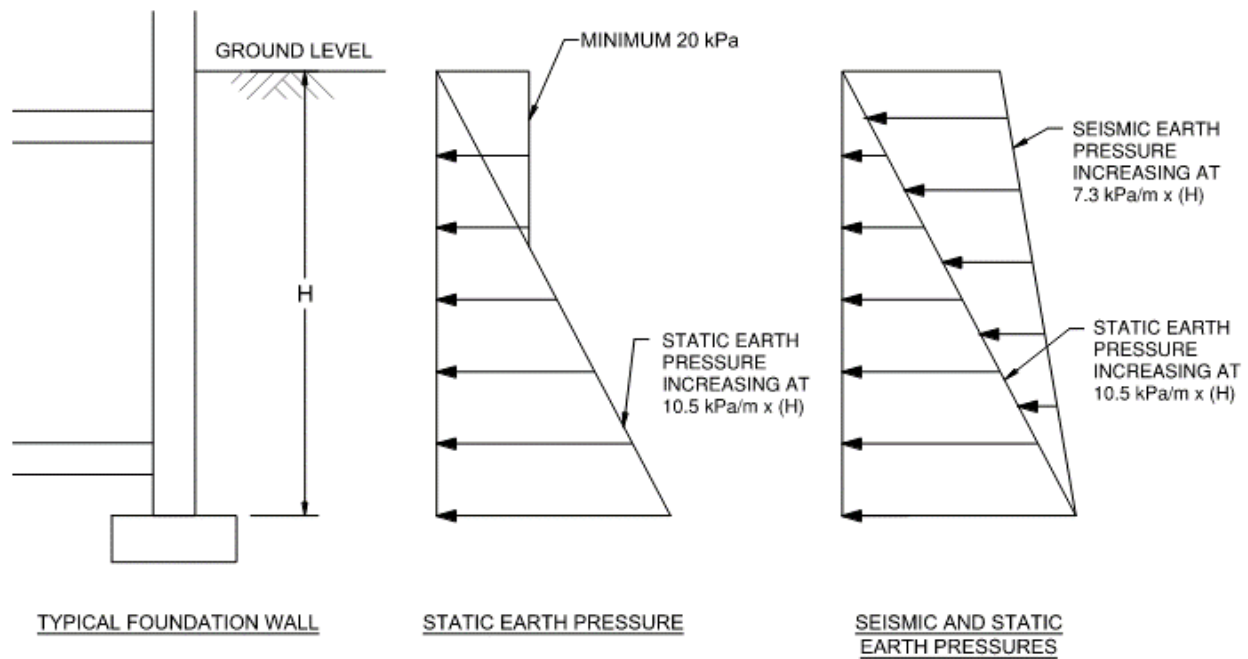
## 5.7 Lateral Earth Pressures Against Basement Walls

Lateral earth pressures against basement walls under static and seismic conditions will depend on whether the walls are “yielding” or “non-yielding”. “Yielding” walls are defined as walls that are able to rotate at least  $0.005H$ , and “non-yielding” walls are defined as walls that are unable to rotate at least  $0.005H$ , where  $H$  is the overall height of the wall.

Unfactored lateral earth pressures for “yielding” and “non-yielding” walls are provided in Figure 5.1 and Figure 5.2, respectively. The lateral earth pressures are applicable for walls with adequate drainage provided to prevent the build-up of hydrostatic pressures.



**Figure 5-1: Unfactored Lateral Earth Pressures for "Yielding" Walls**



**Figure 5-2: Unfactored Lateral Earth Pressures for "Non-Yielding" Walls**

## 5.8 Asphalt Pavement Design

We expect that asphalt pavement drive aisles and parking will be required to support fire, garbage, and loading truck access. We recommend the pavement design for onsite roads and parking areas comprise the following:

- Minimum 35 mm thick asphalt surface course, over
- Minimum 40 mm thick asphalt base course, over
- Minimum 200 mm thick 19 mm minus Crushed Granular Base, as defined by the Master Municipal Construction Documents (MMCD), compacted to at least 95% MPMDD, over
- Minimum 300 mm thick 75 mm minus Select Granular Subbase, as defined by the MMCD, compacted to at least 95% MPMDD, over
- Competent subgrade consisting of either the very dense glacial till-like soil or adequately placed and compacted backfill soils (imported structural fill or glacial till-like fill). The subgrade is to be reviewed by Thurber prior to placement of any Select Granular Subbase material.

We note that the thickness of the Select Granular Subbase layer may be reduced, depending on Thurber's review of the observed quality and relative density of the subgrade.



## 5.9 Methane

The results of the investigations by Thurber and others confirm that organic soils are not expected to underly the new building area. As such, it is our opinion that a methane ventilation system will not be required for the proposed building development.

## 5.10 Radon

Although radon measurements were not collected during the geotechnical investigation, review of the BC Centre of Disease Control – British Columbia Radon Map indicates that the project site is located with the “yellow” zone, which corresponds to 100 to 200 Bq/m<sup>3</sup> (Becquerels per cubic metre). The Mechanical Engineer should review and consider this concentration in their design.

## 6. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

Yours truly,  
Thurber Engineering Ltd.

Steven Coulter, M.A.Sc., P.Eng.  
Review Engineer

Conrad Tench, P.Eng.  
Senior Geotechnical Engineer

Thurber Engineering Ltd. Permit to Practice #1001319
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### Attachments

- Statement of Limitations and Conditions
- Drawing 35998 – 1: Site Location Plan
- Shear Wave Velocity Profile for SH23-01
- Thurber Test Hole Log – SH23-01
- Golder Associates Ltd., 2004 “Test Pit Location Plan” and Test Pit Logs
- Centennial Geotechnical Engineers Ltd., 2011 “Location Plan for Test Pits” and Test Pit Logs
- GeoPacific Consultants Ltd., 2020 “Site Plan” and Test Hole Logs

## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

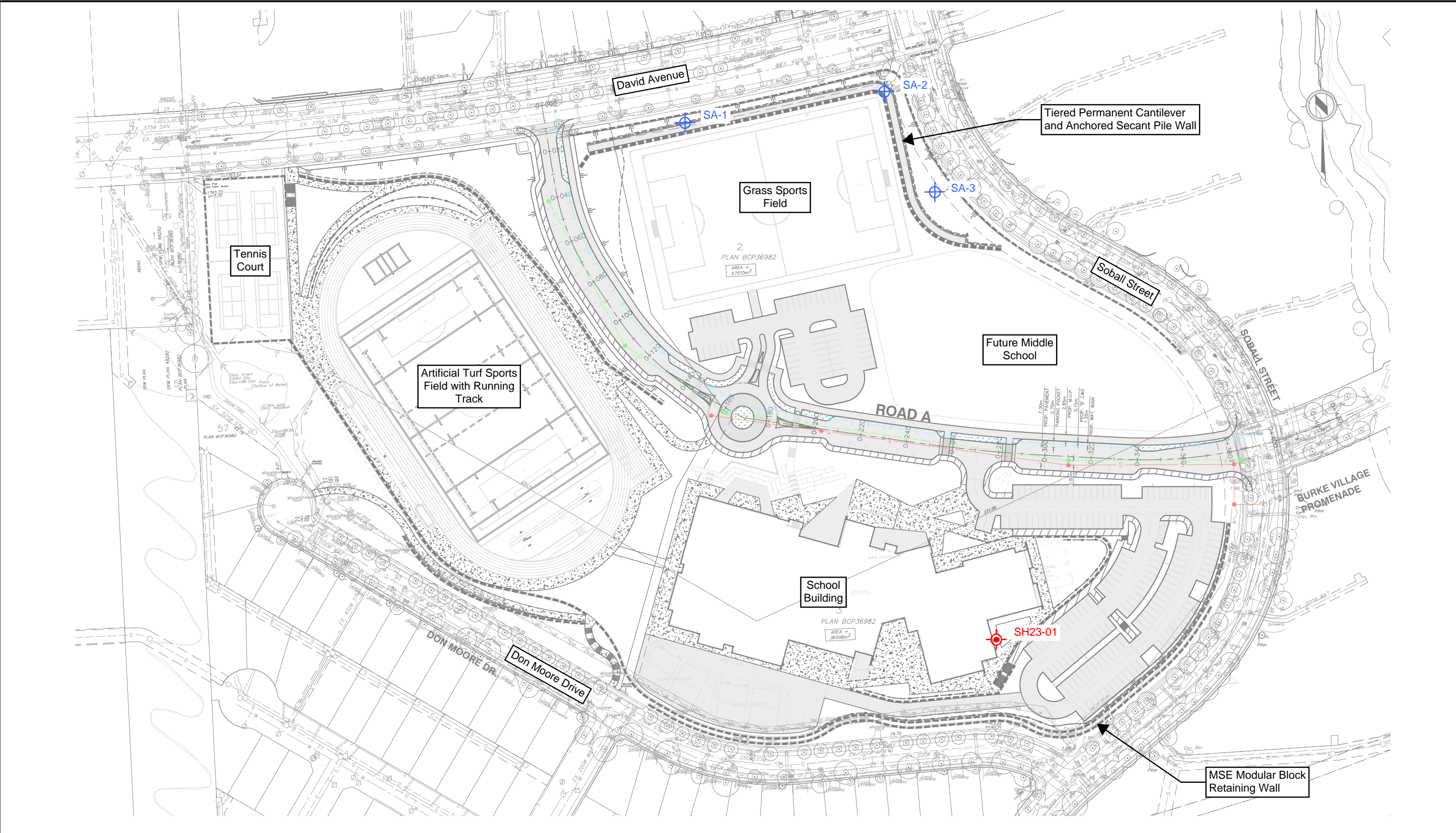
### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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<div>LEGEND / NOTES</div> <div><div><div><div></div></div><div>SA-1</div></div><div>- Approximate Sacrificial Anchor Location (2023)</div></div> <div><div><div><div></div></div><div>SH23-01</div></div><div>- Approximate Sonic-Drilled Test Hole Location (2023)</div></div> <div>Base plan from Aplin Martin Site Grading Plan dated April 12, 2023</div>	<div><div><div></div><div></div></div><div>THURBER ENGINEERING LTD.</div></div>	CLIENT NAME	BOARD OF EDUCATION OF SCHOOL DISTRICT 43 (COQUITLAM) AND THE CITY OF COQUITLAM		DRAWN BY	GS	DATE	2023-04-25
		DRAWING TITLE	SITE LOCATION PLAN		DESIGNED BY	GS	SCALE	1:1500
		PROJECT NAME AND LOCATION	BURKE MOUNTAIN SECONDARY/MIDDLE SCHOOL PROJECT COQUITLAM BC		APPROVED BY	CT	PROJECT No.	35998
					DRAWING / FIGURE No.	35998 - 1	REV.	0



## DOWNHOLE SEISMIC TEST DATA

**Client:** SD43 City of Coquitlam

**Test Hole ID** SH23-01

**Site:** Burke Mountain Secondary School

**Job Number:** 35998

**Date:** 23-Mar-23

**Source Offset:** 1.39 m

**Source:** Wood Beam

Geophone Depth (m)	Measured Travel Time from Source (ms)	Vertical Component of Travel Time (ms)	Incremental Shear Wave Velocity (m/s)
1.00	8.0	-	-
2.00	10.3	8.5	261
3.00	12.1	11.0	395
4.00	14.3	13.5	400
5.00	16.5	15.9	417
6.00	18.9	18.4	401
7.00	21.3	20.9	402
8.00	23.2	22.9	501
9.00	25.0	24.7	565
10.00	26.4	26.2	671
11.00	27.8	27.6	703
12.00	29.1	28.9	732
13.00	30.5	30.3	719
14.00	31.9	31.7	721
15.00	33.3	33.2	683
16.00	34.8	34.6	689
17.00	36.3	36.2	633
18.00	37.8	37.7	681
19.00	39.2	39.1	696
20.00	40.7	40.6	677
21.00	42.2	42.1	664
22.00	43.6	43.5	702
23.00	45.1	45.0	692
24.00	46.6	46.5	652
25.00	48.2	48.1	635
26.00	49.7	49.6	648
27.00	51.3	51.2	624

Vs30 = 550 m/s (Assuming 600 m/s for 28 - 30 m depths).

Shear wave travel time measurements by Thurber Engineering Ltd.

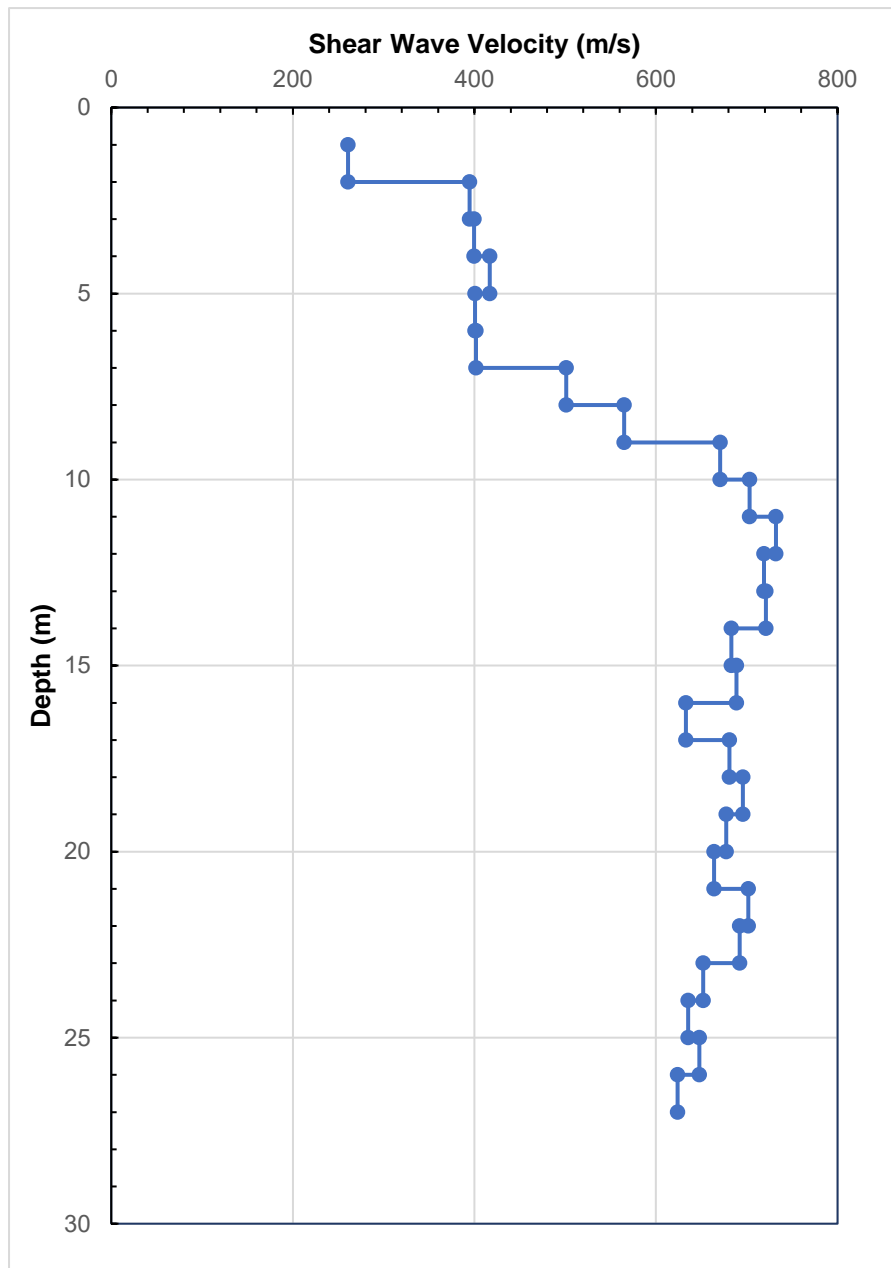




## VELOCITY PROFILE

**Client:** SD43 City of Coquitlam  
**Test ID:** SH23-01  
**Site:** Burke Mountain Secondary School

**Job Number:** 35998  
**Date:** 23-Mar-23  
**Source Offset:** 1.39 m  
**Source:** Wood Beam



Shear wave velocity measurements by Thurber Engineering Ltd.

## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

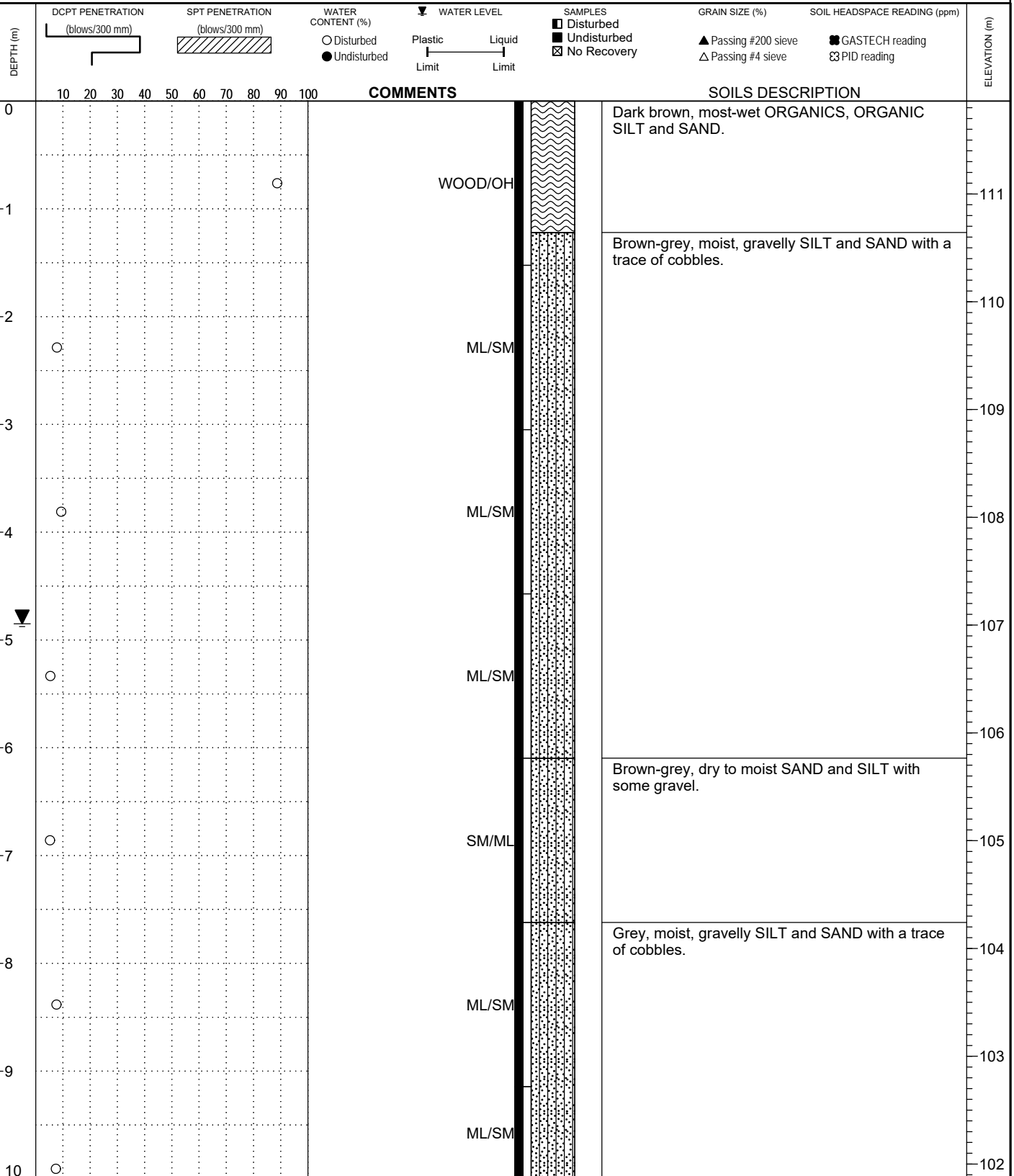
**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

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**METHOD:** Sonic

**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	ELEVATION (m)
			○ Disturbed ● Undisturbed	Plastic Limit Liquid Limit	Disturbed Undisturbed No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ☒ PID reading	
	10 20 30 40 50 60 70 80 90 100							
10								101
11								100
12								99
13								98
14								97
15								96
16								95
17								94
18								93
19								92
20								

## COMMENTS

## SOILS DESCRIPTION

Grey, moist, gravelly SILT and SAND with a trace of cobbles.

ML/SM

ML/SM

Brown-grey, moist GRAVEL, SILT and SAND.

ML/SM

Brown-grey, moist SAND and SILT with some gravel and a trace of cobbles.

SM/ML

Grey, moist, gravelly SILT and SAND with a trace of cobbles.

ML/SM

ML/SM

LOG OF TEST HOLE (COORDS + EL. EST.) 35998.GPJ THURBER\_MOM.GDT 23-4-27-THURBER\_MOM - BC OPERATIONS.GLB

## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	ELEVATION (m)
			○ Disturbed ● Undisturbed	Plastic Limit Liquid Limit	■ Disturbed ■ Undisturbed ☒ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ☒ PID reading	
20								91
21								90
22								89
23								88
24								87
25								86
26								85
27								84
28								83
29								82
30								

LOG OF TEST HOLE (COORDS + EL. EST.) 35998.GPJ THURBER\_MOM.GDT 23-4-27-THURBER MOM - BC OPERATIONS.GLB

## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
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**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	ELEVATION (m)
			○ Disturbed ● Undisturbed	Plastic Limit Liquid Limit	■ Disturbed ■ Undisturbed ☒ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ☒ PID reading	
30								81
31								80
32								79
33								78
34								77
35								76
36								75
37								74
38								73
39								72
40								

COMMENTS

SOILS DESCRIPTION

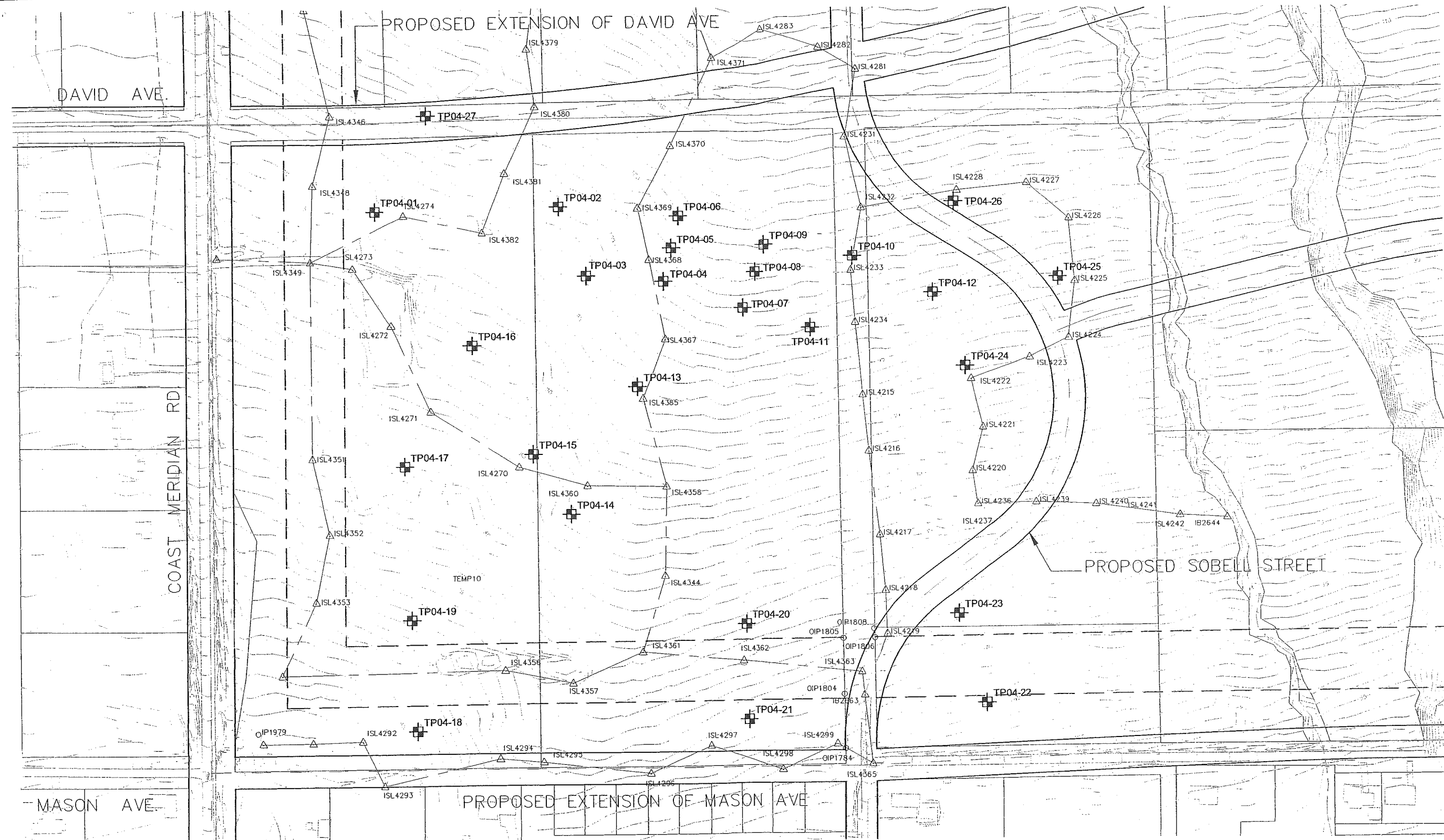
SM/ML

Grey, moist SAND and SILT with some gravel and a trace of cobbles.

End of hole at required depth.

CADD FILE: N:\Bur-Graphics\Projects\2004\1411\04-1411-057\Drafting\cad\04-1411-057-SK01.dwg

REVISION DATE: 04/04/27 2:44pm By: sreddy

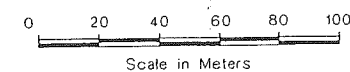



**LEGEND**

- TP04-1 Golder Test Pit Location
- BC Hydro Right of Way

**REFERENCE**

- 1) Base Plan provided by InterCAD.



PROJECT		WESBILD HOLDINGS LTD	
		SECONDARY SCHOOL AND PLAYING FIELD	
		DAVID AVE, COAST MERIDIAN RD, COQUITLAM, B.C.	
TITLE			
<b>TEST PIT LOCATION PLAN</b>			
			
PROJECT No.	04-1411-057	FILE No.	04-1411-057-SK0
DESIGN	RC	27APR04	SCALE AS SHOWN REV.
CADD	SRR	27APR04	
CHECK	RC	27APR04	
REVIEW	RC	27APR04	

**FIGURE 2**

## RECORD OF TEST PITTS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-1	0 - 0.15	Loose, moist to wet, dark brown, organic FOREST LITTER.	
	0.15 - 0.65	Loose to compact, moist to wet, brown, silty SAND, some gravel contains cobbles and boulders up to 0.4 m with organic rootlets.	Sa 1 0.2 - 0.3
	0.65 - 1.25	Dense to very dense, moist, grey, gravelly SAND, some silt to silty.	Sa 2 0.65 - 1.25
Termination of Test Pit at 1.25 m. No seepage noted.			
TP04-2	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER.	
	0.15 - 0.84	Loose, moist, brown, silty SAND, some gravel with organic roots contains cobbles up to 0.3 m.	Sa 1 0.4
	0.84 - 2.1	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.2
Termination of Test Pit at 2.1 m. No seepage noted.			

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-3	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 1.05	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with roots and wood fragments.	Sa 1 0.5
	1.05 - 1.6	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-4	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 0.7	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.3 m.	Sa 1 0.4
	0.7 - 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.35 m.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	



## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-5	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 1.1	Loose, moist, brown, silty SAND, some gravel with boulders up to 0.5 m.	Sa 1 0.4
	1.1 - 1.6	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles/boulders.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-6	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 1.1	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with organics (roots).	Sa 1 0.3
	1.1 - 1.75	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles/boulders up to 0.4 m.	Sa 2 1.5
		Termination of Test Pit at 1.75 m. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-7	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.8	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.2 m with roots.	Sa 1 0.3
	0.8 – 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	
TP04-8	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 – 1.1	Loose, moist, brown, silty SAND, some gravel. Contains cobbles and boulders up to 1 m with roots present.	Sa 1 0.4
	1.1 – 1.25	Dense to very dense, moist grey, SAND, some silt some gravel, contains cobbles (Very difficult to excavate).	
		Termination of Test Pit at 1.25, due to refusal. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-9	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	Sa 1 0.6
	0.9 - 1.65	Dense to very dense, moist, grey, SAND, some silt to silty some gravel, contains cobbles up to 0.3 m.	Sa 2 1.3
		Termination of Test Pit at 1.65 m. No seepage noted.	
TP04-10	0 - 0.1	Loose, moist, dark brown, FOREST LITTER.	
	0.1 - 1.2	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.6
	1.2 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, trace gravel, contains cobbles up to 0.15 m.	Sa 2 1.3
	1.5 - 2.15	Dense to very dense, moist, grey brown, SAND, trace to some silt trace gravel, contains cobbles up to 0.2 m.	Sa 3 2
		Termination of Test Pit at 2.15 m. Minor seepage of less than 1 liter/min noted at 1.2 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-11	0 - 0.25	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.25 - 1	Loose, moist, dark brown, sandy SILT, trace to some gravel contains cobbles up to 0.25 m.	
	1 - 1.2	Dense, moist, grey brown, SAND, some silt trace gravel.	
	1.2 - 2	Dense to very dense, moist to wet, grey SAND, trace to some silt, some gravel to gravelly, contains cobbles up to 0.3 m.	Sa 1 1.5
		Termination of Test Pit at 2 m. Seepage of less than 1 liter/min noted at 1.0 m depth at till interface.	
TP04-12	0 - 0.15	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.15 - 0.75	Loose, moist to wet, dark to med brown, sandy SILT (Topsoil like), trace gravel with organics (roots) with boulders up to 0.5 m.	Sa 1 0.4
	0.75 - 1	Dense, moist to wet, brown, silty SAND, some gravel.	Sa 2 0.8
	1 - 1.95	Dense to very dense, moist to wet, grey, SAND, some gravel to gravelly trace to some silt contains cobbles up to 0.3 m.	Sa 3 1.7
		Termination of Test Pit at 1.95 m. Minor seepage of less than 1 liter/min noted at 0.75 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-13	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.3
	0.9 - 1.8	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 2 1.6
		Termination of Test Pit at 1.8 m. No Seepage noted.	
TP04-14	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.4 m with roots.	Sa 2 0.3
	0.9 - 1.3	Dense to very dense, moist, grey, gravelly SAND, trace to some silt contains cobbles up to 0.3 m.	Sa 2 1.2
		Termination of Test Pit at 1.3 m. No Seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-15	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 1.22	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.6
	1.22 - 1.95	Dense to very dense, moist, grey SILT and fine SAND, to silt, some fine sand trace gravel contains cobbles up to 0.1 m.	Sa 2 1.25
	Termination of Test Pit at 1.95 m. No seepage observed.		
TP04-16	0 - 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 - 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.15 - 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 1 1.3
	Termination of Test Pit. No seepage noted.		
TP04-17	0 - 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 - 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.40
	1.15 - 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt, contains cobbles up to 0.15 m.	Sa 2 1.2
	Termination of Test Pit. No seepage noted.		

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-18	0 – 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 – 1.20	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.5
	1.20 - 2.30	Dense to very dense, moist, grey, fine sandy SILT, trace clay trace gravel.	Sa 2 2.0
		Termination of Test Pit. No seepage noted. Cobbles visible at bottom of Test Pit.	
TP04-19	0 – 0.05	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.05 – 1.0	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.0 – 2.3	Dense, moist, brown to grey, gravelly SAND, some silt to silty contains cobbles and boulders.	Sa 1 1.2
		Termination of Test Pit. No seepage noted. Refusal on boulder > 1 m.	
TP04-20	0 – 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 – 1.0	Loose, moist, brown, silty, SAND, some gravel contains cobbles up to 0.4 m with roots.	
	1.0 – 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel, contains cobbles.	Sa 1 1.3
		Termination of Test Pit. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-21	0 - 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 - 0.95	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles.	
	0.95 - 1.50	Dense to very dense, moist, grey, gravelly SAND, trace to some silt, contains cobbles up to 0.3 m.	Sa 1 1.4
	Termination of Test Pit. No seepage noted.		
TP04-22	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 1.0	Loose, moist, brown, silty sand with roots, contains cobbles\boulders up to 0.5 m.	
	1.0 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel.	Sa 1 1.5
	Termination of Test Pit. Minor seepage of less than 1 liter/min noted between 1.0 m and 1.25 m.		

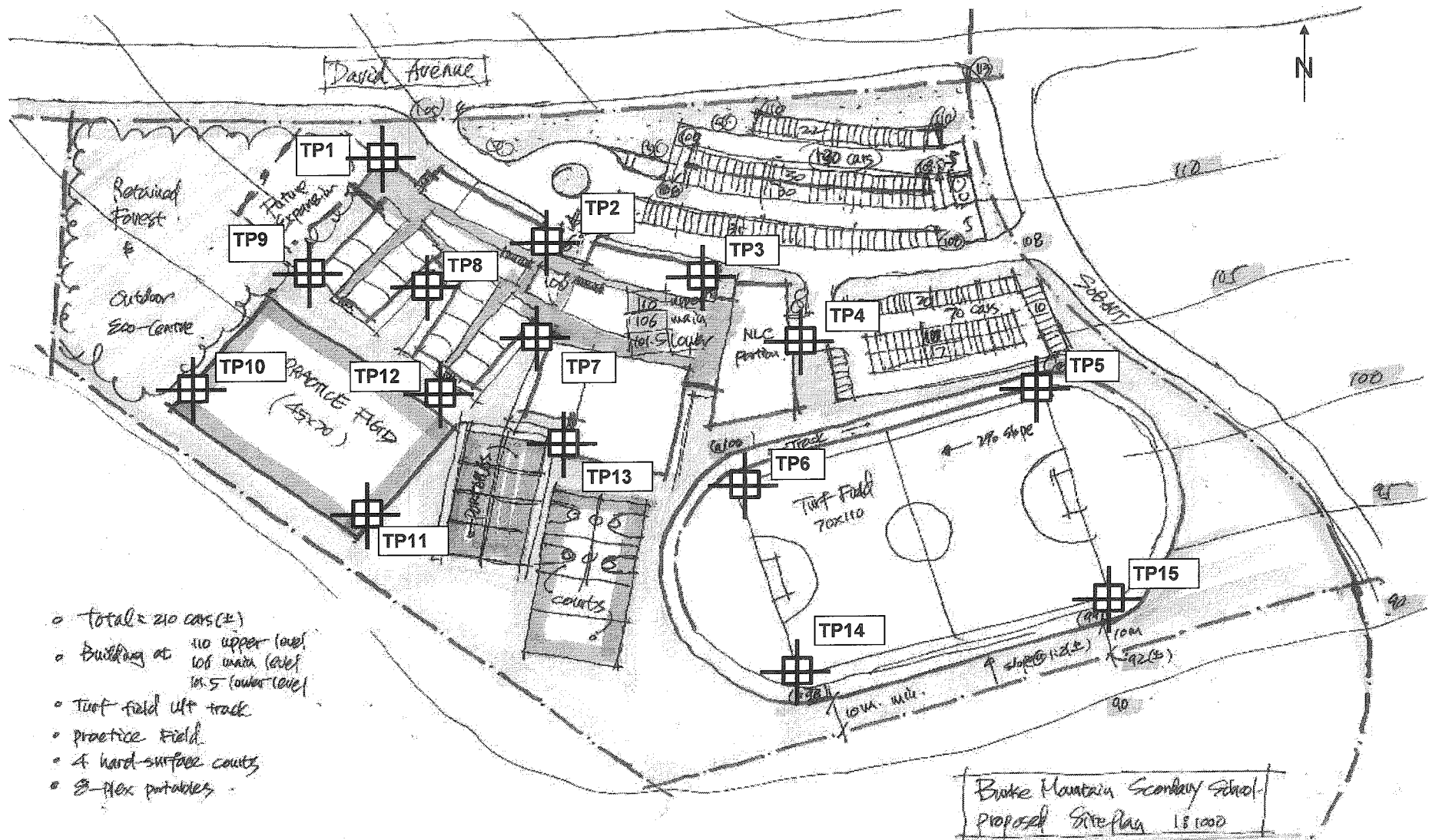


## RECORD OF TEST PITs

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-23	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 0.9	Loose, moist, brown, silty SAND, some gravel, contains cobbles.	
	0.9 - 1.15	Dense to very dense, moist, brownish grey SAND, some silt to silty, trace to some gravel, contains cobbles up to 0.1 m.	Sa 1 1.0
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted from 0.9 m to 1 m depth.	
TP04-24	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.55	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.55 - 0.7	Dense to very dense, moist, grey gravelly SAND, some silt to silty.	
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted at 0.55 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-25	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.6	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.6 – 2.05	Dense to very dense, moist, grey, gravelly SAND; some silt to silty, contains cobbles up to 0.4 m.	Sa 1 2
		Termination of Test Pit. No seepage noted.	
TP04-26	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.9	Loose, moist, brown, silty SAND, some gravel, with roots, contains cobbles up to 0.75 m.	
	0.9 – 1.6	Dense to very dense, moist, grey gravelly SAND, some silt contains cobbles up to 0.25 m.	
		Termination of Test Pit. Minor seepage of less than 1 liter/minute noted at 0.9 and 1.1 m depth.	
TP04-27	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 – 1.0	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.15 m.	
	1.0 – 1.5	Dense to very dense, moist, brownish grey SILT and SAND, some gravel to gravelly, contains cobbles up to 0.15 m.	Sa 1 1.4
		Termination of Test Pit. No seepage noted.	



- Total = 210 cars (±)
- Building at 110 upper level, 106 main level, 105.5 lower level
- Turf field w/ track
- practice field
- 4 hard-surface courts
- 8 flex portables



**LEGEND**

Approximate Test Pit Location

Reference: Proposed Site Plan, by CJP, Rec'd Nov. 2011

PROJECT NO: V11-139  
 PROJECT: Proposed Burke Mountain Secondary School  
 LOCATION: Soball Street and David Road, Coquitlam

**CENTENNIAL GEOTECHNICAL ENGINEERS LTD.**

Location Plan for Test Pits

DATE: 7-Nov-11	DRAWN BY: NC	SCALE: NTS	FIGURE: A1
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DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP1	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 333'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	29.1  18.7  5.4
1 -	SAND (SU2)	-	Rusty brown, silty, fine to medium grained sand, with some gravel, oec. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)	SM	
3 -	SAND (SU5)	-	Grey, silty, fine grained, with oec. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	
4 -	End of test pit @ 3.5 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP2	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 340'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	28.5
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -		-	10% fines		19.2
3 -	SAND (SU3)	-	Tannish grey, fine grained, some silt, with occasional 1/4" to 1/2" dia. gravel, 12% fines (loose)	SM	20.1
4 -	SAND (SU4)	-	Tan grey, silty, fine grained, with oec. pebbles, weathered till, PP ~ 3.0 TSF (dense)	SM	11.7
5 -	SAND (SU5)	-	Grey, silty, fine grained, with oec. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	7.9
	End of Test Pit @ 4.5 feet				
PP - Unconfined Compressive Strength Measurement Using a Poeket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School					
LOCATION: Soball Street and David Road, Coquitlam			TEST PIT LOG		
			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A2

DATE TESTED:		4-Nov-11	INSPECTOR:	NC	TEST PT :	TP3
TEST METHOD:		BACKHOE	SURFACE ELEVATION:		± 341'	
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS				USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)		SM	28.9
-	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)		SM	
-		-	11.3% fines			
1 -						
-						
2 -	SAND (SU3)	-	Tannish grey, silty, fine grained, with occasional 1/4" to 1/2" dia. gravel (loose)		SM	22.4
-						
3 -						
-	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)		SM	13.7
-						
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occasional pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM	11.6
-						
5 -			End of test pit @ 4.5 feet			
-						

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP4	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 335'					
DEPTH	(ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS							USC	MOISTURE CONTENT	
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)					SM	35.2		
-	SAND	-	Rusty brown, fine to medium grained sand, some silt,with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)					SM			
-	(SU2)										
1 -											
-											
-											
2 -											
-	SAND	-	Tan grey, silty, fine grained, occ. 1/4" to 1/2" dia. gravel (loose)					SM	30.4		
-	(SU3)		22.7% fines								
-											
3 -	SAND	-	Tan grey, silty, fine grained, occ. pebbles, weathered till, PP > 4.5 TSF (dense)					SM	12.1		
-	(SU4)										
-											
4 -	SAND	-	Grey, silty, fine grained, with pebbles, unweathered till (very dense)					SM			
-	(SU5)										
-											
-											
5 -			End of Test Pit @ 4.5 feet								
-											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											

<b>PROJECT No:</b> V11-139		<b>CENTENNIAL GEOTECHNICAL ENGINEERS</b>		
<b>PROJECT:</b> Proposed Burke Mountain Secondary School				
<b>LOCATION:</b> Soball Street and David Road, Coquitlam		<b>TEST PIT LOG</b>		
		<b>DATE:</b> 4-Nov-11	<b>DRAWN BY:</b> NC	<b>FIGURE:</b> A3

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP5	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 320'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	124.6
1 -					
2 -	SAND (SU2)	-	Tannish brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., 26% fines(loose)	SM	30.4
2 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 3.5 TSF (dense)	SM	10.3
3 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)	SM	10.9
4 -	End of test pit @ 3.5 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP6	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 332'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	26.5
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -	SAND (SU4)	-	Tan grey, silty, fine grained, with oce. pebbles, weathered till, PP > 4.5 TSF (dense)	SM	4.7
4 -	SAND (SU5)	-	Grey, silty, fine grained, unweathered till, PP > 4.5 TSF (v. dense)	SM	5.4
5 -	End of Test Pit @ 4.0 feet				
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School			TEST PIT LOG		
LOCATION: Soball Street and David Road, Coquitlam			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A4

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP7	
TEST METHOD: BACKHOE		SURFACE ELEVATION: $\pm 332'$			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	36.8
1 -					
2 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
3 -					
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	7.4
5 -	End of test pit @ 4 feet				
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP8	
TEST METHOD: BACKHOE		SURFACE ELEVATION: $\pm 330'$			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	41.7
1 -					
2 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 6" to 24" in dia., some organics, 10.2% fines (loose)	SM	28.6
3 -					33.2
4 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)	SM	10.1
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DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP9	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 321'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1)		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		34.0	
1 -		SAND (SU2)		-		Brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranges from 3" to 10" in dia., some organics (loose)		SM			
2 -		SAND (SU3)		-		Tan grey, silty, fine grained sand with occ. gravel (loose)		SM			
3 -		SAND (SU5)		-		Tan grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)		SM		7.3	
4 -		End of test pit @ 3.5 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP10	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 308'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		32.6	
1 -		SAND (SU2)		-		Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranges from 3" to 10" in diameter, some organics (loose)		SM			
2 -		SAND (SU4)		-		Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)		SM		10.0	
3 -		SAND (SU5)		-		Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM		5.2	
4 -		End of Test Pit @ 4 feet									
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No:				V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS			
PROJECT:				Proposed Burke Mountain Secondary School							
LOCATION:				Soball Street and David Road, Coquitlam				TEST PIT LOG			
				DATE:		DRAWN BY:		FIGURE:			
				4-Nov-11		NC		A6			



DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP11	
TEST METHOD: BACKHOE		SURFACE ELEVATION: $\pm 306'$			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	20.1
1 -	SAND (SU2)	-	Brown, fine to medium grained sand, some silt, with some gravel, o.c. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	16.9
2 -	SAND (SU3)	-	Tan grey, silty, fine grained sand with occ. gravel (loose)	SM	20.9
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with o.c. gravel, weathered till, PP > 4.5 TSF (dense)	SM	10.7
4 -	End of test pit @ 4 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP12	
TEST METHOD: BACKHOE		SURFACE ELEVATION: $\pm 318'$			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 6" to 24" in dia., some organics, 16.3% fines (loose)	SM	27.8
2 -	SAND (SU3)	-	Tan grey, silty, fine grained sand with occ. gravel (loose)	SM	26.1
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)	SM	6.6
4 -	End of Test Pit @ 4 feet				
5 -					
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School			TEST PIT LOG		
LOCATION: Soball Street and David Road, Coquitlam			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A7

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP13	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 341'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	24.6
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, from 3" to 10" in dia., some organics, 14.6% fines (loose)	SM	
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 4.0 TSF (dense)	SM	7.0
4 -	End of test pit @ 4 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP14	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 298'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	28.2
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. gravel, weathered till (dense)	SM	9.6
3 -	SAND (SU5)	-	Grey, silty, fine grained, with oec. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	8.6
4 -	End of Test Pit @ 4.0 feet				
5 -					
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School					
LOCATION: Soball Street and David Road, Coquitlam			TEST PIT LOG		
			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A8

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP15	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 298'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL - Dark brown, silty, fine grained sand with organic matter (loose)						SM		46.9	
- SAND (SU2)		- Brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in diameter, some silt (loose)						SM			
1 -										35.6	
2 -		SAND (SU4) - Tan grey, silty, fine grained, with oec. gravel, weathered till, PP > 4.5 TSF (dense)						SM		10.6	
3 -		SAND (SU5) - Grey, silty, fine grained, with oec. pebbles, unweathered till, PP > 4.5 TSF (v. dense)						SM		11.5	
4 -		End of test pit @ 4 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :			
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± ?'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -											
1 -											
2 -											
3 -											
4 -											
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School											
LOCATION: Soball Street and David Road, Coquitlam				TEST PIT LOG							
				DATE: 4-Nov-11		DRAWN BY: NC		FIGURE: A9			





# LEGEND:

△ TH# - TEST HOLE (TH) LOCATION

# SITE PLAN

\*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:



**GEOPACIFIC**  
VANCOUVER KALISPOPS CANADARY

11710 West 75th Ave  
Vancouver, B.C. V6P 6P2

T 604.494.0822  
F 604.433.3089

DATE:	30-Nov-2020		
DRAWN BY:	CG	APPROVED BY:	BR
		REVIEWED BY:	CG
SCALE:	NTS		

Burke Mountain Secondary  
3400 David Avenue, Coquitlam, BC  
TEST HOLE SITE PLAN

FILE NO.: 18327  
DWG. NO.: 18327-01

REVISIONS:  
A.  
B.  
C.

# Test Hole Log: TH20-01

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.5		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
1.2		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, some wood fibres, brown, moist-wet	0.5				
1.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, till-like, cobbly, brown-grey, slightly moist	1.2				
2.4		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, light grey, dry	1.8				
2.4		End of Borehole	2.4				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.01  
Page: 1 of 1

# Test Hole Log: TH20-02

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		6		
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8		6		
1.6		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	1.6		>50		perched groundwater observed @ 0.6 m
2.1		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	2.1		>50		DCPT refusal @ 1.1 m
6.1		End of Borehole	6.1				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.02  
Page: 1 of 1



# Test Hole Log: TH20-03

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoll</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		3		
0.6		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.6		6		perched groundwater observed @ 0.5 m
0.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, cobbly, grey, slightly moist	0.8				DCPT refusal @ 0.9 m
3.0		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	3.0				
End of Borehole			3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.03

Page: 1 of 1

# Test Hole Log: TH20-04

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		3		
0.3		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.9		3		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	1.2		5		
1.2		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry			>50		DCPT refusal @ 1.43 m
1.43					>50		
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.04

Page: 1 of 1



# Test Hole Log: TH20-05

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9188

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.0 to 0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.3 to 0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8		8		perched groundwater observed @ 0.6 m
0.8 to 3.0		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	3.0		>50		DCPT refusal @ 0.9 m
3.0 to 11		End of Borehole	11				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.05  
Page: 1 of 1

# Test Hole Log: TH20-06

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.6		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.6		4		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		> 50		DCPT refusal @ 0.85 m
1.8		End of Borehole	1.8				Auger refusal @ 1.8 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.06

Page: 1 of 1

# Test Hole Log: TH20-07

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3				
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8				
1.5		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.5				
1.5		End of Borehole	1.5				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.07  
Page: 1 of 1

# Test Hole Log: TH20-08

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.0		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0		4		
0.5		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.5		4		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		28		DCPT refusal @ 1.1 m
1.1					>50		
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.08

Page: 1 of 1

# Test Hole Log: TH20-09

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9185

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.3		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, brown, moist-wet	0.9		1		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.5		2		DCPT refusal @ 1.15 m
1.5		End of Borehole			>50		

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.09

Page: 1 of 1

# Test Hole Log: TH20-10

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.1		5		
0.5		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, wood fibres, brown, moist-wet	0.5		2		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		15		DCPT refusal @ 1.1 m
1.1					>50		
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.10

Page: 1 of 1



March 29, 2023

File No.: 35998

Board of Education of School District 43 (Coquitlam)  
1080 Winslow Avenue  
Coquitlam, BC V3J 0M6  
Attention: Meighan Scott, Architect AIBC, MRAIC, LEED AP BD+C – Senior Manager

and

City of Coquitlam  
3000 Guildford Way  
Coquitlam, BC V3B 7N2  
Attention: Ted Uhrich, MBCSLA - Acting Manager Parks and Facility Planning | Parks,  
Recreation, Culture & Facilities

## **BURKE MOUNTAIN SECONDARY SCHOOL DEVELOPMENT PROJECT**

Dear Meighan / Ted,

Thurber Engineering Ltd. (Thurber) has prepared this letter to support the Conservation Permit application to the City of Coquitlam for the Burke Mountain Secondary School development project. The purpose of this letter is to summarize the subsurface conditions based on geotechnical investigations by Thurber and by others, outline our understanding of the site grading requirements, and provide our recommendations and discussion of backfill considerations.

We understand that the project will be designed and construction in accordance with the upcoming 2023 British Columbia Building Code (BCBC), which will be adopted from the recently published 2020 National Building Code of Canada (NBCC).

It is a condition of this letter that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

### **1. PROJECT AND SITE DESCRIPTION**

The Burke Mountain Secondary School development is a combined project consisting of a new secondary school, play fields, tennis courts, basketball courts, asphalt roadways and parking, and park / landscaping areas. The project is being completed jointly with the Board of Education of School District 43 (Coquitlam) and the City of Coquitlam.

The overall development site is bordered by David Avenue to the north, Soball Street to the east, and Don Moore Drive to the south and south-west. The overall site has approximate dimensions of 300 m (north-south) by 450 m (east-west). The site was previously unoccupied and forested until recently when the site was cleared of trees, except for an area around the existing retention pond located on the south-west side of the site. The regional topography of the site generally slopes downward from the north to the south at a gradient of approximately 5% to 8% with an overall elevation change of 37 m from the highest point to the lowest point on the site.



## **2. BACKGROUND DOCUMENTS**

We understand that several geotechnical investigations were completed by others within the project site. The following relevant geotechnical reports that contain the results of geotechnical investigation completed on site were provided as background information and are attached to this letter for reference:

- “Preliminary Geotechnical Assessment, Secondary School and Playing Field, Northeast Corner of David Ave and Coast Meridian, Burke Mountain, Coquitlam, B.C.”, prepared by Golder Associates Ltd., dated April 30, 2004;
- Preliminary Geotechnical Investigation, Proposed Burke Mountain Secondary School, Soball Street and David Road, Coquitlam, BC., prepared by Centennial Geotechnical Engineers Ltd., dated November 27<sup>th</sup> 2011; and
- Geotechnical Investigation Report – Proposed Burke Mountain Secondary School, 3400 David Avenue, Coquitlam, B.C., prepared by Geopacific Consultants Ltd., dated December 10, 2022;

## **3. THURBER GEOTECHNICAL INVESTIGATIONS**

Thurber completed preliminary investigations on site in January and February 2023. These investigations consist of sacrificial anchor installation and testing and a 30 m deep test hole for downhole seismic shear wave velocity measurements. The results of these investigations were not completed at the time this letter was prepared. We will summarize the results of the investigations, including any subsequent investigations completed, in a future report for the Building Permit application.

## **4. SUBSURFACE CONDITIONS**

The geotechnical reports completed by others include the results of a total of 10 solid-stem auger test holes that were advanced to depths ranging from 1.5 m to 6.1 m as well as 41 excavator-dug test pits that were advanced to depths ranging from 0.7 m to 2.3 m below the original site grades.

Thurber has completed several projects in the Burke Mountain area that have included geotechnical investigations, which have included solid-stem auger test holes, sonic-drilled test holes, downhole seismic testing, and excavator-dug test pits.

Based on our knowledge from previous projects, the geotechnical reports by others, and published surficial geology mapping and water well logs, the subsurface conditions generally consist of the following:

- Organic topsoil, typically very soft to soft, with trace to some gravel and a thickness ranging from 0.2 m to 0.5 m; over
- Loose to compact sand and gravel with a thickness ranging from 0.4 m to 1.0 m; over





- Very dense silty sand and gravel (glacial till-like) is anticipated to be encountered at a depth of about 0.5 m to 1.5 m below original site grades. We note that all of the test pits and test holes, including the 30 m deep test hole completed by Thurber in February 2023, encountered and were terminated within the very dense glacial till-like deposit; over
- Sandstone / Siltstone bedrock. The surface of the bedrock was not encountered in the test hole completed by Thurber or within the background reports by others; however, published surficial geology mapping and water well logs indicate that the surface of the bedrock is expected to be encountered at depths in the order of 50 m to 100 m below original site grades.

The regional static groundwater table will be encountered at a depth of approximately 5 m to 15 m below original site grades (within the glacial till-like soils). We note that the hydraulic conductivity of the glacial till-like soils is very low and that significant drainage of the static groundwater is not expected.

Intermittent perched groundwater will be encountered on the surface of the low-permeability glacial till-like soils, particularly during extended periods of wet weather.

## **5. SITE GRADING AND RETAINING WALL REQUIREMENTS**

The anticipated subsurface conditions are considered favorable for the site re-grading required for the proposed development with a combination of mechanically reinforced earth modular block walls, cast-in-place walls, and cantilever / tieback anchor reinforced secant pile walls.

We understand from the site grading plan prepared by the Civil Engineer (Aplin & Martin Consultants Ltd.) that the site will require permanent cut walls as deep as 15 m within the northern portion of the site and permanent fill walls as high as 10 m within the southern portion of the site. In addition, the site grading plan indicates combination cut / fill walls with an overall height of about 8 m will be required within the central portion of the site. Refer to the site grading plan for wall locations and heights.

Thurber is involved in ongoing collaboration with the Civil Engineer to develop the retaining wall design. We note that the retaining wall designs are in progress and that design drawings suitable for Building Permit applications will be available within approximately 2 to 3 weeks. The walls will be designed in accordance with the upcoming 2023 BCBC under both static and seismic loading conditions.

At this stage the walls are expected to be designed as follows:

- The northern wall along David Avenue and Soball Street is an overall approximately 15 m high cut wall consisting of a permanent tiered secant pile wall system as follows:
  - The upper wall (adjacent to the property line) will consist of a cantilevered secant pile wall offset approximately 2 m from the property line with a maximum finished exposed height of 4 m. The wall will be embedded approximately 6 m to provide sufficient permanent cantilever support.



- The lower wall will consist of a secant pile wall with one (1) to three (3) rows of permanent tieback anchors. The wall will be horizontally offset from the upper wall by approximately 8 m and will have a maximum finished exposed face of 10 m. Horizontal drains are expected to be installed (drilled upward from the wall face to the property line at an angle of about 20 degrees) to reduce the hydrostatic pressures on the lower wall. The wall will be embedded approximately 6 m below final grade.

The secant pile walls described above will include a permanent reinforced shotcrete facing.

Thurber will prepare stand-alone permanent design drawings for the tiered secant pile wall system under a separate cover letter for the Building Permit submission.

- The southern wall along Don Moore Drive and portions of Soball Street (excluding adjacent at the proposed tennis courts) and the central wall along the northern side of the proposed sports field are fill walls that will consist of permanent modular blocks and geogrid reinforcement.

The walls will be tiered with maximum overall heights in the order of 10 m that are separated into 5 m high exposed heights separated horizontally by 2 m wide tiers. The geogrid reinforcement zone will vary, with the maximum geogrid zone approximately 8 m to 10 m beyond the lower tier wall facing. Drainage provisions will include a chimney drain directly behind the wall facing and drainage zones below the base of the geogrid / geotextile zone.

The design notes, sections, and details for these walls will be provided by Thurber to the Civil Engineer for inclusion in their Building Permit design drawings.

- The retaining wall along the west and south sides of the proposed tennis court area is expected to consist of a maximum 4 m high cast-in-place structural wall. Thurber will provide the Structural Engineer with the applicable bearing pressures and lateral earth pressures in our future geotechnical design report, which will be included in the Structural Engineer's design drawings for the Building Permit submission.

## **6. BACKFILL CONSIDERATIONS**

To save material hauling costs, we expect that portions of the cut material from the northern portion of the site will be used as fill material within the southern portion of the site. The near-surface organic topsoil will not be suitable for re-use and is to be disposed of off-site. However, the loose to compact sand and gravel and the silty sand and gravel glacial till-like soil may be re-used as backfill to raise grade.

The re-use of the sand and gravel material will be relatively straightforward in a variety of weather conditions and may be placed throughout the site, except for wall drainage zones and within the road base portion of the pavement section.



The glacial till-like is very sensitive to water content and must be within approximately +/- 2% of its optimum water content when placed and compacted. If the glacial till-like soil is too dry or too wet, it may not be possible to achieve adequate compaction. In addition, the glacial till-like soil must be placed in relatively thin lifts (in the order of 100 mm to 150 mm thick). The earthworks contractor (yet to be engaged) must be experienced in handling, placing, and compacting glacial till-like soils.

If handled correctly during periods of dry weather, the glacial till-like soil may be used as backfill throughout the site (including within the geogrid / geotextile zones) except for within the wall drainage zones and within pavement structures. If handled incorrectly or during periods of wet weather, the glacial till-like material may need to be exported from site and structural fill consisting of well-graded, free-draining sand and gravel will need to be imported. We also note that filter fabric will be used where required at interfaces between the proposed glacial till-like soil backfill, imported structural fill, and drainage zones, where appropriate.

Thurber will include backfill material specifications and compaction requirements in our future geotechnical report.

## **7. CLOSURE**

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

Yours truly,  
Thurber Engineering Ltd.

Steven N. Coulter, M.Sc., P.Eng.  
Review Principal

Conrad Tench, P.Eng.  
Project Engineer

Thurber Engineering Ltd. Permit to Practice #1001319
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### **Attachments**

- Statement of Limitations and Conditions
- Golder Associates Ltd. Report dated April 30, 2004
- Centennial Geotechnical Report dated November 27, 2011
- Geopacific Consultants Ltd. Report dated December 10, 2022

## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

**Golder Associates Ltd.**

500 - 4260 Still Creek Drive  
Burnaby, British Columbia, Canada V5C 6C6  
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Fax (604) 298-5253



**REPORT ON**

**PRELIMINARY GEOTECHNICAL ASSESSMENT  
SECONDARY SCHOOL AND PLAYING FIELD  
NORTHEAST CORNER OF DAVID AVE AND  
COAST MERIDIAN, BURKE MOUNTAIN  
COQUITLAM, B.C.**

Submitted to:

Wesbild Holdings  
1450 Johnson Street  
Coquitlam, B.C.  
V3E 2T1

**DISTRIBUTION:**

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- 2 Copies - Golder Associates Ltd.

April 30, 2004  
04-1411-057



**Golder Associates Ltd.**

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Burnaby, British Columbia, Canada V5C 6C6  
Telephone (604) 296-4200  
Fax (604) 298-5253



April 30, 2004

04-1411-057

Wesbild Holdings  
1450 Johnson Street  
Coquitlam, B.C.  
V3E 2T1

Attention: Mr. Don Moore

**RE: PRELIMINARY GEOTECHNICAL ASSESSMENT  
SECONDARY SCHOOL AND PLAYING FIELD  
NORTHEAST CORNER OF DAVID AVE. AND COAST MERIDIAN  
BURKE MOUNTAIN  
COQUITLAM, B.C.**

Dear Mr. Moore:

As requested, Golder Associates Ltd. (Golder) has completed a preliminary geotechnical assessment for the proposed secondary school and playing field development to be situated on a 40 acre land parcel bordering the southeast corner of David Avenue and Coast Meridian in Coquitlam, B.C. Verbal authorization to proceed was received April 21, 2004. The purpose of this preliminary geotechnical assessment was to evaluate the soil and groundwater conditions at the site and provide preliminary geotechnical recommendations on the suitability of the intended development.

The scope of this assessment is limited solely to the geotechnical aspects of the project and does not include any investigation, analytical testing or assessment of potential soil and groundwater contamination or for any bio-environmental considerations.

This report should be read in conjunction with the "Information and Limitations of This Report" which is appended following the text of the report. The reader's attention is specifically drawn to this information as it is essential that it be followed for the proper use and interpretation of this report.



## **1.0 PROJECT SITE**

The proposed development site is a 40 acre property located on the south east side of the intersection of David Avenue and Coast Meridian on Burke Mountain in Coquitlam, B.C. Immediately west of the site is Coast Meridian, to the north is the proposed extension of David Avenue. Bordering the site on the east side and south sides are the proposed Sobell St. and Mason Ave. respectfully. The site is undeveloped at present and appears to be vegetated by mature second growth timber with a BC Hydro right of way passing through the site in an east west as well as north to south orientation. A few footpaths and overgrown forestry trails are also present on the site. Based upon a site visit and review of the topography survey supplied by InterCAD, the terrain of the site generally slopes to the south, , ranging from about Elevation 113 m geodetic datum at the north end of the property to about Elevation 76 m at the south end, over a distance of about 410 m.

## **2.0 PROPOSED DEVELOPMENT**

Based on discussions with Wesbild, it is understood that the proposed site development will include a secondary school, all weather artificial turf playing field, associated parking, as well as a residential development along the southern and western limits of the school and playing field. No design details were available at the time of preparation of this report.

## **3.0 FIELD EXPLORATION**

The field exploration work for the project was completed on April 22<sup>nd</sup> and 23<sup>rd</sup>, 2004. The field exploration work was completed using a small excavator supplied by Wesbild. We understand the small excavator was chosen for its ability to navigate around the mature vegetation with minimal disturbance versus a medium capacity excavator.

The test pitting program comprised 27 test pits extending to depths varying from approximately 1.3 m to 2.33 m below the existing site grade. Access to the test pits was cleared using the track mounted excavator supplied by Wesbild. All test pits were advanced to practical refusal. The test pit locations were established by Wesbild and surveyed on the site prior to the test pitting. A Wesbild representative was present during the test pitting to aid in locating the test pits and directing the excavator through the mature vegetation.

The test pits were sampled and logged by a representative from Golder. Disturbed soil samples collected from the test pits were taken to the Golder laboratory for future examination, classification and testing if required. Prevailing groundwater levels were recorded at the time of the field work. Upon completion of the field exploration, the test pits were backfilled with the excavation spoil.

## **4.0 SOIL AND GROUNDWATER CONDITIONS**

Detailed descriptions of the subsurface conditions encountered at the test holes are presented in the Record of Test Pit sheets in Appendix A.

The typical indigenous soil profile comprised a mantle of sand, some silt to silty, overlying till-like deposits consisting of sands with varying silt, gravel and cobble contents. A veneer of forest litter and topsoil was encountered at all of the test pit locations. The approximate locations of the test pits are shown on the attached Site Plan. More detailed description of the inferred subsurface conditions is presented below. It should be recognized that subsoil stratigraphy and characteristics varied between individual test holes. Similar and potentially greater variation in subsurface conditions should be expected between the test pits and elsewhere over the site.

### **4.1 Forest Litter**

Forest litter was encountered in all test pits. The forest litter generally comprised black topsoil with decomposing organics. The forest litter thickness varied from a general minimum of 0.1 m to a maximum of 0.25 m thick in TP04-11.

### **4.2 Sand to Silty Sand Strata**

The native deposits encountered beneath the forest litter in all test pits except TP04-12, consisted of a fine to medium grained sand and/or silty sand with a trace to some gravel and a trace of roots with cobbles. The surficial sands were typically brown to rusty brown and were considered to have a loose to compact relative density. Based upon testpit observations it is inferred that this layer was previously disturbed, perhaps during logging and grubbing operations that removed forest growth extending into this stratum. The surficial sand layer generally ranged from about 0.45 m to 1.1 m in thickness. TP04-12 did not have this sand stratum present underlying the forest layer, a layer of moist dark brown silt containing boulders was encountered which was underlain by glacial till.

Considerable moisture was found present within the surficial sand to silty sand layer, which is considered to act as a natural drainage aquifer for the mountainside. The surficial soils were at or near saturation at the time of our investigation.

### **4.3 Glacial Deposits**

The native sands were underlain by highly variable Vashon Drift deposits ranging from silty sands to gravelly sands with some to numerous cobbles and boulders. Boulders encountered at some of the test pit sites ranged up to 2 m across, although experience in



the area has indicated that boulders much greater than 2 m can be found within the glacial deposits. The relative density of these deposits was generally dense to very dense and the materials were typically grey in colour. Some portions of the deposits exhibited minor seepage, indicating that these zones are likely water bearing.

#### 4.4 Groundwater

At the time of the field exploration work, a groundwater table was not observed within the depths explored at the test hole locations. Minor groundwater seepage was observed within seven test pits within a north south alignment including test pits TP04-10, 11, 12, 22, 23, 24, and 26.

### 5.0 SEISMIC CONSIDERATIONS

Seismic design in the Greater Vancouver area is based on the 1995 National Building Code of Canada (Section 4.1.9 entitled "Live Loads due to Earthquakes") and Commentary J, a supplement to the NBCC. The objective of the earthquake resistant design requirements of the NBCC is to prevent structural collapse and loss of life. Structures designed in conformance with NBCC provisions should be able to resist moderate earthquakes without significant damage and major earthquakes without collapse. Collapse is defined to be a state where occupants can no longer exit the building because of structural failure. The latter implies that key structural components of a building and supporting foundations necessary to ensure the buildings post-earthquake stability must be protected against collapse under design levels of shaking.

The NBCC considers the maximum design level earthquake, i.e., a major earthquake, as one which results in ground accelerations and velocities having a 10% chance of being exceeded in 50 years (1 in 475 year earthquake). For the Greater Vancouver area, the magnitude of the design major earthquake is M7. A moderate earthquake is commonly taken to be one with peak firm ground acceleration having a 40% chance of being exceeded in 50 years (1 in 100 year earthquake). The following table presents the peak horizontal firm ground accelerations for the design return periods.

**TABLE 1- SUMMARY OF SEISMIC RISK**

<u>Risk Level</u>	<u>Peak Horizontal Firm Ground Acceleration</u> ( $a_{max}$ )
40% in 50 years (1 in 100 year event)	0.09g
10% in 50 years (1 in 475 year event)	0.23g

According to the seismic design provisions of the 1995 NBCC, this area is classified as a Zone 4 area ( $ZA=ZV=4$ ). Firm ground implies bedrock or dense glaciated soils.

## **5.1 Site Assessment**

Based on the subgrade soil and groundwater conditions encountered at the test pit locations, it is believed that the stiff to very stiff fine-grained and the dense to very dense sandy glacial deposits are liquefaction resistant and are not expected to experience significant loss of stiffness resulting from intense earthquake motions. The surficial loose to compact sands and silty sands may be susceptible to considerable strength loss where saturated conditions prevail.

It is anticipated that the foundations for the proposed school, as well as playing field subgrade, will be situated within the glacial deposits. Where structural fills are required to achieve design grades for the school and playing fields or other structures, the fills should be supported on the dense strata.

## **5.2 Foundation Factor**

For purposes of estimating seismic base shear acting on the proposed structures as per Table 4.1.9C of the NBCC, it is recommended that a foundation factor  $F = 1$  is used. The building foundation systems must be designed to withstand the base shear loads and any potential uplift loads.

# **6.0 SITE PREPARATION AND FOUNDATION DESIGN CONSIDERATIONS**

## **6.1 General**

The soil profiles encountered at the test pit locations were generally consistent with Golder's experience in the general region and are considered to be suitable for support of the proposed school and other auxiliary facilities including an all weather artificial turf playing field. The most significant considerations for the proposed development are the use of select materials structural fills, and temporary/permanent control of surface water and groundwater seepage entering the proposed building and playfield areas.

The glacial deposits in the area are sensitive to disturbance or saturation. Water from groundwater seepage or rainfall combined with construction disturbance could substantially weaken the prepared subgrade soils, particularly if construction takes place during the wetter winter months. These deposits will also be rendered unworkable should the insitu moisture content be permitted to increase above existing levels. Consequently, significant efforts should be undertaken to protect the prepared subgrade where these deposits will be relied upon for supporting light structures such as floor slabs, sidewalks, exterior slabs etc.

Temporary and permanent stability of cut and fill slopes will be contingent on control and management of surface water flows. The sandy silt and silty sand glacial deposits are considered to be prone to erosion, which may be manifested as rilling, scouring and localized instability when exposed to uncontrolled surface water flow. Consequently, the development plan should include measures to control and divert surface water flows away from the building area for both temporary and permanent conditions.

Groundwater seepage encountered within the areal limits of the building footprints or designated fill areas must be collected in a controlled manner and directed away to a suitable discharged area or facility. Water must not be permitted to pond within the prepared building or designated fill subgrade areas due to the moisture sensitivity of the native subgrade deposits, particularly where high bearing capacities are desired within the strong till-like materials, or potential settlements are required to be limited.

Groundwater infiltrating into the playing field would have to be properly accommodated by an engineered drainage system as part of the playing field design. This is typically engineered to meet the specific playing field specifications and coordinated to be compatible with the geotechnical subgrade preparations.

## **6.2 Site Preparation**

Based on the preliminary information available, we recommend that the surficial top soil and mixed sands/silts of variably density and high water content, be stripped to expose undisturbed natural till like soils. This will provide a suitable subbase for founding the both the foundations for the school, and the subgrade structure for the playing field. The soil conditions exposed at the anticipated subgrade levels are expected to predominantly comprise silty sands and/or sandy silts (including cobbles and / or boulders).

It is recommended that all organic material and loose sands and silts be removed from the proposed building footprint to expose the underlying native deposits. Due to the high moisture contents observed within these materials, it is not recommended that these materials be relied upon for reuse as structural fill as the effectiveness of compaction efforts may be limited unless the moisture can be reduced.

The surficial sands encountered at the test hole locations are not considered suitable for foundation support of the proposed structure unless sufficient compaction can be achieved to mitigate undesirable differential settlements and the risk for localized liquefaction within the moist and possibly saturated loose deposits. Foundations should be located below these materials or if required on compacted structural fill.

Excavators and other earth moving equipment should progressively retreat from the prepared subgrade areas and construction equipment should not be permitted to operate on the approved final subgrade. The prepared subgrade should also be graded to provided gravity drainage away from the prepared area to a collector ditch or sump.

Any disturbance of the prepared subgrade soils resulting from exposure to inclement weather or construction traffic should be removed to expose the underlying undisturbed deposits. All prepared building subgrades shall be reviewed on site and approved by the geotechnical engineer prior to placement of structural fills and/or drainage materials.

### **6.3 Structural Fill**

#### **6.3.1 Select Native Deposits**

The native glacial soils consisting of variable silty sands and sandy silts are considered to be suitable for structural fills at their existing in-situ moisture contents and provided that they can be compacted as recommended below. However, as indicated earlier, these deposits are sensitive to moisture increases and can be rendered unworkable should the natural moisture contents be allowed to increase. Native glacial excavation spoils intended to be used for structural fill beneath buildings, or within the upper section for a roadway or playing field *must be well sorted and free of coarse aggregate greater than 100 mm across*. Excavation spoils which are planned to be placed as structural fills should, where possible, be placed as soon as these materials are excavated from the borrow area. If construction sequencing requires stockpiling of select excavation spoils, the stockpiles should be placed over prepared areas stripped of organics and protected from water saturation.

Structural fills placed beneath load bearing structural elements should be placed over prepared subgrades as described above. These structural fills should be placed in uniform horizontal lifts not exceeding 300 mm in thickness and should extend at least "0.5D" beyond the footing edges where "D" is the depth of structural fill placed beneath the footing. The fills should be compacted to a minimum of 95% of MPD. Structural fills supporting floor slabs, sidewalks, patio decks, etc. should be placed in uniform horizontal lifts not exceeding 300 mm in thickness and compacted to a minimum of 90% of MPD. As describe above, such structural fills should extend at least 0.5D beyond the peripheral limits of the slabs on grade or other settlement sensitive elements.

Structural fills supporting utility services should be placed in uniform lifts as described above and extend at least to the edges of the service trenches (excavated within the undisturbed native deposits), or 0.5D beyond the pipe haunches, whichever is greater.

### 6.3.2 Import Fills

Imported fills should consist of a clean (free of organic, man made materials and environmental contaminants), well-graded sand and gravel having a maximum aggregate dimension of 75 mm and a maximum 5% passing the USS 200 sieve (0.075 mm). Imported fills should come from established borrow pits. If suitable fills become available from other sources (such as nearby excavations, etc.), the acceptance of such materials should be made on the basis of geotechnical suitability as well as appropriate certification(s) stating that the specifically sourced fills are free of all environmental contaminants as defined by MWLAP for residential areas. Placement and compaction of the imported fills shall be as described above.

### 6.4 Foundation Recommendations

The proposed school may be supported on conventional foundations bearing on the undisturbed, dense to very dense glacial deposits, or on select structural fills placed over the undisturbed till-like deposits prepared as described above. When detailed design information is known Golder would be pleased to provide specific bearing capacities.

### 6.5 Temporary Slopes

Temporary excavation slopes are not anticipated for the proposed school and playfield. However, if required the temporary excavation slopes within the surficial granular soils and forest litter should not exceed 1H:1V (horizontal: vertical). Temporary cut slopes in the dense to very dense glacial tills (if required) should not exceed 1H: 2V. Flatter slopes may be necessary where moderate to heavy seepage conditions prevail in either the surficial deposits and/or the glacial till materials. Should steeper slopes be necessary due to spatial constraints or other considerations, the temporary slopes may be locally oversteepened, subject to confirmation by site specific geotechnical inspection and review. For oversteepened cut slopes, temporary shoring support, such as shotcrete and anchors, may be necessary.

All temporary excavation slopes that are expected to be open for more than 2 weeks should be protected with polyethylene sheeting. Splicing of the sheeting should be preferably oriented along the slope face, with upslope sheets overlapping the downslope sheets by a minimum of 0.6 m. The sheeting should be secured to the slope at the top, middle and base of the slopes.

Surface grades around excavation areas should be sloped to direct surface water away from the excavation and slopes. In addition, interceptor swales or trenches may be necessary along the excavation perimeter to expedite the removal of the collected surface water. The interceptor swales or trenches should be a minimum of 0.3 m deep, have side

slopes 1H:1V or flatter, and have a minimum gravity gradient of 1% towards suitable discharge facilities. It should be noted that deeper ditches, penetrating through the surficial sands and at least 0.3 m into the underlying less permeable glacial soils, may be necessary to suitably intercept near surface seepage flows.

The base of the excavation should also be sloped to direct seepage water or collected rainfall by gravity to a sump pit for sump pump removal. Collected water containing suspended sediments should be directed to a sediment pond.

## **6.6 Permanent Slopes**

### **6.6.1 Cut Slopes**

All permanent cut slopes should have finished slope gradients not exceeding 2H:1V (horizontal:vertical). Steeper overall slopes may be possible with provision of suitable retaining wall structures as part of the slope treatment. Interceptor swales should be placed along the crest of the slopes to direct overland surface flows away from the cut slopes and directed to an appropriate discharge area. The permanent slopes should also be hydroseeded as soon as practically possible following the final preparation of the slopes. The hydroseed mix design should include plant species which are indigenous to the area, and are able to survive the climatic variations in the region. It is recommended that the hydroseed mix design be undertaken by a certified horticulturist.

Permanent cut slopes in excess of 6 m should be provided with intermediate benches to reduce the potential for rilling or other forms of slope degradation. The benches should have a minimum width of 1 m and a reverse slope of 1% to 2% into the cut slope. The benches should be placed at maximum 6 m vertical spacings and be sloped to direct collected surface water towards the interceptor swale along the slope crest or towards other suitable discharge areas.

### **6.6.2 Fill Slopes**

Areas where permanent fills are to be placed should be prepared as described in the site preparation section of this report. Where fills are placed on existing slopes in excess of 5H:1V, it is recommended that the fill be "keyed" into the existing slope using cut benches to avoid potentially planar weak zones at the interface between the fill and the native sand or till materials. The maximum height of the cut benches should be limited to 1.2 m.

The final configuration of permanent fill slopes will be dependant on the degree of compaction achieved within the fills. For fills placed at a relative density equivalent to 90% of MPD or better, the maximum finished slope gradient should not exceed 2H:1V (horizontal:vertical). For relative densities less than 90% MPD but greater than 80% MPD, the maximum slope gradient should not exceed 3H:1V. Even with such flatter slopes, some slumping, settlement and/or ravelling should be expected for moderately or nominally compacted (less than 90% MPD) fills.

All fill slopes should be provided with interceptor swales placed along the crest of the slopes to direct overland surface flows away from the cut slopes to an appropriate discharge area. All permanent fill slopes shall also be hydroseeded as soon as practically possible following the final preparation of the slopes. The hydroseed mix design shall be as described above.

Permanent fill slopes in excess of 6 m high should be provided with intermediate benches to reduce the potential for rilling or other forms of slope degradation. The benches should have a minimum width of 1 m and have a reverse slope of 1% to 2% into the cut slope. The benches should be placed at maximum 6 m vertical spacings and sloped to direct collected surface water towards the interceptor swale along the slope crest or towards other suitable discharge areas.

### **6.6.3 Groundwater Drainage**

Based on Golder's experience during the construction of other North Coquitlam developments, the mountainside contains numerous water bearing sand zones which manifest as aquifers or springs when daylighted by excavation works. These water-bearing layers can produce significant continuous flows. Where such springs or aquifers are encountered or anticipated at or above the finished subgrade elevation of the building, retaining wall or cut/fill slope areas, it is recommended that the spring water be intercepted with a french drain to permanently remove the water from the development area in a controlled manner. The french drain dimension will be dependant on the extent and magnitude of the flows encountered, and should be designed on an "as-needed" basis as the volume and extent of the source water is confirmed.

## **7.0 CLOSURE**

The factual data, interpretations and recommendations contained in this report are based on the soil conditions encountered at the test pit locations, and preliminary information provided by Wesbild.

This report has been prepared for the exclusive use of Wesbild Holding and their representatives for specific application to the development described within this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. Golder accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warrantee, expressed or implied is made.

We trust that this report is sufficient for your present needs for the proposed secondary school and playfield development at David Avenue and Coast Meridian in Coquitlam. Golder appreciates the opportunity to work with Wesbild and the City of Coquitlam on this unique and interesting project. Please call if you have any questions, or desire additional information.

Yours very truly,

**GOLDER ASSOCIATES LTD.**

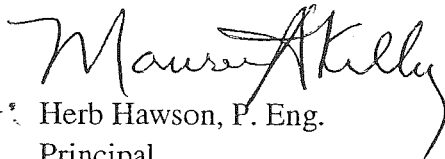


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## IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

**Standard of Care:** Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this report. No other warranty, express or implied is made.

**Basis and Use of the Report:** This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. *No other party may use or rely on this report or any portion thereof without Golder's express written consent. Golder will consent to any reasonable request by the Client to approve the use of this report by other parties as Approved Users.* The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, and only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. *In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use by any party of portions of the report without reference to the entire report.*

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs, techniques and equipment choice, scheduling and sequence of operations would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work.

**Soil, Rock and Groundwater Conditions:** Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect certain conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between sampling points may differ from those that actually exist.

Groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their measurement. Groundwater conditions may vary between reported locations and can be affected by annual, seasonal and special meteorological conditions or tidal fluctuations. Groundwater conditions may also be altered by construction activity on or in the vicinity of the project site.

**Sample Disposal:** All contaminated samples and materials shall remain the property and responsibility of the Client for proper disposal. Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense.

**Follow-Up and Construction Services:** All details of the design and proposed construction may not be known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities.



500 0 500 Meters  
Scale 1:25,000



#### REFERENCE

Source: Triathlon (1995 Orthophotos), DMTI Spatial  
Datum: NAD 83 Projection: UTM Zone 10

PROJECT WESBILD HOLDINGS LTD.  
SECONDARY SCHOOL AND PLAYING FIELD  
DAVID AVE., COAST MERIDIAN RD., COQUITLAM, B.C.

TITLE

#### KEY PLAN



PROJECT No.	04-1411-057
DESIGN	RC 29 Apr. 2004
GIS	CDB 29 Apr. 2004
CHECK	RC 29 Apr. 2004
REVIEW	

SCALE AS SHOWN REV. 0

FIGURE 1

- LEGEND**
- TP04-1 Godder Test Pit Location
  - BC Hydro Right of Way
- REFERENCE**
- 1) Base Plan provided by InterCAD.

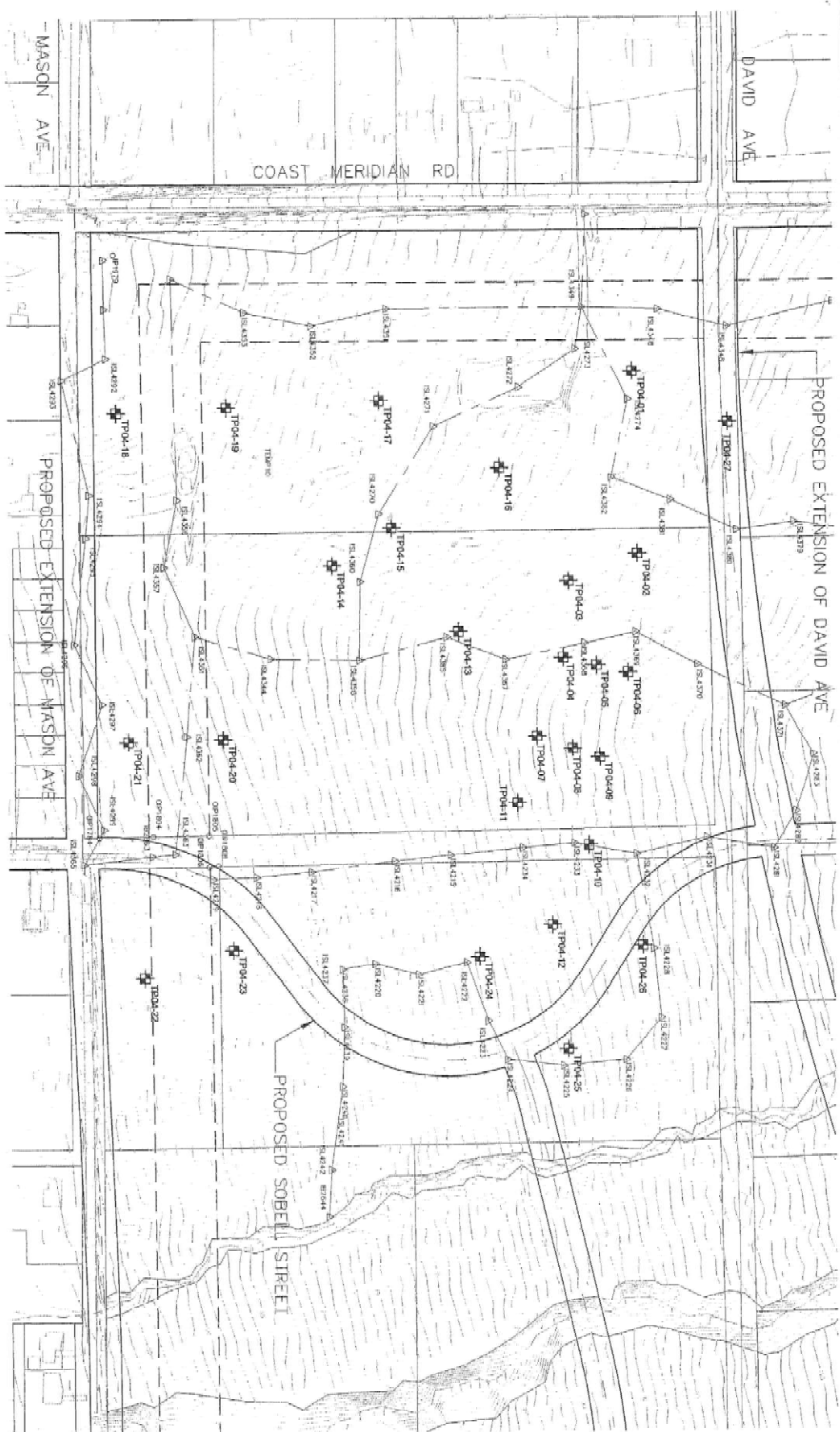


**PROJECT**  
WESBILD HOLDINGS LTD  
SECONDARY SCHOOL AND PLAYING FIELD  
DAVID AVE, COAST MERIDIAN RD, COQUITLAM, B.C.

**TITLE**  
TEST PIT LOCATION PLAN

**FIGURE 2**

PROJECT No.	04-1411-057	FILE No.	04-1411-057-SK01
DESIGN	RC	DATE	12/06/04
CHECK	RC	DATE	12/06/04
REVIEW	RC	DATE	12/06/04





**APPENDIX A**  
**RECORD OF TEST PITS**

## RECORD OF TEST PITTS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-1	0 - 0.15	Loose, moist to wet, dark brown, organic FOREST LITTER.	
	0.15 - 0.65	Loose to compact, moist to wet, brown, silty SAND, some gravel contains cobbles and boulders up to 0.4 m with organic rootlets.	Sa 1 0.2 - 0.3
	0.65 - 1.25	Dense to very dense, moist, grey, gravelly SAND, some silt to silty.	Sa 2 0.65 - 1.25
Termination of Test Pit at 1.25 m. No seepage noted.			
TP04-2	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER.	
	0.15 - 0.84	Loose, moist, brown, silty SAND, some gravel with organic roots contains cobbles up to 0.3 m.	Sa 1 0.4
	0.84 - 2.1	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.2
Termination of Test Pit at 2.1 m. No seepage noted.			

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-3	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 1.05	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with roots and wood fragments.	Sa 1 0.5
	1.05 - 1.6	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-4	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 0.7	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.3 m.	Sa 1 0.4
	0.7 - 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.35 m.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-5	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 – 1.1	Loose, moist, brown, silty SAND, some gravel with boulders up to 0.5 m.	Sa 1 0.4
	1.1 – 1.6	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles/boulders.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-6	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 – 1.1	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with organics (roots).	Sa 1 0.3
	1.1 – 1.75	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles/boulders up to 0.4 m.	Sa 2 1.5
		Termination of Test Pit at 1.75 m. No seepage noted.	



## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-7	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.8	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.2 m with roots.	Sa 1 0.3
	0.8 – 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	
TP04-8	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 – 1.1	Loose, moist, brown, silty SAND, some gravel. Contains cobbles and boulders up to 1 m with roots present.	Sa 1 0.4
	1.1 – 1.25	Dense to very dense, moist grey, SAND, some silt some gravel, contains cobbles (Very difficult to excavate).	
		Termination of Test Pit at 1.25, due to refusal. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-9	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	Sa 1 0.6
	0.9 - 1.65	Dense to very dense, moist, grey, SAND, some silt to silty some gravel, contains cobbles up to 0.3 m.	Sa 2 1.3
		Termination of Test Pit at 1.65 m. No seepage noted.	
TP04-10	0 - 0.1	Loose, moist, dark brown, FOREST LITTER.	
	0.1 - 1.2	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.6
	1.2 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, trace gravel, contains cobbles up to 0.15 m.	Sa 2 1.3
	1.5 - 2.15	Dense to very dense, moist, grey brown, SAND, trace to some silt trace gravel, contains cobbles up to 0.2 m.	Sa 3 2
		Termination of Test Pit at 2.15 m. Minor seepage of less than 1 liter/min noted at 1.2 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-11	0 - 0.25	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.25 - 1	Loose, moist, dark brown, sandy SILT, trace to some gravel contains cobbles up to 0.25 m.	
	1 - 1.2	Dense, moist, grey brown, SAND, some silt trace gravel.	
	1.2 - 2	Dense to very dense, moist to wet, grey SAND, trace to some silt, some gravel to gravelly, contains cobbles up to 0.3 m.	Sa 1 1.5
		Termination of Test Pit at 2 m. Seepage of less than 1 liter/min noted at 1.0 m depth at till interface.	
TP04-12	0 - 0.15	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.15 - 0.75	Loose, moist to wet, dark to med brown, sandy SILT (Topsoil like), trace gravel with organics (roots) with boulders up to 0.5 m.	Sa 1 0.4
	0.75 - 1	Dense, moist to wet, brown, silty SAND, some gravel.	Sa 2 0.8
	1 - 1.95	Dense to very dense, moist to wet, grey, SAND, some gravel to gravelly trace to some silt contains cobbles up to 0.3 m.	Sa 3 1.7
		Termination of Test Pit at 1.95 m. Minor seepage of less than 1 liter/min noted at 0.75 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-13	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.3
	0.9 - 1.8	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 2 1.6
		Termination of Test Pit at 1.8 m. No Seepage noted.	
TP04-14	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.4 m with roots.	Sa 2 0.3
	0.9 - 1.3	Dense to very dense, moist, grey, gravelly SAND, trace to some silt contains cobbles up to 0.3 m.	Sa 2 1.2
		Termination of Test Pit at 1.3 m. No Seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-15	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 1.22	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.6
	1.22 - 1.95	Dense to very dense, moist, grey SILT and fine SAND, to silt, some fine sand trace gravel contains cobbles up to 0.1 m.	Sa 2 1.25
	Termination of Test Pit at 1.95 m. No seepage observed.		
TP04-16	0 - 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 - 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.15 - 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 1 1.3
	Termination of Test Pit. No seepage noted.		
TP04-17	0 - 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 - 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.40
	1.15 - 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt, contains cobbles up to 0.15 m.	Sa 2 1.2
	Termination of Test Pit. No seepage noted.		

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-18	0 – 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 – 1.20	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.5
	1.20 - 2.30	Dense to very dense, moist, grey, fine sandy SILT, trace clay trace gravel.	Sa 2 2.0
	Termination of Test Pit. No seepage noted. Cobbles visible at bottom of Test Pit.		
TP04-19	0 – 0.05	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.05 – 1.0	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.0 – 2.3	Dense, moist, brown to grey, gravelly SAND, some silt to silty contains cobbles and boulders.	Sa 1 1.2
	Termination of Test Pit. No seepage noted. Refusal on boulder > 1 m.		
TP04-20	0 – 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 – 1.0	Loose, moist, brown, silty, SAND, some gravel contains cobbles up to 0.4 m with roots.	
	1.0 – 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel, contains cobbles.	Sa 1 1.3
	Termination of Test Pit. No seepage noted.		

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-21	0 - 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 - 0.95	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles.	
	0.95 - 1.50	Dense to very dense, moist, grey, gravelly SAND, trace to some silt, contains cobbles up to 0.3 m.	Sa 1 1.4
		Termination of Test Pit. No seepage noted.	
TP04-22	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 1.0	Loose, moist, brown, silty sand with roots, contains cobbles\boulders up to 0.5 m.	
	1.0 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel.	Sa 1 1.5
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted between 1.0 m and 1.25 m.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-23	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 0.9	Loose, moist, brown, silty SAND, some gravel, contains cobbles.	
	0.9 - 1.15	Dense to very dense, moist, brownish grey SAND, some silt to silty, trace to some gravel, contains cobbles up to 0.1 m.	Sa 1 1.0
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted from 0.9 m to 1 m depth.	
TP04-24	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.55	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.55 - 0.7	Dense to very dense, moist, grey gravelly SAND, some silt to silty.	
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted at 0.55 m depth.	



## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-25	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.6	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.6 – 2.05	Dense to very dense, moist, grey, gravelly SAND; some silt to silty, contains cobbles up to 0.4 m.	Sa 1 2
		Termination of Test Pit. No seepage noted.	
TP04-26	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.9	Loose, moist, brown, silty SAND, some gravel, with roots, contains cobbles up to 0.75 m.	
	0.9 – 1.6	Dense to very dense, moist, grey gravelly SAND, some silt contains cobbles up to 0.25 m.	
		Termination of Test Pit. Minor seepage of less than 1 liter/minute noted at 0.9 and 1.1 m depth.	
TP04-27	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 – 1.0	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.15 m.	
	1.0 – 1.5	Dense to very dense, moist, brownish grey SILT and SAND, some gravel to gravelly, contains cobbles up to 0.15 m.	Sa 1 1.4
		Termination of Test Pit. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
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## **Centennial Geotechnical Engineers Ltd.**

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**PRELIMINARY GEOTECHNICAL INVESTIGATION  
PROPOSED BURKE MOUNTAIN SECONDARY SCHOOL  
SOBALL STREET AND DAVID ROAD, COQUITLAM, BC.**

**Prepared for:**

**School District No. 43, Coquitlam  
550 Poirier Street  
Coquitlam, BC. V3J 6A7**

**Our File: V11-139  
November 27th, 2011**



## Centennial Geotechnical Engineers Ltd.

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Email: [cgc@telus.net](mailto:cgc@telus.net)

Phone : (604) 255-0828 Fax : (604) 255-0817

November 27th, 2011

File: V11 - 139

Facilities and Planning  
School District 43, Coquitlam  
550 Poirier Street  
Coquitlam, BC. V3J 6A7

Attention: Mr. Jim Domina, Manager, Capital Projects

Dear Mr. Domina:

**RE: PRELIMINARY GEOTECHNICAL INVESTIGATION  
PROPOSED BURKE MOUNTAIN SECONDARY SCHOOL  
SOBALL STREET AND DAVID ROAD, COQUITLAM**

### **1.0 INTRODUCTION**

In accordance with the authorization of Mr. Jim Domina of School District of No. 43 Coquitlam, Centennial Geotechnical Engineers Ltd. (CGE) has completed a preliminary geotechnical investigation for the proposed Burke Mountain Secondary School at the above location in Coquitlam, as shown in Figure 1.

The scope of the geotechnical services was presented in our proposal P11-115a, dated October 28<sup>th</sup>, 2011. The purpose of the geotechnical investigation was to identify soil conditions at the proposed building and playfields' sites. Based on the results of the geotechnical investigation, CGE developed preliminary recommendations including percolation rates for onsite soil conditions, site preparation, earthwork, drainage control, foundation design, slab-on-grade preparation, lateral earth pressures for design of basement walls and retaining wall and site class.

At the time of preparing the soils report, structural loading conditions for the proposed building are not available. When the layout of the proposed school facility is finalized and structural loading conditions are available, CGE shall review our preliminary recommendations for the geotechnical aspects, and revise them accordingly.

## **2.0 PROPOSED SCHOOL FACILITIES**

Based on a preliminary design plan provided by CJP Architects, CGE understands that the proposed school facility will include the construction of a 2-storey building with a partial above grade basement, a Neighbourhood Learning Centre, a turf playfield, a practice play, two hard surface play areas, two parking lots and several onsite access roads. The general layout and locations of the proposed school facility is shown in Figure 2.

## **3.0 SITE DESCRIPTION**

The subject property is pentagonal shaped, which is bounded on the east by Soball Street and on the north by David Avenue. Adjacent to the south side of the school property is city parkland, which adjoins Don Moore Drive. The western side of the property borders a BC Hydro Authority right-of-way with several high voltage overhead power lines.

The subject property is moderately to heavily wooded with mostly coniferous trees. The forest floor generally covered by undergrowth, brushes, moss and numerous dead falls. Domestic refuse including several oil drums, abandoned appliances, etc. were observed near the western side of the property. Near the southeast corner of the property, a large stockpile of boulders (at least 100 pieces), ranging from about 450mm to 1.2m (1.5 feet to 4 feet) in diameter was observed.

According to a 1:1000 map, the topography of the subject property generally slopes down from about elevation 114m at the north to about elevation 91m at the south with a difference in grade of approximately 23 metres (75 feet). The current site grade is generally above the street grade of David Road on the north, but is below Soball Street on the east side. However, the existing site grade is higher than the road grade of Don Moore Drive on the southeast and the southwest.

## **4.0 PRELIMINARY SOILS INVESTIGATION**

The preliminary geotechnical investigation was conducted using a track-mounted excavator under the supervision of our field engineer on November 4th, 2011. The subsurface investigation program included performance of 15 test pits at the approximate locations as shown in Figure A1. The test pits were performed to the depths of about 1.1m to 1.4m (3.5 feet to 4.5) feet below existing ground surfaces, or refusal of the excavator.

The stratigraphy in each test pit was logged by our field engineer. Representative soil samples were obtained from different soil strata encountered in the test pits. The recovered soil samples were returned to our laboratory for further visual examination, moisture content and gradation

tests. The logs of the test pits, moisture content and wash sieve test results are presented in Appendix A, Figures A2 to A9, inclusive. The gradation tests' results are presented in Appendix B, Figures B1 and B2.

## **5.0 SUBSURFACE CONDITIONS**

Subsurface conditions encountered in the test pits are presented in Appendix A, Figures A2 to A9, Logs of Test Pits of this report. However, soil conditions may vary between the test pits and across the site. The following sections provide a summary description of generalized soils profile encountered in the test pits.

- |                        |   |
|------------------------|---|
| Topsoil (SU1)          | A layer of topsoil with some organic matter was encountered below existing ground surfaces in all the test pits. The thickness of the topsoil is not uniform, ranging from about 150mm to 450mm (6 inches to 18 inches). The relative density of the topsoil is generally loose.  |
| Sand (SU2)             | Below the topsoil, a layer of rusty brown, gravelly fine to coarse-grained sand with some silt and organic was encountered. The gravelly sand is generally loose, and ranges from about 150mm to 600mm (6 inches to 2 feet) in thickness. The relative density of this layer is generally loose.  |
| Sand (SU3)             | The SU2 soil is underlain by a layer of tannish brown/grey, silty, fine to coarse-grained sand with some gravel. This stratum was encountered in TP2 to TP4, TP9, TP11 and TP12. The thickness of this layer varies from about 150mm to 450mm (6 inches to 18 inches). The relative density of this layer is generally loose.               |
| Weathered Till (SU4)   | Underlying the rusty brown sand, and/or the tannish brown silty sand, a thin layer of weathered tannish grey, silty, sandy till-like soils, varying from about 300mm to 450mm (12 inches to 18 inches) thick was encountered in most of the test pits, except TP7, TP9 and TP11. The relative density of the weathered till soils is dense. |
| Unweathered Till (SU5) | Beneath the weathered till, a layer of grey, sandy till-like soils was encountered extending to the bottom of most of the test pits. Occasional cobbles and large boulders can be encountered within the till stratum. The relative density of the unweathered sandy till soils is very dense.  |

A perched water table was encountered on the surface of the weathered till (SU4), at the depths of about 600mm to 900mm (2 feet to 3 feet) below existing ground surface, at the time of the soils investigation in November 2011. We anticipate that the perched water table fluctuates with seasonal precipitation.

## **6.0 SEISMIC DESIGN CRITERIA AND LIQUEFACTION EVALUATION**

### **6.1 Seismic Design Criteria**

The design earthquake motions considered in the 2006 BC Building Code (BCBC) have a 2% probability of exceedance in 50 years or a 2475-year return period.

The 2006 BCBC provides Peak Ground Acceleration (PGA) and design response spectrum for near the surface including Site Class A to E for structural design. According to the 2006 BCBC, 'Firm Ground' is defined by shear wave velocity in the range of 360 to 760m/sec and N60 greater than 50. Very dense till-like or soft bedrock sites would classify as 'Firm Ground' – Site Class C.

For the Greater Vancouver area, the PGA for near surface 'Firm Ground – Site Class C' is 0.47g. The inferred earthquake magnitude for this event is M7.

### **6.2 Liquefaction Analysis**

Based on the soil conditions encountered in the test pits and at the level of shaking discussed above, it is our opinion that the native soils including the native sand (SU2 and SU3) and the dense/very dense till-like soils (SU4, SU5) are not susceptible to liquefaction under the current design criteria.

### **6.3 Site Class**

Based on the results of the soils investigation, CGE recommends that Site Class C be used for structural design of the proposed building.

## **7.0 PERCOLATION RATES**

CGE understands that rain gardens would be considered for stormwater management of surface runoff from the hard surface play areas, parking lots and driveways.

Based on the test pits investigation, beneath the surficial topsoil (SU1) is a layer of native rusty brown/tannish brown silty sand and gravel (SU2, SU3) with some cobbles, which varies from about 450mm to 900mm (1.5 feet to 3 feet thick), overlying the basal till (SU4, SU5) strata.

Gradation tests were performed for three composite samples of the SU2 and SU3 soils and the results are presented in Figures B1 to B2. The gradation test results indicated that SU2, gravelly sand with some silt - consists of about 20% to 40% gravel, about 40% to 60% sand and about 15% silts. For SU3, silty sand with some gravel – grain size distribution consists of about 20% gravel, about 55% sand and about 25% silts.

Based upon the gradation of the silty sand strata, the empirical percolation rate for the SU2 and SU3 strata would vary from at least about 30 to 50 minutes per inch, respectively.

The weathered and unweathered till layers are considered impervious because of the very dense relative density. The field percolation rate of these two strata would be greater than 60 minutes per inch.

When the design stormwater management plan is available, CGE recommends that field percolation tests shall be performed to confirm the preliminary percolation rates for the SU2 and SU3 soils.

## **8.0 DISCUSSIONS AND RECOMMENDATIONS**

### **8.1 General**

The soil conditions encountered in the test pits are feasible for construction of the proposed school facility. A conventional shallow foundation system consisting of spread and strip footings can be used for supporting columns and load bearing walls of the proposed building, respectively.

The following sections provide our preliminary recommendations for site preparation, earthwork, drainage control, foundation design, slab-on-grade preparation and lateral earth pressures for basement/retaining walls design.

### **8.2 Site Preparation**

Initial site preparation will include clearing of trees and stripping of vegetation/topsoil, and the gravelly silty sand (SU2, SU3) from within the footprint of the proposed building, driveways, parking areas and all hard landscaped areas to expose the very dense sandy till-like soils (SU5).



The excavated materials shall be disposed in approved landfill facilities. The topsoil may be reused in the landscaped areas, as approved by the landscaped architect.

Stripping should extend at least 3m (10 feet) beyond the footprint of the proposed school building, sidewalks, hard landscaped areas, playfields, driveways and parking lots. Additional stripping would be required where subgrade soil is damaged or softened due to surface ponding or precipitation, or where unsuitable soils are encountered. The exposed subgrade surface should be either sloped or crowned to allow draining of infiltrated ground water and to prevent softening of subgrade.

The native sand (SU2 and SU3) and the sandy till-like (SU4, SU5) soils are sensitive to disturbance by construction traffic when saturated and in wet weather condition. The subgrade surface must be dry, free of ponding water, snow, ice and frozen soils, prior to placement of any fill materials. CGE recommends that a layer of 19mm (¾-inch) dia. clear crushed gravel, minimum 150mm (6 inches) thick be placed on the final subgrade surface for protection against disturbance or softening by construction traffic.

### **8.3 Earthwork**

Construction for the proposed school facility will most likely involve cut-and-fill. The following sections provide our general recommendations for earthwork. Earthwork activities including excavation and fill placement should be performed during dry summer months.

#### **8.3.1 Excavation**

Any excavation deeper than 1.2m (4 feet) must be carried out in accordance with the Industrial Health and Safety Regulations prepared by Work Safe BC.

In general, for temporary slopes of bulk excavation completed above the groundwater table and away from any adjoining footings in compact native sand (SU2/SU3), cut slopes should not be steeper than 1H:1V (horizontal:vertical). For excavation in very dense till-like soils (SU4 and SU5), temporary slopes of excavation should not exceed 1H:2V. The above recommended slope configurations should be flattened where seepage is encountered. The temporary excavated slopes should be protected by plastic sheet to minimize erosion due to seepage.

For permanent cut slopes in dense/very dense sandy till (SU4, SU5), CGE recommends that the final grade shall not exceed 3H:1V. The final surface shall either be vegetated or protected by gravel, and/or durable rip-rap materials.

### **8.3.2 Structural Fill**

Due to the high silt contents of the native soils (SU2, SU3, SU4 and SU5), these materials shall not be reused as structural fill beneath the footprint of the proposed building, playfields, parking lots, fire truck access road and driveways.

Site grading fill and backfill shall consist of clean, free-draining, minus 75mm (3-inch) dia. crushed gravel containing less than 5% passing the No.200 sieve (Type 1). The manufactured 'river sand and minus 75mm (3-inch) dia. crushed gravel' although meets the MMCD gradation is not allowed due to segregation between the two sources.

Site grading fill may be placed to within 300mm (12 inches) of the underside of floor slab as well as to the underside of the pavement structure. The fill materials should be placed in horizontal lifts not exceeding 300mm (12 inches) in loose thickness. Each lift should be compacted to at least 95% modified Proctor maximum dry density (MPMDD).

## **8.4 Drainage Control**

### **8.4.1 Construction Dewatering**

Temporary dewatering including the uses of interceptor ditches and sumps will be required during excavation and construction of the proposed school facility due to the presence of the perched water table. Based on our experience in the general area, automatic sump pumps should be installed to control ground seepage and precipitation during construction.

### **8.4.2 Site Drainage**

Because of the impervious nature of the sandy till (SU4, SU5) underlying the subject property, site drainage will require attention. Grading of the subgrade of the playfields will be necessary to prevent ponding of water. Drain tiles and lawn basins will likely be required to maintain playfields as all weather facilities.

Due to the sloping topography of the property, CGE recommends that a drainage blanket consisting of 19mm (3/4-inch) dia. clear crushed gravel (Type 2), minimum 450mm (18 inches) thick, should be placed on the final stripped surface, which requires permanent filling. Subsurface runoff from the gravel blanket shall be collected by a drainage ditch at the downslope side of any fill embankment. In addition, interceptor ditches should also be included along the upslope side of any fill embankment. Runoff from the ditches should be discharged to the onsite stormwater drainage system.

Due to limited thickness of permeable soils (SU2, SU3) and the shallow depth to the impermeable sandy till (SU4, SU5), ground infiltration system would not be feasible for disposal/absorption of stormwater for the proposed facility without the risk of becoming overland flow.

### **8.5 Foundation Design for Proposed Building**

The proposed school may be supported by conventional shallow foundation including spread and strip footings at columns and load-bearing walls, respectively. CGE recommends that all the perimeter footings be placed below a depth of 450mm (18 inches) for protection against frost penetration.

CGE recommends that footings for the proposed building be located directly in the undisturbed, very dense sandy till-like soils (SU5). For footings founded in very dense sandy till (SU5), CGE recommends that a maximum allowable soil bearing pressure of 200kPa (4,000 pounds per square foot, psf) be used. The allowable soil bearing pressure may be increased by one-half, 300kPa (6,000psf) to account for transient loads such as wind and seismic.

When final structural loading conditions for columns and load-bearing walls are available, CGE will provide settlement estimates for design considerations.

### **8.6 Slab-on-grade Preparation**

For slab-on-grade preparation of the proposed building, CGE recommends that the final stripped surface shall be proof-rolled to determine presence or absence of loose soils. Where soft/loose soils are encountered, the soils should be overexcavated to expose the very dense sandy till (SU5). The areas of overexcavation should be backfilled with structural fill materials, as specified in Section 8.3 of this report.

Beneath the floor slab of the proposed building, CGE recommends that a layer of 19mm (3/4 inch) dia. clear crushed gravel (Type 2) at least 300mm (12 inches) thick be placed on the approved subgrade. A vapour barrier should be placed directly on the gravel drainage blanket to minimize upward migration of moisture and dampness to the floor slab.

### **8.7 Basement walls of Building**

Basement walls of the proposed building should be designed to withstand lateral earth pressures due to static as well as seismic conditions, surcharge load and hydrostatic pressure.

### **8.7.1 Lateral Earth Pressures**

Lateral earth pressures' diagrams for basement walls (restrained) under static and seismic conditions are presented in the top panel of Figure 3.

### **8.7.2 Surcharge Loads**

A compaction 'surcharge' pressure typically increases from zero at the ground surface to a pressure of 25kPa (500psf) at and below a depth of 300mm (12 inches). The compaction pressure is applicable down to the depth where the static earth pressure equals the compaction pressure. This assumes a small walk-behind compactor is used for backfill compaction adjacent to the wall.

Where final grade above the top of wall is not level, a surcharge load for the sloping backfill shall be included in the design.

### **8.7.3 Hydrostatic Pressure**

If backfill material behind basement/retaining walls is not free-draining, full hydrostatic pressure should be included in the analysis. The hydrostatic pressure should be computed based on a water unit weight of 10kN/m<sup>3</sup> (62.4pcf).

## **8.8 Playfields**

Due to the sloping terrain of the site, construction of the proposed playfields would most likely involve cut-and-fill and retaining walls.

Initial site preparation for the playfields would include stripping of random fill and topsoil to expose the native silty sand and gravel (SU2, SU3). The subgrade should be compacted to at least 90% MPMDD. Where soft/disturbed soils are encountered and the compaction effort of 90% MPMDD cannot be achieved, these deleterious materials shall be removed. Imported fill consisting of the Type 1 structural fill can be used as site grading fill.

Refer to Section 8.4 for recommendations of the gravel blanket on the approved subgrade surface and ditches along the upslope and downslope sides of fill embankment.

## **8.9 Free-standing Retaining Walls**

The following sections provide our preliminary recommendations for cast-in-place reinforced concrete retaining walls and mechanical stabilized earth (MSE) retaining walls.

### **8.9.1 Cast-in-place Reinforced Concrete Retaining Walls**

Free standing retaining walls shall be designed to withstand lateral earth pressures due to static as well as seismic conditions, surcharge load and hydrostatic pressure.

The following sections provide engineering parameters and lateral earth pressures for design of cast-in-place retaining (unrestrained) walls with a level back slope above the top of wall.

Lateral earth pressures' diagrams for free standing retaining walls under static and seismic conditions are presented in the bottom panel of Figure 3.

For resistance against sliding, a friction coefficient of 0.4 can be considered between the concrete footing and very dense sandy till (SU5) foundation subgrade soils. A reinforced concrete keyway beneath the footing of the retaining wall, which extends in competent subgrade soil may be considered for an additional resistance against sliding.

### **8.9.2 Mechanical Stabilized Earth (MSE) Walls**

An alternative design to the CIP reinforced concrete retaining wall is the mechanical stabilized earth (MSE) wall, which includes Allan Block, Keystone and Sierra Slope, etc.

For preliminary design of MSE retaining walls where the retained fill height does not exceed 1.2m (4 feet) with a horizontal backfill above the wall and without surcharge load, the wall system can be constructed without internal geogrid reinforcements.

For retained fill height in excess of 1.2m (4 feet), CGE recommends that internal geogrid reinforcements to be installed within the structural fill. The length and spacing of geogrids depend on the height of retained fill, type of retained fill, sloping/level backfill behind the wall and surcharge load above the wall. For seismic design, CGE recommends that a layer of geogrid be placed at least 300mm (12 inches) below the final grade.

The face of the MSE walls should have a maximum batter of 1H:8V. The foundation of the MSE retaining walls shall be placed on a layer of imported Type 2 structural fill at least 200mm (8 inches) thick overlying competent subgrade, compacted to at least 95% MPMDD.

To prevent build-up of hydrostatic pressure against the retaining walls, backfill behind the walls should consist of Type 1 structural fill. The fill materials should be placed in maximum 300mm (12 inches) lift with each lift compacted to at least 95% of its MPMDD. A gravel chimney drain consisting of Type 2 fill, at least 300mm (12 inches) thick should be placed behind the back of the retaining walls and on the cut slope, and in the bottom of the excavation within the length of the geogrids. In addition, a rigid perforated drain pipe, at least 150mm (6-inch) dia., should be

installed at the footing level of the retaining walls and along the toe of the cut slope, connected to the onsite storm water system.

When the final layout and configuration of MSE retaining walls is available, CGE can provide geotechnical design recommendations for the retaining wall system, if necessary.

## **9.0 CLOSURE**

This preliminary soils report was prepared for the exclusive use of School District No. 43, Coquitlam, the Architect and Engineers involved in the design of the proposed Burke Mountain Secondary School in Coquitlam.

This soils report should be made available to prospective contractors and/or the Contractor for information on factual data only and not as a warranty of subsurface conditions, such as those interpreted from the test pits' logs and discussions of subsurface conditions included in this report. Any use which a third party makes of this soils report, or any reliance on or decisions to be made based on this report, are the responsibilities of such third parties. CGE accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

When the final layout and structural loading conditions of the proposed building are available, CGE shall review our preliminary geotechnical recommendations, and provide revisions, if necessary.

We trust that this preliminary soils report meets your current requirements. If there are any questions regarding this soils report, please do not hesitate to contact our office.

Yours very truly,

**CENTENNIAL GEOTECHNICAL ENGINEERS LTD.**

per:

Louis W. H. Lui, P. Eng.  
Principal

## **INTERPRETATION AND USE OF STUDY AND REPORT**

### **1.0 STANDARD OF CARE**

This study and report have been prepared in accordance with generally accepted engineering practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental assessment and/or consulting unless specifically stated in the engineering report.

### **2.0 COMPLETE REPORT**

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### **3.0 BASIS OF REPORT**

The report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specially requested by the Client to review and revise the Report in light of such alteration or variation.

### **4.0 USE OF THE REPORT**

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, is the sole responsibility of such third party. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

### **5.0 INTERPRETATION OF THE REPORT**

- 5.1 Nature and Exactness of Description: Classification and identification of soils, rocks, geological units have been based on investigations performed in accordance with the standard set out in Section 1.0. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Section 1.0 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigation will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purpose of the Report.
- 5.2 Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and other concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy -

contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

- 5.3 To avoid misunderstandings: CGE should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings and specifications relative to engineering issues pertaining to consulting services provided by us. Further, CGE should be retained to provide field reviews during construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with CGE's recommendations. Any reduction from the level of services normally recommended will result in CGE providing qualified opinions regarding adequacy of the work.

## **6.0 RISK LIMITATION**

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

## **7.0 SERVICES OF SUBCONSULTANTS AND CONTRACTORS**

The conduct of engineering studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired these services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

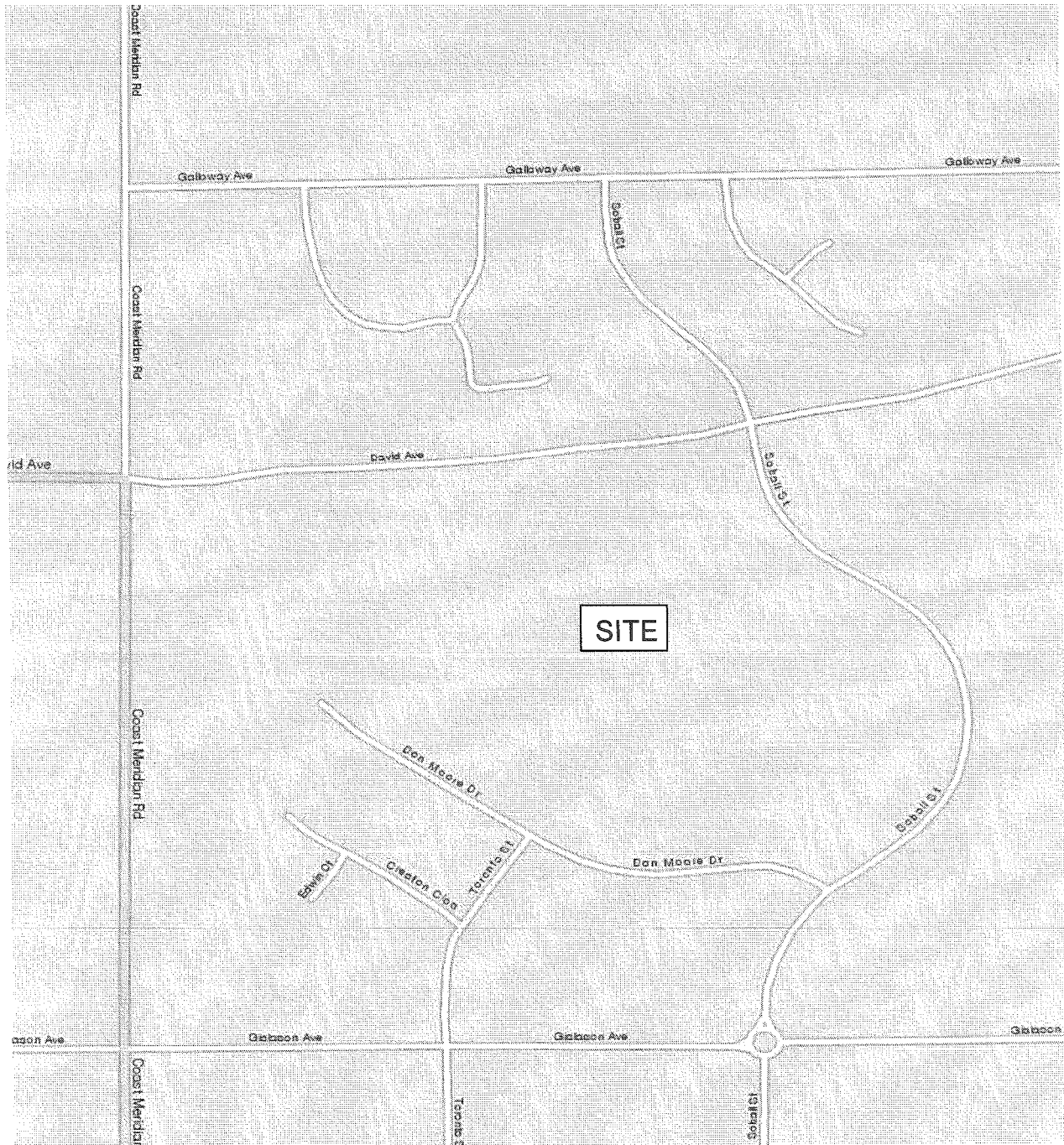
## **8.0 CONTROL OF WORK AND JOBSITE SAFETY**

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

## **9.0 INDEPENDENT JUDGEMENTS OF CLIENT**

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.





PROJECT NO: V10-139  
PROJECT: Proposed Burke Mountain Secondary School  
LOCATION: Sobell Street and David Road, Coquitlam

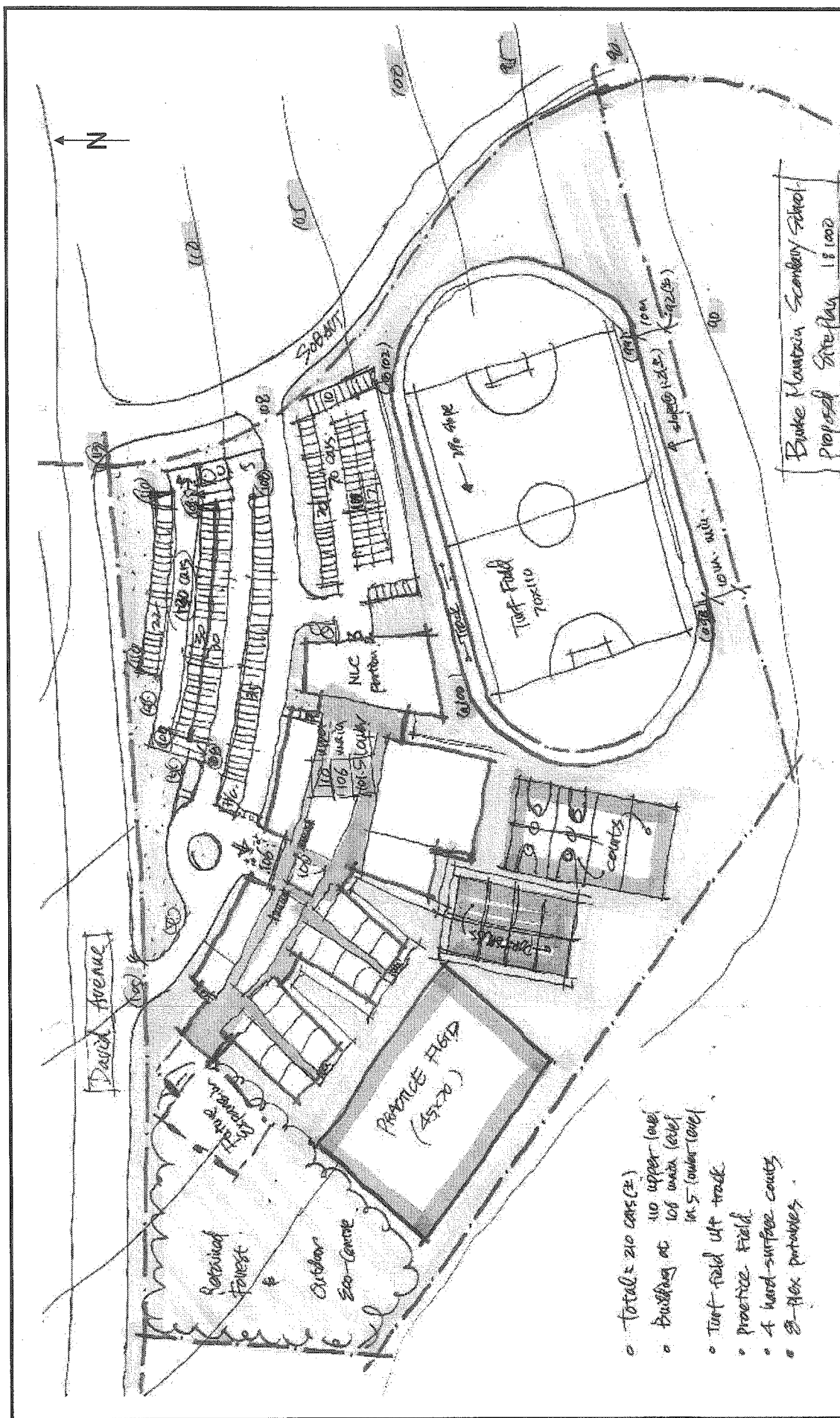
**CENTENNIAL GEOTECHNICAL ENGINEERS LTD.**

Vicinity Map

DATE: 4-Nov-11

SCALE: NTS

FIGURE: 1



Reference: Proposed Site Plan, by CJP, Rec'd Nov. 2011

PROJECT NO: V11-139

PROJECT: Proposed Burke Mountain Secondary School

**LOCATION:** Soball Street and David Road, Coquitlam

**CENTENNIAL GEOTECHNICAL ENGINEERS LTD.**

### Site Plan of Proposed Facilities

DATE: 7-Nov-11

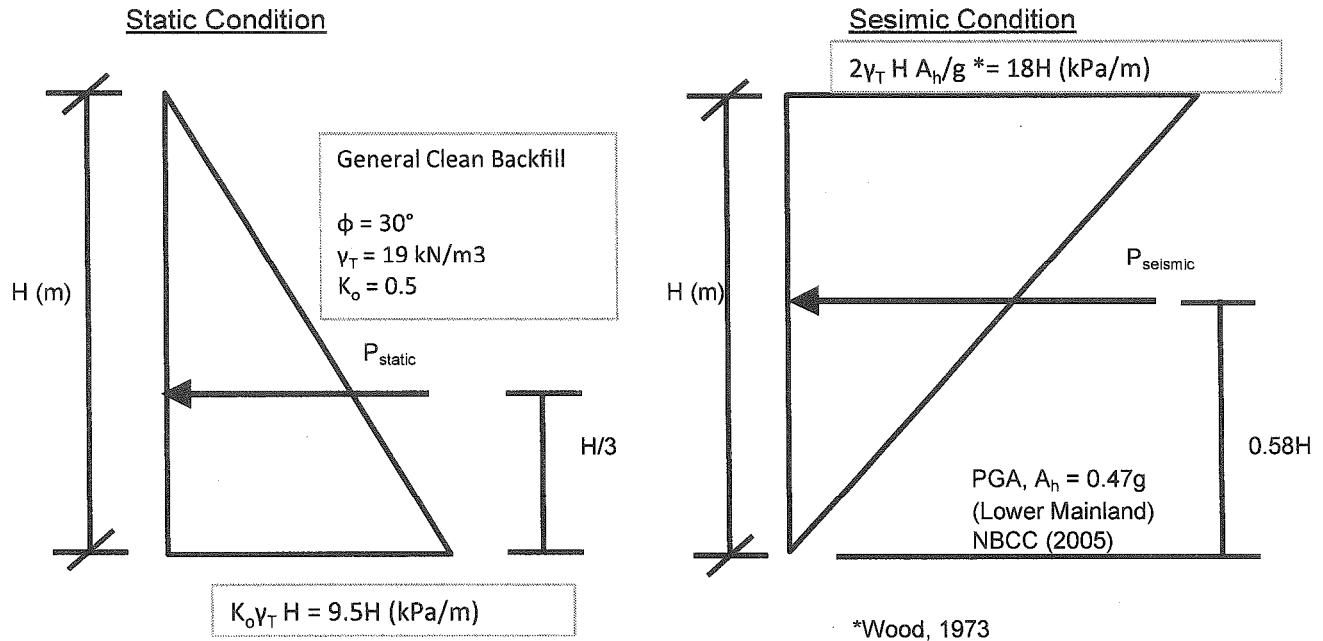
DRAWN BY: NC

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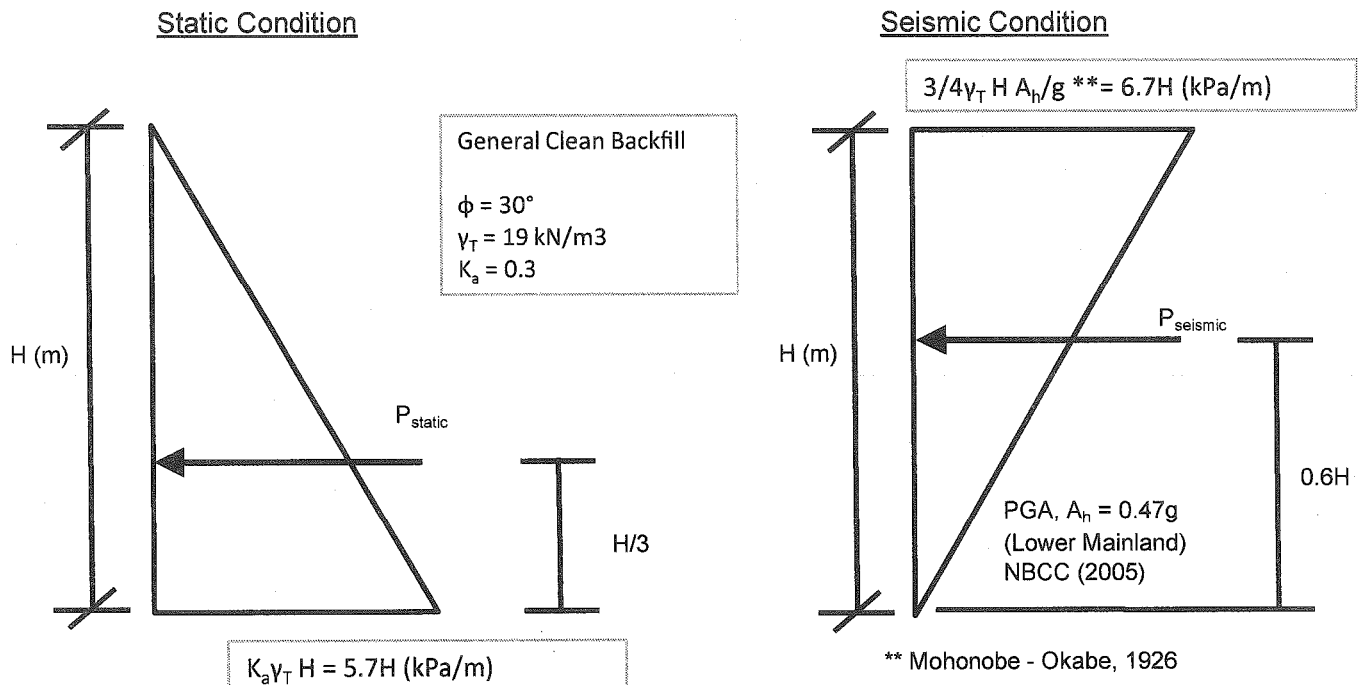
**FIGURE:**

2

## BASEMENT WALL (RESTRAINED)



## RETAINING WALL (UNRESTRAINED, movement 0.004H is allowed)

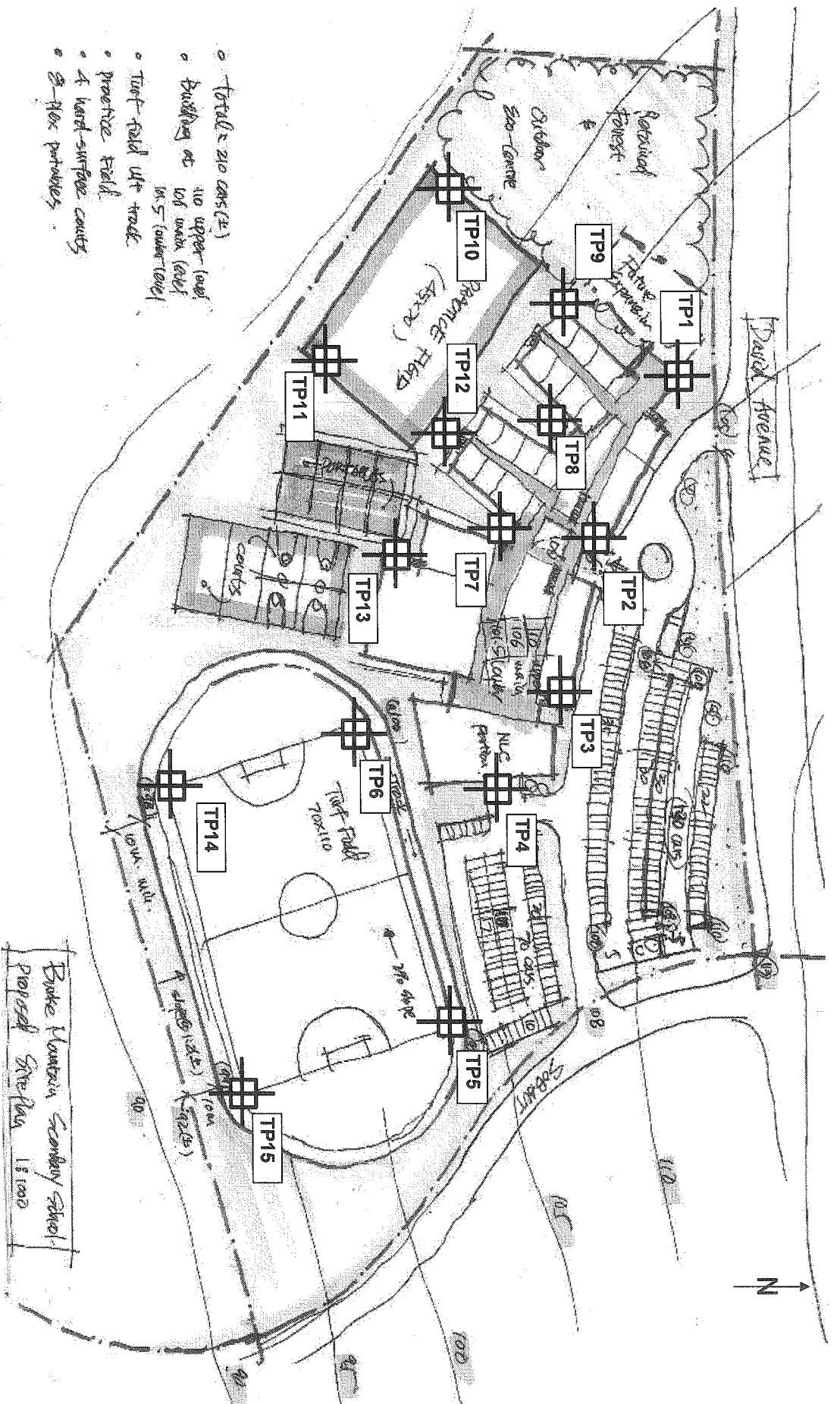


Restrained versus unrestrained conditions depend upon the degree of wall movement. Partial movements of the wall may result in pressures somewhat less than the restrained condition; but it is not possible to predict intermediate cases with any degree of certainty.

PROJECT NO:	V11-139	<b>CENTENNIAL GEOTECHNICAL ENGINEERS LTD.</b>		
PROJECT:	Proposed Burke Mountain Secondary School	Lateral Earth Pressures, Restrained and Unrestrained Conditions		
LOCATION :	Soball Street and David Road, Coquitlam	DATE:	SCALE:	FIGURE:
		7-Nov-11	NTS	3

## APPENDIX A

### LOGS OF TEST PITS



DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP1	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 333'					
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS							USC	MOISTURE CONTENT		
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)					SM	29.1		
1 -	SAND (SU2)	-	Rusty brown, silty, fine to medium grained sand, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)					SM			
2 -									18.7		
3 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)					SM			
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)					SM	5.4		
5 -											
			End of test pit @ 3.5 feet								

DATE TESTED:		4-Nov-11		INSPECTOR: NC		TEST PT :		TP2	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 340'			
DEPTH	DESCRIPTION OF SOIL AND OBSERVATIONS						USC	MOISTURE	
(ft.)								CONTENT	
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)				SM	28.5	
-	SAND	-	Rusty brown, fine to medium grained sand, some silt,with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)				SM		
-	(SU2)								
1 -									
-								19.2	
-									
-									
2 -									
-								20.1	
-									
-									
-									
-								11.7	
-									
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<b>PROJECT No:</b> V11-139		<b>CENTENNIAL GEOTECHNICAL ENGINEERS</b>		
<b>PROJECT:</b> Proposed Burke Mountain Secondary School				
<b>LOCATION:</b> Soball Street and David Road, Coquitlam		<b>TEST PIT LOG</b>		
		<b>DATE:</b> 4-Nov-11	<b>DRAWN BY:</b> NC	<b>FIGURE:</b> A2

DATE TESTED:		4-Nov-11	INSPECTOR:	NC	TEST PT :	TP3
TEST METHOD:		BACKHOE	SURFACE ELEVATION:		± 341'	
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS				USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)		SM	28.9
-	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)		SM	
-		-	11.3% fines			
1 -						
-						
2 -	SAND (SU3)	-	Tannish grey, silty, fine grained, with occasional 1/4" to 1/2" dia. gravel (loose)		SM	22.4
-						
3 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)		SM	13.7
-						
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occasional pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM	11.6
-						
5 -	End of test pit @ 4.5 feet					
-						

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP4	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 335'					
DEPTH	DESCRIPTION OF SOIL AND OBSERVATIONS								USC	MOISTURE	
(ft.)										CONTENT	
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)					SM	35.2		
-	SAND	-	Rusty brown, fine to medium grained sand, some silt,with some gravel,					SM			
-	(SU2)		occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)								
1 -											
-											
-											
2 -											
-	SAND	-	Tan grey, silty, fine grained, occ. 1/4" to 1/2" dia. gravel (loose)					SM	30.4		
-	(SU3)		22.7% fines								
-											
3 -	SAND	-	Tan grey, silty, fine grained, occ. pebbles, weathered till,					SM	12.1		
-	(SU4)		PP > 4.5 TSF (dense)								
-											
4 -	SAND	-	Grey, silty, fine grained, with pebbles, unweathered till (very dense)					SM			
-	(SU5)										
-											
5 -	End of Test Pit @ 4.5 feet										
-											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											

<b>PROJECT No:</b> V11-139		<b>CENTENNIAL GEOTECHNICAL ENGINEERS</b>		
<b>PROJECT:</b> Proposed Burke Mountain Secondary School				
<b>LOCATION:</b> Soball Street and David Road, Coquitlam		<b>TEST PIT LOG</b>		
		<b>DATE:</b> 4-Nov-11	<b>DRAWN BY:</b> NC	<b>FIGURE:</b> A3



DATE TESTED:		4-Nov-11	INSPECTOR:		NC	TEST PT :		TP5
TEST METHOD:		BACKHOE	SURFACE ELEVATION:		± 320'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS					USC	MOISTURE CONTENT	
0 - - - 1 - - - - 2 - - - 3 - - - 4 - - 5 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)			SM	124.6	
	SAND (SU2)	-	Tannish brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., 26% fines(loose)			SM	30.4	
	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 3.5 TSF (dense)			SM	10.3	
	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)			SM	10.9	
	End of test pit @ 3.5 feet							
DATE TESTED:		4-Nov-11	INSPECTOR:		NC	TEST PT :		TP6
TEST METHOD:		BACKHOE	SURFACE ELEVATION:		± 332'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS					USC	MOISTURE CONTENT	
0 - - - 1 - - - 2 - - - 3 - - - 4 - - 5 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)			SM		
	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt,with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)			SM	26.5	
	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)			SM	4.7	
	SAND (SU5)	-	Grey, silty, fine grained, unweathered till, PP > 4.5 TSF (v. dense)			SM	5.4	
	End of Test Pit @ 4.0 feet							
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer								
PROJECT No:			V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT:			Proposed Burke Mountain Secondary School					
LOCATION:			Soball Street and David Road, Coquitlam			TEST PIT LOG		
			DATE:		DRAWN BY:		FIGURE:	
			4-Nov-11		NC		A4	



DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP7	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 332'					
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS							USC	MOISTURE CONTENT		
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)					SM	36.8		
1 -											
2 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)					SM			
3 -											
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)					SM	7.4		
5 -											
			End of test pit @ 4 feet								

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP9	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 321'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1)		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		34.0	
1 -		SAND (SU2)		-		Brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranges from 3" to 10" in dia., some organics (loose)		SM			
2 -		SAND (SU3)		-		Tan grey, silty, fine grained sand with occ. gravel (loose)		SM			
3 -		SAND (SU5)		-		Tan grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)		SM		7.3	
4 -		End of test pit @ 3.5 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP10	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 308'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		32.6	
1 -		SAND (SU2)		-		Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranges from 3" to 10" in diameter, some organics (loose)		SM			
2 -		SAND (SU4)		-		Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)		SM		10.0	
3 -		SAND (SU5)		-		Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM		5.2	
4 -		End of Test Pit @ 4 feet									
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School								TEST PIT LOG			
LOCATION: Soball Street and David Road, Coquitlam				DATE: 4-Nov-11		DRAWN BY: NC		FIGURE: A6			

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP11	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 306'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	20.1 16.9 20.9 10.7
1 -	SAND (SU2)	-	Brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -	SAND (SU3)	-	Tan grey, silty, fine grained sand with occ. gravel (loose)	SM	
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. gravel, weathered till, PP > 4.5 TSF (dense)	SM	
4 -	End of test pit @ 4 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP12	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 318'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	27.8 26.1 6.6
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 6" to 24" in dia., some organics, 16.3% fines (loose)	SM	
2 -	SAND (SU3)	-	Tan grey, silty, fine grained sand with occ. gravel (loose)	SM	
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)	SM	
4 -	End of Test Pit @ 4 feet				
5 -					
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS	
PROJECT: Proposed Burke Mountain Secondary School				TEST PIT LOG	
LOCATION: Soball Street and David Road, Coquitlam				DATE: 4-Nov-11	FIGURE: A7
				DRAWN BY: NC	

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP13	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 341'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	24.6
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, from 3" to 10" in dia., some organics, 14.6% fines (loose)	SM	
2 -					
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 4.0 TSF (dense)	SM	7.0
4 -	End of test pit @ 4 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP14	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 298'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	28.2
	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
1 -					
2 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. gravel, weathered till (dense)	SM	9.6
3 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	8.6
4 -	End of Test Pit @ 4.0 feet				
5 -					
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School					
LOCATION: Soball Street and David Road, Coquitlam			TEST PIT LOG		
			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A8

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP15	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 298'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL - Dark brown, silty, fine grained sand with organic matter (loose)						SM		46.9	
-		SAND - Brown, fine to medium grained sand, some silt, some gravel, (SU2) occ. cobbles, ranging from 3" to 10" in diameter, some silt (loose)						SM			
1 -										35.6	
2 -		SAND - Tan grey, silty, fine grained, with occ. gravel, weathered till, (SU4) PP > 4.5 TSF (dense)						SM		10.6	
3 -		SAND - Grey, silty, fine grained, with occ. pebbles, unweathered till, (SU5) PP > 4.5 TSF (v. dense)						SM		11.5	
4 -		End of test pit @ 4 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :			
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± ?'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -											
1 -											
2 -											
3 -											
4 -											
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School											
LOCATION: Soball Street and David Road, Coquitlam				TEST PIT LOG							
				DATE: 4-Nov-11		DRAWN BY: NC		FIGURE: A9			

## **APPENDIX B**

### **LABORATORY TEST RESULTS**





Coquitlam School District #43  
550 Poirier Street  
Coquitlam, B.C.  
V3J 6A7

December 10, 2020  
File: 18327  
Rev. 0

Attention: Jessica Stark

**Re: Geotechnical Investigation Report - Proposed Burke Mountain Secondary School  
3400 David Avenue, Coquitlam, B.C.**

## **1.0 INTRODUCTION**

We understand that it is intended to construct a new secondary school at the above referenced site. At this time there are no architectural drawings available to reference. A site plan has been provided and is attached following the text of this report. We understand that the development will consist of a three storey 52,000 square foot building shown at the north side of the site, surrounded by paved roads and parking areas. The school would be accessed from both David Avenue to the north or from Soball Street to the south east of the school. We anticipate that the building will be constructed with concrete foundations with a slab-on-grade with moderately heavy column and wall loads.

This report presents the results of an investigation of the soil conditions beneath the site of the proposed development and makes recommendations for the design and construction of the building, pavement structures and related earthworks. The report was prepared exclusively for School District #43 Coquitlam for their use and the use of others on their design and construction team, although remains the property of GeoPacific Consultants Ltd. We also expect that this report would be used by the City of Coquitlam during the development and permitting process.

## **2.0 SITE DESCRIPTION**

The proposed development site includes the subdivision with City property having a track to the west and a future phase middle school at the south east corner. The site is bound by David Avenue to the north, Don Moore Drive to the south and Soball Street to the east. These three roads all have existing residential developments on their opposite sides. The secondary school property is moderately sloped from north to south for a grade differential of approximately 13 metres. The property has no existing improvements and has thick vegetation and stands of trees.

The location of the site relative to the surrounding developments is shown on our Drawing No. 18327-01, following the text of this report.

## **3.0 FIELD INVESTIGATION**

The subsurface ground conditions of the above referenced site were investigated on November 30, 2020 using the subcontracted services of Uniwide Drilling Co Ltd. of Prince George, BC. The site investigation consisted of 10 solid stem auger test holes supplemented with 10 DCPT soundings to assess the geotechnical properties



of the subsurface soils to a suitable depth. All auger test holes were logged in the field by a geologist from our office and samples were collected for laboratory analysis. Following the drill investigation the auger holes were backfilled and sealed immediately in accordance with provincial abandonment requirements after the classification and sampling. The auger test holes were advanced to depths between 1.5 and 6.1 metres below current site grades.

The approximate locations of the auger test holes and DCPTs with respect to the site boundaries are shown on our Drawing number 18327-01 following the text of this report.

## **4.0 SOIL CONDITIONS**

### **4.1 Soil Profile**

The site soil conditions generally consist of loose forest litter and topsoil over a layer of organic rich sands, overlaying sand and gravel (till like post-glacial deposits), then dense to very dense silty sand glacial till. The general geology of the region under investigation is described as Vashon glacial drift according to the Geological Survey of Canada map 1484A. The Vashon glacial drift is characterized as lodgement and minor flow till, with lenses and interbeds of substratified glaciofluvial sand to gravel, and lenses and interbeds of glaciolacustrine laminated stony silt.

The forest litter and topsoil is between 0.3 and 0.5 metres thick at the surface. The organic rich sands encountered consists of loose silty sand, some gravel that is moist to wet with varying organic content typically to a depth of 0.9 metres below grade but did extend to a depth of up to 1.2 metres below grade. The forest litter, topsoil and sand are underlain by post glacial deposits of till like silt, silty sand, silt or sand and gravel or glacial deposits of till which were both found to be very dense. The post-glacial deposits extend to a depth of between 0.8 and 1.8 metres below grade. The post-glacial deposits where encountered are underlain by dense to very dense glacial till which varies between sand and silt dominant and contains varying amounts of gravel, cobbles and boulders. The till extends beyond the depth of our auger holes and is weathered near the upper contact. Refer to the detailed Test Hole Logs for each location in Appendix A of this report.

### **4.2 Groundwater Conditions**

Perched groundwater was noted at all of the test hole locations ranging in depths of 0.5 to 1.2 metres below grade that got shallower to the south down grade. We expect that perched groundwater is present near the upper contact of the till layer during wetter periods of the year.

The static groundwater table was not encountered during the investigations and is expected to be well below the development grades.

## **5.0 DISCUSSION**

As noted, the proposed development is understood to consist of a moderately heavy three storey slab on grade structure with anticipated column and wall loads in the range of 150 kN and 50 kN/m, respectively.

The surficial topsoil, forest litter and organic rich sands observed on site is not suitable to support new buildings, retaining walls or pavement structures and should be stripped from the site. Our recommended minimum stripping depths and recommendations for site preparation for new buildings, retaining walls and pavement structures are provided in Section 6.1.

The subsurface soils are not expected to be prone to liquefaction or other forms of ground softening under the design earthquake defined under the 2018 British Columbia Building Code.

We confirm, from a geotechnical point of view, that the proposed development is feasible provided that the recommendations outlined in Section 6.0 are incorporated into the overall design.

## 6.0 RECOMMENDATIONS

### 6.1 Site Preparation

Prior to construction of foundations, floor slabs, retaining walls or new pavement structures all vegetation, topsoil, fill, organic material, debris, refuse, and loose or otherwise disturbed soils must be removed from the construction areas to expose a subgrade of *dense till like or glacial till deposits*. Our minimum stripping depths for foundations, floor slabs, retaining walls and new on-site lanes are provided in Table 1.

<b>Table 1: Recommended <u>Minimum</u> Stripping Depths for Foundations, Retaining Walls, Floor Slabs, &amp; On-Site Pavement Structures</b>	
<b>GeoPacific Test Hole</b>	<b>Stripping Depth (metres)</b>
TH20-1	1.1
TH20-2	1.1
TH20-3	0.9
TH20-4	1.1
TH20-5	0.8
TH20-6	0.75
TH20-7	0.8
TH20-8	1.0
TH20-9	1.0
TH20-10	1.0

The stripping depths provided in Table 1 are our *minimum* stripping depths at each of the test hole locations. It should be appreciated that the depth of stripping will vary across the site. For example, where the stands of trees are present the presence of the root structures/ root balls in the area are likely to require stripping to greater depths. In determining our minimum stripping depths we have measured from the surface downward to the first suitable foundation bearing stratum.

Where the depth of stripping exceeds proposed foundation elevations foundations may be placed on “engineered fill”. Engineered fill is defined as clean sand to sand and gravel compacted in maximum 300 mm loose lifts to a minimum of 95% Modified Proctor (ASTM D1557) dry density at a moisture content within 2% of optimum for compaction. The on-site glacial till may also be re-used as engineered fill as outlined in Section 6.2.

Stripping should extend out beyond the building envelope and/or footing locations at a distance equal to the thickness of proposed engineered fill beneath the footings. For example, if 1 metre of engineered fill will underlie a footing then stripping should extend a minimum distance of 1 metre beyond the outer edge of that footing.

Stripping is not required in landscaped areas unless the criteria stated in the previous paragraph requires the removal of that material.

## **6.2 Re-Use of Excavated Materials as Fill**

Excavated glacial till may be used as engineered fill. However, due to its relatively high fines content it is extremely difficult to compact these soils to attain the required dry density when the moisture content exceeds the optimum moisture content for compaction. When these materials are moist or wet they should not be used as engineered fill. *We envisage that filling operations with these materials may be restricted to the warmer/drier months of the year.* As well, due to the relatively low permeability of these materials they should not be used in any applications where a well draining soil is required. The use of excavated glacial till as wall backfill or beneath play field areas is not recommended.

*Final approval for use of excavated materials as backfill or engineered fill must be received from the geotechnical engineer.*

## **6.3 Spread Foundations**

We expect the building to be founded on the native dense glacial till or engineered fill as required. Therefore the proposed building can be founded on conventional spread foundations, including pad and strip footings.

For subgrade of dense glacial till, foundations may be designed on the basis of a serviceability limit states (SLS) bearing pressure of 200 kPa (4200 psf) and ultimate limit states (ULS) bearing pressure of 300 kPa (6300 psf). For foundations designed as recommended we expect that settlements should be limited to less than 25 mm total and 20 mm over 10 metres differential.

Foundations which are placed on compacted “Engineered Fill” or till fill, as defined in Sections 6.1 and 6.2 respectively, may be designed on the basis of a service bearing pressure (serviceability limit state) of 120 kPa (SLS) and 180 kPa (ULS).

Irrespective of specified bearing pressures, footings should not be less than 450 mm in width for strip footings and not less than 600 mm in width for square or rectangular footings. Footings should also be buried a minimum of 450 mm below the surface for frost protection.

Adjacent footings constructed at differing elevations should be offset from each other by a minimum distance of twice the difference in elevation 2H:1V (2 horizontal to 1 vertical). For example, two footings separated by 1 metre in elevation should be offset horizontally from each other by a minimum distance of 2 metres as measured from the inside edges of those footings. Footings constructed within 2H:1V of each other may impose additional vertical and horizontal forces on footings, columns, and/or foundation walls. GeoPacific should review foundation layouts which do not achieve the minimum 2H:1V offset.

*Foundation subgrades of all buildings must be reviewed by a geotechnical engineer prior to footing construction.*

## **6.4 Slab-On-Grade Floors**

In order to provide suitable support for slab-on-grade floors we recommend that any fill placed under the slab should be granular and essentially “clean” with not more than 5% passing the #200 sieve. In addition, this granular fill must be compacted to a minimum of 98% Standard Proctor (ASTM D698) maximum dry density with water content within 2% of optimum for compaction.

Floor slabs should be underlain by a minimum of 150 mm of a free draining granular material. A moisture barrier should underlie the slab directly above the free draining granular material.

*Compaction of the slab-on-grade fill must be reviewed by the geotechnical engineer.*

## **6.5 Seismic Design of Foundations**

The site is considered to be generally underlain by dense soils which can be considered as Site Class C, in accordance with Table 4.1.8.4.A. of the 2018 B.C. Building Code. Peak ground accelerations on firm ground for the approximate site location is 0.399 g as per the City of Coquitlam’s Bulletin Number 14-003.

The subsurface soils beyond the depth of foundations are not considered prone to ground liquefaction or other forms of ground softening caused by earthquake induced ground motions.

## **6.6 Foundation Drainage**

Provided that the building slab will be at least 200 mm above surrounding grades and the exterior grades will shed water away from the building, then a perimeter drainage system is not required. If either of these conditions cannot be achieved, then a perimeter drainage system should be provided.

## **6.7 Temporary Excavations**

We expect that temporary excavations would be sloped where possible since it is more economical to do so. We would expect that slopes cut to 4V to 3H can be constructed in the existing dense glacial till. The surficial topsoil and organic rich sand should be benched or sloped back from the top of the excavation based on a 1 horizontal to 1 vertical setback defined by the height of the topsoil and organic rich sand. Temporary cut slopes in excess of 1.2 metres in height require inspection by a professional engineer in accordance with Work Safe BC guidelines.

Light to moderate seepage during the wetter months should be expected due to the formation of perched water tables and minor seepage in the till material. We expect that inflows may be handled with sumps and sump pumps.

## **6.8 On-Site Pavement**

### **6.8.1 Site Preparation**

Following the recommended site preparation noted in Section 6.1 the stripped lane subgrade should be proof rolled to locate any soft/loose spots. Where existing soils are soft/loose and can not be re-compacted to a minimum of 95% Modified Proctor dry density (ASTM D1557) they must be excavated and replaced with engineered fill.

### 6.8.2 On-Site Pavement Recommendations

Following the recommended site preparation, it is our opinion that our recommended pavement section, given in Table 2, is sufficient to carry the anticipated vehicle loads in on-site pavement structures for drive aisles and parking lots.

Table 2: Recommended Minimum Pavement Structure For On-Site Pavement	
<u>Material</u>	<u>Thickness (mm)</u>
<u>Asphaltic Concrete</u>	<u>75</u>
<u>19 mm minus crushed gravel base course</u>	<u>100</u>
<u>100 mm minus, well graded, clean, sand and gravel subbase course</u>	<u>200</u>

The asphalt thickness may be decreased to 65 mm in parking areas to be occupied solely by automobiles and light trucks.

All base and subbase fills should be compacted to a minimum of 95% Modified Proctor dry density with a moisture content within 2% of optimum for compaction. *Density testing should be conducted on these materials and the results forwarded to the geotechnical engineer for review.*

We expect that the pavement structure will be required to support the City of Coquitlam's fire trucks. The typical truck is understood to have a GVW of 82,000 lb and when set up imposes a point load of 42,000 lb, supported on 24 inch square bearing pads. Thus average bearing pressures are less than 11,000 psf. We confirm that the pavement structure specified above, placed over the recommended subgrade, will adequately support the specified fire truck loading.

### 6.9 Earth Pressure on Cast-in-Place Concrete Retaining Walls

If the development is to include cast-in-place concrete walls which would be designed by the structural engineer, these walls should be designed for static and seismic earth pressures as follows.

We recommend that a wall designed for static pressure a pressure distribution of  $5.5H$  (kPa) triangular, where  $H$  is the height of the restrained soil in metres, should be employed. Dynamic loading induced by an earthquake should be added to the static loads and should be taken as  $5.5H$  (kPa) inverted triangular. The preceding loading recommendations assume that the backfill is a clean, free draining sand and gravel, the backfill is level behind the wall, any tiers are setback at least 2H:1V from the wall toe, the wall is yielding and the wall is frictionless.

Our calculations assume that a back-of-wall drainage system will be installed to prevent the build up of any water pressure behind the walls.

All earth pressures are based upon unfactored soil parameters and are assumed to be unfactored loads.

## **6.10 Utilities**

Utilities will be underlain by engineered fill or dense glacial till. Some groundwater may need to be controlled using sumps and pumps.

We recommend that any trenches be sloped or shored as per the latest WorkSafeBC regulations. We recommend that all service trenches be backfilled with clean granular material, which conforms to municipal standards, compacted to 95% "Modified Proctor" dry density (ASTM D1557), with a moisture content within 2% of optimum for compaction. If for any reason the backfill becomes saturated prior to compaction it must be removed and replaced with dry fill.

## **6.11 Slope Stability**

The topography of the secondary school site shows grades much less than 2H:1V from north to south, thus deep seated failures are extremely remote given the dense ground conditions. We expect that if there are any environmental setbacks for this property that these would supercede our geotechnical setback requirements. Furthermore, any new foundation or cast in-place retaining walls should be designed to support the calculated dynamic lateral earth pressures stipulated in Section 6.9.

Based on the current overall grades of the site, we have reviewed the slope stability of the property in accordance with the 2018 BC Building Code (BCBC), which requires that slopes be evaluated under the 1 in 2,475 year return period design earthquake. We have addressed the 2018 BCBC seismic requirements using the guidelines recommended by the Association of Professional Engineers & GeoScientists in their report "Guidelines for Legislated Landslide Assessments for Proposal Residential Developments in BC", dated May 2010.

GeoPacific has visually reviewed the conditions of the slopes on the subject property and adjoining properties and have noted no signs of instability and we have no geotechnical concerns with the proposed development on the subject property. However, GeoPacific cannot investigate the soil conditions on neighbouring properties and as a result our conclusions pertaining to stability on neighbour properties is based on visual observation only.

GeoPacific accepts no responsibility for instability of neighbouring properties or impacts on the subject property caused by third parties.

## **6.12 Methane**

We expect that all surficial soils containing organics will be removed from beneath the proposed building. No other organic soils were encountered in our test pits. Thus, methane relief or abatement systems are not required for this project.

## **7.0 DESIGN REVIEWS AND CONSTRUCTION INSPECTIONS**

The preceding sections make recommendations for the design and construction of the proposed building, on-site pavement structures, and related earthworks. We have recommended the review of certain aspects of the design and construction. It is important that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also important that any contractors working on the site review this document prior to commencing their work.

It is the responsibility of the contractor to contact GeoPacific a minimum of 48 hours in advance to notify us

that a field review is required. In summary, field reviews are required for the following aspects of the work:

1. Review of site stripping
2. Review of foundation subgrade prior to footing construction
3. Review of slab-on-grade fill compaction prior to slab construction
4. Review of the compaction of engineered fill
5. Review of pavement subgrade and proof rolling
6. Review of pavement base and subbase compaction
7. Any excavation in excess of 1.2 metres in height requiring man-entry

## 8.0 CLOSURE

This report has been prepared exclusively for School District 43 Coquitlam for the purpose of providing geotechnical recommendations for the design and construction of the proposed Burke Mountain Secondary School development, pavement structure and related earthworks. The report remains the property of GeoPacific Consultants Ltd. and unauthorized use of, or duplication of, this report is prohibited.

We are pleased to be of assistance to you on this project and we trust that our comments and recommendations are both helpful and sufficient for your current purposes. If you would like further details or would like clarification of any of the above, please do not hesitate to call.

For:

GeoPacific Consultants Ltd.



Bryon Richardson, B.A.Sc., P.Eng  
Senior Project Engineer

Reviewed by:

Kevin Bodnar, M.Eng., P.Eng.  
Principal



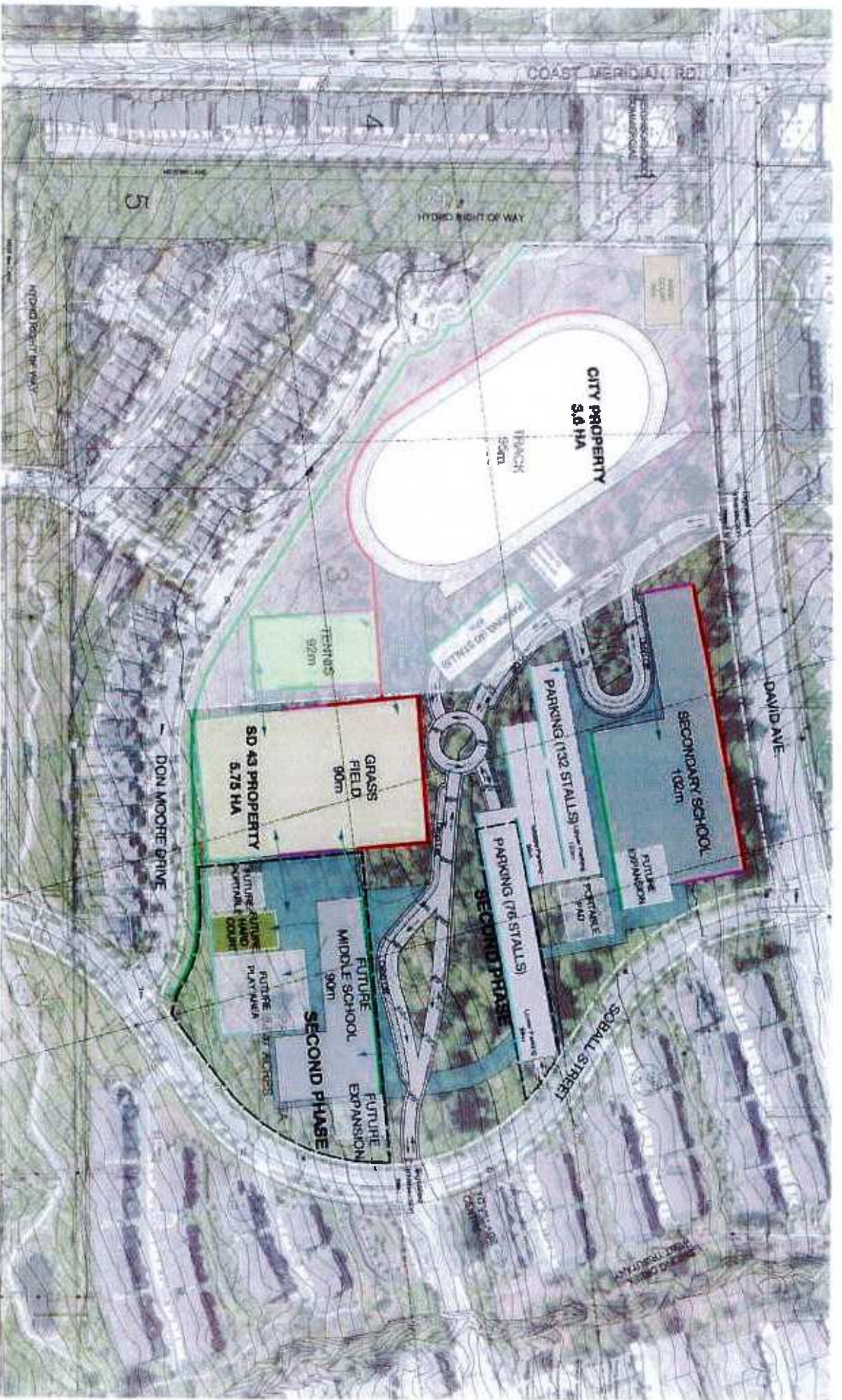


Figure 16: Option 1 Site Plan



# Bulletin



Planning and Development Department  
Building Permits Division  
Fax: 604-927-3445

Issued June 2019

Permits Bulletin Number: 14-003

## Environmental Loads for Use with the British Columbia Building Code (BCBC) 2018

As with previous editions of the Code, the BCBC 2018 does not list environmental loads for the City of Coquitlam in its Division B – Appendix C, Climate and Seismic information for Building Design in British Columbia. In the City of Coquitlam, Building Permit applications under the BCBC 2018 must be based on the climatic and seismic values tabulated in this Bulletin.

The choice of climatic elements tabulated in this Bulletin and the form in which they are expressed correspond to the entries in the Appendix, and are dictated largely by the requirements for specific values in several sections of the BCBC 2018. These elements include the Ground Snow Loads, Wind Pressures, Design Temperatures, Climate Zones, One-Day and 15-Minute Rainfalls, the Annual Total Precipitation values and Seismic Data.

Coquitlam's topography varies significantly resulting in various ranges of data. Snow loads vary continuously as one climbs in elevation and data are provided to reflect this. Three bands of data have been provided to address the remaining environmental loads. The bands correspond to the topographic elevations at which significant threshold values trigger qualitative changes in design requirements that may have cost implications for developers:

- Elevation 250 m - energy efficiency requirements, below this elevation Climate Zone 4, above this elevation is Climate Zone 5 under BCBC Part 9; and
- Elevation 425 m - above this elevation extensive development is unlikely to occur in the near future.

For development above the 425 m elevation, designers should obtain data from the appropriate agencies. Proposed values and data sources must be documented and submitted with the Building Permit application.

The tabulated values for Coquitlam were obtained from BCBC Appendix C and:

### Climatic Design Values

Environment Canada  
Atmospheric Environment Service  
4905 Dufferin Street  
Downsview, Ontario, M3H 5T4  
Tel (416) 739-4365

### Seismic Hazard in Spectral Format

Natural Resources Canada  
Geological Survey of Canada  
P.O. Box 6000  
Sidney, B.C., V8L 4B2.  
Web site [www.earthquakescanada.nrcan.gc.ca](http://www.earthquakescanada.nrcan.gc.ca)

Jim Bontempo  
Permits Manager

JB/gd

Attach.

# City of Coquitlam

## Environmental Loads for Use with the British Columbia Building Code (BCBC) 2018

Refer to Building Code and Division C for additional information

June 2019

Elevation	Snow Load kPa, 1/50		Design Temperature				15 Minute Rain mm	One Day Rain 1/50 mm	Annual Rain mm	Moisture Index	Annual Total Ppn., mm	Driving Rain Wind Pressure s, Pa, 1/5	Hourly Wind Pressures kPa		Frost Depth mm	Climate Zone	Degree- Days Below 18°C
			January		July 1.5%												
			meters	Ss	Sr	2.50% °C							1% °C	Dry °C			
401 to 425 (1)	5.70	0.4															
351 to 400	5.40	0.4	-11	-13	28	20	10	170	1880	1.97	2100	160	0.36	0.48	650	Zone 5 > 250 meters	3000- 3999
326 to 350	4.70	0.4															
301 to 325	4.40	0.3															
251 to 300	4.20	0.3	-10	-12	29	20	10	155	1820	1.91	1960	160	0.36	0.48	450	Zone 4 ≤ or = 250 meters	< 3000
201 to 250	3.70	0.3															
151 to 200	3.30	0.3															
101 to 150	3.00	0.3															
0 to 100	2.60	0.2	-9	-10	29	20	10	140	1750	1.81	1810	160	0.34	0.44			

Notes To Table:

(1) - For elevations exceeding 425 meters obtain data from the appropriate agencies.

Seismic Data							
Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA	PGV
0.784	0.691	0.393	0.24	0.077	0.027	0.399	0.511

Notes To Table:

(1) - See the paragraph dealing with Sentence 4.1.8.4.(1) in the Commentary entitled Design for Seismic Effects in the "User's Guide - NBC 2015, Structural Commentaries (Part 4 of Division B)" for guidance regarding sites in the Yukon and the British Columbia panhandle that are close to active faults.

Elevation meters	Required Performance of Windows and doors in Part 9 Buildings (1)							
	Climate Data		Specified Loads			NAFS		
	1/5 DRWP	1/50 HWP	DRWP	Wind Load		Required Fenestration Performance		
	Pa	kPa	Pa	Pa	(psf)	DP	PG	Water Resistance
151 to 425 (1)	160	0.48	160	972	20.3	1200	25	180
0 to 150	160	0.44	160	960	18.61	960	20	180

Notes To Table:

(1) - For elevations exceeding 425 meters obtain data from the appropriate agencies.

(2) - Table may not be used for skylights see Sentence 9.7.4.3.(1)



**LEGEND:**  
 ▲ TH#-#  
 - TEST HOLE (TH) LOCATION

**SITE PLAN**  
 \*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:



**GEOPACIFIC**  
 VANCOUVER  
 1170 WEST 10TH AVE  
 VANCOUVER, B.C. V6H 2B7  
 TEL: 604-681-0000  
 FAX: 604-681-0001

DATE:	30-Nov-2020		
DRAWN BY:	CS	APPROVED BY:	DR
SCALE:	M/S	REVIEWED BY:	CC

*Burke Mountain Secondary*  
 3400 David Avenue, Coquitlam, BC  
 TEST HOLE SITE PLAN

FILE NO.: 18327  
 DMC NO.: 18327-01

REVISIONS:  
 A.  
 B.  
 C.

## **APPENDIX A – TEST HOLE LOGS**



# Test Hole Log: TH20-01

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.5		<b>Topsoli</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
1.2		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, some wood fibres, brown, moist-wet	0.5				
1.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, till-like, cobbly, brown-grey, slightly moist	1.2				
2.4		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, light grey, dry	1.8				
2.4		End of Borehole	2.4				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.01  
Page: 1 of 1

# Test Hole Log: TH20-02

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
1		<b>Topsoli</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		6		
2		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8		6		
3		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	1.5		>50		perched groundwater observed @ 0.6 m
4		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry			>50		DCPT refusal @ 1.1 m
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21		End of Borehole	5.1				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.02

Page: 1 of 1

# Test Hole Log: TH20-03

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.1		<b>Topsoli</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3				
0.4		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8				perched groundwater observed @ 0.5 m
0.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, cobbly, grey, slightly moist	0.8				DCPT refusal @ 0.9 m
1.0		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry					
10.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.03

Page: 1 of 1

# Test Hole Log: TH20-04

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		3		
0.3		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.9		3		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	1.2		5		
1.2		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry			>50		DCPT refusal @ 1.43 m
1.43					>50		
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.04

Page: 1 of 1



# Test Hole Log: TH20-05

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8		8		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		>50		DCPT refusal @ 0.9 m
3.0		End of Borehole	3.0				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.05  
Page: 1 of 1

# Test Hole Log: TH20-06

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) • 10 20 30 40 •	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.9		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.9		4		
1.8		<b>Sand and Gravel (TILL)</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.8		>50		
1.8		End of Borehole	1.8				
							perched groundwater observed @ 0.6 m  DCPT refusal @ 0.85 m    Auger refusal @ 1.8 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.06

Page: 1 of 1

# Test Hole Log: TH20-07

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1778 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-8189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3				
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8				
1.5		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.5				
1.5		End of Borehole	1.5				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.07  
Page: 1 of 1

# Test Hole Log: TH20-08

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface					
0.0		<b>Topsoll</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
0.5		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.5				
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9				
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.08

Page: 1 of 1

# Test Hole Log: TH20-09

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 8P2  
Tel: 604-438-0922 Fax: 604-438-8188

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsail</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.6		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, brown, moist-wet	0.6		1		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		2		
1.5		End of Borehole	1.5		>50		DCPT refusal @ 1.15 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.09

Page: 1 of 1

# Test Hole Log: TH20-10

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEO PACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0 ft 0 m		Ground Surface					
0.0		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
0.5		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, wood fibres, brown, moist-wet	0.5				
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9				
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MOISTURE CONTENT REPORT  
(ASTM D2216)

CLIENT:	SCHOOL DISTRICT #43 - COQUITLAM	JOB #:	18327
PROJECT:	BURKE MOUNTAIN SECONDARY	RECEIVED:	1-Dec-20
LOCATION:	3400 DAVID AVENUE, COQUITLAM	TESTED:	1-Dec-20

HOLE #:	TH20 - 01	TH20 - 01	TH20 - 01	TH20 - 02	TH20 - 02
DEPTH:	2'	4'	7'	2'	4'
M/C:	51.0%	8.2%	6.9%	33.1%	10.2%

HOLE #:	TH20 - 02	TH20 - 02	TH20 - 02	TH20 - 03	TH20 - 03
DEPTH:	8'	14'	18'	1.5'	5'
M/C:	8.5%	6.7%	7.1%	43.5%	9.2%

HOLE #:	TH20 - 03	TH20 - 04	TH20 - 04	TH20 - 04	TH20 - 05
DEPTH:	9'	2'	4'	8'	4'
M/C:	9.1%	34.6%	11.0%	11.5%	8.7%

HOLE #:	TH20 - 05	TH20 - 06	TH20 - 06	TH20 - 07	TH20 - 07
DEPTH:	7'	2'	5'	2'	4'
M/C:	8.4%	35.6%	8.6%	31.9%	7.9%

HOLE #:	TH20 - 08	TH20 - 08	TH20 - 08	TH20 - 09	TH20 - 09
DEPTH:	1.5'	5'	8'	2'	5'
M/C:	15.0%	6.9%	9.1%	29.2%	9.1%

HOLE #:	TH20 - 10	TH20 - 10			
DEPTH:	2'	7'			
M/C:	25.6%	11.0%			

COMMENTS:

DISTRIBUTION:

Connor Griffin, GeoPacific

Per: Cindy Marinovic, B.Sc.

Reviewed By: Jakub Szary, B.Sc., ASCT

Lab Technician

Lab Manager





January 17, 2025

File No.: 35998 (BM-AP)

City of Coquitlam – Parks, Recreation, Culture &  
Facilities – Capital Construction  
3000 Guildford Way  
Coquitlam, BC  
V3B 7N2

Attention: Rajinder Singh | Park Planning Project Manager

**BURKE MOUNTAIN PROJECT, COQUITLAM, B.C.  
BURKE ATHLETIC PARK (BM-AP) CONTRACT  
GEOTECHNICAL RECOMMENDATIONS – Rev. 3**

Dear Rajinder,

Thurber has prepared this letter to summary our geotechnical input as required by the design team for the Burke Athletic Park project. This memo contains our recommendations for seismic design, input for wall design and pavement structure. This memo has been revised to incorporate changes to the project made since the memo was first issued on December 6, 2024.

It is a condition of this letter that the performance of Thurber's professional services is subject to the attached Statement of Limitations and Conditions.

**1. SEISMIC HAZARD VALUES FOR USE WITH BCBC 2024**

Cast-in-place concrete retaining walls are to be constructed on the east and west sides of the proposed tennis courts. We understand that the structural design of these walls will be in accordance with the 2024 BCBC which, until May 2025, still uses the seismic model from the 2018 BCBC/2015 NBCC.

Based on the results of Thurber's geotechnical investigation completed on March 13, 2023, the site is underlain by very dense, glacial till-like soils with an average shear wave velocity in the top 30 m ( $V_{s30}$ ) of 550 m/s. In accordance with Table 4.1.8.4.-A of the 2015 NBCC, the project site is considered Site Class C.

The 2018 BCBC seismic hazard for the project site is provided in Table 1-1. These spectral accelerations were obtained from the City of Coquitlam Environmental Loads for use with the BCBC 2018 (Permits Bulletin No. 14-003) dated June 2019.

**Table 1-1:  $S_a(T)$ , PGA, and PGV for Site Class C for 5% Damping (2,475-Year Return Period)**

Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)	Sa (5.0)	Sa (10.0)	PGA	PGV
(g)							(m/s)
0.784	0.691	0.393	0.24	0.077	0.027	0.399	0.511

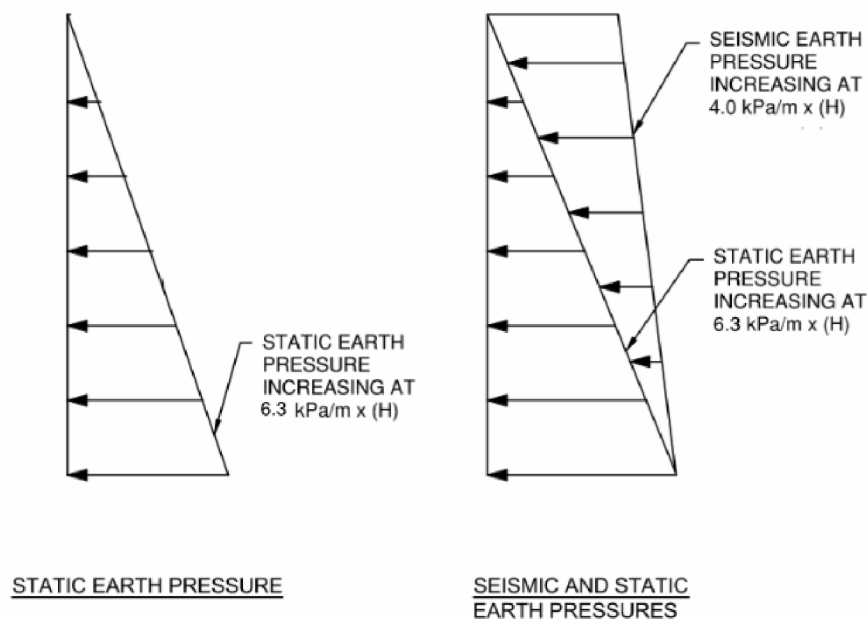


## 2. WALL DESIGN INPUT

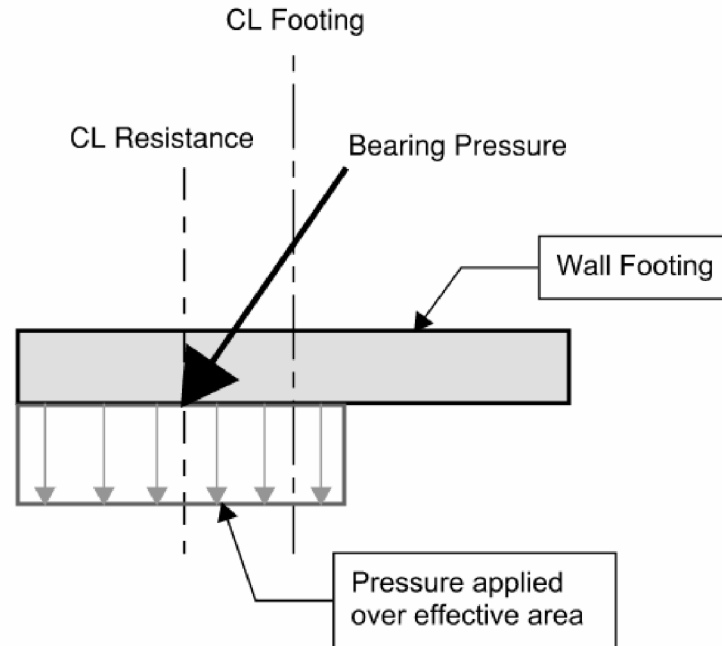
The cast-in-place retaining walls on the east and west sides of the tennis courts are expected to be founded on engineered fill or dense till-like soils. The zone behind the wall will be backfilled with well-graded granular fill and drainage will include either a perforated drainpipe near the base of the wall or regularly spaced weep holes through the face of the wall.

The design of the cast-in-place walls is being completed by others. For assessment of the external stability of the wall and the structural design, the following geotechnical inputs are recommended for Allowable Stress Design (ASD) or Working Stress Design (WSD):

- Ultimate (Unfactored) Bearing Resistance: 500 kPa
- Coefficient of Friction (Unfactored) (Within 6.5 m of the SP3 Retaining Wall): 0.5
- Coefficient of Friction (Unfactored) (All Other Locations): 0.4
- Lateral earth pressure distribution as shown in Figure 1.
- The bearing pressure of the wall should be applied as an equivalent uniform pressure (i.e., not trapezoidal) applied over the effective area as shown in Figure 2.



**Figure 1: Lateral earth pressure distribution where  $H$  is equal to the height of the wall.**



**Figure 2: Bearing pressure distribution adapted from the Canadian Highway Bridge Design Code (CSA S6:19)**

### 3. PAVEMENT DESIGN

For all drivable asphalt areas, we recommend use of the pavement section as follows:

- Minimum 35 mm thick asphalt surface course
- Minimum 40 mm thick asphalt base course
- Minimum 200 mm thick 19 mm minus Crushed Granular Base, as defined by MMCD, compacted to at least 95% modified Proctor maximum dry density (MPMDD)
- Minimum 300 mm thick 75 mm minus Select Granular Subbase, as defined by MMCD, compacted to at least 95% MPMDD. If 75 mm minus fill is already present on the surface of the site, the thickness of that fill can be counted towards this layer where present within the elevation range of the proposed subbase layer. However, test pits approximately 300 mm deep should be undertaken to demonstrate the thickness of the existing 75 mm before it is relied upon by the contractor.
- Competent subgrade consisting of either the very dense glacial till-like soil or adequately placed and compacted backfill soils (imported structural fill or glacial till-like fill). The subgrade should be reviewed by Thurber before placement of Select Granular Subbase.

These recommendations should be applied to the pavement sections in both vehicle traffic areas and non-traffic areas. Note that where the tennis or track designer requires thicker asphalt or base and subbase layers, those thicker layers should take precedent over the pavement section recommended in this memo.

#### **4. LIGHT POLE FOUNDATIONS**

We understand that the light pole foundations have been designed by Musco Lighting. On their design drawings, they listed their design assumes “IBC class 5 soils.” We confirm the soils on site are class 5 or better.

#### **5. EXPECTED SOIL CONDITIONS**

The expected soil conditions for the general site area are provided in the attached geotechnical report from the adjacent Burke Mountain Secondary School project. At the time of our geotechnical investigation, the majority of the site soils consisted of very-dense till-like soils potentially containing boulders. These boulders resulted in difficulty with the installation of some of the existing secant piles. Since the initial geotechnical investigation, some portions of the site have been cut, and others have been filled with 75 mm minus or reused till-fill.

#### **6. REUSE OF NATIVE TILL-LIKE SOILS**

The existing till-like soils on site are moisture sensitive and are difficult to work with in wet weather conditions. We do not recommend that this material be reused as part of this project. If construction occurs during long periods of dry weather, reuse of this material at select locations can be discussed between the contractor, the owner and Thurber. However, reuse of this material should not be relied upon.

#### **7. SECANT PILE WALL CONSIDERATIONS**

##### **7.1 Permanent Drainage and Shotcrete**

To establish permanent drainage, a minimum 1 m wide drainage mat should be placed over the existing drain holes in the secant walls. The drainage mat should extend from the top drainage hole to a minimum of 300 mm below final grade and should be hydraulically connected by permeable fill or PVC pipe to the drainage shown on the civil drainage plan. The below grade portion of the drainage mat should be fully covered with backfill prior to construction of the structural shotcrete wall detailed on the attached structural shotcrete wall detail.

The attached drawings illustrate the drainage details. They also detail the structural shotcrete wall to be constructed.

## **7.2 Existing Till-Like Slope at West End of SP5**

Site grading at the west end of SP5 incorporates an existing slope comprising native till-like soils. This slope is currently covered with poly sheeting and could potentially be mistaken for a material stockpile placed up against the secant pile wall. However, the secant piles which extend into this existing slope rely on the slope for lateral resistance. Disturbance to this material may result in movement or failure of the existing secant pile walls. This material must not be excavated nor disturbed except as discussed in Section 7.3.

## **7.3 Staircase Adjacent Tennis Courts**

The project incorporates a retaining wall and staircase located at the northeast corner of the tennis courts, near the intersection of the SP3 and SP5 retaining walls. The secant piles of SP3 are designed with embedment based on the tennis court elevation. However, as discussed in Section 6.0, the secant piles in the adjacent SP5 wall are founded at a higher elevation and rely on the existing till-like slope for support.

Based on discussions with the structural engineer and review of available drawings, we understand that the temporary excavation for the staircase will mostly be located in front of the SP3 wall. However, a portion of the foundation may extend roughly 0.3 m into the existing till-like slope in front of the SP5 wall. This would require excavation of a portion of the till-like slope, removing the soil supporting the SP5 wall.

Thurber will be providing an excavation and shoring design at a later date.

## **7.4 Utility Trench Excavations**

Utility trench excavations within 4 m of the existing secant piles should not extend deeper than 0.6 m below final grade without excavation specific review from Thurber and possibly an excavation shoring design from the contractor.

# **8. LOCK-BLOCK WALL CONSIDERATIONS**

## **8.1 Railing/Fence**

The attached structural drawings detail guard rail height and support spacing for cases where the Lock-Block Wall has a cast-in-place concrete cap, and cases where the top tier consists only of full sized Lock-Blocks. We understand that the City of Coquitlam no longer wishes to install the cast-in-place concrete cap on the wall. Guard rail height and support spacing is limited by the overturning resistance of each block. Where attached to the top or side of a full height block, the guard rail can be no more than 1.2 m high with supports spaced at 1.5 m horizontally for a 2024 BCBC lateral load of 0.75 kN/m with a load factor of 1.5.

## **8.2 Lift Point Infill**

The top row of the Lock-Block walls is generally flat except for a depressed lift point. These lift points are to be cleaned of soil and water and then infilled with concrete cement as appropriate.

## **8.3 Utility Trench Excavations**

Utility trench excavations within 4 m of the existing Lock-Blocks should not extend deeper than the bottom of the Lock-Block wall without excavation-specific written design input and field review from Thurber and possibly an excavation shoring design from the contractor.

## **9. RETAINING WALLS LESS THAN 1.2 M TALL**

Retaining walls that are less than 1.2 m tall are considered landscape walls and geotechnical input is not required. However, we recommend that any drains associated with landscape walls be wrapped in filter cloth to prevent soil migration and internal erosion.

## **10. EXISTING CONDITIONS**

Numerous components of the proposed project will interact with the secant pile and Lock-Block retaining walls constructed recently. We recommend a copy of the August 2024 Issued for Construction Drawings for the retaining walls be included in the tender package. These drawings should be provided for reference only and may vary from the as-built condition of the wall.

## 11. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact us at your convenience.

Yours truly,  
Thurber Engineering Ltd.  
Steven Coulter, M.Sc., P.Eng.  
Review Engineer

Ryan W.J. Mills, M.Eng., P.Eng.  
Geotechnical Engineer

### Attachment

- Statement of Limitations and Conditions
- Drawing – Geotechnical Details for SP3, SP5, LB2 and LB1
- Drawings – Structural Shotcrete Facing Details
- Geotechnical Report for Burke Mountain Secondary School (May 5, 2023)

## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

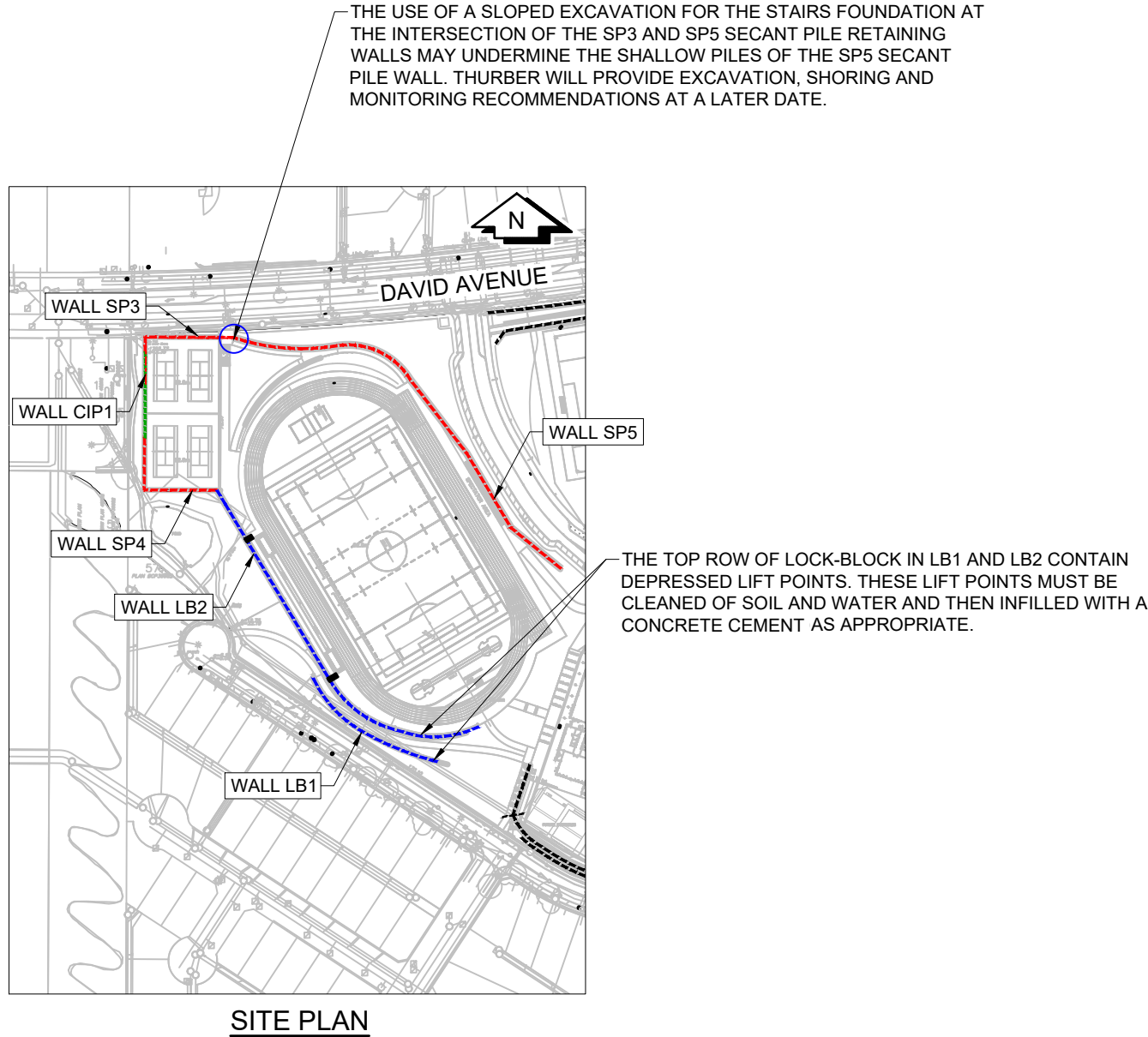
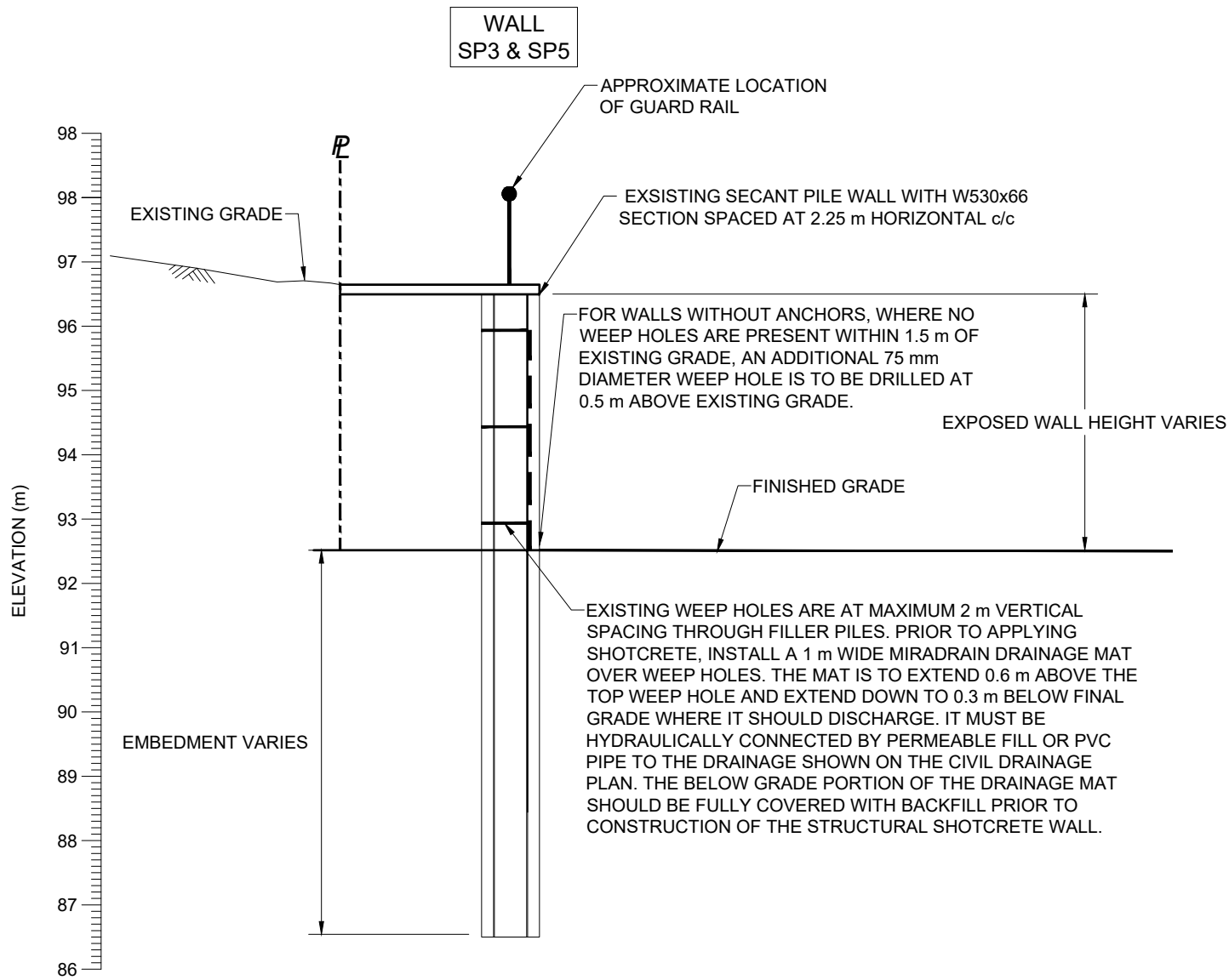
### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.




Plotted: January 16, 2025

\\bcvserver2\\Server\\Data\\B\\ST Projects\\35xxx\\35998\\06\_Drafting\\03\_Working\\JAN 2025\\35998\_SECANT WALL DETAILS\_2025.01.dwg



Thurber Engineering Ltd.  
Permit to Practice #1001319

					SEAL		SCHOOL DISTRICT # 43							
							GEOTECHNICAL DETAILS FOR SP3, SP5, LB1 AND LB2							
							BURKE MOUNTAIN SCHOOL				COQUITLAM, BC			
							DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
0	2025-01-17	RWJM	ISSUED FOR TENDER				RWJM	MOM		JAN. 16, 2025	N.T.S.	35998 - G01		0
REV.No.	DATE (Y,MTH., D)	BY	DESCRIPTION											



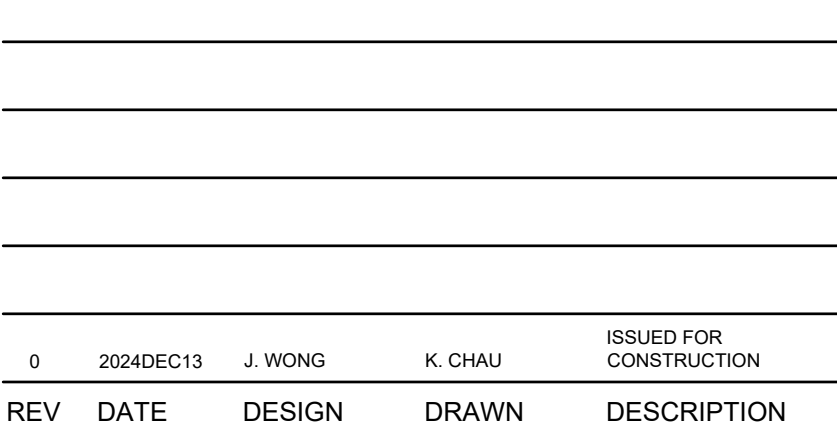
REINFORCEMENT:

2. LIGHT POLE BUTTRESS WALLS HAS BEEN DESIGNED FOR THE POLE BASE LOADS SHOWN IN THE SHOP DRAWINGS ENTITLED "BURKE MOUNTAIN SECONDARY SCHOOL FIELD LIGHTING" PREPARED BY MUSCO LIGHTING AND STRUCTURAL ENGINEERS, P.C. DATED AUGUST 24, 2023, WITH DRAWING NUMBERS C1 AND C2.
3. SEISMIC DESIGN ASSUMPTIONS:
- 3.1. SITE CLASS C
- 3.2. DESIGN OF THE SHOTCRETE WALLS WAS PER THE BC BUILDING CODE 2024. SEISMIC DESIGN OF THE SHOTCRETE WALLS WAS COMPLETED USING SEISMIC HAZARD VALUES TO ACCOMMODATE THE CITY OF COQUITLAM ENVIRONMENTAL LOADS FOR USE WITH THE BC BUILDING CODE 2018 (PERMITS BULLETIN NO. 14-003) WHICH ARE IN EFFECT UNTIL MAY 2025. THE UNIFORM HAZARD RESPONSE SPECTRUM IS PROVIDED BELOW.
- |          |           |
|----------|-----------|
| Sa(0.2)  | 0.784g    |
| Sa(0.5)  | 0.691g    |
| Sa(1.0)  | 0.393g    |
| Sa(2.0)  | 0.240g    |
| Sa(5.0)  | 0.077g    |
| Sa(10.0) | 0.027g    |
| PGA      | 0.399g    |
| PGV      | 0.511 m/s |
- 3.3 ASSUMED FACTORED ULS BEARINGS CAPACITY BELOW BUTTRESS FOOTING = 1000 kPa AS PER GEOTECHNICAL RECOMMENDATIONS FROM THURBER ENGINEERING.

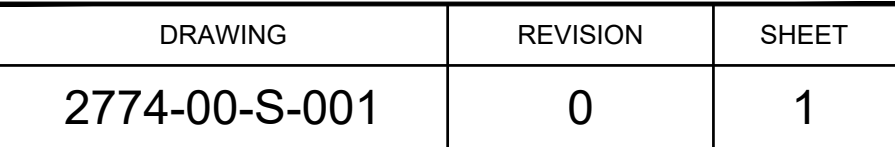
1. REFER TO SPECIFICATION SECTION 03371.

3. REBAR SPLICE LENGTHS (UNLESS NOTED OTHERWISE):  
LENGTHS SHOWN ARE IN mm

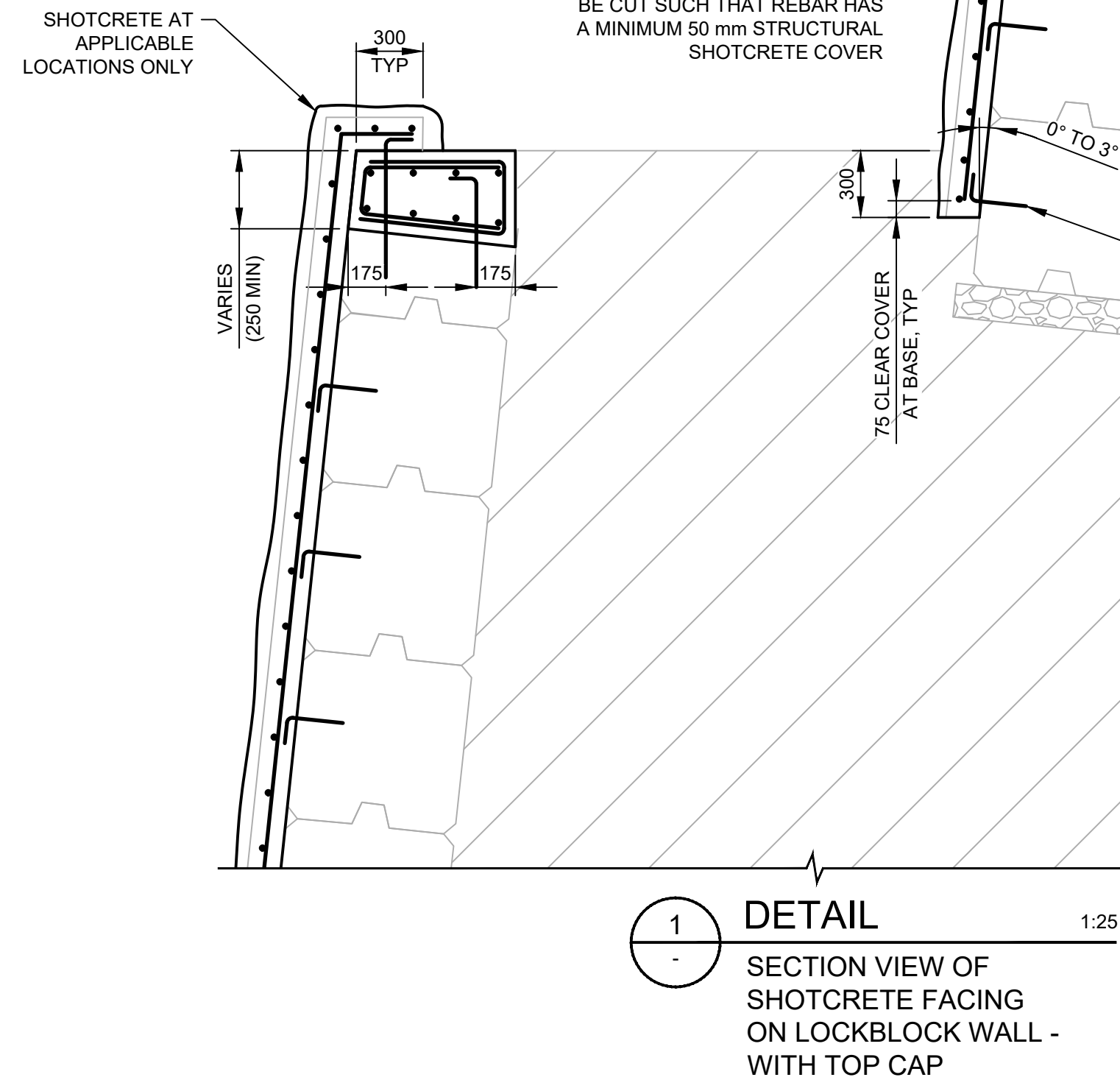
15. IF LAP SPLICES ARE NOT SPECIFICALLY INDICATED, LAP SPLICES SHOULD BE LOCATED AT POINTS OF MINIMUM STRESS AND SHOULD BE OUTSIDE OF HIGH STRESS REGIONS AND REBAR CONGESTED AREAS. THE NUMBER OF SPLICES SHOULD BE KEPT AS A MINIMUM AND THE SPLICES SHOULD STAGGER AND ALTERNATE.



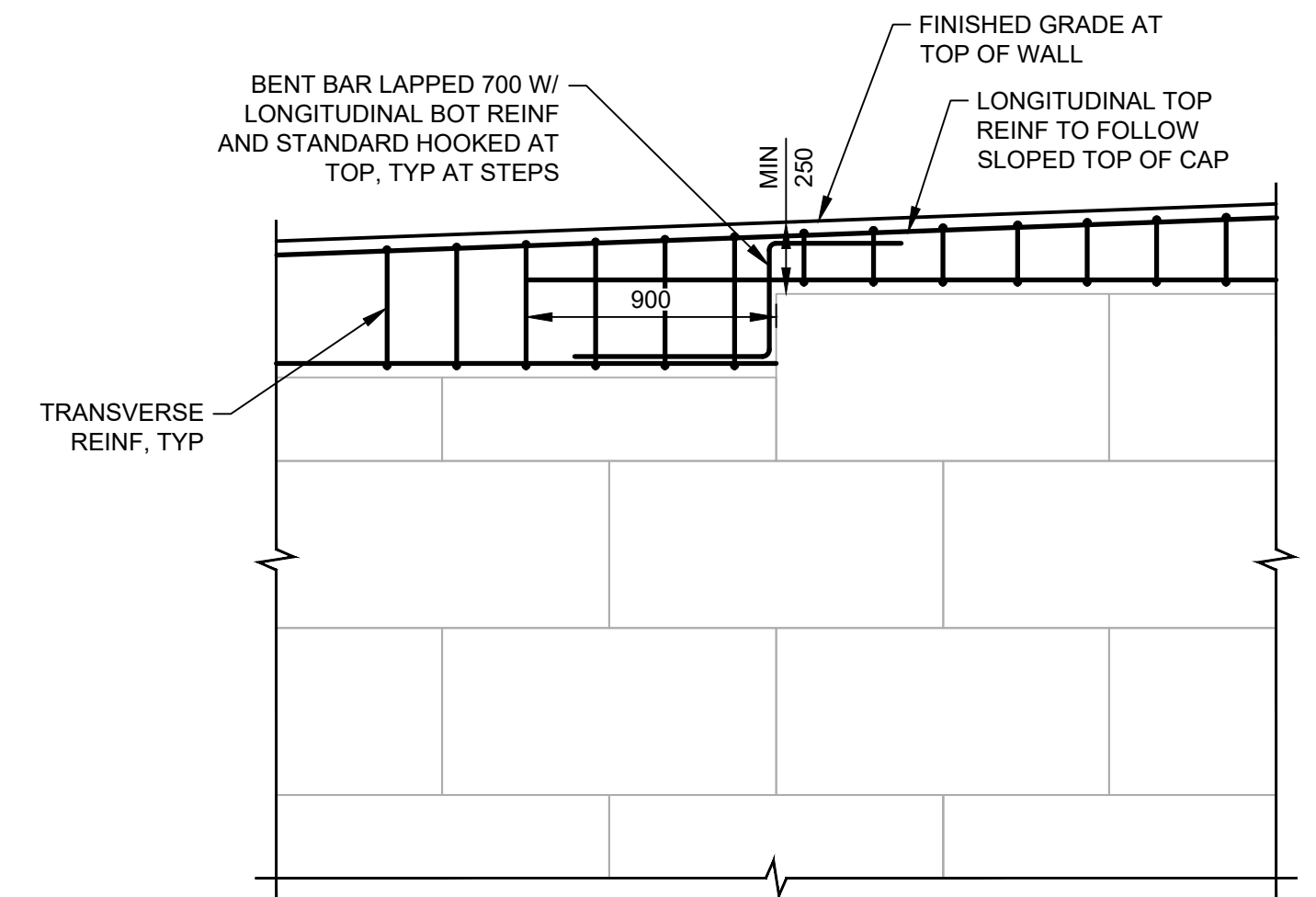
SCALE: AS SHOWN



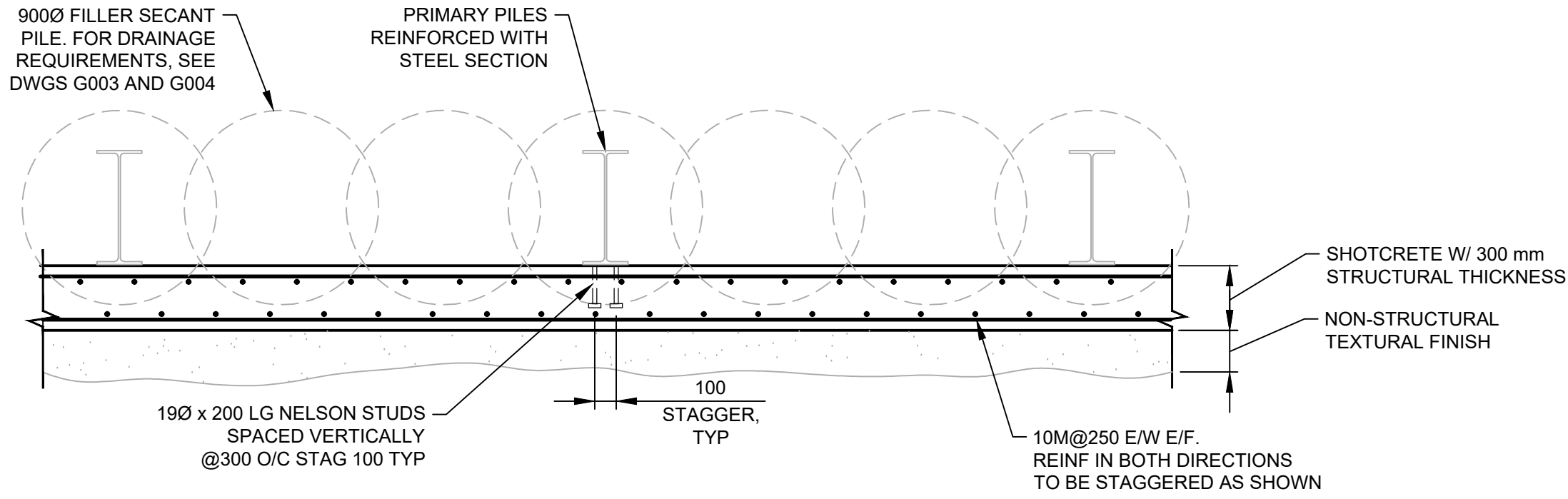




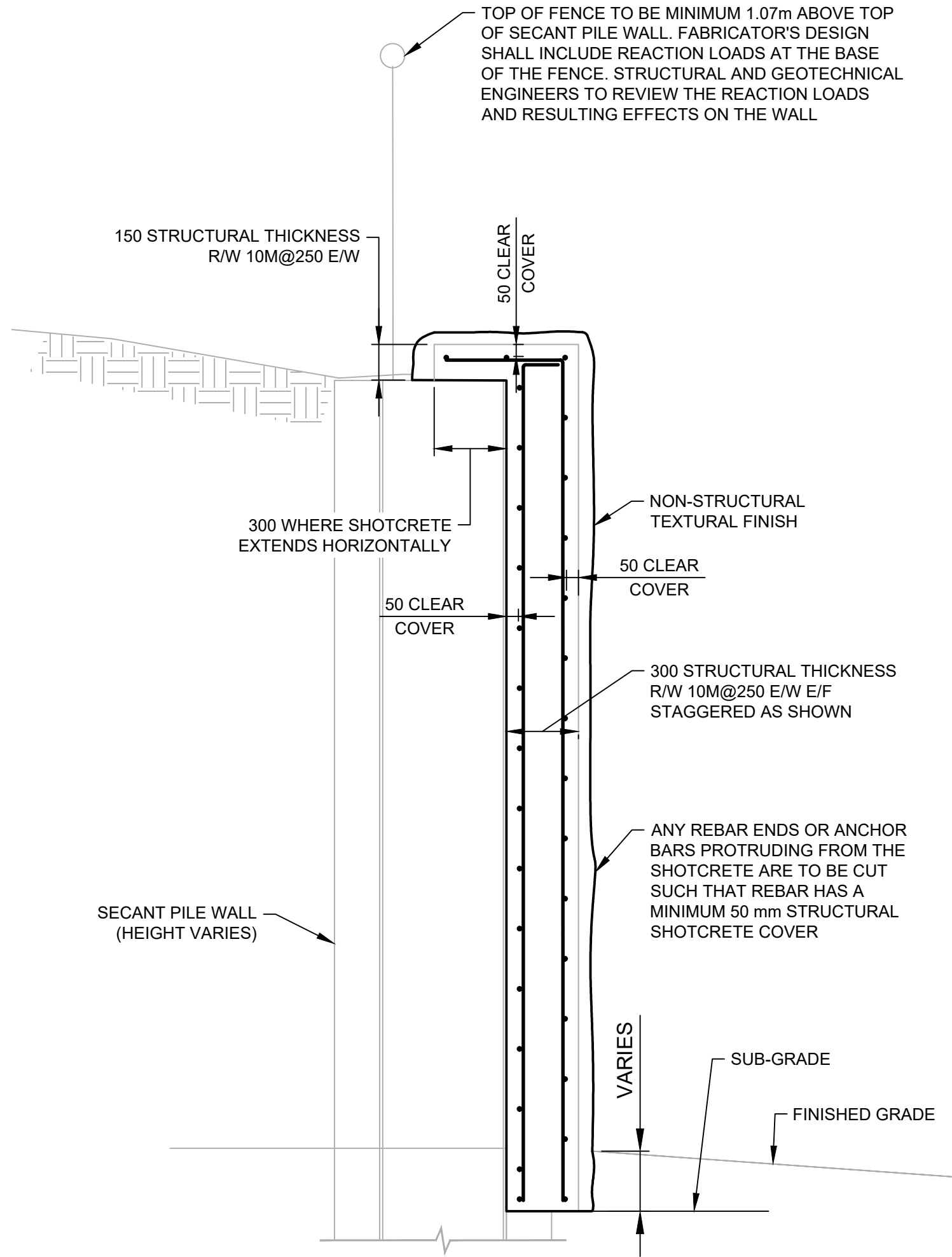
**NOTE:**  
FOR SHOTCRETE AND  
LOCKBLOCK NOTES  
SEE DETAIL 1.



3 DETAIL 1:25  
- PARTIAL ELEVATION VIEW  
OF CONCRETE TOP CAP ON  
LOCKBLOCK WALL



**1** DETAIL 1:25  
PARTIAL PLAN SECTION VIEW  
OF SHOTCRETE FACING ON  
SECANT PILE WALL



**2** DETAIL 1:20  
SECTION VIEW OF  
SHOTCRETE FACING  
ON SECANT PILE WALL

PLOT DATE: 12/12/2024 1:36:02 PM  
SAVE DATE: 12/12/2024 1:35:35 PM  
DWG PATH: G:\2025\2774-00\2774-00-S-501.dwg



PERMIT TO PRACTICE  
ASSOCIATED ENGINEERING (B.C.) LTD.  
PERMIT NUMBER: 1000163  
Engineers & Geoscientists BC

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2024DEC13	J. WONG	K. CHAU	ISSUED FOR CONSTRUCTION

THURBER ENGINEERING LTD

BURKE ATHLETIC PARK  
RETAINING WALLS

20222774-00

SCALE: AS SHOWN



THURBER ENGINEERING LTD.  
STRUCTURAL  
SHOTCRETE FACING AT SECANT PILE WALLS  
DETAILS

DRAWING	REVISION	SHEET
2774-00-S-504	0	3



May 5, 2023

File No.: 35998

The Board of Education of School District 43 (Coquitlam)  
1080 Winslow Avenue  
Coquitlam, BC V3J 0M6  
V3J 2G2

Attention: Meighan Scott, Architect AIBC, MRAIC, LEED AP BD + C – Senior Manager

and

City of Coquitlam  
3000 Guildford Way

Coquitlam, BC V3B 7N2

Attention: Ted Uhrich, MBCSLA – Acting Manager Parks and Facility Planning | Parks, Recreation, Cultures & Facilities

## **BURKE MOUNTAIN SECONDARY/MIDDLE SCHOOL PROJECT GEOTECHNICAL BASE REPORT**

Dear Meighan / Ted,

Thurber Engineering Ltd. (Thurber) has prepared this report to provide preliminary geotechnical recommendations and comments for the proposed development of the Secondary/Middle School located at 3390 and 3400 David Avenue in Coquitlam, BC. We understand that this project is a joint project between the Board of Education of School District 43 (the Board) and the City of Coquitlam (the City). The project includes a new school along with sports fields and running track, tennis court area, and multiple asphalt surface parking areas with access roads and drive aisles.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

### **1. SITE AND PROJECT DESCRIPTION**

The site is bordered by David Avenue to the north, Soball Street to the east, and Don Moore Drive to the south and southwest. The site is irregularly shaped, with maximum dimensions of about 400 m (east-west) and about 250 m (north-south) with a total area of 93,520 m<sup>2</sup>. The site is currently two separate legal properties, namely 3390 and 3400 David Avenue that will be realigned and subdivided. After subdivision, the eastern 57,510 m<sup>2</sup> will be owned by the Board and the western 36,010 m<sup>2</sup> will be owned by the City.

The existing site topography generally slopes downward from the northeast to the southwest at gradients ranging from about 8% to 12%. The overall elevation change along Soball Street and along David Avenue is 35 m and 25 m, respectively. The site was previously unoccupied and heavily forested with a water retention pond on the west side of site, which we understand is part of the local stormwater management system. At the time this report was prepared, the site had been cleared of trees.

This report and accompanying design work are based on the site grading plan by the Civil Engineer (Aplin & Martin Consultants Ltd.). At the time this report was prepared, the site grading plan is being developed and is not complete and may change after this report is written. If the design substantively changes, Thurber should be contacted to revise our report, if necessary.

The general site layout of the project includes the construction of a two-storey school building (initially operated as two schools), an artificial turf sports field, a new grass sports field, tennis court area, asphalt driveway with roundabout connected to access points off David Avenue and Soball Street, and asphalt parking areas. The site layout also includes a future portable construction area and the location of a future middle school. Refer to drawing Appendix A for the site location plan.

Given the site topography and the site grading plan, significant site earthworks along with permanent retaining walls and fill slopes will be required. The site grading plan indicates the following design elements will be required:

- A permanent vertical retaining wall with a maximum overall total height of about 15 m along the northern and eastern sides of the Board's grass sports field (adjacent to David Avenue). This wall will consist of tiered, permanent cantilevered and tieback anchored continuous secant pile walls.
- The southernmost portion of the site, near the southern end of the west side of Soball Street and along the entire north side of Don Moore Drive will require tiered retaining walls to support the placement of as much as 12 m of fill material. This wall will consist of geogrid reinforced, mechanically stabilized earth (MSE) modular block walls.
- Around the running track and tennis court areas, permanent retaining walls and / or excavation slopes will be required to facilitate a grade change of up to 4 m on the north side (cut into the slope) and up to 7 m high fill slopes on the south side. We understand that where walls are required, they will be constructed with a combination of cantilevered secant piles, MSE modular blocks, and cast-in-place concrete.



- The northern side of the school will be required to retain as much as 7 m of soil while the southern side of the school will be constructed over as much of 8 m of fill. The fill placement will require retaining walls to achieve the site grades.

## **2. BUILDING CODE CONSIDERATIONS**

We understand from discussions with the project team that although the building permit will be submitted while the current 2018 British Columbia Building Code (BCBC) governs, this project will be designed and constructed under the upcoming 2023 BCBC, which will be adopted from the recently released 2020 National Building Code of Canada (NBCC). The 2020 NBCC includes several changes, including those to seismic design that are more onerous than the 2018 BCBC. The recommendations provided in this report are based on the 2020 NBCC.

## **3. SUBSURFACE CONDITIONS**

### **3.1 Surficial Geology**

According to the Geological Survey of Canada Surficial Geology Map 1484A, the subsurface soils of the site comprise Vashon drift soils, including lodgement and minor flow till, with lenses and interbeds of substratified glaciofluvial sand and gravel, and lenses and interbeds of glaciolacustrine laminated stony till.

### **3.2 Previous Geotechnical Reports**

We were provided with three geotechnical reports (Golder Associates Ltd., 2004; Centennial Geotechnical Engineers Ltd., 2011, and GeoPacific Consultants Ltd., 2020) that include the results of a total of 10 solid-stem auger test holes and 41 excavator-dug test pits. The solid-stem auger test holes were advanced to depths ranging from 1.5 m to 6.1 m below ground surface and the test pit investigations were advanced to depths ranging from 0.7 m to 2.3 m below ground surface. The approximate locations of the solid-stem auger test holes and excavator dug test pits as well as the associated test hole logs and test pit logs have been extracted from the reports and are attached to this report.

We note that we have used the extracted pages for information only and have not relied on the recommendations provided in the individual reports in any way.

### **3.3 Thurber Geotechnical Investigation and Testing**

Thurber completed a geotechnical investigation on March 14, 2023, within the proposed school footprint that consisted of a sonic-drilled test hole advanced to a depth of 30.5 m below existing site grade. A downhole seismic casing was installed within the test hole and a vibrating wire piezometer was installed at a depth of 10 m. Downhole seismic testing was completed to determine the shear wave velocity profile and calculate the  $V_{s30}$  at the test hole location, which is a required for structural design purposes.

Thurber also coordinated the installation and testing of three sacrificial anchors (labelled SA-1, SA-2, and SA-3) that were installed vertically and incrementally loaded to failure. The purpose of the sacrificial anchors was to evaluate the site-specific soil bond capacity for the permanent tieback anchors required for the northern wall adjacent to David Avenue. Anchors SA-1 and SA-2 were both installed to a total depth of 8.2 m below existing site grade while anchor SA-3 was installed to a total depth of 6.2 m below existing site grade. The anchors were installed with 2.1 m long bond lengths.

The approximate locations of the sonic-drilled test hole and sacrificial anchor test are shown on Appendix A.

## **4. SUBSURFACE CONDITIONS AND TEST RESULTS**

### **4.1 Soil Conditions**

Based on our knowledge of the soil conditions on previous nearby projects, published surficial geology mapping and water well logs, the geotechnical reports by others, and the results of our investigation, the subsurface conditions generally consist of the following:

- Organic topsoil, typically very soft to soft, with trace to some gravel with a thickness ranging from 0.2 m to 1.2 m; over
- Loose to compact sand and gravel with a thickness ranging from 0.4 m to 1.0 m; over
- Very dense silty sand and gravel (glacial till-like) anticipated to be encountered at a depth of about 0.5 m to 1.2 m below existing site grades. We note that all the solid-stem auger test holes and excavator dug test pits encountered the very dense glacial till-like deposit. The glacial till-like soils are expected to extend to depths greater than 40 m below existing site grades. The permeability of the glacial till-like material is very low, with a hydraulic conductivity in the order of  $1 \times 10^{-8}$  m/s, but could vary by an order of magnitude higher or lower; over

- Sandstone / Siltstone bedrock. We note that the bedrock was not encountered in any of the on-site investigations completed; however, the bedrock is known to be present at a depth of about 100 m to 150 m below existing site grades based on regional geology mapping.

## **4.2 Groundwater Conditions**

The vibrating wire piezometer installed in Thurber's test hole SH23-01 indicates that the groundwater table is at a depth of about 5 m below existing site grades (within the glacial till-like soils). The depth to the static groundwater is expected to vary somewhat across the site but will generally follow the existing topography. Although the water level was measured at a depth of about 5 m, the seepage of groundwater into excavations is anticipated to be very low based on the hydraulic conductivity of the glacial till-like soil, even where the excavations will advance deeper than the groundwater level.

Intermittent perched groundwater is expected to be encountered on the surface of the low-permeability glacial till-like soils (within 1 m below the original grade), particularly during extended periods of wet weather.

## **4.3 Downhole Seismic Test Results**

Thurber completed downhole seismic testing at SH23-01. The testing included collecting shear wave velocity measurements at 1 m depth increments. The downhole shear wave velocity profile is shown on Appendix B.

The resulting  $V_{s30}$  of the soils at the school location is 550 m/s.

## **4.4 Sacrificial Anchor Test Results**

Thurber completed sacrificial testing of the three sacrificial anchors at the north end of the site. The results of the test loading of the sacrificial anchors indicate that the ultimate bond capacity of the glacial till-like soil to anchor grout is 270 kN/m at SA-1, 223 kN/m at SA-2, and 53 kN/m at SA-3.

Based on our experience with anchor testing within this deposit, the test results at SA-1 and SA-2 are in line with our expectations. Since SA-3 was installed 2 m shallower than SA-1 and SA-2, the lower bond strength value obtained is likely due to the weaker upper layer of glacial till. We will utilize a conservative bond capacity for initial design of permanent tieback anchors and will revise the design if future test results of production anchors indicate a higher capacity is available.



## 5. GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Based on our understanding of the project and the subsurface conditions we consider that the subsurface soils are favorable to complete the site grading and construct the associated permanent retaining walls as well as support the new school on conventional pad/strip footings and large mat foundations to support seismic elements.

The key geotechnical consideration for this project is the significant extent of site grading, including the excavation of a maximum 15 m high cut that requires a permanent wall and the construction of maximum 10 m high permanent MSE walls.

Furthermore, it is our opinion that the management of the soil to maximize reuse of excavated material to reduce costs will be the most important aspect of construction. To allow for the highest volume of reused materials while maintaining the static and seismic performance of the new school, the school foundations are expected to be constructed directly on undisturbed very dense glacial till-like soils. Furthermore, site services (water, storm sewer, sanitary sewer, gas, etc.) should also be coordinated to avoid, where possible, the geotextile / geogrid required for the MSE walls.

### 5.1 Seismic Design

In accordance with table 4.1.8.4.A of the 2020 NBCC (which will be adopted by the upcoming 2023 BCBC) the subject site should be classified based on the  $V_{s30}$  calculated from in situ measurements of shear wave velocity. As noted, the  $V_{s30}$  at the school location is 550 m/s.

The 2020 NBCC seismic hazard values for the 2,475-year return period earthquake obtained from GSC's website are provided in Table 5-1.

**Table 5-1:  $S_a(T)$ , PGA, and PGV for Site Designation  $X_{550}$  for 5% Damping and 2% / 50 Years Probability for the 2,475 Year Return Period Design Earthquake – 2023 BCBC (2020 NBCC)**

<b><math>S_a</math> (0.2, <math>X_{550}</math>)</b>	<b><math>S_a</math> (0.5, <math>X_{550}</math>)</b>	<b><math>S_a</math> (1.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (2.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (5.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (10.0, <math>X_{550}</math>)</b>	<b>PGA (0.05, <math>X_{550}</math>)</b>	<b>PGV (0.05, <math>X_{550}</math>)</b>
<b>(g)</b>							<b>(m/s)</b>
0.834	0.551	0.318	0.199	0.057	0.026	0.361	0.348

We understand that since the new school is considered a “high importance” structure, the Structural Engineer will require the 475-year return period earthquake seismic hazard values as part of their design, which are provided in Table 5-2.

**Table 5-2:  $S_a(T)$ , PGA, and PGV for Site Designation  $X_{550}$  for 5% Damping and 10% / 50 Years Probability for the 2,475 Year Return Period Design Earthquake – 2023 BCBC (2020 NBCC)**

<b><math>S_a</math> (0.2, <math>X_{550}</math>)</b>	<b><math>S_a</math> (0.5, <math>X_{550}</math>)</b>	<b><math>S_a</math> (1.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (2.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (5.0, <math>X_{550}</math>)</b>	<b><math>S_a</math> (10.0, <math>X_{550}</math>)</b>	<b>PGA (0.05, <math>X_{550}</math>)</b>	<b>PGV (0.05, <math>X_{550}</math>)</b>
<b>(g)</b>							<b>(m/s)</b>
0.411	0.0270	0.146	0.078	0.020	0.008	0.180	0.156

Since the site is underlain by very dense glacial till-like soils, the site is not expected to liquefy when subjected to the 2020 NBCC (2023 BCBC) 2,475-year return period design earthquake.

## 5.2 Site Preparation

The areas where the building foundations, retaining walls, roads, and parking will be constructed should be stripped of any loose, organic, and/or soft material to expose the very dense glacial till-like soils. From the subsurface information we have to date, we expect the depth of stripping required to be in the order of 0.8 m to 1.2 m from the existing ground surface.

Occasional cobbles and boulders are expected to be encountered during excavation, which will likely require special measures to remove. The excavation contractor should be made aware of this potential and will need to develop an excavation plan to remove these obstructions or to crush them on site for use as backfill materials.

We note that the exposed glacial till-like soil is susceptible to disturbance by construction equipment, especially during wet weather. To reduce the potential for disturbance, we recommend that the earthworks contractor account for the placement of at least 150 mm of 19 mm minus crushed gravel working surface in the overall excavation volume calculation. The working surface should be placed in relatively small sections as the excavation progresses to limit the duration that the till-like surface is exposed. The actual size of the sections will depend on weather conditions and the contractor's excavation methodology.

## 5.3 Backfill Materials and Compaction

The site grading for this project will involve significant volumes of cut and fill. To reduce costs, we recommend that the site fills consist of a combination of imported structural fill and reused excavated glacial till-like soils. We note that glacial till-like soils are difficult to work with and control water content, particularly during periods of wet weather. As such, the volume of reused till-like soil suitable for reuse will depend on the earthworks construction schedule and the methodology to protect the soil from water.

### **5.3.1 Imported Structural Fill**

Imported granular structural fill will be required to be placed and compacted throughout the site to achieve the grade to the design elevation. Any imported fill should consist of inert, durable, free-draining, well-graded granular material comprised of either pit run or crushed 75 mm minus sand and gravel conforming with the MMCD gradation requirements for subbase. The structural fill should be placed in maximum 300 mm thick lifts that are compacted to 95% of the material's modified Proctor maximum dry density (MPMDD) prior to placing subsequent lifts.

### **5.3.2 Potential Reuse of Glacial Till-Like Soil**

The reuse of glacial till-like fill may be considered throughout the project site except within the MSE wall geogrid reinforcement zone and where drainage is required.

- Where suitable, the placement and compaction of the glacial till-like fill will be subject to the following conditions:
- Any proposed glacial till-like fill should be free of pockets of high plasticity clay, organics, debris, cobbles larger than 100 mm in diameter, and boulders. These undesirable materials should be removed and exported from site.
- The material should be used during periods of dry weather and should not be used while raining.
- Proposed glacial till-like fill material should be stockpiled and covered with tarps to protect it from rain.
- The material must be placed at a water content within 1% of its optimum water content. If the material becomes too wet, it will likely need to be exported from site. If the material is too dry, it will be difficult to add water since the material is highly water sensitive and may also need to be removed from site.
- The material will need to be placed in relatively thin lifts in the order of 100 mm to 150 mm thick to achieve adequate compaction of 95% of the material's MPMDD.
- Thurber must review the placement and test the compaction of each lift of material; any material that does not achieve the required compaction must be removed and replaced.
- The prepared surface must be protected from rain and surface runoff during construction. This may require that tarps, cut off ditches, and placing structural fill over the prepared glacial till-like surface may be necessary. Any areas that become softened or disturbed will need to be excavated and replaced.

## **5.4 Permanent Retaining Walls**

As previously noted, to achieve the desired design grades, several permanent secant pile, MSE, and cast-in-place retaining walls will be required. The following sections provide a brief description of the secant pile and MSE wall designs; the cast-in-place wall designs will be provided by the Structural Engineer.

The permanent secant pile wall design will be provided on stand-alone Thurber design drawings; however, the permanent MSE wall design will be provided on the Civil Engineer's site grading drawings with Thurber providing input on the design details, sections, and notes.

### **5.4.1 Permanent Secant Pile Walls**

To accommodate for the excavation along the northeast corner property line, an approximately 300 m long retaining wall with exposed height up to approximately 15 m will be required. To satisfy the geometry constraints, the wall will be constructed as a tiered secant pile wall with the upper tier constructed as a cantilever wall with an exposed height of about 4 m and the lower tier constructed as an anchor tieback reinforced wall with a maximum 11 m exposed height. The finished face of these walls will be completed with a faux-bedrock shotcrete facing to satisfy aesthetic requirements.

### **5.4.2 Permanent MSE Walls**

Where the exposed height of the retaining wall exceeds 2.0 m and there is sufficient room behind the proposed wall for reinforcement and temporary excavation, geogrid reinforced MSE walls with modular block facing constructed with a 6-degree batter will be used. Walls up to about 6 m high will be constructed as a single wall and walls up to 10 m will be constructed as a tiered wall with minimum 2.5 m wide benches.

All MSE walls should be equipped with drainage tile connected to positive outlet to prevent any softening of foundation soils or water pressure build up in the reinforced backfill. The backfill within the geogrid reinforcement zone is expected to consist of imported structural fill.

## **5.5 Foundation Design**

Based on the subsurface conditions, and provided that the site is prepared in accordance with our recommendations, the school foundations may be supported on exposed very dense glacial till-like soil or engineered fill. However, for long-term performance under static and seismic performance, we strongly recommend that the school foundations be lowered such that they are founded on the glacial till-like soils.

The foundations can be designed using the Serviceability Limit State (SLS) bearing pressure, factored Ultimate Limit State (ULS) bearing resistance, and modulus of subgrade reaction presented in Table 5-2.

**Table 5-3: Foundation Design Parameters**

Foundation Soil	SLS Bearing Pressure		Factored ULS Bearing Resistance** (kPa)	Modulus of Subgrade Reaction*** (MPa/m)
	Footing Width	Bearing Resistance* (kPa)		
Engineered Fill Either Structural Fill or Reused Glacial Till-Like Fill	< 3.5 m	150	250	10
	3.5 m to 4.5 m	125		
	> 4.5 m	Thurber to be contacted to review.		
Glacial Till-Like Soil Very Dense / Hard Sandy SILT to SAND AND SILT	< 3.5 m	1,000	1,000	150
	3.5 m to 4.5 m	800		
	Up to 6.0 m	700		
	> 6.0 m	Thurber to be contacted to review.		

\* SLS Bearing Pressure based on limiting total post-construction settlement to 25 mm and differential settlement to 20 mm over a horizontal distance of 10 m.

\*\* Geotechnical resistance factor of 0.5 used per Canadian Foundation Engineering Manual, 2006

\*\*\* Modulus of subgrade reaction is to be applied to raft foundations and large pad footings based on a grid spacing of 0.3 m by 0.3 m. Thurber must be contacted if alternative spacing is required.

We note that the modulus of subgrade reaction is not a real soil parameter; it is a response of a soil system to load application and is dependent on several factors, including the size of the loaded area, the layering of the subgrade soils, the shear modulus (which is strain dependent), the direction of loading, the type of loading, rigidity of the foundation, and other factors. It is a calculation used by structural engineers to estimate shear force and bending moments in raft slabs and large footings but is not rigorously correct. For design expediency, we suggest that the stresses and moments in the footings and larger mat footings be estimated using the modulus of subgrade reaction values provided. Within about 1 m of the edges of the slab, the modulus should be doubled. According to the American Concrete Institute suggested procedures for design, the sensitivity of the design should be checked by using moduli of subgrade reaction equal to one-half and five times the estimates provided.

The sliding of foundations can be resisted by friction at the interface between concrete and the foundation soils. A factored coefficient of friction of 0.40, based on a resistance factor of 0.5 per the Canadian Foundation Engineering Manual, 2006, can be used for design.

The building foundations should be designed with a minimum dimension of 600 mm for pad footings and 500 mm for strip footings for confinement and frost protection purposes.

## **5.6 Drainage and Backfill Considerations**

The slab-on-grade of the new school should be underlain with an underslab drainage layer consisting of at least 150 mm of 19 mm clear crushed gravel to provide a capillary break and prevent water from contacting the underside of the slab-on-grade. In addition, an underslab and perimeter drainage system should be placed to collect and discharge stormwater into a suitable municipal drainage system that meets the City's bylaws and guidelines. We note that the subsurface conditions consist of low-permeability glacial till-like soils that are not suitable for infiltration of stormwater.

The underslab and perimeter drains should consist of minimum 100 mm diameter perforated PVC pipe surrounded with at least 150 mm of 19 mm clear crushed gravel that is either wrapped in filter cloth or covered with a minimum of 150 mm of birds-eye gravel. The underslab drain should be placed at a maximum 12 m horizontal centre-to centre (c/c) spacing configured to fit between footings, sumps, and elevator cores/stair cores, preferably in straight lines to reduce elbows in the pipe. We expect that the perimeter drain will be constructed on the outside of the building. To hydraulically connect the interior drains to the perimeter drain, weep holes should be installed through the foundation wall at approximately 2 m c/c horizontal spacing. Alternatively, the drainage discharge for the perimeter drain and interior drains may be separated.

Backfill to achieve finished grade elevation around the school should consist of free-draining 75 mm minus sand and gravel that are placed and compacted in discrete lifts to at least 95% MPMDD.

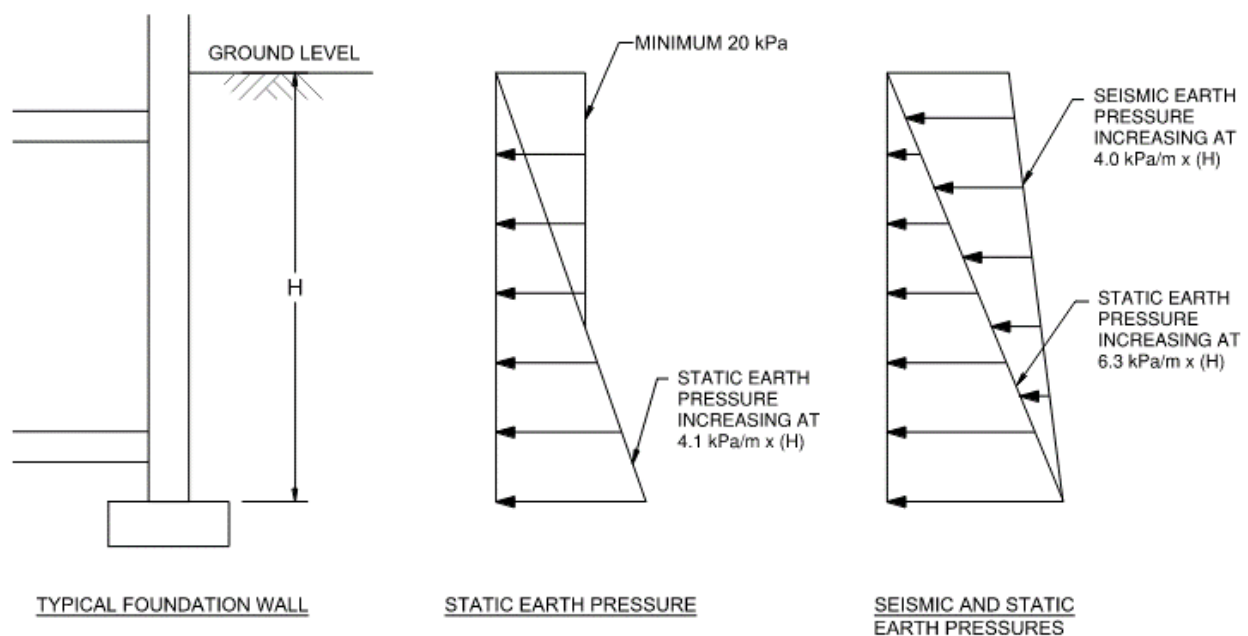
The finished grade around the building should be sloped such that surface runoff is carried away from the building and subsequently collected and discharged into the City drainage system. Where practical, the finished surface should also consist of impermeable materials to limit infiltration of stormwater into the ground.

The purpose of the drainage and backfill provisions in this section is to prevent the build-up of hydrostatic pressures against the underside of the slab-on-grade and foundation walls. The requirement for water-proofing and/or damp-proofing are the responsibility of the Architect or Building Envelope consultant.

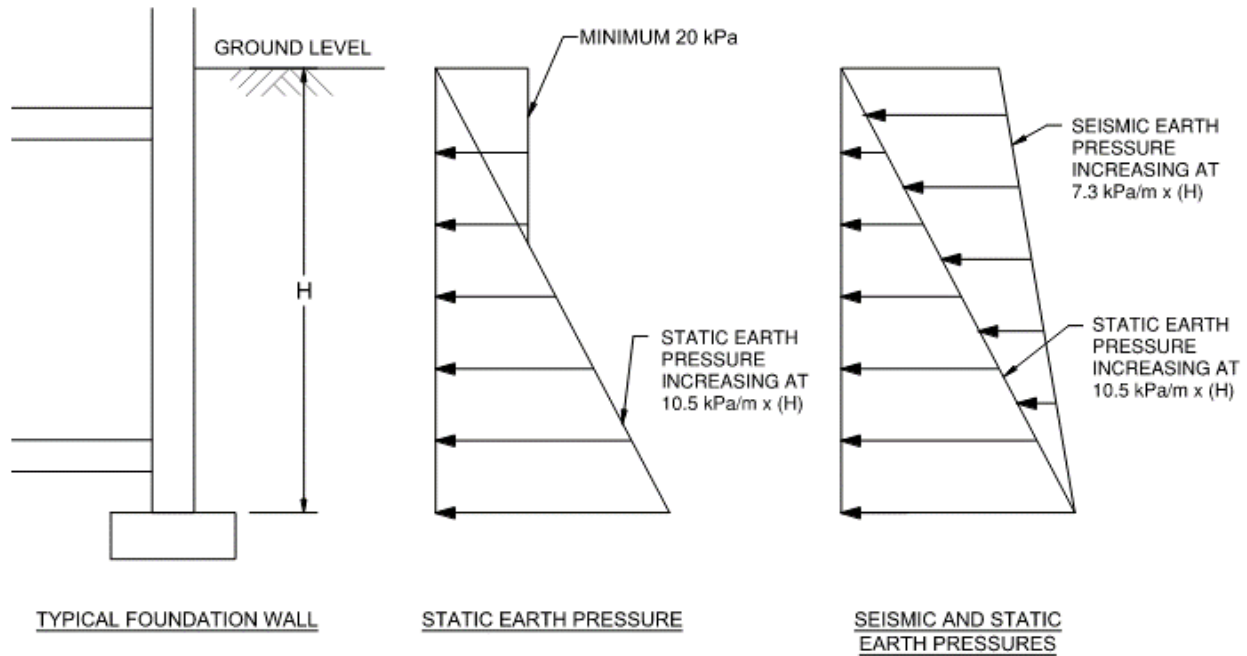
## 5.7 Lateral Earth Pressures Against Basement Walls

Lateral earth pressures against basement walls under static and seismic conditions will depend on whether the walls are “yielding” or “non-yielding”. “Yielding” walls are defined as walls that are able to rotate at least  $0.005H$ , and “non-yielding” walls are defined as walls that are unable to rotate at least  $0.005H$ , where  $H$  is the overall height of the wall.

Unfactored lateral earth pressures for “yielding” and “non-yielding” walls are provided in Figure 5.1 and Figure 5.2, respectively. The lateral earth pressures are applicable for walls with adequate drainage provided to prevent the build-up of hydrostatic pressures.



**Figure 5-1: Unfactored Lateral Earth Pressures for "Yielding" Walls**



**Figure 5-2: Unfactored Lateral Earth Pressures for "Non-Yielding" Walls**

## 5.8 Asphalt Pavement Design

We expect that asphalt pavement drive aisles and parking will be required to support fire, garbage, and loading truck access. We recommend the pavement design for onsite roads and parking areas comprise the following:

- Minimum 35 mm thick asphalt surface course, over
- Minimum 40 mm thick asphalt base course, over
- Minimum 200 mm thick 19 mm minus Crushed Granular Base, as defined by the Master Municipal Construction Documents (MMCD), compacted to at least 95% MPMDD, over
- Minimum 300 mm thick 75 mm minus Select Granular Subbase, as defined by the MMCD, compacted to at least 95% MPMDD, over
- Competent subgrade consisting of either the very dense glacial till-like soil or adequately placed and compacted backfill soils (imported structural fill or glacial till-like fill). The subgrade is to be reviewed by Thurber prior to placement of any Select Granular Subbase material.

We note that the thickness of the Select Granular Subbase layer may be reduced, depending on Thurber's review of the observed quality and relative density of the subgrade.



## 5.9 Methane

The results of the investigations by Thurber and others confirm that organic soils are not expected to underly the new building area. As such, it is our opinion that a methane ventilation system will not be required for the proposed building development.

## 5.10 Radon

Although radon measurements were not collected during the geotechnical investigation, review of the BC Centre of Disease Control – British Columbia Radon Map indicates that the project site is located with the “yellow” zone, which corresponds to 100 to 200 Bq/m<sup>3</sup> (Becquerels per cubic metre). The Mechanical Engineer should review and consider this concentration in their design.

## 6. CLOSURE

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

Yours truly,  
Thurber Engineering Ltd.

Steven Coulter, M.A.Sc., P.Eng.  
Review Engineer

Conrad Tench, P.Eng.  
Senior Geotechnical Engineer

Thurber Engineering Ltd. Permit to Practice #1001319
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### Attachments

- Statement of Limitations and Conditions
- Drawing 35998 – 1: Site Location Plan
- Shear Wave Velocity Profile for SH23-01
- Thurber Test Hole Log – SH23-01
- Golder Associates Ltd., 2004 “Test Pit Location Plan” and Test Pit Logs
- Centennial Geotechnical Engineers Ltd., 2011 “Location Plan for Test Pits” and Test Pit Logs
- GeoPacific Consultants Ltd., 2020 “Site Plan” and Test Hole Logs

## STATEMENT OF LIMITATIONS AND CONDITIONS

### 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

### 5. INTERPRETATION OF THE REPORT

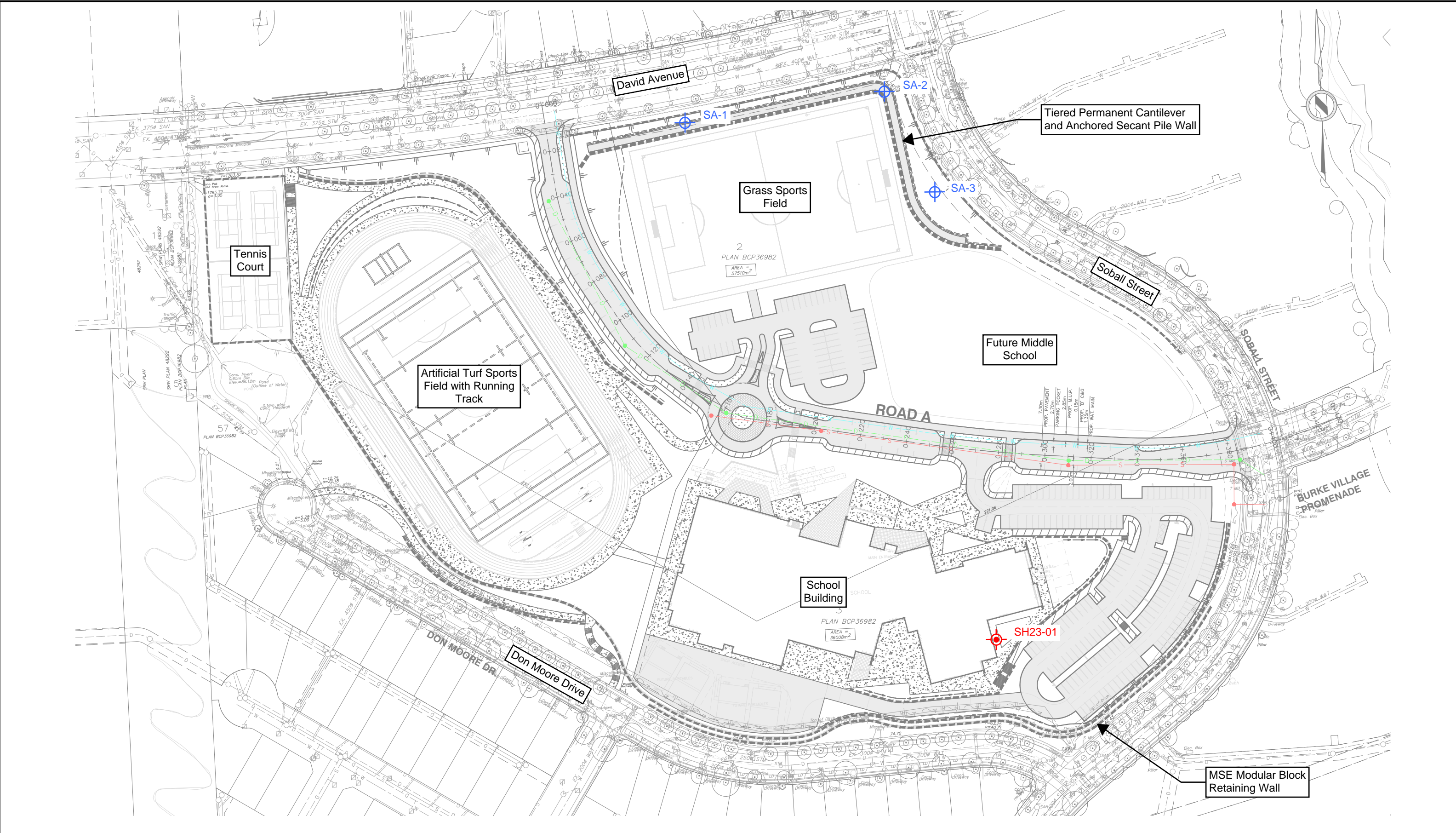
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

### 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



<div>LEGEND / NOTES</div> <div><div><div><div></div></div><div>SA-1</div></div><div>- Approximate Sacrificial Anchor Location (2023)</div></div> <div><div><div><div></div></div><div>SH23-01</div></div><div>- Approximate Sonic-Drilled Test Hole Location (2023)</div></div> <div>Base plan from Aplin Martin Site Grading Plan dated April 12, 2023</div>	<div><div><div></div><div></div></div><div>THURBER ENGINEERING LTD.</div></div>	CLIENT NAME	BOARD OF EDUCATION OF SCHOOL DISTRICT 43 (COQUITLAM) AND THE CITY OF COQUITLAM		DRAWN BY	GS	DATE	2023-04-25
		DRAWING TITLE	SITE LOCATION PLAN		DESIGNED BY	GS	SCALE	1:1500
		PROJECT NAME AND LOCATION	BURKE MOUNTAIN SECONDARY/MIDDLE SCHOOL PROJECT COQUITLAM BC		APPROVED BY	CT	PROJECT No.	35998
					DRAWING / FIGURE No.	35998 - 1	REV.	0





## DOWNHOLE SEISMIC TEST DATA

**Client:** SD43 City of Coquitlam

**Test Hole ID** SH23-01

**Site:** Burke Mountain Secondary School

**Job Number:** 35998

**Date:** 23-Mar-23

**Source Offset:** 1.39 m

**Source:** Wood Beam

Geophone Depth (m)	Measured Travel Time from Source (ms)	Vertical Component of Travel Time (ms)	Incremental Shear Wave Velocity (m/s)
1.00	8.0	-	-
2.00	10.3	8.5	261
3.00	12.1	11.0	395
4.00	14.3	13.5	400
5.00	16.5	15.9	417
6.00	18.9	18.4	401
7.00	21.3	20.9	402
8.00	23.2	22.9	501
9.00	25.0	24.7	565
10.00	26.4	26.2	671
11.00	27.8	27.6	703
12.00	29.1	28.9	732
13.00	30.5	30.3	719
14.00	31.9	31.7	721
15.00	33.3	33.2	683
16.00	34.8	34.6	689
17.00	36.3	36.2	633
18.00	37.8	37.7	681
19.00	39.2	39.1	696
20.00	40.7	40.6	677
21.00	42.2	42.1	664
22.00	43.6	43.5	702
23.00	45.1	45.0	692
24.00	46.6	46.5	652
25.00	48.2	48.1	635
26.00	49.7	49.6	648
27.00	51.3	51.2	624

Vs30 = 550 m/s (Assuming 600 m/s for 28 - 30 m depths).

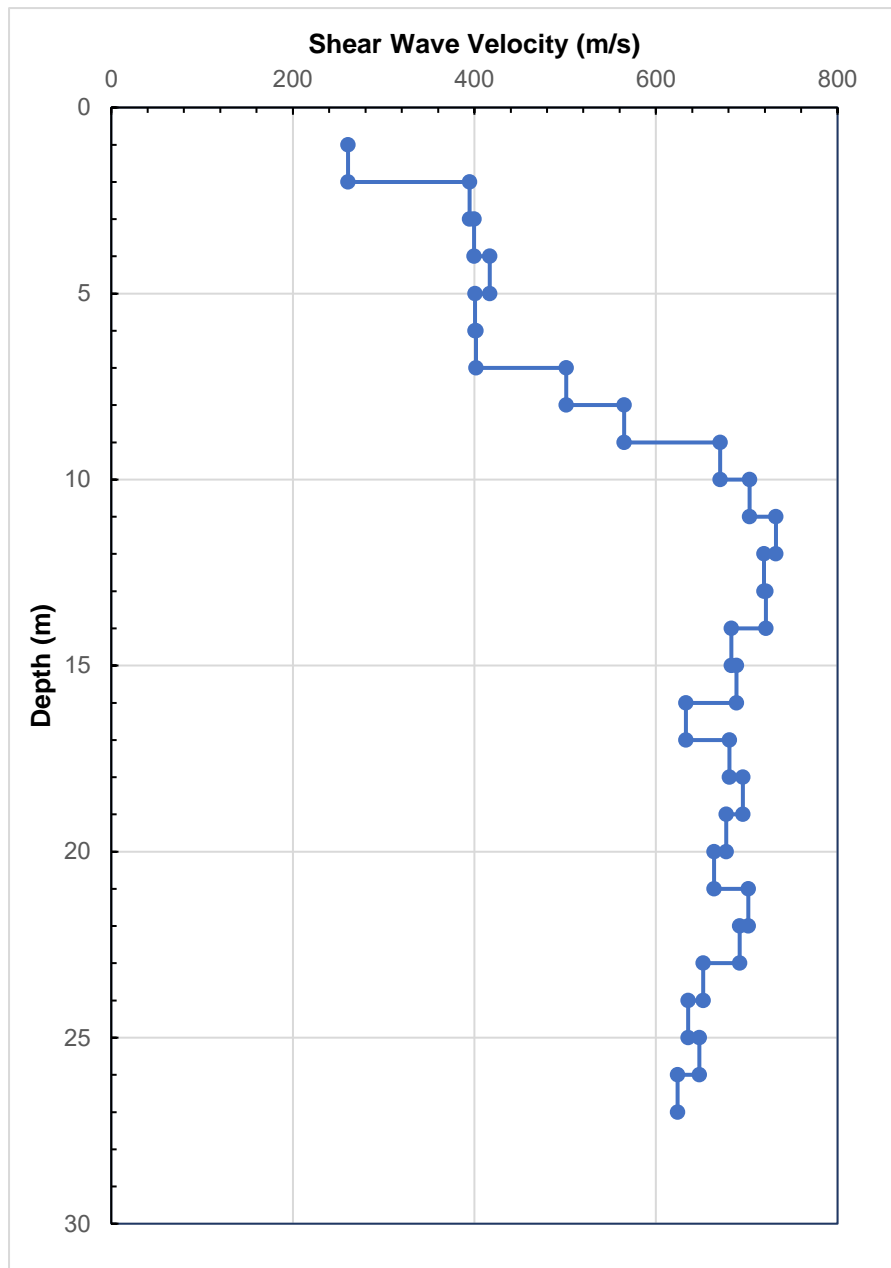
Shear wave travel time measurements by Thurber Engineering Ltd.



## VELOCITY PROFILE

**Client:** SD43 City of Coquitlam  
**Test ID:** SH23-01  
**Site:** Burke Mountain Secondary School

**Job Number:** 35998  
**Date:** 23-Mar-23  
**Source Offset:** 1.39 m  
**Source:** Wood Beam



Shear wave velocity measurements by Thurber Engineering Ltd.

## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

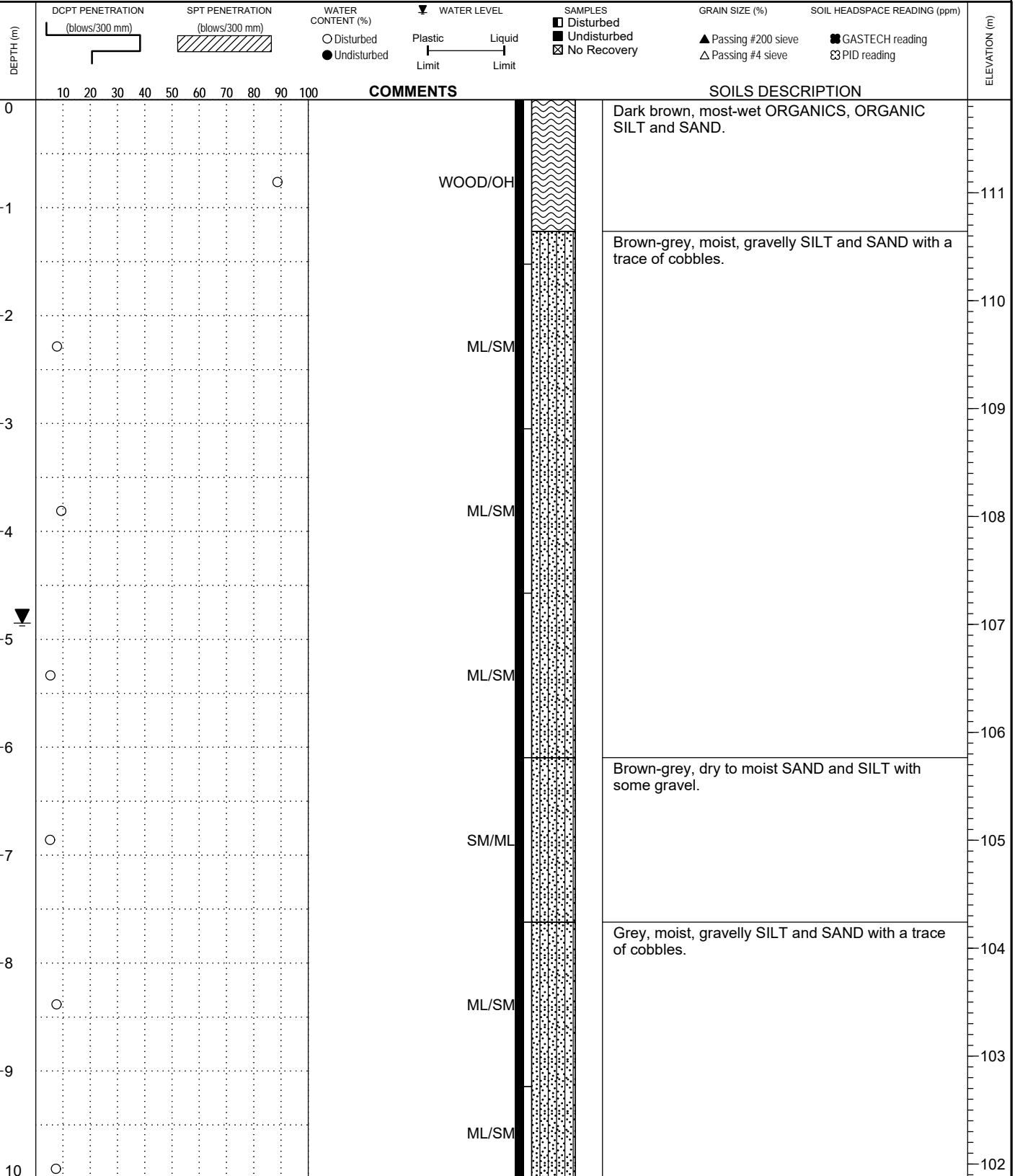
**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	ELEVATION (m)
			○ Disturbed ● Undisturbed	Plastic Limit Liquid Limit	Disturbed Undisturbed No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ⊞ PID reading	
	10 20 30 40 50 60 70 80 90 100							
10								101
11								100
12								99
13								98
14								97
15								96
16								95
17								94
18								93
19								92
20								

## COMMENTS

## SOILS DESCRIPTION

Grey, moist, gravelly SILT and SAND with a trace of cobbles.

ML/SM

ML/SM

Brown-grey, moist GRAVEL, SILT and SAND.

ML/SM

Brown-grey, moist SAND and SILT with some gravel and a trace of cobbles.

SM/ML

Grey, moist, gravelly SILT and SAND with a trace of cobbles.

ML/SM

ML/SM

LOG OF TEST HOLE (COORDS + EL. EST.) 35998.GPJ THURBER\_MOM.GDT 23-4-27-THURBER\_MOM - BC OPERATIONS.GLB

## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%) ○ Disturbed ● Undisturbed	WATER LEVEL ▼ Plastic Limit Liquid Limit	SAMPLES ■ Disturbed ■ Undisturbed ☒ No Recovery	GRAIN SIZE (%) ▲ Passing #200 sieve △ Passing #4 sieve	SOIL HEADSPACE READING (ppm) ■ GASTECH reading ☒ PID reading	ELEVATION (m)
20								91
21								90
22								89
23								88
24								87
25								86
26								85
27								84
28								83
29								82
30								

LOG OF TEST HOLE (COORDS + EL. EST.) 35998.GPJ THURBER\_MOM.GDT 23-4-27-THURBER\_MOM - BC OPERATIONS.GLB



## LOG OF TEST HOLE

TEST HOLE NO.

SH23-01

**LOCATION:** Coquitlam, BC  
N 5459686, E 518152 (Est.)

**CLIENT:** Station One Architects / S.D. #43  
**PROJECT:** Burke Mountain Secondary School

**TOP OF HOLE ELEV:** 111.9 m (Est.)

**METHOD:** Sonic

**DATE:** March 13, 2023

**DRILLING CO.:** Mud Bay Drilling Ltd.

**FILE NO.:** 35998

**INSPECTOR:** DKP

**REVIEWED BY:** GS



DEPTH (m)	DCPT PENETRATION (blows/300 mm)	SPT PENETRATION (blows/300 mm)	WATER CONTENT (%)	WATER LEVEL	SAMPLES	GRAIN SIZE (%)	SOIL HEADSPACE READING (ppm)	ELEVATION (m)
			○ Disturbed ● Undisturbed	Plastic Limit Liquid Limit	■ Disturbed ■ Undisturbed ☒ No Recovery	▲ Passing #200 sieve △ Passing #4 sieve	■ GASTECH reading ☒ PID reading	
30								81
31								80
32								79
33								78
34								77
35								76
36								75
37								74
38								73
39								72
40								

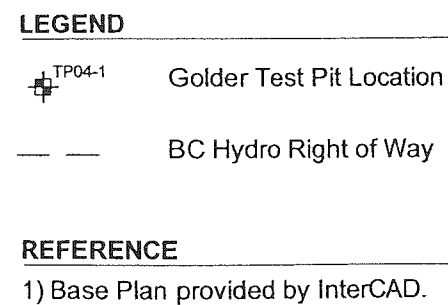
COMMENTS

SOILS DESCRIPTION

SM/ML

Grey, moist SAND and SILT with some gravel and a trace of cobbles.

End of hole at required depth.

FIGURE 2

## RECORD OF TEST PITTS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-1	0 - 0.15	Loose, moist to wet, dark brown, organic FOREST LITTER.	
	0.15 - 0.65	Loose to compact, moist to wet, brown, silty SAND, some gravel contains cobbles and boulders up to 0.4 m with organic rootlets.	Sa 1 0.2 - 0.3
	0.65 - 1.25	Dense to very dense, moist, grey, gravelly SAND, some silt to silty.	Sa 2 0.65 - 1.25
Termination of Test Pit at 1.25 m. No seepage noted.			
TP04-2	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER.	
	0.15 - 0.84	Loose, moist, brown, silty SAND, some gravel with organic roots contains cobbles up to 0.3 m.	Sa 1 0.4
	0.84 - 2.1	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.2
Termination of Test Pit at 2.1 m. No seepage noted.			

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-3	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 1.05	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with roots and wood fragments.	Sa 1 0.5
	1.05 - 1.6	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.3 m.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-4	0 - 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 - 0.7	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.3 m.	Sa 1 0.4
	0.7 - 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles up to 0.35 m.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-5	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 – 1.1	Loose, moist, brown, silty SAND, some gravel with boulders up to 0.5 m.	Sa 1 0.4
	1.1 – 1.6	Dense to very dense, moist, grey, gravelly SAND some silt to silty contains cobbles/boulders.	Sa 2 1.5
		Termination of Test Pit at 1.6 m. No seepage noted.	
TP04-6	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER.	
	0.2 – 1.1	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m with organics (roots).	Sa 1 0.3
	1.1 – 1.75	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles/boulders up to 0.4 m.	Sa 2 1.5
		Termination of Test Pit at 1.75 m. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-7	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.8	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.2 m with roots.	Sa 1 0.3
	0.8 – 1.4	Dense to very dense, moist, grey, gravelly SAND, some silt to silty contains cobbles.	Sa 2 1.2
		Termination of Test Pit at 1.4 m. No seepage noted.	
TP04-8	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 – 1.1	Loose, moist, brown, silty SAND, some gravel. Contains cobbles and boulders up to 1 m with roots present.	Sa 1 0.4
	1.1 – 1.25	Dense to very dense, moist grey, SAND, some silt some gravel, contains cobbles (Very difficult to excavate).	
		Termination of Test Pit at 1.25, due to refusal. No seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-9	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	Sa 1 0.6
	0.9 - 1.65	Dense to very dense, moist, grey, SAND, some silt to silty some gravel, contains cobbles up to 0.3 m.	Sa 2 1.3
		Termination of Test Pit at 1.65 m. No seepage noted.	
TP04-10	0 - 0.1	Loose, moist, dark brown, FOREST LITTER.	
	0.1 - 1.2	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.6
	1.2 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, trace gravel, contains cobbles up to 0.15 m.	Sa 2 1.3
	1.5 - 2.15	Dense to very dense, moist, grey brown, SAND, trace to some silt trace gravel, contains cobbles up to 0.2 m.	Sa 3 2
		Termination of Test Pit at 2.15 m. Minor seepage of less than 1 liter/min noted at 1.2 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-11	0 - 0.25	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.25 - 1	Loose, moist, dark brown, sandy SILT, trace to some gravel contains cobbles up to 0.25 m.	
	1 - 1.2	Dense, moist, grey brown, SAND, some silt trace gravel.	
	1.2 - 2	Dense to very dense, moist to wet, grey SAND, trace to some silt, some gravel to gravelly, contains cobbles up to 0.3 m.	Sa 1 1.5
		Termination of Test Pit at 2 m. Seepage of less than 1 liter/min noted at 1.0 m depth at till interface.	
TP04-12	0 - 0.15	Loose, moist, dark brown, organic TOPSOIL/FOREST LITTER.	
	0.15 - 0.75	Loose, moist to wet, dark to med brown, sandy SILT (Topsoil like), trace gravel with organics (roots) with boulders up to 0.5 m.	Sa 1 0.4
	0.75 - 1	Dense, moist to wet, brown, silty SAND, some gravel.	Sa 2 0.8
	1 - 1.95	Dense to very dense, moist to wet, grey, SAND, some gravel to gravelly trace to some silt contains cobbles up to 0.3 m.	Sa 3 1.7
		Termination of Test Pit at 1.95 m. Minor seepage of less than 1 liter/min noted at 0.75 m depth.	



## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-13	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.3 m.	Sa 1 0.3
	0.9 - 1.8	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 2 1.6
		Termination of Test Pit at 1.8 m. No Seepage noted.	
TP04-14	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.9	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.4 m with roots.	Sa 2 0.3
	0.9 - 1.3	Dense to very dense, moist, grey, gravelly SAND, trace to some silt contains cobbles up to 0.3 m.	Sa 2 1.2
		Termination of Test Pit at 1.3 m. No Seepage noted.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/Depth
TP04-15	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 – 1.22	Loose, moist, brown, silty SAND, trace to some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.6
	1.22 – 1.95	Dense to very dense, moist, grey SILT and fine SAND, to silt, some fine sand trace gravel contains cobbles up to 0.1 m.	Sa 2 1.25
	Termination of Test Pit at 1.95 m. No seepage observed.		
TP04-16	0 – 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 – 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.15 – 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt contains cobbles up to 0.3 m.	Sa 1 1.3
	Termination of Test Pit. No seepage noted.		
TP04-17	0 – 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 – 1.15	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.40
	1.15 – 1.60	Dense to very dense, moist, grey, gravelly SAND, some silt, contains cobbles up to 0.15 m.	Sa 2 1.2
	Termination of Test Pit. No seepage noted.		

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-18	0 – 0.10	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.10 – 1.20	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	Sa 1 0.5
	1.20 - 2.30	Dense to very dense, moist, grey, fine sandy SILT, trace clay trace gravel.	Sa 2 2.0
		Termination of Test Pit. No seepage noted. Cobbles visible at bottom of Test Pit.	
TP04-19	0 – 0.05	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.05 – 1.0	Loose, moist, brown, silty SAND, some gravel contains cobbles up to 0.15 m with roots.	
	1.0 – 2.3	Dense, moist, brown to grey, gravelly SAND, some silt to silty contains cobbles and boulders.	Sa 1 1.2
		Termination of Test Pit. No seepage noted. Refusal on boulder > 1 m.	
TP04-20	0 – 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 – 1.0	Loose, moist, brown, silty, SAND, some gravel contains cobbles up to 0.4 m with roots.	
	1.0 – 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel, contains cobbles.	Sa 1 1.3
		Termination of Test Pit. No seepage noted.	

## RECORD OF TEST PITS

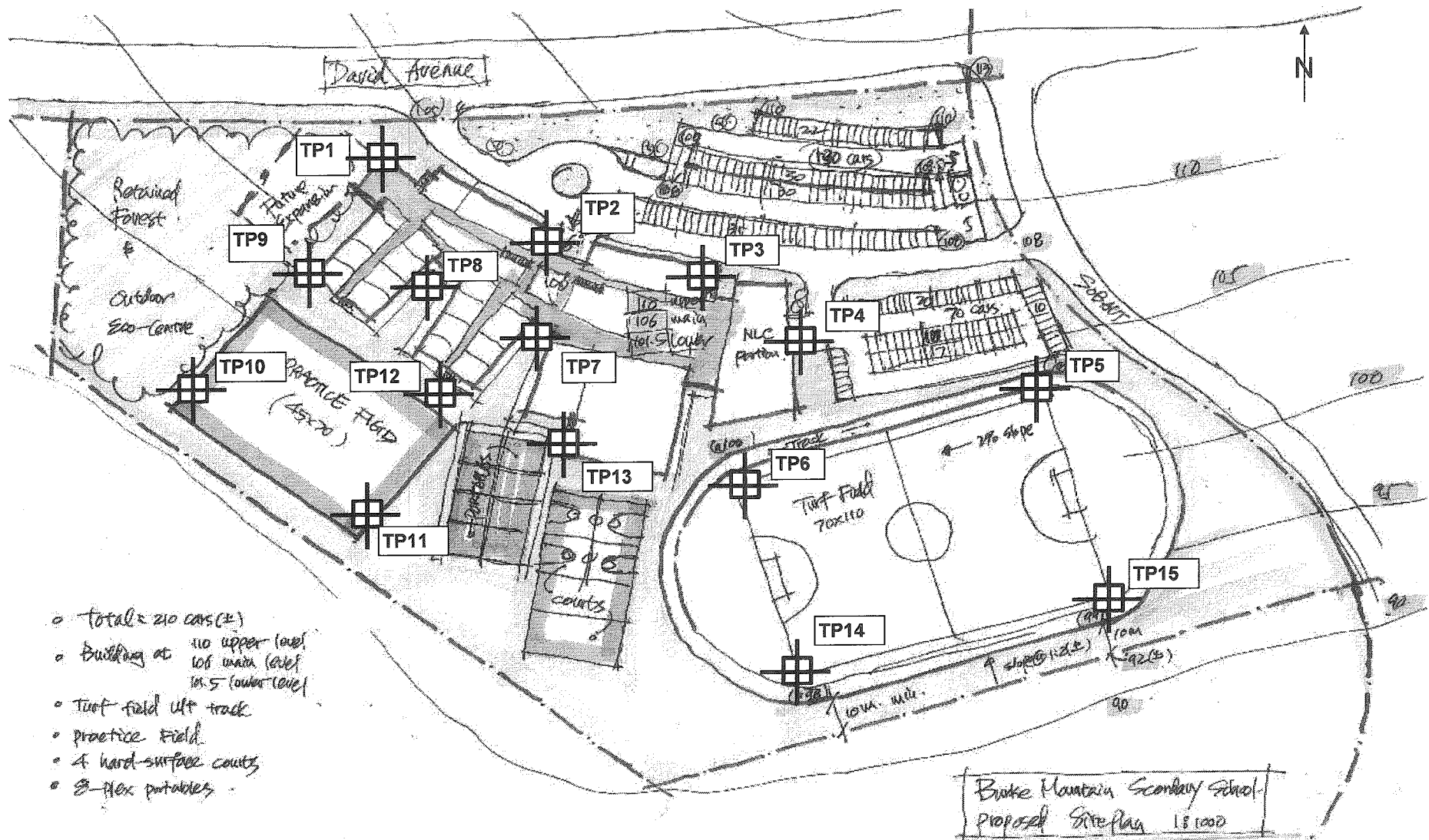
Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-21	0 - 0.20	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.20 - 0.95	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles.	
	0.95 - 1.50	Dense to very dense, moist, grey, gravelly SAND, trace to some silt, contains cobbles up to 0.3 m.	Sa 1 1.4
	Termination of Test Pit. No seepage noted.		
TP04-22	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 1.0	Loose, moist, brown, silty sand with roots, contains cobbles\boulders up to 0.5 m.	
	1.0 - 1.5	Dense to very dense, moist, grey SAND, some silt to silty, some gravel.	Sa 1 1.5
	Termination of Test Pit. Minor seepage of less than 1 liter/min noted between 1.0 m and 1.25 m.		

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-23	0 - 0.15	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.15 - 0.9	Loose, moist, brown, silty SAND, some gravel, contains cobbles.	
	0.9 - 1.15	Dense to very dense, moist, brownish grey SAND, some silt to silty, trace to some gravel, contains cobbles up to 0.1 m.	Sa 1 1.0
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted from 0.9 m to 1 m depth.	
TP04-24	0 - 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 - 0.55	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.55 - 0.7	Dense to very dense, moist, grey gravelly SAND, some silt to silty.	
		Termination of Test Pit. Minor seepage of less than 1 liter/min noted at 0.55 m depth.	

## RECORD OF TEST PITS

Test Pit No.	Depth (m)	Description	Sample/ Depth
TP04-25	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.6	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.2 m.	
	0.6 – 2.05	Dense to very dense, moist, grey, gravelly SAND; some silt to silty, contains cobbles up to 0.4 m.	Sa 1 2
		Termination of Test Pit. No seepage noted.	
TP04-26	0 – 0.2	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.2 – 0.9	Loose, moist, brown, silty SAND, some gravel, with roots, contains cobbles up to 0.75 m.	
	0.9 – 1.6	Dense to very dense, moist, grey gravelly SAND, some silt contains cobbles up to 0.25 m.	
		Termination of Test Pit. Minor seepage of less than 1 liter/minute noted at 0.9 and 1.1 m depth.	
TP04-27	0 – 0.1	Loose, moist, dark brown, organic FOREST LITTER/TOPSOIL.	
	0.1 – 1.0	Loose, moist, brown, silty SAND, some gravel with roots, contains cobbles up to 0.15 m.	
	1.0 – 1.5	Dense to very dense, moist, brownish grey SILT and SAND, some gravel to gravelly, contains cobbles up to 0.15 m.	Sa 1 1.4
		Termination of Test Pit. No seepage noted.	



- Total = 210 cars (±)
- Building at 110 upper level, 106 main level, 105.5 lower level
- Turf field w/ track
- practice field
- 4 hard-surface courts
- 8 flex portables



**LEGEND**

Approximate Test Pit Location

Reference: Proposed Site Plan, by CJP, Rec'd Nov. 2011

PROJECT NO: V11-139  
 PROJECT: Proposed Burke Mountain Secondary School  
 LOCATION: Soball Street and David Road, Coquitlam

**CENTENNIAL GEOTECHNICAL ENGINEERS LTD.**

Location Plan for Test Pits

DATE: 7-Nov-11	DRAWN BY: NC	SCALE: NTS	FIGURE: A1
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DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP1	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 333'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	29.1  18.7  5.4
1 -	SAND (SU2)	-	Rusty brown, silty, fine to medium grained sand, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)	SM	
3 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	
4 -	End of test pit @ 3.5 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP2	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 340'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	28.5
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
2 -		-	10% fines		19.2
3 -	SAND (SU3)	-	Tannish grey, fine grained, some silt, with occasional 1/4" to 1/2" dia. gravel, 12% fines (loose)	SM	20.1
4 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP ~ 3.0 TSF (dense)	SM	11.7
5 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	7.9
	End of Test Pit @ 4.5 feet				
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS	
PROJECT: Proposed Burke Mountain Secondary School				TEST PIT LOG	
LOCATION: Soball Street and David Road, Coquitlam				DATE: 4-Nov-11	FIGURE: A2
				DRAWN BY: NC	



DATE TESTED:		4-Nov-11	INSPECTOR:	NC	TEST PT :	TP3
TEST METHOD:		BACKHOE	SURFACE ELEVATION:		± 341'	
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS				USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)		SM	28.9
-	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)		SM	
-		-	11.3% fines			
1 -						
-						
2 -	SAND (SU3)	-	Tannish grey, silty, fine grained, with occasional 1/4" to 1/2" dia. gravel (loose)		SM	22.4
-						
3 -	SAND (SU4)	-	Tannish grey, silty, fine grained, with occasional gravel, weathered till (dense)		SM	13.7
-						
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occasional pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM	11.6
-						
5 -	End of test pit @ 4.5 feet					
-						

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP4	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 335'					
DEPTH	(ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS							USC	MOISTURE CONTENT	
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)					SM	35.2		
-	SAND	-	Rusty brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)					SM			
-	(SU2)										
1 -											
-											
2 -											
-											
-											
2 -	SAND	-	Tan grey, silty, fine grained, occ. 1/4" to 1/2" dia. gravel (loose)					SM	30.4		
-	(SU3)		22.7% fines								
-											
3 -	SAND	-	Tan grey, silty, fine grained, occ. pebbles, weathered till, PP > 4.5 TSF (dense)					SM	12.1		
-	(SU4)										
-											
4 -	SAND	-	Grey, silty, fine grained, with pebbles, unweathered till (very dense)					SM			
-	(SU5)										
-											
-											
5 -			End of Test Pit @ 4.5 feet								
-											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											

<b>PROJECT No:</b> V11-139		<b>CENTENNIAL GEOTECHNICAL ENGINEERS</b>		
<b>PROJECT:</b> Proposed Burke Mountain Secondary School				
<b>LOCATION:</b> Soball Street and David Road, Coquitlam		<b>TEST PIT LOG</b>		
		<b>DATE:</b> 4-Nov-11	<b>DRAWN BY:</b> NC	<b>FIGURE:</b> A3

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP5	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 320'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1)		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		124.6	
1 -											
2 -		SAND (SU2)		-		Tannish brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., 26% fines(loose)		SM		30.4	
3 -		SAND (SU4)		-		Tannish grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 3.5 TSF (dense)		SM		10.3	
4 -		SAND (SU5)		-		Grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)		SM		10.9	
5 -		End of test pit @ 3.5 feet									
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DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP7	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 332'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	36.8
1 -					
2 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
3 -					
4 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	7.4
5 -					
	End of test pit @ 4 feet				
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT : TP8	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 330'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	41.7
1 -					
2 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 6" to 24" in dia., some organics, 10.2% fines (loose)	SM	28.6
3 -					33.2
4 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)	SM	10.1
5 -					
	SAND (SU5)	-	Grey, silty, fine grained, unweathered till, PP > 4.5 TSF (v. dense)	SM	7.6
	End of Test Pit @ 4.5 feet				
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School			TEST PIT LOG		
LOCATION: Soball Street and David Road, Coquitlam			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A5

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP9	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 321'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1)		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		34.0	
1 -		SAND (SU2)		-		Brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranges from 3" to 10" in dia., some organics (loose)		SM			
2 -		SAND (SU3)		-		Tan grey, silty, fine grained sand with occ. gravel (loose)		SM			
3 -		SAND (SU5)		-		Tan grey, silty, fine grained, with occ. pebbles, unweathered till (v. dense)		SM		7.3	
4 -		End of test pit @ 3.5 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP10	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 308'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL		-		Dark brown, silty, fine grained sand with organic matter (loose)		SM		32.6	
1 -		SAND (SU2)		-		Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranges from 3" to 10" in diameter, some organics (loose)		SM			
2 -		SAND (SU4)		-		Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)		SM		10.0	
3 -		SAND (SU5)		-		Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)		SM		5.2	
4 -		End of Test Pit @ 4 feet									
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School											
LOCATION: Soball Street and David Road, Coquitlam				TEST PIT LOG							
				DATE: 4-Nov-11		DRAWN BY: NC		FIGURE: A6			

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP11	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 306'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1) - Dark brown, silty, fine grained sand with organic matter (loose)						SM		20.1	
1 -		SAND (SU2) - Brown, fine to medium grained sand, some silt, with some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)						SM		16.9	
2 -		SAND (SU3) - Tan grey, silty, fine grained sand with occ. gravel (loose)						SM		20.9	
3 -		SAND (SU4) - Tan grey, silty, fine grained, with occ. gravel, weathered till, PP > 4.5 TSF (dense)						SM		10.7	
4 -		End of test pit @ 4 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP12	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 318'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL (SU1) - Dark brown, silty, fine grained sand with organic matter (loose)						SM		27.8	
1 -		SAND (SU2) - Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 6" to 24" in dia., some organics, 16.3% fines (loose)						SM		26.1	
2 -		SAND (SU3) - Tan grey, silty, fine grained sand with occ. gravel (loose)						SM		6.6	
3 -		SAND (SU4) - Tan grey, silty, fine grained, with occ. pebbles, weathered till, PP > 4.5 TSF (dense)						SM			
4 -		End of Test Pit @ 4 feet									
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School											
LOCATION: Soball Street and David Road, Coquitlam				TEST PIT LOG							
				DATE: 4-Nov-11				DRAWN BY: NC			

DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP13	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 341'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL (SU1)	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	24.6
1 -	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, from 3" to 10" in dia., some organics, 14.6% fines (loose)	SM	
2 -					
3 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occasional gravel, weathered till, PP ~ 4.0 TSF (dense)	SM	7.0
4 -	End of test pit @ 4 feet				
5 -					
DATE TESTED: 4-Nov-11		INSPECTOR: NC		TEST PT: TP14	
TEST METHOD: BACKHOE		SURFACE ELEVATION: ± 298'			
DEPTH (ft.)	DESCRIPTION OF SOIL AND OBSERVATIONS			USC	MOISTURE CONTENT
0 -	TOPSOIL	-	Dark brown, silty, fine grained sand with organic matter (loose)	SM	28.2
	SAND (SU2)	-	Rusty brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in dia., some organics (loose)	SM	
1 -					
2 -	SAND (SU4)	-	Tan grey, silty, fine grained, with occ. gravel, weathered till (dense)	SM	9.6
3 -	SAND (SU5)	-	Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)	SM	8.6
4 -	End of Test Pit @ 4.0 feet				
5 -					
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer					
PROJECT No: V11-139			CENTENNIAL GEOTECHNICAL ENGINEERS		
PROJECT: Proposed Burke Mountain Secondary School			TEST PIT LOG		
LOCATION: Soball Street and David Road, Coquitlam			DATE: 4-Nov-11	DRAWN BY: NC	FIGURE: A8

DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :		TP15	
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± 298'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -		TOPSOIL - Dark brown, silty, fine grained sand with organic matter (loose)						SM		46.9	
- SAND (SU2)		- Brown, fine to medium grained sand, some silt, some gravel, occ. cobbles, ranging from 3" to 10" in diameter, some silt (loose)						SM			
1 -										35.6	
2 -		SAND (SU4) - Tan grey, silty, fine grained, with occ. gravel, weathered till, PP > 4.5 TSF (dense)						SM		10.6	
3 -		SAND (SU5) - Grey, silty, fine grained, with occ. pebbles, unweathered till, PP > 4.5 TSF (v. dense)						SM		11.5	
4 -		End of test pit @ 4 feet									
5 -											
DATE TESTED:		4-Nov-11		INSPECTOR:		NC		TEST PT :			
TEST METHOD:		BACKHOE		SURFACE ELEVATION:		± ?'					
DEPTH (ft.)		DESCRIPTION OF SOIL AND OBSERVATIONS						USC		MOISTURE CONTENT	
0 -											
1 -											
2 -											
3 -											
4 -											
5 -											
PP - Unconfined Compressive Strength Measurement Using a Pocket Penetrometer											
PROJECT No: V11-139				CENTENNIAL GEOTECHNICAL ENGINEERS							
PROJECT: Proposed Burke Mountain Secondary School											
LOCATION: Soball Street and David Road, Coquitlam				TEST PIT LOG							
				DATE: 4-Nov-11		DRAWN BY: NC		FIGURE: A9			





### LEGEND:

△ TH# - TEST HOLE (TH) LOCATION

### SITE PLAN

\*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:



**GEOPACIFIC**  
VANCOUVER KALISPOPS CANADARY

11710 West 75th Ave  
Vancouver, B.C. V6P 6P2

T 604.438.0822  
F 604.438.3088

DATE:	30-Nov-2020		
DRAWN BY:	CG	APPROVED BY:	BR
		REVIEWED BY:	CG
SCALE:	NTS		

Burke Mountain Secondary  
3400 David Avenue, Coquitlam, BC  
TEST HOLE SITE PLAN

FILE NO.: 18327  
DWG. NO.: 18327-01

REVISIONS:  
A.  
B.  
C.



# Test Hole Log: TH20-01

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.5		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
1.2		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, some wood fibres, brown, moist-wet	0.5				
1.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, till-like, cobbly, brown-grey, slightly moist	1.2				
2.4		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, light grey, dry	1.8				
2.4		End of Borehole	2.4				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.01  
Page: 1 of 1

# Test Hole Log: TH20-02

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



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Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		6		
2					6		
3		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8				
4							
5		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	1.5				
6							
7							
8		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry					
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21		End of Borehole	6.1				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.02

Page: 1 of 1

# Test Hole Log: TH20-03

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoll</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		3		
0.6		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.6		6		perched groundwater observed @ 0.5 m
0.8		<b>Sand and Gravel</b> very dense SAND and GRAVEL, cobbly, grey, slightly moist	0.8				DCPT refusal @ 0.9 m
3.0		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	3.0		>50		
End of Borehole							

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.03

Page: 1 of 1

# Test Hole Log: TH20-04

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		3		
0.6		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.6		3		perched groundwater observed @ 0.6 m
0.9		<b>Sand and Gravel [Weathered TILL]</b> very dense SAND and GRAVEL, weathered till, cobbly, grey, slightly moist	0.9		5		
1.2		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.2		>50		DCPT refusal @ 1.43 m
1.43			1.43		>50		
3.0		End of Borehole	3.0				

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.04

Page: 1 of 1

# Test Hole Log: TH20-05

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8		8		
0.9		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9		>50		perched groundwater observed @ 0.6 m
3.0		End of Borehole	3.0				DCPT refusal @ 0.9 m

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.05  
Page: 1 of 1



# Test Hole Log: TH20-06

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.9		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.9		4		
1.8		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.8		>50		
1.8		End of Borehole	1.8				
							perched groundwater observed @ 0.6 m
							DCPT refusal @ 0.85 m
							Auger refusal @ 1.8 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.06

Page: 1 of 1

# Test Hole Log: TH20-07

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot)	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3				
0.8		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.8				
1.5		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.5				
1.5		End of Borehole	1.5				

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.07  
Page: 1 of 1

# Test Hole Log: TH20-08

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0 to 1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
1 to 2		<b>Sand</b> loose silty SAND, organic rich, some gravel, cobbly, brown, moist- wet	0.5				
2 to 3		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9				
3 to 10							
10 to 11		End of Borehole	3.0				
						 perched groundwater observed @ 0.6 m	DCPT refusal @ 1.1 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.08

Page: 1 of 1



# Test Hole Log: TH20-09

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9185

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0.3		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.3		4		
0.9		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, brown, moist-wet	0.9		1		
1.15		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	1.15		2		
1.5		End of Borehole	1.5		>50		
0.6							perched groundwater observed @ 0.6 m
1.15							DCPT refusal @ 1.15 m

Logged: CG

Method: Solid Stem Auger

Date: 30-Nov-2020

Datum: Ground Elevation

Figure Number: A.09

Page: 1 of 1

# Test Hole Log: TH20-10

File: 18327

Project: Burke Mountain Secondary School

Client: School District 43 (Coquitlam)

Site Location: 3400 David Avenue, Coquitlam, BC



**GEOPACIFIC**  
CONSULTANTS

1779 West 75th Avenue, Vancouver, BC, V6P 6P2  
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
0		Ground Surface	0.0				
0 to 1		<b>Topsoil</b> loose TOPSOIL, sandy, some silt, forest litter, organic rich, dark brown, moist	0.0				
1 to 2		<b>Sand</b> very loose silty SAND, organic rich, some gravel, cobbly, wood fibres, brown, moist-wet	0.5				
2 to 3		<b>Sand and Gravel [TILL]</b> very dense silty SAND and GRAVEL till, occasional cobbles, light grey, dry	0.9				
3 to 10							
10 to 11		End of Borehole	3.0				
							perched groundwater observed @ 0.6 m  DCPT refusal @ 1.1 m

Logged: CG  
Method: Solid Stem Auger  
Date: 30-Nov-2020

Datum: Ground Elevation  
Figure Number: A.10  
Page: 1 of 1



TOPOGRAPHIC SITE OVER LOT A AND PART OF LOT B SECTION 7 AND 18,  
TOWNSHIP 40 NEW WESTMINSTER DISTRICT PLAN EPP135503

CIVIC ADDRESS:  
3390 & 3400 David Avenue, Coquitlam, BC  
PID: 032-337-337 (LOT A )  
PID: 032-337-353 (LOT B)

SCALE 1 : 500  
0 10 20 30  
ALL DISTANCES ARE IN METRES

The intended plot size of this plan is 1120mm in width  
by 864mm in height (E size) when plotted at a scale of 1:500.







## **BURKE MOUNTAIN ATHLETIC PARK FIELD AND SPORT TRACK**

3390 & 3400 DAVID AVENUE, COQUITLAM, BC

### **Division 26 - Electrical Specifications**

J.E. Project No.: 24026

ISSUED FOR RFP

May 5, 2025

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<b><u>Section No.</u></b>	<b><u>Description</u></b>	<b><u>No. of Pages</u></b>
26 00 10	General Electrical Requirements	8
26 00 11	Basic Materials & Methods	5
26 05 03	Requirements for Schedule C-B	1
26 05 44	Underground Services	2
26 12 16	Transformers	1
26 24 05	Electrical Kiosk	1
26 28 10	Arc Flash Analysis & Labels	1
Appendix A	Sports Field Lighting	4

## **SECTION 26 00 11 – BASIC MATERIALS & METHODS**

### **1.0 RELATED WORK**

- .1 Section 26 00 10: General Electrical Requirements
- .2 Section 26 05 44: Underground Services
- .3 Section 26 24 05 - Electrical Kiosk

### **2.0 EXAMINATION OF SITE**

- .1 Prior to submitting tender, visit site and thoroughly investigate the terrain and all existing structures, services, and systems which may in any way affect or relate to the work called for by these specifications and drawings.
- .2 Contact BC One Call at 1-800-474-6886 to locate any existing underground facilities prior to excavation.
- .3 No extras will be allowed for work resulting from conditions which would have been evident upon a thorough examination of the site.
- .4 Notify the Engineer and the Contract Administrator in writing at least three (3) days prior to the tender closing date of any discrepancies or points of doubt or contention. Failing this, allow in tender for most expensive course of action.

### **3.0 SETTING OUT OF WORK**

- .1 Contractor to lay out work and perform all necessary leveling and measuring. Figures, full size and detail drawings to take precedence over scale measurements of drawings. No plea to the action or direction of anyone other than the Coordinating Consultant and Engineer will be admitted in justification of any error in construction where departure is made from drawings and specifications.
- .2 Provide prompt installation of work when coordinating with other subcontractors, as in advance of concrete pouring or similar work. Coordinate and provide sleeves for electrical services in coordination with all other contractors.
- .3 Special attention is to be made, in coordination with the other trades, to ensure that required clearances to other underground services are provided. Extra costs incurred from failure to coordinate this work will not be considered.
- .4 Make reference to Electrical, Civil, Mechanical, Architectural & Landscape drawings when setting out work. Consult with respective Divisions in setting out locations for conduit runs, luminaires, panel assemblies, etc., so that conflicts are avoided, and symmetrical even spacing and clearances are maintained.
- .5 Layouts shown for Electrical Kiosks and/or Rooms are for estimating purposes only. Coordinate installation of conduit, outlets and equipment with final Kiosk/Room layout. Ensure all clearances and access requirements are met.

### **4.0 INCOMING ELECTRICAL SERVICE**

- .1 Supply and install new 3-phase underground power service as detailed on the drawings and in Electrical Specifications. Include all required civil work. Coordinate all work with West Vancouver School District at project award.
- .2 Provide all necessary underground ducts including any required trenching, backfilling, and concrete work.

- .3 Ducts will be rigid non-metallic conduit of unplasticized polyvinyl chloride Type 1 primary requiring concrete encasement; type II heavier wall for direct burial secondary without concrete encasement, conforming to CSA Standard B196-1.
- .4 Accessories: bell ends, couplings, adapters, bends and other fittings of same material as duct. Solvent recommended by manufacturer will be used.
- .5 Only factory bends will be acceptable.
- .6 Contractor will be responsible for placement, testing, and energizing of all secondary voltage equipment and cabling.
- .7 BC Hydro service charges are the responsibility of the Owner.
- .8 Coordinate and schedule all work and inspections to be completed by BC Hydro.

#### **5.0 GROUNDING**

- .1 Provide a complete system of grounding as specified herein and to CEC requirements as per drawings.

#### **6.0 BRANCH CIRCUIT PANEL BOARDS**

- .1 Panel boards to be constructed to CSA standards and bear CSA approval. All surface mounted tubs to be finished in enamel over corrosion-resistant primer. Finish colour shall be ASA 61 Grey.
- .2 Surface or flush mounted as indicated complete with panel trim having concealed hinges and trim mounting screws, hinged locking door with flush catch.
- .3 Provide two (2) keys for each panel, interchangeable with panels of same voltage.
- .4 Eighty-four circuit double tubs (i.e., side by side) are not acceptable. Tubs for eighty-four circuit panels must be stacked vertically unless specifically noted otherwise.
- .5 Phase as shown on drawings, solid neutral design with sequence style bussing and full capacity neutral of capacity indicated, composed of an assembly of bolt-in-place moulded case circuit breakers as indicated with thermal and magnetic trip and trip free position separate from either the "On" or the "Off" positions. Two and three pole breakers to have common simultaneous trip.
- .6 Provide all mounting brackets, busbar drillings and filling pieces for spaces.
- .7 Affix typewritten directory to the inside cover of panel board indicating loads controlled by each circuit.
- .8 Acceptable manufacturers: Eaton Cutler-Hammer, General Electric, Square-D, Siemens.

#### **7.0 OVERCURRENT PROTECTION DEVICES**

- .1 Provide overcurrent protection devices as indicated in the drawings and specified herein.
- .2 Where permitted by code, series rated combinations are acceptable. Where used, these must be clearly indicated in the manufacturer's shop drawings. The manufacturer shall affirm that the combination has been successfully tested for the applicable fault current.

#### **8.0 WIRING METHODS**

- .1 All wiring shall be copper, 98% conductivity, with RW90 X-link P.E. insulation. Minimum size #12 AWG. Wire sized #10 AWG or larger may be stranded, smaller shall be solid.
- .2 Neutral conductors shall be fully rated.
- .3 Conductors shall be sized to limit voltage drop to no more than 3% in any feeder or branch circuit.
- .4 Panel board feeders shall be multiple conductors in conduits.
- .5 Where conduit is installed, EMT conduit shall be used throughout except for underground.

- .6 Seal conduit with oakum or fiberglass where conduits leave heated area and enter unheated area. Provide 12 mm (0.5") minimum ductseal in addition to oakum and fiberglass sealants.
- .7 Rigid PVC conduit (i.e., of unplasticized PVC) shall be used in underground runs either directly buried or encased in concrete. Rigid types EB1, DB2, and ES2 PVC conduit are not acceptable except that DB2 is permitted for service entry conduits where approved by the service utilities.

## 9.0 WIRING DEVICES

- .1 Line voltage switches shall be rated for 120 volt, 15 amp operation with quiet, quick make/break toggle movement and totally enclosed case. Mounting height shall be 1265 mm (51 inches) to center above finished floor except where noted otherwise.
- .2 All wiring devices shall be white in colour.
- .3 Switches shall be as follows:
  - .1 Pass & Seymour #CSB15AC1
- .4 Receptacles shall be duplex, polarized type complete with parallel and U-grounding slots and rated at 15 amps, 125 volt. Mounting height will be 400 mm (14 inches) to centre above finished floor or 1150 mm (45 inches) to centre at counter locations. All receptacles boxes shall permanently labeled with circuit identification.
- .5 Receptacles shall be as follows:
  - .1 Pass & Seymour #5262
- .6 All other wiring devices shall be Commercial Specification Grade manufactured by Pass & Seymour, colour to match other devices in area.
- .7 All wiring device cover plates shall type 430 stainless steel.
- .8 Weatherproof plates shall be PVC complete with gasket and spring-loaded, twin hinged cover plate for outdoor and wet location receptacles.

## 10.0 IDENTIFICATION

- .1 Provide labeling of all electrical equipment. Any variation to the identification requirements below shall only be by written acceptance from the Engineer prior to installation.
- .2 Labelling:
  - .1 Lamicoid label colouring shall be as follows:
    - .1 120/208V normal power: black text on white background
    - .2 347/600V normal power: white text on blue background
    - .3 Low voltage: black text on yellow background
  - .2 Provide lamicoid labels with 19mm (0.75") high primary text on the top of the label and 13mm (0.5") high secondary text lines below for the following equipment:
    - .1 Branch Circuit Panels: Primary text to indicate panel designation (e.g. "Panel A"). Provide typewritten panel directories inside the panel cover sleeve. Top of panel schedule shall indicate panel designation, panel voltage, phase, feeder wires and upstream distribution (e.g., "Panel A – 120/208V, 3Ø, 4W – Fed from MDP").
    - .2 Transformers: Primary text to indicate transformer designation. Secondary text to indicate kVA size, primary voltage, secondary voltage, secondary phase, secondary feeder wires and upstream distribution (e.g., "TMFR T1 – 600V to 120/208V, 3Ø, 4W – Fed from SDP A").



- .3 Disconnect Switches: Primary text to indicate load served. Secondary text shall indicate area being served and circuit (e.g., "EF-4 – Storage Room – A-23").
- .3 Provide clear peel & stick labels with 6.5mm (1/4") high black lettering:
  - .1 All remote location switches and controls. Indicate controlled device and location served (e.g., "EF-2, Storage B231"). Centre label on lower section of coverplate.
  - .2 All receptacles. Indicate circuit (e.g., "A-23"). Centre label on lower section of coverplate.
- .4 Inside all pullboxes, junction boxes, and device outlet boxes, identify each conductor contained therein as to panel and circuit with permanent black marker, (e.g., Panel 2A, circuit 23 - identify as "2A-23").
- .5 Similar to the permanent black marker identification system proposed for power, provide conductor identification for all other systems, such as telephone, data, television, and other low tension systems inside all pullbox, junction box and device outlet box locations.
- .6 Provide cable labels for all low tension cabling within 150mm (6") of both cable ends. Cable labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.
- .7 All labels must be machine printed using a laser/inkjet printer and be smudge-proof. Hand-written labels will not be accepted.
- .3 Conduit and Conductor Identification
  - .1 Clean and dry surfaces prior to applying tape. When applying tape, provide a minimum of two complete wrappings.
  - .2 Conductors shall be colour coded throughout with the same colour applying to the same phase throughout. Colour coding to be by insulation colour or permanently applied colour banding at all distribution centres and panels.
  - .3 Colour coding of conductors and conduits shall be as follows:
 

SYSTEM	CONDUCTOR	CONDUIT TAPE COLOUR
Equipment grounding	Green	Green
120 volt neutral	White	Grey
120/208 volt phase wires	Light red, light blue, black	Grey
347 volt neutral	Grey	Yellow
347/600 volt phase wires	Dark red, Dark blue, black	Yellow
Communications (Tel or Data)	Blue	Blue
Public Address and Sound	Cyan	Blue
CCTV	White	Orange
  - .4 All colour coding shall be neatly applied to the satisfaction of the Engineer.
  - .5 At all distribution centres, pullboxes, wireways, etc., feeder conductors of each system shall be neatly laced or clipped into respective feeder groups.

## 11.0 LIGHTING

- .1 Refer to drawings and Appendix A "Sports Field Lighting".

**12.0 ELECTRICAL HEATERS**

- .1 Electrical Contractor shall supply and install all electrical baseboard heaters complete with associated thermostats and relays as shown on the electrical drawings.
- .2 Force Flow Heater Products shall be Chromalox RFI series (wall recessed style) or Engineer approval equal, 120 volt, single phase.
- .3 Individual heater sizes to be as indicated on the electrical drawings, built-in thermostat, white in colour.

**END OF SECTION 26 00 11**

## **SECTION 26 05 03 – REQUIREMENTS FOR SCHEDULE C-B AND PROJECT CLOSE-OUT**

### **1.0 SCHEDULE C-B OCCUPANCY REQUIREMENTS**

- .1 The following documents must be submitted to the Engineer prior to issue of the Electrical Schedule C-B:
  - .1 Final Electrical Inspection Certificate from the Authority Having Jurisdiction (AHJ). If the AHJ does not inspect, provide proof, on the letterhead and bearing an authorized signature of the AHJ, that an inspection was called and that the AHJ chose not to inspect.
  - .2 Contractor's Declaration, signed by authorized personnel, affirming that all work has been performed in accordance with the applicable version of the Canadian Electrical Code. Declaration must include Contractor's FSR class and number.
  - .3 All identified life safety electrical deficiencies must be proven complete.

### **2.0 PROJECT CLOSE-OUT REQUIREMENTS**

- .1 The following documents must be submitted to the Engineer prior to project closeout:
  - .1 All items noted in the "SCHEDULE C-B OCCUPANCY REQUIREMENTS" section above.
  - .2 Approved As-Built drawings (as per SECTION 26 00 10 – GENERAL ELECTRICAL REQUIREMENTS)
  - .3 Approved O&M manuals (hard copy and digital pdf). O&M manuals are to include the following reports:
    - .1 Load balance test report.
    - .2 Lighting controls commissioning report.
    - .3 All other reports not listed here.
    - .4 Signed letter on Contractor's letterhead listing each electrical system and noting the time, date, and attendance of all system demonstrations. This letter is to be signed by the Owner as accepted.
  - .4 All identified non-life safety electrical deficiencies must be proven complete.
  - .5 All labelling and tags.
  - .6 All reports and documentation must be approved by the Engineer. Make changes and add information/testing to the reports and documentation to the Engineer's satisfaction.

**END OF SECTION 26 05 03**

## **SECTION 26 05 44 – UNDERGROUND SERVICES**

### **1.0 GENERAL**

- .1 RELATED WORK
  - 1. 26 00 10 - General Electrical Requirements
  - 2. 26 00 11 - Basic Materials & Methods
  - 3. 26 05 03 - Requirements for Schedule C-B

### **2.0 PRODUCTS**

- .1 DUCTBANK
  - 1. Non-Metallic Duct: Rigid PVC Schedule 40. DB2 duct may be used for secondary power service. All other underground ducts shall be RPVC.
  - 2. Plastic Tape Trace: 150mm (6") wide yellow polyvinyl tape.
- .2 UNDERGROUND JUNCTION BOXES
  - 1. Install underground utility service boxes as directed by the service supply authority approved final "For Construction" drawings.
  - 2. All other underground junction boxes shall be as noted on drawings complete with galvanized steel lid, plastic drain plate and recessed padlock option. Size junction box to allow for 25% additional incoming and outgoing conduits.
  - 3. Provide drainage rock pit below all junction boxes.

### **3.0 EXECUTION**

- .1 DUCTBANK INSTALLATION
  - 1. Contractor shall contact and coordinate with each service supply authority prior to installation of any underground services to ensure full coordination with the service supply authority's approved final "For Construction" drawings and all Civil site and offsite servicing drawings. Any costs resulting from the failure to fully coordinate all the underground services prior to installation shall be at the Contractor's expense.
  - 2. Install on undisturbed soil where possible. Backfill required to be compacted pit run gravel and sand, 200mm (8") lifts maximum.
  - 3. Clean ducts with full size mandrel and swab all ducts. Install 7mm (¼") poly pull rope in all ducts.
  - 4. Halfway between ductbank and finished grade, supply and install 150mm (6") wide polyvinyl tape for entire length of each ductbank on site.
  - 5. Clean ductbanks before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
  - 6. Refer to electrical site servicing drawings for services required for this project.
- .2 BC HYDRO INSTALLATION
  - 1. Primary service to be cable in duct from service entry point to the new pad mounted transformer (PMT). Secondary service to be cable in duct from new pad mounted transformer to new Electrical Kiosk.
  - 2. Provide trenching and conduit(s) from Service Entry Point and PMT and between PMT and Electrical Kiosk. Primary cables and terminations to be supplied and installed by the BC Hydro. Secondary cables and terminations to be supplied and installed by the Contractor as noted on the Single Line Diagram for BC Hydro service areas.

3. Installation to comply with all regulations and by-laws of BC Hydro and inspection authorities.
4. Contractor shall install all power service requirements as directed by BC Hydro's final "For Construction" design documents.
5. Contractor to arrange, schedule and coordinate power service requirements with the Owner and BC Hydro.

.3 Q-NET SERVICE INSTALLATION

1. General routing to be coordinated with new and existing underground services.
2. Q-Net service to be installed as noted on drawings.
3. Provide substantial corrosion-resistant pullwire in each and every Q-Net conduit run.
4. Q-Net service cables to be supplied and installed by the Owner representative.
5. Contractor shall install all Q-Net service requirements as directed by the Owner's representatives.
6. Contractor to arrange, schedule and coordinate Q-Net service requirements with Owner representative.

.4 DUCT DRAINAGE

Slope ducts to low point for drainage purposes. Provide T-Drain fittings and drain pipe to field drainage system for each service duct at low point.

.5 TEMPORARY CONSTRUCTION UTILITY SERVICES

7. Contractor to arrange, schedule and coordinate all temporary utility services required during construction.

**END OF SECTION 26 05 44**

## **SECTION 26 12 16 – TRANSFORMERS**

### **1.0 GENERAL**

#### **1.1 RELATED WORK**

- .1 Section 26 00 10: General Electrical Requirements
- .2 Section 26 00 11: Basic Materials & Methods

#### **1.2 SYSTEM**

- .1 This section includes for 600/208/120V transformation.

#### **1.3 PRODUCT DATA**

- .1 Submit full performance test data including noise levels to the Engineer prior to fabrication.
- .2 All performance and test data to meet with the Engineer's approval, CEMA and IEEE Standards.

### **2.0 PRODUCTS**

#### **2.1 TRANSFORMERS**

- .1 Transformers are to be 3 phase, 60 Hz, delta 600/208/120V, 3 phase, 4 wire, grounded, air cooled type, natural circulation in ventilated metal case to CSA and CEMA standards, Class B insulation with temperature rise not exceeding Class H for 150°C rise above 40°C.
- .2 Provide four 2.5 per cent full capacity taps, two above and two below normal voltage.
- .3 General Purpose Transformers: Common core construction with 220°C class insulation, aluminum wound, Impedance from 4% to 6%. Acceptable manufacturer Hammond Power Solutions Inc., Delta.

#### **2.2 MOUNTING**

- .1 Floor mounted transformers shall be secured to the floor complete with vibration isolation dampers and seismic restraints. Maintain 6" clearance around transformer for ventilation.
- .2 Wall mounted transformers shall be mounted on brackets 6" clear of wall or column complete with vibration isolation dampers and seismic restraints. Mounting brackets to be designed by project Structural Engineer, coordinate fabrication and installation with General Contractor.
- .3 Seismic Restraint system shall be designed and installation approved by the Contractor's Seismic Engineer.

### **3.0 EXECUTION**

#### **3.1 SEISMIC RESTRAINT**

- .1 Submit details of engineered mounting and seismic restraint to the Engineer for approval.

#### **3.2 NAME TAGS**

- .1 Provide name tags indicating transformer name, full electrical data, connection diagrams, etc.

**END OF SECTION 26 12 16**

## SECTION 26 24 05 – ELECTRICAL KIOSK

### 1.0 GENERAL

- .1 SCOPE
  - .1 Supply and install BC Hydro approved metering kiosk.
- .2 STANDARDS
  - .1 Design and manufacture to BC Hydro Standard ES54 S2-01 R8 and details shown on Drawing E5.
- .3 SUBMITTALS
  - .1 Submit detailed shop drawings to Engineer for review prior to manufacturing.
  - .2 Shop drawing submittal shall be a single, indexed PDF file and shall include overcurrent protective devices.

### 2.0 PRODUCTS

- .1 BC HYDRO METERING KIOSK
  - .1 Rating: 200A, 347/600V, 3 phase, 4 wire.
  - .2 Main Breaker: 200A, 347/600V, 3 phase, 4 wire.
  - .3 Main breaker shall be complete with solid state ALSI trip units with adjustable long, short, and instantaneous settings.
  - .4 CSA 3R enclosure: 5052 Aluminium 1/8, factory powder coated RAL 9005 (Black).
  - .5 **Front** and **Rear** access with 3-point handle dual padlock.
  - .6 Side mounted, BC Hydro approved, externally mounted 13 jaw/ 20A outdoor type meter base enclosure.
  - .7 **Front** section to include BC Hydro incoming bussed wireway with cable clamp and grounding ball, main breaker, utility metering section, ground lug, and provisional space for communication (Q-Net) equipment.
  - .8 **Rear** 347/600V distribution panel, transformer, 120/208V distribution panel, and provisional space for irrigation equipment.
  - .9 Bussing to be tin plated aluminium.
  - .10 Bus bracing for 50KA.
  - .11 Pre-approved manufacturers:
    - .1 Code Electric Products
    - .2 Valid Manufacturing

### 3.0 EXECUTION

- .1 INSTALLATION
  - .1 Coordinate metering kiosk delivery and installation with site construction.
  - .2 Install metering kiosk on reinforced concrete pad to BC Hydro standards.
  - .3 Install grounding as per Section 26 05 26 Grounding – Secondary.
  - .4 Arrange for BC Hydro supply of and install BC Hydro metering CTs and PTs.

END OF SECTION 26 24 05

## **SECTION 26 28 10 – ARC FLASH HAZARD ANALYSIS & LABELS**

### **1.0 GENERAL**

#### **.1 RELATED WORK**

- .1 Section 26 00 10: General Electrical Requirements
- .2 Section 26 00 11: Basic Materials and Methods

#### **.2 REFERENCES**

- .1 CSA Z462-15, Workplace Electrical Safety

### **2.0 EXECUTION**

- .1 Furnish Arc Flash Hazard Analysis Study per the requirements set forth in the current issue of CSA Z462 Workplace Electrical Safety. The arc flash hazard analysis shall determine the:
  - .1 Arc flash boundary.
  - .2 Incident energy at the working distance.
  - .3 PPE that personnel within the arc flash boundary shall use.
  - .4 Equipment labeling.
- .2 Supply and install equipment labels as determined from the Arc Flash Analysis Study and as per CSA Z462-15 Workplace Electrical Safety.

**END OF SECTION 26 28 10**



## **SECTION 26 00 10 – GENERAL ELECTRICAL REQUIREMENTS**

### **1.0 GENERAL**

- .1 Division 26 to note that electrical specifications and drawings form part of the contract documents and are to be read, interpreted and coordinated with all other divisions. General conditions, general requirements, supplementary general conditions and amendments and supplements thereto to form a part of the contract documents and contain items related to this Division.
- .2 Division 26 to provide all labour and materials necessary for complete and operating electrical systems as indicated on the drawings and specified herein. Any work, even if not specifically shown or specified, which is obviously necessary or reasonably implied to complete the work or provide the operation required shall be done as if it was both shown and specified.
- .3 The Coordinating Consultant for this project is Station One Architecture. All inquiries and changes to the scope of work shall be issued through the Coordinating Consultant in writing.
- .4 The "Owner" mentioned in this Division shall mean the City of Coquitlam.
- .5 The "Engineer" mentioned in this Division shall mean the Electrical Engineer (Jarvis Engineering Consultants Ltd.)
- .6 The "Contractor" mentioned in this Division shall mean the Electrical Contractor (Division 26).
- .7 The "Sportsfield Lighting Consultant" mentioned in this Division shall mean Musco Sports Lighting (or Engineer approved equal)
- .8 Work Not Included:
  - .1 All low voltage (less than 50V) control conduit and wiring for motors and mechanical equipment, unless specifically noted otherwise, will be the responsibility of Division 25.
  - .2 Unless noted otherwise, motors for mechanical equipment will be supplied and set in place by Division 25.

### **2.0 EXAMINATION OF SITE**

- .1 Prior to submitting tender, visit site and thoroughly investigate all existing structures, services, and systems which may in any way affect or relate to the work called for by these specifications and drawings.
- .2 No extras will be allowed for work resulting from conditions which would have been evident upon a thorough examination of the site.
- .3 Notify the Engineer and the Coordinating Consultant in writing at least three (3) days prior to the tender closing date of any discrepancies or points of doubt or contention. Failing this, allow in tender for most expensive course of action.

### **3.0 DRAWINGS AND SPECIFICATIONS**

- .1 Drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between drawings and specifications which leaves doubt as to true intent and meaning, obtain a ruling from the Coordinating Consultant.
- .2 Electrical drawings indicate general location and route to be followed by conduits and/or wire and do not show all structural and mechanical details. In some cases, conduit or wiring is not shown on the plans or is shown diagrammatically in schematic or riser diagrams. Conduit and wire to be installed to provide a complete operating system and to be installed physically to conserve headroom, furring spaces, etc.
- .3 Follow drawings of other divisions for details of this work and install electrical conduit, boxes and fittings to coordinate with the work indicated in the drawings of these other divisions. Other

divisions to include architectural, structural, mechanical, civil and landscape. Refer to architectural and structural drawings for accurate building dimensions.

- .4 Examine Architectural, Structural, Landscape, Mechanical and Civil drawings and work of other relevant subcontractors to ensure that the work of this Division can be satisfactorily carried out without changes to structures as shown on plans. Conflicts to be brought to the attention of the Engineer immediately.
- .5 In order to provide sufficient detail and maximum degree of clarity on drawings, symbols used for various electrical devices, take up more space on the drawings than on site or in structures. All poles to be confirmed with Sportsfield Lighting Consultant and General Contractor prior to rough-in.

#### **4.0 CODES AND STANDARDS**

- .1 The entire installation shall comply in all respects with the requirements of the local inspection authority and the latest editions of the following documents:
  - .1 Canadian Electrical Code, Part 1-C22.1-2024, as adopted for use in British Columbia;
  - .2 2024 BC Building Code;
  - .3 CAN/ULC S537 Standard for the Verification of Fire Alarm Systems – latest edition;
  - .4 CAN/ULC S524 Standard for the Installation of Fire Alarm Systems– latest edition;
  - .5 SD41 Electrical Standards.
  - .6 Current version of Master Municipal Construction Documents (MMCD)
  - .7 City of Coquitlam Supplementary Specifications & Drawings to the Current MMCD
- .2 Where reference is made to the standards and specifications of organizations such as EEMAC, NEMA, CSA, NFPA, IESNA, ASTM etc., the latest editions and revisions of such standards and specifications shall apply.

#### **5.0 STANDARDS OF MATERIALS AND WORKMANSHIP**

- .1 All materials shall be supplied as specified. Any proposed alternatives shall be submitted in writing to the Engineer for approval at least 5 business days prior to tender closing. Faxed copies of requests for approval of alternates will not be accepted.
- .2 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality obtainable for the purpose.
- .3 All electrical material, equipment, and fittings shall be approved by CSA or equivalent agency recognized in British Columbia and shall bear evidence of such approval.
- .4 All material shall be new. Where existing material is specifically allowed, it shall be thoroughly cleaned and reconditioned.
- .5 All like items to be of uniform manufacturer.
- .6 All work to be executed in a neat and workmanlike manner by qualified tradesmen. Division 26 to keep a competent foreman and all necessary assistants, all satisfactory to the Engineer, on the job during progress of work.

#### **6.0 ELECTRICAL CONTRACTOR AND ELECTRICAL FOREMAN - QUALIFICATIONS AND EXPERIENCE**

- .1 Each electrical contractor who submits a quotation for electrical work on this project must:
  - .1 Be in possession of a Class 'B' Electrical Contractor's license recognized by the Authority Having Jurisdiction.
  - .2 Have been in business as an electrical contractor for a minimum of 10 years.

- .3 Be capable of providing documented evidence that the electrical contractor has successfully completed work on at least three projects in British Columbia within the last five years, where in each case, the scope and complexity of the work was comparable to or exceeded that of the electrical work associated with this project.
- .4 Be capable of providing contact information for the Site Superintendent associated with each of the three projects described above.
- .5 Be capable of providing contact information for the Owner's Representative associated with each of the three projects described above.
- .2 Each electrical contractor who submits a quotation for electrical work on this project must confirm in writing that the electrical work will be performed under the direct on-site supervision of an Electrical Foreman who:
  - .1 Is a full-time employee of the Electrical Contractor.
  - .2 Holds an electrical journeyman's qualification recognized by the Authority Having Jurisdiction.
  - .3 Has held the journeyman's qualification for a minimum of 10 years.
  - .4 Holds a Class 'A' or 'B' Field Safety Representative (FSR) certificate.
  - .5 Has worked as an Electrical Foreman for a minimum of 5 years.
  - .6 Is able to provide documented evidence that he has successfully worked as an Electrical Foreman for the full construction schedule of at least three projects in British Columbia within the last five years, where in each case, the scope and complexity of the work was comparable to or exceeded that of the electrical work associated with this project.
  - .7 Can provide contact information for the Site Superintendent associated with each of the three projects described above.

## 7.0 PERMITS AND INSPECTIONS

- .1 Division 26 to obtain and pay for all permits required and, after completion of work, furnish to the Engineer a Certificate of Final Inspection and Approval from the Electrical Inspection Authority. Division 26 to take out all permits at the beginning of the work.
- .2 Division 26 shall obtain Electrical Plans and Specifications and submit to the local Electrical Safety Branch for approvals.

## 8.0 OVERALL WARRANTY

- .1 The Electrical Contractor must provide a complete and comprehensive warranty which covers the Electrical Work for a period of one-year following notice of substantial completion.
- .2 During the one-year warranty period, any problems discovered with the **Electrical Work** must be fully rectified at no cost to the Owner.

Problems include:

- a. poor or marginal workmanship;
- b. poor or marginal equipment condition;
- c. poor or marginal equipment or system performance;
- d. lack of conformance with applicable codes and standards.

## 9.0 SHOP DRAWINGS

- .1 Submit detailed shop drawings to the Coordinating Consultant for review as specified herein. These drawings shall be reviewed, approved, and stamped by Electrical Sub-Contractor and the

General Contractor prior to submission. Electrical Contractor shall verify conformance with specification. Submission shall include:

- .1 Electrical Kiosk
- .2 Junction Boxes
- .3 Circuit breakers / fuses and characteristics
- .4 Panel boards
- .5 Contactors
- .6 Transformers
- .7 Switches, receptacles, and cover plates
- .8 Luminaires, drivers, poles and pole bases
- .9 Lighting Control System

#### **10.0 SEISMIC RESTRAINT**

- .1 Provide seismic restraint for all electrical equipment and accessories covered by Division 26, including the attachment to the structural members, in accordance with the BC Building Code and ECABC Seismic Restraint Standards Manual.
- .2 Division 26 shall engage a Seismic Engineer registered in the Province of British Columbia, and who has experience in seismic and vibration control design, to design and review installation of all electrical equipment seismic restraints. Submit Seismic Engineer's Schedule B Letters of Assurance to the Engineer upon commencement of the design, and Schedule C-B Letter of Assurance to the Engineer prior to substantial completion.
- .3 Submit shop drawings including details of all connections and restraints for equipment requiring seismic restraint and/or vibration isolation. Shop drawings submitted shall bear the Seismic Engineer's Seal.

#### **11.0 IDENTIFICATION**

- .1 All main distribution switches, breakers, panels, transformers, control devices, and other major electrical equipment shall be identified with Lamicoid plates. Use black lettering on white face.
- .2 The Lamicoid plate on all equipment starters and controls shall include identification of the unit controlled.
- .3 Conductors shall be colour coded with the same colour applying to the same phase throughout. Colour coding to be by insulation colour or permanently applied colour banding at all distribution centres and panels. Colour coding to be as follows:
  - .1 Equipment grounding conductor - green
  - .2 Neutral conductor - white
  - .3 120/208 volt phase wires - red, black and blue conductors
  - .4 347/600 volt phase wires - red, black and blue conductor
  - .5 Data - blue
- .4 At all distribution centres, pullboxes, wireways, etc., feeder conductors of each system shall be neatly laced or clipped into respective feeder groups.
- .5 At all pullboxes, junction boxes and inside device outlet box locations, identify each conductor as to panel and circuit with permanent black marker, i.e. Panel 2A circuit 23 - identify 2A-23. At each device coverplate provide similar identification utilizing peel and stick clear labels.

- .6 Similar to system proposed for power, conductor identification to be provided for all other systems, such as telephone, data, and television, at all pullbox, junction box and device locations.
- .7 All communication cables to be identified by room number at all pullboxes and terminal boards.
- .8 Provide a typewritten panel directory for each panel.

#### 12.0 TESTS

- .1 Test and check all portions of the electrical systems for satisfactory operation.
- .2 Before energizing any portion of the electrical systems, perform Megger tests on all feeders. Results to conform to the Canadian Electrical Code, to the satisfaction of the authorized inspection authority and the Engineer. Megger tests on all feeder conductors to be done in the presence of the Engineer and/or his representative, suitably logged, tabulated, signed and included in the Operation and Maintenance Manuals.
- .3 Upon completion and immediately prior to final inspection and takeover, check load balance on all feeders at panel boards. Tests to be carried out by turning on all possible loads and checking load current balance. If load unbalance exceeds 15 per cent, reconfigure circuits to balance load.

#### 13.0 CERTIFICATION

- .1 Submit certification to the Electrical Inspector and the Engineer that the installation has been carried out in accordance with the contract documents and the Canadian Electrical Code.

#### 14.0 PROJECT AS-BUILT AND RECORD DRAWINGS

- .1 An up-to-date set of **As-Built** drawings shall be maintained in the field office. Using colours other than black, accurately record on these drawings, day by day, all locations and types of conduits, junction boxes, luminaires and equipment as actually installed on the job. Similarly, all changes (Addenda, Change Orders, Site Instructions, modifications due to field conditions and trade coordination, etc.) shall be recorded on the drawings, including:
  - .1 Dimensioned locations of underground conduit runs, pull boxes and junction boxes.
- .2 The marked-up As-Built drawings shall be submitted to the Engineer (original or scanned colour copy of the original) prior to the Substantial Completion for review and approval.
- .3 After the As-Built drawings are approved by the Engineer, the Engineer will transfer all mark-ups to CAD (AutoCAD format) for **Record Drawing** purposes. Engineer will provide PDF files of both As-Built drawings and Record Drawing drawings copied to a USB flash drive or emailed for inclusion in the Operation and Maintenance (O&M) Manuals. O&M production by Contractor as noted in this Section.
- .4 CAD preparation and reproduction of Record Drawing noted above shall **only** be performed by the Engineer. Final Record Drawings to be provided within one month of project completion and confirmation of invoicing details.
- .5 Under no circumstances will the AutoCAD files, used by the Engineer to prepare the Building Permit, Issued for Tender, or Issued for Construction drawings, be provided to the Contractor, or to any other third party.

#### 15.0 OPERATION AND MAINTENANCE MANUALS

- .1 Four (4) copies of Operation and Maintenance manuals shall be provided containing the following information:
  - .1 Cover sheet showing the project name, the date of completion and "Electrical Operation & Maintenance Manual".

- .2 The first page of the binder shall show the project name along with the name and contact information of the Owner, Coordinating Consultant, Electrical Engineer, General Contractor and Electrical Contractor.
- .3 The second page shall be an index showing each major category of electrical equipment used in this project. Provide section dividers for each major category. No handwriting for any labels will be accepted.
- .4 All final approved/corrected Shop Drawings c/w Engineer's stamp/comments.
- .5 Local source of supply of all major equipment. Include a table showing all luminaires (light fixture) types along with the driver for easy re-ordering.
- .6 Copies of all guarantees, tests, and certificates grouped with their respective category.
- .7 Copy of Final Acceptance from Electrical Inspector.
- .8 Copy of Seismic Engineer's SB and SC schedules.
- .9 Recommended preventative maintenance procedures and schedules for all electrical systems and components.
- .10 Contact information of project team, including designers, contractors, suppliers, commissioning agents.
- .11 Copies of warrantee and guarantees.
- .12 Copy of Electrical Contractor's Declaration of Safety.
- .13 Reports from all test and commissioning activities, including signed verification of coordination above.
- .14 Complete maintenance manuals and instructions for all equipment.
- .15 Sports Field Lighting designer's (i.e. Musco) lighting level testing documentation.
- .2 Electrical Operation and Maintenance Manuals shall be assembled in black heavy-duty post type binders, clearly labelled with project name, division of work and date. In addition, provide four USB flash drives with indexed electronic files (PDF) of all files.
- .3 All Operation and Maintenance data referencing room numbers shall use actual room numbers, not the plan room numbers. Confirm final room numbers with the Coordinating Consultant.
- .4 Provide tabbed dividers between each section with machine printed label on the tab.
- .5 All indexes, cover pages, labels shall be machine printed.
- .6 Three (3) copies of the Operation and Maintenance manuals shall be for the Owner's files and one (1) copy of the operation and maintenance manuals shall be for the Engineer's files.
- .7 Contractor to include all costs for preparation of Operation and Maintenance manuals.

#### **16.0 DEMONSTRATION AND TRAINING REQUIREMENTS**

- .1 System demonstration and turnover to the Owner shall occur when:
  - .1 Installation is complete.
  - .2 Acceptance test conducted by the Engineer has been successfully completed.
  - .3 Commissioning Agent system testing has been successfully complete.
  - .4 Training and instruction have been completed.
  - .5 Operating and Maintenance Manual have been accepted.
  - .6 System Operating Manuals have been accepted.

- .7 Shop drawings have been updated.
- .8 Record drawings have been completed.
- .2 Systems demonstration shall be conducted by Electrical Contractor, respective manufacturers, and Sportsfield Lighting Consultant. The demonstration shall cover all operation and maintenance requirements and a physical demonstration of equipment installation and operation.
- .3 [1] 1/2-hour orientation session for the power distribution system must be provided to Owner's designated representatives for Operations and Maintenance. The session must be led by the Electrical Foreman.
- .4 [1] 1-hour orientation session for the Sportsfield Lighting System, including controls, must be provided to Owner's designated representatives for Operations and Maintenance. The session must be led by the Sportsfield Lighting Consultant's representative with the Electrical Contractor present.

#### **17.0 CHANGES TO WORK**

- .1 Official written change orders, signed by the Coordinating Consultant and Owner, shall be required before commencing any changes, extras, or credits to contract.
- .2 When requested by the Engineer, supply detailed information for the valuation of changes to the Contract. Such information shall include but not necessarily be limited to the following:
  - .1 Labour hours per unit of material or equipment to be added, deleted or altered per NECA 1-2019/20.
  - .2 Units of material or equipment to be added or deleted.
  - .3 Cost per unit of material, equipment and labour broken down by category of labour and type of material of equipment.
  - .4 Extensions of the above to arrive at total costs.
  - .5 Other miscellaneous and identifiable charges such as conveyancing, re-stocking, overhead and profit.
- .3 Include in the valuation of any change to the Contract the cost, if any, of recording such change on the record drawings.

#### **18.0 OPTIONAL PRICING**

- .1 None

#### **19.0 CONSTRUCTION SCHEDULE**

- .1 All materials shall be ordered promptly upon award of the contract. Material delivery date shall not delay the construction schedule. Materials are not to be ordered from suppliers who cannot meet the requirements of the schedule. When requested by the Coordinating Consultant, provide evidence that materials have been ordered.

#### **20.0 FIELD REVIEWS**

- .1 During the course of the construction, there are certain stages when inspections are required by the Engineer. The electrical contractor is responsible for contacting the Electrical Engineer at the milestones listed below. These stages can include, but are not limited to the following, depending on types of projects:
  - .1 Underground ducts installation prior to backfilling.
  - .2 Pole foundation installations.
  - .3 Other Intermediate inspections.
  - .4 Substantial Completion.

- .5 Final Inspection.
- .2 Submit monthly progress claim breakdown to the Coordinating Consultant. Format and detail contained in each claim shall be as agreed with the Coordinating Consultant and Engineer.

**21.0 SUBSTANTIAL COMPLETION AND DEFICIENCY HOLD BACK**

- .1 Before Substantial Completion can be declared, all power, lighting, and communications systems will be fully operational as intended. In addition, the Engineer will be in receipt of all of the following:
  - .1 Record drawings and maintenance manuals.
  - .2 Final fire alarm verification report and certificate.
  - .3 Certificate and report confirming remote monitoring station has received test signals.
  - .4 Confirmation letter that emergency lighting is tested and fully operational in accordance with applicable codes.
  - .5 Seismic Engineer's Schedule B and C-B Letters of Assurance.
  - .6 Final electrical inspection certificate.
  - .7 Letter from the Contractor stating that all work is Substantially completed and operational.
  - .8 Test reports for all systems where called for by the specifications.
- .2 The deficiency hold back will be 3.0 times of the costs of correcting and/or completing all outstanding deficiencies as estimated by the Coordinating Consultant and Engineer.

**22.0 FINAL ACCEPTANCE**

- .1 Before final acceptance may be recommended to the Owner, the following items must be submitted to the Coordinating Consultant:
  - .1 Contractor's written one (1) year guarantee and letter stating that the system is totally completed and that it has been installed as per specifications and drawings.
  - .2 Electrical Inspector's Letter of Final Acceptance.
  - .3 All Submittals listed in "**Section 26 05 03 - Requirements for Schedule C-B and Project Close-Out**" have been received and approved by the Engineer.
  - .4 Correction of previously identified deficiencies.

**END OF SECTION 26 00 10**



## APPENDIX A – SPORTS FIELD LIGHTING

### 1.0 GENERAL

#### .1 RELATED WORK

- .1 Section 26 00 10: General Electrical Requirements
- .2 Section 26 00 11: Basic Materials & Methods

#### .2 SYSTEM

- .1 This section includes for Sport Field Lighting System.

### 2.0 PRODUCTS

#### .1 APPROVED PRODUCTS

- .1 All lighting system components shall be manufactured by Musco Lighting or Engineer approved equal.

#### .2 PERFORMANCE AND LIFE CYCLE COST CRITERIA

- .1 The sports field lighting manufacturer shall supply lighting equipment to meet the following performance and life cycle cost criteria:

##### .1 Lighting Levels & Uniformity

AREA DESCRIPTION	LIGHTING DESIGN REQUIREMENTS
<b>SOCCER</b> (Exterior) Amateur Leagues Class of Play: III	Average Hoirozontal Lux: 300 Max:Min Uniformity: 2.5:1
<b>TENNIS</b> (Exterior) Recreational Class of Play: IV	Average Hoirozontal Lux: 300 Max:Min Uniformity: 2.5:1
<b>FIELD HOCKEY</b> (Exterior) Amateur Leagues Class of Play: III	Average Hoirozontal Lux: 300 Max:Min Uniformity: 3:1

- .2 Lighting calculations shall be developed and field measurements as per the IESNA RP-6-01 and IESNA LM-5-04; including, but not limited to, the following:

- .1 Measurements to be taken on a 9.14m x 9.14m grid.
- .2 Measured average illumination level shall be +/- 10% of predicted mean
- .3 Measurements to be taken at the first 100 hours of operation.

#### .3 Maximum Spill Light Values

- .1 Maximum vertical lux taken with the meter aimed at the brightest light bank at a distance of 45m from the field perimeter shall not exceed 7.22 lux.

#### .4 Remote Monitoring System

- .1 System shall monitor lighting performance and proactively notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can

be scheduled. The controller shall determine switch position (Manual or Auto) and contactor status (open or closed).

.5 Remote Lighting Control System

- .1 System shall include lighting contactors. System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a cellular link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
- .2 The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields, to only having permission to execute "early off" commands by phone.
- .3 On site equipment shall include Manual Off-On-Auto Switches to allow for maintenance, and shall accept and store 7-day schedules. A manual on/off switch must also be included for activation of scheduled lighting, accessible on the outside of the electrical kiosk behind a pad-lockable cover.
- .4 The controller shall be protected against power outages/memory loss and shall reboot once power is regained and execute any commands that would have occurred during the outage.

.6 Management Tools

- .1 Manufacturer shall provide a web-based database of actual field usage and provide reports by facility and user group.

.7 Communication Costs

- .1 Manufacturer shall include communication costs for operating the controls and monitoring for a period of 25 years.

.3 LIGHTING SYSTEM CONSTRUCTION

- .1 The sports field lighting system shall have the following construction criteria:

.1 System Description

- .1 The lighting system shall comply with the current edition of the British Columbia Building Code and Canadian Electrical Code.
- .2 The lighting system including the pole, luminaire, visor and crossarm shall withstand a minimum of 150mph winds and maintain luminaire aiming alignment.
- .3 The lighting system shall include but not be limited to the following:
  - .1 Galvanized steel poles (factory powder coat black (RAL 9005))
  - .2 Engineered pre-cast concrete pole foundations with concrete backfill.
  - .3 Luminaires with a die-cast aluminum housing to protect the luminaire reflector system.
  - .4 Remote LED drivers and supporting electrical equipment mounted in aluminum enclosures mounted approximately 3m above grade. The enclosures shall include driver and fusing for each luminaire. Safety disconnect per circuit for each pole structure will be located in the enclosure.

- .5 Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble free installation.
  - .2 Manufacturing Requirements
    - .1 All components shall be designed and manufactured as a system. All luminaries, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
  - .3 Durability
    - .1 All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed steel shall be hot dip galvanized per ASTM A123. All exposed hardware and fasteners shall be stainless steel of at least 18-8 grade, passivated and polymer coated to prevent possible galvanic corrosion to adjoining metals. All exposed aluminum shall be powder coated with high performance polyester. All exterior reflective inserts shall be anodized, coated with a clear, high gloss, durable fluorocarbon, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All wiring shall be enclosed within the crossarms, pole, or electrical components enclosure.
  - .4 Lightning Protection
    - .1 All structures shall be equipped with lightning protection meeting CAN/CSA B72 standards. Contractor shall supply and install a ground rod of not less than 16mm in diameter and 2.44m in length, with a minimum of 3m embedment. Ground rod should be connected to the structure by a copper main down conductor with a minimum size of #2 for poles with less than 22.9m mounting height and 2/O for poles with more than 22.9m mounting height.
  - .5 Safety
    - .1 All system components shall be ULC listed for the appropriate application.
- .4 WARRANTY AND GUARANTEE
- .1 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
  - .2 Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.
  - .3 Manufacturer shall guarantee constant light levels specified above for 80,000 hours at L70 as recommended by IESNA.

### 3.0 EXECUTION

#### .1 DELIVERY

- .1 All materials shall be delivered to the site undamaged and stored in an area safe from damage of all nature.
- .2 Damaged material shall be rejected.
- .3 The contractor shall be responsible for receiving the sports lighting system and poles at the site and shall provide all equipment and labour required to unload the materials. Poles shall be stored as recommended by the manufacturer.

#### .2 INSTALLATION

- .1 The contractor shall install the bases and poles according to the manufacturer's system proposal.
- .2 All luminaries shall be operating and properly aimed.
- .3 The manufacturer shall provide a representative on-site during the installation to ensure the installation meets the manufacturer's design proposal and the specification requirements.
- .4 The manufacturer shall program the entire system per the owner's requirements.

#### .3 TESTING (by MUSCO LIGHTING or Engineer approved equal)

- .1 All testing and measuring as per the IESNA RP-6-01 and IESNA LM-5-04.
- .2 Provide light meter readings on a 9.14m x 9.14m grid.
- .3 Testing shall be done when the air and sky are clear and extraneous light is at a minimum.
- .4 Care shall be taken that test personnel do not cast shadows or reflected light from clothing or measurement instruments.
- .5 The photometer shall be of good quality and accuracy, recently calibrated or its accuracy otherwise verified.
- .6 The measurement record shall include the following information:
  - .1 Name of installation
  - .2 Date and time of measurements
  - .3 Description of the lighting system, including luminaire and driver type and quantities, mounting heights, and other pertinent details.
  - .4 Type, make and serial number of the photometer.
- .7 A variation between computer-predicted performance and the site-measured results is to be expected. However, the actual results shall be within 10% of the predicted results.
- .8 Test all controls, disconnects and the remote access system.
- .9 Provide 2 hours of instruction time to the Owner's forces for all control and maintenance aspects of the system.

#### .4 NAME TAGS

- .1 Provide name tags indicating transformer name, full electrical data, connection diagrams, etc.

**END OF SECTION APPENDIX A**



Specification created using NBS Chorus