

An aerial photograph of the Lions Gate Bridge in Vancouver, Canada. The bridge is a green suspension bridge crossing a body of water. It is surrounded by dense green forested hills. A road runs along the base of the hills, and a parking lot with several cars is visible on the right side of the image. The text "VANCOUVER BOARD OF PARKS AND RECREATION" is overlaid in the top left corner.

VANCOUVER BOARD OF PARKS AND RECREATION

PARK DEVELOPMENT STANDARDS

CITY OF VANCOUVER

VANCOUVER BOARD OF PARKS AND RECREATION

PARK DEVELOPMENT STANDARDS

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REFER TO REVISION LOGS SECTION 3 AND SECTION 4



1-00 INTRODUCTION

- 1-02 Background
- 1-02 Context
- 1-03 Purpose and Applicability
- 1-04 Process and Systems

2-00 BEST MANAGEMENT PRACTICES

- 2-02 Importing Fill Material
- 2-06 Site Design for Stormwater Management
- 2-08 Contamination Management
- 2-10 Cultural and Archaeological Resources

3-00 STANDARD DRAWINGS

- 3-03 Drawing Index
- Revision Log
- Hardscape
- Infrastructure
- Pathways
- Play Areas
- Landscaping
- Drainage
- Community Gardens
- Planting
- Irrigation

4-00 STANDARD TECHNICAL SPECIFICATIONS

- 4-03 Specification Index
- Revision Log

5-00 APPENDIX A
**City of Vancouver and Park Board
Sustainability Initiatives**

- VanPlay, Vancouver Park Board Services Master Plan
- Vancouver Park Board Strategic Plan
- Capital Plan
- Climate Change Adaptation Strategy
- Climate Emergency Action Plan
- Vancouver's Healthy City Strategy
- City-wide Integrated Rainwater Management Plan
- Vancouver's Bird Strategy
- Vancouver's Biodiversity Strategy
- Vancouver's Urban Forest Strategy
- Local Food Systems Action Plan
- MetroVancouver Ecological Health Action Plan
- Transportation 2040

INTRODUCTION







Photo Source: City of Vancouver Archives



Photo Source: City of Vancouver Archives



Photo Source: City of Vancouver Archives

Background

To the use and enjoyment of peoples of all colours, creeds, and customs for all time. I name thee Stanley Park
Lord Stanley, 1888

In September 1888, the City of Vancouver opened its first official green space, Stanley Park. Two years later, Vancouver City Council created the Park Board, a separately elected board, to manage the park. This Board, now known as the Vancouver Board of Parks and Recreation, known colloquially as the Vancouver Park Board (VPB), was the only of its kind in Canada. Since its inception in 1890, the VPB has grown to hold exclusive possession, jurisdiction, and control of over more than 230 public parks, which comprise 11% of Vancouver's land mass. These include destination and neighbourhood parks, playgrounds, dog parks, jogging trails, beaches, a freshwater lake and 22-kilometers of sea wall. The VPB also maintains a large system of public recreational facilities including community centres, pools, rinks, fitness centres, golf courses, marinas and playing fields and is responsible for maintaining the thousands of street trees located across the city. Driven by the values conceived at its inception and renewed in its strategic plan, the VPB is committed to being a leader in parks and recreation by connecting people to green space, active living and community.

In the spirit and tradition of maintaining and expanding one of Canada's greatest municipal park systems the Vancouver Board of Parks and Recreation initiated a process to develop standards that will ensure the availability of parks of the highest quality for all of Vancouver's citizens and visitors into the future. This document echoes Lord Stanley's decree, but also recognizes the imperative that parks must become multi-layered systems in order to provide a rich and resilient framework for life in the city.

Context

Over the more than 100 years since the creation of Stanley Park, global circumstances have drastically changed and many cities have recognized that parks can be, and are, much more than green spaces for recreation. Today many of the world's most progressive and innovative cities are envisioning parks

as fundamental to an urban ecosystem that provides habitat, helps clean the air, filters stormwater, regulates temperature and provides habitat for pollinators, among many other crucial functions.

Within this new context, The City of Vancouver has adopted a number of initiatives around the topics of climate change adaptation and sustainability that aim to make Vancouver the world's Greenest City by 2020. As a high-level policy document, The Parks Development Standards is rooted in the strategies, goals, and targets identified by the various initiatives, which include the Park Board's Strategic Plan; the Vancouver 2020 Initiative; the Greenest City 2020 Action Plan; the Capital Plan; the Metro Ecological Health Plan; Bird Strategy; Neighbourhood Energy Strategy; City-wide Integrated Stormwater Management Plan; Urban Forest Strategy; Climate Change Adaptation Strategy; Food Strategy; Vancouver Sport Strategy; the Transportation 2040 plan which includes the Cycling Network for All Ages and Abilities (AAA); and the Healthy City Strategy. These initiatives are further described in Appendix A.

As the primary "owner" of Vancouver's open green spaces, the VPB plays a pivotal role in realizing the goals set out by these various sustainability initiatives and has significant roles to play in climate change and energy issues, stormwater, dark skies, species diversity, food security and public health. Whether it be providing routes for non-auto commutes and mitigating urban heat islands; means of protecting against sea level rise and storm surge; absorbing heavy rainfall events; or creating spaces for agriculture that can help secure a local food supply, these issues are now and will be central to maintaining quality of life standards for Vancouver residents as change continues to take place. These imperatives must be simultaneously balanced with the need to protect, maintain and enhance existing green spaces that are safe, beautiful and beloved by the citizens of Vancouver.

The emerging needs that the city has identified will continue to be fluid and difficult to predict. Within the context of limited operating funds, this uncertainty must be mitigated through standards that target the best information available to design and maintain consistent and high quality park spaces that stand the



Photo Source: City of Vancouver Archives



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test of time. However, It is critical to recognize that no standard should be adhered to if it is no longer useful to its current context. As a living document, the Park Development Standards should be reviewed and upgraded as circumstances and technology change so that limited resources are always applied to their greatest possible effect.

Purpose and Applicability

Sustainable development is about meeting the needs of today without compromising the needs of future generations.

Environment Canada (2014). EC Website. Retrieved from <http://www.ec.gc.ca/dd-sd>.

This document, the Park Development Standards, is intended to provide a comprehensive guide to the park development and maintenance process. The standard drawings, technical specifications and Best Management Practices (BMP's) contained herein together provide a manual guiding Park Board staff, Consultants (planners, landscape architects and engineers), and Contractors through the planning, design, construction and maintenance of Vancouver's park system.

This document aims to create a new standard for park development that will ultimately result in high-performance park landscapes that are not only beautiful and inspiring but are also resilient and truly sustainable. Maintainability is a critical component in the creation of a sustainable park system and it is this component in particular that the Standards document seeks to address. For this purpose, consideration was given in the creation of the document to site preservation, park performance, long term sustainable design practice, the longevity of materials, safety, the standardization of design details and specifications, best management practices, operations budgets, as well as the methods of maintenance of individual park components and the park at large.

Process and Systems

While the Park Development Standards focus is on the construction and maintenance of parks, achieving high-performance park spaces requires significant investments in integrated design process as well. The standards describe design elements that will be required as part of the park design process, but many

additional decisions need to be made that should involve the public, the design team and the operations and maintenance team. If there are elements of the final design that the public does not support or that cannot be maintained it is very likely the park will fail to perform at some point in its life. It is important to identify these issues early by consulting all parties involved, and revise the project as needed. Strategies to consider are integrating maintenance into the design process, developing a public involvement plan, conducting constructibility reviews during the design process and seeking materials that are durable and of high quality. Within material selection it is paramount to consider where the material is originating and what its availability will be in the future. Choosing domestic materials will help ensure consistency in quality and will allow more transparency in the manufacturing process.

At the same time, it is important to recognize that high-performance parks, like any park, may require additional effort to keep them at their peak. Strategies to consider that could assist in these efforts include providing a maintenance plan as part of the design process that should be reviewed and approved by VPB staff; maintenance partnerships with private sector and local community groups when local unions are supportive; involving maintenance staff in the construction process; and implementing a public information and education program as part of maintenance and operations.

The Park Development Standards describe the practical components that all VPB parks will be comprised of into the future while recognizing change and updates over time. During the design and construction of any project, however, the project team should be thinking about not only how these components combine as a system within the park boundaries itself, but also how they may integrate with adjacent sites and the park system throughout the region. Factors to bear in mind might include restoring natural hydrology and eliminating flow off site or even absorbing flow from adjacent sites; creating and protecting habitat corridors; and rejuvenating on site soils before importing soils from off site.

The future of parks are central to the future of cities. Parks create opportunities for integrated systems

of biodiversity, movement networks, flood mitigation strategies and habitat corridors flowing seamlessly through a fabric of outdoor spaces for people to enjoy and feel rejuvenated. These are systems that are complex and require significant effort and vigilance to manage and maintain. This document provides the backbone for that future thinking by providing parks that are maintainable, efficient in their use of capital resources, and durable in their material selection. The Park Development Standards are a commitment to providing a park system of the highest quality possible. It is hoped that the information contained herein not constrain projects but lead to greater innovation and creativity by setting a high standard.



Photo Source: PwL Partnership Landscape Architects Inc.



Photo Source: PwL Partnership Landscape Architects Inc.

BEST MANAGEMENT PRACTICES





BEST MANAGEMENT PRACTICES

IMPORTING FILL MATERIAL



Photo Source: City of Vancouver

PART 1: PURPOSE AND DEFINITION

The Park Board accepts free topsoil and fill material from a variety of sources as a cost saving measure. These guidelines are intended to ensure that inappropriate soils are not introduced onto Park Board properties. The focus is on selecting topsoil and fill material that meets horticultural and engineering specifications for organic and physical/mineral properties while minimizing the chance of introducing materials that may result in poor drainage or nutrients, or present a potential risk to human health or the environment.

Soil and fill materials usually become available on short notice. If the supplier does not have adequate documentation verifying the properties of the material that allows the Park Board to assess its ability to meet specifications, the soil should be rejected. If the supplier will allow time to have the material tested, the appropriate analyses to be conducted will have to be determined and carried out by a qualified agency. Appropriate analyses can be based on the history of the site use and what the material is to be used for.

All imported topsoil and fill material must meet applicable specification quality requirements and be capable of being placed and compacted at or close to its maximum achievable density. A soil relocation permit is also required. All testing must be reported in writing and a record kept for verification. Unless material to be imported can be demonstrated to be free of contamination and/or appropriate for the proposed use, the use of that material shall be rejected.

PART 2: APPLICATIONS AND LIMITATIONS

Topsoil for horticultural use may be obtained from acceptable residential or commercial/industrial sites and existing parks. On site or imported soil shall be friable "A Horizon" topsoil to the requirements of the B.C. Landscape Standard, stripped and stockpiled on site in an approved location. Stripping and stockpiling work shall be such that the soil structure is not damaged and contamination is avoided.

Topsoil properties are controlled to meet specifications for nutrients and particle size. Mineral particle sizes shall be within the following ranges by weight:

- 100% shall pass a 10 mm (3/8") sieve
- Maximum of 10% shall pass a #200 sieve (silt and clay)

Soil shall be of a sandy loam or loamy sand texture containing between 3% and 15% organic matter (dry weight basis). Soil shall be virtually free from subsoil, wood including woody plant parts, weeds, stones over 30 mm, pests, undesirable grasses or weeds, and seeds or parts thereof and foreign objects. Soil shall be free from crabgrass, couch grass, *Equisetum* sp., *Convolvulus* sp. or other weeds or seeds or parts thereof.

Soil shall be suitable for modification by screening and additives to meet the requirements for Screened Growing Medium except where specified and approved for use as Unscreened Imported Soil (Refer to Section 32 91 13 Growing Medium).

Fill materials in Vancouver are most often obtainable from construction sites and from demolition debris including concrete and asphalt. Materials from these types of sites may or may not be appropriate depending on the proposed use of the fill and the quality of assessment and /or mitigation measures, if necessary. Unless construction projects can be demonstrated to be free of contamination and/or appropriate for the proposed use, the material should not be accepted.

In general, fill source site should be located in non-industrial areas and not from sites undergoing environmental clean up. Non-industrial sites include those that have never been developed or have been used solely for residential or agricultural uses. If the source is an agricultural site, care should be taken to ensure that the fill does not include agricultural waste process by-products such as manure or decomposed organic matter. Material should also not be accepted from lands within the Agricultural Land Reserve.

The following types of sites are unacceptable sources of fill material:

- Industrial sites where hazardous materials were used, handled or stored
- Unpaved parking areas where petroleum hydrocarbons may have been spilled or leaked into the soil
- Residential sites with underground fuel/oil tanks
- Former gasoline stations
- Retail sites that contain dry cleaners
- Photographic processing facilities
- Paint stores
- Auto repair shops
- Auto painting facilities
- Metal processing shops
- Manufacturing facilities
- Oil refineries
- Waste treatment plants, etc.
- Current or former landfills

Fill obtained from a commercial supplier of manufactured top soil (growing medium) or fill material or from soil pits in rural and suburban areas must be documented as uncontaminated.

The type of soil suitable for fill material depends on the proposed facility to be built. Fills range from granular soils (sand and gravel), which are most desirable, to more finely sized soils (silt and clay), which are usually less desirable. Certain types of soils such as saturated clays and highly organic soils are unsuitable for use as materials for most fill construction. Fill materials should be well graded, capable of being well compacted, be within a proper range of moisture to optimize compaction and be free of unsuitable or deleterious materials such as tree roots, branches, stumps, sludge, metal, trash, or contamination.

Some materials over 100 mm (4 in.) in size, such as rocks, large stones, or reclaimed paving materials (recycled concrete aggregate) can be used as fills if deemed suitable by a Geo-technical Engineer. Oversize materials should have strong particles that do not readily break down under the action of construction machinery and which have a range of sizes so that voids are partially filled.

BEST MANAGEMENT PRACTICES

Contractors must submit documentation showing proof of insurance to the City prior to delivery and/or placement of fill material on a construction site. The required types of insurance include but are not limited to the following:

- Comprehensive Liability Insurance
- Automobile Liability Insurance
- Worker's Compensation Insurance

PART 3: DOCUMENTATION

To minimize the introduction of contaminated fill onto a site it must be verified through documentation that the source is acceptable and/or have the material analyzed for potential contaminants based on the location and history of the source area.

Documentation required for use of imported fill material shall include:

- A review of available historic records including street directories, the British Columbia Ministry of Water, Land and Air Protection (MWLAP) on-line site registry, aerial photographs, fire insurance maps, land use maps and current title searches, City of Vancouver business licenses issued to municipal address of property (reviewed and approved by District Director);
- A site reconnaissance to observe conditions which may indicate the potential presence of contamination, and to prepare a photographic record;
- A review of available documents and reports relating to waste management and site contamination;
- Interviews with individuals knowledgeable about the site;
- If a building exists, a preliminary survey for special attention substances such as polychlorinated biphenyls (PCB's), asbestos, lead paint, urea formaldehyde foam insulation (UFFI), and mercury which may be present in construction materials at the site.
- Any such documentation shall be signed by an experienced Environmental Consultant.

If signed documentation is not available or is determined to be inadequate, samples of the fill material shall be submitted for chemical analysis.

PART 4: SAMPLING AND TESTING

If there are detectable amounts of compounds of concern, the material should be evaluated by the Consultant for risk in accordance with City and/or Provincial environmental assessment guidelines. Metal analysis needs only to be performed for those metals to which risk levels have been assigned. The same applies to chemical and petroleum hydrocarbon contaminated soil.

Representative samples should be collected from material still in place at source. The appropriate number of samples should be taken based on the approximate area or volume of soil to be used as recommended in the following table.

Recommended Fill Material Sampling Schedule

| Area of Source Site | Sampling Requirements |
|--|---|
| 2 acres (.81 h) or less | Minimum 4 samples taken from quadrants |
| 2 to 4 acres (.81 to 1.62 h) | Minimum 1 sample every 2 acre |
| 4 to 10 acres (1.62 to 4.05 h) | Minimum 8 samples |
| Greater than 10 acres (4.05 h) | Minimum of 8 locations with 4 sub-samples per location |
| Volume of Stockpile | Sample per Volume |
| Up to 1000 yd; (764.6 m) | 1 sample per 250 yd; (191 m ³) |
| 1000 to 5000 yd; (764.6 to 3823.8 m ³) | 4 samples for first 1000 yd; + 1 sample per each additional 500 yd; (382.3 m ³) |
| Greater than 5000 yd; (3823.8 m ³) | 12 samples for first 5000 yd; + 1 sample per each additional 1000 yd; |

Note: Samples requiring chemical analysis shall not be combined.

Sampling Alternatives

- An Environmental Stage I Preliminary Site Investigation (history of site uses) may be conducted prior to sampling to determine whether the site has been impacted by previous activities. After being evaluated, any sampling that may be required can be determined.
- If it is not possible to analyze fill material at the source or determine that it is appropriate for use from the Stage 1 investigation, one sample per truckload shall be collected and analyzed for all compounds of concern.

Material Properties and Testing Methods

- Submit a copy of an analysis by an approved independent soil-testing laboratory, (current contracted vendor is Pacific Soil Analysis; #5 11720 Voyager Way, Richmond B.C. Ph. 273-8226). The analysis shall be of tests done on the proposed top soils or structural soils and additives

proposed for the work from samples taken at the supply source, within three weeks immediately prior to placement. Costs of the initial analysis, and subsequent tests to ensure compliance with the specification shall be borne by the Contractor. Failure to submit soils analysis is cause for immediate rejection of any placed soils.

- The analysis for planting soils shall include a breakdown of the following components: total nitrogen by weight, available levels of phosphorous, potassium, calcium, magnesium, soluble salt content, organic matter by weight, % sand, % fines (silt and clay) and pH value. In addition, the analysis shall clearly indicate the Project Name, Date Tested and Contractor's Name. Submit with the above analysis, the testing laboratory's recommendations for amendments, fertilizers and other modifications to make the proposed growing medium meet the requirements of this specification.
- A particle size analysis shall be undertaken by a qualified and approved soils testing laboratory.
- Fill material shall be natural mineral material of a consistent quality throughout, free from foreign matter such as construction debris, plant and grass seeds, organic matter and pests, and meeting the requirements set out, depending on the application.
- Obtain the approval of fill material before delivering to the site if imported, or before moving on site if native. If imported material is approved for use, supply a written notification a minimum of thirty (30) days prior to beginning fill operations a complete statement of origin, compensation, suitability, environmental clearance and proposed location of all deposits that is intended for imported fill.
- Fill shall be classified depending on its application and shall meet the following requirements:
 - Topsoil – under planted and grass areas. Maximum aggregate size 200mm evenly graded, containing not more than 20% fines (clay and silt) and not more than 5% organic matter.
 - Structural Soil - under sub-base for pathways, paved areas, structures. Maximum aggregate size 200mm evenly graded, containing not more than 15% fines passing a No. 200 (0.075mm) sieve when tested according to ASTM designation C-136. Refer to Structural Growing Medium specification.

PART 5: CHECKLIST

The following provides basic checks that will assist staff in determining if a material is suitable for use:

- ☐ Has an Environmental Stage 1 Preliminary Site Investigation been performed for the site?
 - A history of site use and adjacent site use(s) is generally a good indication as to whether further analysis is required. Refer to the list of land uses that are considered undesirable.
- ☐ Has a geotechnical investigation been carried out on the site or a location adjacent to the site?
- ☐ What are the results of any analyses that have been carried out?
 - If the site use is questionable and no analyses have been carried out, the type of analysis required is determined by whether the soil is for horticultural use or for structural fill.
- ☐ Is sampling of the fill material being conducted per the 'Recommended Fill Material Sampling Schedule'?
 - Sampling requirements are based on the size of the site area from which material is being imported.
- ☐ Is placement of the fill material being monitored at the source and/or at the delivery site by an experienced soils engineer?
 - Subsequent testing requirements will be based on information regarding the source of the fill and from ongoing visual examination of the imported material.

END OF BMP

BEST MANAGEMENT PRACTICES

SITE DESIGN FOR STORMWATER MANAGEMENT



Photo Source: PWL Partnership Landscape Architects Inc.

PART 1: PURPOSE AND DEFINITION

Fundamental hydrological concepts and stormwater management concepts can be applied at the site design phase that are:

- more integrated with natural topography,
- reinforce the hydrologic cycle,
- more aesthetically pleasing, and
- often less expensive to build.

A few site planning principles help to locate development on the least sensitive portions of a site and accommodate land development and use while mitigating its impact on stormwater quality.

PART 2: DESIGN GUIDELINES

• **Define Development Envelope and Protected Areas** - The first step in site planning is to define the development envelope. This is done by identifying protected areas, setbacks, easements and other site features, and by consulting applicable standards and requirements. Site features to be protected may include important existing trees, steep slopes, erosive soils, riparian areas, or wetlands.

By keeping the development envelope compact, environmental impacts can be minimized, construction costs can be reduced, and many of the site's most attractive landscape features can be retained. In some cases, economics or other factors may not allow avoidance of all sensitive areas. In these cases, care can be taken to mitigate the impacts of development through site work and other landscape treatments

• **Minimize Directly Connected Impervious Areas** - Impervious areas directly connected to the storm drain system are the greatest contributors to urban non-point source pollution. Any impervious surface that drains into a catch basin or other conveyance structure is a "directly connected impervious surface." As stormwater runoff flows across parking lots, roadways, and other paved areas, the oil, sediment, metals, and other pollutants are collected and concentrated. If this runoff is collected by a drainage structure and carried directly along impervious gutters or in sealed underground pipes, it has no opportunity for filtering by plant material or infiltration into the soil. It also increases in velocity and amount, causing increased peak-flows in the winter and decreased base-flows in the summer.

A basic site design principle for stormwater management is to minimize these directly connected impervious areas. This can be done by limiting overall impervious land coverage or by infiltrating and/or dispersing runoff from these impervious areas.

- **Maximize Permeability** - Within the development envelope, many opportunities are available to maximize the permeability of new construction. These include minimizing impervious areas, paving with permeable materials, clustering buildings, and reducing the land coverage of structures by smaller footprints. All of these strategies make more land available for infiltration and dispersion through natural vegetation.

Once site coverage is minimized through clustering and careful planning, pavement surfaces can be selected for permeability. A paved area of brick-on-sand, for example, is more permeable than a large concrete slab. Engineered soil/landscape systems are permeable ground covers suitable for a wide variety of uses. Permeable/porous pavements can be used in place of traditional concrete or asphalt pavements in many applications.

Maximizing permeability at every possible opportunity requires the integration of many small strategies. These strategies will be reflected at all levels of a project, from site planning to materials selection. In addition to the environmental and aesthetic benefits, a high-permeability site plan may allow the reduction or elimination of expensive runoff underground conveyance systems, flow control and treatment facilities, yielding significant savings in development costs.

- **Maximize Choices for Mobility** - Given the costs of automobile use, both in land area consumed and pollutants generated, maximizing choices for mobility is a basic principle for environmentally responsible site design. By designing to promote alternatives to automobile use, a primary source of stormwater pollution can be mitigated.

Bicycle lanes and paths, secure bicycle parking at community centers and shops, direct, safe pedestrian connections, and transit facilities are all site-planning elements that maximize choices for mobility.

- **Use Drainage as a Design Element** - Unlike conveyance storm drain systems that hide water beneath the surface and work independently of surface topography, a drainage system for stormwater infiltration or dispersion can work with natural land forms and land uses to become a major design element of a site plan.

By applying stormwater management techniques early in the site plan development, the drainage system can suggest pathway alignments and optimum locations for various park elements. In this way, the drainage system helps to generate the form of the site design, giving the development an integral, more aesthetically pleasing relationship to the natural features of the site. Not only does the integrated site plan complement the land, it can also save on development costs by minimizing earthwork and expensive drainage features.

END OF BMP

BEST MANAGEMENT PRACTICES

CONTAMINATION MANAGEMENT



Photo Source: PWL Partnership Landscape Architects Inc.

PART 1: PURPOSE AND DEFINITION

The purpose of this BMP is to provide for the planning and maintenance of an uncontaminated park system that may result during excavation work. It provides guidelines for the health and safety of construction workers as well as the protection of park sites for the health and safety of park users, the flora and fauna found within the park system, and to eliminate the potential for the spread of contaminants to other areas during construction work, whether by removing soils from the site, releasing particulates into the air or allowing contaminants to leach off site.

Common sources of contamination include underground storage tanks, railway ties and tracks, creosote piles, and known or suspected contaminated areas, such as manufacturing facilities, service stations, dry cleaners and junkyard or salvage properties or other sites types as listed in BMP 000 Importing Fill Material. Signs of contamination may include a rainbow sheen on soil or groundwater, discoloration of the soil, floating oil or fuel, and unusual odours. Many of these contaminants can be identified during the planning phase by consulting the city database for known contaminated sites and by consulting with the City of Vancouver Contaminated Sites Team (CST) prior to excavation.

PART 2: APPLICATIONS AND LIMITATIONS

This BMP applies to all VPB worksites where excavation will occur. While site contamination may be more likely in new park construction, particularly on sites that have experienced previous uses as listed above. However, the same procedures as listed below should be followed where excavation is to take place within existing VPB parks. This can include but is not limited to fencing, irrigation, drainage system and play field installations.

When contaminated materials are suspected to be present, workers should protect eyes, lungs and skin from potentially contaminated material. In addition to avoiding vapour inhalation, contact with the material, and recognizing potentially flammable material all workers should wear at a minimum a respirator with an organic vapour cartridge as required, gloves, safety glasses, pants and long sleeve shirts. For additional worker precautions the CST should be contacted.

PART 3: GUIDELINES

Guidelines are listed below that describe the procedures to take when contamination is encountered. However, as previously mentioned, it is important to note that many issues can and should be avoided by consulting CST and the city database of contaminated sites during the planning phase. These steps will help limit the discovery of unexpected contamination and will allow for removal of the contaminants more effectively and under optimal conditions. However, there are still instances in which unexpected soil or groundwater contamination is identified after excavation begins. In these circumstances the Site Supervisor must:

- Stop excavation work and call CST immediately to seek advice.
- Inform the Operations Superintendent and work crew they may have encountered contamination during excavation.
- Implement required health and safety procedures in accordance with Exposure Control Plan and use PPE related to the contaminated material.
- If approved by CST (or their pre-qualified environmental consultant) and if there is sufficient space, stockpile suspect contaminated soil on 6 Mil polyethylene liner and ensure stockpile is not located near or upslope from a storm sewer catch basin.
- Not relocate soil offsite until required licensing, documentation and disposal facility has been confirmed by CST. NOTE: known or suspect contaminated soil cannot be transported to Kent Yard; suspect contaminated soil with pending laboratory results cannot be transported to the Vancouver Landfill until classified by CST.
- Ensure excavation water is not discharged to storm sewer until CST (or their pre-qualified environmental consultant) has confirmed treatment is not required.
- Not leave site at end of day until stockpiled soil is covered with 6 Mil polyethylene liner.
- Work with CST (or their pre-qualified environmental consultant) to monitor removal of contamination and conduct appropriate sampling as determined by CST.
- If required, have Operations Superintendent obtain Waste Discharge Permit as required under the City of Vancouver's Sewer and Watercourse Bylaw No. 8093 and the Greater Vancouver Sewerage and Drainage District Sewer Use Bylaw No. 299, 2007.
- If required, ensure groundwater treatment system operates correctly and that CST (or their pre-qualified environmental consultant) conducts required sampling.
- Keep records of the amount of contaminated soil removed offsite and the disposal location.
- Ensure any Hazardous Waste (as identified by CST) is transported in accordance with the Hazardous Waste Regulation (i.e. License to Transport and Provincial Waste Manifests utilized; waste transported to facility permitted to accept Hazardous Waste).
- Maintain all records of loads of Hazardous Waste transported from the work site to the disposal site.
- Provide all documentation of contamination transportation and disposal to Operations Superintendent.

END OF BMP

BEST MANAGEMENT PRACTICES

CULTURAL AND ARCHAEOLOGICAL RESOURCES



Photo Source: PWL Partnership Landscape Architects Inc.

PART 1: PURPOSE AND DEFINITION

All Vancouver Park Board led construction projects should ensure compliance with the BC Heritage Conservation Act (HCA). The purpose of the act is to encourage and facilitate the protection and conservation of heritage property in British Columbia and to facilitate the respectful and appropriate treatment of human remains or artifacts. No known archaeological site may be disturbed or altered without a Provincial Alteration Permit, and explicit conditions in the permit must be followed. Particularly critical sites will include Coast Salish traditional lands, most especially ocean and river fronts. Within this context it is very important to consult with and coordinate relevant plans with the Musqueam, Squamish and Tsleil-Waututh. Each of these nation's own chance find processes must be taken into account.

PART 2: APPLICATIONS AND LIMITATIONS

This BMP applies to all worksites with excavation work. The HCA identifies the types of artifacts and remains that may not be damaged, desecrated, altered, covered or excavated. This includes pre-contact (prior to 1846) heritage objects, artifacts, features, materials or other physical evidence of human habitation and post-contact items such as bottles and boats. Certain and differing procedures should be followed for the project planning phase and in the event of a chance discovery during the construction phase. Additionally, different procedures should be followed if the discovery is suspected to be human remains or material of archaeological significance.

PART 3: GUIDELINES

- **Project planning phase.** The project manager will consult with the City of Vancouver's Provincial Heritage Sites Map (as shown on VanMap) to determine if the work site is within or near a Pre-contact Designated Heritage Site (DHS). The map layer is based on the Provincial Remote Access to Archaeological Data (RAAD) application data and is updated every 5 years.
- If found to be **in or within 50m of a DHS**, area of significant archaeological potential, or if the project has a site area of over 10 hectares, the Project Manager will review alternative design options and/or engage an archaeologist to

conduct an archaeological review and obtain Provincial Permits in accordance with the HCA. An Archaeologist may need to be contracted to monitor activities during construction. If a permit is deemed necessary and obtained, further procedures shall follow the conditions outlined in the permit. If a permit is not obtained the procedures listed below shall apply.

- If found to be **between 50m and 200m from a DHS** or area of significant archaeological potential, a “Chance Find Procedure” shall be implemented. An archaeologist should be contracted to conduct a brief archaeological assessment and prepare a project specific “Chance Find Procedure” if an applicable, acceptable and up-to-date neighbourhood specific “Chance Find Procedure” does not already exist. (contact the Director of Parks for clarification of existing chance find procedures). Excavation crews shall be briefed on the “Chance Find Procedure” during the pre-job meeting and/or daily crew talks. Completed project specific “Chance Find Procedures” shall be filed with the Vancouver Parks Board as a resource for future projects.
- If found to be outside of the areas described above, no special procedure is required. However, if unrecorded archaeological sites are encountered during construction, activities must be halted and crews should follow the “Typical Chance Find Procedure” outlined below.
- **Construction phase.** If archaeological sites are encountered during work on projects that are not being completed under provincial archaeological permits or do not have a project specific “Chance Find Procedure” then the “Typical Chance Find Procedure” outlined below must be followed.
- **General Archaeological Sites Chance Find Procedure.** If materials known or suspected to be of archaeological significance are encountered:
 - Stop all construction activity in the immediate vicinity of the suspected archaeological site.
 - Contact the Project Manager and/or Director of Parks for further direction.
 - The Project Manager will contract an

Archaeologist to review the site and provide further direction.

- **Human Remains Chance Find Procedure.** If materials known or suspected to be human remains are encountered:
 - Stop all construction activity in the immediate vicinity of the remains. Do not move soil from the vicinity of the remains, including adjacent spoil material.
 - If the remains appear to be recent, immediately contact the Vancouver Police Department (VPD).
 - After contacting the VPD, or if the remains appear to be historical or archaeological in nature, contact the Project Manager and/or the Director of Parks for further direction.
 - The Project Manager and/or the Director of Parks will contact the Vancouver Police Department and the Coroner’s Office (if they were not contacted previously). If the remains are not of forensic concern, the Project Manager will contract an Archaeologist to review the site and provide further direction as necessary.

END OF BMP

STANDARD DRAWINGS





HARDSCAPE

- 1-01 Expansion and Control Joints
- 1-02 CIP Concrete Band
- 1-03-1 Concrete Seatwall Expansion Joint
- 1-03-2 Concrete Seatwall
- 1-04 CIP Asphalt Mow Band
- 1-05 CIP Concrete Mow Band
- 1-06 Concrete Stairs
- 1-07 Handrail at Concrete Stairs

INFRASTRUCTURE AND FURNISHINGS

- 2-01 Standard Bench Installation
- 2-02 Standard Bench Armrest Installation
- 2-03 Standard Bike Rack Installation
- 2-04 Removable Bollard
- 2-05 Removable Flush Mount Bollard
- 2-06 Permanent Bollard - Non-Removable
- 2-07 Standard Frost Free Water Fountain
- 2-08 Standard Water Fountain with Bottle Filler
- 2-09 Standard Picnic Table
- 2-10 COV Parks Sign
- 2-11 3' Chain Link Fence and Gate at Dog Park
- 2-12 Split Rail Fence

PATHWAYS

- 3-01 Asphalt Road
- 3-02 Bike Path Over Root Zone
- 3-03 Crushed Granite Path with Edging
- 3-04-1 CIP Concrete Paving - No Reinforcing
- 3-04-2 CIP Concrete Paving - Welded Mesh Reinforcing
- 3-04-2 CIP Concrete Paving - Rebar Reinforcing
- 3-05 Wood Mulch Path
- 3-06 Temporary Access Road

PLAY AREAS

- 4-01 Poured-in-Place Rubber Surfacing
- 4-02 Rubber Play Tile
- 4-03 Sand Play Area Flush Edge
- 4-04 Engineered Wood Fibre
- 4-05 Ramp at Play Area

LANDSCAPING

- 5-01 Landscape Boulder

DRAINAGE

- 6-01-1 Catch Basin - Flat Open Bottom
- 6-01-2 Catch Basin - Flat Closed Bottom
- 6-02 Drainage Cleanout in Lawn
- 6-03 Drainage Perforated
- 6-04 Infiltration Trench with Grass

COMMUNITY GARDENS

- 7-01 Hose Bib in Community Gardens

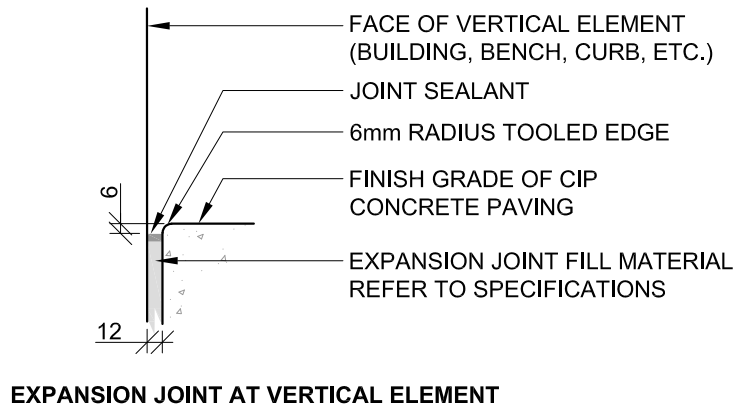
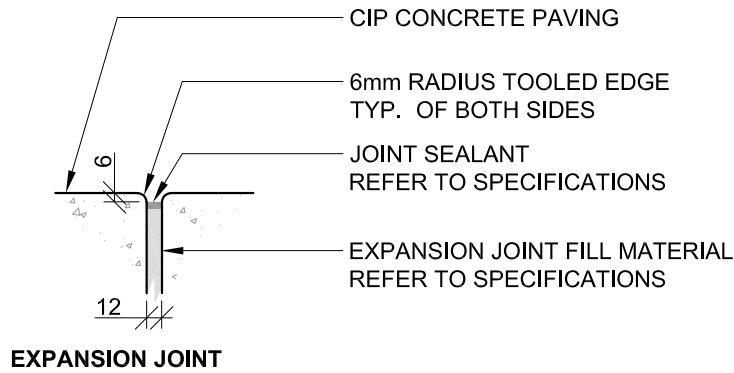
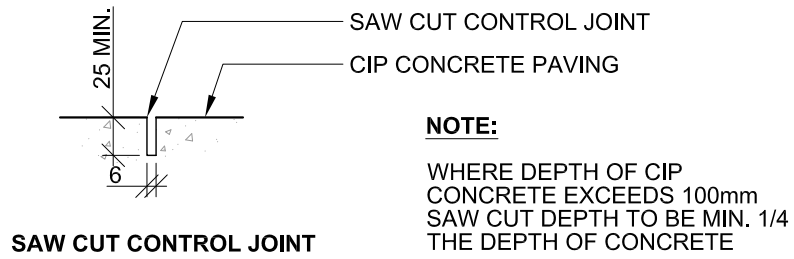
PLANTING

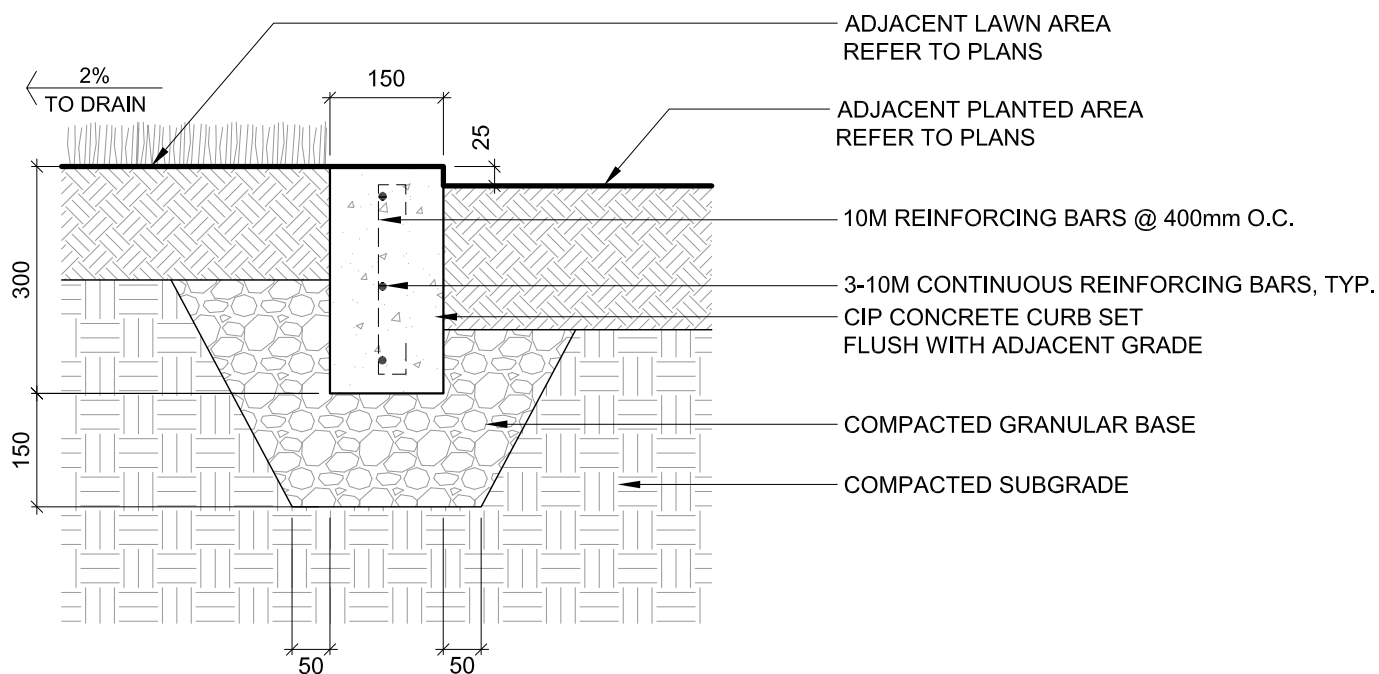
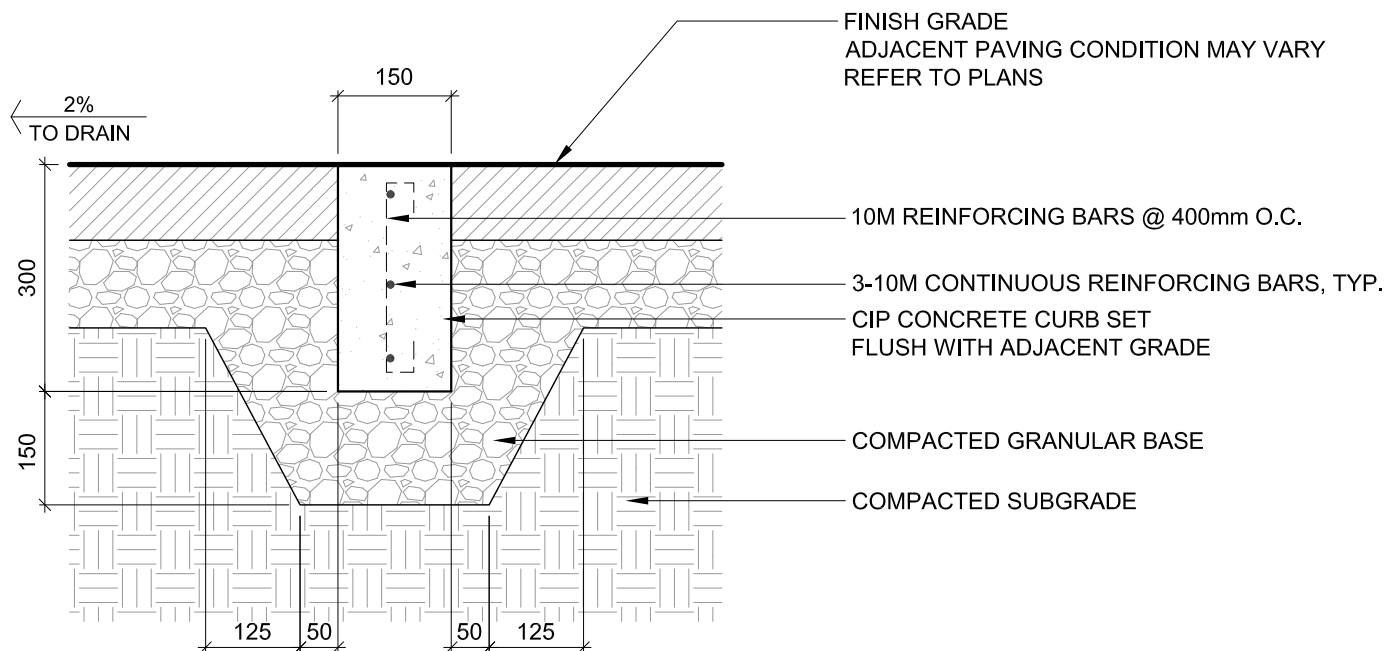
- 8-01 Tree Planting
- 8-02 Tree Planting on Slope
- 8-03 Shrub Planting
- 8-04 Shrub Planting on Slope
- 8-05 Groundcover Planting
- 8-06 Tree Protection Barrier Fencing

IRRIGATION

- 9-01 Backflow Preventer
- 9-02 Quick Coupler in Valve Box
- 9-03 Irrigation Vault
- 9-04 1.5m Service Vault
- 9-05 Isolation Valve
- 9-06 Irrigation Trenching
- 9-07 Thrust Blocks
- 9-08 Sleeve at Street / Parking
- 9-09 Sleeve at Path
- 9-10 Rotor Spray Head
- 9-11 Pop-Up Spray Head
- 9-12 Remote Control Valve Assembly
- 9-13 Master Valve Assembly
- 9-14 Flow Sensor Assembly

[illegible]





NOTE:

1. MIN. 50mm COVER OF CONCRETE OVER ALL REBAR
2. ADJACENT CONDITIONS MAY VARY, REFER TO PROJECT PLANS



DRAWING
CIP CONCRETE BAND

DATE
JUNE-2022

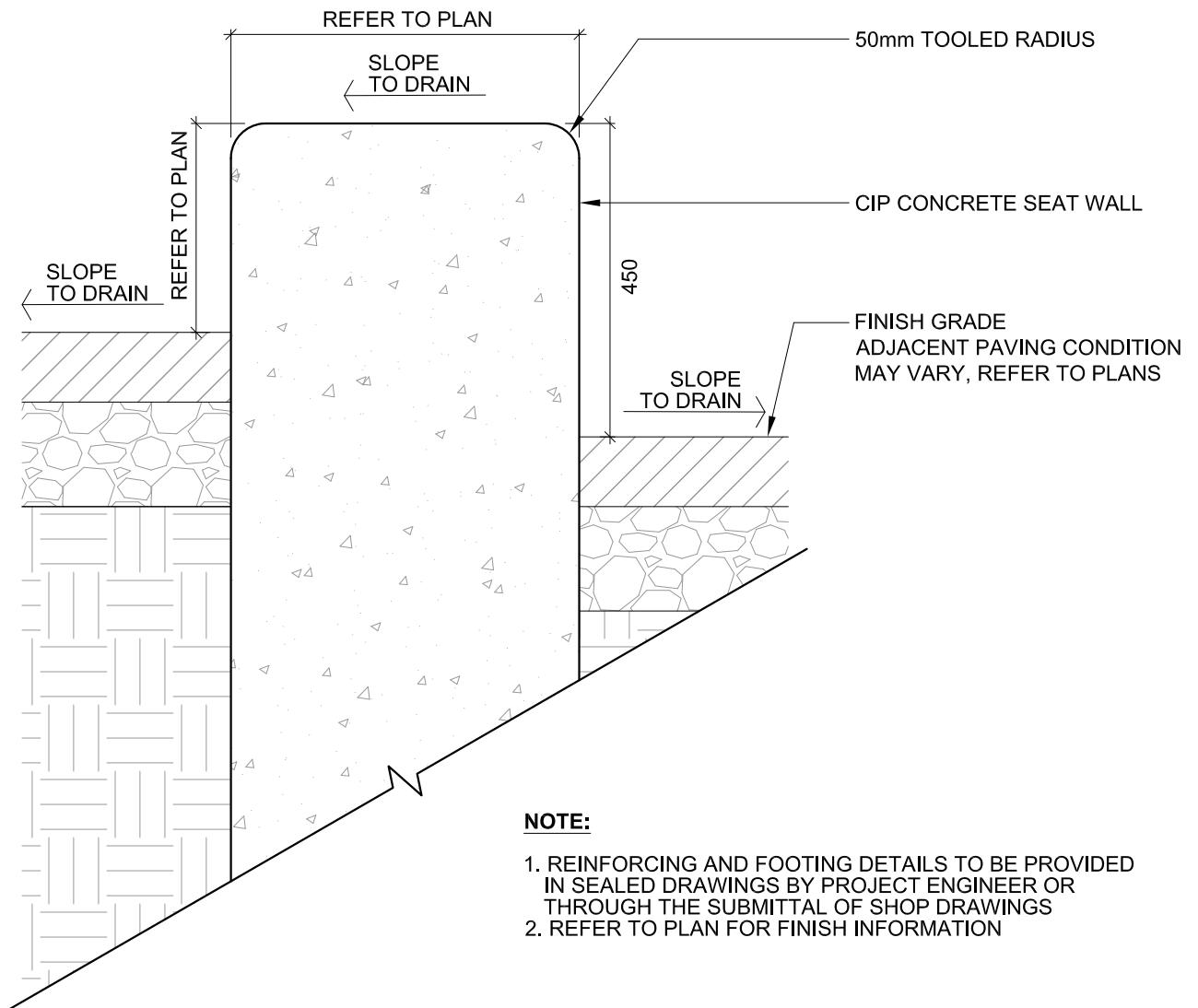
REV

SCALE
1:10

NOTES

SHEET

1-02



DRAWING

CONCRETE SEAT WALL

DATE

JUNE-2022

REV

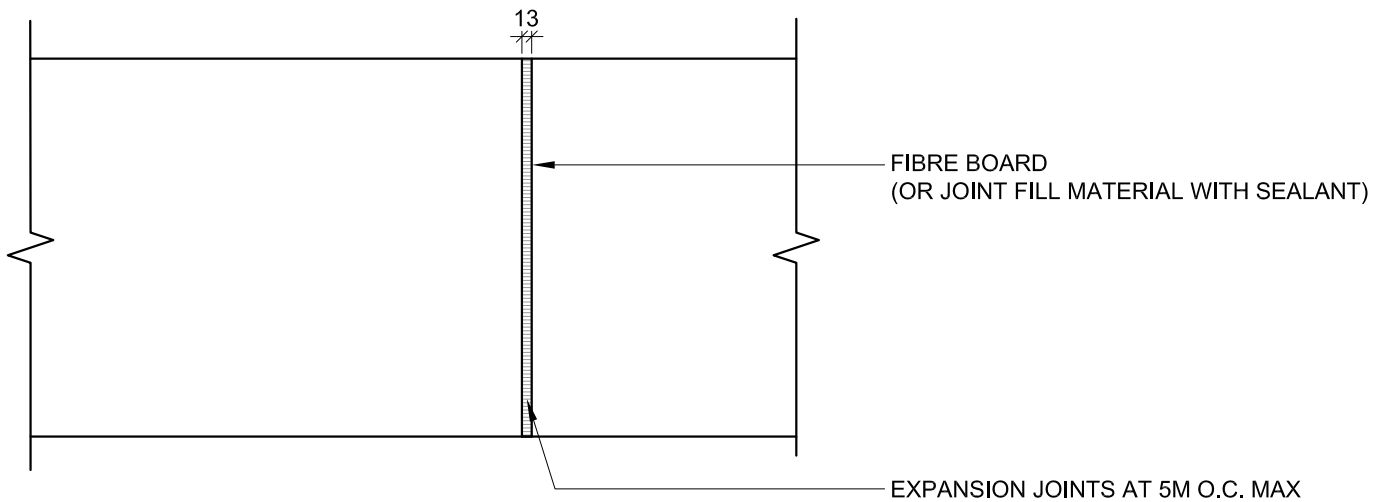
SCALE

1:10

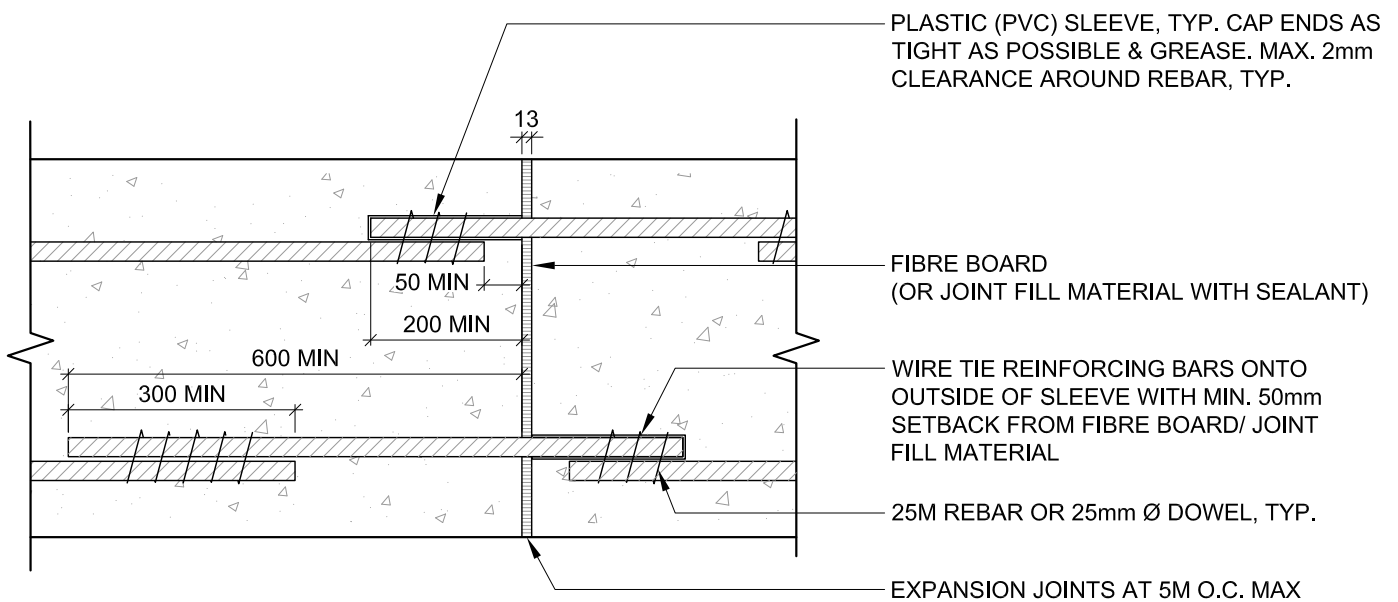
NOTES

SHEET

1-03-1



PLAN VIEW



SECTION VIEW

NOTE:

1. REFER TO PLANS FOR SEAT WALL DESIGN AND ADDITIONAL DETAILS
2. MIN. 50mm COVER OF CONCRETE OVER ALL REBAR



DRAWING
CONCRETE SEAT WALL WITH
EXPANSION JOINTS

DATE
JUNE-2022

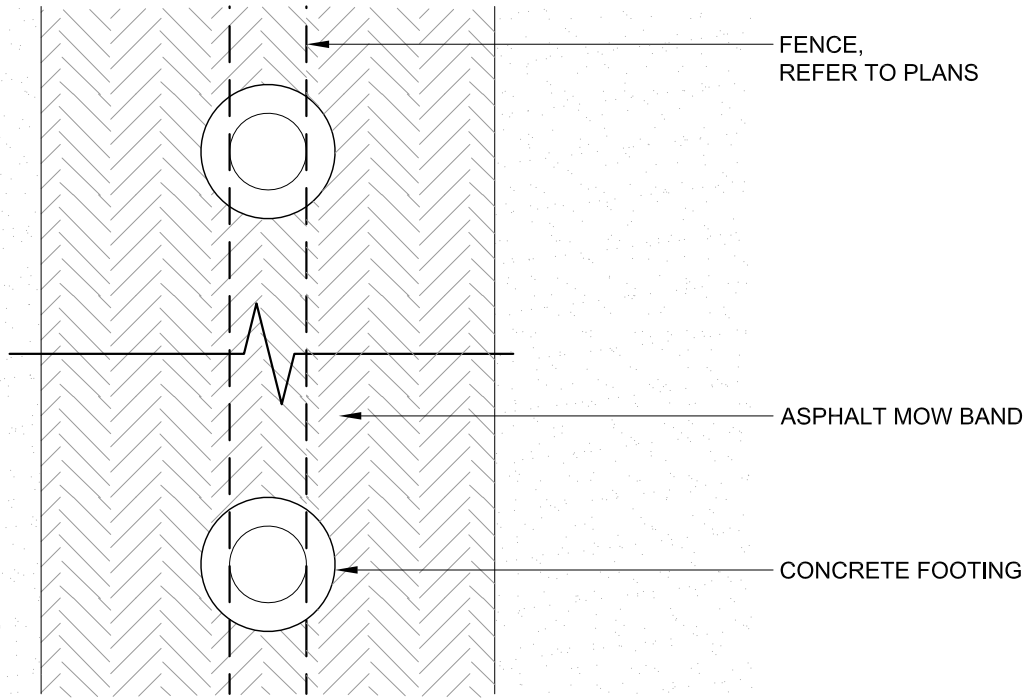
REV

SCALE
1:10

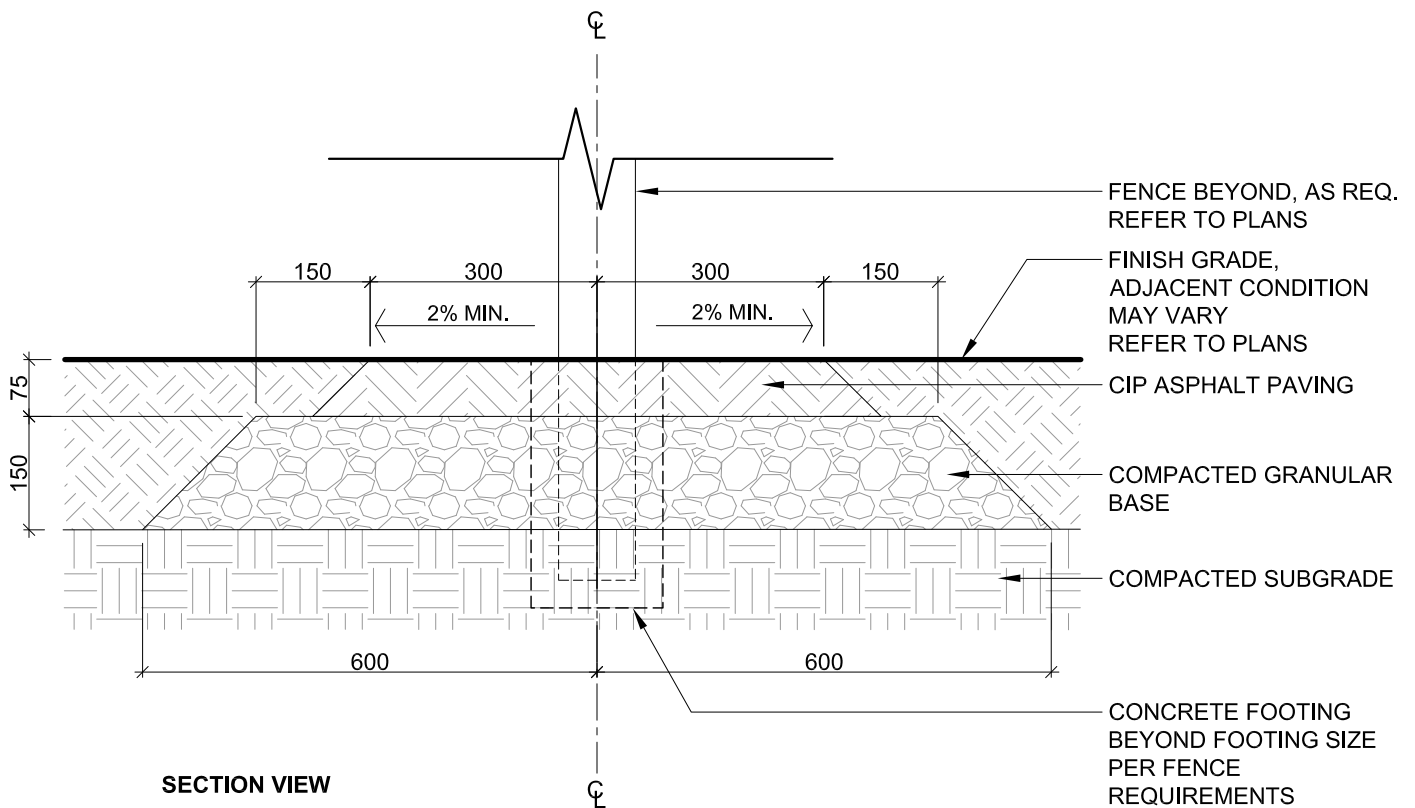
NOTES

SHEET

1-03-2



PLAN VIEW



SECTION VIEW



DRAWING
CIP ASPHALT MOW BAND

DATE
JUNE-2022

REV

SCALE
1:10

NOTES

SHEET

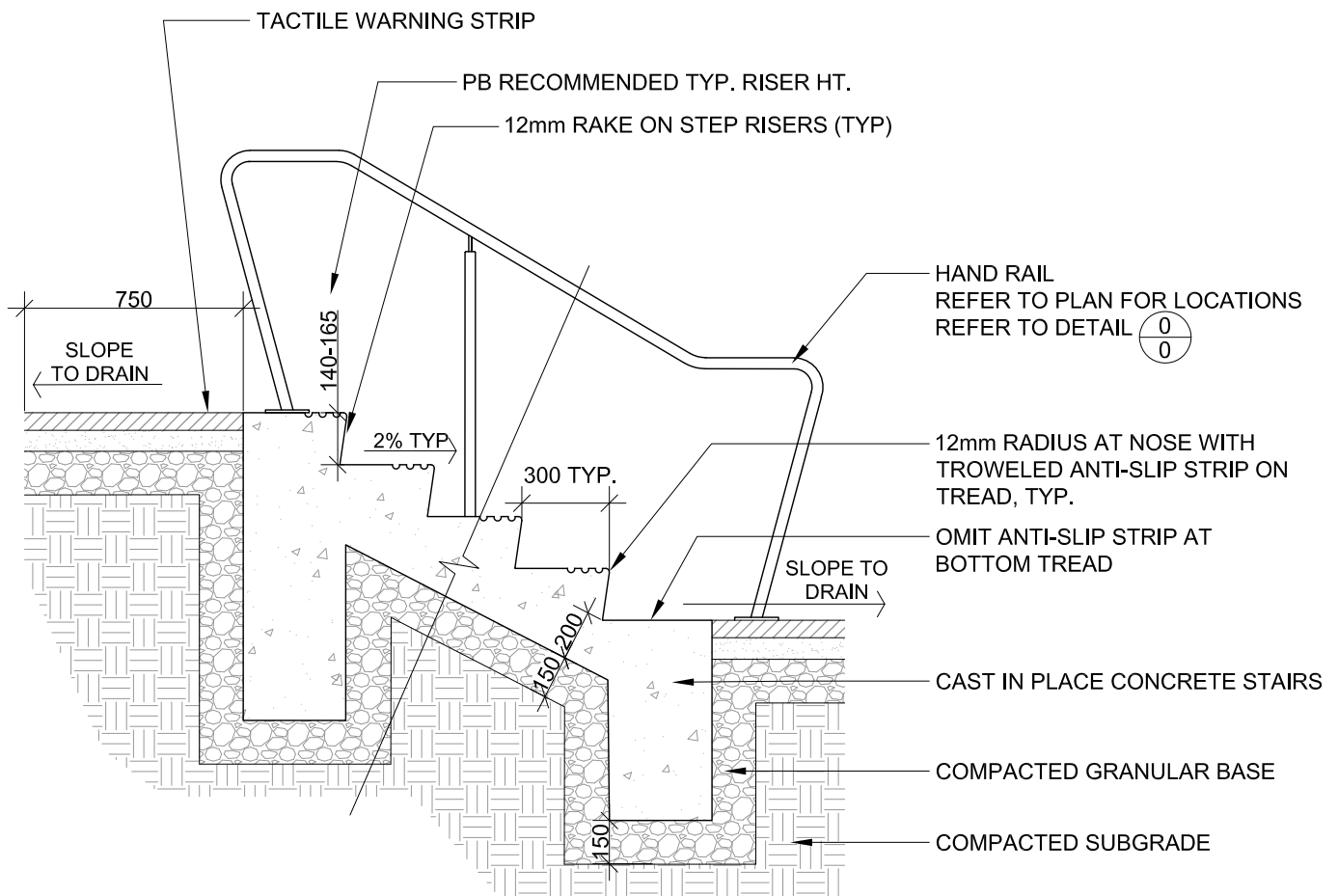
1-04



1. CONTROL JOINTS AS PER DETAIL #2 TO BE PROVIDED 1.5m O.C MAX. CENTERED ON / BETWEEN POSTS.
2. EXPANSION JOINTS C/W WITH FIBREBOARD TO BE PROVIDED 6m O.C. MAX.



| | | | |
|-----------------------|-----------|-----|--------------------|
| DRAWING | DATE | REV | SCALE |
| CIP CONCRETE MOW BAND | JUNE-2022 | | 1:10 |
| NOTES | | | SHEET |
| <p>.</p> | | | <p>1-05</p> |



NOTE:

1. ALL STAIRS TO BE TROWEL FINISH, AND TOOL ALL STAIR NOSING TO 12mm R. UNLESS OTHERWISE STATED
2. PROVIDE 2% SLOPE ON ALL STAIR TREADS AS SHOWN.
3. REFER TO PLAN FOR NUMBER OF STEPS.
4. REINFORCING AND FOOTING DETAILS TO BE PROVIDED IN SEALED DRAWINGS BY PROJECT ENGINEER OR THROUGH THE SUBMITTAL OF SHOP DRAWINGS



DRAWING
CIP CONCRETE STAIRS

DATE
JUNE-2022

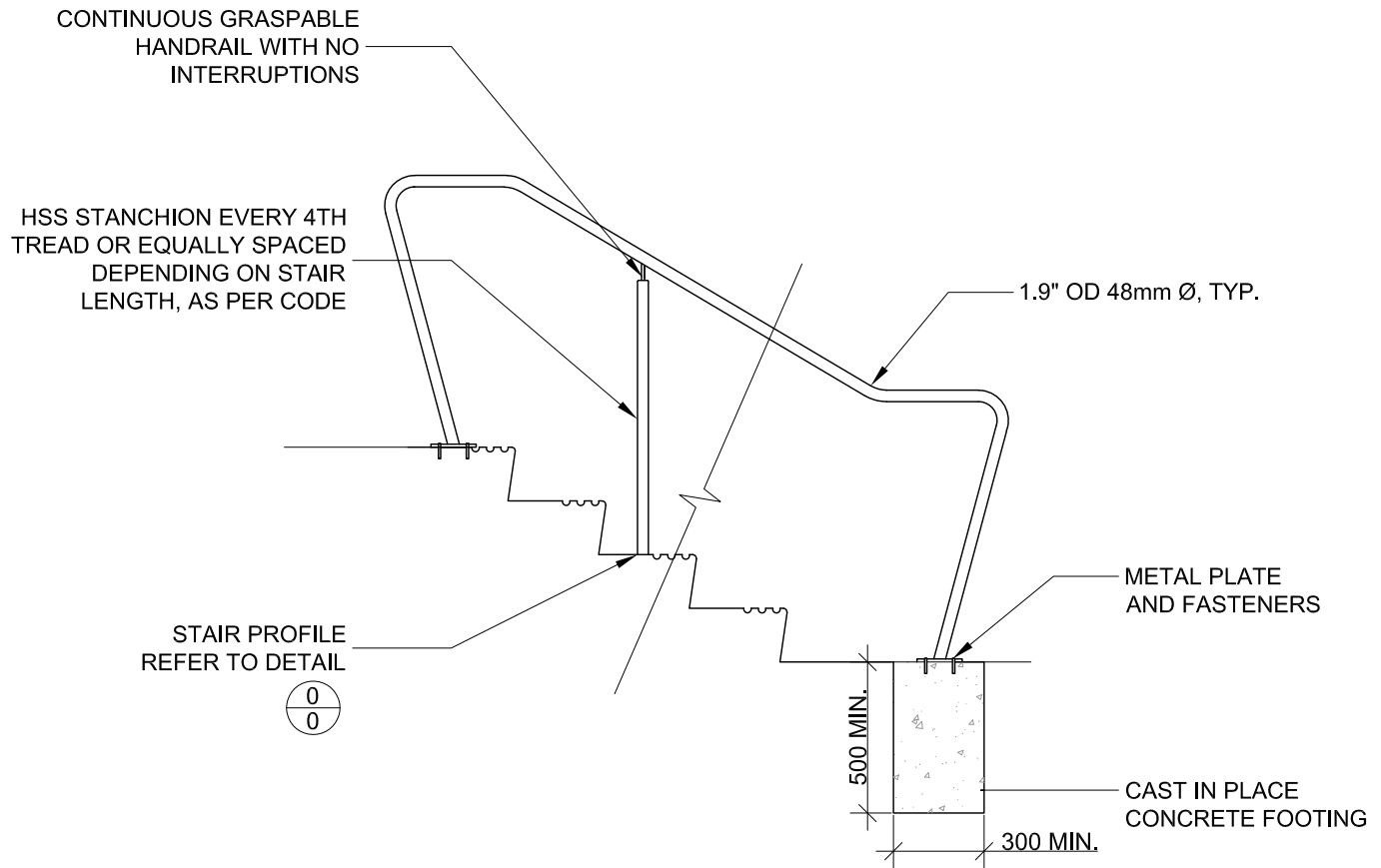
REV

SCALE
1:25

NOTES

SHEET

1-06



NOTE:

1. ENGINEERED SHOP DRAWINGS REQUIRED FOR HANDRAIL AND ALL CONNECTIONS AND TO BE APPROVED BY "OWNERS REPRESENTATIVE" PRIOR TO FABRICATION.
2. ALL WELDS TO BE GROUND SMOOTH.
3. NO SITE PATCHING OR TOUCH-UP OF FINISHES WILL BE PERMITTED.



DRAWING
HANDRAIL AT CIP
CONCRETE STAIRS

DATE
JUNE-2022

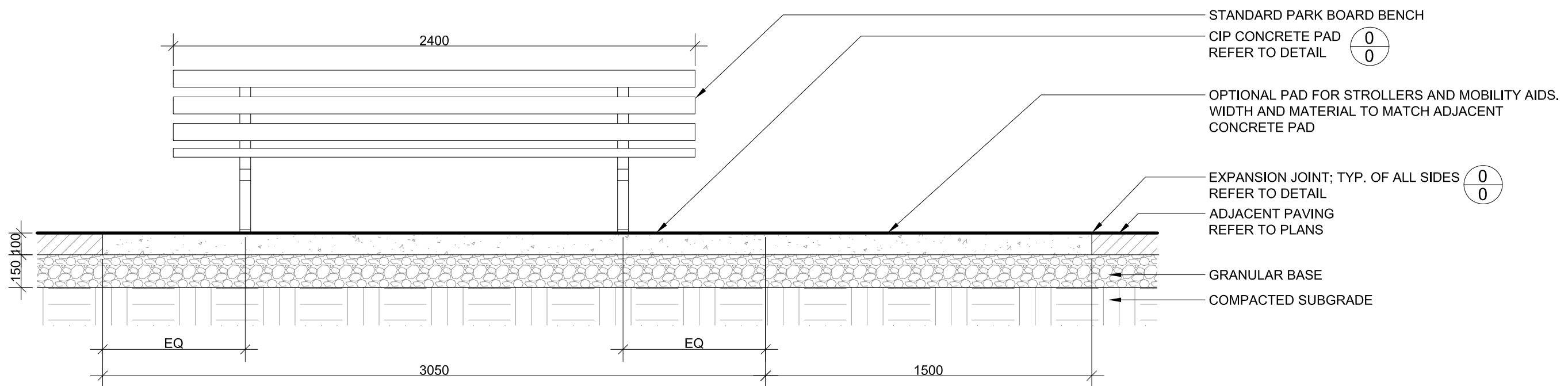
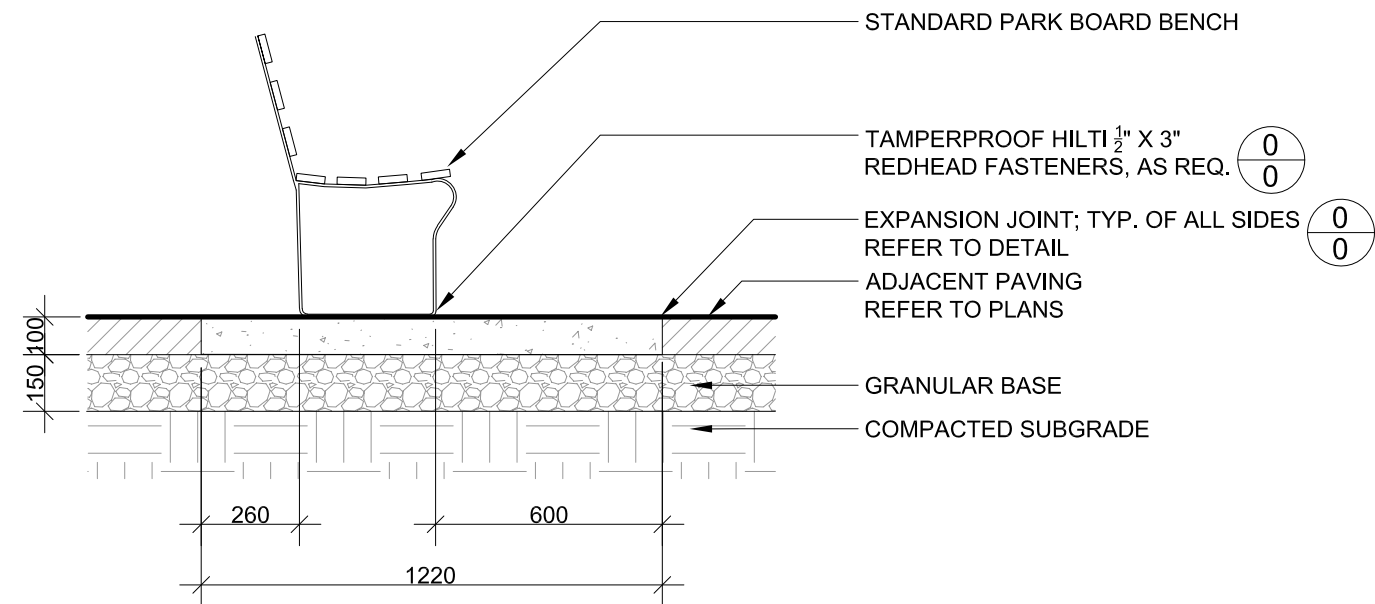
REV

SCALE
1:25

NOTES

SHEET

1-07



ELEVATION

NOTE:

1. BENCH TO BE SUPPLIED BY OWNER

DATE
JUNE-2022

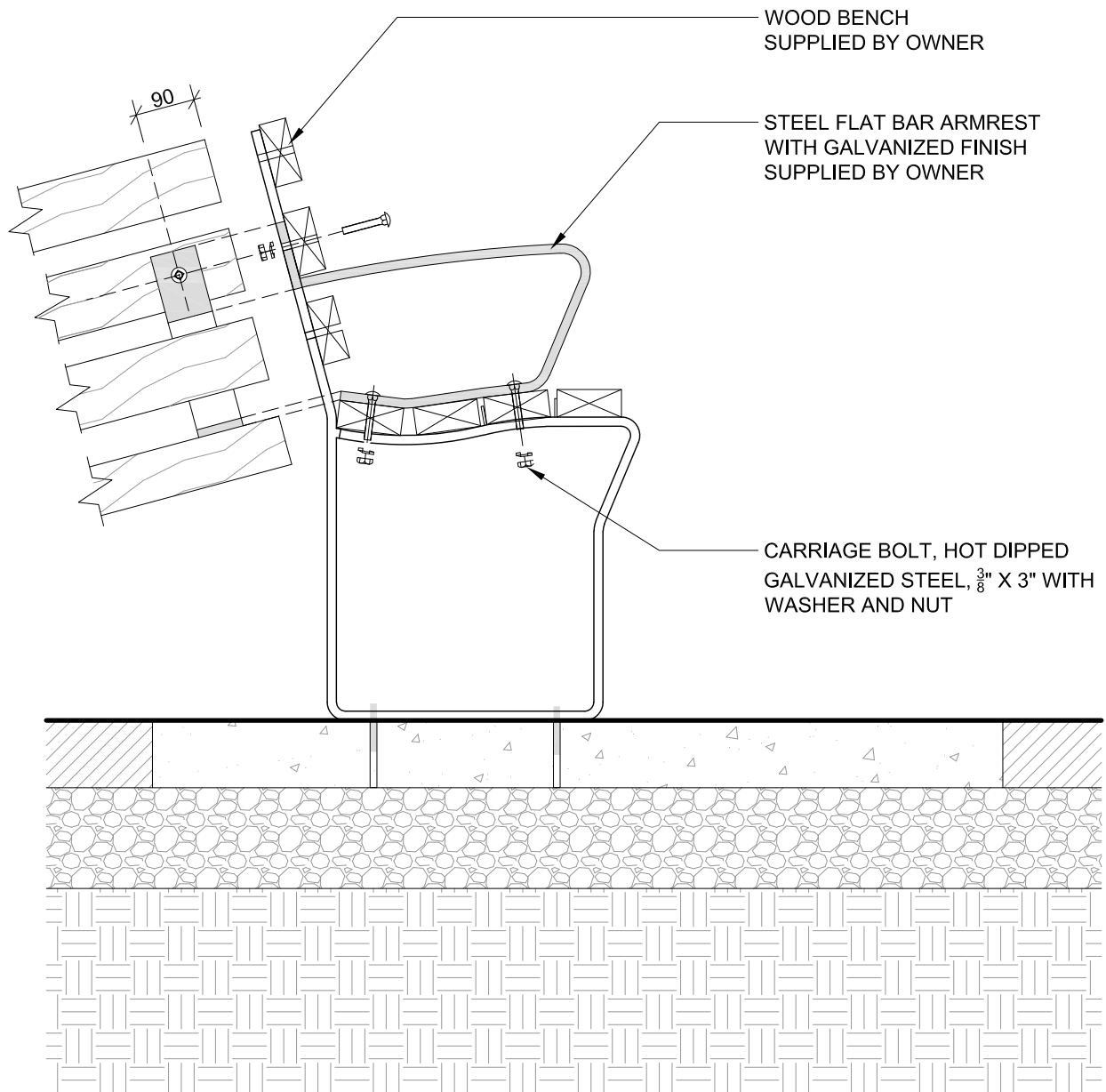
REV

SCALE
1:20

DRAWING
STANDARD BENCH
INSTALLATION

SHEET

2-01



NOTE:

1. ARMREST AND BENCH TO BE PROVIDED BY OWNER.
2. ALL FASTENERS TO BE TAMPERPROOF.



DRAWING
STANDARD BENCH
ARMREST INSTALL

DATE
JUNE-2022

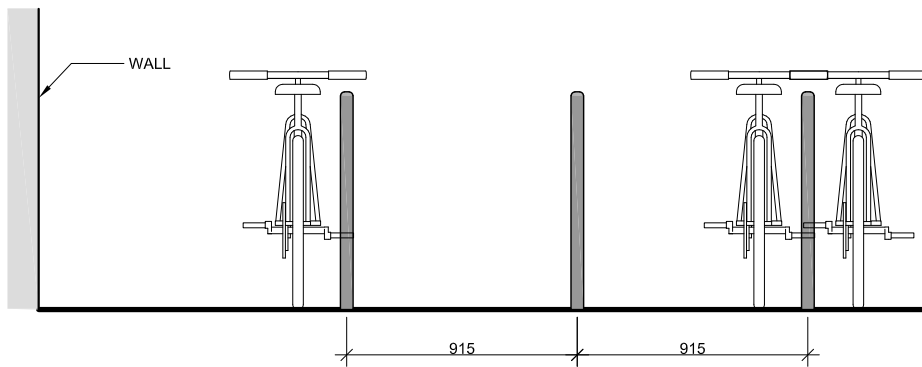
REV

SCALE
1:10

NOTES

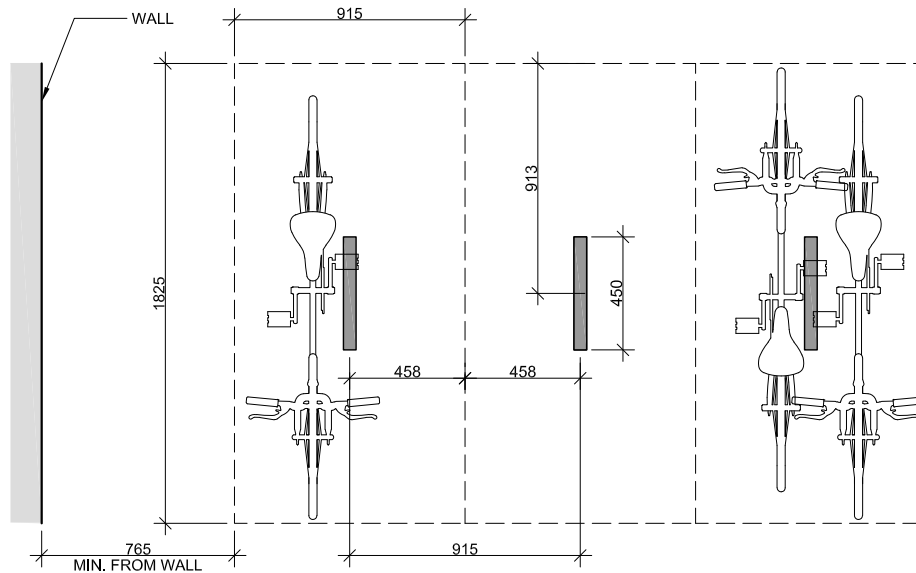
SHEET

2-02



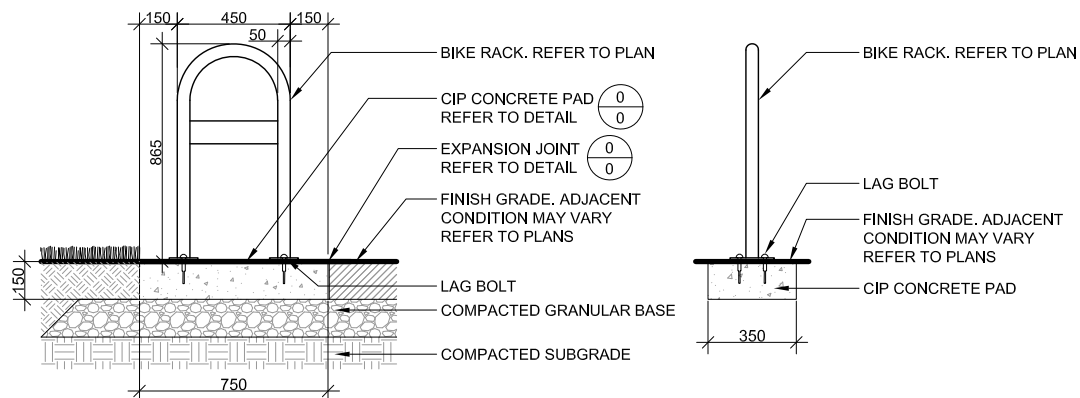
915mm PREFERRED BETWEEN BIKE RACKS O.C.
(760mm MIN. BY BICYCLE PARKING REQUIREMENT)

ELEVATION



915mm PREFERRED BETWEEN BIKE RACKS O.C.
(760mm MIN. BY BICYCLE PARKING REQUIREMENT)

PLAN



SECTION ELEVATION

SECTION ELEVATION

NOTE:

1. PRODUCT TO BE SUPPLIED BY CONTRACTOR.
2. REFER TO PRODUCT INFORMATION SHEET AND PLAN



DRAWING
STANDARD BIKE RACK
INSTALLATION

DATE
JUNE-2022

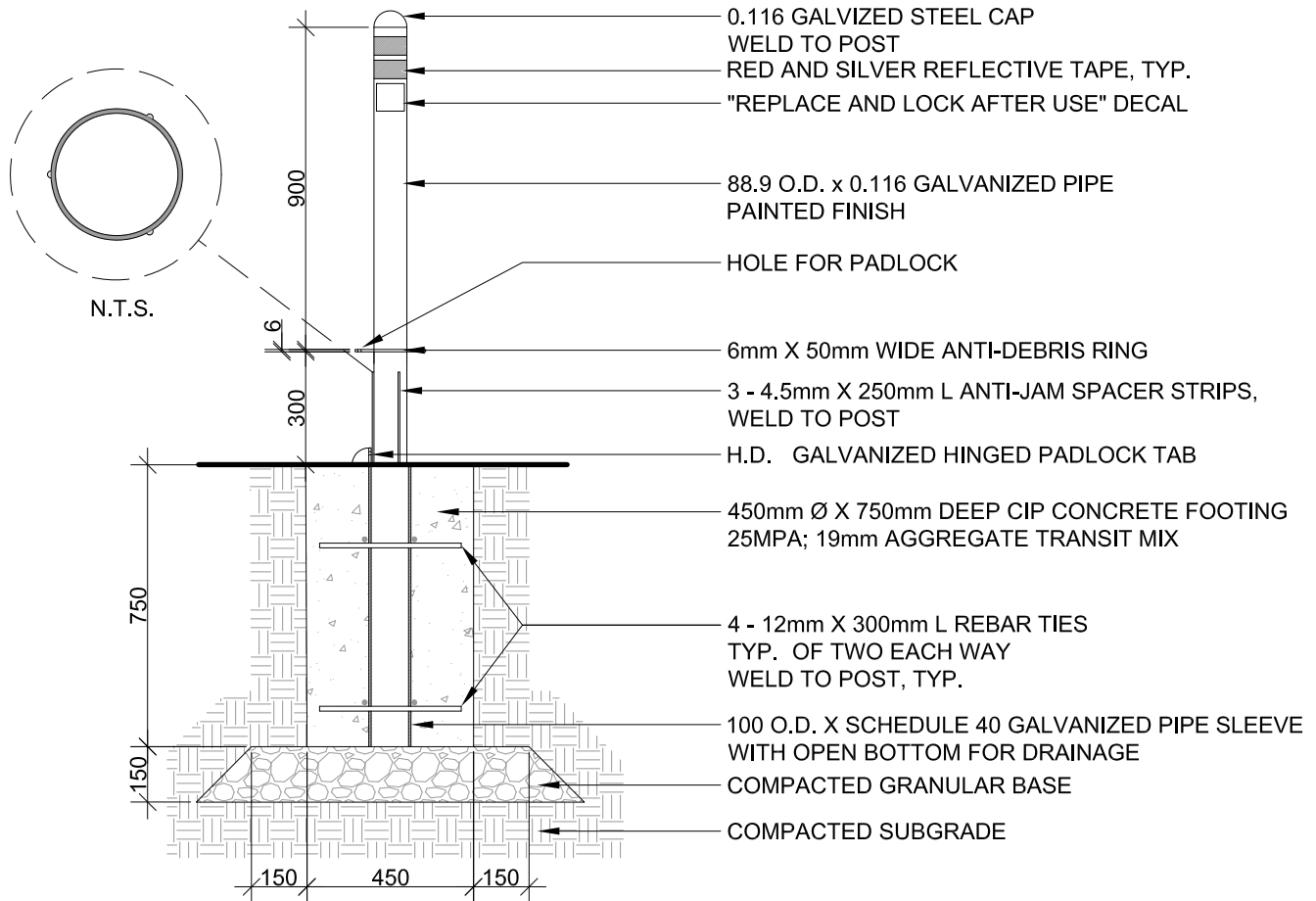
REV

SCALE
1:10

NOTES

SHEET

2-03



DRAWING
REMOVABLE BOLLARD

DATE
JUNE-2022

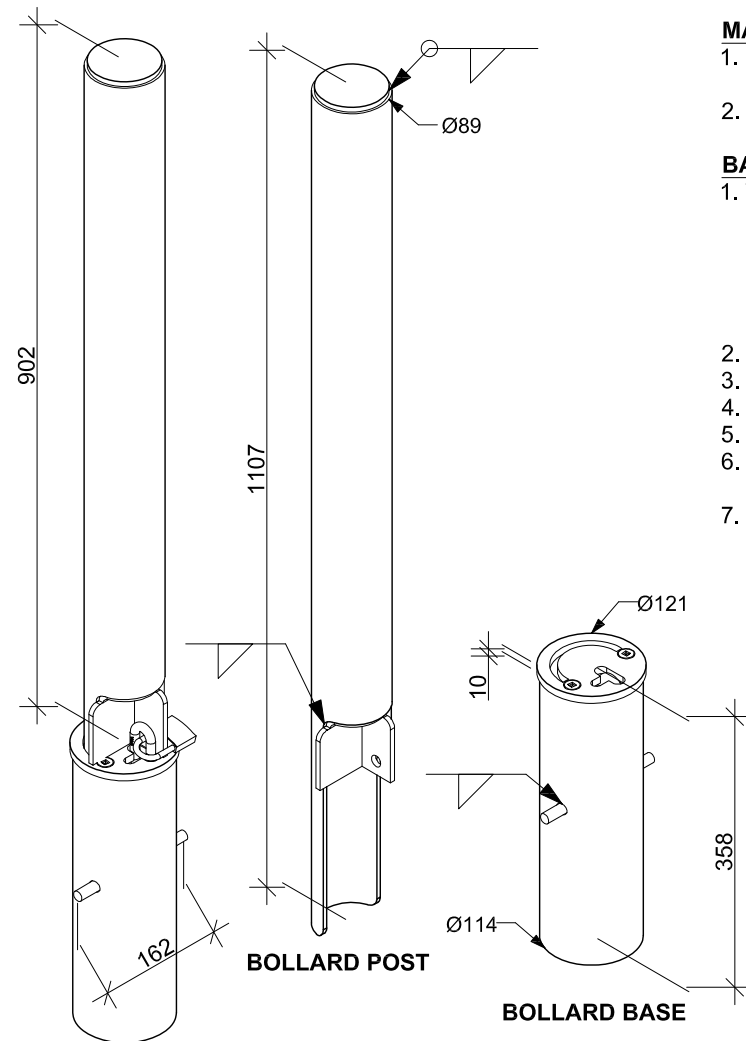
REV

SCALE
1:20

NOTES

SHEET

2-04



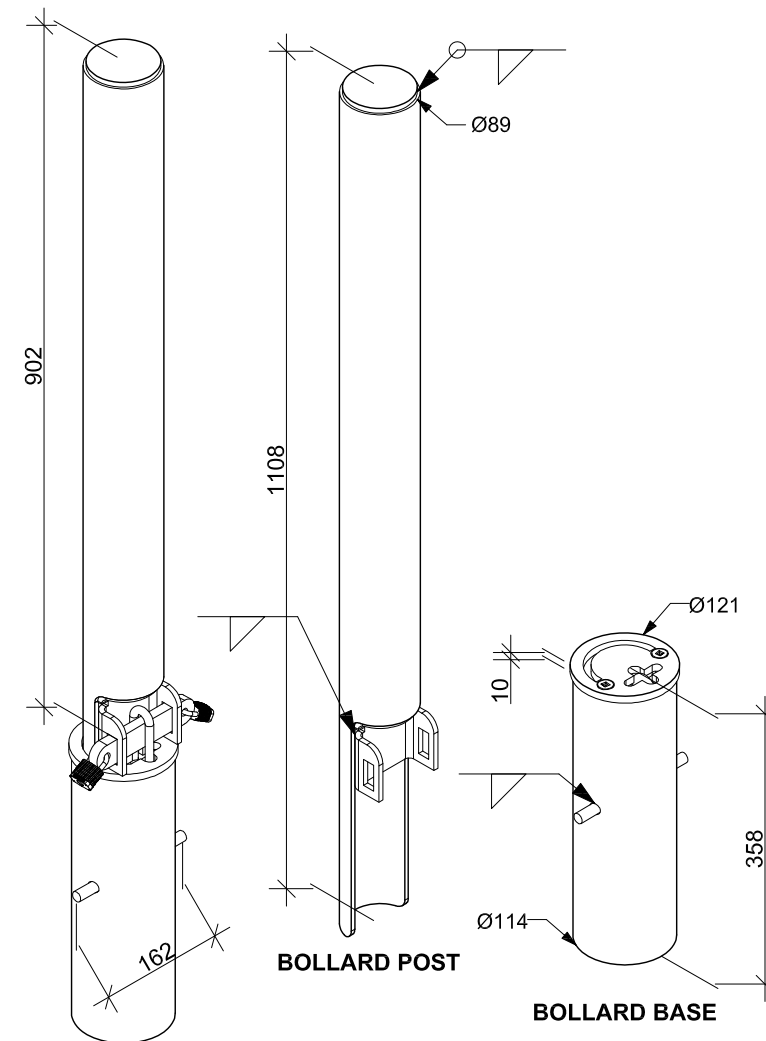
SINGLE LOCK "SMILEY FACE" BOLLARD

MANUFACTURING NOTES:

1. BOLLARDS MAY BE LEFT BARE, POWDERCOATED, OR HDG (HOT DIPPED GALVANIZED)
2. OTHER OPTIONS AND CUSTOMIZATIONS ARE AVAILABLE

BASIC INSTALLATION NOTES:

1. TEMPORARY SLEEVE MAY BE REQUIRED TO ENSURE THAT COVER PLATE DOES NOT ADHERE TO CONCRETE/ASPHALT SO THAT IT MAY BE REMOVED IN FUTURE IF HOLE NEEDS CLEANING OUT (ESPECIALLY IMPORTANT FOR ROAD INSTALLS)
2. CONCRETE DIAMETER AS PER PROJECT ENGINEER
3. CONCRETE DEPTH TO BE APPROX THAT OF RECEIVER
4. KEEP CONCRETE OUT OF RECEIVER DURING INSTALL
5. RECEIVER MUST BE INSTALLED IN DRAINAGE ROCK
6. DRAINAGE ROCK DIAMETER AS PER PROJECT ENGINEER (USU. AT LEAST 600mm)
7. DRAINAGE ROCK DEPTH AS PER PROJECT ENGINEER (VARIES AS PER SOIL CONDITIONS USU. 100mm - 600mm)



DOUBLE LOCK "SMILEY FACE" BOLLARD

DATE
JUNE-2022

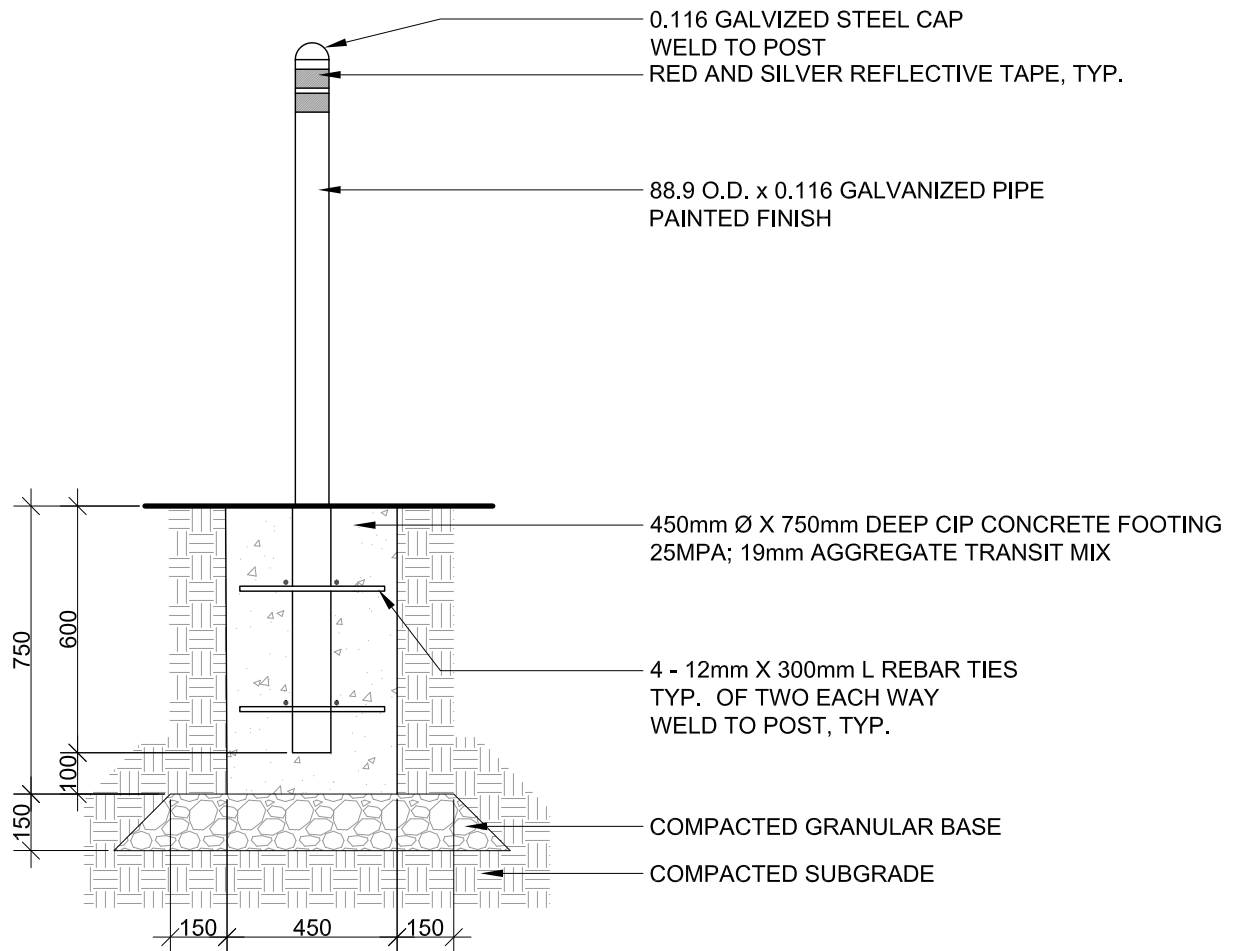
REV

SCALE
NTS

DRAWING
REMOVABLE FLUSH
MOUNT BOLLARD

SHEET

2-05



NOTE:

1. ALL METAL MUST HAVE HOT DIPPED GALVANIZED FINISH AFTER FABRICATION
2. GRIND ALL WELDS SMOOTH PRIOR TO H.D. GALVANIZING
3. CONTRACTOR TO PROVIDE ENGINEERED SHOP DRAWINGS



DRAWING
PERMANENT BOLLARD
(NON-REMOVABLE)

DATE
JUNE-2022

REV

SCALE
1:20

NOTES

SHEET

2-06

NOTE:

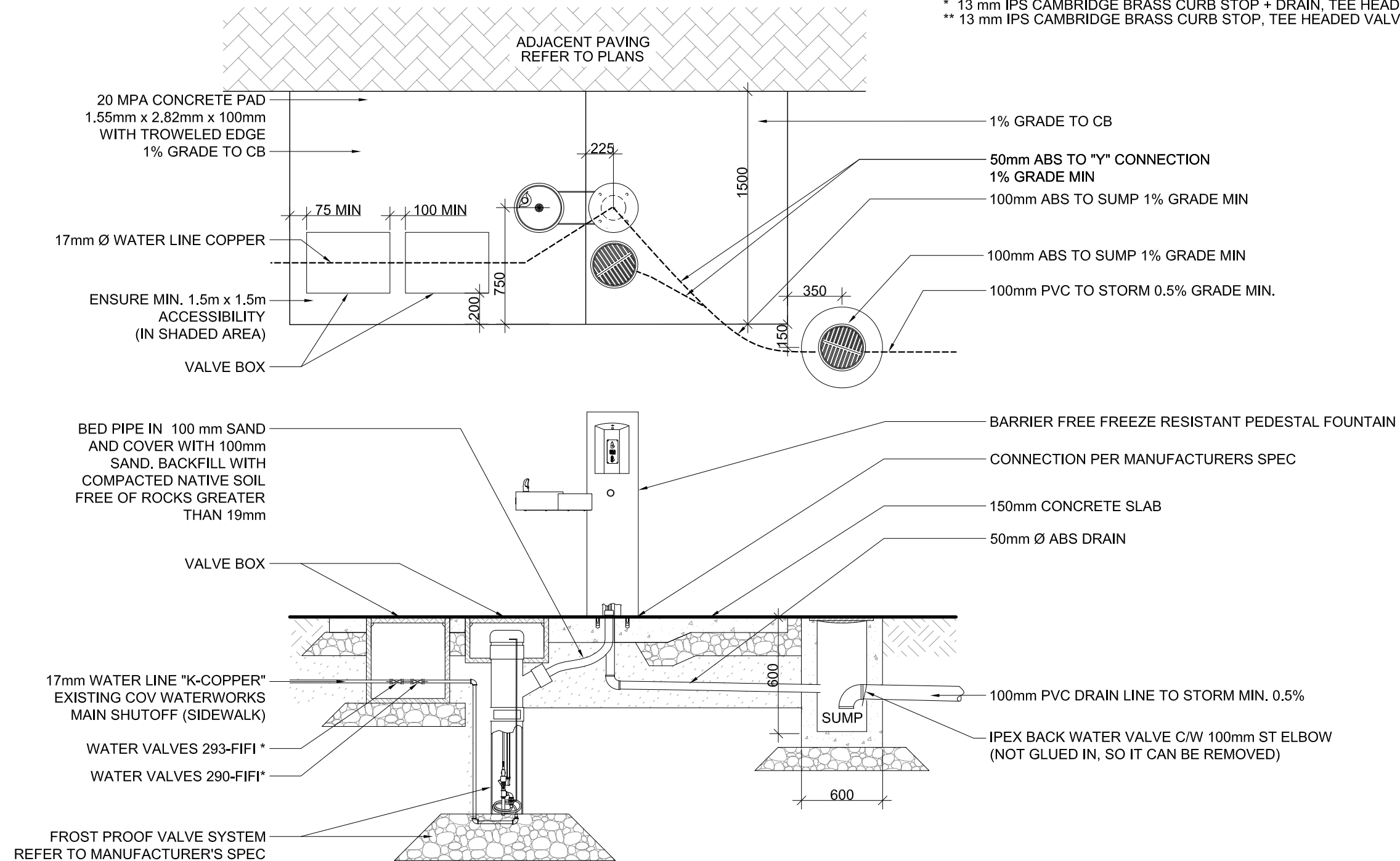
1. VALVE BOXES SHALL BE A CONCRETE BOX WITH A GALVANIZED STEEL CHECKER PLATE LID WITH CAPTIVE LOCK BOLTCOVER; BOX TO BE SIZED TO SUIT VALVES AND OTHER COMPONENTS WITH ADEQUATE ROOM FOR OPERATING AND MAINTENANCE ACCESS

SUGGESTED: AE CONCRETE T266-6I-BOLT MARKED "WATER" & T266-06-0324 CONCRETE BOX COMES WITH HOLE

2. ALL WATER LINE "K-COPPER" TO BE PLACED A MINIMUM OF 450mm BELOW GRADE

* 13 mm IPS CAMBRIDGE BRASS CURB STOP + DRAIN, TEE HEADED VALVE (3) 293-FIFI

** 13 mm IPS CAMBRIDGE BRASS CURB STOP, TEE HEADED VALVE (3) 290-FIFI



DATE
JUNE-2022

SCALE
1:30

DRAWING
STANDARD FROST FREE
DRINKING FOUNTAIN

SHEET

2-07

NOTE:

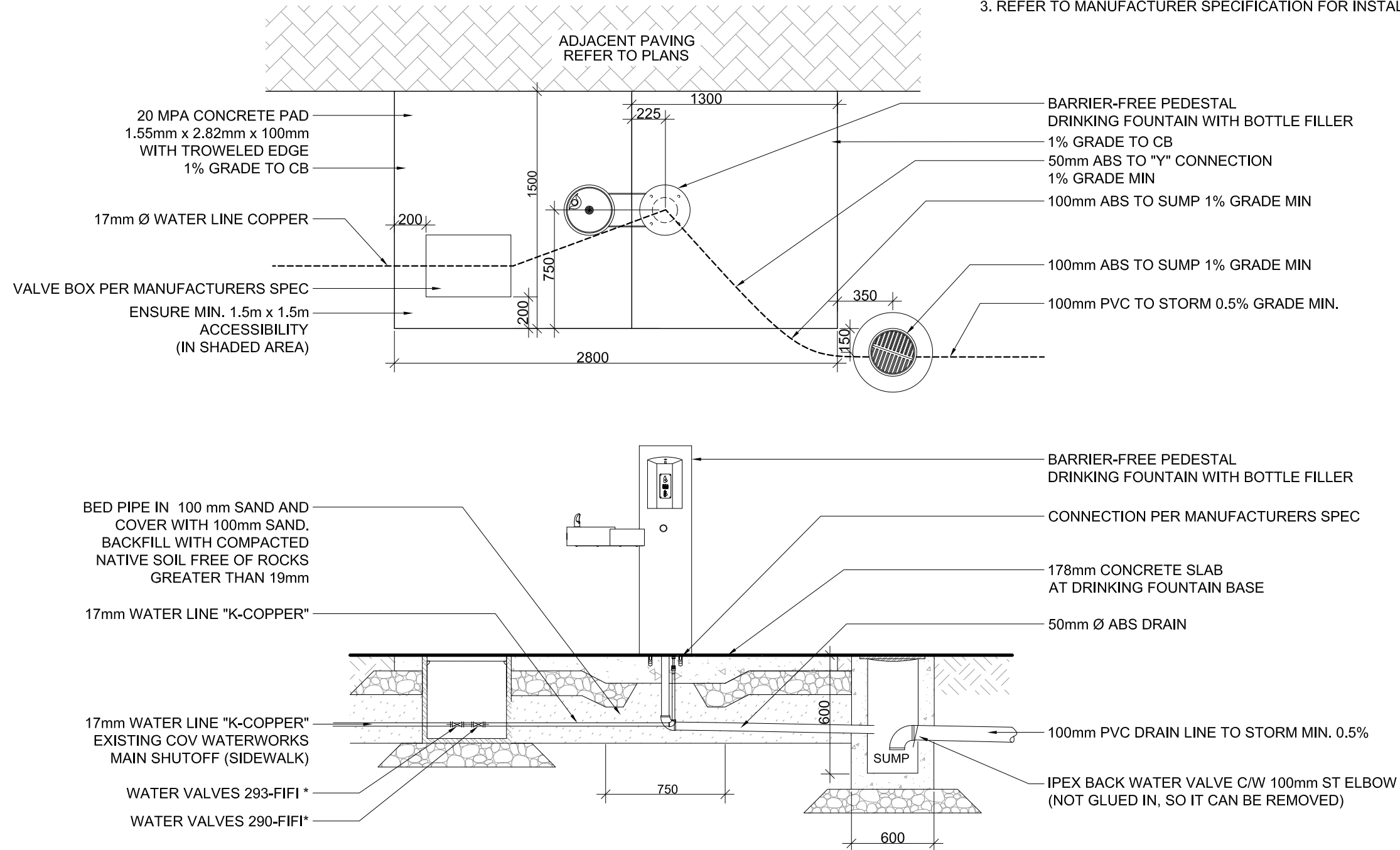
1. VALVE BOXES SHALL BE A CONCRETE BOX WITH A GALVANIZED STEEL CHECKER PLATE LID WITH CAPTIVE LOCK BOLTCOVER; BOX TO BE SIZED TO SUIT VALVES AND OTHER COMPONENTS WITH ADEQUATE ROOM FOR OPERATING AND MAINTENANCE ACCESS

SUGGESTED: AE CONCRETE T266-6I-BOLT MARKED "WATER" & T266-06-0324 CONCRETE BOX COMES WITH HOLE

2. ALL WATER LINE "K-COPPER" TO BE PLACED A MINIMUM OF 450mm BELOW GRADE

* 13 mm IPS CAMBRIDGE BRASS CURB STOP + DRAIN, TEE HEADED VALVE (3) 293-FIFI
 ** 13 mm IPS CAMBRIDGE BRASS CURB STOP, TEE HEADED VALVE (3) 290-FIFI

3. REFER TO MANUFACTURER SPECIFICATION FOR INSTALLATION RECOMMENDATIONS



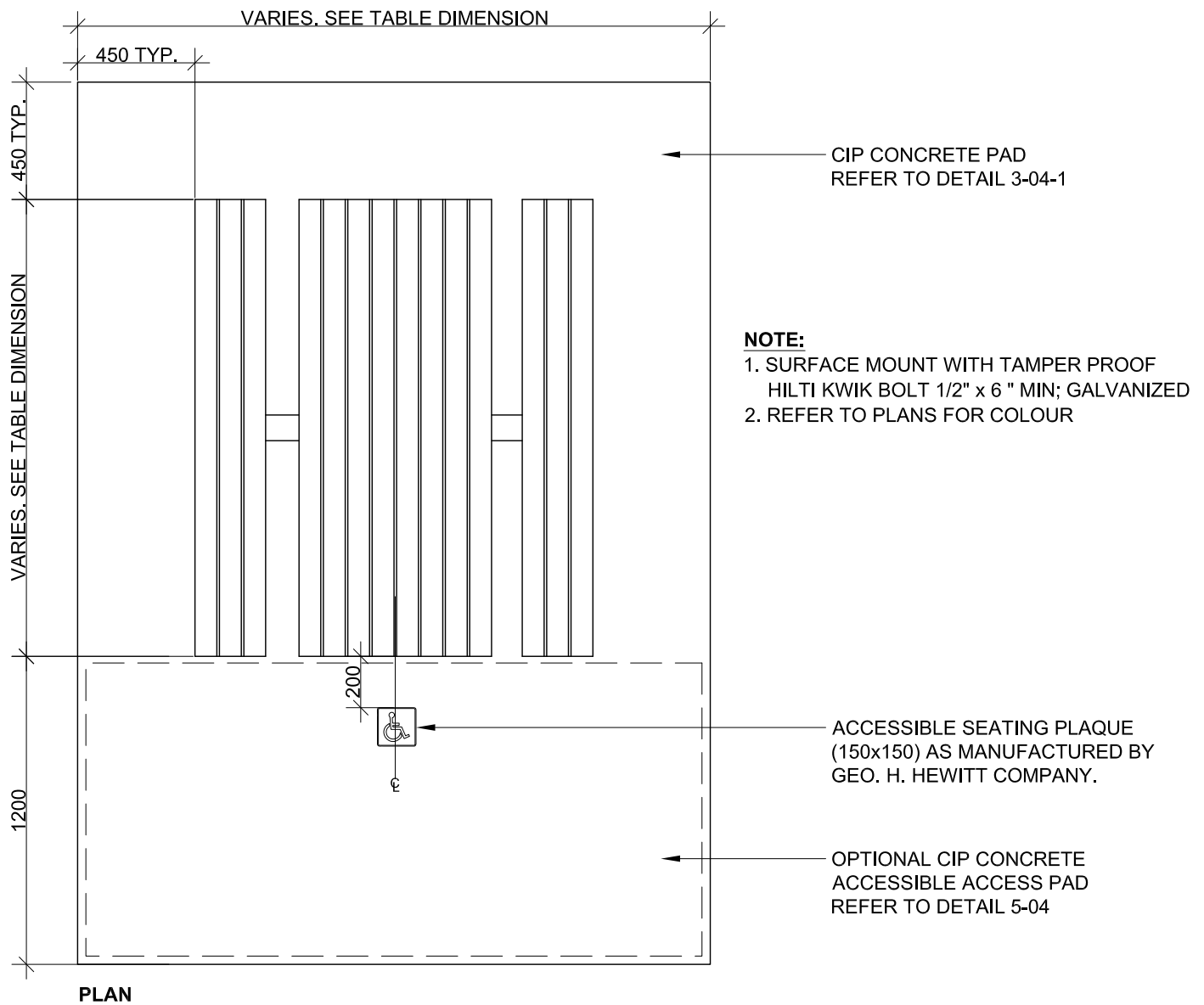
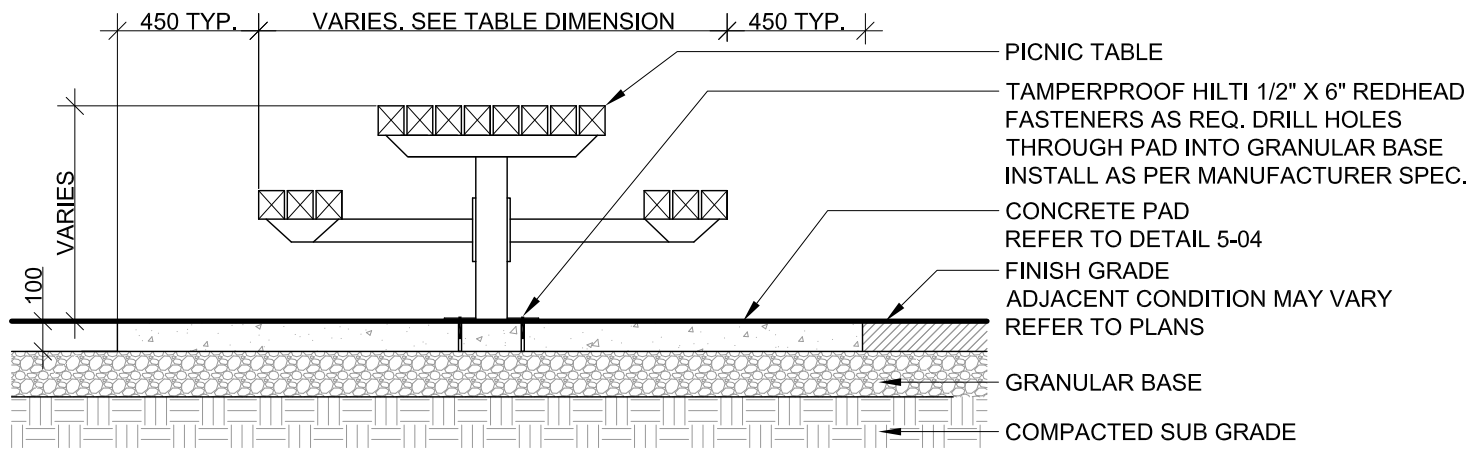
DATE
JUNE-2022

SCALE
1:30

DRAWING
STANDARD DRINKING FOUNTAIN
WITH BOTTLE FILLER

SHEET

2-08



DRAWING
STANDARD PICNIC TABLE

DATE
JUNE-2022

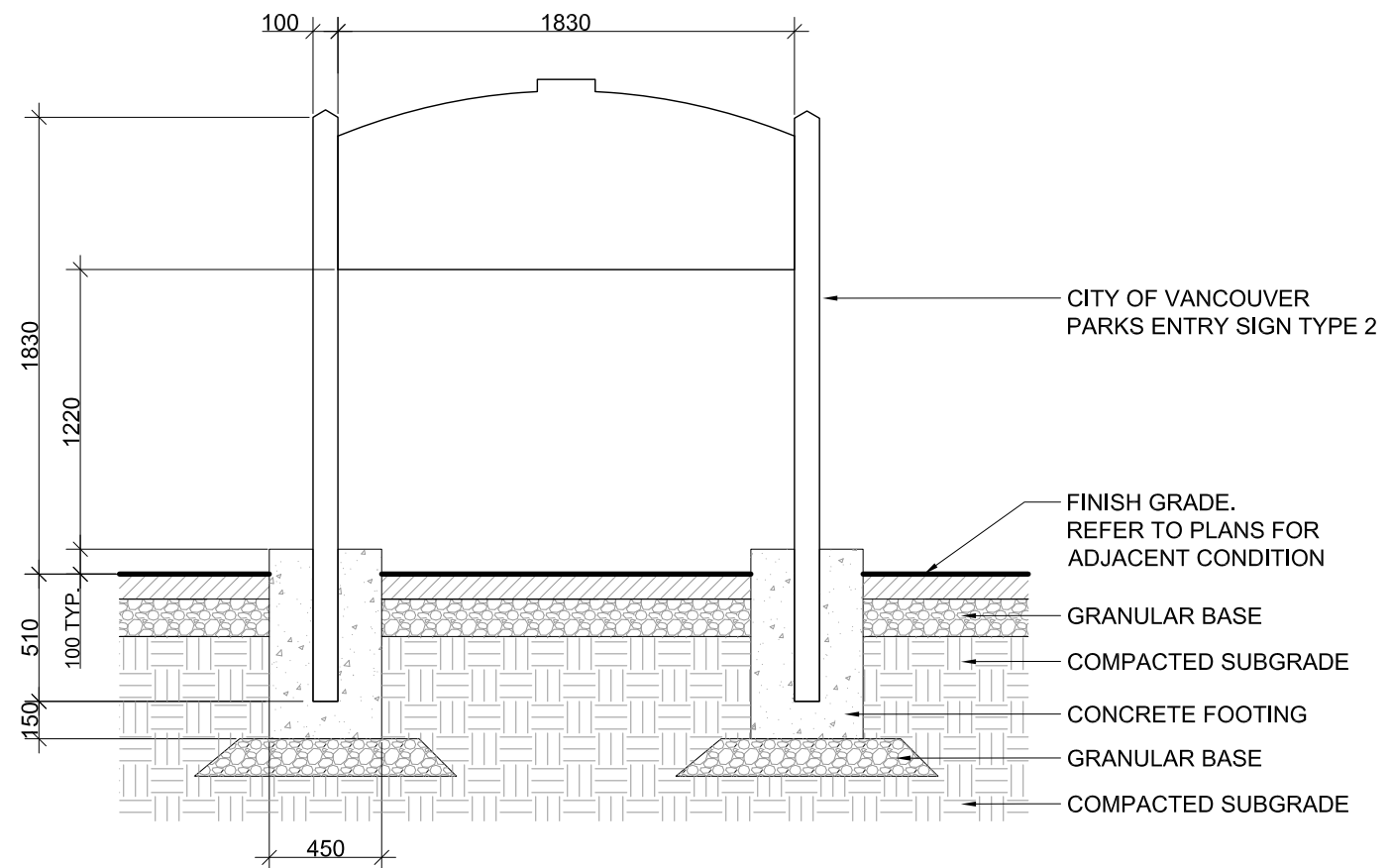
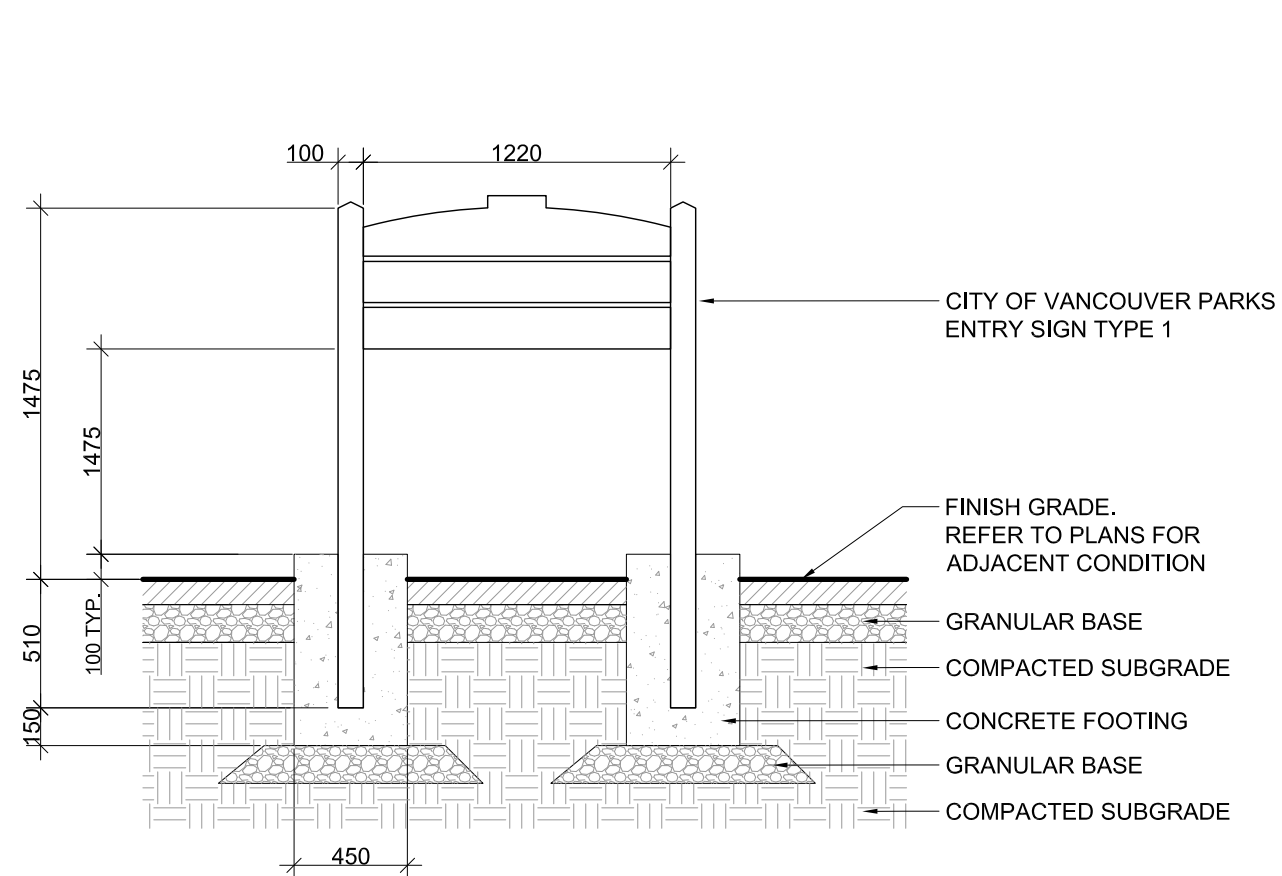
REV

SCALE
1:25

NOTES

SHEET

2-09



NOTE:

1. CONCRETE REINFORCEMENT INFORMATION AND FOOTING DESIGN TO BE PROVIDED BY STRUCTURAL ENGINEER BASED ON PROJECT CONDITION AND INPUTS FROM GEOTECHNICAL ENGINEER

DATE
JUNE-2022

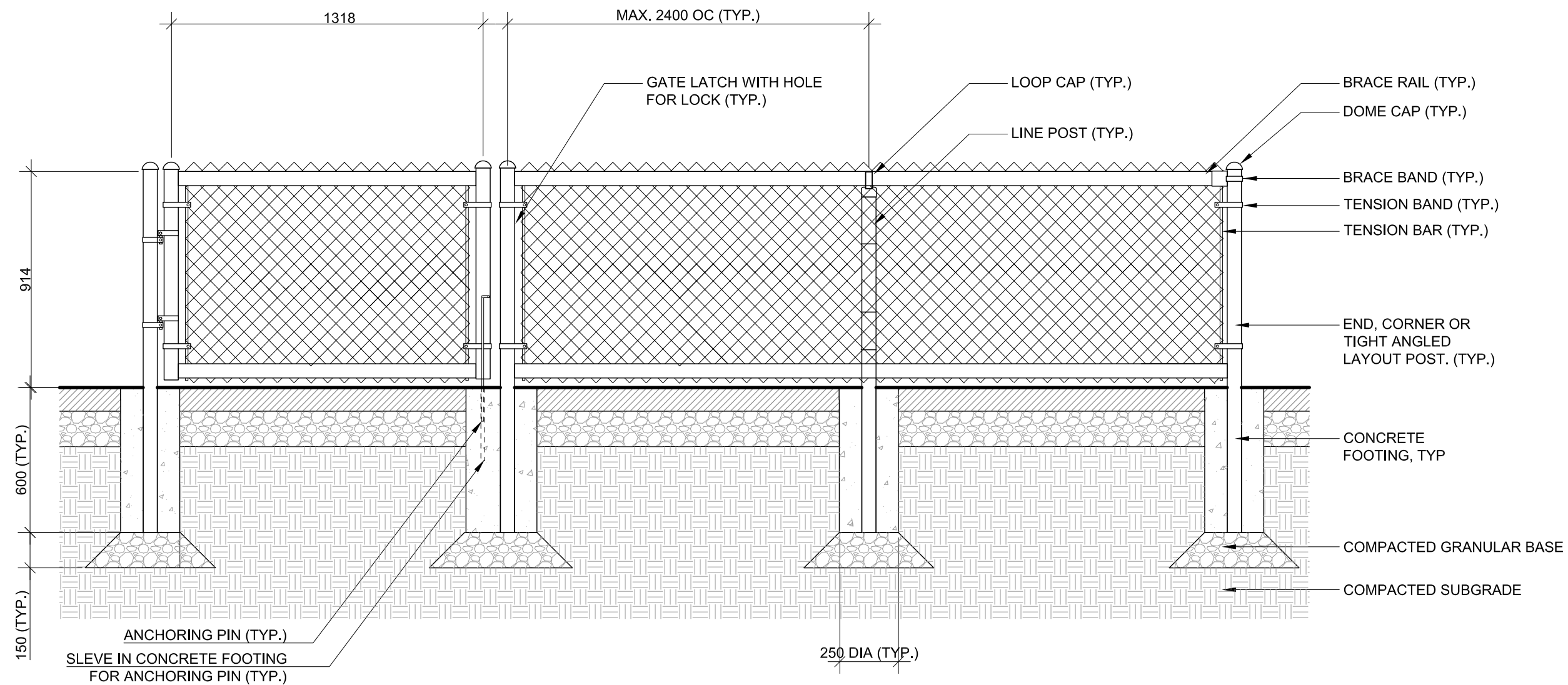
REV

SCALE
1:30

DRAWING
COV PARKS ENTRY
SIGNAGE

SHEET

2-10



NOTE:

1. ALL METAL COMPONENTS TO BE GALVANIZED PER SPECIFICATIONS
2. ALL POST AND RAIL JUNCTIONS TO BE COPED AND WELDED PER SPECIFICATIONS (GRIND ALL WELDS AND PAINT WITH GALVICON)
3. CONCRETE REINFORCEMENT INFORMATION AND FOOTING DESIGN TO BE PROVIDED BY STRUCTURAL ENGINEER BASED ON PROJECT CONDITION AND INPUTS FROM GEOTECHNICAL ENGINEER

DATE
JUNE-2022

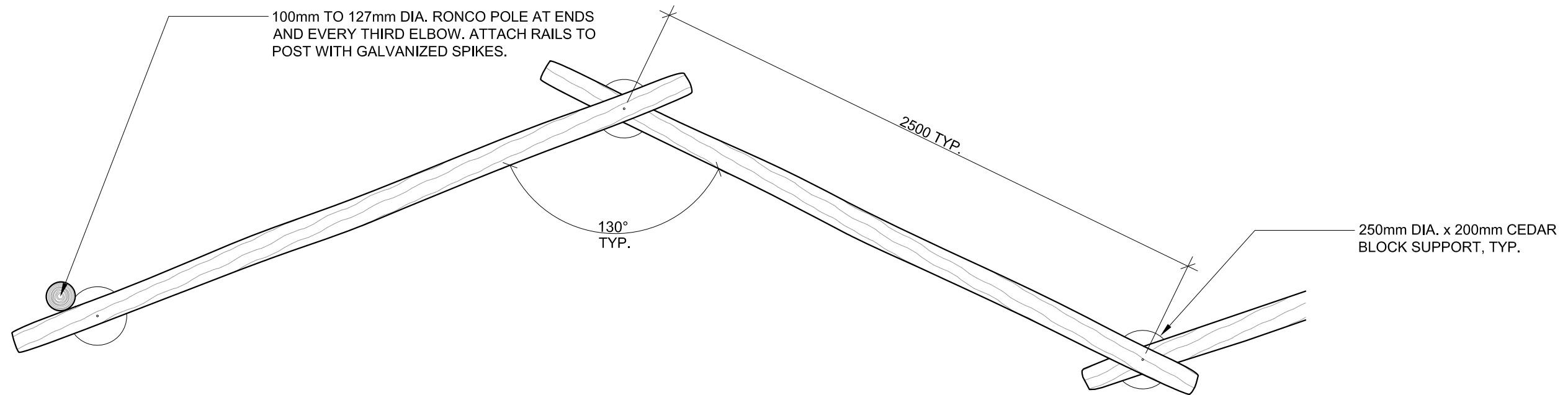
REV

SCALE
1:20

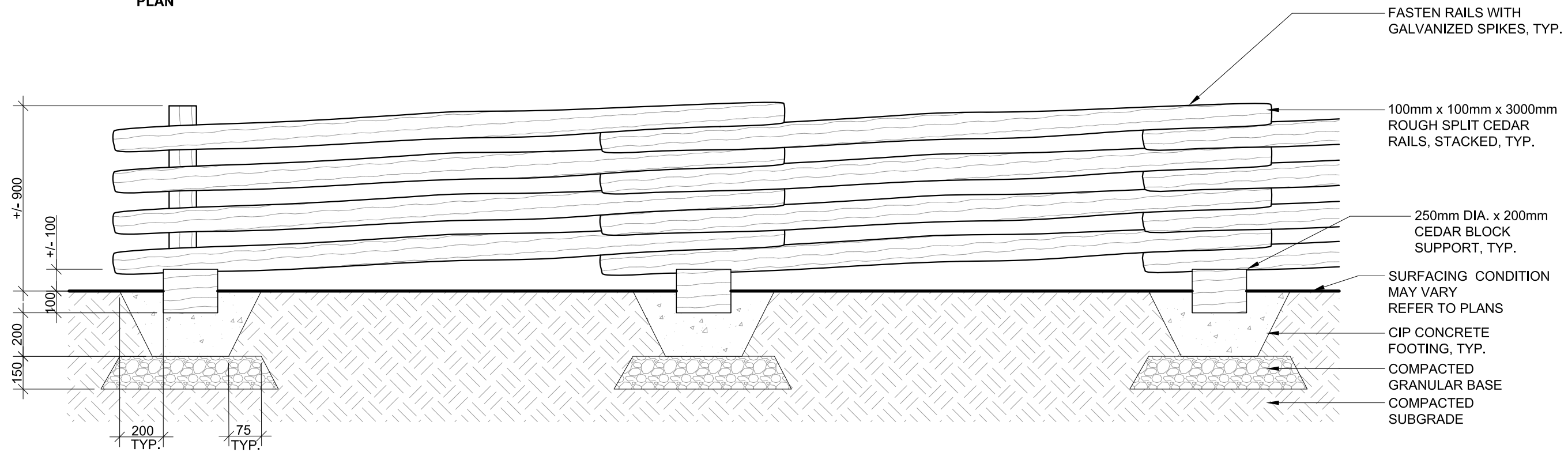
DRAWING
3" CHAIN LINK FENCE AND GATE AT DOG PARK

SHEET

2-11



PLAN



SECTION

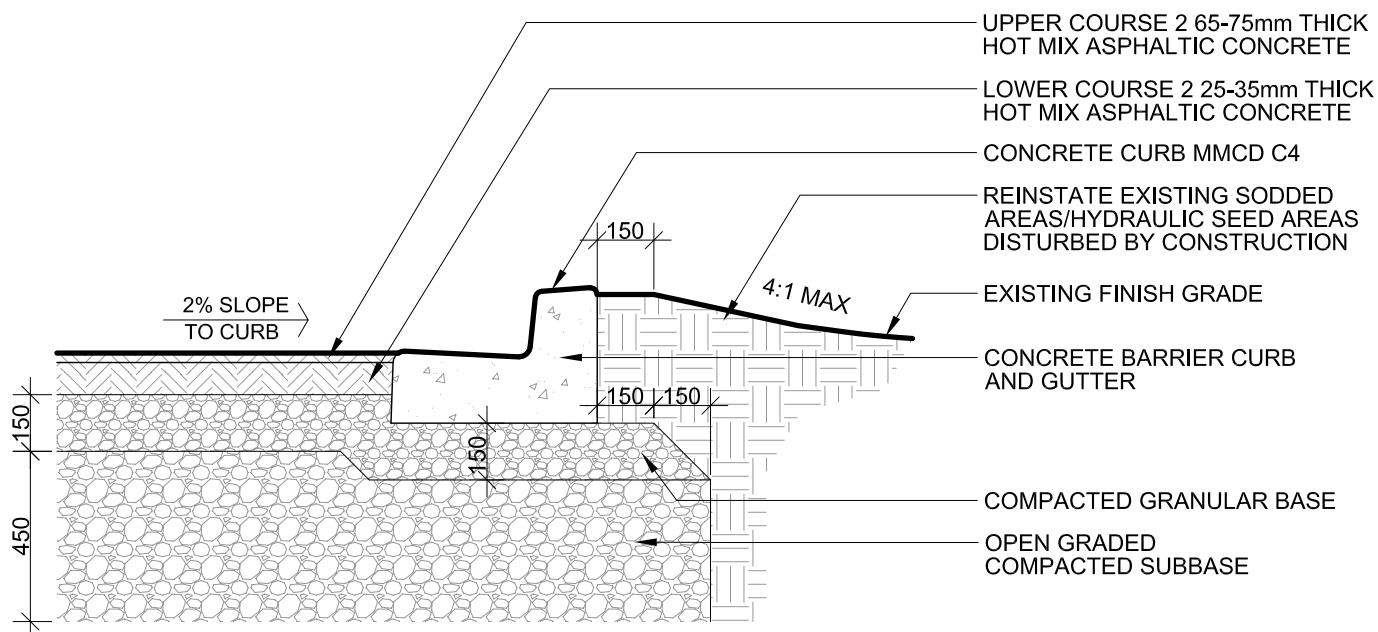
DATE
JUNE-2022

REV

SCALE
1:10

DRAWING
SPLIT RAIL FENCE

SHEET
2-12



NOTES:

1. REMOVE AND DISPOSE OF EXISTING ASPHALT
2. EXCAVATE 710mm BELOW EXISTING GRADE AND RECONSTRUCT AS PER DETAIL BELOW
3. STORMWATER COLLECTED IN CATCH BASINS AND THEN SENT TO STORM SEWER SYSTEM

NOTES TO CONSULTANT:

1. DETAIL IS SUITABLE FOR PEDESTRIAN USE. FOR ROADWAYS WITH VEHICLES, REFER TO CITY OF VANCOUVER STREETSCAPE RESTORATION MANUAL.
2. REVIEW AGGREGATE REQUIREMENTS WITH APPROPRIATE ENGINEER.



DRAWING
ASPHALT ROAD

DATE
JUNE-2022

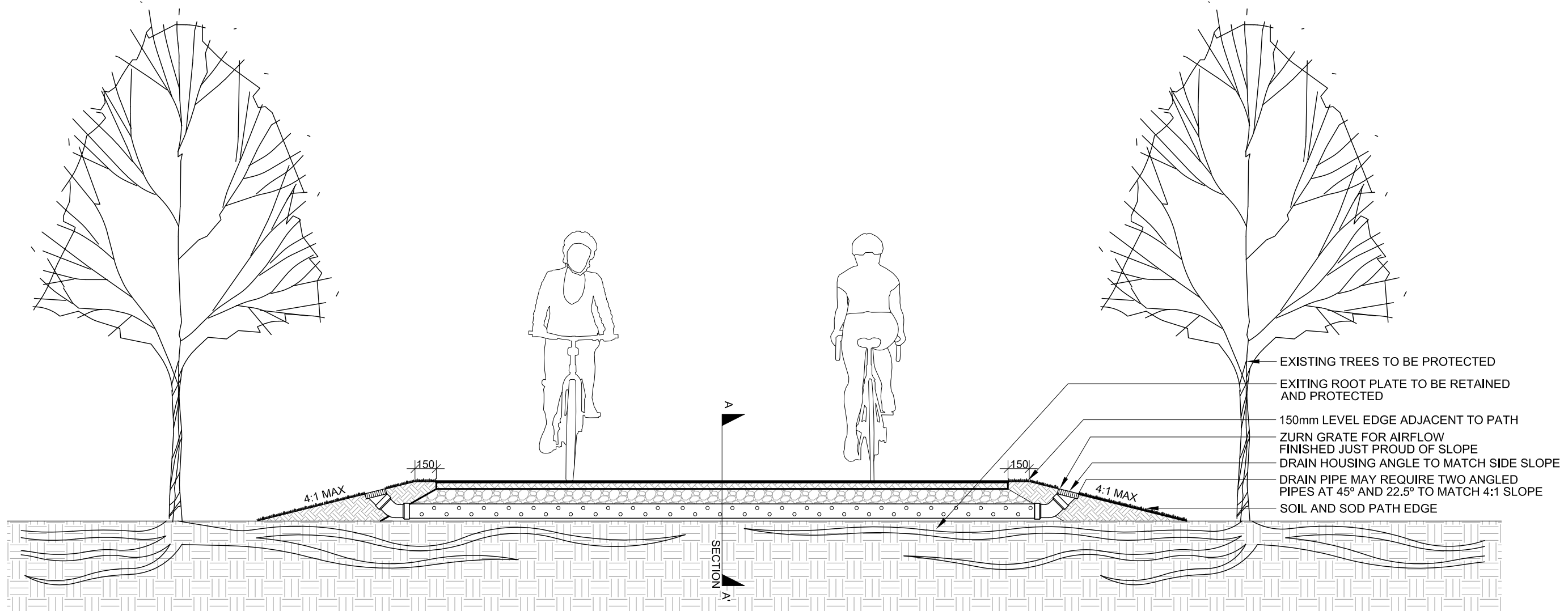
REV

SCALE
1:20

NOTES

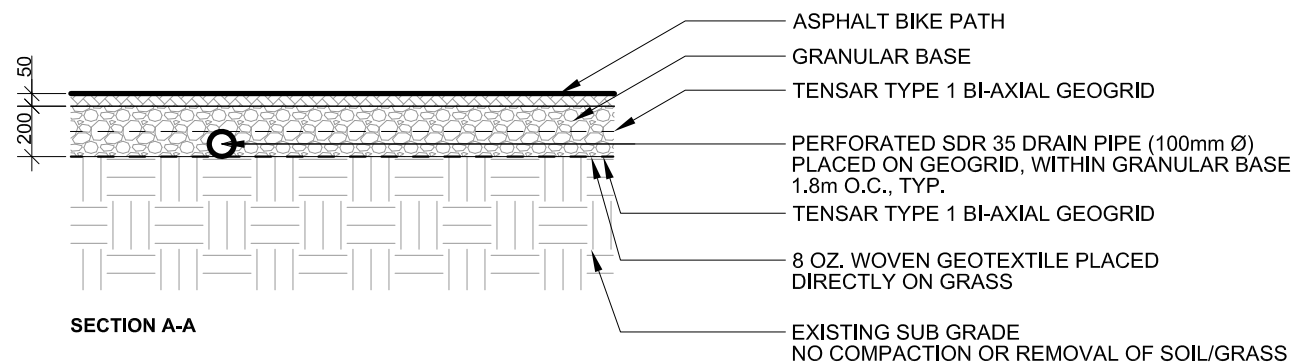
SHEET

3-01



NOTE:

1. CONFIRM THE LAYOUT OF ALL PERFORATED PIPES WITH OWNER'S REPRESENTATIVE BEFORE INSTALLATION OF GRANULAR BASE MATERIAL
2. PLACE MATERIALS DIRECTLY ON EXISTING SOIL SURFACE, DO NOT REMOVE GRASS
3. DO NOT COMPACT SUBGRADE IN TREE PROTECTION ZONE



DATE
JUNE-2022

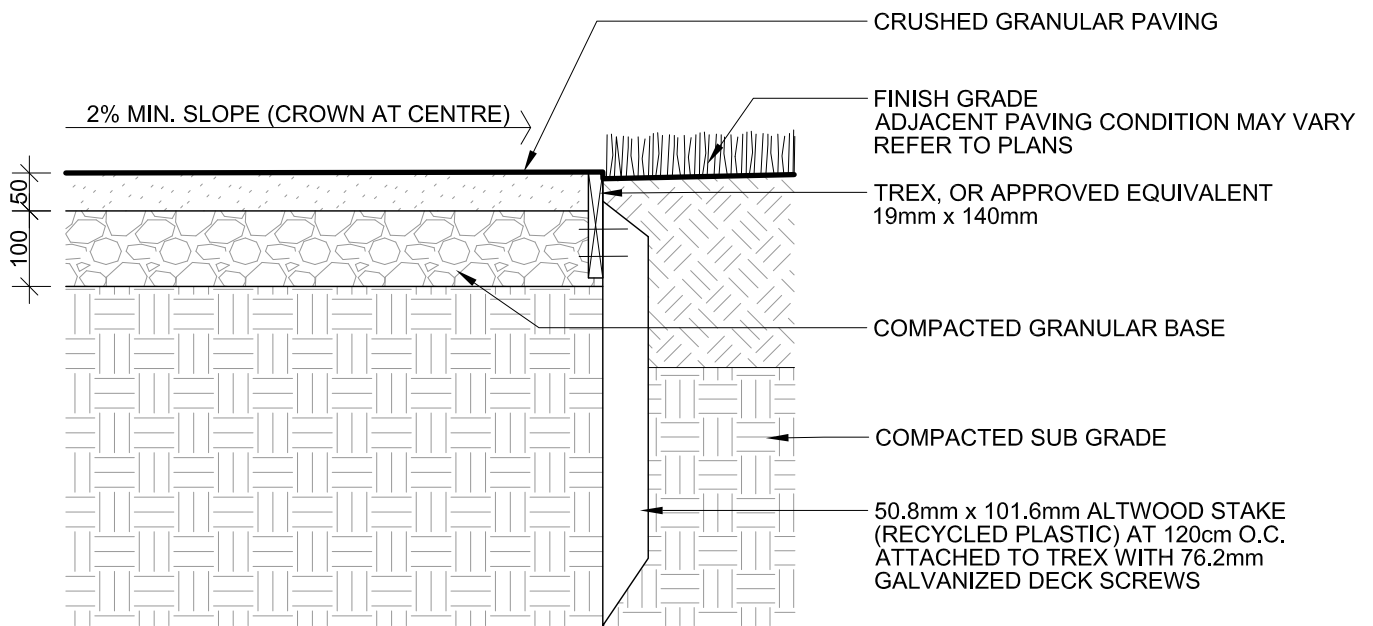
REV

SCALE
1:30

DRAWING
BIKE PATH OVER ROOT
ZONE OF EXISTING TREES

SHEET

3-02



DRAWING
CRUSHED GRANULAR PATH
WITH EDGING

DATE
JUNE-2022

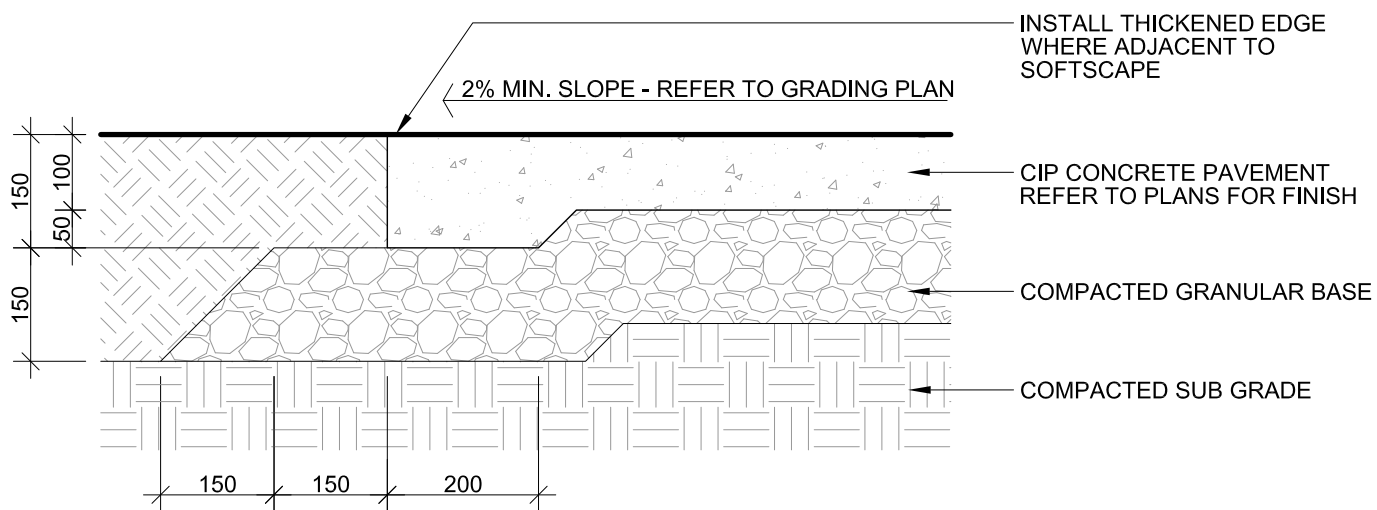
REV

SCALE
1:10

NOTES

SHEET

3-03



NOTE:

1. REFER TO DETAIL 1-01 FOR CONTROL AND EXPANSION JOINT DETAILS
CONTROL JOINTS AS PER DETAIL #2 TO BE PROVIDED 1.5m MIN. O.C.
UNLESS SHOWN OTHERWISE ON PLAN, NO TROWEL MARK
2. EXPANSION JOINTS COME WITH FIBREBOARD TO BE PROVIDED 6m MAX. O.C.
AND AT INTERFACE WITH STRUCTURES SUCH AS WALLS, STEPS, AND CURBS



DRAWING
CIP CONCRETE PAVING
WITHOUT REINFORCING

DATE
JUNE-2022

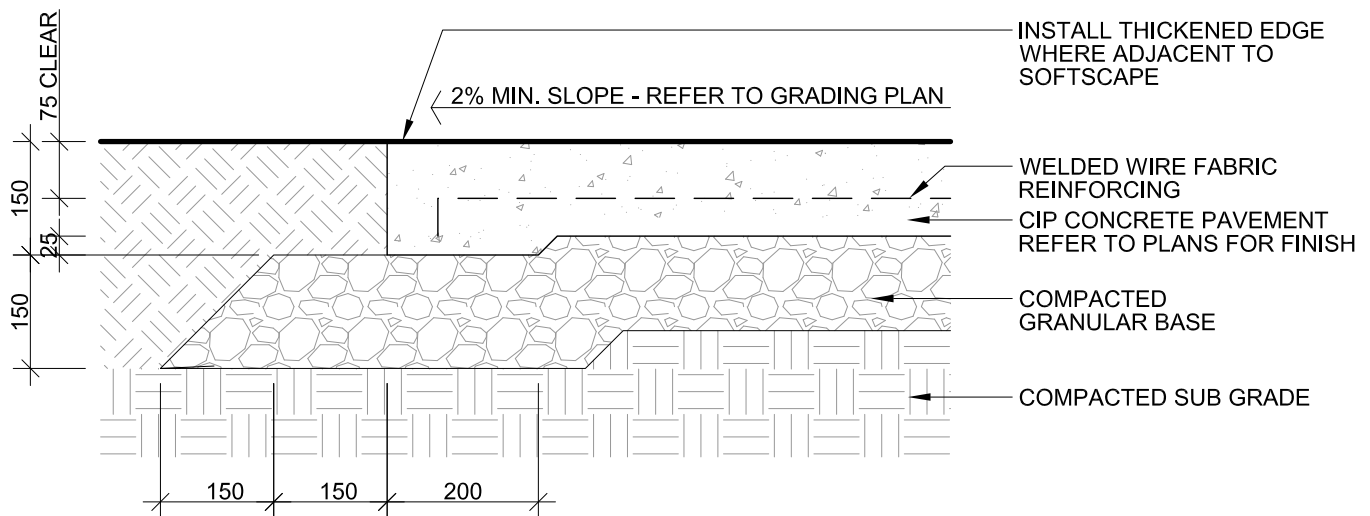
REV

SCALE
1:10

NOTES

SHEET

3-04-1



NOTE:

1. REFER TO DETAIL 1-01 FOR CONTROL AND EXPANSION JOINT DETAILS
CONTROL JOINTS AS PER DETAIL #2 TO BE PROVIDED 1.5m MIN. O.C.
UNLESS SHOWN OTHERWISE ON PLAN, NO TROWEL MARK
2. EXPANSION JOINTS COME WITH FIBREBOARD TO BE PROVIDED 6m MAX. O.C.
AND AT INTERFACE WITH STRUCTURES SUCH AS WALLS, STEPS, AND CURBS



DRAWING
CIP CONCRETE PAVING - WELDED
WIRE FABRIC REINFORCING

DATE
MAY-2021

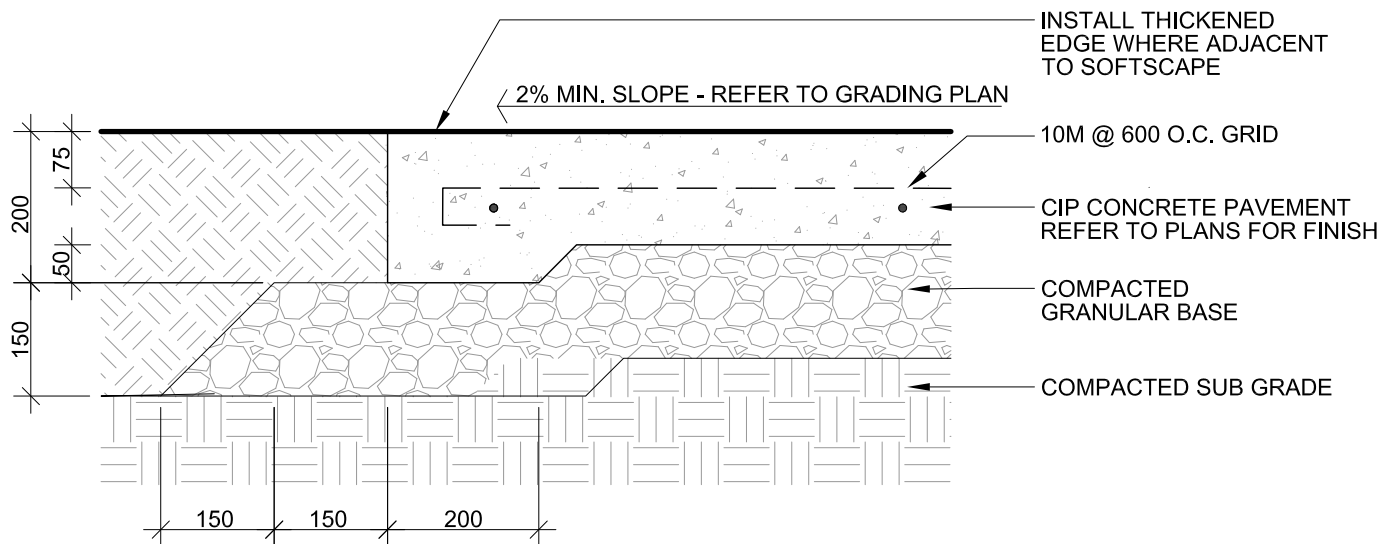
REV

SCALE
1:10

NOTES

SHEET

3-04-2



NOTE:

1. REFER TO DETAIL 1-01 FOR CONTROL AND EXPANSION JOINT DETAILS
CONTROL JOINTS AS PER DETAIL #2 TO BE PROVIDED 1.5m MIN. O.C.
UNLESS SHOWN OTHERWISE ON PLAN, NO TROWEL MARK
2. EXPANSION JOINTS COME WITH FIBREBOARD TO BE PROVIDED 6m MAX. O.C.
AND AT INTERFACE WITH STRUCTURES SUCH AS WALLS, STEPS, AND CURBS



DRAWING
CIP CONCRETE PATH WITH
10M REBAR AT 600 O.C.

DATE
JUNE-2022

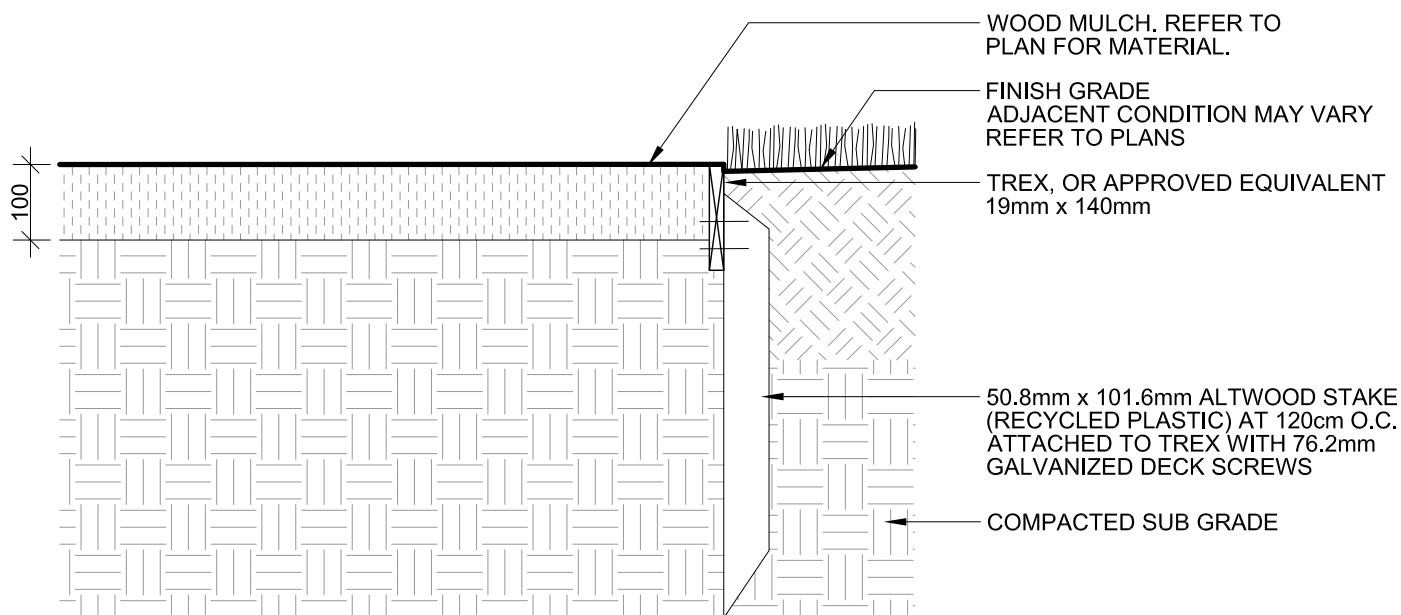
REV

SCALE
1:10

NOTES

SHEET

3-04-3



DRAWING
WOOD MULCH PATH

DATE
JUNE-2022

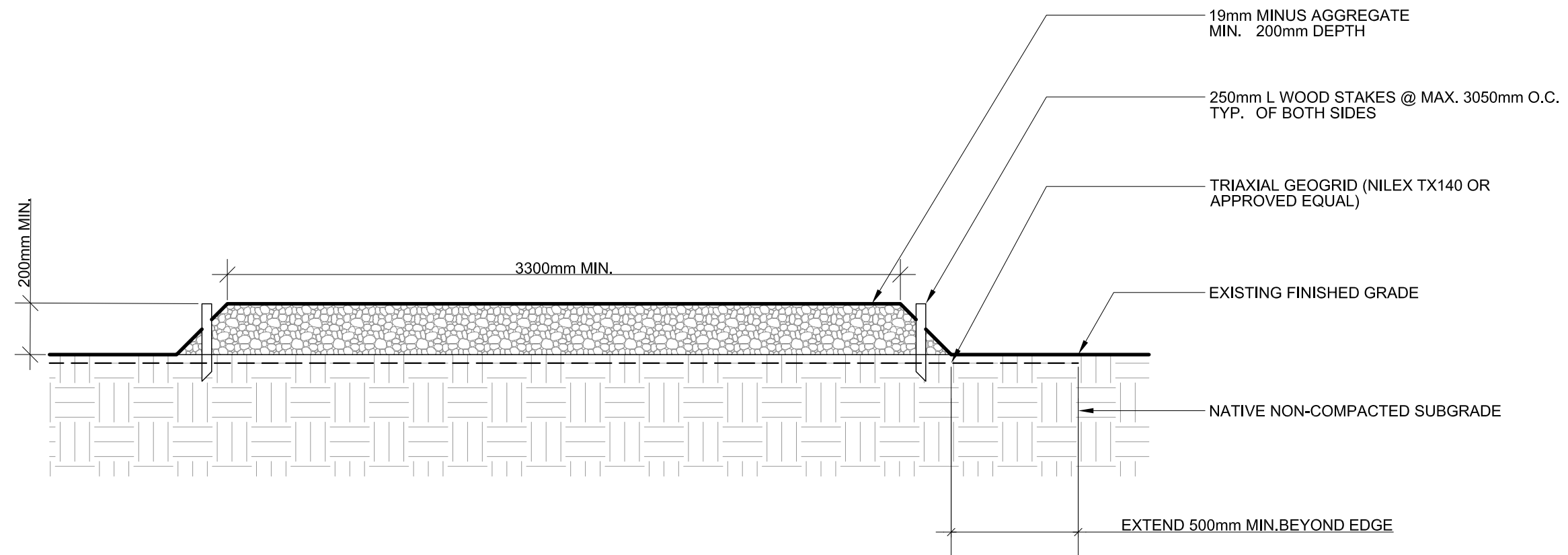
REV

SCALE
1:10

NOTES

SHEET

3-05



NOTES:

1. LAYOUT OF ACCESS ROAD TO BE APPROVED BY OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.
2. INSTALLATION OF GEOTEXTILE AND GEOGRID TO BE REVIEWED BY OWNER'S REPRESENTATIVE PRIOR TO PLACEMENT OF AGGREGATE.
3. COMPLETED ACCESS ROAD TO BE REVIEWED BY OWNER'S REPRESENTATIVE PRIOR TO USE.

DATE
JUNE-2022

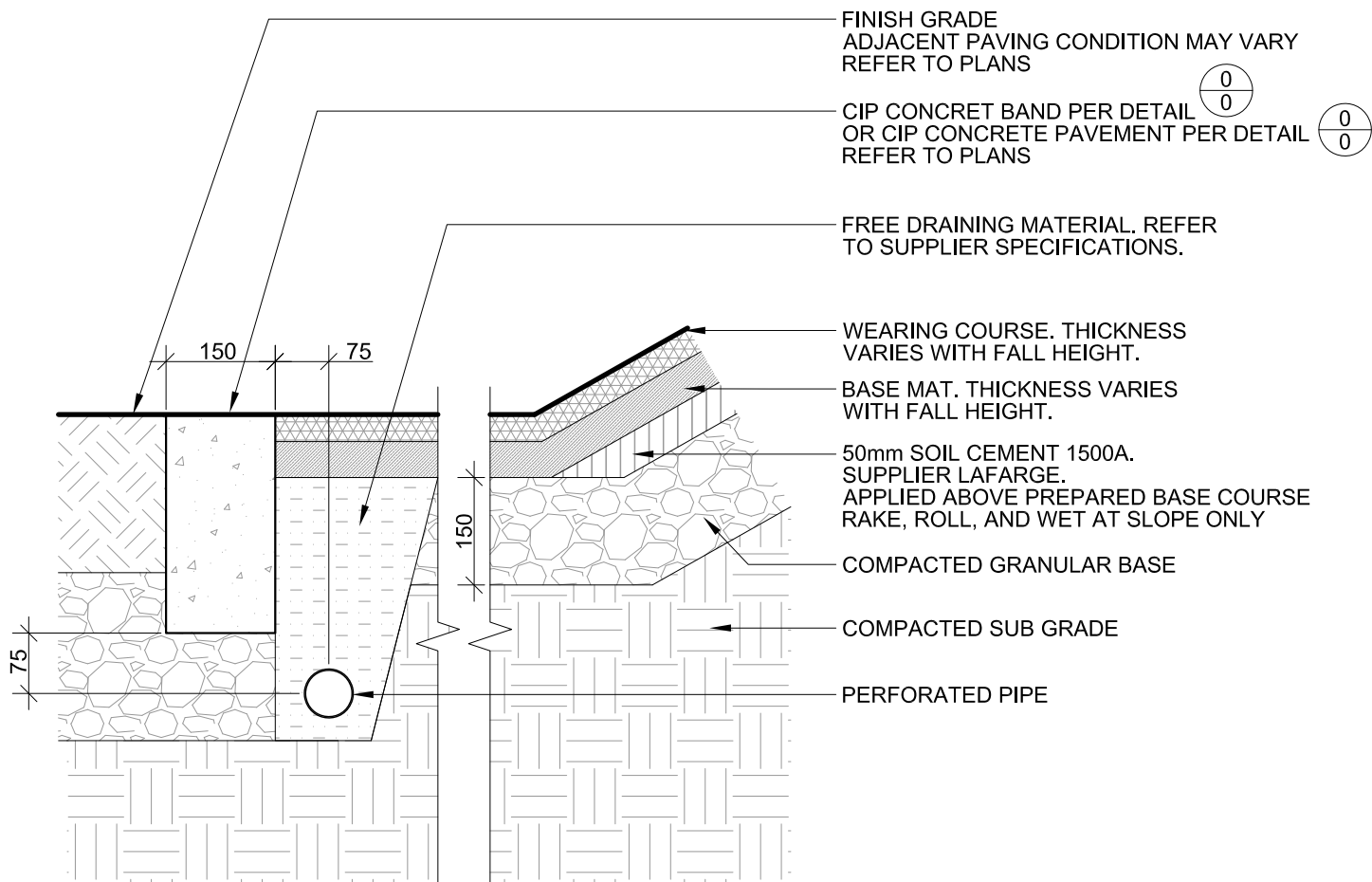
REV

SCALE
1:20

DRAWING
TEMPORARY ROAD
ACCESS

SHEET

3-06



NOTE:

1. CONTRACTOR TO REVIEW AND INCORPORATE SUPPLIER SPECIFICATIONS AND INSTALLATION RECOMMENDATIONS.
2. ALL DEPTHS TO BE AS PER MANUFACTURER'S RECOMMENDATIONS.
3. REFERENCE CURRENT CSA STANDARDS FOR PLAYGROUNDS TO ESTABLISH BASE MAT THICKNESS BASED ON FALL HEIGHT.



DRAWING
POURED-IN-PLACE RUBBER
SURFACING

DATE
JUNE-2022

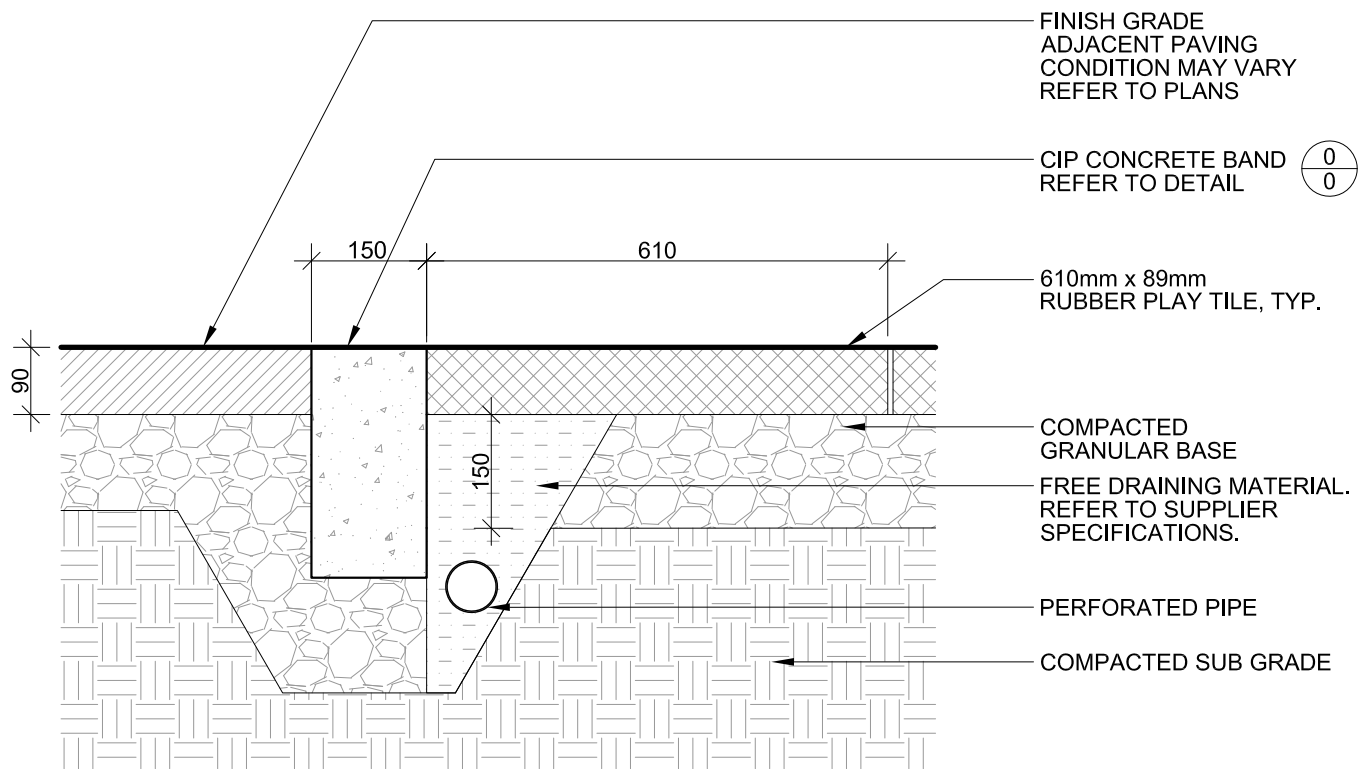
REV

SCALE
1:10

NOTES

SHEET

4-01



NOTE:

1. RUBBER PLAYGROUND TILES SUPPLIED BY DINO FLEX GROUP LIMITED PARTNERSHIP OR PRE-APPROVED EQUAL
2. INSTALL AS PER MANUFACTURER'S SPECIFICATIONS



DRAWING
RUBBER PLAY TILE

DATE
JUNE-2022

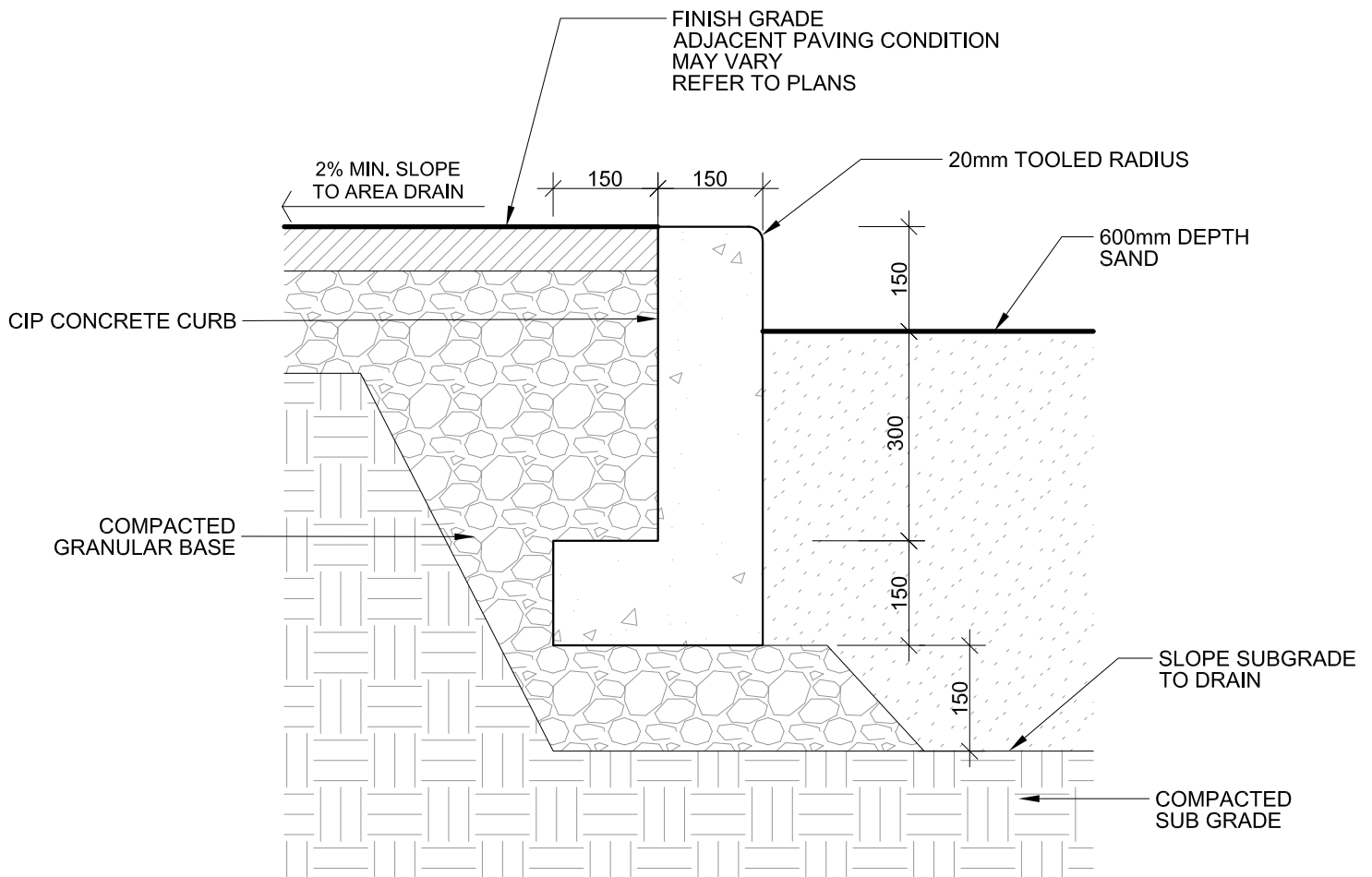
REV

SCALE
1:10

NOTES

SHEET

4-02



NOTE:

1. REINFORCING AND FOOTING DETAILS TO BE PROVIDED IN SEALED DRAWINGS BY PROJECT ENGINEER OR THROUGH THE SUBMITTAL OF SHOP DRAWINGS



DRAWING

SAND PLAY AREA FLUSH EDGE

DATE

JUNE-2022

REV

1

SCALE

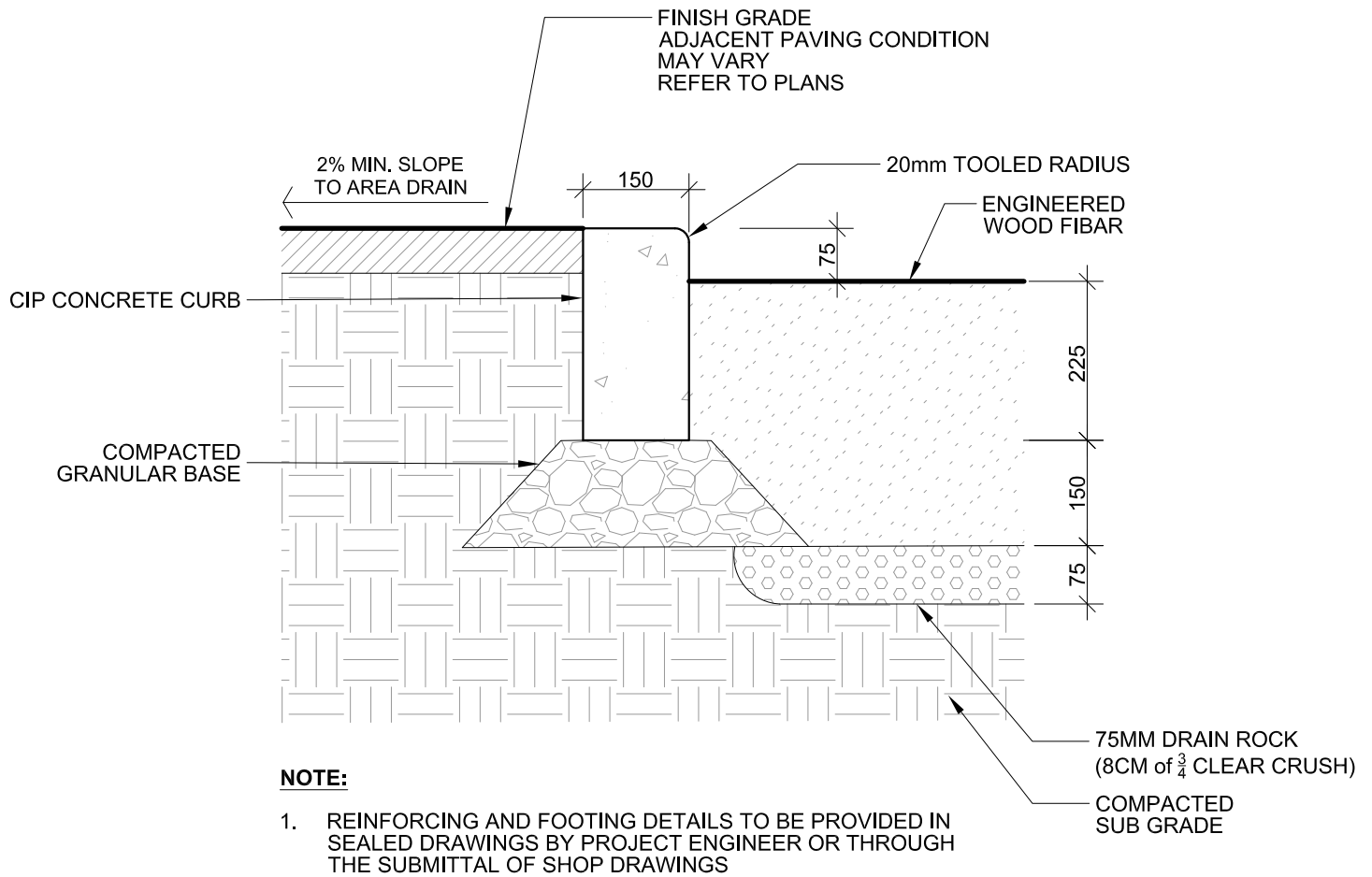
1:10

NOTES

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SHEET

4-03



DRAWING
ENGINEERED WOOD FIBRE -
PLAY AREA

DATE
JUNE-2022

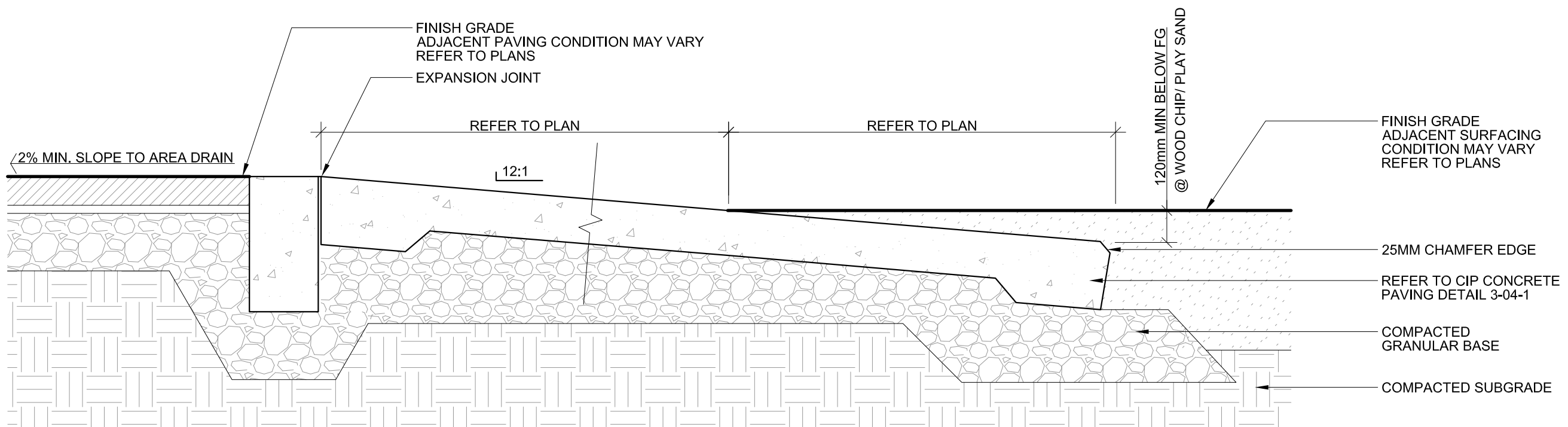
REV

SCALE
1:10

NOTES

SHEET

4-04



NOTE:

1. CONTROL JOINTS AS PER DETAIL #2 TO BE PROVIDED 1.5m MIN. O.C. UNLESS SHOWN OTHERWISE ON PLAN, NO TROWEL MARK
2. EXPANSION JOINTS C/W WITH FIBREBOARD TO BE PROVIDED 6m MAX. O.C. AND AT INTERFACE WITH STRUCTURES SUCH AS WALLS, STEPS, AND CURBS
3. REFER TO DETAIL 1-01 FOR CONTROL AND EXPANSION JOINT DETAILS
4. WIDTH VARIES. REFER TO PLAN
5. REINFORCING AND FOOTING DETAILS TO BE PROVIDED IN SEALED DRAWINGS BY PROJECT ENGINEER OR THROUGH THE SUBMITTAL OF SHOP DRAWINGS

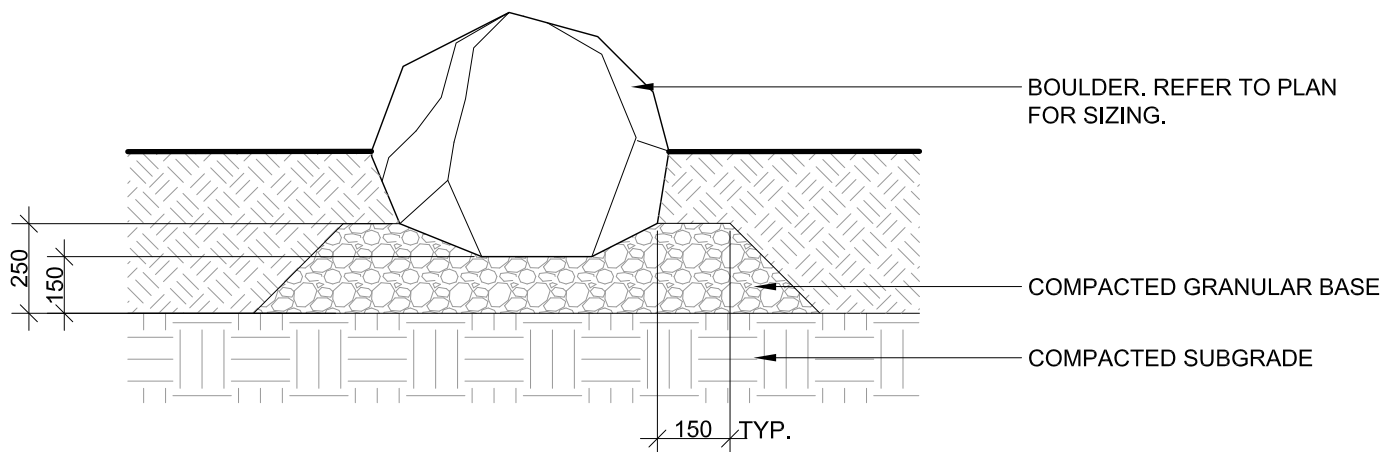
DATE
JUNE-2022

REV

SCALE
1:10

DRAWING
RAMP AT PLAY AREA

SHEET
4-05



NOTES:

1. SET BOULDERS $\frac{1}{3}$ TO $\frac{1}{2}$ \varnothing BELOW GRADE
2. NO CRACKED OR BROKEN EDGES SHALL BE EXPOSED ABOVE FINISH GRADE
3. BOULDERS PLACEMENT TO BE REVIEWED AND APPROVED BY OWNER REPRESENTATIVE



DRAWING
LANDSCAPE BOULDER

DATE
JUNE-2022

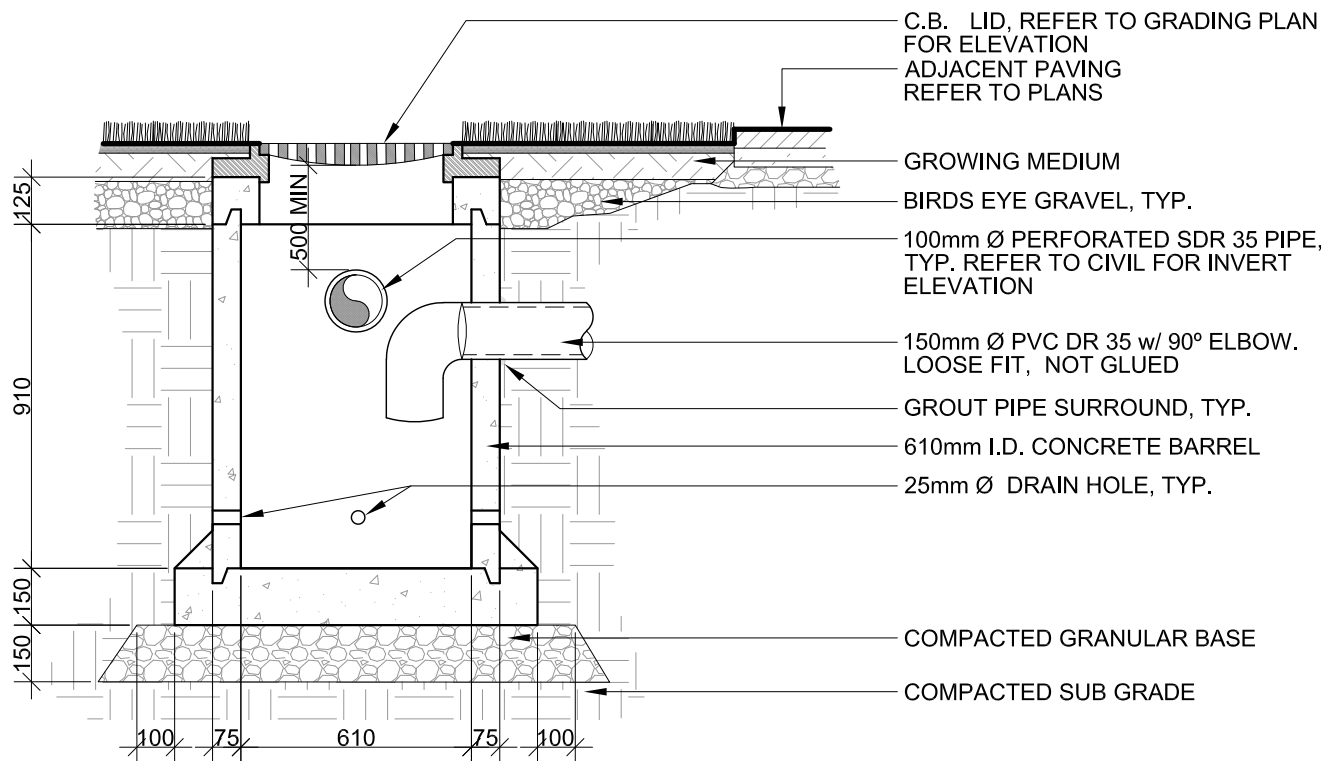
REV

SCALE
1:20

NOTES

SHEET

5-01



NOTE:

1. GRADE ALL AREAS 1.5% - 2% SLOPE TOWARDS THE CATCH BASIN.
2. SURFACE OF EXCAVATED AREA TO BE RESODDED NOT SEEDED.
3. SIZING OF CATCH BASIN TO BE VERIFIED BY PROJECT REQUIREMENTS.
4. CATCH BASIN TO BE COVERED WITH METAL HEEL PROOF GRATE.



DRAWING
CATCH BASIN - FLAT WITH
CLOSED BOTTOM

DATE
JUNE-2022

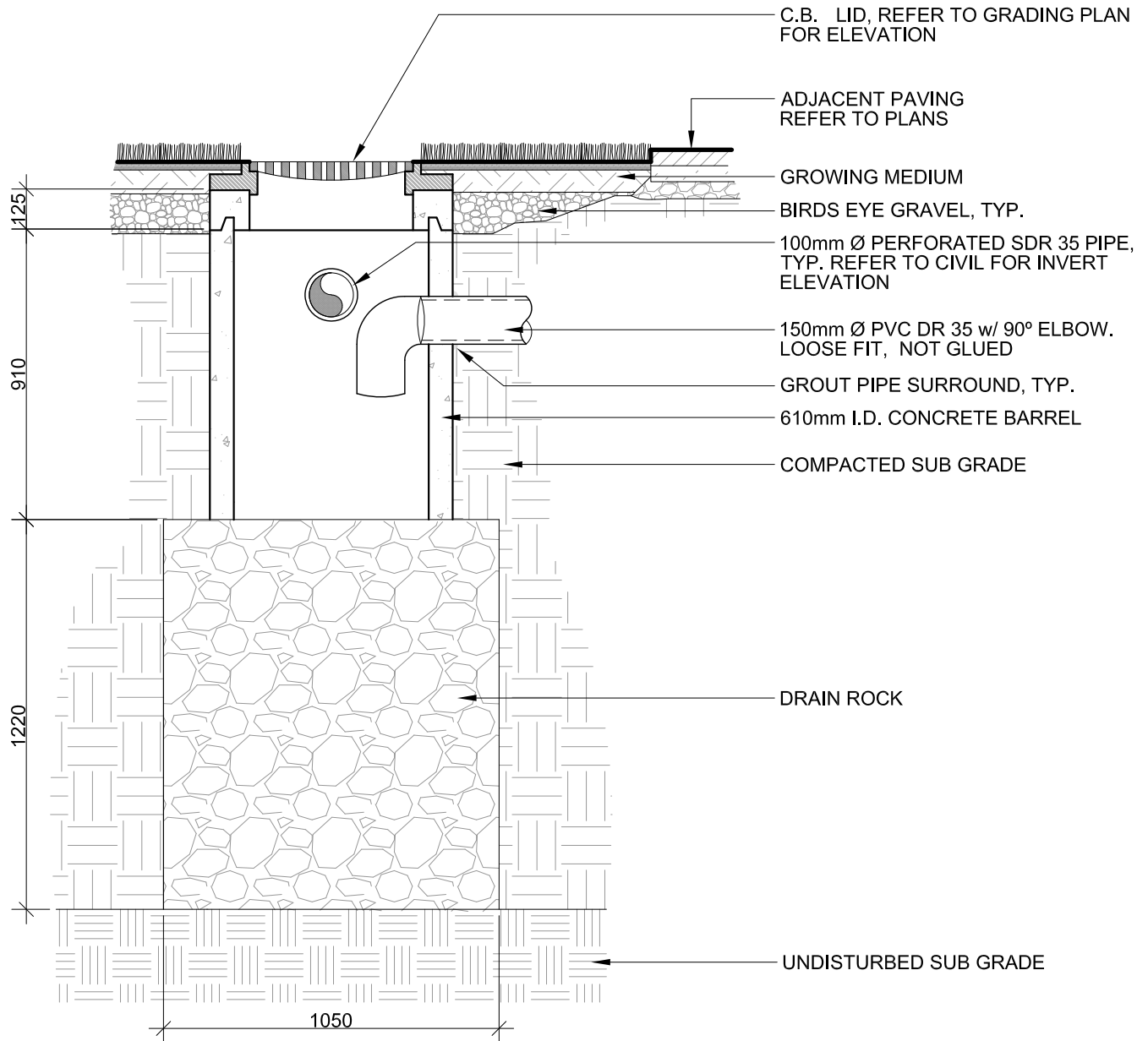
REV

SCALE
1:20

NOTES

SHEET

6-01-1



NOTE:

1. GRADE ALL AREAS 1.5% - 2% SLOPE TOWARDS THE CATCHBASIN
2. SURFACE OF EXCAVATED AREA TO BE RESODDED NOT SEEDED
3. SIZING OF CATCH BASIN TO BE VERIFIED BY PROJECT REQUIREMENTS.
4. CATCH BASIN TO BE COVERED WITH METAL HEEL PROOF GRATE.



DRAWING
CATCH BASIN - FLAT WITH
OPEN BOTTOM

DATE
JUNE-2022

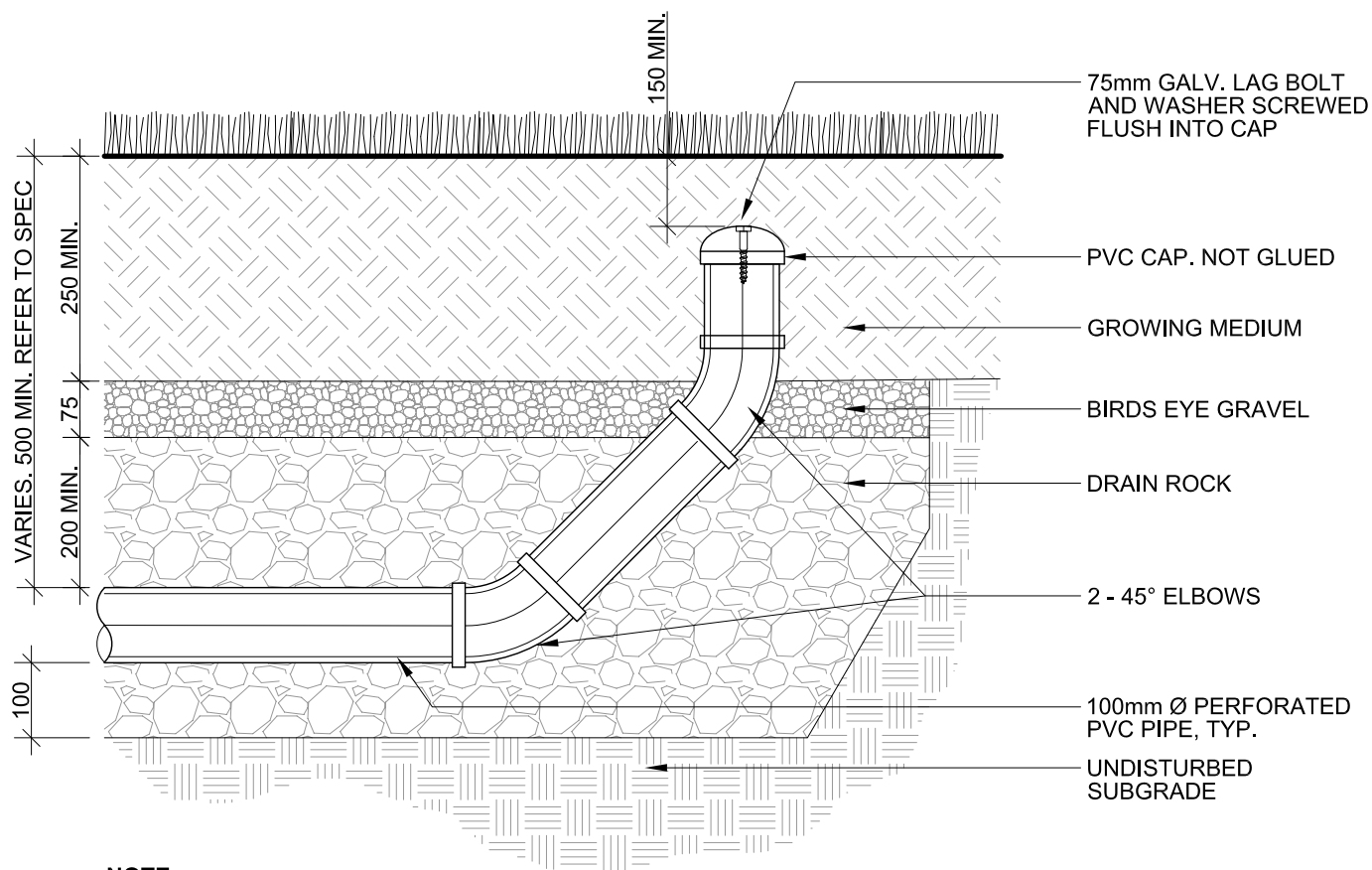
REV

SCALE
1:20

NOTES

SHEET

6-01-2



NOTE:

1. ALL TRENCHES TO BE MINIMUM OF 600mm AWAY FROM FROM HARDSCAPE



DRAWING

DRAINAGE CLEANOUT IN LAWN

DATE

JUNE-2022

REV

SCALE

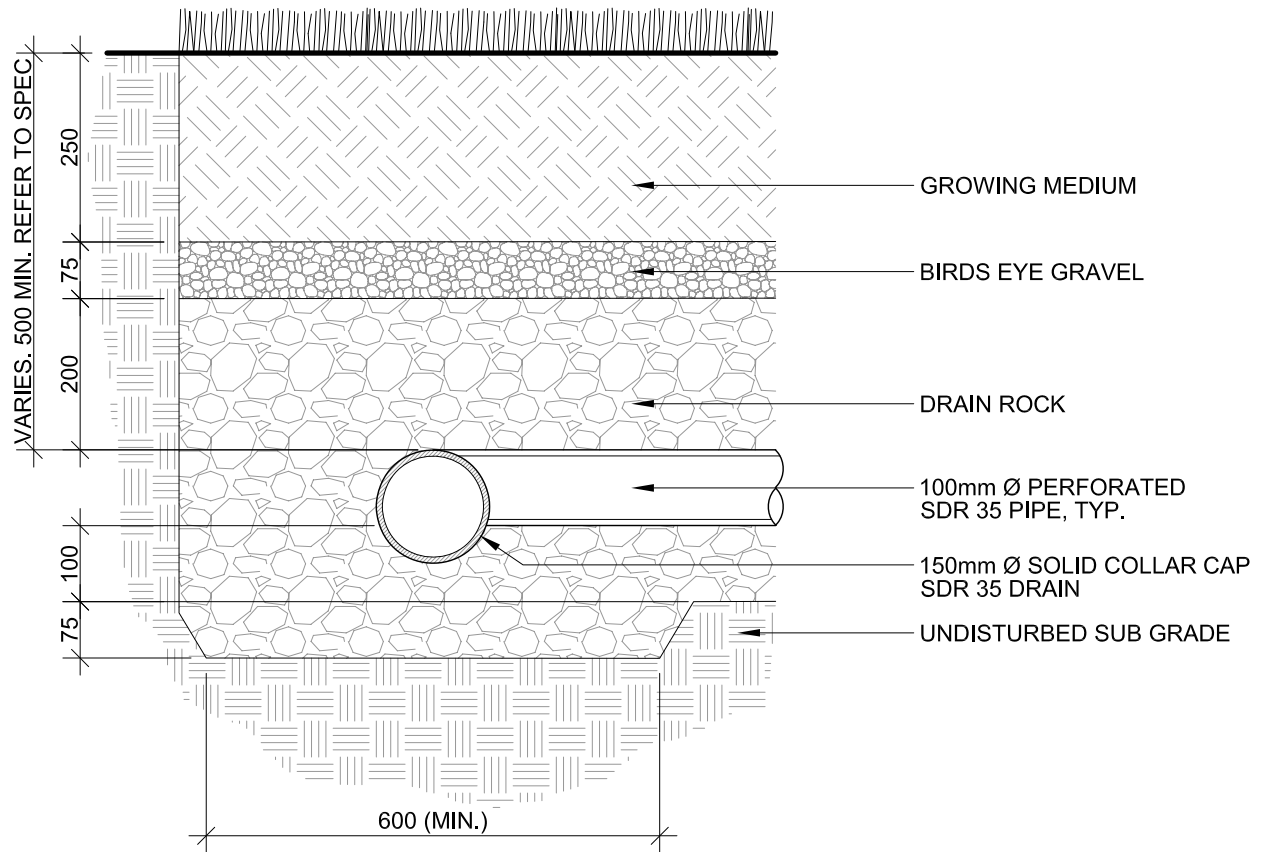
1:10

NOTES

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SHEET

6-02



NOTE:

1. SPECIFICATIONS TO BE VERIFIED BY PROJECT REQUIREMENTS.



DRAWING
DRAINAGE PERFORATED

DATE
JUNE-2022

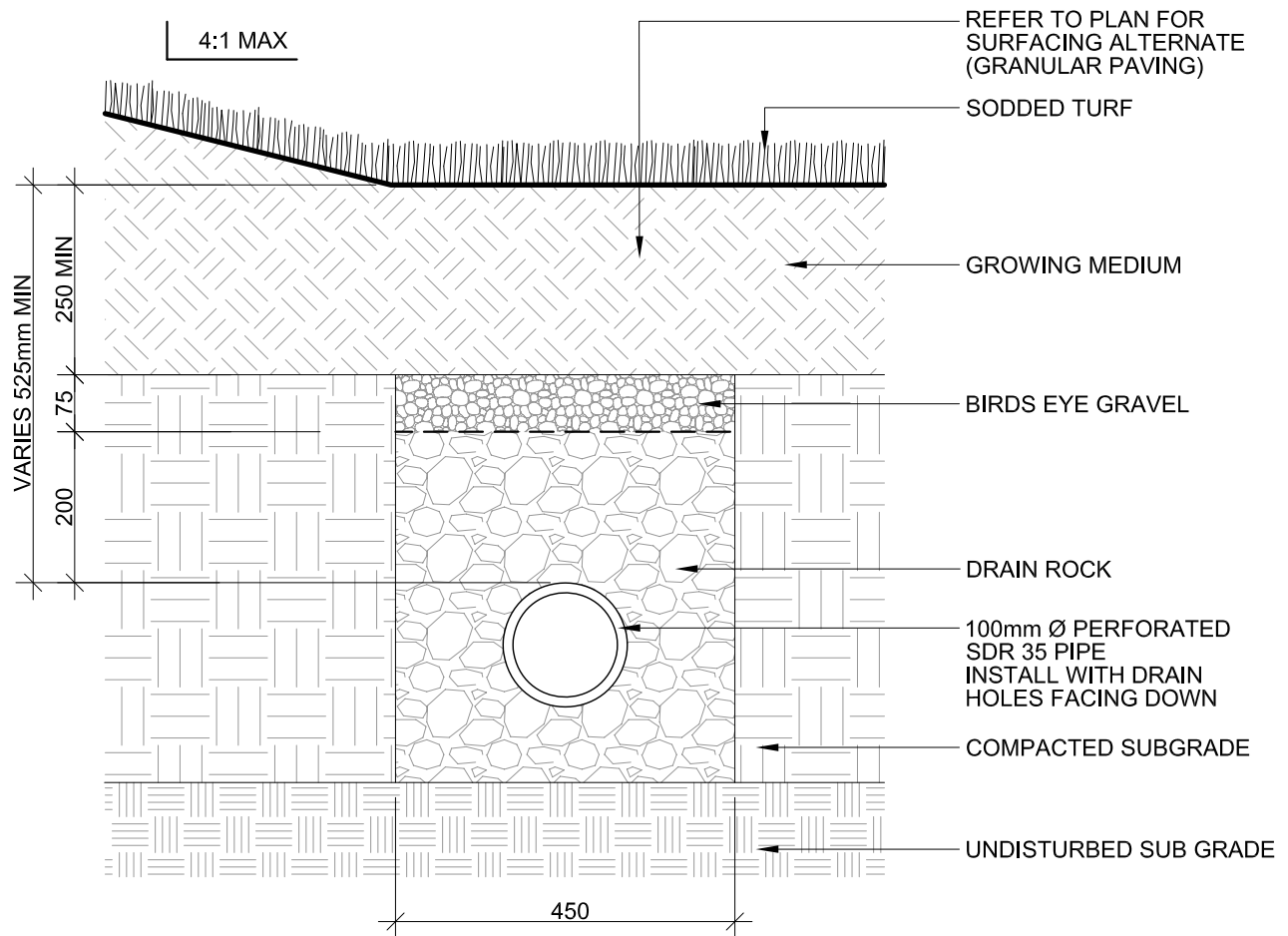
REV

SCALE
1:10

NOTES

SHEET

6-03



NOTES:

1. RESERVOIR MUST BE PROPERLY SIZED BASED ON THE GEOTECHNICAL INVESTIGATION AND INFILTRATION VOLUME.
2. DEPTH AND REQUIREMENTS TO BE PROVIDED BY CIVIL ENGINEER.



DRAWING
INFILTRATION TRENCH
WITH GRASS

DATE
JUNE-2022

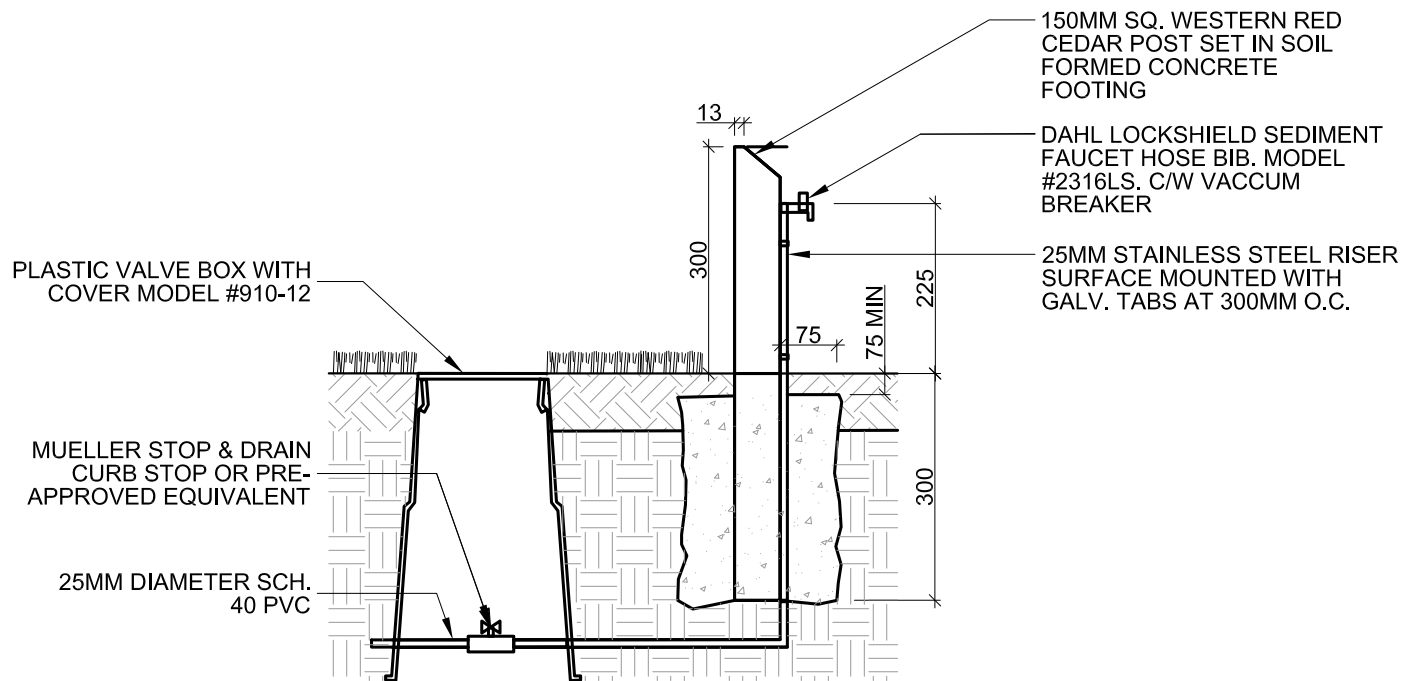
REV

SCALE
1:10

NOTES

SHEET

6-04



DRAWING
HOSE BIB IN COMMUNITY
GARDENS

DATE
JUNE-2022

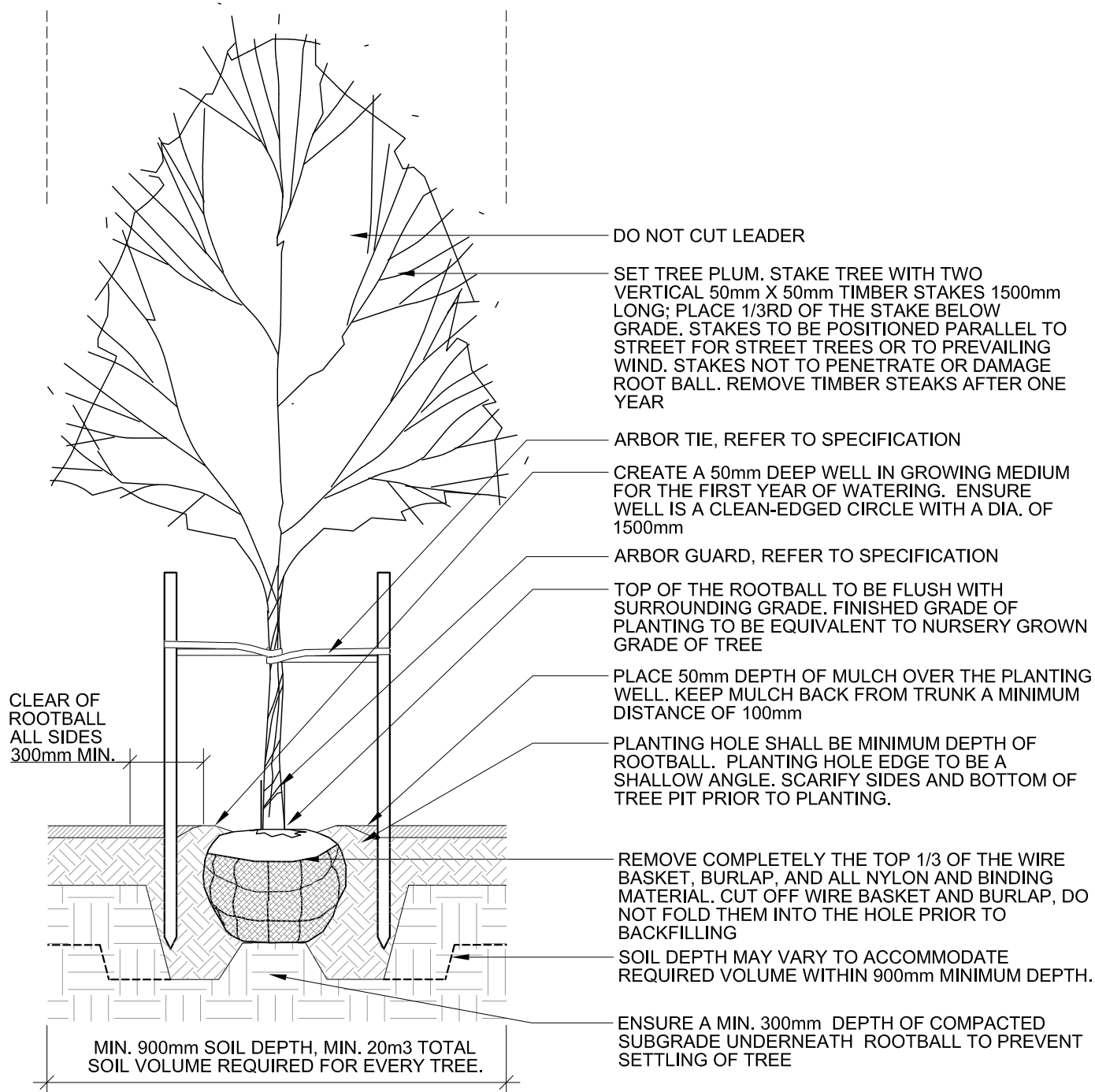
REV

SCALE
1:10

NOTES

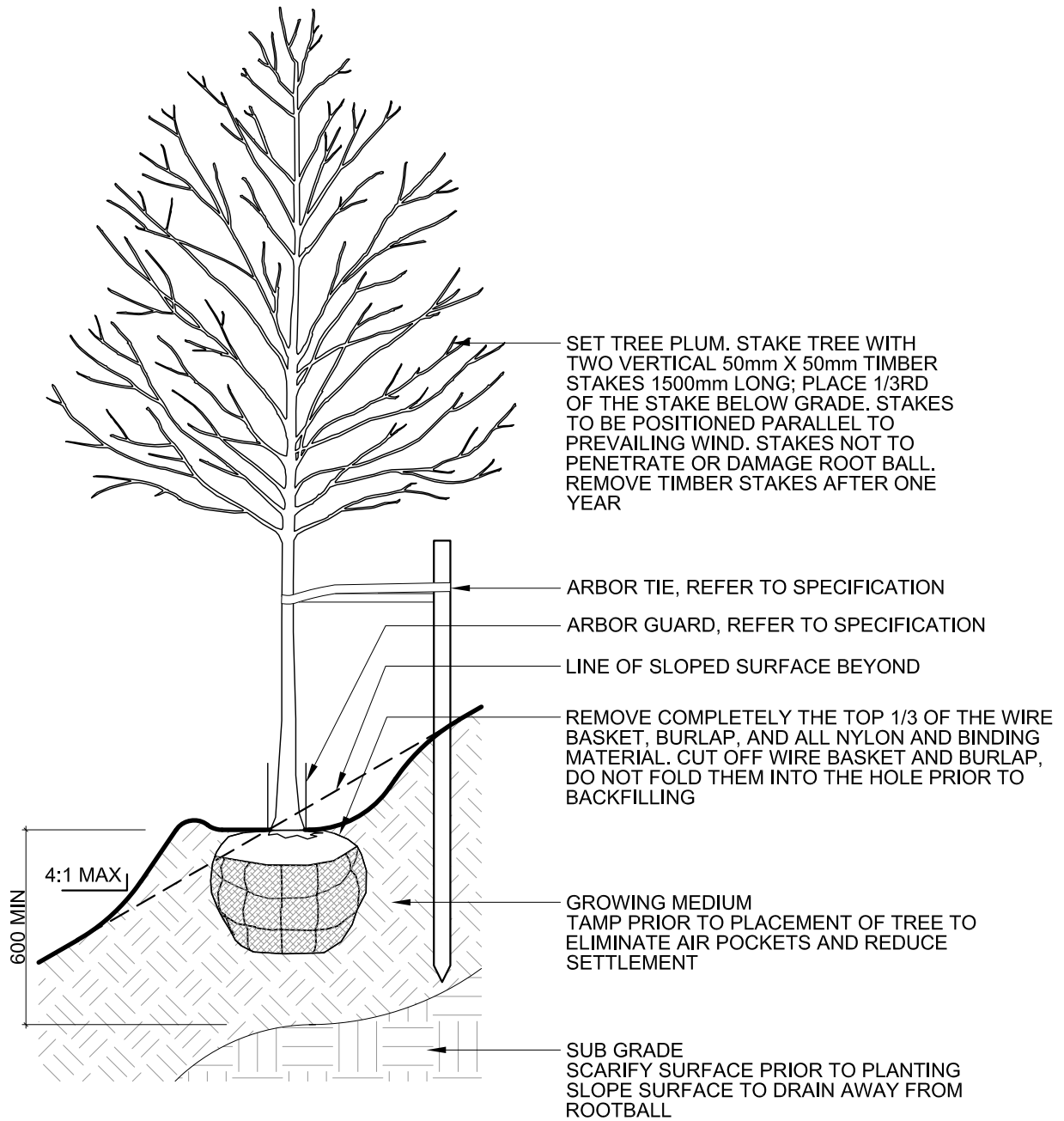
SHEET

7-01



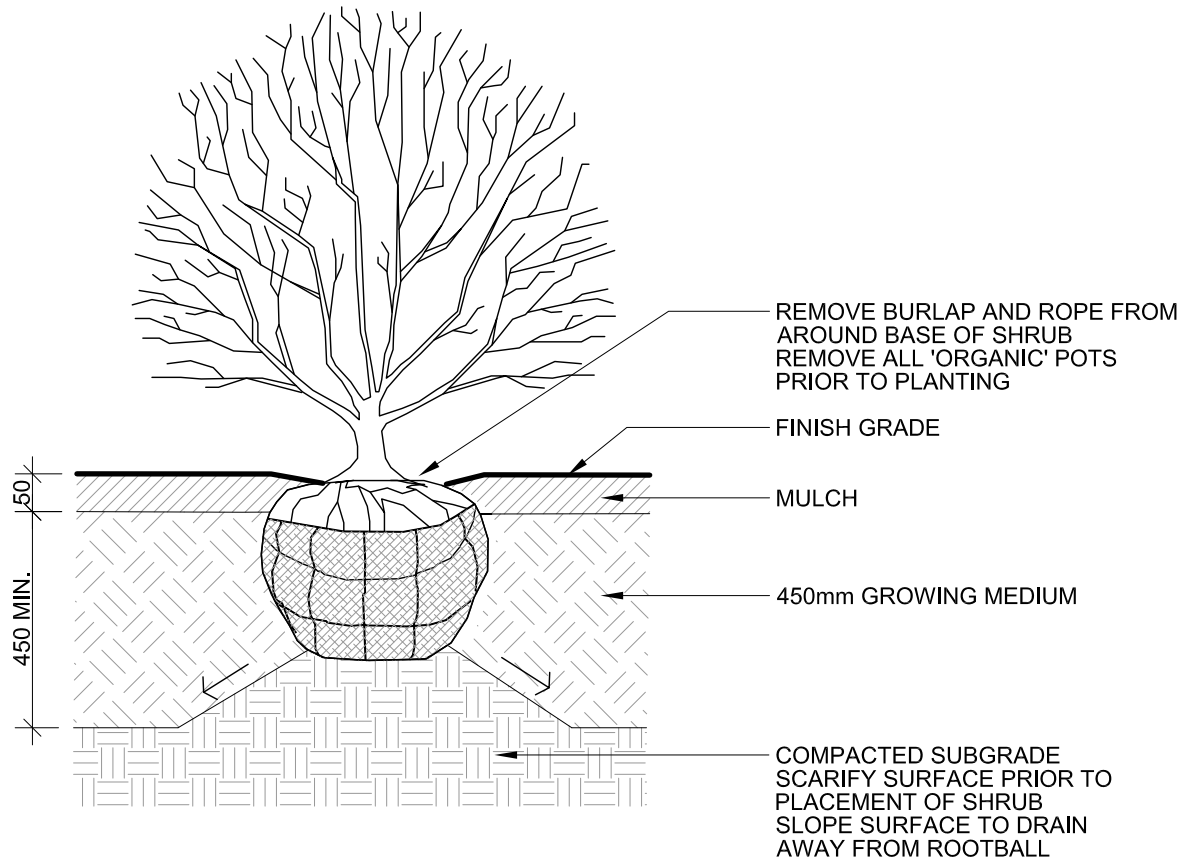
NOTES:

1. ONLY PRUNE BROKEN OR DAMAGED BRANCHES USING APPROVED PRUNING TOOLS AND STANDARD I.S.A. PRUNING PRACTICES AS DIRECTED BY CONSULTANT OR PROJECT ARBORIST. SEE SPECIFICATIONS. ANY PRUNING NEED TO ENSURE A CENTRAL LEADER.
2. PLANTING PIT MUST BE FREE DRAINING.



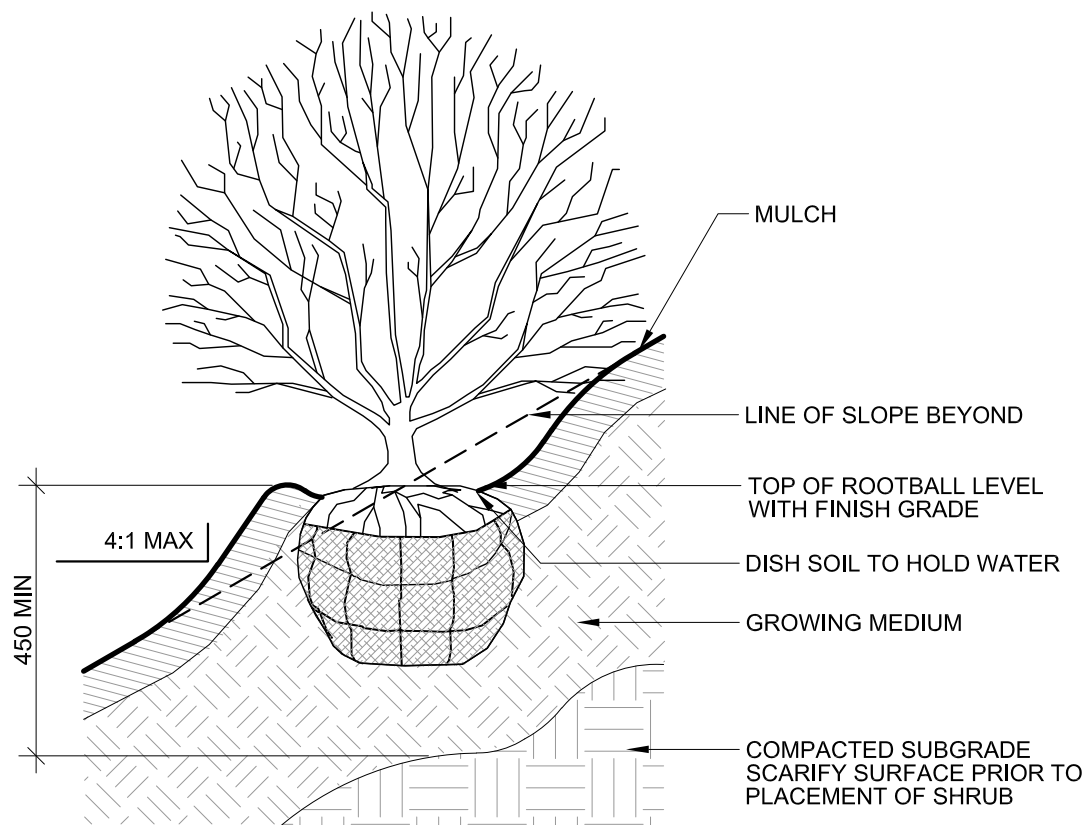
NOTES:

1. TREE TO BE PLANTED WITH ELEVATION OF TOP OF ROOTBALL LEVEL WITH FINISH GRADE ELEVATION.
2. COMPOSTED BARK MULCH TO BE KEPT AT LEAST 100mm AWAY FROM BASE OF TREE TRUNK.
3. ONLY PRUNE BROKEN OR DAMAGED BRANCHES USING APPROVED PRUNING TOOLS AND STANDARD I.S.A. PRUNING PRACTICES AS DIRECTED BY CONSULTANT OR PROJECT ARBORIST. SEE SPECIFICATIONS. ANY PRUNING NEEDS TO ENSURE A CENTRAL LEADER.
4. PLANTING PIT MUST BE FREE DRAINING.



NOTES:

1. SHRUB TO BE PLANTED WITH ELEVATION OF TOP OF ROOTBALL OR POT LEVEL WITH FINISH GRADE OF GROWING MEDIUM.
2. COMPOSTED BARK MULCH AT 50mm DEPTH TO BE KEPT AT LEAST 50mm AWAY FROM STEMS OF SHRUB.
3. PLANTING PIT MUST BE FREE DRAINING



NOTES:

1. SHRUB TO BE PLANTED WITH TOP OF ROOTBALL LEVEL WITH FINISH GRADE
2. COMPOSTED BARK MULCH TO BE KEPT AT LEAST 50mm AWAY FROM STEMS
3. PRUNE ANY BROKEN OR DAMAGED BRANCHES USING APPROVED PRUNING TOOLS AND STANDARD I.S.A. PRUNING PRACTICES



DRAWING

SHRUB PLANTING ON SLOPE

DATE

JUNE-2022

REV

SCALE

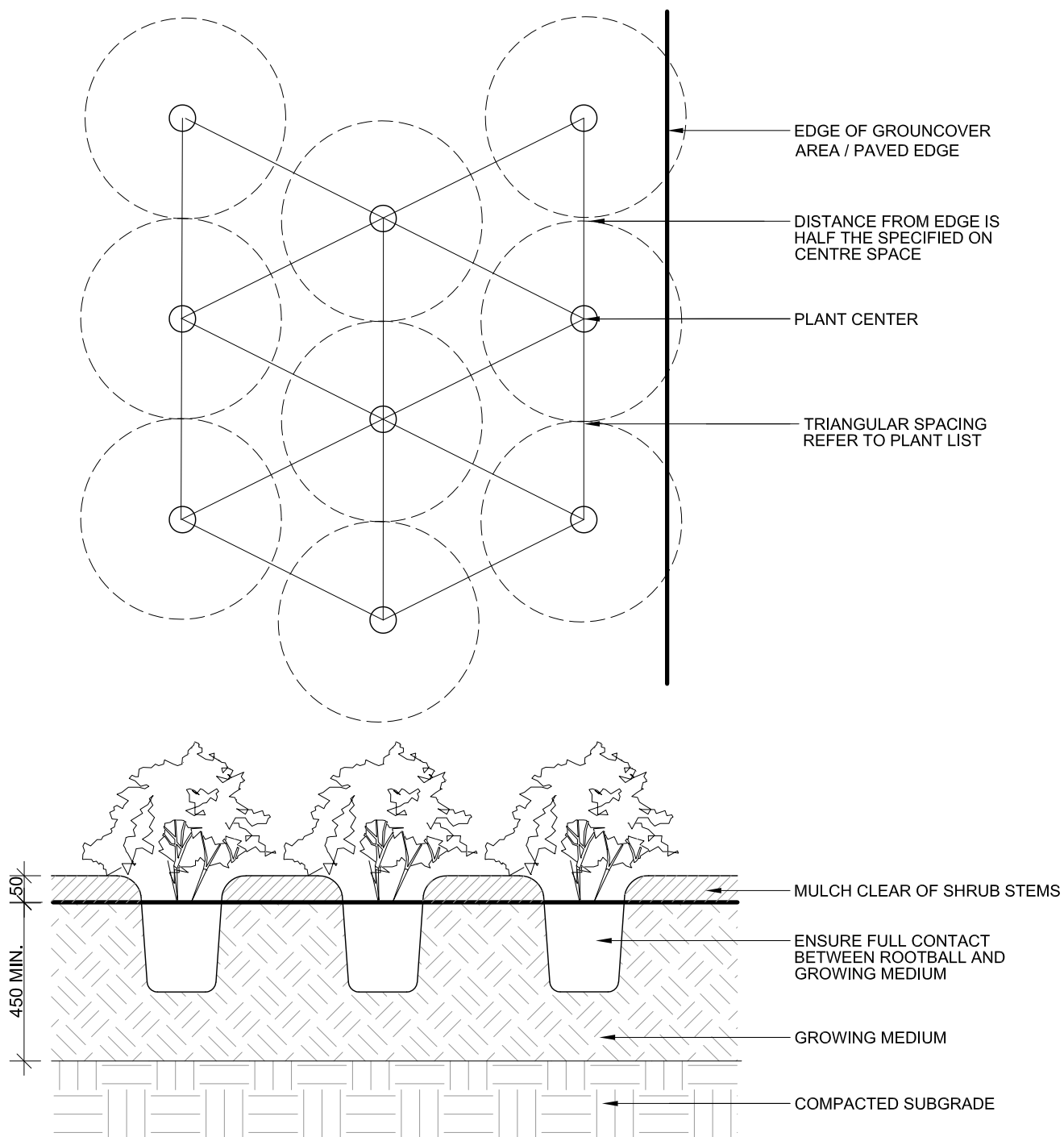
1:5

NOTES

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SHEET

8-04



NOTES:

1. PLANT TO BE PLANTED WITH TOP OF ROOTBALL LEVEL WITH FINISH GRADE.
2. COMPOSTED BARK MULCH TO BE KEPT AT LEAST 2" AWAY FROM STEMS.
3. PRUNE ANY BROKEN OR DAMAGED BRANCHES AND DOUBLE LEADERS USING APPROVED PRUNING TOOLS AND STANDARD I.S.A. PRUNING PRACTICES. SEE SPECIFICATIONS.
4. A REPRESENTATIVE AREA OF EACH PLANT SPECIES IS TO BE LAID OUT AND APPROVED BY OWNER'S REPRESENTATIVE PRIOR TO PLANTING



DRAWING
GROUND COVER PLANTING
AND LAYOUT

DATE
JUNE-2022

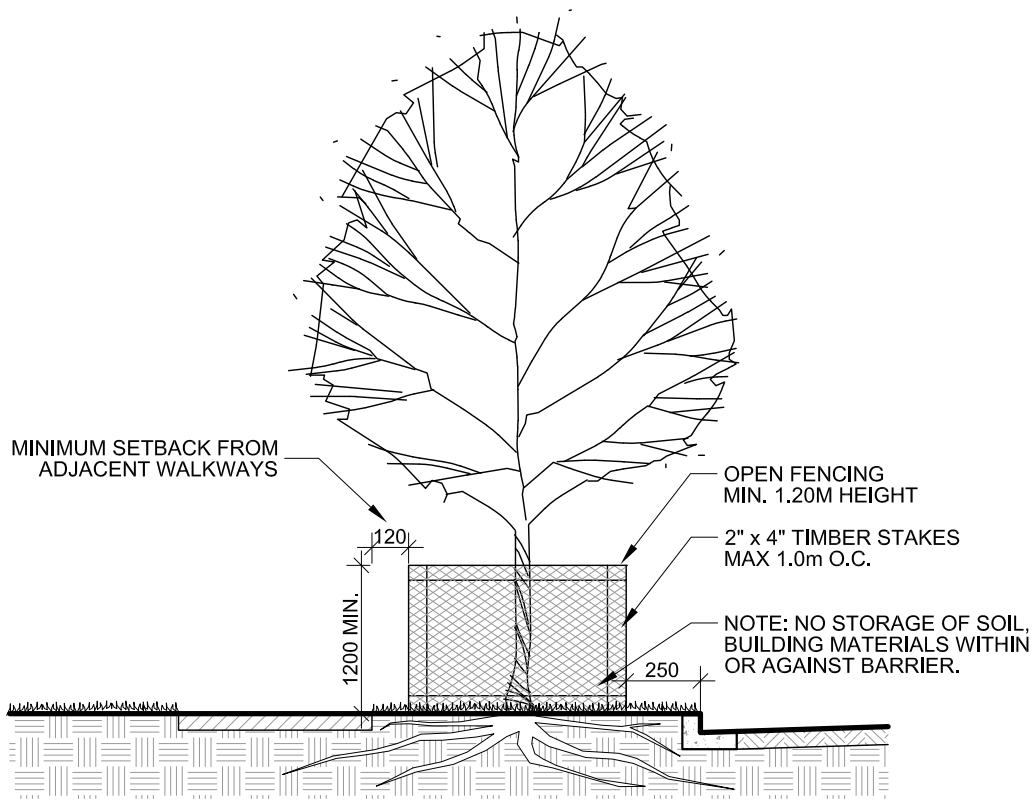
REV

SCALE
1:10

NOTES

SHEET

8-05



NOTE:

1. TREE PROTECTION BARRIERS MUST BE AT LEAST 1.20M IN HEIGHT AND CONSTRUCTED OF EITHER, SNOW FENCING SECURELY FASTENED TO 2x4 TIMBER STAKES OR METAL STAKES, SPACED NO FURTHER THAN 1.00M APART.
2. INSTALL AT THE CRITICAL ROOT ZONE OR DESIGNATED LIMIT OF DISTURBANCE OF THE TREE TO BE SAVED, AS SHOWN ON PLANS AND/OR ARBORIST REPORT, AND SHALL COMPLETELY ENCIRCLE TREE(S).
3. TREE PROTECTION FENCING TO BE INSTALLED PRIOR TO ANY LAND DISTURBANCE ON SITE.
4. FENCING SHALL NOT BE MOVED OR REMOVED UNLESS APPROVED BY THE VPB ARBORIST.
5. NO STOCKPILING OF MATERIALS, VEHICULAR TRAFFIC OR STORAGE OF EQUIPMENT OR MACHINERY SHALL BE ALLOWED UNLESS APPROVED BY THE VPB ARBORIST.
6. WORK WITHIN PROTECTION FENCE SHALL BE DONE MANUALLY UNDER THE SUPERVISION OF THE VPB ARBORIST AND WITH PRIOR APPROVAL.
7. WHERE SOME EXCAVATE OR FILL HAS TO BE TEMPORARILY LOCATED NEAR A TREE PROTECTION BARRIER, PLYWOOD MUST BE USED TO ENSURE NO MATERIAL ENTERS THE TREE PROTECTION ZONE.
8. FENCING MUST REMAIN THROUGH THE DURATION OF ALL CONSTRUCTION ACTIVITIES. REMOVAL OR RELOCATION OF FENCING FOR TEMPORARY ACCESS MUST BE REPLACED DAILY AND IMMEDIATELY UPON COMPLETION OF WORK REQUIRING ACCESS.



DRAWING
TREE PROTECTION BARRIER
FENCING

DATE
JUNE-2022

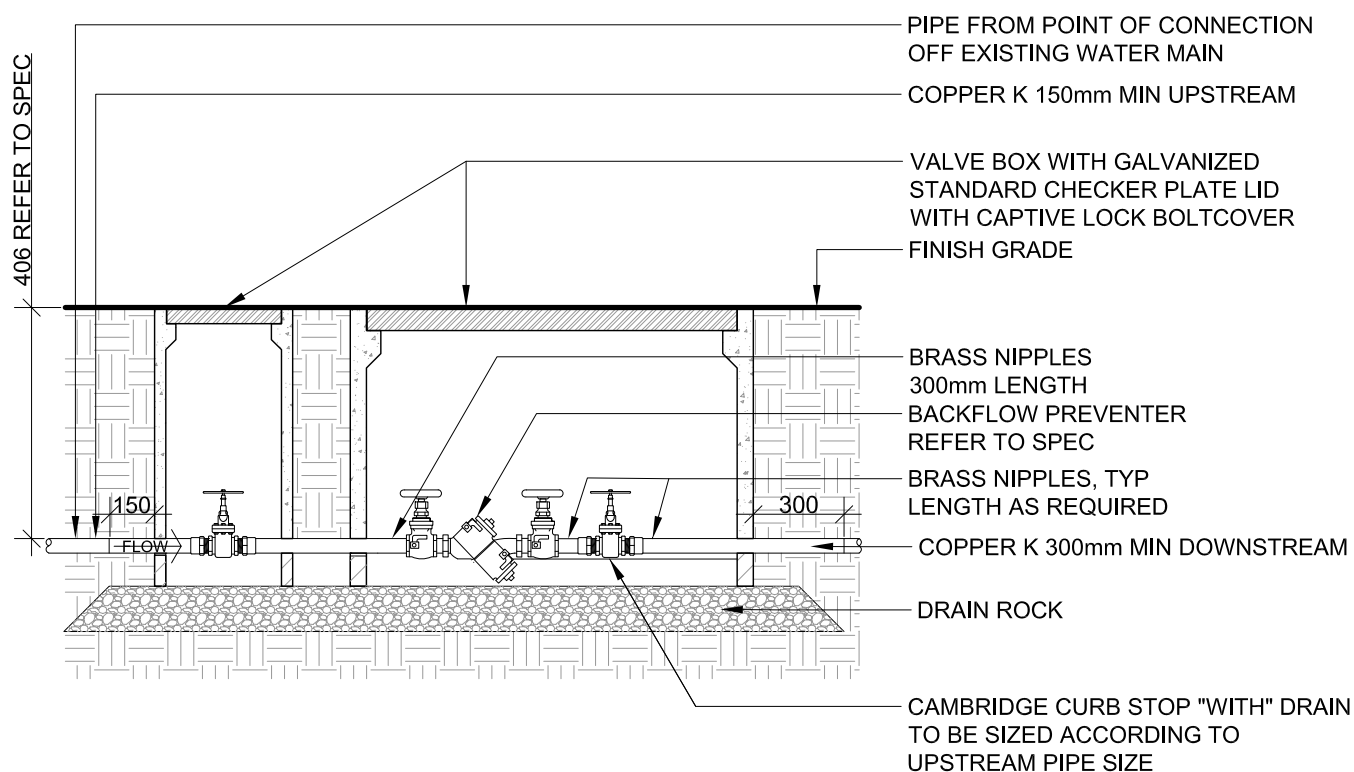
REV

SCALE
1:25

NOTES

SHEET

8-06



NOTE:

1. ENSURE ALL DIMENSIONS AND CLEARANCES COMPLY WITH MANUFACTURER'S INSTALLATION RECOMMENDATIONS
2. INSTALLATION MUST BE APPROVED BY LOCAL PLUMBING INSPECTOR
3. ALL MATERIALS TO BE IN ACCORDANCE WITH CURRENT BC PLUMBING CODES
4. UTILITY BOX SHOWN FOR BACK FLOW PREVENTER IS DIAGRAMMATIC
5. PROVISIONS FOR FREEZING WINTER CONDITIONS ARE NOT SHOWN. WHERE CLIMATE REQUIRES, THEY SHALL BE ADDED TO MEET THE REQUIREMENTS OF THE CITY ENGINEER
6. INCLUDE WATTS PRESSURE REDUCING VALVE FOR 25mm LINE
7. RISERS (IF NEEDED, BY AE CONCRETE OR PRE-APPROVED EQUAL)



DRAWING
BACKFLOW PREVENTER

DATE
JUNE-2022

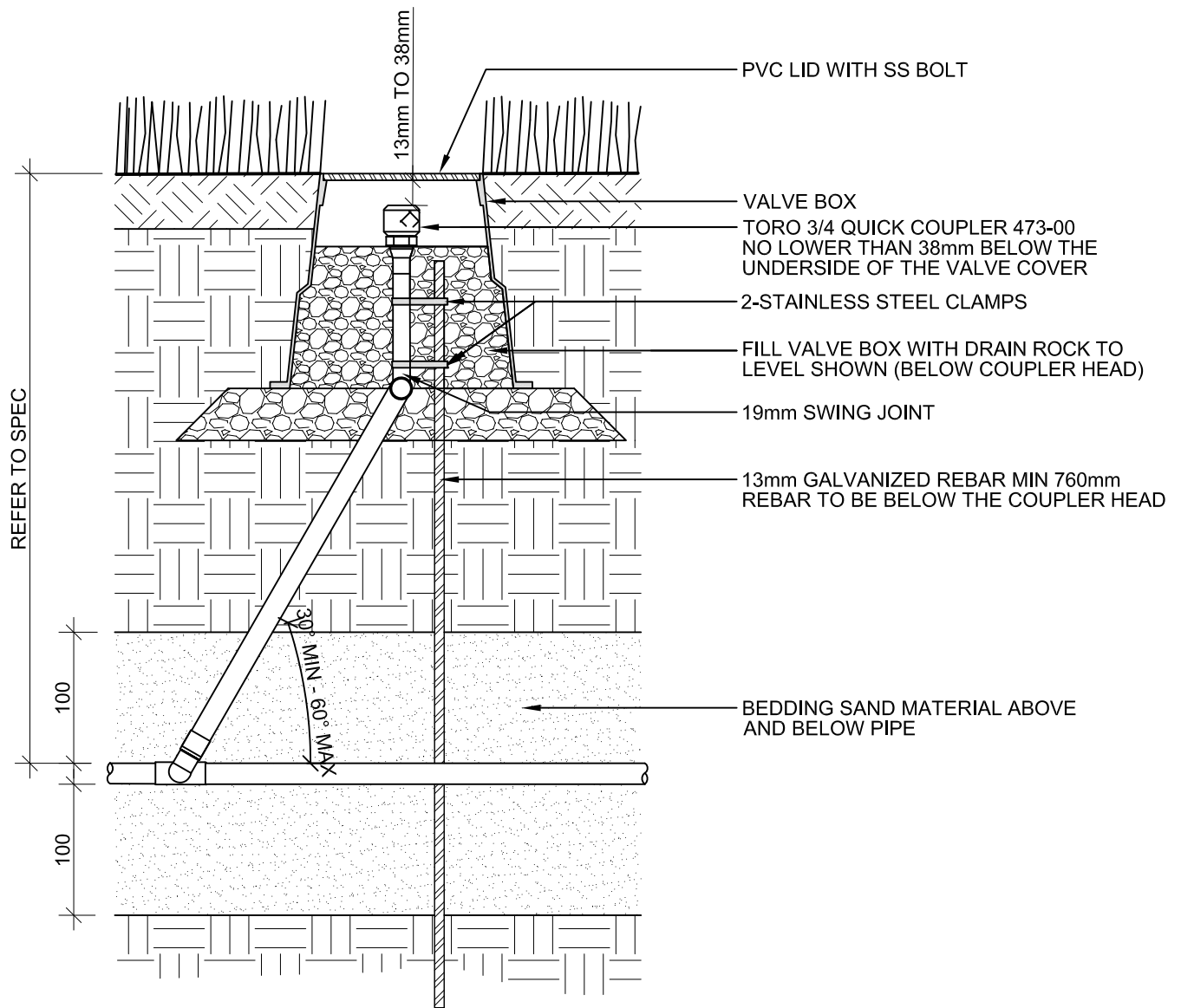
REV

SCALE
1:25

NOTES

SHEET

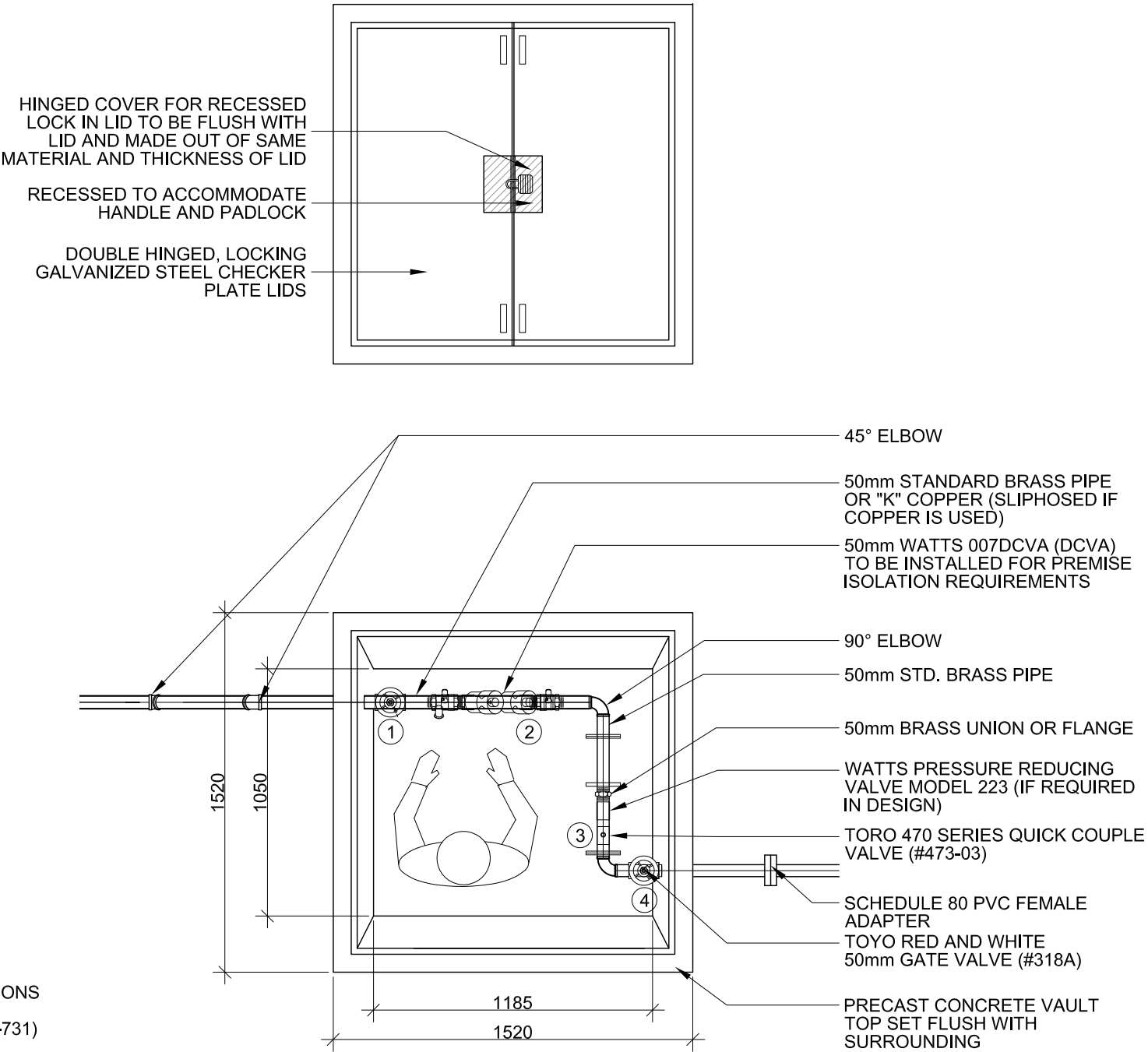
9-01



| BILL OF MATERIALS | | | COMPONENT MODEL NUMBER FOR REQUIRED PIPE SIZES | | |
|-------------------|-----|--|--|---------|--------|
| ITEM | QTY | DESCRIPTION | 38mm | 50mm | 76mm |
| 1 | 2 | 45 ° ELBOW | - | - | - |
| 2 | - | 50mm STANDARD BRASS PIPE | - | - | - |
| 3 | 1 | WATTS 007 (DCVA) 50mm DOUBLE CHECK VALVE ASSEMBLY OR "ALTERNATIVE ACCEPTABLE WILKINS (DCVA)" | 950 XLT | 950 XLT | 350 |
| 4 | 1 | 90° ELBOW | - | - | - |
| 5 | 1 | 1.5m SERVICE VAULT - K/O (A.E.CONCRETE PRECAST PRODUCTS) | - | - | * |
| 6 | 1 | RAINBIRD PEB | 910P | 910P | 910P |
| 7 | 1 | TORO 470 SERIES QUICK COUPLE VALVE | 473-03 | 473-03 | 473-03 |
| 8 | 2 | TOYO RED AND WHITE 50mm GATE VALVE | 318A | 318A | 272A |
| 9 | 1 | SCHEDULE 80 PVC FEMALE ADAPTER | - | - | - |
| 10 | 2 | PIPE SUPPORTS TO BE BOLTED TO BASE | - | - | - |
| 11 | 1 | MAINLINE BACKFLOW TERMINAL VALVE AND ASSEMBLY | 4963P | 49663P | 4963P |
| 12 | 1 | WATTS PRESSURE REDUCING VALVE (IF REQUIRED IN DESIGN) | 223 | 223 | N223B |
| 13 | 1 | 470 QUICK COUPLER WITH TRIPLE SWING JOINT. | - | - | - |
| 14 | 2 | UNISTRUTS AND CLAMPS | - | - | - |
| 15 | 1 | IPEX DWV HUB # 017494 | - | - | - |

NOTE:

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE INDICATED
2. VAULT SIZE MAY VARY DUE TO PIPE SIZE AND COMPONENTS REQUIRED
3. SITE MEASURED CONCRETE VAULT TO CONFIRM DIMENSIONS PRIOR TO FABRICATION
4. WIRING TO BE #12AWG, COPPER STANDARD, COLOR CODED IN ACCORDANCE WITH SPECIFICATIONS
5. RIGID PVC TO BE CONTINUOUS BETWEEN KIOSK AND VAULT
6. 50mm METER TO BE INSTALLED (CALL DAN WALKER TO ARRANGE METER INSTALLATION 604-873-731)
7. ALL BREAKS OR IN CONCRETE TO BE PARGED WITH GROUT. VAULT TO BE MASTIC COATED
8. PADLOCK POCKET TO BE WELDED TO FRAME
9. ALL PIPING ENTERING AND EXITING THE VAULT SHOULD BE COPPER OR BRASS



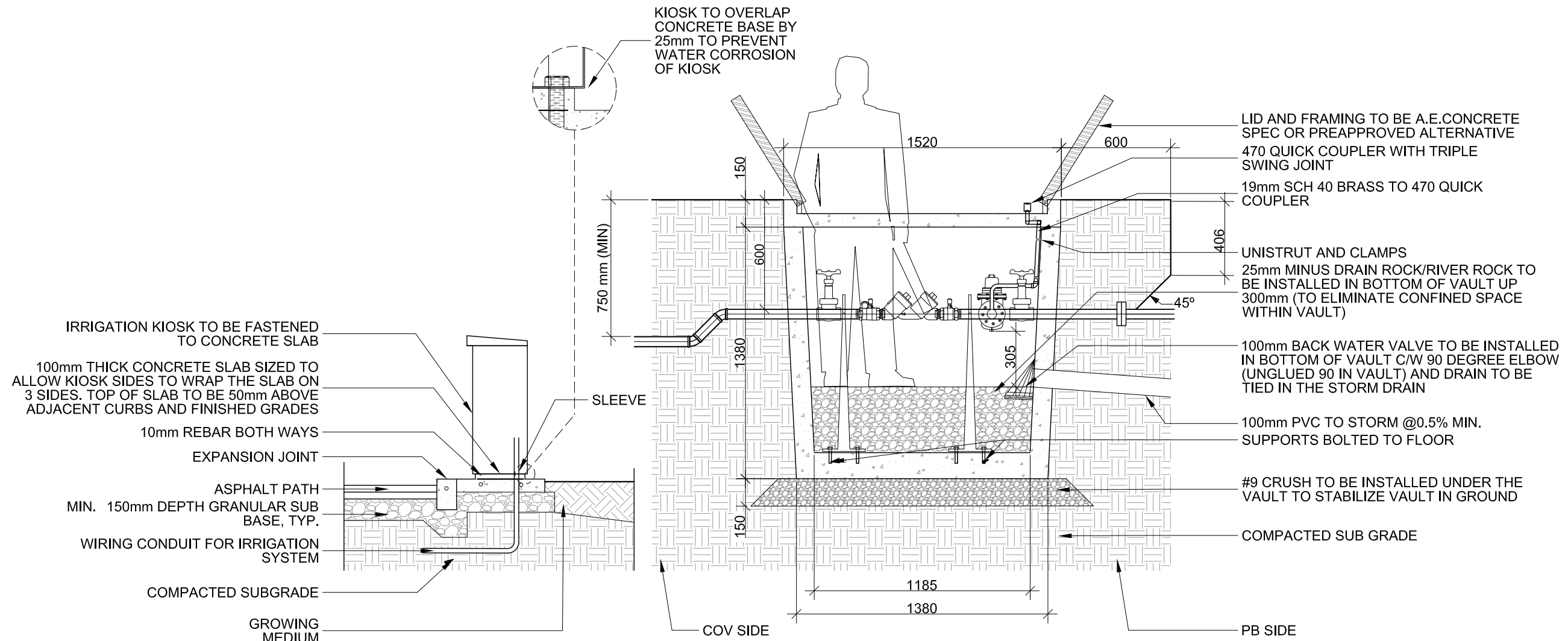
DATE
JUNE-2022

REV

SCALE
1:25

DRAWING
IRRIGATION VAULT
PAGE 1 OF 2

SHEET
9-03-1



DATE
JUNE-2022

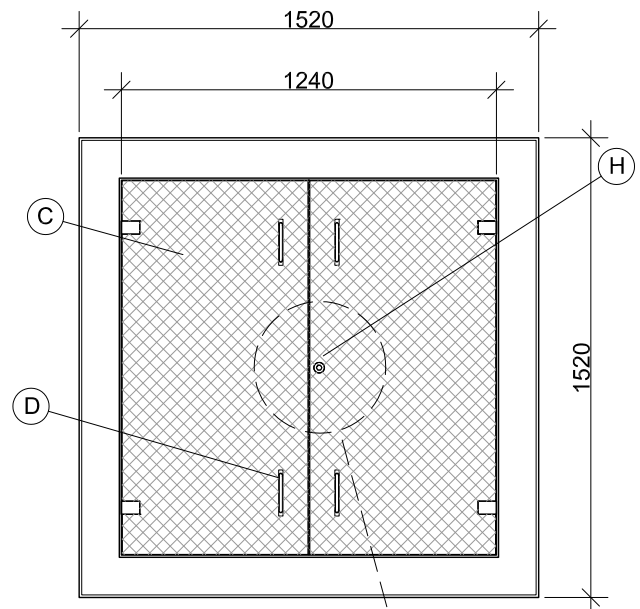
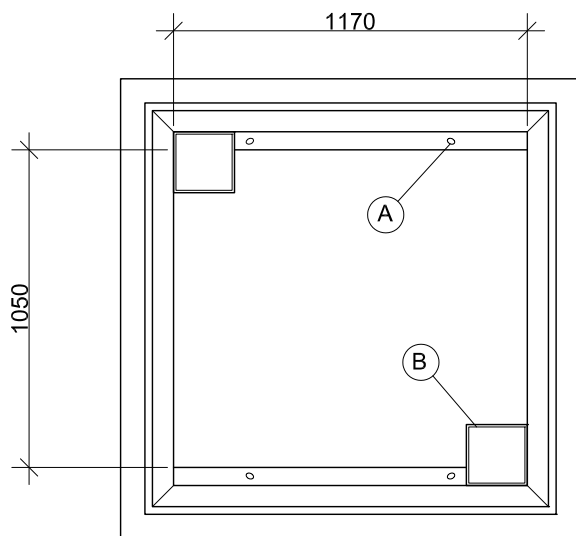
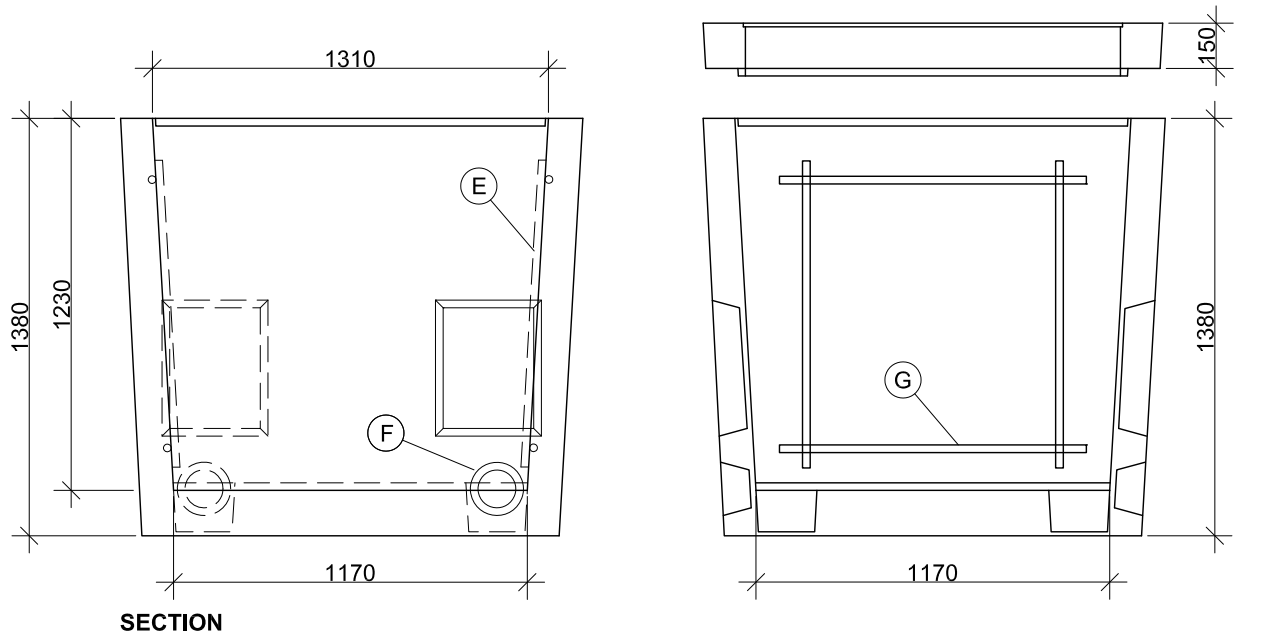
REV

SCALE
1:25

DRAWING
IRRIGATION VAULT
PAGE 2 OF 2

SHEET

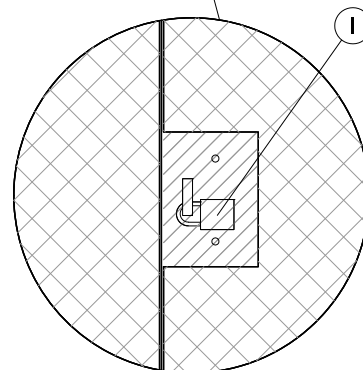
9-03-2



- A. 25mm INSERT TYP OF 4
- B. SUMP
- C. GALVANIZED STEEL CHECKER PLATE COVER
- D. LIFTING HANDLE
- E. 4 PIECES CABLE RACKING (1015mm LONG)
- K. K/OUT
- G. 4 PIECES UNISTRUT P-3270 (1015mm LONG)
- H. BOLT DOWN COVER AND RECESSED LOCK CONFIGURATION TO BE DETERMINED BY VPB
- I. OPTIONAL RECESSED PADLOCK WITH GALVANIZED STEEL COVER PLATE

NOTE:

1. SUPPLIER: AE CONCRETE PRECAST PRODUCTS LTD.



DRAWING
1.5M SERVICE VAULT

DATE
JUNE-2022

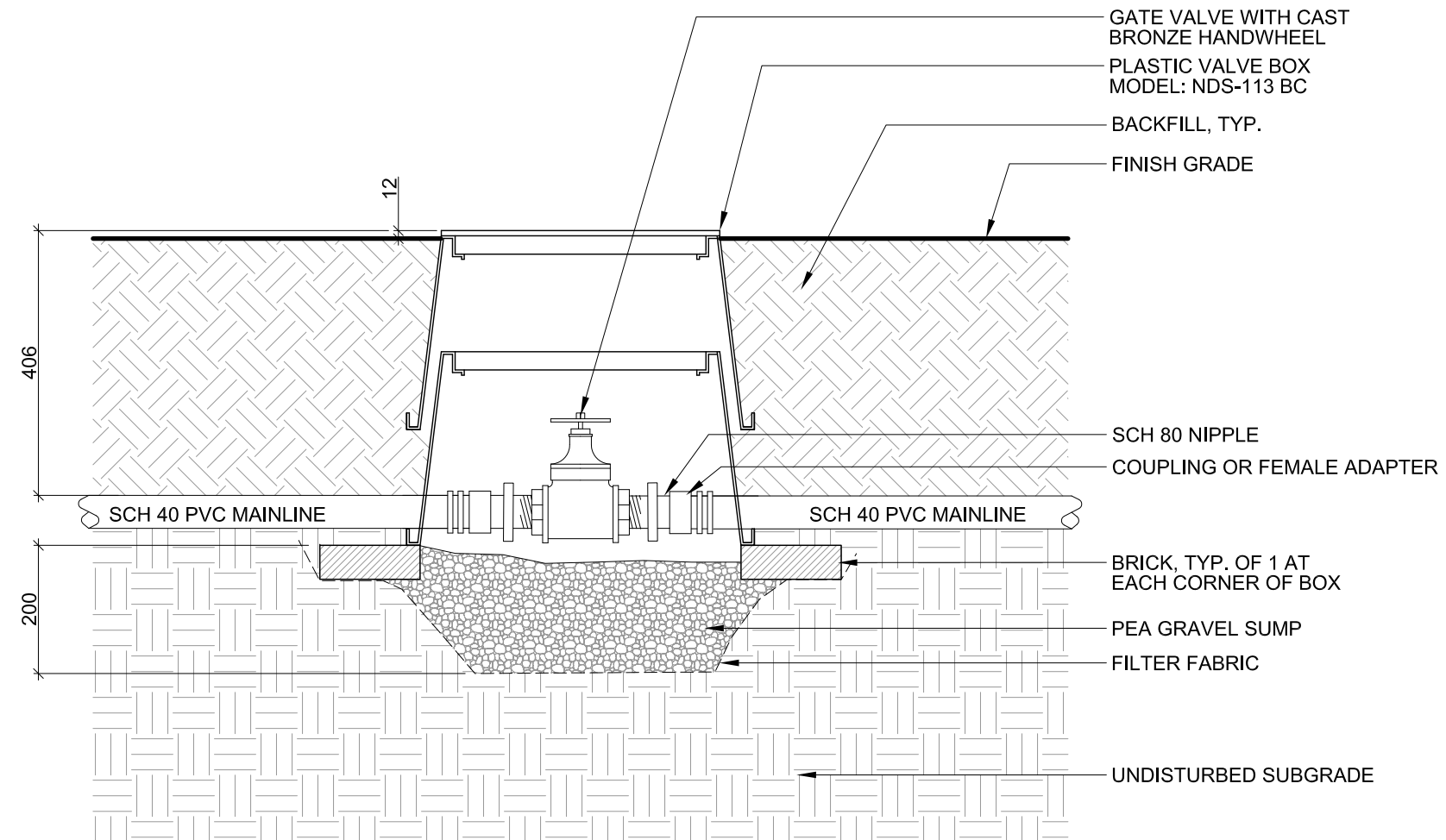
REV

SCALE
1:25

NOTES

SHEET

9-04



DATE
JUNE-2022

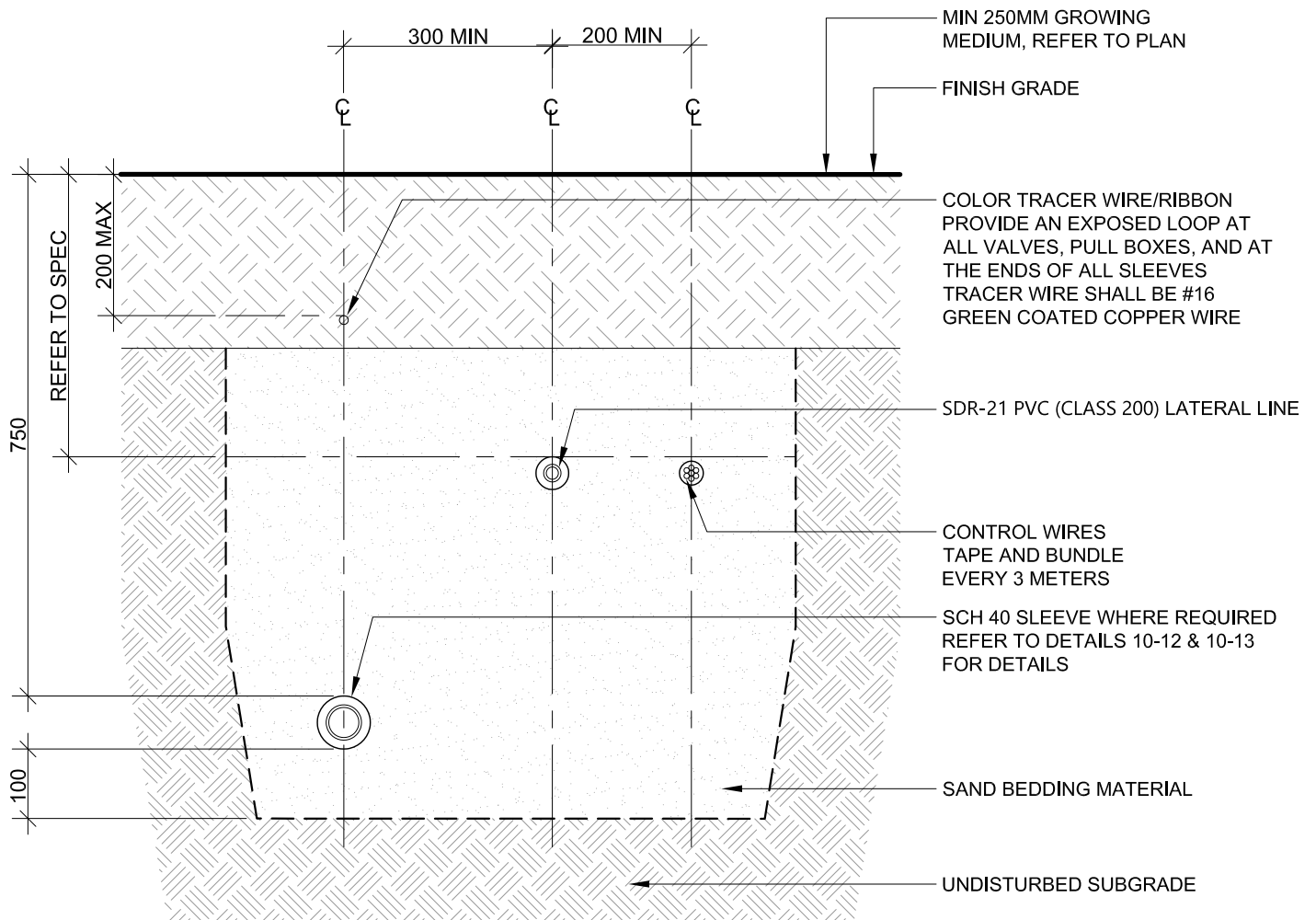
REV

SCALE
1:10

DRAWING
IRRIGATION MAINLINE
ISOLATION VALVE

SHEET

9-05



NOTES:

1. ALL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. IRRIGATION PIPING TO BE SLEEVED AT ALL LOCATIONS WHERE INSTALLED UNDER PAVED SURFACES.
REFER TO DETAILS 10-12 & 10-13 FOR SLEEVING DETAILS.



DRAWING
IRRIGATION TRENCHING

DATE
JUNE-2022

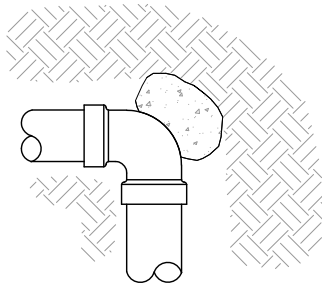
REV

SCALE
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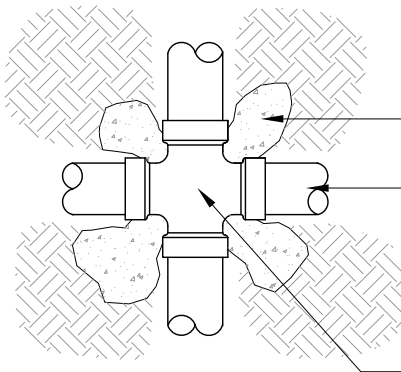
NOTES

SHEET

9-06



ELL

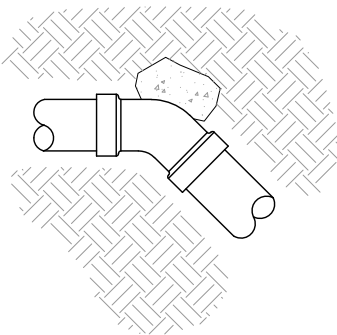


CROSS

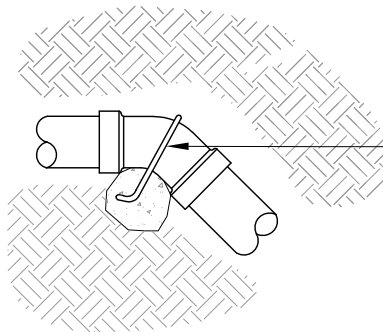
CONCRETE THRUST BLOCK
(TYP.)

PIPE (TYP.)

FITTING (TYP.)

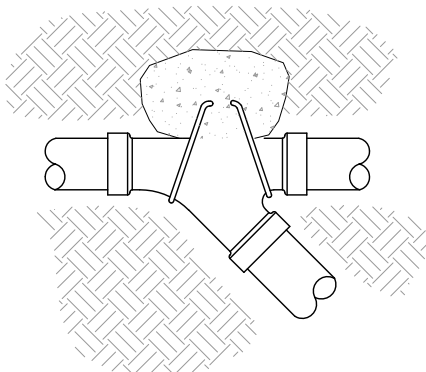


45° ELL

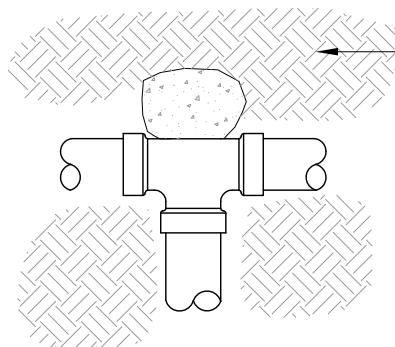


45° ELL

ANCHOR ROD (TYP.)



WYE



TEE

UNDISTURBED SOIL
(TYP.)

NOTES:

1. PLASTIC PIPE SHALL BE INSTALLED ACCORDING TO THESE DETAILS, UNLESS OTHERWISE NOTED ON THE PLANS.
2. SUPPLY LINES 50mm OR LARGER SHALL RECEIVE CONCRETE THRUST BLOCKS.
3. ALL ANCHOR RODS SHALL BE GALVANIZED STEEL, MIN. 12mm Ø.
4. SIZE OF THRUST BLOCK: 50mm-75mm PIPE = 4 CU. FT., 100mm PIPE = 5 CU. FT., 150mm PIPE = 6 CU. FT.
5. WRAP ALL EPOXY COATED FITTING W/ 6 MIL PLASTIC PRIOR TO POURING THRUST BLOCK.
6. ALL THRUST BLOCKS SHALL BEAR AGAINST UNDISTURBED SOIL.



DRAWING
THRUST BLOCKS

DATE
JUNE-2022

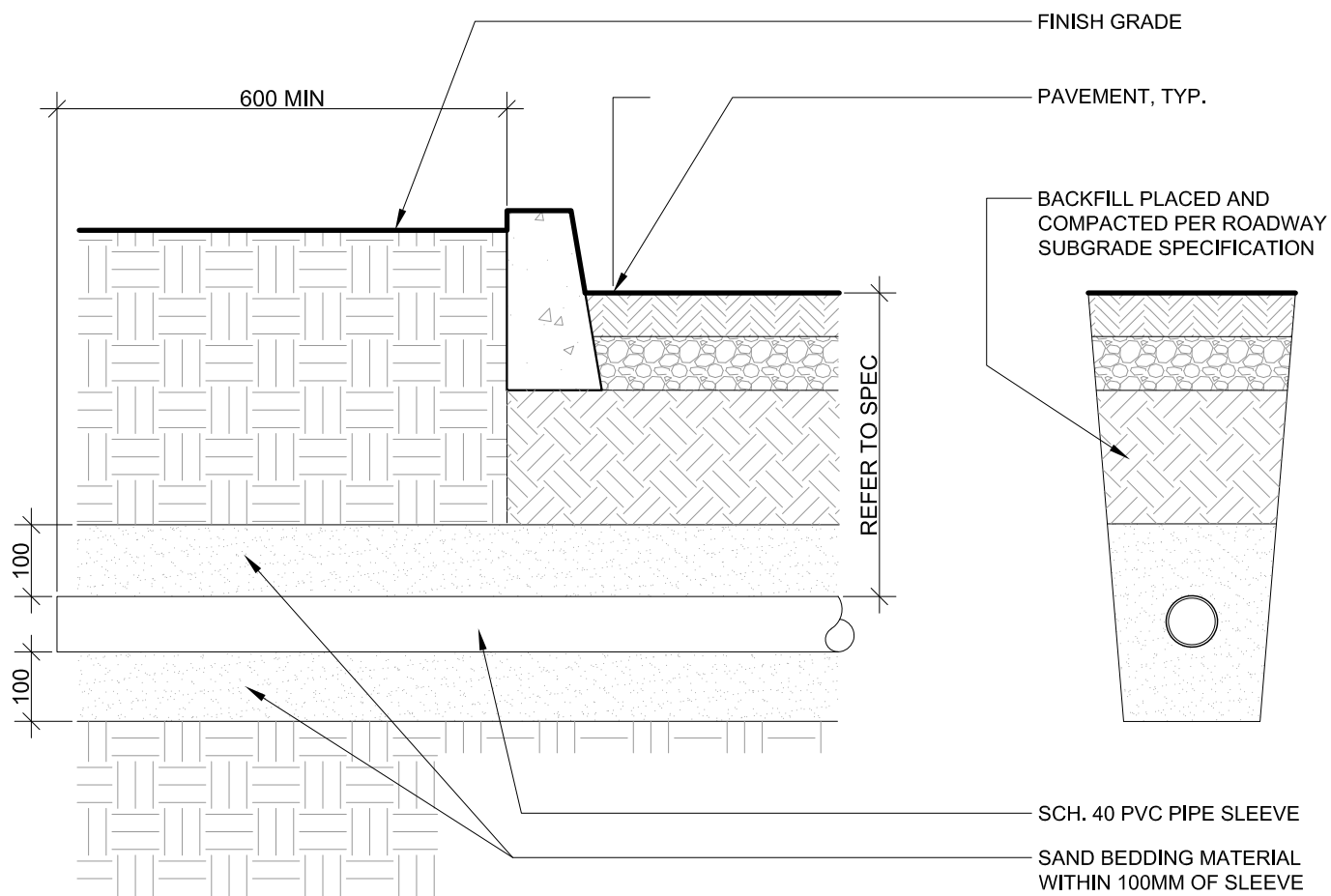
REV

SCALE
1:5

NOTES

SHEET

9-07



NOTE:

1. DIAMETER OF SLEEVE PIPE TO BE 25mm LARGER THAN DIAMETER OF IRRIGATION PIPE. IF SLEEVING MULTIPLE PIPES, SLEEVE DIAMETER TO BE 25mm LARGER THAN THE COMBINED TOTAL OF ALL PIPES.



DRAWING
SLEEVE AT STREET OR
PARKING

DATE
JUNE-2022

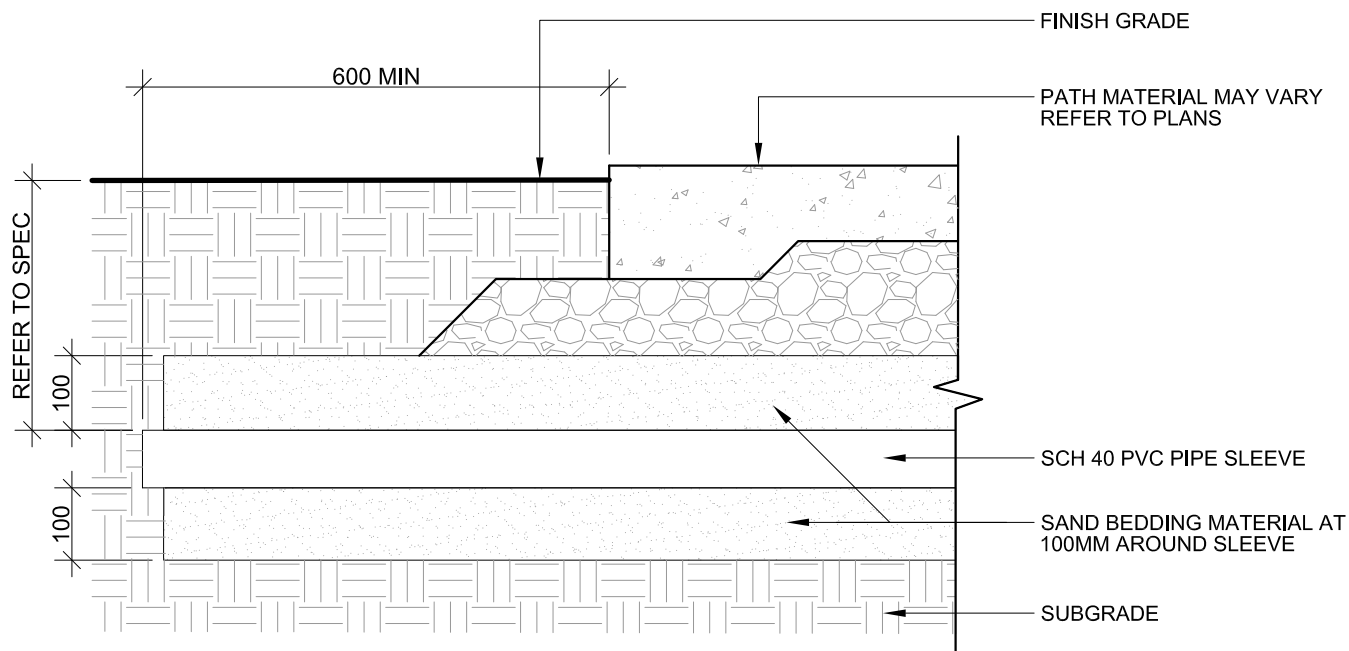
REV

SCALE
1:10

NOTES

SHEET

9-08



NOTE:

1. DIAMETER OF SLEEVE PIPE TO BE 2X LARGER THAN DIAMETER OF IRRIGATION PIPE.
2. IF SLEEVING MULTIPLE PIPES, SLEEVE DIAMETER TO BE 25mm LARGER THAN THE COMBINED TOTAL OF ALL PIPES.
3. WIRES TO BE LOCATED IN SEPARATE CONDUIT
4. PVC SLEEVING IS ACCEPTABLE, EXCEPT IN VEHICULAR PATHWAYS



DRAWING
SLEEVE AT PATH

DATE
JUNE-2022

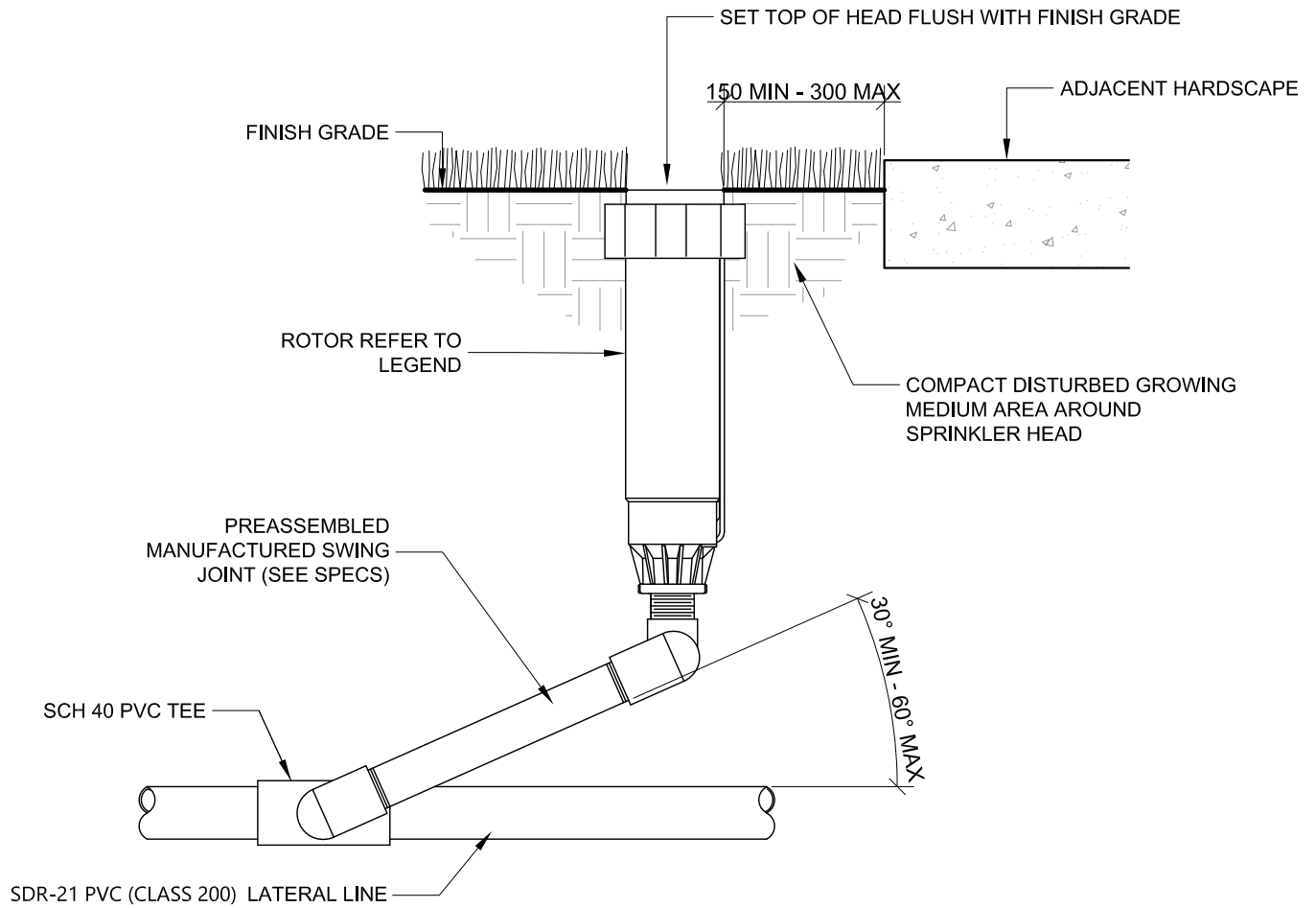
REV

SCALE
1:10

NOTES

SHEET

9-09



NOTE: STREET ELBOW SIZE TO INLET OF SPRAY HEAD



DRAWING
ROTOR SPRAY HEAD

DATE
JUNE-2022

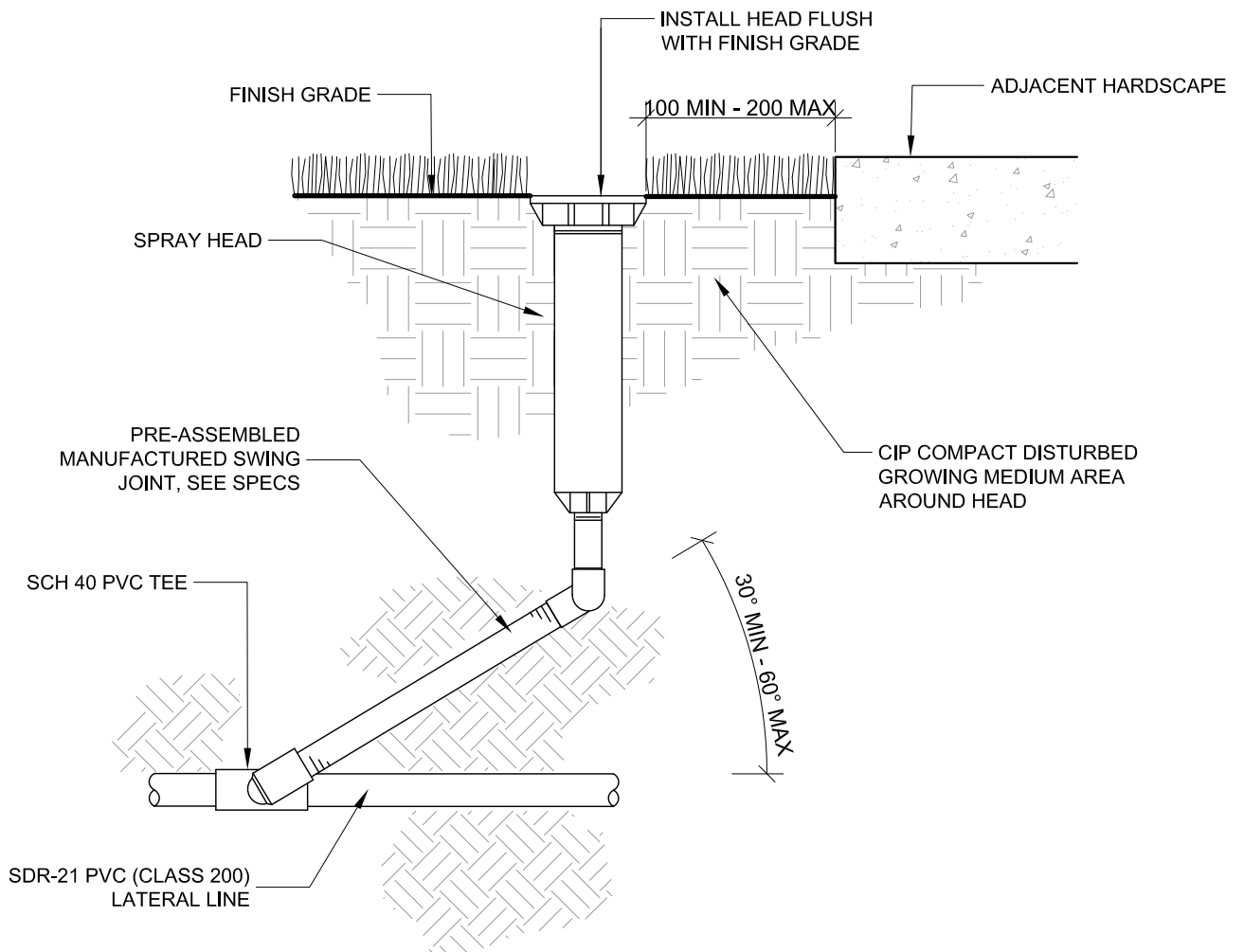
REV

SCALE
1:10

NOTES

SHEET

9-10



NOTE: STREET ELBOW SIZE TO INLET OF SPRAY HEAD



DRAWING
POP-UP SPRAY HEAD

DATE
JUNE-2022

REV

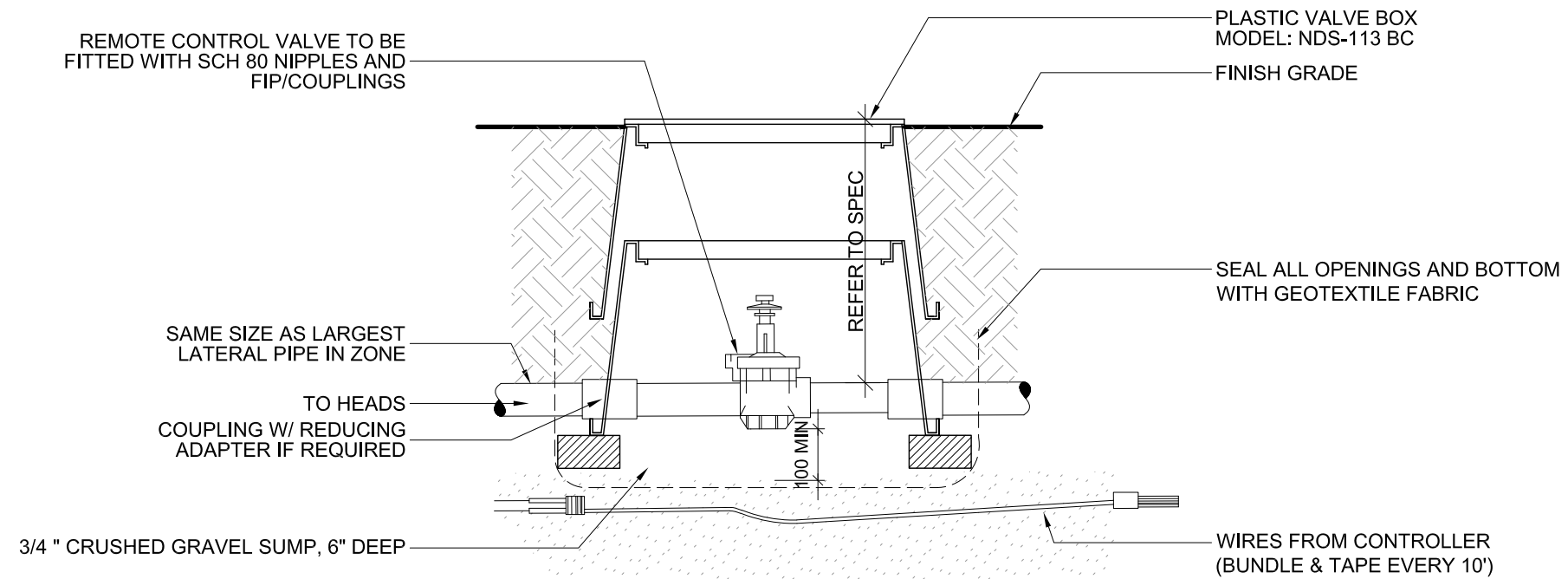
SCALE
1:10

NOTES

.

SHEET

9-11



NOTES:

1. ALL WIRE TO BE INSTALLED & SUPPLIED PER LOCAL CODE.
2. PROVIDE EXPANSION COIL AT EACH CONNECTION IN VALVE BOX (COIL WIRE AROUND 1/2" PIPE 10 TIMES).
3. VALE WILL BE SIZED ACCORDING TO FLOW REQUIRED.

DATE
JUNE-2022

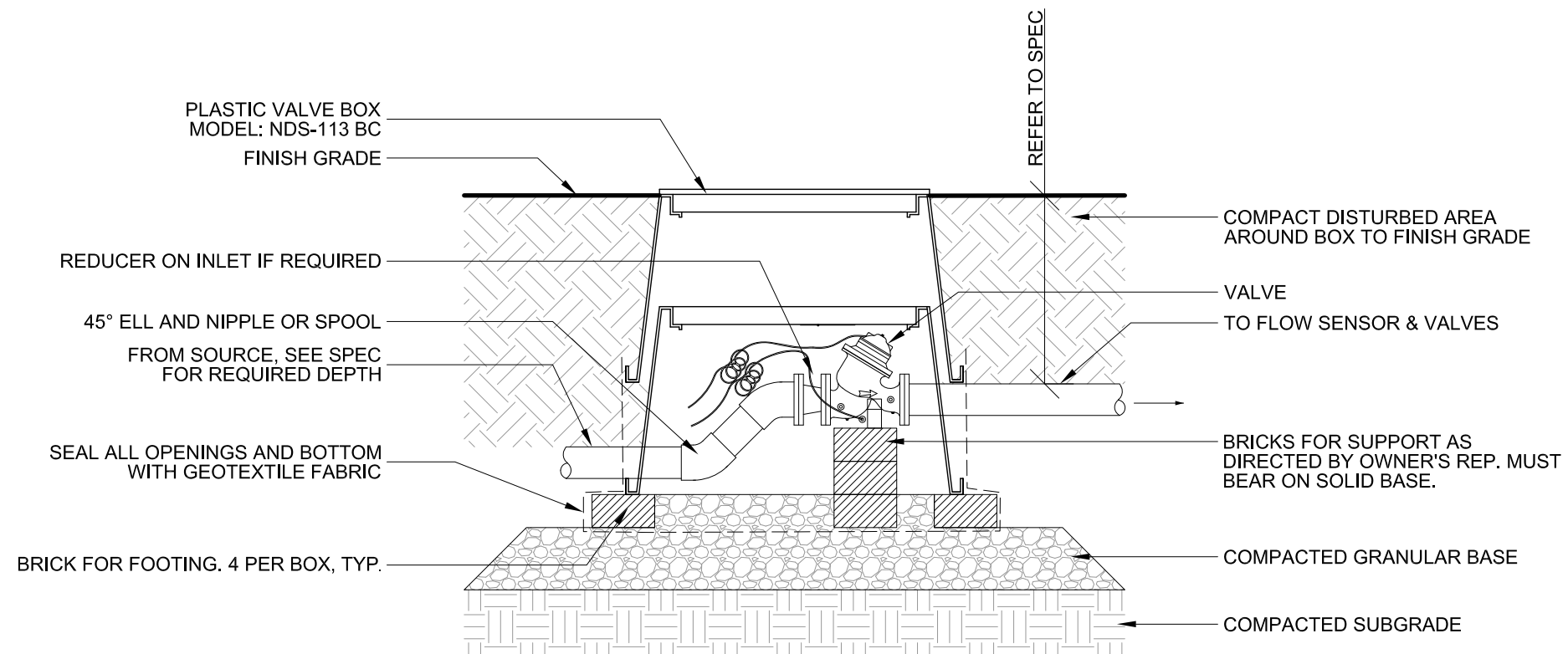
REV

SCALE
1:10

DRAWING
REMOTE CONTROL
VALVE ASSEMBLY

SHEET

9-12



NOTES:

1. SEE PLAN & SPECIFICATIONS FOR OPTIONS REQUIRED ON VALVE APPLICATIONS (SUCH AS, N.O./N.C./PRESS. REG., LOW WATT SOLENOIDS)
2. FOR VALVES 3" AND LARGER USE FLANGED MASTER VALVE IRON FITTINGS INCLUDING 45° ELLS AND REDUCERS. FOR VALVES 2 1/2" AND SMALLER USE THREADED MASTER VALVE AND SCH. 80 PVC FITTINGS. 45° ELLS TO BE SxS.

DATE
JUNE-2022

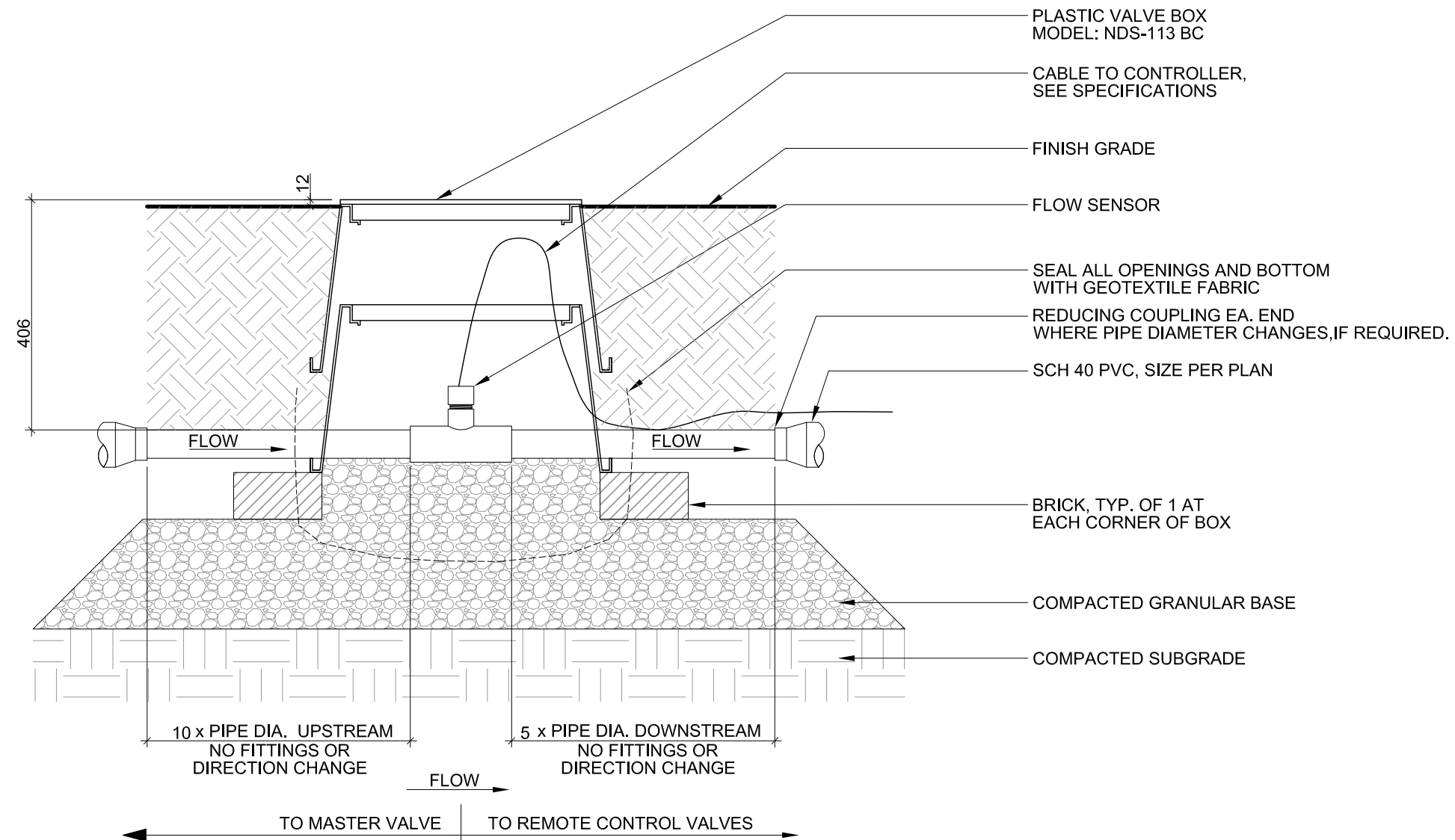
REV

SCALE
1:20

DRAWING
MASTER VALVE
ASSEMBLY

SHEET

9-13



NOTE:

STREET ELBOW SIZE TO INLET OF SPRAY HEAD

DATE
JUNE-2022

SCALE
1:10

DRAWING

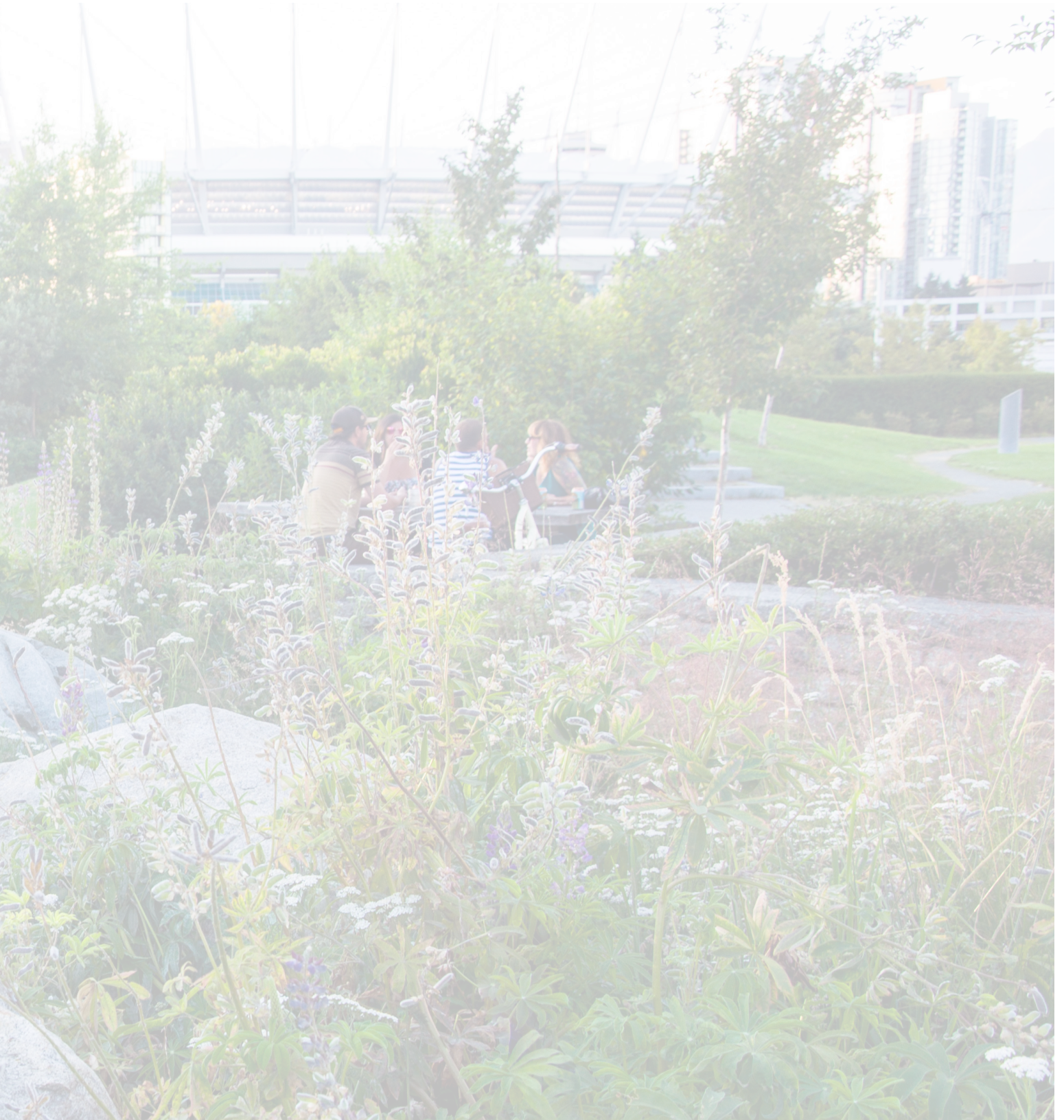
FLOW SENSORY ASSEMBLY

SHEET

9-14

SPECIFICATIONS





STANDARD TECHNICAL SPECIFICATIONS

| | |
|-------------|--|
| 00 00 00 | List of Submittals |
| 00 65 00 | Contract Closeout |
| 01 33 23 | Shop Drawings and Product Data |
| 01 89 13 | Site Preparation and Grading |
| 02 41 13 | Selective Site Demolition |
| 03 10 00 | Concrete Forming and Accessories |
| 03 20 00 | Concrete Reinforcing |
| 03 33 00 | Cast-In-Place Concrete Non Flatwork |
| 03 35 00 | Concrete Finishing |
| 03 35 10 | Abrasive Blast Finish |
| 03 45 00 | Precast Architectural Concrete |
| 04 43 00 | Miscellaneous Stone Work |
| 05 70 00 | Miscellaneous Metal |
| 06 40 13 | Exterior Architectural Woodwork |
| 09 96 00 | Exterior Painting and Powder Coating |
| 11 68 13 | Play Equipment |
| 13 12 13 | Water Feature |
| 31 11 00 | Clearing and Grubbing |
| 31 23 10 | Excavation and Backfill |
| 32 01 56 | Tree Protection |
| 32 01 90 | Landscape Maintenance |
| 32 12 16 | Hot Mix Asphalt Paving |
| 32 13 13 | Cast-In-Place Concrete Paving |
| 32 13 13.16 | Concrete Paving – Exposed Aggregate |
| 32 14 13 | Precast Concrete Unit Paving |
| 32 14 40 | Stone Paving |
| 32 14 43 | Precast Concrete Unit Paving – Permeable |
| 32 15 40 | Crushed Granular Paving |
| 32 17 23.13 | Painted Pavement Markings |
| 32 18 23 | Sand Playing Field |
| 32 31 13 | Chain Link Fences and Gates |
| 32 37 00 | Exterior Site Furnishings |
| 32 80 00 | Irrigation System |
| 32 91 13 | Growing Medium |
| 32 91 13.33 | Growing Medium – Pond |
| 32 91 21.03 | Growing Medium – Structural |
| 32 92 19 | Mechanical Seeding |
| 32 92 21 | Hydraulic Seeding (Hydroseeding) |
| 32 92 23 | Sod Lawn |
| 32 93 10 | Plants and Planting |
| 32 96 43 | Tree Digging and Relocation |
| 33 46 16 | Subsurface Drainage Systems |
| 33 47 13.13 | HDPE Pond Liner |

STANDARD TECHNICAL OUTLINES

| | |
|----------|--------------------|
| 00 00 00 | Electrical Outline |
|----------|--------------------|

INSTRUCTIONS FOR EDITING VPB STANDARD TECHNICAL SPECIFICATIONS

The following Technical Specification sections are provided to the Consultant for use in the preparation of contract document package that describes how the Contractor shall execute the Work. Each section has instructions to the Consultant at the beginning describing how to edit the Microsoft Word version of that section. Text identified in *bold and italics* is intended to be reviewed and edited based on individual project conditions.

The Consultant shall always use the VPB Standard Technical Specifications unless otherwise directed by the VPB Project Manager.

Additional sections may need to be included if not provided, based on project conditions. Similar formatting of those sections is required.

[illegible]

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 Substantial Performance, Final Review, delivery of Bonds and Warranties, submittal of Maintenance Manual, and Project Record Documents, Delivery of Release of Liens, and Warranty.

1.3 Related Work

- .1 Landscape Maintenance Section 32 01 90

PART 2: PRODUCTS

2.1 Deficiency list

- .1 Owner's representative shall conduct site inspection with contractor and project consultant. Identify any deficiencies that are required to correct as per the contract documents.
 - .1 The deficiency list should include project name, date, name of consultant, deficiency items, related descriptions why the item is deficient and actions required for correction.
 - .2 The deficiency list should include value for each deficiency items.
 - .3 The deficiency list should include spaces for completion time and consultant's verification.
 - .4 The deficiency should be prepared by consultant. A deficiency list example is as below:

| Item Number | Location/Zone | Description | Value (\$) | Completion Date | Consultant Verification |
|-------------|---------------|-------------|------------|-----------------|-------------------------|
| | | | | | |

2.2 Operation and Maintenance Instructions

- .1 The Contractor shall furnish one (1) digital version in current PDF file format and two (2) paper hard copies of complete sets of manuals, containing the manufacturer's instructions for maintenance and operation of each item of equipment and apparatus furnished under the Contract and any additional data specifically required under the Specifications for each division of the work. The manuals shall be arranged in the order that these items appear in the Specifications and shall be indexed, substantially bound and titled. Manuals shall be project specific and shall not include items that are not a part of this project.
- .2 Manuals shall be delivered to the Owner's Representative prior to application for final payment and as a condition of approval of final payment.

2.3 Project Warranty

- .1 The Contractor shall deliver to the Owner's Representative upon completion of all work under the Contract, a written warranty addressed to the Owner on the Contractor's letterhead. This warranty shall be made **to cover a period of one year from date of Substantial Performance** under the contract as determined by the Owner's Representative.
- .2 Warranties from Contractor shall be organized as required by Specification Section including individual warranties from each trade, subcontractor, manufacturer or supplier. Where specific sections of the Specifications call for longer warranties, these time periods shall so be stated. Warranties shall be delivered to the Owner's Representative prior to application for final payment and as a condition of approval of final payment.

2.4 Project Record Documents

- .1 Throughout the progress of the work, maintain an accurate record of all changes in the Contract Documents.
- .2 Record Documents shall be protected from loss, damage, or deterioration until completion of the work and transfer of data to the final Record Documents.
- .3 All entries to the Record Documents shall be made within 48 hours of receipt of information.
- .4 Upon completion of work, and as a condition of Acceptance of Work, transfer the recorded changes to a set of Record Documents and submit to the Owner's Representative. This will include, but not be limited to, as-built drawings in digital format using current PDF, AutoCAD file formats as well as printed hard-copies. The CAD file should be in NAD 1983 UTM Zone 10 coordinate system.

PART 3: EXECUTION

3.1 Contract Closeout Procedure

- .1 This Section outlines administrative and procedural requirement for contract closeout, which will be conducted in accordance with a specific take-over process as follows:

.1 Preparation of Deficiency List,

.1 Contractor shall notify the consultant and owner when the project is ready for Substantial Performance review.

.2 Owner's Representative shall conduct an inspection of the work with contractor and project consultant, and prepare deficiency list as described in the above section.

.2 Submission of Project Closeout Document.

.1 Contractor to provide the following Project Closeout Document prior to the declaration of Substantial Performance:

.1 Submit Specific Warranties and Bonds

.2 Maintenance Service Agreements

.3 Test results, include but not limited to concrete testing, coating and paint testing, soil testing, water testing as required

.4 Design record drawings

.5 Operations/maintenance manuals, tools, equipment, spare parts, extra materials, and similar items

.6 Certificates and Permits as per project specifications

.7 Final construction photos

.8 System Demonstration and Instruction to Owner and Owner's Representative

.3 Declaration of Substantial Performance:

.1 Deficiency items have been completed and corrected by contractor.

.2 Review and acceptance by Consultant and Owner's Representative prior to posting of Declaration of Substantial Performance.

.3 Submittal of Declaration of Substantial Performance in accordance with Builders Lien Act of British Columbia signifying that:

a. Project is ready to be turned over to the Owner

b. Application for Final Payment is completed; and,

c. Commencement date for warranty obligations under contract has stated

.4 Administration of Lien Fund and other Holdback amount

.4 Final Review and Acceptance of Completed work

3.2 Final Review

- .1 Final Review will not be made until all work listed in the Deficiency List is completed. The Contractor shall notify Owner's Representative in writing at least five (5) days prior to date on which work will be ready for final review. Any delay in making Final Review shall not relieve the Contractor of responsibility for work, nor shall the Owner be held responsible for damages or claims for compensation due to continuing maintenance or other work occasioned by such delay.

If the Owner's Representative making the final review finds the work so far from completion to make a later visit necessary, or that undue delay in making final review is incurred, Contractor shall, if determined by the Owner, be liable for expenses to Owner incurred by reason of such delay or re-review.

3.3 Delivery of Bonds, Release of Liens, and Warranties

- .1 Bonds, Release of Liens, and Warranties shall be provided for those portions of this work where required by specific sections or as determined in the General Conditions of the Supplementary Conditions. Submittal of releases and warranties shall comply with conditions of the Contract.

3.4 Acceptance of Completed Work

- .1 When all work required by the Contract Documents for this project has been performed, furnished, and/or installed as specified in each specific section, acceptance of work covered by the Contract will be given by means of a Certificate of Completion and until such acceptance the Contractor will be responsible for work covered by the Contract. Contractor's responsibilities will cease, except as provided by the warranties, when acceptance of the work is given.

SAMPLE WRITTEN WARRANTY LETTER

Date: _____
Re: _____ (Title of Project)

Name and Address of Owner

[Enter Owner's Representative's Name]:

The undersigned attest to the Owner that the Contractor will warranty materials, equipment and workmanship under this contract, that the Contractor will remedy any defects and pay for any damage to related work and building contents resulting from said defects, which shall occur for a period of one (1) year from the date of certification of final completion by the Owner's Representative.

This warranty shall not be construed as to shorten the life of specific warranties/guarantees/bonds as required elsewhere under this contract.

During this period, upon written notice to do so, the Contractor will proceed with due diligence, at the Contractor's expense, to properly replace any defective materials and/or equipment and to perform any labor necessary to correct any defect in the work.

In the event that the Contractor fails upon reasonable notice to remedy such defects, the Owner may furnish such materials or labor as necessary to place work in the condition required by the Contract Documents, and the Contractor agrees to reimburse the Owner fully and promptly for his expense.

Signature and Name of Contractor

ATTEST: (Signature must be notarized)

END OF SECTION 00 65 00

PART 1: OBJECTIVE

1.1 Objective

- .1 The objective of this outline is to provide electrical consultants with the Real Estate and Facilities Management (REFM) base requirements for electrical design. These minimum requirements must be incorporated in all electrical specifications, drawings and contract documents.
- .2 The REFM electrical contact shall be either the Electrical Superintendent or the Manager of Building Maintenance.

1.2 Regulatory Requirements

- .1 Electrical permit is required for all electrical work.
- .2 Submit a copy of final electrical inspection certificate to REFM.
- .3 REFM contact is to be invited to all site meetings and inspections.

1.3 Shop Drawing Approvals

- .1 After Consultant has reviewed the shop drawings and prior to returning to contractor, submit copy to REFM for their review.

1.4 ARC Flash Hazard Assessment

- .1 Include arc flash hazard assessment as per CSA Z462.
- .2 Provide REFM with related documents.

1.5 Wiring Methods

- .1 Conduits to be Electro-Metallic Tubing (EMT) or rigid galvanized steel for interior use.
 - .2 Conduits to be rigid PVC (RPVC) or DB2 where underground.
 - .3 All exposed interior wiring must be installed in conduit or surface raceway.
 - .4 Armoured cable type AC90 to be used only where concealed in walls.
 - .5 Underground conduits to be rigid PVC or DB2.
 - .6 Conduit stubbed out of the ground in public places to be adapted to Rigid Steel where they emerge.
 - .7 Conduit stubbed out of the ground in non-public areas may be RPVC.
 - .8 All EMT fittings to be Steel. No dye-cast fittings allowed.
 - .9 Underground wiring to be installed in conduits.
 - .10 Underground Armoured cables by permission of REFM only.
 - .11 Underground wiring depth to be min 1 meter except with special permission of REFM.
 - .12 All wiring (feeders and branch circuits) to be Copper only.
 - .13 Branch wiring minimum size #12.
-

- .14 Provide identification name tags on all pull and junction boxes.

1.6 Wiring Devices

- .1 All devices and products of each type to be of one manufacturer throughout project
- .2 Approved manufacturers are Hubbell, Bryant, Pass & Seymour, and Leviton or pre-approved equal.
- .3 Devices and products shall be specification grade.
- .4 Devices shall be suitable for #10 AWG and where outdoors, side wired only.
- .5 Exposed devices to have white or ivory enclosure colour or colour to suite wall colours.
- .6 Cover plates in public areas shall be stainless steel.
- .7 Cover plates in mechanical rooms may be galvanized 'Taylor' style.
- .8 Cover plates in outdoor areas to be 'in-use' style with pad lockable covers.

1.7 Panel Boards and Distribution

- .1 Approved manufacturers are Cutler Hammer or Square D only.
- .2 Breakers shall be bolt-on type only.
- .3 Provide identification name tags on all distribution equipment.

1.8 Interior Lighting

- .1 Provide commercially stocked luminaires when possible. Consult REFM for luminaire standards.
- .2 Luminaires in public areas to be vandal resistant.
- .3 Ensure luminaires are installed in readily accessible areas.
- .4 Lighting to be controlled, as a minimum, by room occupancy sensors and local switching. Provide control in accordance with the requirements of ASHREA 90.1 – 2010 where applicable.
- .5 Lighting to be swept off at night by the Mechanical Building Management system (DDC) in buildings with such control.
- .6 No compact fluorescent (CFL) style lighting allowed.
- .7 Recessed down lighting to use LED sources. LED sources to be supplied to standard LM80 at 50,000 hours.
- .8 Fluorescent lighting to use T-8 or T-5 lamps.

1.9 Exterior Lighting

- .1 Provide commercially stocked luminaires when possible. Consult REFM for luminaire standards.
 - .2 Lighting poles to be painted aluminum or galvanized steel. Consult REFM for pole standards.
-

- .3 Concrete bases shall be installed with the top of the base min 300 mm above finished grade.
- .4 Luminaires to be vandal resistant.
- .5 Luminaires to be shrouded or aimed to minimize glare to adjacent properties.
- .6 Fixtures to use LED sources where possible, otherwise use Metal Halide.
- .7 Lighting to be controlled by photo cell on/off with time clock backup and hand off auto switch to allow testing.

1.10 Hand or Hair Dryers

- .1 Hand dryers to be Dyson Air Blade V in sprayed nickel.
- .2 Hair dryers to be by World Dryer Air Style model B

1.11 Tests and Reports Required

- .1 Test results and reports to be submitted to REFM prior to final acceptance by REFM's Electrical Superintendent.
- .2 Infra-scan for each feeder termination.
- .3 Ground resistance report for grounding system.

1.12 As-built Drawings and Maintenance Manuals

- .1 ACAD Include As-built drawings to the same standard as the construction drawings. These drawings to include all completed changes.
- .2 Provide to REFM two copies of the printed maintenance manuals as well as a complete electronic copy, which will include all shop drawings, equipment manuals, preventative maintenance instructions, spare parts, etc.
- .3 Submit sample of maintenance manual for REFM approval.

END OF SECTION

INSTRUCTIONS FOR OWNER'S REPRESENTATIVES: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 specifies general requirements and procedures for the Contractor to make submissions of shop drawings, product samples and other submittals to Owner's Representative for review. Additional specific requirements for submissions are specified in individual sections. Submissions may include:
 - .1 Shop Drawings.
 - .2 Product Data.
 - .3 Product Samples
 - .4 Mock-Ups.

1.3 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 The Owner's Representative review of submittals made by the Contractor shall not relieve the Contractor from the responsibility for complying with contract drawings or specifications, unless the Contractor has secured the written approval of the Owner's Representative for all deviations.
- .3 Owner's Representative review for submittals shall not relieve the Contractor from responsibility for error and omissions in the submittals.
- .4 Submittals shall contain only those items specified and shall not include items which are not provided for under this contract unless they are clearly marked and/or voided as not being part of the contract.
- .5 Comply with progress schedule for a timely submission of submittals as they relate to work progress. Coordinate submittal of related items.
- .6 Allow 10 working days for Owner's Representative review of each submission.
- .7 Maintain submittal log to ensure timely and complete submittals.
- .8 Accompany submissions with transmittal letter containing:
 - .1 Date
 - .2 Project title and number

- .3 Contractor's name, address, telephone and facsimile
- .4 Contact person's name and position
- .5 Identification and quantity of each shop drawing, product data, and sample (if requested or required)
- .6 Other pertinent data
- .9 Submissions shall include:
 - .1 Date and revision dates
 - .2 Project title and number.
 - .3 Name, address telephone, facsimile, and contact person 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. Submittals, which do not contain this information, will be returned without being examined and shall be considered rejected.
- .10 Details of appropriate portions of Work as applicable:
 - .1 Fabrication
 - .2 Layout, showing dimensions, including identified field dimensions, and Clearances
 - .3 Setting or erection details
 - .4 Capacities
 - .5 Performance characteristics
 - .6 Standards
 - .7 Operating weight
 - .8 Wiring diagrams
 - .9 Single line and schematic diagrams
 - .10 Relationship to adjacent work
 - .11 Materials
 - .12 Finishes
- .11 After Owner's Representative review and written approval distribute copies to persons necessary to complete the work. Ensure one copy of reviewed submission is kept on site.

1.4 General Requirements

- .1 Work affected by the submittal shall not proceed until review is complete.
- .2 Present shop drawings, product data, samples, and mock-ups in the same units used in the contract documents.
- .3 Where items or information is not produced in SI Metric units converted values are accepted.

- .4 Contractor's responsibility for errors and omissions in submission is not relieved by Owner's Representative review and/or approval of submissions.
- .5 Notify Owner's Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Owner's Representative review of submission, unless Owner's Representative gives written acceptance of specific deviations.
- .7 Make any changes in submission which Owner's Representative may require consistent with Contract Documents and resubmit as directed by Owner's Representative.
- .8 Notify Owner's Representative, in writing when resubmitting, any revisions other than those requested by Owner's Representative.

1.5 Shop Drawings

- .1 Shop drawings: are defined as original drawings, or modified standard drawings, catalogue information, illustrations, schedules, performance charts, brochures and other product data provided by Contractor, to illustrate details of portions of Work, which are specific to project requirements.
- .2 Adjustments made on shop drawings by the Owner's Representative are not intended to change the Contract Price. If adjustments affect the value of work, state such in writing to the Owner's Representative prior to proceeding with work.
- .3 Submission of reproductions for each requirement requested can be made by email using the current digital PDF file format.
- .4 Faxed shop drawings are not acceptable.
- .5 Include a cross-reference of shop drawing information to applicable portions of Contract Documents.
- .6 Engineered shop drawings are to be provided if requested on the drawings.

1.6 Samples

- .1 Samples: examples of materials, equipment, quality, finishes, workmanship.
- .2 Deliver samples prepaid to the Owner's Representative's business address.
- .3 Where colour, pattern or texture is criterion submit full range of samples.
- .4 Adjustments made to samples by the Owner's Representative are not intended to change the Contract Price. If adjustments affect the value of work, state such in writing to the Owner's Representative prior to proceeding with work.
- .5 Reviewed samples will become standard of workmanship and material against which installed work will be verified.

1.7 Mock-Ups

- .1 Mock-ups: field-erected example of work complete with specified materials and workmanship.

- .2 Erect mock-ups at locations acceptable to Owner's Representative.
- .3 Adjustments made to mock-ups by the Owner's Representative are not intended to change the Contract Price. If adjustments affect the value of work, state such in writing to the Owner's Representative prior to proceeding with work
- .4 Reviewed mock-ups will become standards of workmanship and material against which installed work will be verified.

1.8 Shop Drawing, Mock-Up and Sample Review

- .1 The review of shop drawings, mock-ups and samples by the Owner's Representative is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that the Owner's Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for requirements of the construction and contract documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all subtrades.

PART 2: PRODUCTS (Not Applicable)

PART 3: EXECUTION (Not Applicable)

END OF SECTION 01 33 23

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 prepare the site suitable for subsequent work indicated in the contract documents, including but not limited to:
 - .1 Preservation and protection of existing plants, site features and intertidal habitat.
 - .2 Draining of wet areas of the site by means of temporary ditches, pumping and other means approved by the Owner's Representative.
 - .3 Tree removal and removal of tree roots only where explicitly shown on drawings and as required to obtain satisfactory base for paving.
 - .4 Stripping and disposal of all existing materials to prepare for path and base as detailed. All other deleterious materials, including unsuitable material under areas to be filled, shall be treated as over excavation.
 - .5 Stripping and removal of all deleterious materials.
 - .6 Stripping and stockpiling topsoil (if any).
 - .7 Grading of the site, including the importation of and relocation of fill to create compacted subgrades as required for subsequent work as detailed and specified.
 - .8 Placing approved fill, subbase, base and associated materials as detailed.
 - .9 Finished grading of the site for landscaping including unit concrete pavers, C.I.P. concrete paving, asphalt paving, irrigation, sodding, seeding and planting.

1.3 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Geotechnical Report | Section 00 31 32 |
| .2 | Aggregates and Granular Materials | Section 02 41 14 |
| .3 | Tree Protection | Section 32 01 56 |
| .4 | Playing Field | Section 32 18 23 |
| .5 | Subsurface Drainage | Section 33 46 16 |
| .6 | Growing Medium | Section 32 91 13 |
| .7 | Irrigation | Section 32 80 00 |

1.4 Reference Standards

- .1 Contractor is responsible for complying with all current Work Safe BC requirements for site safety related to the scope of work in this section. This includes but is not limited to protection of personnel and site safety procedures related to open excavation.
- .2 All work under this section shall conform to the requirements of the American Society for Testing and Materials (ASTM), Standards as referenced herein.

1.5 Quality Assurance

- .1 Codes and Standards: Perform backfilling work in compliance with applicable requirements of governing authorities having jurisdiction.
- .2 Inspection: The Owner's Representative or his representative is to inspect and approve all stages of the work. The Contractor shall give forty-eight (48) hours notice to the Owner's Representative when inspection is required.

1.6 Job Conditions

- .1 Use all means necessary to control dust, dirt and debris on and near the worksite, including Construction Access Route (C.A.R.), caused by the Contractor's operations. Thoroughly moisten all surfaces, when necessary, to prevent dust being a nuisance in adjoining areas.
- .2 Use all means to protect all materials of this Section before, during and after installation. Protect all trees designated to remain. Make good any damage. **Follow Vancouver Park Board Tree Protection Guidelines as required.** Protect existing fencing, walls, curbs, sidewalks, pavement, benchmarks, surface or underground utilities that are to remain. Notify the Owner's Representative immediately if any damage occurs. Restore to original or better condition, unless directed otherwise.
- .3 Protect adjacent construction and all surrounding properties, including municipal streets, sidewalks, above and under ground services.
- .4 Obtain approval from Owner's Representative on designated Construction Access Route (C.A.R.) Ensure C.A.R. is appropriately signed and maintained during course of construction. Remediate to original condition prior to Substantial Performance.
- .5 Maintain any existing fence barriers currently on site surrounding areas of preserved existing vegetation. Do not enter areas of preserved existing vegetation without the approval of the Owner's Representative.

1.7 Site Conditions

- .1 Start of work shall signify acceptance of site as satisfactory and no claim will be recognized for extra work nor any allowance made for defective work due to site conditions.

- .2 Investigate the site to verify information shown in Contract Documents. **Verify that existing grades are as shown on Drawings and notify Owner's Representative immediately of any discrepancies.**
- .3 Review existing site conditions with regard to subsurface conditions. Data on indicated subsurface conditions is not intended as representations or warrants of continuity of such conditions. Additional test borings and other exploratory operations may be made by Contractors at no cost to the Park Board. Notify Owner's Representative prior to carrying out any such work.

1.8 Testing and Approvals

- .1 A testing agency will be retained by the Owner or its representative to perform periodic testing of the subgrade preparation if required, to ensure the requirements of the Contract and General Conditions are being met. The Contractor at no extra cost to the contract shall provide any retesting due to non-conformance.
- .2 Cooperate and assist as required the testing agency in the execution of their work.

1.8 Submittals

- .1 If required, provide representative samples for subbase, base, drain rock (clear crush), quarry tailings, rip-rap or any another aggregate materials used on site, at least fourteen (14) days before scheduled time of delivery to site.

PART 2: PRODUCTS

2.1 Subgrade

- .1 Subgrade is a dense surface that has been proof rolled as specified and which has been treated to eliminate all soft or spongy areas. Compaction and uniformity of subgrade shall be subject to approval by the Owner's Representative.
- .2 Subgrade may be existing, undisturbed material resulting from cutting or may be built up using Type 1 fill or Type 2 fill, depending on the applications.

2.2 Fill

- .1 Fill material shall be natural mineral material of a consistent quality throughout, free from foreign matter such as construction debris, plant and grass seeds, organic matter (except within limits shown for Type 1) and pests, and meeting the requirements set out for Type 1 or Type 2 fill, depending on the application.

- .2 Obtain the Owner's Representative's approval of fill material before delivering to the site if imported, or before moving on site if native. **If imported material is approved for use, supply Owner's Representative with written notification a minimum of thirty (30) days prior to beginning fill operations a complete statement of origin, compensation, suitability, environmental clearance and proposed location of all deposits that is intended for imported fill.**
- .3 Fill shall be classed as Type 1 or Type 2, depending on its application and shall meet the following requirements for each type:

| TYPE | APPLICATION | REQUIREMENTS |
|--------|---|--|
| Type 1 | Under planted and grass areas | Maximum aggregate size 200mm evenly graded, containing not more than 20% fines (clay and silt) and not more than 5% organic matter, or as approved by the Owner's Representative. |
| Type 2 | Under subbase for pathways, paved areas, structures | Maximum aggregate size 200mm evenly graded, containing not more than 15% fines passing a No. 200 (0.075mm) sieve when tested according to ASTM designation C-136. The Owner's Representative may approve alternatives. |

2.3 Crushed Granular Sub-base

- .1 To be 75 mm (3") crushed gravel minus, clean, free of organic material. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.4 Drain Rock

- .1 To consist of clean round stone or crushed rock. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.5 Filter Fabric

- .1 Needle-punched, non-woven filter fabric, Nilex 4551 as manufactured by Nilex, or pre-approved equivalent.

2.6 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.7 Construction Fencing (PICK ONE)

- .1 Metal fencing is required around the entire construction site. Fencing to be a minimum of 1.8m in height. Fencing to be "Modu-Loc" or equivalent, and is to be approved by Owner's Representative before installation. The Contractor is to ensure fencing is secure at all times, so as to prevent intrusion into the construction site by any unauthorized persons. Panels to be pinned to the ground and bolted together. Plastic feet covers are required to be installed on the exterior of the fence. Contractor is responsible for maintaining the integrity of the fencing in a vertical position at all times. Fencing is to be reviewed by the Owner's Representative before the start of any construction activities and is to remain in place until Final Acceptance.
- .1 Metal fencing is required around the entire construction site. Fencing to be a minimum of 2.5m in height. Fencing to be "Modu-Loc" or equivalent, and is to be approved by Owner's Representative before installation. The Contractor is to ensure fencing is secure at all times, so as to prevent intrusion into the construction site by any unauthorized persons. Panels to be pinned to the ground and bolted together. Plastic feet covers are required to be installed on the exterior of the fence. Contractor is responsible for maintaining the integrity of the fencing in a vertical position at all times. Fencing is to be reviewed by the Owner's Representative before the start of any construction activities and is to remain in place until Final Acceptance.

PART 3: EXECUTION

3.1 Limits Of Work

- .1 Before starting work identify the limits of work on site by accurate survey. Prior to grading, excavating or trenching the Contractor shall locate and expose all utility lines, drain pipes and all other services which are within the areas of this work, and where the existing services are located less than 300mm below the proposed depth of trenching or excavation, such existing services shall be exposed by hand and adequately marked and protected. All separation distance requirements of the local authorities having jurisdiction over the service shall be observed.
- .2 Take all measures necessary to prevent the following activities outside the limits of work except as authorized by the Owner's Representative:
 - .1 Travel of equipment and vehicles
 - .2 Storage of materials or equipment
 - .3 Stockpiling of soil or excavated materials
 - .4 Burning
 - .5 Excavating or trenching
 - .6 Cutting of roots or branches
 - .7 Disposal or spilling of toxic matter

3.2 Tree Removal

- .1 Remove trees only as shown on the plan, or as requested by the Owner's Representative. Remove all debris from site. Remove all roots and parts that would be detrimental to the construction.
- .2 Strip topsoil, surface silts and organics, down to approved subgrade. Remove topsoil, surface silts and organics from the site, except for clean topsoil approved by the Owner's Representative for stockpiling for future use.

3.3 Unsuitable Material

- .1 Remove from the site all material unsuitable for use as fill.

3.4 Drainage

- .1 Drain and/or dewater all areas to be regraded using methods acceptable to the Owner's Representative and local environmental authorities having jurisdiction.
- .2 Slope rough grades away from any building envelopes/ structures at a minimum 2%, unless specifically shown on drawings or directed by Owner's Representative.

3.5 Excavation And Filling

- .1 Cut, fill and import material as required to create subgrades as detailed and specified herein.
- .2 Remove all deleterious material and ponded water from the site.
- .3 Compact exposed ground surface beneath all fill areas with a minimum 5 ton vibrator roller, except in "soft" landscape areas, i.e. areas to receive grass or planting.
- .4 Any soft or spongy areas shall be sub-excavated, removed and replaced with granular subbase material. Such fill shall be placed in maximum 200mm lifts and compacted to the densities required for Type 1 or Type 2 fill.
- .5 Scarify existing grades to a minimum depth of 150mm prior to placing of fill. Move excavated material intended for reuse as fill directly from the cut to the fill area, spread and compact to the required densities.
- .6 Place fill in maximum 200mm lifts and compact each lift to the following Standard Proctor Densities, to ASTM D698 using approved vibratory compaction equipment, prior to placing subsequent layers as follows:
Type 1 Fill: 95% Standard Proctor Density (S.P.D.).
Type 2 Fill: 98% Standard Proctor Density (S.P.D.).
- .7 Compact fill materials only when the moisture content is suitable for obtaining the specified density. If moisture content is too low, apply water by means of approved distribution. If moisture content is too high, dry the fill material by blading, diskings, or other approved method. **DO NOT OVER COMPACT FILL TYPE 1.**

- .8 Excavated material used as Fill Type 2, shall be overlaid with a minimum of 200mm of subbase, compacted to 98% Standard Proctor Density.

3.6 Grading

- .1 **DO NOT GRADE SOIL WHEN SOIL IS WET.** Uniformly grade areas within limits of grading under this Section. Smooth finished surface within specified tolerances, compact with levels or slopes between elevations as shown, or between such points and existing grades.
- .2 Grade areas to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and to allow for specified depths of base courses and finished materials.
- .3 Remove particles larger than 100mm diameter from the surface leaving a smooth compacted surface to required subgrade.
- .4 Compact subgrade as required, to stated densities in the above section.

3.7 Subbase And Base

- .1 Ensure base materials and existing surface are at approximately the same moisture content to facilitate bonding.
- .2 Install subbase, base, and filter fabric as detailed. Place in maximum 200mm lifts and compact to minimum 98% Standard Proctor Density (S.P.D.).
- .3 Finish to subgrades as detailed, suitable for subsequent installation of path and base, structures and paving.

3.8 Tolerances

- .1 Maximum subgrade tolerance is ± 25 mm when checked with a 3 m straight edge placed in any direction, and the subgrade shall not be consistently above or below the design grades.

3.9 Maintenance

- .1 Protect newly graded areas from traffic, erosion, and standing water and free of debris. Provide temporary drainage ditches from graded areas as required.
- .2 The site surface shall always be contoured to direct precipitation and run-off to drainage ditches or slopes leading away from the work area. Surfaces shall always be left graded smooth and rolled with a smooth drum roller to minimize infiltration of water and subsequent deterioration of material due to excessive moisture content. The surface shall never be left with undrained depressions or with a rough texture.
- .3 Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

- .4 Repair and make good and clean up any damage and/or debris to municipal roads and streets caused by work of this Contract. Obtain and pay for all permits required for use of municipal roads and streets.

3.10 Cleaning

- .1 Remove excess excavated material, trash, debris and waste materials and dispose of off site as directed by Owner's Representative at no additional cost to the Board.

END OF SECTION 01 89 13

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 for the demolition and removal of all materials as indicated in the contract documents.
- .2 Concrete shall be broken into pieces 200 mm and remain on site to be buried with fill material as shown on the drawing.
- .3 The work shall include all coordination required for the shut-off, isolation and capping of all utilities such as water, sewer, electricity, telephone and gas services.

1.3 Related Work

- .1 Shrub and Tree Preservation Section 32 01 56

1.4 Quality Assurance

- .1 Demolition to be carried out in accordance with Vancouver Building Bylaw, latest edition and all regulatory authorities as applicable.
- .2 Procedures and methods of demolition shall be to the approval of the Owner's Representative and Owner.
- .3 Codes and Regulations: Do all demolition work according to the requirements of the Vancouver Building By-law and WorkSafeBC Accident Prevention Regulations, and the Canadian Construction Safety Code.

1.5 Qualifications

- .1 Qualifications of Workers: Provide a Supervisor who shall be present at all times during the demolition work and who shall be thoroughly familiar with the work required and who shall direct and coordinate all work.
- .2 All areas of responsibility for demolition and cutting shall be thoroughly coordinated by the Contractor.

- .3 Provide one (1) person on site who is responsible for maintaining the safety barriers and protection of the workers and the public. Provide the name of this person to the Owner's Representative.
- .4 Any changes in personnel must be reported to the Owner's Representative.
- .5 Each subtrade is required to coordinate its work with the work of this section as to the amount of demolition work required and as to termination conditions to be left at the junction of existing work to remain.
- .6 Each subtrade shall be responsible to ensure that all demolition and cutting does not destroy more than is required, or what is needed for future construction.
- .7 Any demolition and cutting carried beyond the necessary requirements shall be the responsibility of the Contractor, and shall be reinstated at no cost to the Owner.

1.6 Job Conditions

- .1 The Contractor shall provide for temporary connections to power and water and drainage lines as required. No outages, limitations or obstructions shall be permitted unless with the prior approval of the Owner.
- .2 The Contractor shall contact the Owner and/or Owner's Representative prior to any service interruptions and obtain permission for interruption at a specific time.
- .3 The Contractor shall take the necessary precautions to fully protect existing surfaces against damage from demolition and/or removal of existing work.

1.7 Permits

- .1 If a demolition permit is required the Contractor shall be responsible for obtaining this permit.

1.8 Reference Standards

- .1 Signs attached to temporary construction fences and walkway shall meet the standards outlined in the City of Vancouver Sign By-Law Guide.

PART 2: PRODUCTS (Not Applicable)

PART 3: EXECUTION

3.1 Hazardous Materials

- .1 Carefully examine work to be removed. Report the presence of hazardous materials or potentially hazardous materials to the Owner immediately.

- .2 Hazardous materials are not to be disturbed if located or suspected until their presences has been reported to the Owner. Vancouver Park Board will be responsible for the removal of any hazardous materials if they were not identified and included in the base contract.

3.2 Inspection of Existing Conditions

- .1 Carefully examine areas to be demolished. Report any discrepancies with the Contract Documents to the Owner's Representative immediately.
- .2 The Contractor shall accept the site as it exists and will be responsible for all demolition work as required.
- .3 The Contractor shall visit the site at their own expense prior to the submission of tenders and take whatever time is required to ascertain existing site conditions and surrounding features related to the proposed demolition and ensure that conditions are suitable for execution of the work.
- .4 No additional sums of money will be allowed for any items resulting from lack of familiarity with the site conditions. Report any discrepancies to the Owner's Representative.
- .5 Arrange for a site visit together with Owner to examine existing site conditions adjacent to demolition. Take pictures of any existing damage and record them in writing to avoid any disputes at a later date.

3.3 Protection

- .1 The Owner shall be saved harmless by the Contractor from any loss, damage, death or injury occurring through neglect, carelessness or incompetence of the Contractor, or the handling or condition of the Contractor's equipment.
- .2 Existing trees shall be fully protected at all times during the work of this Section as required.
- .3 Immediately make all repairs and replacements to adjacent existing works caused by the Work of this Section.
- .4 Provide temporary enclosures for securing the work area and the maintenance of any services necessary to the proper and efficient operation of the project.
- .5 Protect site improvements such as sidewalks, curbs, existing landscaped and asphalt areas and all interior finishes that lie along the path of removal.
- .6 Conduct construction operations with minimum interference to existing buildings operations, adjacent buildings, adjacent public or private roadways, parking lots, sidewalks and access facilities in general. Keep such areas free of material debris and equipment at all times.
- .7 The Contractor shall provide any hoardings, barricades, warning signs and lights, as necessary, for the protection of all people and property on and adjacent to the site as specified herein or by WorkSafeBC. The Contractor shall alter, adapt, maintain, relocate and remove these additional barricades, etc. as necessary due to the work.

- .8 All barricades provided by the Contractor shall be removed from the site upon completion of the work and any damage caused repaired to the satisfaction of the Owner.
- .9 Prevent movement, settlement or damage to existing building, finishes, services, walks, paving and parts of existing building to remain. Provide shoring and bracing as required. Make good any damage and be liable for injury caused by demolition.
- .10 Provide necessary temporary weather protection with dust screens if and when required to protect existing adjacent buildings from dust penetration during demolition work.
- .11 Protect adjacent work from damage, staining, or disfigurement caused by the work of this section.
- .12 Promptly as the work proceeds, and on completion, keep the premises clean and free from rubbish, debris, surplus materials and equipment.
- .13 At the end of each day's work, leave the work area and surrounds in a safe condition so that no parts are in danger of toppling or falling.

3.4 Demolition

- .1 Remove materials from demolition promptly as the demolition work progresses. Materials shall not be sold, buried or burned at the site. The Contractor shall be assumed to have allowed for any credit that may be obtained for such materials.
- .2 Temporary stockpiling of demolished materials that are required to be removed from the site is not permitted. All demolition materials from excavations must be removed from site daily.
- .3 The Contractor is responsible for disposing of demolition materials in a legal manner.
- .4 Carry out all necessary temporary bracing and supporting to existing structures to remain as required during demolitions.
- .5 Prevent debris from blocking surface drainage inlets and systems that must remain in operation.
- .6 Carry out all demolitions and making good. Patch and make good to a standard at least equal to that of adjacent surfaces when related work is completed.
- .7 Any items containing PCBs should be stockpiled in a safe location. The Owner should be notified and will arrange subsequently removal and disposal of items if not included in the base contract.
- .8 No heavy equipment causing excessive vibrations to the existing structures is permitted.
- .9 Make cut clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .10 Demolish existing walls with care, do not damage adjacent surfaces noted to remain.
- .11 Remove existing millwork fixtures, services, and building components where required.
- .12 Remove existing asphalt and concrete paving, concrete curbs as required for new site development.
- .13 Remove existing site services and catch basins as noted.
- .14 Subsurface structure: remove all subsurface foundations, piles and pile caps as per the contract documents.
- .15 Refer to moving plans for equipment moving requirements.

- .16 Complete demolition work to produce clean exposed sub-grade where demolition is indicated. Remove extraneous materials.
- .17 Large boulders or rocks over two feet diameter shall remain on site unless otherwise noted by Owner's Representative.
- .18 Drilling through concrete and masonry shall be carried out using diamond drills.
- .19 Procedures and methods of drilling, coring and/or cutting shall be to the approval of the Owner.

3.5 Debris

- .1 Condemned material becomes the Contractor's property and must be removed completely from the site. Keep clean all areas in use at all times.
- .2 Contractor shall be held responsible for all costs, penalties, summonses and notices arising from the failure to comply with the keeping of the adjacent site, local roads, and thoroughfares clean and free from debris and damages caused by debris and demolition work.

3.6 Cleaning

- .1 Upon the completion of all demolition work remove all equipment, materials, and debris. Leave the area clean.

END OF SECTION 02 41 13

PART 1: GENERAL

1.01 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.

1.02 Description

- .1 This section refers to the portions of the work that are specific to the supply and processing of aggregates.

1.03 Related Work

- .1 This section includes specifications for aggregates and granular materials referred to in the following sections:
 - .1 Site Preparation and Grading Section 01 89 13
 - .2 Miscellaneous Stone Work Section 04 43 00
 - .3 Excavation and Backfill Section 31 23 10
 - .4 Cast in Place Concrete Paving Section 32 13 12
 - .5 Cast in Place Exposed Aggregate Concrete Section 32 13 13.16
 - .6 Crushed Granular Paving Section 32 15 40
 - .7 Subsurface Drainage Systems Section 33 46 16
- .2 This section does not include specifications for aggregates and granular materials to be incorporated into Hot Mix Asphalt Paving, Precast Concrete Unit Paving, Sand Playing Fields, Growing Medium. These specifications are specified as follows:
 - .1 Hot Mix Asphalt Paving Section 32 12 16
 - .2 Precast Concrete Unit Paving Section 32 14 13
 - .3 Sand Playing Fields Section 32 18 23
 - .4 Growing Medium Section 32 91 13

1.04 Reference Standards

- .1 Master Municipal Construction Document (MMCD) Platinum Edition, Specifications

1.05 Testing, inspection and Approvals

- .1 Inform VPB Project Manager of proposed source and provide samples and sleeve analysis for review and approval at least 2 weeks prior to start of production..2 If sourced materials do not meet specification requirements, locate alternative source or demonstrate that material can be processed to meet specified requirements.

- .3 If a material source is to be changed during work, Contractor to advise VPB Project Manager at least 2 weeks prior to the proposed change to allow for product testing and sampling.
- .4 Acceptance of material does not prevent future rejection of material if it is later found to fail conforming to requirements specified.
- .5 The Contractor as part of the work of this section shall schedule, perform, or cause to be performed, all tests, inspections and approvals by the testing agency and the Consultant. All test results shall be provided to the Consultant in PDF format. The cost of testing shall be paid for by the contractor.
- .6 Should the test, inspection or approval require a representative sample of the material or workmanship the Contractor shall at no cost to the Owner supply the labour and materials necessary to provide the sample or test.
- .7 Should the test or inspection indicate that the material or work completed does not conform to the specifications the Contractor shall at no cost to the Park Board promptly remove this work, dispose of it off site and re-execute it in accordance with the Contract Documents. The remedial work shall include retesting as required to establish conformance with the Contract Documents. Retesting shall be paid for by the Contractor. All retest results shall be provided to the Consultant in PDF format.

1.06 Measurement and Payment

- .1 Payment for work requiring aggregates and granular material will be included under payment of Sections which include aggregates and granular materials unless specifically shown otherwise as separate pay item.

PART 2: PRODUCTS

2.01 Materials – General

- .1 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
- .2 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following gradation limits and 60% of the material passing each sieve must have one or more fractured

faces. Determination of the amount of fractured material shall be in accordance with the Ministry of Transportation and Highways' Specifications I-11, Fractured Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

2.02 Native Material

- .1 To be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for purposes if it approved by The Owner or The Owners Representative. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.

2.03 Pit Run Gravel

- .1 To be well graded granular material, substantially free from clay lumps, organic matter and other extraneous material, screened to remove all stones in excess of maximum diameter specified in material description, e.g. (300mm Pit Run Gravel, 200mm Pit Run Gravel, 100mm Pit Run Gravel). Recycled concrete free from contaminated and other extraneous material, conforming to the specified gradations may be used as pit run gravel. Material to compact to specified density and conform to the following gradations:

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| (300 dia) | 100 |
| (200 dia) | 100 |
| (100 dia) | 100 |
| 75 | 100 |
| 50 | 70-100 |
| 25 | 50-100 |
| 4.75 | 22-100 |
| 2.36 | 10-85 |
| 0.075 | 2-8 |

2.04 Pit Run Sand

- .1 To be well graded pit run sand, free from organic materials and conform to following gradations:

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| 12.5 | 100 |
| 4.75 | 35-100 |
| 2.36 | 20-70 |
| 1.18 | 13-50 |
| 0.600 | 8-35 |
| 0.300 | 5-25 |
| 0.150 | 2-15 |
| 0.075 | 0-6 |

2.05 River Sand

- .1 River sand, to be used only where shown on Contract Drawings or otherwise specified and approved by The Owner or The Owners Representative to be free of organic material, salt and foreign objects and conform to following gradations:

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| 19 | 100 |
| 4.75 | 80-100 |
| 0.600 | 20-80 |
| 0.150 | 0-20 |
| 0.075 | 0-8 |

2.06 Drain Rock

- .1 To consist of clean round stone or crushed rock conforming to the following gradations:

| Sieve Size (mm) | Percent Passing | |
|-----------------|-----------------|-----------------------|
| | Coarse | Fine (Torpedo Gravel) |
| 25.0 | 100 | |
| 19.0 | 0-100 | |
| 9.5 | 0-5 | 100 |
| 4.75 | 0 | 50-100 |
| 2.36 | | 10-35 |
| 1.18 | | 5-15 |
| 0.600 | | 0-8 |
| 0.300 | | 0-5 |
| 0.150 | | 0-2 |
| 0.075 | | 0 |

- .2 Drain rock to be used only where specified on Vancouver Park Board Detail Drawings or Contract Documents. Use of drain rock other than specified requires approval of The Owner or The Owners Representative after examination of soils against which drain rock will be placed.

2.07 Granular Pipe Bedding and Surround Material

- .1 Crushed or graded gravels: to conform to the following gradations:

| Sieve Size (mm) | Percent Passing | |
|-----------------|-----------------|--------|
| | Type 1 | Type 2 |
| 25.0 | 100 | 100 |
| 19.0 | 90-100 | 90-100 |
| 12.5 | 65-85 | 70-100 |
| 9.5 | 50-75 | 50-100 |
| 4.75 | 25-50 | 40-70 |
| 2.36 | 10-35 | 25-52 |
| 1.18 | 6-26 | 15-38 |
| 0.600 | 3-17 | 6-27 |
| 0.300 | | 3-20 |
| 0.075 | 0-5 | 0-80 |

**Type 1: standard gradation*

**Type 2: to be used only in dry trench conditions and with The Owners or The Owners Representatives prior approval*

Recycled concrete free from contaminated and other extraneous material, conforming to the Type 1 gradations, may be used as pipe bedding and surround material.

- .2 Other permissible materials: only when shown on Contract Drawings or directed by VPB Project Manager shall drain rock, pit run sand or approved native material be used for bedding and pipe surround.

2.08 Select Granular Sub-base

- .1 To be well graded granular material, substantially free from lumps and organic matter, screened if required to conform to following gradations:

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| 75 | 100 |
| 25 | 50-85 |
| 0.150 | 0-15 |
| 0.075 | 0-8 |

2.09 Crushed Granular Sub-base

- .1 To be 75 mm (3") crushed gravel minus, clean, free of organic material conforming to following gradations:

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| 80 | |
| 75 | 100 |
| 38 | 60-100 |
| 25 | |
| 19 | 35-80 |
| 12.5 | |
| 9.5 | 26-60 |

| | |
|---------|-------|
| 4.75 | 20-40 |
| 2.36 | 15-30 |
| 1.18 | 10-20 |
| 0.6um | 5-15 |
| 0.3um | 3-10 |
| 0.18um | |
| 0.15um | |
| 0.075um | 0-5 |

2.10 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded, conforming to following gradations:

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

- .2 Alternatively, the Item # 30 19mm Minus Recycled granular material available from City of Vancouver Kent Materials Branch is acceptable.

2.11 Recycled Aggregate Material

- .1 Aggregates containing recycled material may be utilized if approved by The Owner or The Owners Representative. Recycled material should not reduce the quality of construction achievable with quarried materials with the addition of meeting all other conditions of this specification. Recycled material should consist only of crushed Portland cement concrete; other construction and demolition materials such as asphaltic pavements, bricks, plaster, etc. are not acceptable.

PART 3: EXECUTION

3.01 Handling

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
.2 Do not use intermixed or contaminated materials. Remove and dispose materials within 48h of rejection.

END OF SECTION 02 41 14

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 erect, and strip all formwork and false work for cast-in-place concrete as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|--------------------------------|------------------|
| .1 | Shop Drawings and Product Data | Section 01 33 23 |
| .2 | Concrete Reinforcing | Section 03 20 00 |
| .3 | Cast-In-Place Concrete | Section 03 33 00 |
| .4 | Concrete Finishing | Section 03 35 00 |

1.4 Reference Standards

- .1 Concrete formwork shall conform to the requirements of the following standards unless otherwise required by this specification:
 - .1 B.C. Building Code: Current Edition.
 - .2 CAN3-A23.1-M90 Concrete Materials and Methods of Concrete Construction.
 - .3 CAN/CSA-A23.3 Code for the Design of Concrete Structures for Buildings.
 - .4 CAN/CSA S269.3 Design, Fabrication, Erection and Use of Concrete Formwork.
 - .5 ACI 347 Recommended Practice for Concrete Formwork.
 - .6 WorkSafeBC - Section 34.28
- .2 Where the standard is referred to in this specification it shall mean the documents specified in this clause and their referenced documents.

1.5 Quality Assurance

- .1 Concrete formwork fabrication and erection shall be done by experienced and competent personnel having adequate training and equipment for all phases of the work specified.

1.6 Quality Control

- .1 Where slopes illustrating 'positive drainage' on a horizontal surface either as labels or spot elevations are indicated on construction drawings the Contractor shall construct the formwork as required to ensure that when the concrete is placed the formwork does not hinder the finishing of concrete to achieve positive drainage.

1.7 Submittals

- .1 The Contractor shall submit to the Owner's Representative three (3) copies of shop drawings illustrating the form tie layout for all concrete surfaces exposed to view.
- .2 The Contractor shall submit to the Owner's Representative three (3) copies of product data for form material to be used.

PART 2: PRODUCTS**2.1 General**

- .1 Products shall satisfy the requirements of the standard unless otherwise specified or indicated on the Contract drawings.

2.2 Forms for concrete:

- .1 Non-Exposed Concrete Surfaces: Plywood, shiplap or dimensional lumber, for rough-form finish in accordance with CAN/CSA A23.1-94, Section 24, Item 24.3.2.
- .2 Architectural Concrete Surface (concrete surfaces exposed to view): as per CSA A23.1-94 24.3.3
- .3 Form work for smooth, form finish concrete shall have a form facing material which will provide smooth, hard, uniform texture on the concrete.
- .4 The form material may be medium density overlay (MDO) plywood, tempered concrete – form-grade hardboard, metal, plastic, paper or other material capable of producing smooth finish.
- .5 Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of the concrete surface shall not be used.
- .6 Acceptable products include but are not limited to:
 - .1 Multipour MDO Form Panel,
 - .2 B-Matte 333 MDO Form Panel
- .7 Form material thickness shall be sufficient to ensure that finished concrete work is true to lines, shapes, angles and finishes indicated on the Contract drawings. Minimum thickness of form material shall be 19 mm (3/4"). Ensure that the same type of formwork material is used throughout the entire scope of the project.

- .8 Form Release Agents: Concrete form release shall be composed of an organic chemical that reacts with the alkali content of concrete to form a release film, along with providing an inert barrier to provide double separation. Acceptable materials include but are not limited to:
 - .1 Duogard Concrete Form Release Agent by W.R. Meadows
 - .2 Eco-Coat by W R Meadows
- .9 Form ties complete with precast concrete plugs shall leave no metal within 25 mm (1") of the concrete surface. Acceptable products include but are not limited to:
 - .1 Meadow Burke Snap Ties,
 - .2 Dayton Superior Plastic Snap Ties with Plastic Cone
- .10 Void Form: Closed cell expanded polystyrene (EPS) voiding. Acceptable products include but are not limited to:
 - .1 Korolite Type 2, Mansonville Plastics, Surrey, BC,
 - .2 Korvoid, Mansonville Plastics, Surrey, BC (where compressive loads exceed 110 Kpa (16psi))
 - .3 Plastispan, Plasti-Fab EPS

PART 3: EXECUTION

3.1 Design Of Formwork, Falsework and Reshoring

- .1 The Contractor shall assume full responsibility for the design of form work and ensure structural adequacy of the forms to withstand all concrete and construction loads.
- .2 As a minimum, the work shall conform to CAN/CSA-A23.1, Section 24 for regular work (concrete surfaces not exposed to view) and CAN/CSA-A23.1, Section 28 for architectural concrete (concrete surfaces exposed to view).
- .3 Forms shall be so constructed that the finished concrete will conform to the shape, dimensions and tolerances as specified in the drawings. As required they shall also incorporate the cambers specified on the structural drawings.
- .4 The strength and rigidity of forms shall be such that they will not leak mortar or result in visible irregularities in the finished concrete, but in any case the deflection of facing materials between studs as well as deflection of studs and walers shall be in accordance with the CAN/CSA S269.3.
- .5 Where concrete is exposed to view, forms are to be laid out so that joints are kept to a minimum and located in an orderly and symmetrical arrangement where possible.
- .6 Unless otherwise indicated on the construction drawings the location of form ties shall be evenly spaced and in straight horizontal and vertical lines. Prior to the start of work in this section the Contractor shall provide the Owner's Representative a shop drawing illustrating the spacing and location of form tie holes.

- .7 The Contractor shall take care to ensure not to exceed the live load of the structure with any construction or shoring loads.
- .8 The Contractor is responsible for monitoring the curing time and related strength of the concrete. These shall be factored into the scheduling, staging and progress of all concrete work.

3.2 Form Work Construction

- .1 Construct formwork using appropriately sized timber or steel members, braces, walers, ties, etc. to ensure that the forms will not deflect, blow out, or deform as a result of concrete load.
- .2 Contractor shall ensure that where a positive slope is indicated on the construction drawings that the form work is constructed to achieve this slope. This includes but is not limited to cast in place concrete stair form construction.
 - .1 The Contractor shall clearly indicate, using an indelible line the entire length of the stair tread the elevation of the back of the stair tread.
 - .2 Prior to the placement of concrete using the line layout noted and the finished elevation of the top of the riser formwork the Contractor shall illustrate to the Owner's Representative that the formwork has been constructed to allow for positive drainage to the lines and levels indicated on the construction drawings from the back of the tread to the nose of the tread.
- .3 Install all inserts including cant and reveal strips, anchors, ties, bolts, nailers, anchor bolts, embedded plates, indicated on the contract documents and/ or required by other trades. Ensure cant and reveal strips are true to line and grade and joints are butt tight and smooth.
- .4 Provide all voids: openings and block outs indicated on the contract documents and/ or required by other trades.
- .5 Openings that have not specifically been indicated on the structural engineer's drawings must be approved in writing by the structural engineer.
- .6 Joints and corners shall be constructed so that they will not leak as a result of pressure from freshly placed concrete. Caulk as required.
- .7 The Contractor shall ensure that all forms not treated with a form release agent are to be kept evenly moist to prevent shrinkage. Wet the surface of untreated forms just prior to placing concrete.
- .8 Form release agent shall be applied in strict accordance with the manufacturers written instructions.

3.3 Removal of Formwork

- .1 Forms shall not be removed until concrete has attained sufficient strength to ensure that no damage or continuity of concrete will occur when forms are removed.

- .2 The structural engineer shall advise the Contractor as to the duration of cure time required prior to the removal of suspended formwork.
- .3 The Contractor shall use wooden wedges when prying directly against face of concrete during form removal. Do not pry directly against concrete surface.
- .4 Carefully remove form ties to avoid marking concrete. Unless otherwise indicated on the construction drawings plug and grout form tie holes to prevent rust staining. Ensure grout is finished smooth and flush to finished face of concrete.
- .5 Thoroughly clean and retreat forms prior to reuse.

3.4 Architectural Concrete Formwork

- .1 With respect to these specifications Architectural Concrete refers to concrete surfaces that are exposed to view. In addition to requirements of this section and those outlined in Section 28 of CAN/CSA-A23.1, formwork for architectural concrete shall specifically address the following:
 - .1 Formwork shall be constructed so that finished concrete surface 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 Maintain true right-angled corners for all exposed edges of concrete, unless otherwise indicated.
 - .3 The pattern for form ties shall be in accordance with the approved shop drawings.
 - .4 Back all edges of forms and brace to assure that mortar leakage is eliminated.
 - .5 Thoroughly inspect all forms prior to reuse. Do not reuse forms when surfaces that will come in contact with concrete have been damaged to the extent that the finished surface will not conform to the specifications.

3.5 Cleaning

- .1 Rubbish and debris resulting from work of this section shall be collected regularly and removed from the project site and properly disposed.

END OF SECTION 03 10 00

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 reinforcing steel as indicated in the contract documents.

1.3 Related Work

- .1 Concrete Forming and Accessories Section 03 10 00
- .2 Cast-in-Place Concrete Section 03 33 00

1.4 Reference Standards

- .1 Except as stated otherwise, all work shall conform to the following:
 - .1 B.C. Building Code 1998.
 - .2 City of Vancouver Building Bylaw No. 6134.
 - .3 CAN/CSA-A23.2 Methods of Tests for Concrete
 - .4 CAN/CSA-A23.3 Code for the Design of Concrete Structures for Buildings.
 - .5 CAN/CSA- A23.1 Concrete Materials and Methods of Concrete Construction
 - .6 CAN/CSA G30.5-M Welded Steel Wire Fabric for Concrete Reinforcement.
 - .7 CAN/CSA G30.12-M Billet-Steel Bars for Concrete Reinforcement.
 - .8 CAN/CSA W186-M Welding of Reinforcement Bars in Reinforced Concrete Construction.
 - .9 ACI manual of Standard Practice for Detailing
- .2 Where the standard is referred to in this specification is shall mean the documents specified in this clause and their referenced documents.

1.5 Inspection

- .1 All steel for the section shall be placed before pouring of concrete is begun.

1.6 Testing and Approvals

- .1 As per Section 03110 - Concrete/Reinforcement Testing.

1.7 Submittals

- .1 Submit mill certificates properly correlated to the materials in accordance with CAN/CSA G30.18.

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 Reinforcing bars will conform to CAN/CSA G30.18, Grade 400 R, unless otherwise specified herein or on the drawings.
- .2 Reinforcing not in accordance with the above standards shall not be used.
- .3 Reinforcing bars to be welded will conform to CAN/CSA G30.18, Grade 400 W.
- .4 Welded wire fabric will conform to CAN/CSA G.30.5, size and gauges as shown on the drawings.
- .5 Welded wire fabric for slabs will be delivered in flat sheets only.
- .6 Accessories: tie wire, hangers, bolsters, bar supports and spacers adequate for strength and support of reinforcing construction conditions. (Use non-staining supports for architectural concrete.)

PART 3: EXECUTION

3.1 General

- .1 All phases of concrete reinforcement 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.
- .2 The Contractor shall notify the Owner's Representative at least 48 hours before any concrete is placed in order that an inspection may be made.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with the bar list.

3.2 Fabrication

- .1 Fabricate reinforcing to CSA-A23.1.
- .2 Reinforcing bars will be cold bent. Bars will not be straightened or rebent.

- .3 Splices in reinforcing bars at locations not shown on the Drawings must be submitted for review by the Owner's Representative. Such splices will conform to the standards.

3.3 Placing

- .1 Reinforcing of size and shapes shown on the Drawings will be accurately placed in accordance with the Drawings and the requirements of the standard.
- .2 Reinforcement shall be adequately supported by chairs, spacers, support bars, hangers, or other accessories, and secured against displacement within the tolerances permitted in the standard. Support devices contacting surfaces exposed to the exterior shall be non-corroding.
- .3 Reinforcing bars that are not part of the structural design or drawing, and whose only function is supporting other reinforcing in lieu of other support accessories, will be considered as accessories.
- .4 Clean reinforcement before concrete is placed.
- .5 Contractor to coordinate a site meeting for the Owner's Representative to review reinforcing steel and placing before concrete is placed. A minimum of 48 hours notice is required for this review meeting.

3.4 Welding

- .1 Any welding of reinforcing steel shall be in accordance with CAN/CSA W186.
- .2 Copies of the Canadian Welding Bureau approved welding procedure and certificate of current operator qualification shall be submitted to the Owner's Representative prior to commencement of welding

END OF SECTION 03 20 00

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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 architectural cast in place concrete as indicated in the contract documents.
- .2 Install all anchor bolts, embedded metal, inserts, hangers, etc. supplied by other project trades to be cast into concrete. The Contractor shall be responsible for the correct positioning, depth, exposure and installation of these elements.
- .3 Install all openings, sleeves, block outs, etc. required by other trades and indicated on the construction drawings. The Contractor shall be responsible for the correct positioning, depth and installation of these elements.

1.3 Related Work

- | | | |
|----|----------------------------------|------------------|
| .1 | Concrete Reinforcement | Section 03 20 00 |
| .2 | Concrete Forming and Accessories | Section 03 10 00 |
| .3 | Concrete Finishing | Section 03 35 00 |

1.4 Reference Standards

- .1 Unless otherwise noted concrete work shall conform to the requirements of the following standards:
 - .1 B.C. Building Code Current Edition
 - .2 CSA CAN3-A23.1.
 - .3 CAN/CSA-A23.2 Methods of Tests for Concrete.
 - .4 CAN/CSA-A23.3 Code for the Design of Concrete Structures for Buildings.
- .2 A copy of the standard shall be kept by the Contractor on site for the duration of the work.

1.5 Submittals

- .1 A minimum of two (2) weeks prior to the start of work in this section the Contractor shall submit to the Owner's Representative the following information:

- .1 Written confirmation of the mix design criteria from the concrete batch plant. Confirmation shall also be sent to the project Testing Agency.
- .2 Shop drawings indicating the layout of all form ties.

1.6 Quality Assurance

- .1 To ensure consistency in the mix design, colour, and finished appearance, the supply of concrete and aggregate to be used in the concrete mix shall be from a single source throughout the duration of work of this Contract.
- .2 Quality of Finish: The quality of finish shall be such that, when the forms are stripped, it meets the standards set out below, without further finishing work other than sandblasting as required, and clean-up.
- .3 Concrete finishes shall exhibit sharp, accurate definition at corners, arises, reglets and the like, generally free of chipped or spalled areas and within dimensional tolerances set out in CAN/CSA A23.1/A23.2-00, except in the instance of "bug holes" or "honey-combing", in which a maximum of 5 mm diameter holes will be allowed. Members shall be visually straight. Major defects will necessitate replacement. The judgement as to what constitutes major defects will be by the Owner's Representative.
- .4 Concrete finish shall be uniform in colour.
- .5 Plane surfaces without protuberances, indentations, ridges or bulges.
- .6 Abrasive blasted surfaces shall have uniform depth of cutback, distribution of aggregate and colour and texture matching the sample panel designated by the Owner's Representative
- .7 Under no circumstances shall repair to any architectural concrete be undertaken without the Owner's Representative's written consent. Concrete members that are repaired without written consent may be classified as defective work at the discretion of the Owner's Representative.

1.7 Testing and Approvals

- .1 All required sampling, preparation of specimens and testing shall be performed by an independent testing agency appointed by the Owner's Representative. The testing agency shall report any procedures that are contrary to the specifications or accepted practice to the Owner's Representative.
- .2 Testing will be paid for by the Contractor. The testing agency shall submit all results directly to the Owner's Representative.
- .3 The cost of supplying the material for samples shall be borne by the Contractor. The Contractor shall provide adequate notice and coordinate the scheduling of all concrete placements with the testing agency. The Contractor shall cooperate with the testing agency during the sampling process.
- .4 The testing agency shall perform the following:

- .1 Review mix designs to ensure conformance with the specifications. Provision of a written report to the Owner's Representative.
 - .2 Test cement and aggregate for conformance with the material requirements of the specification.
 - .3 Supply cylinder moulds, sample the concrete, make and cure test cylinders and perform compressive strength tests in accordance with specification standards.
 - .4 Carry out slump and air content tests for each concrete test in accordance with specification standards.
 - .5 Take three (3) test cylinders for each 25 cubic Metres (33 cubic yards) or fraction thereof for each class of concrete placed in any one day. In no case shall any one class of concrete be represented by less than three (3) tests.
 - .6 All cylinders shall be made from concrete taken from the forms.
 - .7 The Owner's Representative at their discretion may reduce or eliminate the test cylinders to be taken for minor pours or pours not of structural significance.
 - .8 The testing agency shall perform the following tests on the each set of cylinders:
 - .1 Compression test of one (1) of the cylinder specimens after seven (7) days.
 - .2 Compression test of the remaining two (2) cylinders of each group after twenty eight (28) days.
 - .3 One (1) twenty-eight (28) day strength test result shall be calculated from the average of the compressive strength tests of the two (2) companion cylinders.
 - .9 The testing agency shall provide certified copies of the test result to the Owner's Representative. The test results shall meet the requirements of the mix designs indicated on the Contract documents.
- .5 Should any test indicate concrete below strength, the Owner's Representative shall have the right to stop work on the suspect area until subsequent tests are made. The Contractor shall bear the cost of such required tests. Should all tests indicate below strength concrete, the Contractor shall remove this portion of the work at the Owner's Representatives request. The removal and replacement of this work by the Contractor shall be at no expense to the Owner.

1.8 Protection

- .1 Cold and hot weather requirements to CAN/CSA A23.1.

1.9 On Site Mock-Up

- .1 ***Construct a 1.2m long x 1.0m high x detailed thickness of cast in place concrete wall. Mock-up shall include a representative of all wall elements noted in the construction details and plans including but not limited skate board abatement, reveals, joints, edge treatments, etc. The Owner's Representative will review and approve the mock-up prior to the start of any work of this section. The approved***

mock-up shall form the basis of acceptable quality required for the remainder of the concrete work.

- .2 The approved mock-up shall be a stand-alone element and not form part of the finished project. The mock-up is to be retained on site until the project has been concluded at which point the mock-up will be disposed of by the Contractor at no additional cost to the owner.*
- .3 The mock-up can remain part of the final work at the discretion of the Owner's Representative.*

PART 2: PRODUCTS

2.1 Concrete Mixing Materials

- .1 Portland Cement: to CAN/CSA-A5.
- .2 Aggregates: fine and coarse to CAN/CSA-A23.1
- .3 Water: potable to CAN/CSA-A23.
- .4 Air entraining admixtures: To requirements of ASTM C260. Acceptable products include but are not limited to:
 - .1 N.V.R, Sternson Ltd.
 - .2 Darex AEA, Grace Construction Materials
 - .3 MB-VR, Master Builders
- .5 Chemical Admixtures: To CAN/CSA-A266.2. The Owner's Representative shall approve use in writing.
- .6 Calcium Chloride: As a raw material or as a constituent in other admixtures, shall not be used unless approved in writing by the Owner's Representative.
- .7 Curing Compound: To requirements of ASTM C309 spray applied liquid containing a fugitive dye to be applied in accordance with manufacturers written instructions.
 - .1 Curing compounds shall be compatible with other specified floor hardeners, covering adhesives and waterproofing compounds.
 - .2 The use of other curing methods including the use of burlap and sheet materials shall be at the discretion of the Owner's Representative.
- .8 Form Release Agents: Concrete form release shall be composed of an organic chemical that reacts with the alkali content of concrete to form a release film, along with providing an inert barrier to provide double separation. Acceptable materials include but are not limited to:
 - .1 Duogard Concrete Form Release Agent by W.R. Meadows
 - .2 Eco-Coat by W R Meadows
 - .3 No Hold Concentrate, Grace Construction Materials

- .9 Joint Fill Material: Fibre Board: 12mm (1/2") pre-moulded bituminous impregnated fibre board to ASTM D 1751. Acceptable materials include but are not limited to:
- .1 Flexcell, Sternson
 - .2 027 Fibre Expansion Joint, W R Meadows
- .10 Backer Rod: Closed cell, polyurethane foam to ASTM C 1330, Type C. For Joint widths up to 19mm (3/4") diameter of rod shall be 3mm (1/8") larger than the joint width.
- .11 Joint Sealant: Shall be self-levelling, non sag, two (2) part polyurethane type, conforming to CGSB 19.24-M80, Type II, Class B. Acceptable products include:
- .1 Sika; Sikaflex-2C NS Mix TG
 - .2 Iso-Flex 880 GB self leveling
 - .3 Sonneborn SL2
- .12 Colour from standard range as indicated on the Contract Drawings.
- .13 Primers and bond breakers as required to install the joint sealant system shall be in strict accordance with sealant manufacturers written recommendations.

2.2 Mix Designs

- .1 Unless otherwise noted on the Contract documents the concrete mix design shall meet the following requirements:
- .1 Ramps, stairs, and curbs:

| | |
|-------------------------|-----------------------------|
| Minimum 28 Day Strength | 32 MPa |
| Slump | 75mm, (3"), +/- 20mm (3/4") |
| Maximum Aggregate Size | 19mm (3/4") |
| Water Cement Ratio | 0.45 |
| Air Content | 5 – 8% |
| Exposure Class | C-2 |

.2 Walls and Columns:

| | |
|-------------------------|-----------------------------|
| Minimum 28 Day Strength | 28 MPa |
| Slump | 75mm, (3"), +/- 20mm (3/4") |
| Maximum Aggregate Size | 19mm (3/4") |
| Water Cement Ratio | 0.55 |
| Air Content | 4 – 7% |
| Exposure Class | F-2 |

PART 3: EXECUTION

3.1 General

- .1 Concrete Supply: Concrete shall only be supplied by a ready-mix concrete plant indicated by the Contractor in the submittals provided as part of the approval for work of this section.
- .2 The transport of concrete in non-agitating equipment is not permitted without the prior written permission of the Owner's Representative.
- .3 Concrete shall be discharged to the specified on site locations no longer than one and one half (1.5) hours after the introduction of the mixing water to the cement and aggregates.

3.2 Openings and Inserts

- .1 The Contractor is responsible for the coordination with all trades in the setting of all slots, sleeves, openings, fasteners, block outs, bolts, dowels, hangers, inserts, conduits, clips, etc., that described or detailed in the Contract documents.

3.3 Preparation for Concrete Pour

- .1 Owner's Representative Review: A minimum of 48 hours prior to the placement of concrete the Owner's Representative shall review the following elements:
 - .1 Layout and construction of formwork.
 - .2 Layout and placement of reinforcing.
- .2 Inserts and Block Outs: The Contractor shall have all inserts, anchors, embed items, etc. positioned or close at hand to ensure a seamless, efficient concrete placement operation.
- .3 The Contractor is to review with the Owner's Representative procedures, reference lines, form construction and other practices that will be employed to ensure that concrete that is placed in areas where the Contract documents require a positive slope to ensure drainage will after final surface finishing achieve the specified slopes.

3.4 Addition of Water

- .1 To conform to CAN/CSA-A23.1.18.4.3.

- .2 In brief – no water from the truck system or elsewhere shall be added after the initial introduction of the mixing water at the batch plant. The only exception shall be as follows:
 - .1 At the start of discharge if the measured slump of the concrete is less than that specified and no more than sixty (60) minutes have elapsed from the time the concrete was loaded at the batch plant to the start of discharge, then at the discretion of the Owner's Representative up to 12 litres per cubic metre (3 gallons per cubic yard) of water may be added to concrete in the ready mix truck. The resulting concrete must satisfy the mix design requirements of the Contract documents.

3.5 Placing of Concrete

- .1 Concrete shall be deposited in the forms as close as is practicable to its final position to avoid segregation due to re handling.
- .2 Place concrete in generally horizontal, level lifts to a maximum depth of 300 mm (12"). Ensure the free fall of concrete does not exceed 1.5 Metres (5'-0").
- .3 Consolidate each lift of concrete thoroughly and uniformly by means of vibrators or finishing machines. The resultant mix should be a dense, homogeneous structure closely bonded to the reinforcing.
- .4 Vibrators shall be internal type having a minimum frequency of 7,000 revolutions per minute. A spare vibrator shall be readily accessible during all placement operations.
- .5 Ensure that the placing of concrete and the subsequent vibration process does not disturb reinforcing, location of inserts and block outs or the position of the forms.
- .6 Concrete shall not be placed during rain or snow unless Contractor has reviewed procedures for providing adequate protection to finished surfaces with the Owner's Representative. All procedures, equipment, tarps and overhead cover to be in place prior to the start of concrete placement.

3.6 Curing and Protection

- .1 Curing: Concrete shall be cured in accordance with CAN/CSA 23.1.
- .2 Unless otherwise indicated slabs shall be cured using curing compound specified. Coverage rates and method of application shall be as per manufacturers written instructions.
- .3 Freshly placed concrete shall be protected from the effects of sunshine, drying winds, cold, heat, and flowing water including rain by the use of adequate tarpaulins or other suitable materials to cover completely or enclose freshly finished surfaces, until the end of the curing period.

3.7 Finishes

- .1 Prior to final finishing, unless otherwise indicated on drawings tie holes shall be filled, formed surfaces shall be treated in accordance with CAN/CSA-A23.1. 24.

- .2 Final concrete finishes shall be as detailed in Contract documents.

3.8 Concrete Joints

- .1 Joints are to occur at regular intervals as required by the existing conditions, no further than 9 M (30 ft) apart unless noted otherwise.
- .2 Joint locations in beams or walls shall be approved by the Owner's Representative prior to their installation. Ensure proper key and dowels or extensions of reinforcing are provided at all joints.
- .3 The Contractor shall seek the approval of the Owner's Representative for installation of joints not indicated in the Construction documents.

3.9 Joint Fill and Sealant

- .1 Provide joint fillers and sealant to all joints unless otherwise indicated in the Contract documents.
- .2 Ensure that all joints are thoroughly prepared and cleaned of all foreign material that may impair the proper function of the joint of adhesion of the sealer. Cleaning procedures shall be in accordance with the manufacturers written instructions.
- .3 Unless otherwise indicated in the Contract documents or required by the sealant manufacturer the joint fill material shall terminate 12mm (1/2") below the top of the joint. The resultant space shall be space shall be filled with joint sealer in accordance with the manufacturers written instructions.

3.10 Patching

- .1 The Owner's Representative shall review all "bug holes" or "honey-combing", prior to any remedial work performed by the Contractor. Repair of these types of defects shall be as per CAN/CSA-A23.1.24.2. Patching and remedial work shall be performed by the Contractor at no cost to the Owner.
- .2 No other patching or repair of concrete surface shall be allowed. Defective work identified by the Owner's Representative shall be completely removed and replaced at no cost to the Owner.

3.11 Flood Test

- .1 Immediately upon removal of the formwork of cast-in-place improvements or placement of precast concrete elements, a flood test shall be conducted by the Contractor in the presence of the Owner's Representative to ensure proper drainage of all concrete improvements. Improvements subject to a flood test shall include but are not limited to all stairs and ramps. The flood test shall consist of the application of a volume of water sufficient to allow the visual verification of all slopes and drainage patterns and ensure that ponding does not occur. The volume of water necessary to facilitate testing and the

determination of the success or failure of the flood test shall be at the discretion of the Owner's Representative.

- .2 Should the concrete not meet the grade tolerances of the Contract documents or ponding is evident after a flood test the Contractor shall at the discretion of the Owner's Representative completely remove and replace all concrete. Grinding, partial removal and patching to resolve ponding or insufficient grade is not acceptable.

END OF SECTION 03 33 00

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 architectural finish, rough formed finish and the installation of anti graffiti coatings on cast in place concrete.

1.3 Related Work

- | | | |
|----|--------------------------------|------------------|
| .1 | Shop Drawings and Product Data | Section 01 33 23 |
| .2 | Concrete Reinforcing | Section 03 20 00 |
| .3 | Cast-In-Place Concrete | Section 03 33 00 |
| .4 | Abrasive Blast Finish | Section 03 35 10 |

1.4 Reference Standards

- .1 Concrete finishes shall conform to the requirements of the following standards unless otherwise required by this specification:
 - .1 CSA/CAN3-A23.1, Concrete Materials and Methods of Concrete Construction

1.5 Submittals

- .1 Manufacturers product information sheets for all component parts of the concrete installation including but not limited to, coloured, or stained concrete.
- .2 Quality control procedures for coloured or stained concrete.

PART 2: PRODUCTS

2.1 Concrete Materials: In accordance with CSA/CAN3-A23.1.

2.2 Bonding Agent: Formulated for bonding new concrete to cured concrete. Acceptable materials include but are not limited to:

- .1 Daraweld C, Grace Construction Materials

- .2 Polymer Bonding Agent, Target
 - .3 Concreseive Liquid LPL, Master Builders
 - 2.3 Non-shrink Grout for Patching: Acceptable materials include but are not limited to:**
 - .1 Embeco Mortar, Master Builder's,
 - .2 Fast- Set Patching Concrete, Target
 - 2.4 Integral Liquid Colour Additive:** Iron oxide pigment suitable for sandblasted concrete that will produce a uniform, consistent colour. Colour pigment shall be permanent, inert, stable in atmospheric conditions, sun fast, weather resistant, alkali resistant, lime proof and non-bleeding. Particle size shall be 95to 99% minus 325 mesh.
 - .1 Acceptable products include; SGS Color-Flo Liquid Colours, by Solomon Colors, Springfield, Illinois, sgs@solomoncolor.com or pre approved equal.
 - .2 Colour as indicated on Contract drawings.
 - 2.5 Anti Graffiti Coating:** All walls exceeding a height of 0.60M shall be protected with an Anti Graffiti Coating. Acceptable suppliers and proprietary products include;
 - .1 CBR 501-AG Anti Graffiti Coating by Broda Stains and Coatings, as supplied by CBR Products, 102-876 Cordova, Vancouver BC. (604) 254.3325.
 - .2 Pre approved equal
- INSTRUCTIONS FOR CONSULTANTS: Ensure that anti-graffiti coating requirements are clearly noted on drawings as required.
Delete this note.***

PART 3: EXECUTION

3.1 Site Mock Up - Architectural Concrete

- .1 A minimum of ten (10) working days prior to the start of work of this section a mock up of the components listed shall be constructed on site. Do not proceed with work of this section until the mock up(s) have been reviewed and approved by the Owner's Representative. If the mock up(s) are not approved, construct additional mock up(s) until approval is obtained.
- .2 The mock up shall be stored on site as a standard of quality, colour, finish and anti graffiti coating for each component. At the discretion of the Owner's Representative the mock up may be constructed as part of the finished component.
- .3 The mock up shall clearly illustrate all finishes, reveals, patterns, shapes and colours indicated on construction drawings and details.
- .4 Construct a 2.5M (8'-0") length mock up of each of the following:**
 - .1 Concrete cheek wall**
 - .2 Concrete stairs (anti graffiti coating to risers and treads)**
 - .3 Concrete seat step**
 - .4 Concrete wall**

3.2 Finishing of Concrete Surfaces

- .1 Architectural Concrete Finish (concrete surfaces that are exposed to view):
 - .1 Surface finishing shall conform to CAN 3-A23.1-M94, Section 24, Finishing of Formed Surfaces, Clause 24.3.3, Smooth Form Finish.
- .2 Rough Form Finish: All concealed concrete surfaces.
 - .1 Surface finishing shall conform to CAN 3-A23.1-M94, Section 24, Finishing of Formed Surfaces, Clause 24.3.2, Rough Form Finish. Patching to be done in accordance with clause 24.2 Patching.
- .3 Sandblast Surface Finish: On concrete surfaces noted on drawings as per Section 03351.

3.3 Repairs to Defects

- .1 Architectural concrete shall have a pleasing appearance, free of defects, with minimal colour and texture variation when viewed at a distance of 6 metres (20'-0").
- .2 Should the variation in colour and texture or the appearance of defect(s), including but not limited to honeycombing, rock pockets, chips, cracks, spalls, fins and stains, exceed the tolerance of the specification or CAN3 - A23.1-M94, whichever is more onerous, the concrete work will be rejected. At the discretion of the Owner's Representative rejected concrete, at no cost to the owner will be demolished and replaced by the Contractor.
- .3 Grinding or repair of stair treads to facilitate positive drainage will not be accepted. Contractor at no expense to the Owner will completely remove and replace all stair systems that exhibit ponding of water on the stair treads.
- .4 At the discretion of the Owner's Representative the Contractor may be given the opportunity to provide in writing accompanied by product information and cut sheets, a detailed methodology of repair of defective concrete. The methodology should reference the manufacturers written instructions for each product and procedure and shall clearly outline the full process for repair of defective work.
- .5 Should the Owner's Representative approve the defect repair methodology a trial repair will be carried out on the mock up. In the event the mock up was incorporated into the finished work a discrete location will be chosen by the Owner's Representative for testing of the defect repair.
- .6 The acceptance of the repair shall be at the sole discretion of the Owner's Representative. Should the repair not be acceptable to the Owner's Representative the Contractor shall, at no cost to the owner demolish, and replace the defective work.

3.4 Application of Anti Graffiti Coating

- .1 Unless otherwise indicated in the specifications or on the contract drawings, anti graffiti coating is to be applied to all exposed vertical concrete surfaces.

- .2 Surface preparation and application in strict accordance with the manufacturer's technical data and application instruction sheet.

3.5 Protection

- .1 Protect architectural concrete from any damage by the elements and defacement of any nature during construction operation.
- .2 All corners and surfaces subject to possible damage shall be suitably protected with boards or hoardings.
- .3 The Contractor shall make adequate provision to keep all exposed concrete free from laitance caused by spillage, leaking forms or other contaminants. In no event shall laitance be allowed to penetrate, stain or harden on surfaces that have been sandblasted.
- .4 Adequate protection shall be given to all exposed reinforcing steel in architectural concrete to prevent staining of surfaces of concrete due to rust and corrosion. If any rust or corrosion does occur it shall be removed immediately to avoid permanent staining.

3.6 Cleaning

- .1 Rubbish, debris and demolition material resulting from work of this section shall be collected regularly, removed from the project site and properly disposed.
- .2 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

END OF SECTION 03 35 00

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 for abrasive blasting of surfaces as indicated in the contract documents.
- .2 The work shall include but is not limited to the following components:
 - .1 Concrete Walls and Cheek Walls
 - .2 Concrete Seat Walls and Steps
 - .3 Concrete Planters
 - .4 Concrete Banding
 - .5 Cast in Place Concrete Walks, and Miscellaneous Flat Work

1.3 Related Work

- | | | |
|----|--------------------------------|------------------|
| .1 | Shop Drawings and Product Data | Section 01 33 20 |
| .2 | Concrete Forming | Section 03 10 00 |
| .3 | Reinforcing Steel | Section 03 20 00 |
| .4 | Cast-In-Place Concrete | Section 03 33 00 |

1.4 Reference Standards

- .1 All work and material shall conform to Chapter 9 of CPCA/MPDA Specification Manual (latest edition) and as herein specified.

1.5 Qualifications

- .1 This Contractor shall have a record of satisfactory performance in the trade and shall maintain a qualified crew of abrasive blasters throughout the duration of the work.

1.6 Requirements of Regulatory Agencies

- .1 Applicable Provincial, municipal regulations and environmental requirements shall be fully maintained during abrasive blasting operations.

- .2 WorkSafe BC safety regulations shall be strictly adhered to in all respects. Specific emphasis shall be placed on monitoring and adhering to permissible noise levels and air borne particulate levels.

1.7 On Site Mock-Up

- .1 *A minimum of ten (10) working days prior to the start of work of this section mock up(s) of the abrasive blast finishes shall be prepared by the Contractor. Do not proceed with work of this section until the mock up(s) have been reviewed and approved by the Owner's Representative. If the mock up(s) are not approved, construct additional mock up(s) until approval is obtained.*
- .2 *Construct two (2) 1.8M x 1.8M (6'-0"x 6'-0") mock up panels. Each panel shall be divided into three (3) equal zones, one for each intensity of abrasive blast finish, i.e. light, medium and heavy or as indicated on construction drawings and details. One mock up panel shall be of a vertical section of wall, the second shall a horizontal concrete surface.*
- .3 *Sample panels shall be abrasive blasted after the specified curing time has elapsed. Finish abrasive blast work will follow the curing procedure and timing.*
- .4 *The mock up shall be stored on site as a standard of quality, and finish for each component.*

1.8 Job Conditions

- .1 Equipment used in abrasive blasting operations shall be properly muffled. All dust shall be completely controlled during the operation.
- .2 Protect surrounding and adjoining work by adequately covering with tarpaulins or other necessary protective covering. At no cost to the Owner, make good any damage caused by failure to provide suitable protection.

PART 2: PRODUCTS

2.1 Materials

- .1 Abrasives shall conform to The International Concrete Repair Institute No. 310.2R-2013
- .2 Material and material gradation will be selected by the Abrasive blasting Subcontractor to achieve finishes described in the construction drawings and details, implemented on the mock up panels and approved by the Owner's Representative.

2.2 Product Delivery, Storage and Handling

- .1 Deliver materials to the site in unopened, weather tight packaging that is clearly marked with the manufacturers name and product information.
- .2 All materials shall be protected from the rain and excessive moisture, sit on pallets and stored in a location that will not impact other trades working on the site.

PART 3: EXECUTION

3.1 Inspection

- .1 The Contractor shall inspect all surfaces to be abrasive blasted and report to the Owner's Representative in writing any defects or elements that will hinder the completion of abrasive blast operations. Commencement of work indicates acceptance for the above condition.
- .2 Prior to start of work of this section the Contractor shall ensure that the Owner's Representative has reviewed and accepted all surfaces to be abrasive blasted.

3.2 Finish

- .1 Abrasive blasting finishes shall be light, medium and heavy abrasive blast finishes as called up on details and drawings. The exact finish of abrasive blast will be governed by matching samples reviewed by the Owner's Representative.
- .2 Refer to drawing for location, type and extent of abrasive blast finishes.

3.3 Abrasive Blast Operation

- .1 All abrasive blasting required on this project shall be carried out by the air-blasting method.
- .2 Concrete shall have cured for a minimum of twenty-one (21) days prior to abrasive blasting.
- .3 Schedule abrasive blasting operations to ensure cure times match those of the approved mock up panels.
- .4 Abrasive blasting operation shall yield uniform texture and colour to all surfaces. The texture and colour shall match the approved mock up panels.

3.4 Cleaning

- .1 During the progress of the work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- .2 Upon completion of the work remove all excess materials and clean all surfaces.

END OF SECTION 03 35 10

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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, place, cure, and finish all precast concrete, including coloured architectural concrete as indicated in the contract documents.
- .2 All exposed concrete shall have a high quality architectural finish.
- .3 The work of this section shall also include but shall not necessarily be limited to the following:
 - .1 Supply and installation of expansion joints and control joints
 - .2 Supply of all testing services.
 - .3 Supply and installation of all concrete reinforcement.

1.3 Related Work

- | | | |
|----|------------------------------|------------------|
| .1 | Sandblast Finish to Concrete | Section 03 35 10 |
| .2 | Anchors Set in Concrete | Section 05 50 00 |
| .3 | Sealants | Section 07 92 00 |
| .4 | Concrete Paving | Section 32 13 13 |

1.4 Reference Standards

- .1 CAN3 A23.4-94 "Precast concrete - Materials and Construction" and CSA A251-M1982 "Qualification Code for Manufacturers of Architectural and Structural Concrete".
- .2 Concrete shall be ready-mixed and conforming to CSA A23.1 and most recent NBC for mixing, transporting and placing.

1.5 Quality Assurance

- .1 All design work shall be under the direct supervision of and be prepared by, a registered professional structural engineer in the Province of British Columbia.

- .2 The engineer shall be responsible for complete design of precast concrete units specified in this section as per CSA A23.3 including structural adequacy of units used individually, in combination with other elements, structural handling and connection design, formwork and design and all other design related to the structural aspect of precast work in accordance with design criteria established by the Owner's Representative and engineering Owner's Representative of the building structure to ensure that the precast concrete units shall:
 - .1 Withstand lateral loads, both wind and seismic;
 - .2 Withstand all loads incurred by handling, storage, transportation and erection, without forming tension cracks; and
 - .3 Satisfy all applicable requirements of the B.C. Building Code, local building codes and by-laws and authorities having jurisdiction.
- .3 Lifting devices shall have an ultimate lifting capacity of a minimum of four (4) times the dead weight of the appropriate portion of the precast concrete unit. Inclination of the lifting forces shall be considered.

1.6 Qualifications

- .1 Precast concrete units shall be fabricated and erected by a manufacturer certified by CSA to meet requirements of CSA A251-M1982 for Class AC products.

1.7 Submittals

- .1 Submit duplicate (2) 12" x 12" x 2" samples of precast concrete finish for approval by the Owner's Representative prior to fabrication of panels. Approved samples will become standards of finish against which installed work will be checked on project completion. One sample for submission to Owner's Representative and one sample to be retained on site for comparative/in process inspections.
- .2 Submit shop drawings for approval prior to fabrication, in accordance with Section 01300.
- .3 Submit additional copies of shop drawings to other trades, as required, for indicating inserts, openings, blockings, etc., which are required to be built into the work of this section.
- .4 Supply setting plans and erection procedures to other trades for placement of all anchoring and securing devices for connection of the work of this section to the structure.
- .5 Each shop drawing submitted by the manufacturer shall be prepared, signed and sealed by a professional structural engineer registered to practice in the Province of British Columbia certifying adequacy that each precast concrete unit, lifting device and connection to the building structure is designed to carry the loads indicated. **Ensure shop drawings show minimum concrete cover over all reinforcing steel as per CSA A 23.4-94 section 12.5.1.**
- .6 Show clearly the support and connection details and all connection components.
- .7 Upon request, provide the Owner's Representative with certified copies of quality control tests related to this project as specified in CSA A23.2-94 "Method of Test for Concrete".

PART 2: PRODUCTS

2.1 Materials

- .1 Cement: Type 10, white, conforming to CSA A5-M1983.
- .2 Air Entraining Agent: Conform to CSA 266.1-M78.
- .3 Water: Potable.
- .4 Reinforcing Bars and Stirrups: Grade 400 W conforming to CSA G30.16-M1977 epoxy coated..5 Welded Wire Fabric: Conforming to CSA G30.5-M1983.
- .5 Anchors and Supports: Type 300W conforming to CSA G40.21-M81, hot dipped galvanized fabrications.
- .6 Welding Materials: Conforming to CSA W48.1-M1980.
- .7 Galvanizing: Hot-dipped galvanizing with a minimum coating of 600 g/m² to CSA G164-1981.
- .8 Zinc-rich Primer: Conforming to CGSB 1-GP-181a.
- .9 Epoxy Coating: Conforming to ASTM A775-81.
- .10 Bearing Pads: Neoprene, 60 durometer hardness to ASTM D2240-81 and 17 MPa minimum tensile strength to ASTM D412-80.
- .11 Shims: Plastic.
- .12 Weephole Tubes: Properly made plastic.

2.2 Concrete Mixes

- .1 Use concrete mix designed to produce a minimum of 35 MPa compressive cylinder strength at 28 days, with a maximum water/cement ratio to CAN3 A23.1-M77, Table 7 for Class C exposure.
- .2 Air entrainment in accordance with CSA A266.1-M78 and the manufacturer's directions.
- .3 Use of calcium chloride not permitted.

2.3 Curing

- .1 Curing as per CSA A23.1-94 and CSA A23.4-94

2.4 Reinforcement and Anchors

- .1 Weld reinforcement at intersections and weld anchors securely to reinforcements. If certified and approved by Structural Engineer and Owner's Representative. Do not weld 400R Reinforcing Bar - weakened if welded).
- .2 Hot dipped galvanize connections and anchors after fabrication and touch-up with "Galvacon" zinc rich primer after welding or pre-approved equivalent.
- .3 Concrete cover over reinforcing steel shall be as per shop drawings or CSA A 23.4-94 Table 1.

2.5 Fabrication

- .1 Fabricate units to CSA A251-M1982 in accordance with approved shop drawings.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location.
- .3 Mark each precast unit with date cast.

2.6 Finishes

- .1 Finish of coloured precast concrete units shall be custom match to approved sample panels and in accordance with related specification sections.
- .2 Waterproof interior face of all precast architectural concrete units at the lower section completely with an elastomeric waterproof coating as detailed and shown on the drawings.
- .3 All walls exceeding a height of 0.60M shall be protected with an Anti Graffiti Coating. Acceptable suppliers and proprietary products include;
 - .1 CBR 501-AG Anti Graffiti Coating by Broda Stains and Coatings, as supplied by CBR Products, 102-876 Cordova, Vancouver BC. (604) 254.3325.
 - .2 Pre approved equal

***INSTRUCTIONS FOR CONSULTANTS: Ensure that anti-graffiti coating requirements are clearly noted on drawings as required.
~~delete this note.~~***

2.7 Openings and Inserts

- .1 Incorporate in the precast concrete units all openings, holes, sleeves, inserts, chases, blockouts, attachments, etc., as required by the drawings and the specifications.
- .2 Mechanical and electrical subcontractors shall indicate location and type of openings, inserts, sleeves, etc., required by their work.
- .3 Fasteners shall be threaded inserts with loop anchorage sized suitable for the load imposed by the units indicated.
- .4 All anchors must be cast-in-place and accurately located, +/- 3mm unless otherwise noted. Fired pins will not later be accepted as a substitute for these anchors.
- .5 Should the requirements of a trade interfere with the structural adequacy of the precast concrete units, or be impractical for the production of the units, alternate arrangements shall be made with this section and accepted by the engineering Owner's Representative and the Owner's Representative.
- .6 Should additional openings, etc., be found necessary after the manufacture of the units concerned, they should be cored by this section at the expense of the other trade involved. Obtain permission from the Owner's Representative prior to cutting holes.
- .7 If electrical or mechanical items are required to be built into the precast work the respective trade will be responsible to supply and install the items at the precast shop. Permit use of facilities and provide full cooperation.

2.8 Connections

- .1 Connections between all precast concrete units and connection of units with building structure as shown may be modified if the Contractor wishes to propose an alternative type of detail.
- .2 Where connections are not shown or detailed, it shall be the responsibility of the fabricator to design and detail these connections.
- .3 Wherever possible, design connections to utilize either high tensile bolts or machine bolts rather than welding.
- .4 Where welding of reinforcing steel is required, or where structural plates and shapes are welded to reinforcing steel, provisions of CSA W186-M1981, shall apply.
- .5 If welded connections must be made, they shall be done in such a manner as to least affect concrete in precast concrete.

2.9 Quality Control

- .1 In-plant control shall comply with CSA A251-M1982.

2.10 Water Absorption

- .1 Water absorption of the surfaces shall not exceed 4% by mass.

PART 3: EXECUTION

3.1 Inspection

- .1 Before erecting precast concrete units, verify that building structures and anchorage inserts are within tolerances required to erect unit.
- .2 Determine field conditions by actual measurements.

3.2 Erection

- .1 Set precast concrete units straight, level and square in accordance with approved shop drawings.
- .2 Non-cumulative Erection Tolerances:
 - .1 Joint Dimension: Nominal 50mm; to vary not more than + 5mm or - 6mm.
 - .2 Joint Taper: Unit edges at joint not out of parallel over 0.6mm per 300mm but not more than 9mm total.
 - .3 Edge Alignment: Alignment of unit edges not exceeding 6mm.
 - .4 Faces of adjacent units offset not over 3mm
 - .5 Bowed units, within allowable bowing tolerances, arranged so offset between adjacent units does not exceed 3mm
- .3 Set units dry, without mortar, attaining specified joint dimension with lead or plastic spacers.
- .4 Fasten units in place by bolting or welding.

- .5 Tighten bolted connections with equal torque.
- .6 Secure bolts and tack-weld nut to bolt.
- .7 Provide temporary erection anchorage for welded anchorage system.
- .8 Clean field welds with wire brush and touch up with "Galvacon" zinc rich primer or pre-approved equivalent.

3.3 Patching

- .1 Mix and place patching mixture to match colour and texture of surrounding concrete and to minimize shrinkage.
- .2 Adhere patch to hardened concrete with high strength epoxy. Refer to Section 03 30 00.
- .3 Replace defective precast units if patching is not acceptable to the Owner's Representative.

3.4 Cleaning

- .1 After installation, clean soiled precast concrete areas to match adjacent surfaces to the satisfaction of the Owner's Representative. Seal exterior exposed surfaces in accordance with Section 03 35 00.

3.5 Protection

- .1 Protect finished precast concrete work and all other adjacent and surrounding work and materials from damage during the work of this section. Protect sills, ledges, and exposed corners with boards.
- .2 Make good all areas damaged by the Operations in connection with work of this section regardless of the limits of the Contract as shown on the drawings, as directed by the Owner's Representative.

3.6 Field Quality Control

- .1 The Contractor's design engineer shall be responsible for production of the engineered shop drawings and shall provide periodic inspections during construction as required. Such inspections and associated costs shall be included in the Contract at no cost to the Owner.
- .2 At completion of the work, the manufacturer's or supplier's design engineer shall submit to the Owner's Representative copies of field review reports for each site visit made and a final signed and sealed Letter of Assurance of "Field Review" and "Compliance" indicating the precast architectural concrete work has been installed in accordance with the standards specified herein and with the final reviewed shop drawings.

3.7 Inspection and Records

- .1 The manufacturer shall keep a record of each day's work showing:

- .1 Members cast that day.
- .2 Concrete Information: Mix proportions and additives, slump, air content, compressive strength, curing cycle.
- .3 Any unusual problems.
- .2 One (1) copy of these records shall be forwarded to the Owner's Representative.

END OF SECTION 03 45 00

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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 miscellaneous stone work as indicated in the contract documents. Work includes but is not limited to:
 - .1 Accessory Granite Elements, Supply and Install
 - .1 Granite Block Shoreline Markers as per landscape drawings.
 - .2 Granite Blocks @ Sports Court as per landscape drawings.
 - .3 Granite Block and Steps @ Play Mounds / lawn terrace as per landscape drawings.
 - .4 Granite Edging and Setts.
 - .5 Granite Blocks and Steps at North Mound.
 - .6 Granite Slabs under benches and picnic tables.
 - .7 Granite wall caps as per landscape details.
 - .8 Granite Shoreline.
 - .9 Granite Block Terrace @ retaining headwall.
 - .2 Accessory Basalt Elements, Supply and Install
 - .1 Basalt Stone for Basalt Walls
- .2 All stone to be quarried from Quarries in British Columbia
- .3 All stone to be finished in British Columbia.

1.3 Related Work

- | | | |
|----|--|------------------|
| .1 | Aggregates and Granular Material | Section 02 41 14 |
| .2 | Cast-In-Place Concrete | Section 03 33 00 |
| .3 | Excavation and Backfill | Section 31 23 10 |
| .4 | Precast Concrete Unit Paving | Section 32 14 00 |
| .5 | Precast Concrete Unit Paving – Permeable | Section 32 14 43 |

1.4 Quality Assurance

- .1 Source Supply: All material shall be obtained from quarries having adequate capacity and facilities to meet specified requirements. Cutting and finishing shall be carried out by a firm equipped to process material promptly on order and in strict accord with specifications.
- .2 All materials delivered to the site shall be clean, in good condition free of defects, stains and markings.

1.5 Protection

- .1 Site and Adjacent Property
 - .1 Protect all work from damage related to weather, other trades, and/or on site construction activities.
 - .2 Protect adjacent property and construction activities from damage arising from this contract.
- .2 Finished Stone
 - .1 Properly protect all stone against damage in transit or at project site.
 - .2 Place wood timbers under stone when stored on open ground to prevent contact with grade.

1.6 Existing Utilities and Structures

- .1 Exact location of all existing utilities and structures, whether or not indicated on the drawings will be determined by the Contractor. Conduct work so as to prevent interruption of service or damage.
- .2 Ensure that all underground utilities including drainage and irrigation systems are clearly located and protected during construction. Make good all damages.

1.7 Submittals

- .1 Material Samples; Two weeks prior to the start of construction submit to the Owner's Representative three (3) representative samples to the sizes and finishes noted. Clearly label the stone name or product name, quarry location, various finishes, project name and date.
 - .1 Granite: 300mm x 300mm x 100mm samples illustrating the following finishes on at least one face of each sample; split face finish, flame finish and or tumbled. Sample finish required for each for granite block and granite edging.
 - .2 Basalt Wall Stone: Representative of size, shape colour, texture.
- .2 All materials delivered to site will conform to selected samples, subject to normal stone variations. One (1) submitted sample will be retained on site at Site Office as record of approved material.

1.8 Schedule

- .1 Provide the Owner's Representative three (3) copies of a schedule outlining the key milestone dates related to quantity and sequence as required to properly expedite installation.
 - .1 The completion of quarry extraction and dressing of stone
 - .2 Delivery to the site
 - .3 Installation and completion

1.9 Examination

- .1 Prior to the commencement of work of this section, inspect all surfaces on which work is to be laid and ascertain that surfaces are adequate in relationship to the preparation of work to be performed under this section. Commencement of work will signify acceptance.
- .2 Report any defects or perceived conflicts to the Owner's Representative.

PART 2: PRODUCTS

2.1 Approved Equals

- .1 It is the intent of the City to specify Locally Quarried and Finished Stone.
- .2 Should the Contractor be seeking permission for use of an approved equal beyond the suppliers identified in this specification the following process shall be followed for the review and approval of an alternate material. See granite types for acceptable approved equal supply locations in Section 2.01.
- .3 Within the first ten (10) business days from the date of the Tender call for work of this section the Contractor shall provide in writing either by fax or email a notification to the Owner's Representative of the intention to seek an approved equal.
- .4 Following notification and within the first fourteen (14) days from the date of the Tender call supply documentation as noted to the Owner's Representative at no cost to the Owner or the Owner's Representative. Documentation to include;
 - .1 One (1) 200 mm(width) x 150 mm(depth) x 600mm(length) sample of material proposed as 'Approved Equal'. The sample shall clearly illustrate specified finishes and be labeled with the supplier name, address and phone number, stone name or product name, quarry location, and type of stone.
- .5 Owner's Representative shall review proposal for 'Approved Equal' and notify the Contractor in writing either by fax or email that the sample proposed as an 'Approved Equal' has been either accepted or rejected within five (5) business days of receipt of sample.
- .6 Rejected proposals will not be considered during the Tender evaluation.

2.2 Materials

.1 Granite Seating/Stepping Blocks

- .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
- .2 Supply granite blocks to sizes and surface finishes as noted on the drawings.
- .3 Split face on 4 sides with top face tolerances of 75mm – 100mm variation when placed against a plumb vertical edge. Ensure not more than 30% of drill/ wedge grooves remain on block. Tolerances on other 4 split faces to be 75mm - 100mm when placed against a plumb vertical edge. (see granite block schedule)
- .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
- .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**

.2 Granite Blocks Terrace at Retaining Head Wall

- .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
- .2 Supply granite blocks to sizes and surface finishes as noted on the drawings.
- .3 Split face on 2 sides with top and front face tolerances of 25mm – 45mm variation when placed against a plumb vertical edge. Ensure not more than 30% of drill/ wedge grooves remain on block. (see granite block schedule)
- .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
- .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**

.3 Granite Blocks at Sports Court

- .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
- .2 Supply granite blocks to sizes and surface finishes as noted on the drawings.
- .3 Saw Cut all sides and Flame Finished on 5 sides with bottom left unfinished. Patterns to etched and or patterned when sides are flamed finished. Landscape architect to provide digital and to scale patterns. Patterns noted on Granite Legend.

- .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
- .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .4 Granite Block Steps at Play Mound
 - .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
 - .2 Supply granite blocks to sizes and surface finishes as noted on the drawings.
 - .3 Split face on 4 sides with top face tolerances of 25mm – 45mm variation when placed against a plumb vertical edge. Ensure not more than 30% of drill/ wedge grooves remain on block. Tolerances on other 3 split faces to be 25mm - 60mm when placed against a plumb vertical edge. (see granite block schedule)
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .5 Granite Slab and Sett Edging
 - .1 All Granite to be quarried from a **Canadian Quarry** or pre approved as per Section 1.06.
 - .2 Supply granite edges to sizes and surface finishes as noted on the drawings.
 - .3 Split face on one side (top face) with top face tolerances of 10mm - 25mm variation when placed against a plumb vertical edge. (see granite block schedule for sizes)
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530

- .4 Pre approved equal as per section 1.06.
- .6 Granite Slab Steps at Path and North Mound
 - .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
 - .2 Supply granite edges to sizes and surface finishes as noted on the drawings.
 - .3 Saw cut all faces. Flame finish 4 faces, top, front, and sides.
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .7 Granite Slabs under Benches and Picnic Tables
 - .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
 - .2 Supply granite edges to sizes and surface finishes as noted on the drawings.
 - .3 Split face on 5 sides (top face & 4 side faces) with top face tolerances of 25mm – 45mm variation when placed against a plumb vertical edge. Ensure not more than 30% of drill/ wedge grooves remain on block.
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .8 Granite Wall Cap Stone
 - .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
 - .2 Supply cap stone to sizes and surface finishes as noted on the drawings.
 - .3 Split face on two faces (top face & front face) with top face tolerances of 25mm - 45mm variation when placed against a plumb vertical edge.
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.

- .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .9 Granite Shoreline
 - .1 All Granite to be quarried from a **Canadian Quarry** and locally supplied.
 - .2 Supply stone to sizes and surface finishes as noted on the drawings.
 - .3 Split face surface surfaces to have tolerances of 25mm - 45mm variation when placed against a plumb vertical edge. Flame finish surfaces to be rough flame finish.
 - .4 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .5 Provide sample of engraving for approval by Owner's Representative. Owner's Representative to provide digital text to scale of text to be engraved.
 - .5 All granite to be generally salt and pepper mix character look of grey, black and white fleck. Acceptable suppliers and proprietary products include;
 - .1 Hardy Island Granite as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783.
 - .2 Polycor – Quebec, QC 418.692.4695
 - .3 Granicor – Saint-Augustin, QC. 418.878.3530
 - .4 **Pre approved equal for other Canadian quarries only accepted.**
- .10 Accessory Basalt Elements, Supply and Install
 - .1 Free of cracks, seams or starts that may impair structural integrity or function. Minor variations in stone characteristic will be acceptable.
 - .2 All basalt to be predominantly charcoal gray with tan/brown mottling and quarried locally in the Fraser Valley Region of BC. Acceptable suppliers and proprietary products include;
 - .1 Basalt Wallstone as supplied by Northwest Landscape and Stone Supply – Burnaby, BC 604.435.4842
 - .2 Cheakamus Dry Stack Basalt as supplied by Adera Natural Stone Supply – Burnaby BC 604.436.0204
 - .3 Whistler Basalt as supplied by Bedrock Granite Sales – Coquitlam, BC 604.941.7783
 - .4 Pre approved equal as per Section 1.06 Approved Equals.

- .3 Granular Base: To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to 02 41 14 Aggregates and Granular Materials Section for specified gradations.

PART 3: EXECUTION

3.1 Layout

- .1 Prior to the start of construction, stake layout of all granite elements for Owner's Representative review.
- .2 Verify all locations and dimensions and report to Owner's Representative any deviation or conflicts between drawings, specifications and site conditions.

3.2 Subgrade Preparation

- .1 Compact subgrade to 95% Modified Proctor Density.
- .2 Excavate soft and unstable areas of subgrade that cannot be compacted to standard noted, fill and compact with approved granular material.
- .3 Ensure subgrade is true to line and grade and allows for sufficient depth to ensure finish grade can be established as noted on plans.

3.3 Placement of Accessory Granite and Basalt Elements

- .1 Examine material prior to installation for visible defects or damage. Do not install cracked, chipped, stained or physically damaged pieces. Report any damages to Owner's Representative immediately.
- .2 Place crushed granular base to lines and levels noted on drawings.
- .3 Set Granite Block Shoreline Marker and other Granite Blocks to lines and levels noted on drawings.
 - .1 Set blocks to pattern and layout indicated on Contract Documents.
 - .2 Ensure blocks sit true, level, and do not rock or move under pedestrian load.
 - .3 Do not use shims or spacers to level blocks. Blocks to sit tight edge to edge to lines and grades indicated on drawings.
- .4 Dry Stack Basalt Masonry Wall
 - .1 Set blocks to pattern and layout indicated on Contract Documents.
 - .2 Ensure blocks sit true, level, and do not rock or move under pedestrian load.
 - .3 Minimize use of basalt shims or spacers to level blocks. Blocks to sit tight edge to edge to lines and grades indicated on drawings.
 - .4 Prepare 2-metre long sample wall section for review and approval by Owner's Representative

3.4 Adjust and Clean

- .1 Carefully clean all stone removing all dirt and debris from all surfaces.
- .2 Remove and dispose of off site all debris as a result of work in this section.

END OF SECTION 04 43 00

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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 miscellaneous metalwork items as indicated in the contract documents.
 - .1 Handrails,
 - .2 Guardrails,
 - .3 Balustrades.

1.3 Related Work

- .1 Exterior Painting and Powder Coating Section 09 96 00
- .2 Exterior Site Furnishings Section 32 37 00

1.4 Reference Standards

- .1 Conform to CAN3-S16.1-M for design of steel structures, unit stresses and workmanship.
- .2 Handrails and balustrades when installed shall conform to local municipal loading requirements. Maximum deflection 1/360 of the span.

1.5 Quality Assurance

- .1 Welding work to conform to CSA Standard W59 and shall only be performed by organizations and operators qualified under CSA Welding Qualification Code, CSA W47.
- .2 Electrodes to conform to CSA Standard W48.
- .3 Painted finishes of exterior galvanized metal to conform with requirements of Section 09 96 00. Surface preparation for painting of exterior exposed steel to conform to Steel Structural Painting Council Standards - refer also to Section 09 96 00.

1.6 Submittals

- .1 Submit shop drawings of all miscellaneous metalwork for review by Owner's Representative. Completely detail items indicating all dimensions, materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcements and fixing details and accessories. **Confirm all dimensions on site prior to fabrication.**
- .2 Submit shop drawings in accordance with General Condition GC 34 as amended under Supplementary Conditions and Section 01 33 23 (as applicable).
- .3 Do not commence fabrication of miscellaneous metal items until shop drawings are reviewed/stamped by the Owner's Representative.
- .4 Shop drawings for metal balustrades, railings and guardrails, including all connection detailing, shall be sealed by a Professional Engineer registered in the province of B.C.

1.7 Protection

- .1 Use all means necessary to protect miscellaneous metal before, during and after installation and to protect the installed work and materials of all other items until Substantial Completion.
- .2 In the event of damage immediately make all repairs and replacements necessary to the approval of the Owner's Representative at no extra cost.

1.8 Quality Assurance

- .1 Prior to commencement of any work of this Section, the contractor is required to make contact with the designated Owner's Representative properly authorized to make project decisions, and to determine schedule of inspections required and parties to be present for review/approval.
- .2 All work is to be presented at fabricator's shop for inspection of workmanship and materials prior to arrival on site and/or forwarding to paint shop for finishing work. Notify Owner's Representative a minimum of **forty-eight (48) hours** prior to all required inspections.

PART 2: PRODUCTS

2.1 **Steel:** shall be one of the following types as designated on the drawings or specified herein.

- .1 Structural steel, miscellaneous steel shapes, conforming to CAN3-G40.21-98, Grade 300W, 44W for flat shapes.
- .2 Seamless hollow structural sections, conforming to CAN3-G40.21, Grade 50W, Type H.
- .3 Pipe, schedule 40 standard weight, conforming to ASTM Specification A53, Grade A. Include galvanized sleeves for setting verticals, as required. Bends as detailed.

2.2 **Bolts, Nuts and Washers:** In accordance with material and size requirements of CAN3-S16.1-94M. (ASTM A307).

- 2.3 Galvanizing:** Hot dipped galvanizing with zinc coating 610 grams per square meter area conforming to CSA G164-M92.
- 2.4 Galvanized Metal Primer:** Shall conform to CGSB 1-GP-198-95 Cementitious Primer for Galvanized Surfaces.
- 2.5 Non-Galvanized Ferrous Metal Primer:** Shall conform to CGSB 1-GP-40M or 1-GP-132M90 Zinc Chromate Primer for Low Moisture Sensitivity.
- 2.6 Grout:** For fill at pipe sleeves and other locations use a, non-shrink, non-metallic, non-corrosive, flowing, 24h, MPa.15, pullout strength 7.0 MPa grout for setting metal posts.
- 2.7 Concrete Inserts:** Threaded or wedge type galvanized ferrous castings, either malleable iron to ASTM A47, or cast steel to ASTM A27 Standards. Provide bolts, washers and shims as required hot-dip galvanized as specified.
- 2.8 Fastenings:** Supply and install all hardware as required for installation. Installation hardware shall be sized to suit the material to which railings and other miscellaneous metal items are attached and shall meet the loading requirements. Hilti sleeve/chemical anchors as noted by Engineer. Submit samples for approval.
- 2.9 Angles, Clips, Channels etc.:** Provide all angles, anchors, clips, plates, channels, etc. required to support or fix items of work installed by other sections save where specifically excepted and supply and fix any other miscellaneous ironwork required in the work.
- 2.10 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.
- 2.11 Approved Equals**
- .1 All items as specified or pre-approved equals.

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 it to the Owner's Representative.

3.2 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.
- .5 Fit and shop assemble in largest practical sections for delivery to the site.
- .6 Fabricate and assemble miscellaneous metal items true, square and free from warpage or other defects.
- .7 Items to be fixed to concrete or masonry with expansion shields, expansion bolts or self-drilling anchors. Fixing to be of correct size to suit load being imposed.
- .8 Design, fabrication and workmanship shall conform to CAN3-S16.1-M94.
- .9 Welding shall conform to CSA W59-M89.
- .10 Use self-tapping shake-proof flat-headed screws on items requiring assembly by screws or as indicated.
- .11 Grind smooth all exposed welds, sharp edges, angles and corners.
- .12 Ensure exposed welds are continuous for length of each joint.
- .13 Bolted work shall be carefully tightened with threads of bolts nicked to prevent subsequent loosening, unless work indicated is noted as removable.
- .14 Drill or punch all holes required for the attachment of work of other trades and bolted connections.
- .15 Provide smooth exposed surfaces with all fastenings and connections hidden where possible.
- .16 Curved work shall be true to radii shown.
- .17 Galvanize all steel noted on drawings after fabrication of Sections prior to delivery to site.

3.3 Shop Preparation and Priming

- .1 All metal items shall be hot-dipped galvanized, primed and painted to requirements of Section 09900 - Aliphatic Urethane except where shown otherwise.
- .2 Apply one shop coat of primer to all miscellaneous metal items, except any items specified to be factory finished and any concrete encased items.
- .3 Prepare all miscellaneous metal for priming to Steel Structural Painting Council Standards; S.S.P.C. SP-1-82 Solvent Cleaning, followed by S.S.P.C. SP-6-85 Commercial Blast Cleaning.(if applicable and recommended by Owner's Representative). Refer to SSPC Manuals, Guide to Good Painting Practices Volumes 1 and 2 for complete details.
- .4 Apply primer in accordance with manufacturer's directions.
- .5 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is lower than 7 degrees Celsius.
- .6 Clean surfaces to be field welded; do not paint.

3.4 Preparation for Powder Coating

- .1 Thoroughly descale all steel work after fabrication. Remove roughness and irregularities by grinding and clean wire brush. Remove oil and grease from steel surfaces.
- .2 Do not coat surfaces that are to be field welded.
- .3 Coat steel as soon as possible after cleaning.

3.5 Erection

- .1 Erect metalwork square, plumb, straight and true, accurately fitted, with tight joints and intersections.
- .2 Provide suitable means of anchorage acceptable to Owner's Representative, 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 and workmanlike 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 building into masonry to appropriate trades together with setting templates.
- .6 Touch up rivets, field welds, bolts and burnt or scratched surfaces after completion or erection with appropriate primer.
- .7 Touch up galvanized surfaces with zinc primer where burned by field welding - refer to Section 09900. Ensure that all welds have been ground smooth and flush prior to applying zinc primer.
- .8 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.
- .9 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.

3.6 Installation

- .1 Install handrails in concrete by inserting over spigot as detailed, formed in concrete. Secure with stainless steel bolts, drilling concrete and installing wedge anchors, two per connection or as otherwise detailed. Support in accurate final location, plumb and level.

3.7 Powder Coating (if applicable):

- .1 Powder coating shall be carried out in shop by a pre- approved powder coating company. Minor marks in powder coating due to delivery and storage shall be promptly repaired by an approved method-confirm with Owner's Representative prior to repair. Damaged surfaces determined to be unacceptable for on-site repair shall be removed and re-coated at the plant.
- .2 Submit colour sample to the Owner's Representative, size of sample at least 100mm x 100mm Final colour shall match approved samples.
- .3 Apply powder coating to match approved sample, leaving final surfaces uniform. Hard and dry and free from foreign matter and other flaws. Repair flawed items completely; patching will not be acceptable.

3.8 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 WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structure/element due to work of this Section shall be immediately repaired at the Contractor's expense to satisfaction of Owner's Representative.
- .4 Remove and dispose of off site all surplus material, excess excavated materials, trash, debris, residue and waste material from the work of this Section.

END OF SECTION 05 70 00

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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 exterior architectural wood work as indicated in the contract documents.
 - .1 Wood Topped Benches

1.3 Related Work

- .1 Cast-in-Place Concrete Section 03 33 00
- .2 Growing Medium Preparation and Placement Section 32 91 13

1.4 Reference Standards

- .1 Exterior wood, wood sizes and surface finish shall conform to the following:
 - .1 NLGA – National Lumber Grades Authority - Latest Edition, Standard Grading Rules of B.C. Coast Dimension Lumber Grades.
 - .2 WCLIB – West Coast Lumber Inspection Bureau
 - .3 WRCLA – Western Red Cedar Lumber Association
 - .4 IWPA – International Wood Products Association
 - .5 BC Building Code – Current Edition

1.5 Submittals

- .1 Samples:
 - .1 Wood: Submit two 600mm (24") long samples of each wood member element forming a finished surface. Samples are to be clearly labeled with wood type, grade, origin and member dimension.
 - .2 Fasteners, Plates and Connectors: Product information sheet and one (1) representative sample of each element.
 - .3 Hardware: Product information sheet and one (1) representative sample of each element. Sample, if approved may be used in the final installation.

- .2 Shop drawings: Shop drawings shall illustrate details necessary for fabrication and erection of the component parts including location, type, size and detail of all fastening systems.
- .3 Mock Ups: Prior to the complete fabrication of exterior architectural elements provide a full-scale mock-up the following elements:
 - .1 Countersunk and plugged fastener.
 - .2 Trellis end condition
 - .3 Wood treatment sample

1.6 Quality Assurance

- .1 Qualifications of Contractor and Crew:
 - .1 The Contractor performing work of this section shall have a successfully completed the Interprovincial Standards Exam and hold Interprovincial Red Seal status as a carpenter. Prior to the start of work of this section the Contractor shall; provide the Owner's Representative with written confirmation that he will maintain a crew with at least one carpenter holding Red Seal status.
- .2 Erection methods and procedures shall meet the minimum standards set out by the BC Building Code. Where this specification exceeds this standard the specification shall govern.

PART 2: PRODUCTS

2.1 Lumber

- .1 Lumber Grades
 - .1 Shall conform with the NGLA latest edition Standard Grading Rules of B.C. Coast Dimension Lumber Grades.
 - .2 All S4S unless otherwise indicated.
 - .3 Moisture content (MC) at time of installation shall be in accordance with the NLGA current standards, which currently is 19% or less kiln dried or air seasoned for structural or appearance graded.
 - .4 All lumber shall be straight, sound, and free of splits, warps and cracks.
- .2 Western Red Cedar:
 - .1 ***Standard Beams, Posts and Timbers – Western Red Cedar, S4S, 'D or better', clear, (NLGA 203b,c,d WCLIB 150-b,c,d, air dried/ seasoned.***
 - .2 ***Standard Beams, Posts and Timbers – Western Red Cedar, S4S, WRCLA 'Appearance Knotty', unseasoned.***
 - .3 ***Decking - Western Red Cedar, S4S, WRCLA 'Custom' Clear or better, unseasoned. NOTE: Good quality, some knots, but knots are tight. Typically 5/4 thickness, 4" and 6" widths)***

- .4 **Decking - Western Red Cedar, S4S, WRCLA 'Architect' knotty or better, air dried/seasoned.**
- .5 **Lumber – Western Red Cedar, S4S, 'C or better' Clear (NLGA 202b,c, WCLIB 149-b,c or WWPA 10.11,12), unseasoned.**
- .6 **Lumber - Western Red Cedar, S4S, 'A' Clear (NLGA 202b, WCLIB 102-c or kiln dried.**
- .3 Pressure Treated Lumber

NOTE: ACQ is the default pressure treated wood. CCA treated wood is not to be specified. All fasteners for ACQ treated wood must be stainless steel.

- .1 Pressure-treated members shall be cut and machined prior to application of preservative. Where precutting is not feasible then untreated surfaces exposed due to cutting or boring shall be thoroughly soaked with the same preservative used in the initial treatment.
- .2 All lumber which has been pressure-treated shall bear the inspection and classification label of the Underwriter's Laboratories of Canada as well as documentation confirming treatment meets or exceeds standards specified.
- .4 ACQ (Alkaline Copper Quat) treated Hem Fir to CSA 080-97
 - .1 Deck Boards and Fascia Boards - CSA 080.36, Use category UC3.2, Residential Product Group B, ACQ –C.
 - .2 Railing components - CSA 080.36, Use category UC3.2, Residential Product Group B, ACQ – D.
 - .3 Deck Joists and Beams – CSA 080.2, Use category UC3.2, Residential Product Group C, ACQ – C.
 - .4 Deck Supports and Guardrails (4x and 6x members in contact with ground or water) – CSA 080.2, Use category UC4.1, Residential Product Group D, ACQ – C.
 - .5 Posts (8x members in contact with ground or water) – CSA 080.2, use category UC4.1, Residential Product Group D, ACQ – D.
- .5 Exotic Hardwood Decking This includes Ipe and other tropical hardwoods
 - .1 IWPA Premium AD S4S E4E, species as indicated on the contract drawings. Average moisture content not exceeding 12.
- .6 End Sealer: Non-toxic wax based end sealer. Acceptable products include Anchorseal 2 by the UC Coatings Corporation, Ipe Seal distributed by Goodfellow Inc. Richmond BC or pre approved equal.
- .7 Galvanizing Touch Up: zinc rich (minimum 96% zinc) paint or powder aerosol spray. Acceptable products include Zinga and Zingaspray as supplied by Zinga – USA (www.zinga-usa.com) or pre approved equal.

2.2 Fasteners

- .1 All fasteners and metals to meet the following standards:

- .1 Fasteners - Hot Dip Galvanized to ASTM A153 (Class C or D).
- .2 Metal Hangers and Plates – Hot dipped galvanized to ASTM A653 G185 continuously galvanized sheet metal or ASTM A123 batch galvanizing after fabrication.
- .3 Stainless Steel - Fasteners, metal hangers and plates – Type 304.
- .4 Organic Polymeric Coated Electroplated Fasteners, Metal Hangers and Plates – Provide product information for Owner's Representative review prior to use.
- .5 Electroplated galvanized fasteners are not acceptable.

2.3 Miscellaneous Hardware

- .1 Hinges, hasps, door knobs, locksets and other miscellaneous elements to be suitable for exposed outdoor use and compatible with use and material indicated on contract drawings.

2.4 Adhesives

- .1 Exterior Waterproof Wood Glue (non load bearing applications): Exceed ANSI/HPVA Type I water resistant specifications, non-toxic, solvent clean, water clean up. Acceptable products include; Titebond III as manufactured by Franklin International, Columbus Ohio.
- .2 Construction Adhesive: Synthetic rubber base, non-flammable, water resistant adhesive. Acceptable products include; Lepage PL9000 Premium Construction Adhesive as manufactured by Henkel Canada, Mississauga Ontario.

2.5 Moisture Break

- .1 Moisture Break; Foamsealr foam sill gasket by Owens Corning or approved equal.

PART 3: EXECUTION

3.1 Installation

- .1 Install members to lines, levels and elevations indicated.
- .2 Space members uniformly ensuring adequate allowance for material expansion.
- .3 Unless otherwise noted on drawings or details, ease all edges of wood members.
- .4 Use hot-dipped galvanized, stainless steel or approved non-corrosive fasteners. Unless otherwise noted on drawings fasteners sizes and types shall be as follows:

| | |
|--------------------------------|--|
| 19mm (3/4") members or thinner | Casing Nails |
| 38mm (1/2") members | Screw |
| 89 mm (3 1/2") or larger | Bolt and washer, threaded rod bolt and washer assembly |

- .5 Touch up all areas of galvanized steel that have been marred, scratched or compromised during installation.

- .6 Unless otherwise indicated use joist hangers and connecting plates for structural members hidden from view.
- .7 Where indicated on drawings for fastener to be countersunk the finish surface of the top of the fastener shall be set at least 6mm (1/4") below the finish surface of the wood member.
- .8 Where indicated on the drawings for fastener to be countersunk and plugged the species of wood for the plug shall match the species of wood for the constructed element. All plugs shall be glued in place, be of sufficient thickness to allow for a durable finish, finished flush with surrounding finished surface.
- .9 Where wood is in direct contact with concrete or non-porous materials provide a continuous foam gasket moisture break between the two materials.

3.2 Cleaning

- .1 Upon completion remove from the site all waste and residue from work of this section.
- .2 Pressure Treated Wood: dispose of at approved facility.
- .3 Untreated Wood: dispose of at approved wood recycling facility.

END OF SECTION 06 40 13

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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 all exterior coating work as indicated in the contract documents.
- .2 The work of this contract includes but is not limited to:
 - .1 Surface preparation of substrates as required for acceptance of coating, including but not limited to: high-pressure washing, chemical cleaning, abrasive blast cleaning and making good surfaces and areas to the limits defined under preparation requirements.
 - .2 Removal of shop coatings, cleaning of surfaces and re-applying damaged and/or non-conforming shop coats of coating, other than minimal spot touch-up.
 - .3 Priming and coating of structural steel, miscellaneous metal, aluminium, galvanized steel, and ornamental metal.
 - .4 Provision of safe and adequate ventilation and protection of adjacent components.
 - .5 Touch-up and field coating necessary to repair damage due to installation and construction activity.

1.3 Related Work

- .1 Miscellaneous Metal Section 05 70 00

1.4 Reference Standards

- .1 Master Painters Institute (MPI) - Architectural Painting Specification Manual Identifiers, Evaluation, Systems, Preparation and Approved Product List. (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.
- .2 AAMA – American Architectural Manufacturers Association
- .3 SSPC Surface Preparation Standards – Latest Edition
- .4 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

- .5 Preparation of surfaces and application of coating systems shall be in accordance with the applicable chapters of Master Painters Institute (MPI) and Master Painters and Decorators Association (MPDA) Specification Manual (latest edition).
- .6 All work, unless otherwise specified, shall be to Master Painters and Decorators Association "Premium Grade"
- .7 The coating products of the coating manufacturer shall be as listed in the MPI Manual (latest edition), under Paint Product Recommendation section, sourced from a single manufacturer and form a fully compatible coating system. A copy of this manual shall be kept in the shop and on site for the full duration of the contract.

1.5 Qualifications

- .1 The Contractor shall have a minimum of five (5) years proven satisfactory performance with:
 - .1 Coating systems specified for this project,
 - .2 Coating projects of similar size to this project.
- .2 Prior to the start of work of this section the Contractor shall:
 - .1 Provide the VPB Project Manager with written confirmation that he will maintain a qualified crew of **Trade Qualified Journeymen Painters** and apprentices with experience in application of coating systems specified for this project throughout the duration of the work.
 - .2 The Trade Qualified Journeymen Painters hold a Provincial or Inter provincial Painter & Decorator or Painting & Decorating Certificate of Qualification throughout the duration of this work. Provide trade certification and apprentice registration numbers to the VPB Project Manager.
- .3 Coating Shop:
 - .1 Prior to the start of work of this section Quality Control Inspector (QCI) shall review and approve the Contractors controlled environment to ensure that the finished quality and standards described in this specification are achievable.

1.6 Quality Assurance

- .1 The Contractor shall retain an independent third party Quality Control Inspector (QCI) to carry out the Quality Control for the work of this section. Acceptable third party inspectors include but are not limited to; MPDA Inspection Services Inc., Burnaby, British Columbia.
 - .1 Prior to the start of work of this section the Contractor shall provide written documentation that the Quality Control Inspector (QCI) is in good standing with the MPI Accredited Quality Assurance Association.

- .2 Prior to the start of work of this section the QCI shall submit to the VPB Project Manager a 'Quality Control Plan' outlining all quality control procedures including but not limited to review test methods, test intervals, environmental requirements, processes, materials and interfaces necessary to ensure preparation surfaces, application of coating systems and field touch up conform to the specifications.
- .3 The QCI shall maintain a written record of all work undertaken during the course of work of this section.
- .4 The QCI shall provide copies of all test reports and review reports to the VPB Project Manager for their review and records.
- .2 The Contractor shall provide the QCI a minimum of one (1) week notice that work of this section is to begin and provide the QCI with the following:
 - .1 A copy of the project coating specification.
 - .2 A full set of construction documents 'Issued for Construction' including specifications.
 - .3 A copy of the project construction and fabrication schedule.
 - .4 Confirmation of specific surface preparation procedures and primers used for all fabricated metal and miscellaneous metal items by the fabricator/ supplier.
- .3 Prior to the application of any primer or top coat(s) the QCI shall review all materials and surfaces for defects or improper preparation. The QCI shall under take a second review for defects after the application of the prime coat. The QCI shall notify the VPB Project Manager and the Contractor in writing of any defects or improper preparation observed.
- .4 The VPB Project Manager at their discretion may conduct Quality Assurance reviews to ensure that their expectations of colour and finish meet or exceed the requirements of this section.

1.7 Requirements of Regulatory Agencies

- .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 coating and related waste materials.

1.8 Warranty

- .1 The Contractor shall provide the one of the following forms of warranty for the work performed in this section:
 - .1 A local MPI Accredited Quality Assurance Association's two (2) year warranty or,
 - .2 A two (2) year maintenance bond the value of which shall be equal to one hundred percent (100%) of the contract value for work of this section.
- .2 The warranty shall warrant that the work of this section has been performed and tested in accordance with the standards and requirements incorporated in the MPI Specification Manual (latest edition). The cost of the warranty shall be included in the Contractors bid price.

- .3 Should the Contractor select the Maintenance Bond he will provide the VPB Project manager with Maintenance Bond Consent from a reputable surety company licensed to do business in Canada. Cash or certified cheques are not acceptable in lieu of surety consent.
- .4 The warranty or bond option shall both relate to the rework, repair, making good any and all defects in the work of this section due to faulty workmanship or defective material that appear during a two (2) year period following date substantial performance of the Project. The review of defective work will be undertaken by a third party inspector from MPDA Inspection Services Inc.- Burnaby, British Columbia. The cost of initial warranty or bond inspections and all follow up inspections carried out during the warranty period will be borne by the Contractor.

1.9 Submittals

- .1 Prior to the start of work of this section the Contractor shall provide the VPB Project Manager with full the following:
 - .1 Manufacturers technical product information, preparation and application procedures for each type of priming and coating system.
 - .2 Two (2) sets of 300mm (12") square colour samples for each colour indicated on the contract drawings. Each colour sample shall have the specified sheen/ gloss, coating colour/ name, Contractors name and date indicated on the back. One (1) set of colour samples shall be retained on site.
- .2 Prior to the start of work of this section the Contractor shall prepare a mockup of coating application for each type of metal, sheen/ gloss and texture indicated on the Contract documents. The Contractor may use a portion of the fabricated metal components for the mockup. The mock up shall be of suitable size to accurately illustrate the workmanship proposed for the finished product. Following the VPB Project Manager review the mockup will become the acceptable standard of finish quality and workmanship for similar on-site work.

1.10 Site Conditions

- .1 Unless specifically pre-approved VPB Project Manager, QCI and the applied product manufacturer, perform no coating when the ambient air and substrate temperatures are below 50° F (10° C).
- .2 Perform no exterior coating work unless environmental conditions are meet the requirements of the QCI and coating manufacturer.
- .3 Should field coating be required. The Contractor shall provide suitable weather-proof covering and sufficient heating facilities to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after coating application.
- .4 Perform no coating 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.

- .5 Conduct all moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
- .6 Apply coating only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .7 The Contractor shall provide and maintain lighting facilities as required to ensure a minimum lighting level of 323 Lux (30 foot candles) is provided on surfaces to be coated.

1.11 Waste Management and Disposal

- .1 Coating 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 government departments having jurisdiction.
- .2 The Contractor shall separate and recycle all waste materials. Where coating recycling is available, the Contractor shall collect waste coating by type and provide for delivery to recycling or collection facility. Materials that cannot be reused the Contractor must be treat them as hazardous waste and dispose of them in an appropriate manner in accordance with all government regulations.
- .3 The Contractor shall 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 Contractor shall strictly adhere to the following procedures:
 - .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 coating and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil-soaked rags used during coating 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 coating 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 The Contractor shall set aside and protect surplus and uncontaminated finish materials not required by the Park Board and deliver or arrange collection for verifiable re-use or re-manufacturing.

PART 2: PRODUCTS

2.1 Product Delivery, Storage and Handling

- .1 Deliver all coating materials in sealed, original labelled containers bearing manufacturer's name, product name, colour number, batch date, type of coating and colour designation, standard of environmental compliance, VOC content, materials content as well as mixing and/or reducing and application requirements.
- .2 Store all coating materials in original labelled containers in a secure (lockable), dry, heated and well ventilated single designated area meeting the minimum requirements of both coating manufacturer and authorities having jurisdiction and at a minimum ambient temperature of 45° F (7°C). Only material used on this project is 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 (coating, 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.

2.2 Coatings: Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

2.3 Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.4 Coating system for ferrous metals, galvanized steel shall be a three coat build up sourced from a single manufacturer to MPI EXT 5.1G.

- .1 High Build Epoxy Finish: Three coat system manufacturers listed or pre approved equal

| | Product/Manufacturer | Product/Manufacturer | Product/Manufacturer |
|--|--|--|--|
| 1st Coat Zinc Rich Primer Dry Film Thickness: 3.0 mil | <i>PPG</i> Pitt – Guard 95-245 Epoxy Zinc Rich Primer | <i>Cloverdale</i> High Performance ClovaZinc 3 | <i>Sherwin Williams</i> Zinc Clad IV |
| 2nd Coat High Build Epoxy Dry Film Thickness: 6.0 mil | <i>PPG</i> Acupon 35 | <i>Cloverdale</i> High Performance Clovathane | <i>Sherwin Williams Pro</i> Industrial and Marine Macropoxy 646 Fast Cure Epoxy |
| 3 rd and 4 th Coat Polyurethane Pigment Dry Film Thickness: 2.0 mil (each coat) | <i>PPG</i> Pithane Ultra Gloss Urethane Enamel | <i>Cloverdale</i> High Performance Clovaguard | <i>Sherwin Williams</i> Industrial and Marine Macropoxy 646 Fast Cure Epoxy |

- .2 The contractor shall pay for testing and or independent evaluation of alternate products if not currently on approved list to demonstrate equal to or better than listed product.**

2.5 Coating system for aluminium shall be a two coat powder coat build up sourced from a single manufacturer to AAMA 2604 standard.

- .1 Primer:** Zinc Chromate, Dry Film Thickness, 0.75 mil minimum
- .2 Powder Coating:** Polyester, Dry Film Thickness: ASTM D 1400: 2.0mil, minimum thickness.
 - .1** Acceptable products include but are not limited to: Envirocron Ultra-Durable Powder Coating, PPG Industries Inc., Powdura 4000, Sherwin Williams, TCI Powder Coatings.
- .3** Pencil Hardness, ASTM D 3363: H – 2H.
- .4** Salt Spray Resistance: ASTM B 117: 3,000 hours.
- .5** Humidity Resistance: ASTM D 2247: 3,000 hours.
- .6** Gloss/ Sheen Ratings: Finish coat gloss shall be in accordance with the following MPI sheen rating:

| Gloss Level | Description | Units @ 60 degrees | Units @ 85 degrees |
|-------------|-------------------------------|-----------------------|--------------------|
| G1 | <i>Matte or Flat finish</i> | <i>0 to 5 units</i> | <i>10 max.</i> |
| G2 | <i>High Sheen Flat Velvet</i> | <i>0 to 10 units</i> | <i>10 to 35</i> |
| G3 | <i>Eggshell finish</i> | <i>10 to 25 units</i> | <i>10 to 35</i> |
| G4 | <i>Satin finish</i> | <i>20 to 35 units</i> | <i>35 min.</i> |
| G5 | <i>Semi-Gloss finish</i> | <i>35 to 70 units</i> | |
| G6 | <i>Gloss finish</i> | <i>70 to 85 units</i> | |
| G7 | <i>High-Gloss finish</i> | <i>> 85 units</i> | |

2.6 Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required per manufacturer's specifications.

- .1 All materials including primers, coatings, coatings, etc. shall be listed in the latest edition of the **MPI** Approved Product List. All such material shall fully compatible with component parts and be from a single manufacturer for each system used.
- .2 All materials used shall be lead and mercury free and shall have low VOC content where possible.
- .3 All coating materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment.

2.7 Coating Equipment: To best trade standards for type of product and application. Spray equipment shall be of ample capacity, suited to the type and consistency of coating or coating being applied and kept clean and in good working order at all times.

2.8 Maintenance Materials

- .1 At project completion the Contractor shall provide 4 litres (1 gallon) of each type and colour of coating from same production run (batch mix) used in unopened cans, properly labelled and identified for Park Board's later use in maintenance.

PART 3: EXECUTION

3.1 Inspection

- .1 Examine all surfaces to receive coatings prior to commencing work. Do not apply finishes until surfaces have been properly prepared and inspected by the project QCI. Report any unsatisfactory surfaces to the appointed QCI and VPB Project Manager.
- .2 The Contractor shall, in writing verify with the fabricator of steel and miscellaneous metal items the various preparation procedures and primers used by the steel fabricator for all metal items to be coated for this contract. The written confirmation shall be provided to the QCI for his records.

- .3 The commencement of work indicates acceptance of the surfaces and job conditions. Coatings applied by the Contractor to improperly prepared surfaces will be removed, surfaces treated as per MPI Maintenance Recoating specifications and recoated at no cost to the Park Board.

3.2 Surface Preparation

- .1 The surface to be coated must be dimensionally stable, dry, clean and free of oil, grease, release agents, curing compound, and other foreign materials.
- .2 Prepare surfaces to receive coatings in strict accordance with manufacturers highest standard and recommendations with reference to SSPC surface preparation method. QCI shall inspect all surfaces prior to and upon completion of surface preparation.
 - .1 Galvanized Metal
 - .1 Solvent Clean per SSPC-SP1. If any oxidation (white rust) has formed, sand and remove all forms of contamination. If the galvanized has been passivated or stabilized, the surface must be abraded via Brush-Off Blast Clean per SSPCSP7.
 - .2 Aluminium
 - .1 Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
 - .3 Ferrous Metal (minimum requirement)
 - .1 Commercial Blast Cleaning, SSPC-SP6
 - .2 A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discolouration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
- .3 Preparation of surfaces shall be done under adequate illumination, ventilation and temperature.
- .4 Remove and securely store all miscellaneous hardware and surface fittings / fastenings. Carefully clean and replace all such items upon completion of coating work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes.

3.3 Mixing and Tinting

- .1 Unless otherwise specified all coating material shall be ready-mixed and pre-tinted. Re-mix all coating in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .2 Use of thinners shall be in strict accordance with manufacturers written recommendations. QCI to approve and monitor addition of thinners.

- .3 Thinning of coatings for spray applications shall be in strict accordance with coating manufacturer's written instructions. QCI to approve and monitor addition of thinners.

3.4 Application of Coatings

- .1 Application of all coatings shall be in strict accordance with the manufacturers written instruction.
- .2 Ensure that the application of coatings over primers is carried out within manufacturer's specified time limits. Application of primer shall not begin until the QCI has reviewed and approved the surface preparation.
- .3 Apply coatings at spreading rate required to achieve the dry film thickness noted for each coating. Do not apply finishes on surfaces that are not sufficiently dry and hard. Ensure that the coated surface has been inspected by the QCI prior to the application of the next coat.
- .4 Application of finish coatings shall completely hide the previous coating, yield a uniform sheen, colour and texture with not drips, sags, runs or imperfections to the satisfaction of the QCI and the VPB Project Manager.
- .5 All coatings shall be applied using manufacturer recommended spray, or electrostatic spray, rates.
- .6 The use of rollers and or brush application as part of the shop coating applied process is not acceptable.

3.5 Inspection

- .1 All stages of the work of this section will be subject to inspection by the QCI. Inspection hold points shall include but may not be limited to:
 - .1 After solvent washing, before any abrasive blast cleaning or coating application.
 - .2 After abrasive blast cleaning and before any coating application.
 - .3 After primer application.
 - .4 After each topcoat.

3.6 Protection

- .1 Field Applied Coatings For Repair: Field applied coatings shall be for repair only and are at the discretion of the VPB Project Manager.
 - .1 Protect work of other trades, adjacent surfaces, buildings, etc. against damage, overspray, contamination. At no cost to the Park Board make good any damage caused by failure to provide such protection.
 - .2 Protect finished coatings from damage until completion of project.
 - .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.7 Review and Final Acceptance

- .1 Prior to the Final Acceptance of coating system the QCI shall verify that all required inspections have been completed to his satisfaction.
- .2 Coated exterior surfaces shall be considered to lack uniformity and soundness if any of the following defects are visually apparent to the QCI and the VPB Project Manager:
 - .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 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 coating is sufficiently dry or any other contributory cause.
 - .4 Damage due to application on moist surfaces.
 - .5 Damage to field repaired surfaces caused by inadequate protection from air borne dust, debris or weather.
 - .6 Damage and/or contamination of coating due to blown contaminants dust, spray coating, etc.
- .3 Coated surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior 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 overhead surfaces when viewed at normal viewing angles.
 - .4 When the final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area.
- .4 Coated surfaces rejected by the QCI or the VPB Project Manager shall be made good following the methods outlined in this section at no expense to the Park Board.

3.8 Field Repair

- .1 Any damage to coatings on components that have been installed at the project site and in the opinion of the QCI and VPB Project Manager cannot be removed and repaired at the coating shop shall be repaired on site. The finish quality, texture, colour, sheen and appearance shall be to the original specification and to the satisfaction of the QCI and the VPB Project Manager.

- .2 In the event that abrasive blasting in the field is deemed impractical by the QCI, power tool clean all damaged areas to SSPC –S11T ‘Power Tool Cleaning Bare Metal” standard. Clean back to where coating is tightly adhered to the substrate. Feather the rough edge between the cleaned area and the existing sound coating by air driven disc sander or other suitable means. Roughen the remaining painted area by sanding or other suitable means to enhance the adhesion of subsequent application of coating. All spot cleaned areas shall be primer coated the same day. If any rust or rust bloom is evident before priming, these areas will require cleaning to the appropriate standard to the satisfaction of the QCI. All repairs and recoating procedures shall be inspected by the QCI at each step of the process.

3.9 Adjust and Clean

- .1 Remove all coating 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.
- .3 Remove combustible rubbish materials and empty coating 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.), coatings, thinners, coating removers/strippers in accordance with the safety requirements of authorities having jurisdiction.
- .5 Remove all material and debris from the site and dispose of in approved facility.

END OF SECTION 09 96 00

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 play equipment with required safety zones as indicated in the contract documents.

1.3 Related Work

- .1 Fibar System 300 Specification
- .2 Concrete Forming and Accessories Section 03 10 00
- .3 Concrete Reinforcing Section 03 20 00

1.4 Qualifications

- .1 The Playground Equipment installer shall have a minimum of five (5) years proven record of satisfactory performance and experience on projects of similar size and scope and shall maintain a qualified crew with at least one (1) Canadian Certified Playground Inspector throughout the duration of the work who shall be qualified with the CPRA.
- .2 Qualifications of Workers:
 - .1 Only competent skilled trades people holding the designation Canadian Certified Playground Inspectors who are thoroughly experienced with the material and methods specified may perform any playground installation work specified under the work of the Section.
 - .2 General labour type activities related to playground equipment installations may be performed by labourers and trades helpers who are thoroughly experienced with preparation procedures provided they work under the direct supervision of a skilled Canadian Certified Playground Inspector.
 - .3 Certification must be presented to the Owner's Representative or designated representative within 48 hours upon request, and produce written proof of such. A skilled Canadian Certified Playground Inspector shall be present at all times during the execution of the playground installation work.

1.5 Quality Assurance

- .1 All layout, materials and work must meet or exceed requirements of the latest edition of the CSA standard CAN/CSA-Z614-14 Children's Play spaces and Equipment and the IPEMA (International Play Equipment Manufacturers Association) standard.
- .2 Hazardous materials such as asbestos, polychlorinated byphenyls (PCB's) and lead based paints are not permitted on site.
 - .1 A copy of the CSA standard CAN/CSA-Z614-14 Children's Play Spaces and Equipment shall be kept on site for the duration of the construction schedule.
 - .2 Should modifications to the CSA Guidelines occur, and then the modifications shall govern.

1.6 Protection

- .1 Protect all play equipment and components against damage during shipping, handling, storage and installation, and until Final Acceptance.
- .2 Provide protected storage of play equipment prior to installation off the ground and free from dampness.
- .3 Provide all necessary facilities/equipment for handling and lifting site furnishings-play equipment into final location.
- .4 Take all reasonable measures to protect surrounding or adjoining work or as requested by the Owner's Representative, including all material, plant and real property related to the Work against loss or damage from any cause.
- .5 Safety: The Contractor will be responsible for all aspects of job safety at the work site as per the contract documents. All work must be carried out in a safe and responsible manner. Where applicable, Workers Compensation Board "Industrial Health and Safety Regulations" must be followed.
- .6 Contractor is responsible for ensuring adequate public safety in his work area at all times. No operating equipment is to be left unattended and the work area is to be left in a safe, secure condition at the end of each workday. Ensure that any partially installed play equipment is adequately signed with warning signs stating "CONSTRUCTION AREA - KEEP OFF" and that the overall area is properly barricaded by fences or approved guards from public access until Final Acceptance.

1.7 Submittals

- .1 Provide shop drawings of all play equipment, and obtain Owner's Representative's approval prior to manufacture. Shop drawings shall show overall dimensions, layout, height relationships, and footing and anchoring methods adapted as necessary to the requirements of this project. Shop drawings shall show clearances to the edge of play area to meet the CSA Standards. The provided installation instructions and maintenance instructions shall be "project" specific containing component information that is part of the

- playground design. A “generic” package of installation instruction and maintenance instructions is not acceptable. Shop Drawings will become part of the Maintenance Manual.
- .2 Submit a copy of the supplier’s warranty statement stating all exclusions. The warranty certificate shall be filled out/completed by the Contractor/Supplier acknowledging the Vancouver Park Board (with site location) as the Owner.
 - .3 Submit completed Schedule A - Sample Inspection Report Form to the Owner’s Representative upon completion of the project. See Schedule A below.
 - .4 Maintenance Manual/Kit: Prior to and as a condition of Substantial Performance the Contractor shall submit a project specific maintenance manual/kit for all Project Play Equipment. This manual shall:
 - .1 Provide information to establish the frequency of inspections.
 - .2 Describe preventative maintenance and repair procedures.
 - .3 Provide copies of project specific inspection Report Forms for each play component shown on the Drawings.
 - .4 A reproducible copy of the as constructed Play Component System produced by the Contractor or supplier/manufacture.
 - .5 Provide 2 sets of any special tools or wrenches necessary to adjust or replace any special vandal resistant fasteners.
 - .6 Provide a PVC repair kit for repair of minor PVC damage.
 - .7 Provide an anti-graffiti chemical cleaner for removal of paint, ink or other forms of graffiti from the various surfaces/materials used on the play structure.
 - .8 Provide a primer and matching colour touch-up kit compatible with the original manufacturer’s finishing system.
 - .5 The Contractor/manufacture shall submit with their bid a list of all variances from these specifications.
 - .6 Provide all necessary templates for location of fixing devices prior to pouring of concrete bases.

1.8 Warranty

- .1 The play equipment and complete installation shall be warranted for three (3) full years from the date of Substantial Performance. Repair or replace any faulty work or parts within 7 days after notification by the Park Board. Do not permit dangerous conditions in or around the play equipment. Refer also to inspection requirements Item 3.4.2 of this Specification.

PART 2: PRODUCTS

2.1 General

- .1 All materials shall have demonstrated record of durability in the playground or similar outdoor settings.
- .2 Site Specificity of Design - Equipment selection is based on specific program requirements, physical constraints within the site, and public input. Requests for Product Substitution will be subject to certain subjective criteria including (in no particular order):
 - .1 Similarity to specified play structure components
 - .2 Footprint
 - .3 Colour Availability
 - .4 Geometry
 - .5 Apparent Mass and/or Visual Density
 - .6 Proven Performance Record
 - .7 Variance - The Contractor/manufacturer shall submit with their bid a list of all variances from these specifications.

2.2 Play Equipment

- .1 Play equipment shall be CSA-approved manufactured units, consisting of the components shown in the drawings and itemized herein, and all incidental components required for a proper warranted installation. As manufactured by _____ or pre-approved equal.
- .2 Colour of play components: select from manufacturer's standard colour range.
- .3 Play equipment shall consist of the following elements:
 - .1 2 decks, 3'-6" and 5'-6" ht., each 4'-0" square
 - .2 3'-0" tunnel or clatterboard with side rails, 6'-0" long, linking the two decks
 - .3 Safety side rails, etc. as required
 - .4 Ladder and rungs to 3'-6" deck
 - .5 Double wave slide to 3'-6" deck
 - .6 Rappel wall to 5'-6" deck
 - .7 Fire pole and loops to 5'-6" deck

2.3 Basketball Goal

- .1 ***Heavy-duty goal with 4-1/2" galvanized steel pole, 4'-0" extension arm, cast aluminum backboard powder-coated white, double rim and chain net. Model No. BB-541616 as supplied by Tomko Systems Ltd., telephone (604)273-0257, or pre-approved equal.***

2.4 Resilient Play Area Safety Surfacing

- .1 ***Pea Gravel: shall be WASHED granular, durable round rock, 6mm (1/4") to 13mm (2"), free from organic material, toxic substances, and mineral particles larger or smaller than the stated size range. Submit 1litre sample for approval.***
- .2 ***Sand: shall be medium WASHED play sand as supplied by_____. Submit 1litre sample for approval.***

- .3 *Engineered Wood Fibre/Chip: Fibar System 300 complete w/ FibarMat, FibarFelt and FibarDrain as supplied/installed by RecTec Industries, Delta B.C., Contact: Susan Crawford, ph. 940-0067 or pre-approved equal.***
- .4 *Rubber Surfacing: Vitriturf Playground System as supplied by Marathon Athletic Surfaces, Vancouver, B.C. Contact: Robert Sinclair, ph. 878-0625 or pre-approved equal. 5 year minimum warranty as a performance requirement.***

2.5 Soccer Goals Spec Note: Insert Appropriate Information

- .1 *Soccer goals shall be model _____, for in-ground installation, as manufactured by _____.***

2.6 Approved Equals

- .1 All items shall be as specified or approved equals.**

PART 3: EXECUTION

3.1 Preparation and Layout

- .1** Examine the areas and conditions under which work of this Section will be performed. Verify safety zones of all equipment before setting posts in concrete footings. Do not proceed until conditions detrimental to proper and timely completion of the work have been satisfactorily corrected and thus meet the manufacturer's instructions and the requirements. Beginning work constitutes acceptance of conditions as satisfactory.
- .2** Before installing play equipment or safety surfacing, verify that the subgrades are uniform, smooth, well drained and set at correct elevations to allow for installation of specified depth of resilient safety surfacing to the correct finished grade.
- .3** Lay out the play equipment in the designated area to ensure compliance with safety zone clearances. Stake the locations of all equipment/site furnishings and obtain the approval of the Owner's Representative prior to installation. Lay out play equipment locations with flags and short lengths of string as required/requested by Owner's Representative. Obtain Owner's Representative approval before proceeding. Install with the required safety clearances between play equipment units and to retaining curb or other objects. The layout shall be in accordance with the drawings. Proposed alternative layouts shall be reviewed by Owner's Representative and must be approved before proceeding.

3.2 Installation of Compound Structures and Independent Activities

- .1** Install play equipment and resilient safety surfacing in strict adherence to manufacturer's instructions, level and plumb and maintaining recommended safety clearances. Adapt

footing and anchoring methods as necessary to the requirements and specific site conditions of this project in accordance with approved shop drawings and in such fashion that work of other Sections is not damaged. Layout all equipment prior to construction.

- .2 Provide all concrete footings as required to properly place the equipment components. It is the Contractor's responsibility to adjust drainage pipe or other new utility locations to accommodate the equipment footings.
- .3 Place specified depths and areas of resilient safety surfacing as per detail drawings.

3.3 Protection

- .1 During construction of the play equipment structures, provide PVC web fence material in sufficient quantities and wrap the structures to prevent public access onto the equipment. Maintain the fencing wrap after completion of the play equipment and safety surfacing installation through completion of the project.

3.4 Inspections

- .1 Provide a min. 48 hours notice in order to schedule all inspections. Delay claims filed by the Contractor resulting from failure to provide adequate notice of inspection required will not be entertained. All aspects of this work shall be subject to inspection by the Owner's Representative or their designated inspector. Inspector/approval points shall be of a frequency sufficient to ensure adequate Quality Control in accordance with this specification and will occur thorough the duration of the Contract. The Contractor must supply access to the work for the Owner's Representative or their Inspector. As a minimum, inspections will occur as follows:
 - .1 Upon arrival of play equipment to the site.
 - .2 After staked layout of proposed play equipment locations.
 - .3 After play equipment anchor post installation.
 - .4 Upon Final Acceptance/Assumption by the Vancouver Park Board.
- .2 The Contractor is required to visit the site a minimum of two (2) times during the warranty period to ensure all play equipment/site furnishings are performing satisfactorily/functioning as intended and perform any maintenance services required. The first visit is to occur approximately six (6) months after the Assumption Date by the Board and the second visit is to occur approximately two (2) weeks prior to the end of the warranty period.

3.5 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 Footing excavation and backfilling shall be continuous so that the amount of open excavation at the end of each workday is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility marking tape to current WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structures/elements due to settlement of improperly compacted footings shall be immediately repaired at the Contractor's expense to the satisfaction of the Owner's Representative.
- .4 Remove and dispose of offsite all surplus material, excess excavated materials, trash, debris and waste material from the work of this Section. This clean up shall include removal of all delivery packaging.

Schedule A: Inspection Report Form

Park Name: _____
Inspection Date: _____
Inspector's Name: _____

Location: _____
Time: _____

| Individual Equipment Components | Equipment | | | | | | | | | | |
|--------------------------------------|------------------|-----------------|------------|------------------------------|-------------|----------|------------------------|---------------------|------------------------|------------------------|---------------------|
| | Toddler Swing | Junior Swing | Tire Swing | Spiral/ Straight Slide | Spring Toys | See-Saws | Climbing Structures | Merry Go- Rounds | Composite Structure | Composite Structure | Safety Surfacing |
| Chains | | | | | | | | | | | |
| S-Hooks/C-Hooks | | | | | | | | | | | |
| Seats/Tire/Belts | | | | | | | | | | | |
| Hanger Bearings | | | | | | | | | | | |
| Grease Fittings | | | | | | | | | | | |
| Stability/Tilting | | | | | | | | | | | |
| Exposed Concrete | | | | | | | | | | | |
| Entanglement Points | | | | | | | | | | | |
| End/Center Fittings | | | | | | | | | | | |
| Chain Covers | | | | | | | | | | | |
| Hand Rails | | | | | | | | | | | |
| Support Bars/Legs | | | | | | | | | | | |
| Fastening Point/Areas | | | | | | | | | | | |
| Sidewalls/Bedway | | | | | | | | | | | |
| Entrapment Point/Areas | | | | | | | | | | | |
| Sharp Edges/Points | | | | | | | | | | | |
| Stair/Steps | | | | | | | | | | | |
| Plastic Component Cracking/Damage | | | | | | | | | | | |
| Spring/Bars | | | | | | | | | | | |
| Handles | | | | | | | | | | | |
| Pivot Points | | | | | | | | | | | |

| Individual Equipment Components | Equipment | | | | | | | | | |
|------------------------------------|------------------|-----------------|------------|------------------------------|-------------|----------|------------------------|---------------------|------------------------|--------------------------|
| | Toddler Swing | Junior Swing | Tire Swing | Spiral/ Straight Slide | Spring Toys | See-Saws | Climbing Structures | Merry Go- Rounds | Composite Structure | Composite Structure 2 |
| Nuts and Bolts | | | | | | | | | | |
| Ground Clearance | | | | | | | | | | |
| Locking Devices | | | | | | | | | | |
| Wood Checks/Splits (max. 19mm) | | | | | | | | | | |
| Protrusions | | | | | | | | | | |
| Caps/Plugs | | | | | | | | | | |
| Protective Surfaces Borders | | | | | | | | | | |
| Equip. Spacing/ Encroachment | | | | | | | | | | |
| Bench Seats | | | | | | | | | | |
| Debris/Broken Glass | | | | | | | | | | |
| Asphalt Paths | | | | | | | | | | |
| Fencing | | | | | | | | | | |
| Condition: Satisfactory T | | | | | | | | | | |
| Condition: Requires Attention X | | | | | | | | | | |

Other Comments:

END OF SECTION 11 68 13

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 the water feature mechanical system including: enclosures, weirs, pond liners, feature rock, piping, pumps, valves, fittings, filtration and water treatment systems, and hardware for all pool penetrations as indicated in the contract documents.
- .2 The subcontractor of this work shall be responsible for coordinating and control of the installation of the water feature lighting, and for the entire operation of the water feature mechanical and electrical control systems including testing and troubleshooting.

1.3 Related Work

- | | | |
|----|------------------------------|---------------------|
| .1 | Site Preparation and Grading | Section 01 89 13 |
| .2 | Concrete Work | Section 03 00 00 |
| .3 | Plumbing | Section 22 00 00 |
| .4 | Electrical | Section 26 00 00 |
| .5 | Excavation and Backfill | Section 31 23 10 |
| .6 | HDPE Pond Liner | Section 33 47 13.13 |

1.4 Reference Standards

- .1 Codes and Standards: perform all work in compliance with applicable requirements of all governing authorities having jurisdiction. Applicable Reference Standards Include:
 - .1 BCBC - British Columbia Building Code 1998(National Building Code 1995) (includes BC Plumbing Code update 1995).
 - .2 CPC/UPC - Canadian/Uniform Plumbing Code - 1997 Edition
 - .3 CEC - Canadian Electrical Code - Current Edition
 - .4 CAN/CSA - Canadian Standards Association - latest standards for PVC Pipe (and fire rated CPVC) and Fittings CSA B137.3-93 (CPVC - CSA B137.6-96) and B181.2-96 PVC Drain, Waste and Vent Pipe and Pipe Fittings.

- .5 CAN/CSA-B64.10-94 Manual for the Selection, Installation, Maintenance and Field Testing of Backflow Prevention Devices.
- .6 ASTM - American Society for Testing and Materials:
 - .1 Latest standard for Stainless Steel Pressure Tubing.
 - .2 Specification for Seamless Copper Tube ASTM B75-97.
 - .3 Specification for Seamless Copper Water Tube ASTM B88-96.
 - .4 Specification for Packaged Dry, Hydraulic-Cement Grout ASTM C1107-97.

1.5 Qualifications

- .1 Supplier Qualifications: Main Feature/Fittings Equipment Supplier shall have a minimum of 10 years experience in supply and installation of water features of similar size and scope.
- .2 Contractor Qualifications: Water feature mechanical and electrical systems, liner placement, rock placement, waterproof concrete form work and finishing and related work shall be done by qualified tradesmen who have a minimum 5 years experience with water feature installations of similar size and scope using accepted methods and skilled workmen who are completely familiar with the specified requirements and methods needed for a first class installation of the work of this Section.

1.6 Job Conditions

- .1 Use all means to protect all materials of this Section before, during and after installation.
- .2 Work from subgrade provided under Site Preparation or from top of waterproofed, protected concrete structure - refer to Drawings. Verify that subgrade or waterproofing and protection board have been approved by Owner's Representative prior to proceeding with work of this Section.
- .3 Co-ordinate this work with work of other Sections, including plumbing and electrical to ensure that proper water tight seals are made at all pool penetrations, required edges, pipes, fittings etc.

1.7 Submittals

- .1 Product Data: submit a complete list of catalogue "cut" information/data sheets for all products, materials, equipment and assemblies to be installed under work of this Section.
- .2 Testing Results: Provide results of all tests noted under Part 3 Execution of this Section.
- .3 Record Drawings: Submit four copies (4) with the operating and maintenance materials, of a suitably scaled reproducible copy of the "as constructed" condition of the mechanical and electrical systems for the water feature. This drawing should be professionally drawn or produced with the use of computer aided drafting/design (CADD) where possible and should be submitted to the water feature Owner's Representative Inspector for review of content. Record the following information on the As constructed@ drawings for the system:

- .1 Exact routing and elevation of both the mechanical system piping and electrical system conduit runs during construction showing locations in relationship to clearly identifiable reference points.
 - .2 All **approved** changes and substitutions.
 - .3 Manufacturer's names and catalogue numbers for all materials and equipment used in the construction of the water feature.
 - .4 Titleblock with the Contractor's Name/Address/Phone Number.
 - .5 **CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ACCURACY OF INFORMATION AND FOR ANY ERRORS AND OMISSIONS.**
 - .6 **See also requirements for laminated valve schedule in Mechanical Room/Vault under 3.7.2 this Section**
- .4 Maintenance Data and Operational Instructions Manual: Prior to and as a condition of Substantial Performance, submit to the Owner's Representative three copies (3) of an operating and maintenance manual containing:
- .1 Operational information for all operating components; including complete diagrams and spare parts lists, catalogue numbers and manufacturer's name/address.
 - .2 Cleaning and lubrication schedules, overhaul/adjustment schedules, start-up and shut-down procedures and other similar maintenance operations to allow Owner's Representatives to understand, operate and maintain the entire system.
 - .3 Table of Contents and a Title Sheet with the contractor's contact information.
 - .4 Copies of the equipment warranties and certificates.
 - .5 **CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ACCURACY OF INFORMATION AND FOR ANY ERRORS AND OMISSIONS.**
 - .6 Submit two (2) copies/sets of any special tools required for the maintenance of each type of component used in the system.
 - .7 Submit any other extra materials/maintenance specific materials as outlined on the Drawings.
 - .8 Each manual shall be bound in a three ring binder or similar format.
- .5 Installer's Maintenance Service: **(Only As Requested)**
- .1 Provide maintenance service for 1 year from date of Final Completion/Assumption by the Owner. Maintenance to include the following activities:
 - .2 If system has been shut-down for Winter Months, provide one service call in Spring for complete cleaning and start-up of system. Coordinate service call with Owner's Representative, ensuring Owner's Representative are present for start-up operations.
 - .3 If system is completed after Sept. 15th of any year and is intended for winterization, provide one service call in Fall for complete cleaning and winterization of the system. Winterization to include all necessary measures to ensure that all pools/basins are drained and cleaned, all piping is "blown dry" by means of air compressor or similar approved method, all hose bibbs have been opened and lines

- drained by gravity where designed for, nozzles are removed or protected and power to all electrical components has been turned off. **Coordinate service call with Owner's Representative, ensuring Owner's Representative are present.**
- .4 Provide additional instructions for maintenance, if required during service calls to Owner's Representatives and ensure maintenance manuals are updated accordingly.
 - .6 Schedule: Prior to and as a condition of Substantial Performance provide a schedule of ongoing field reviews with Owner's Representative, in accordance with Part 3 of this Specification during construction up to and including Final Acceptance (and during Installer's Maintenance Period, if applicable).
 - .7 Shop Drawings: Provide shop drawings for Municipal Connection Vault complete with all dimensions, material description finishes and connection details (as applicable). Refer to ***Standard Drawing. No: CONFIRM WITH PLUMBING DEPARTMENT***
 - .8 Instructions: Instruct the Owner's Representative in the complete operating and maintenance procedures for this system. This instruction shall include but not be limited to showing the relative running time differences between display and filtration systems (if applicable) and a schedule of adjustments suggested for various weather/seasonal conditions.

1.8 System Description (Sequence of Operation)

- .1 The complete System shall be operable all year round. All piping runs must be designed such that they may be easily drained for servicing/winterization by means of hose bibbs (gravity drains).
- .2 ***Both systems shall be capable of winterization should OWNER'S REPRESENTATIVE decide that weather conditions warrant.***
- .3 ***The season of operation will be full year round as dictated by Owner's Representative. Adjustments may be necessary to hours of operation and length of season. Modify controller timers as directed by Owner's Representative.***
- .4 ***Control of the mechanical and electrical systems for the water feature will be via a custom electrical duplex control panel to be located in the pool mechanical room. Minimum requirements of the control panel shall be:***
 - .1 ***Power Supply: xxx V, three phase power.***
 - .2 ***Manual disconnect, magnetic starter and motor protection.***
 - .3 ***HOA Operation (HAND, OFF AUTO).***
 - .4 ***Run light indicators for each pump (display and filtration pumps).***
 - .5 ***CSA Approved weatherproof enclosure with time control for display pump and terminals for interconnection to low level shutdown control (confirm with OWNER'S REPRESENTATIVE Electrical Dept. for approved enclosure).***
 - .6 ***Other? Such as terminals for connection of photocell for light system.***

1.9 Site Condition

- .1 Manufacturer's Recommendations and Assistance: Review the proposed installation with the manufacturers/suppliers of the pool mechanical and electrical systems components pool liner (or supplier of the waterproof admixture), or with its representative(s) or distributor(s), as necessary to ensure that installers use correct materials, accessories and methods for a proper warranted installation.
- .2 Prior to commencement of work, review locations of all existing underground utilities, services, structures with local utility companies or other trades on site. In addition, coordinate as necessary all utilities, services or structures to be installed on site by others. Coordinate routing as required and mark all locations in the field with clearly identifiable markings.
- .3 Start of work shall signify acceptance of site as satisfactory and no claim will be recognized for extra work nor any allowance made for defective work due to site conditions.
- .4 Environmental Restrictions:
 - .1 Do not lay any PVC pipe or conduit in any trench where standing water is present.
 - .2 **The Owner does not accept any pipe or fittings which have been cemented under wet or muddy conditions.**

1.9 Testing And Approvals

- .1 As a condition of acceptance of the water feature and related work, the water feature shall be tested for leaks as follows: fill the pools and monitor for at least three days for "topping up" requirements in excess of what would be expected due to normal evaporation loss. Review for any visible signs of leaks. Repair as necessary and retest.
- .2 As a condition of acceptance the Owner's Representatives are to be present for initial start-up/testing of water feature.

1.10 Submittals

- .1 Submit samples of the proposed rocks (if applicable) and photographs of larger pieces where samples would not be practical. Re-submit as necessary if submitted information is not approved. Approved samples and photographs will be retained as the standard for comparison against materials to be used in the Work.
- .2 Submit product specifications and samples of pool liner and attachment details for approval prior to installation.
- .3 Submit product specifications and data for water feature mechanical and (low voltage) electrical system for approval prior to installation.

1.11 Warranty

- .1 **Provide a written Warranty for all workmanship and materials for TWO YEARS from date of Substantial Performance.** Make all corrections, adjustments and maintenance operations required as a result of failure of the water feature system to perform due to the work of this Section. Warranty shall also cover settlement of trench backfill and repair of damage to other materials and workmanship resulting directly from defects in materials and workmanship under work of this Section.
- .2 Manufactured products, including but not limited to nozzles, jets, specialty fittings, pumps, couplers, controllers, chlorination systems, filtration systems, valve boxes and valves, pipes and pipe fittings shall be warranted as per the manufacturer's standard warranty period or a minimum of one year, whichever is greater.

PART 2: PRODUCTS

2.1 Acceptable Manufacturers Approved Equals

- .1 All items as specified or as per pre-approved equals. **Ensure Vancouver Parks Board pre-approval process is strictly adhered to.** Acceptable suppliers/manufacturer's include:
 - .1 PEM Fountain Company/Vincent F. Helton and Associates
 - .2 DEFO Fountains/Trasolini Pool Supply
 - .3 OASE Fountain Co./Vancouver Irrigation Supply
 - .4 Barnes AND Pac Fab Pumps
- .2 Alternative equipment will be considered for inclusion in this project. The proposed alternatives shall meet or exceed the specifications in durability, warranty, performance, flow, pressure loss and all other important characteristics of the original equipment specified. The alternative equipment shall be of good quality construction, with a proven record of trouble free performance and low maintenance, on projects of similar size and scope. In addition, the alternative equipment must be available from a local distributor with a well-stocked inventory of all readily available spare parts. The alternative equipment must have a comparable warranty to the original equipment specified and must not compromise the intent of the original design.
- .3 Alternative equipment must be compatible with all other remaining system components.

2.2 Liner/Membrane

- .1 Liner shall be 80 mil. thick National Seal Company Enviroseal HDPE membrane as distributed by Western Tank and Lining, telephone 241-9487, complete with all required accessories, cements, cleaners, solvents, fasteners, etc. compatible with liner from the same source of supply.
- .2 Membrane shall be CIM 1000 Commercial Industrial Membrane as manufactured by CIM Industries Inc., Peterborough, New Hampshire - Distributed by Quadro Coatings Ph. 591-2445.

2.3 Mechanical System Components

- .1 Supply water feature mechanical equipment in quantities as per schedule on Drawings. Provide all miscellaneous fasteners, sealers and glues required for a complete and fully operable installation.

Equipment List:

- .1 Suction Fittings -PEM 6094/6217 Fixture Base w/ Antivortex Suction Fitting 100mm FIPT c/w Debris Screens - custom fabricated and suitably sized over all suction fittings.
- .2 Balance Pipe Fittings - PEM 6094/6214 Fixture Base w/Balancing Pipe Intake 100mm FIPT
- .3 Service Drains - PEM 6092-05/6222-05 Fixture Base w/ Threaded Service Drain 50mm FIPT
- .4 Overflow Fitting - PEM 6317 Wall Mounted Adjustable Overflow Fitting, 75mm FIPT
- .5 Water Level Control System - PEM L101-32 Wall Mounted Dual Water Level Sensor w/ PEM L101-71 Dual Water Level Control Panel, w/ PEM EV-105 Solenoid Fill Valve, 38mm FIPT
- .6 Eyeball Return Fittings - PEM 6345A Adjustable Eyeball Return, 38mm FIPT
- .7 Butterfly Valves - Grinnel Wafer Style BF Valve to indicated line size, see Drawings
- .8 Basket Strainer - Mueller CI 150 Flanged Basket Strainer w/ Clamp Cover
- .9 Reducer - SS Type 316 150 x 100mm Eccentric Reducer
- .10 Display Pump(s) - Berkeley CI Display Pump, 5.0 hp, 575 V ODP Motor
- .11 Check Valves - R&W Swing Type Check to indicated line size, see Drawings
- .12 Sediment Drain - 19mm, see Drawings
- .13 Ball Valves - R&W Swing Type Check to indicated line size, see Drawings
- .14 Filter Pump - Premier BRS Filter Pump, 1.5 hp, 575 V ODP Motor
- .15 Filter - Pac Fab TR-100 Filter c/w Side Mount Dial Valve.
- .16 Chlorination System/Hypochlorite Chlorination System - Pump to be LMI Model P131-391-T1 with adjustable speed/adjustable stroke. On site drum storage of minimum 200 gallons.
- .17 Waterstops - PVC as shown on Details
- .18 Nozzles/Jets - PEM insert model no.

2.4 Electrical System And Lighting System Components

- .1 Supply low voltage fixtures and transformers as per schedule on Landscape/Electrical Drawings. Provide all miscellaneous connectors, sealers and glues required for a complete and fully operable installation.

Equipment List:

- .1 List lighting Components

- .2 Water Feature Control Panel - custom control panel as supplied by Vincent F. Helton and Associates, c/w - list specifics

2.5 Rock/Natural Stone

- .1 Rocks, stones and pebbles for water feature shall be hard, durable natural granite, generally grey in colour, matching approved samples within a reasonable range, in sizes and quantities as shown and detailed on the drawings.

2.6 Metal Components And Hardware

- .1 All metal components and hardware shall be hot-dipped galvanized after fabrication, except as shown otherwise (Stainless steel 304 or 316).
- .2 Hilti bolts shall be as supplied by Hilti, or pre-approved equivalent, and shall be suited to the application as determined by the manufacturer's representative.
- .3 **All metal components within water feature and surrounding radius of 1.5m from water's edge shall be grounded to current CEC requirements. Ensure all additional ground wire and miscellaneous clips/clamps are provided for and meet code requirements. This includes all rebar enforcing within the concrete walls and slabs.**

2.7 Wood And Timber

- .1 All lumber and timber incorporated into the water feature shall be Standard & Better Grade Fir, Cedar, or Hemlock conforming to Section 06 40 13 Exterior Architectural Woodwork.
- .2 Pressure treated wood using the CCA process shall not be used in decorative water features.

2.8 Sand

- .1 Sand shall be washed medium river pump sand free from contaminants, as specified under 32 91 13 Growing Medium, and free from oversized particles.

PART 3: EXECUTION

3.1 Examination

- .1 Verification of Conditions: Prior to commencement of the work of the Section, carefully inspect work of all other trades and verify that there are no defects or conditions which will cause latent defects in workmanship, function and materials.
- .2. Notify Owner's Representative, **giving at least 48 hours notice**, of all conditions which are unsuitable and prevent work of this Section from proceeding.

3.2 Preparation

- .1 Protection:

- .1 Obtain locations and depths of all utilities in the vicinity of the Work of this Section. Report any discrepancies and/or conflicts to the water Feature Owner's Representative Inspector prior to commencing any excavation.
- .2 Exercise all suitable precautions to protect work or existing conditions to remain; such as structures, furnishings, utilities, automatic irrigation systems, planting and paving on or adjacent to the Site.
- .3 Erect barricades/fences/screens or other temporary barriers to the approval of the Owner's Representative Inspector to protect existing conditions and the general public from damage or danger for the duration of the construction schedule.
- .4 Do not store any equipment or materials, permit any burning of debris, or operate any heavy machinery within the root zones of any existing trees. Ensure trees are protected to requirements of Section 02210 and COV Tree By-Law.
- .5 Work on Structural Slab: Ensure all precautions are taken to prevent damage to work of others. Do not pierce/penetrate protection board or waterproof membrane without prior approval from the Owner's Representative and waterproofing sub-trade. Ensure any damage to waterproof membrane is restored to original condition by waterproof subtrade. Any costs associated with repairs are full responsibility of this Contractor.
- .6 Submit written notification of all damage to work by others or to existing conditions during work of this Section, complete with a detailed proposal and schedule of remedial measures to restore the damaged work to its original condition. Obtain approval of the Owner's Representative prior to proceeding with repair work.

3.3 Layout

- .1 Conform with the layout shown on the Drawings/Details.

3.4 Piping Installation

- .1 Manufacturer's Requirements: Meet all requirements of the manufacturer's current printed installation recommendations.
- .2 Cleaning: Clean all pipe and fittings of dirt, scale, debris and moisture prior to assembly and installation.
- .3 Assembly: Layout all equipment to be located in the mechanical vault (equipment room) as shown and detailed on the Drawings. Confirm all critical elevations and observe all minimum clearances required for adequate servicing by the Owner's Representatives.
- .4 General Installation:
 - .1 Provide all flanges or unions as indicated and required to allow for easy removal and servicing of any item of equipment (or accessories) without cutting, welding or soldering.

- .2 Provide readily accessible 19mm drain valves at all low points in the piping system and immediately downstream of any check valves to allow for complete drainage and winterization of the system.
- .3 Cut all pipe and tubing ends square and remove all rough edges by deburring so that smooth uninterrupted flow within piping is achieved.
- .4 Arrange all exposed piping straight, parallel and perpendicular to any walls of the structure or as shown on the drawings.
- .5 Where 2 or more pipes are to be installed in same trench or lay on any slab or suspended from the slab underside, ensure that minimum clearance requirements for servicing the piping is observed.
- .6 Ensure all piping is sloped by gravity to storm or sanitary as per local Code. Ensure min 0.25%.
- .7 Above Ground Piping:
 - .1 Support pipe lines individually with proper manufactured hangers **-wire or other make shift supports will not be permitted**. Ensure each branch has at least one hanger.
 - .2 Support all piping near floors with non corrosive copper or PVC stanchions with end plates secured to the floor.
 - .3 Size hangers properly to fit around pipes and size hanger rods, screws, bolts, nuts, etc. according to manufacturer's sizing/loading charts.
 - .4 **Equipment shall not support any of the pipe loading, and pipe shall not support any of the equipment.**
- .8 Pipe Protection:
 - .1 Cover all interior copper or brass **water supply piping** (not recirculation system piping) with 12mm foam pipe wrap insulation, neatly taped and spliced where required.
- .9 Slab and Mechanical Room/Pit Penetrations:
 - .1 Use appropriate slab penetration fittings where required and as noted on the drawings.
 - .2 Provide oversized holes (minimum 1 pipe size larger than pipe to be carried) and Schedule 40 PVC pipe sleeving through all pump vault, mechanical room/pit walls. Seal with approved non-shrink epoxy grout.
- .10 Penetrations Through Pool Walls/Slabs:
 - .1 Provide waterstop flanges or fittings at all penetrations through the pool walls or floors.
 - .2 All penetrations over 100mm dia. shall be Sch. 80 PVC with waterstop flanges double welded to pipe top and bottom and exterior coated with sand where stubs cast into concrete.
 - .3 Penetrations 100mm dia. and under shall be copper or bronze sch. 40 c/w bronze stop leak flange and grounding lugs. Tape all copper in concrete with isolation tape.

3.5 Equipment

- .1 Moisture and Vibration Protection:
 - .1 Pump, filtration and chlorination systems **must be installed on (10mm thick rubber isolation pads as required; noise sensitive situations) 100mm height housekeeping pads.** Pad size to suit equipment footprint.
 - .2 Install equipment level, secure and out of direct moisture to the manufacturer's recommendations/details. Use stainless steel anchor bolts only.
- .2 Ventilation/Service Space: Ensure adequate space is provided at time of installation to allow for sufficient ventilation to manufacturer's recommendations and allow for easy servicing and removal by the Owner's Representatives. Confirm layout with Owner's Representative prior to bolting any equipment permanently in place.
- .3 Hardware: Install all hardware true and plumb in a professional well thought out fashion. Ensure all fabricated hardware is uniform in finish.

3.6 Valve And Flow Identification

- .1 Tagging: Clearly identify each valve with engraved and numbered plastic tags chained to the handle.
- .2 Chart: Provide a computer drawn valve identification chart clearly indicating completed mechanical room valve layout which will serve as part of Record Drawings, refer to 1.5.3. Scale to be suitably sized. Drawing to be clear laminated and mounted on equipment room/vault sidewall in pre-approved location. **Indicate flow directions through valving directly on adjacent sections of piping. In addition, clearly label all sections of piping to main discharge or eyeball fittings etc.**
- .3 Locate all valve handles within **x** meters of the floor and in horizontal plane of pipe, accessible with adequate clearance for easy operation/servicing.

3.7 Field Testing/Quality Control

- .1 Pressure testing: Upon completion of the water feature piping system, arrange for Owner's Representative to be present to observe pressure testing. Test all plastic pipe and fittings as follows:
 - .1 After the pipe is in place in the bottom of the trench, **(modify for on slab conditions)** cap the pipes/stubs where the fixtures will be attached and where all pipe couplings and fittings are exposed.

- .2 Apply a pressure equal to 3x operating pressure or 0.680 MPa (100 psi), whichever is less to all sections of piping, using a test pump and calibrated container. Inspect visually for leaks at couplings and fittings, cut out and replace any that leak. **Maintain test pressure for three hours during which time no appreciable loss in pressure is to occur.** After replacing any defective sections, pressure test for three hours and note any pressure loss. **Repair all leakage encountered to approval of Owner's Representative Inspector.**
- .3 After approval by Owner's Representative, backfill the pipe maintaining pressure in the line, noting any sudden drop in pressure. If there is any indication of a leak, locate the defective section and replace. Leaks shall not be repaired by patching. Inspect all non-pressure pipe for visible leaks.
- .4 Provide written notice that pressure testing has been completed satisfactorily, including re-testing (for 3 hours) of all defective sections. Written notice shall state the date, parties present, pressures applied and duration of pressure tests.
- .2 Certification: Obtain certificate of compliance from COV Plumbing Inspector of all mechanical work as required. Ensure backflow prevention installation is to COV cross connection control standards. **Submit Certificate of Proof of Double Check Valve Assembly Test and Pass to the Owner's Representative.**
- .3 Field Observation: Ensure Owner's Representative is notified and present for all scheduled reviews. Submit schedule of reviews as part of Submittals under Part 1 of this Section.
- .4. Operational Test: When the water feature system has been completed, a design test will be completed in the presence of the Water Feature Owner's Representative to determine if design intent has been met and whether any adjustments are required. **Any damage to (and subsequent repair of) the system or equipment during testing will be the responsibility of this Contractor. No claims against the Board arising out of the testing operations will be entertained.**
- .5 Controller Test: As part of the above, and prior to Final Acceptance/Assumption by Owner's Representative the automatic controller(s) mechanisms shall be set and thoroughly tested to determine if any adjustments are required.
- .6 Automatic Water Level Control System Test: As part of above testing, and prior to Final Acceptance/Assumption by the Owner's Representative the automatic water level control system shall be thoroughly tested to demonstrate operation as specified.

3.8 Adjusting/Cleaning

- .1 Adjust all valves and balance all flows to source feature (display) and through filtration systems as required and dictated by Water Feature Owner's Representative Inspector to achieve and maximize design intent for water feature. **ENSURE ALL VALVE POSITIONS ARE MARKED APPROPRIATELY AAS BALANCED@.**
- .2 Flush all pipe and equipment as necessary prior to energizing the system, including cleaning of strainers and filters.

3.9 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 Trenching, laying pipe and backfilling shall be continuous so that the amount of open trenching at the end of each work day is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility marking tape to current WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structures/elements due to settlement of improperly compacted trenches shall be immediately repaired at the Contractor 's expense to satisfaction of Owner's Representative.
- .4 Remove and dispose of off site all surplus material, excess excavated materials, trash, debris and waste material from the work of this Section. Neatly place spare parts in a clearly labelled box and provide to Owner's Representative.
- .5 Clean by sweeping and hosing the mechanical equipment room/vault/pit floor.

3.10 Acceptance

- .1 The conditions for acceptance of the water feature and for turning over the water feature to the Vancouver Park Board for subsequent maintenance are:
 - .1 Substantial Performance for the entire project shall have been declared.
 - .2 The water feature shall have been maintained as specified for at least 55 days.
 - .3 At the time of Acceptance the water feature shall be clean and operating as specified.
 - .4 **A REPRESENTATIVE OF THE BOARD SHALL HAVE BEEN THOROUGHLY TRAINED BY THE CONTRACTOR IN OPERATION AND MAINTENANCE OF THE WATER FEATURE SYSTEM INCLUDING FAMILIARIZING WITH ALL COMPONENTS, EQUIPMENT, SERVICING AND WINTER/SUMMER OPERATIONS.**
 - .5 All submittals as per Part 1 of this Section shall be complete.

END OF SECTION 13 12 13

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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 clear and grub site in preparation for landscape or site work indicated on the contract drawings.
- .2 The work shall include but is not limited to the following areas:
 - .1 Clearing and grubbing operation.
 - .2 Disposal of material cleared and grubbed from the site.

1.3 Related Work

- .1 Site Preparation and Grading Section 01 89 13
- .2 Tree Protection Section 32 01 56

1.4 Protection

- .1 Protect existing fencing, natural features, bench marks, existing buildings, existing pavement, sub surface and surface utility lines, and water courses and miscellaneous items noted on contract drawings as to remain.
- .2 Protect all existing trees, landscape plant beds, miscellaneous plant material and their associated root areas within the area to be cleared and grubbed that have been identified to remain on the contract drawings.
- .3 Protect all existing trees, landscape plant beds, miscellaneous plant material and their associated root areas that are outside of area to be cleared and grubbed.
- .4 The Contractor, at no cost to the Owner shall make good all damages incurred during the clearing and grubbing process.

PART 2: PRODUCTS (Not Applicable)

PART 3: EXECUTION

3.1 Clearing and Grubbing

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Clear and grubbing operations shall be limited to areas indicated on the Contract drawings. Contractor shall identify the areas to be cleared and grubbed in the field by flagging or staking for Owner's Representative review prior to the start of work.
- .3 Clear all trees, existing plant growth, undergrowth, dead wood, surface rocks or boulders and all deleterious material.
- .4 Grub out all stumps, roots rubbish over 50mm (2") in size to minimum depth of 300mm (12") below indicated finish grade.
- .5 Grub out all parts of noxious or invasive plants including but not limited to varieties of Equisetum, Rubus, Hedera and Fallopia japonica. Refer to Province of BC website for current full list of noxious plants.
- .6 Contractor to submit methodology on how they will deal with noxious weed removal. Process should follow Province of BC's Integrated Pest Management Regulation to control invasive plants.
- .7 Remove and dispose of off site, embedded rocks and boulder less than 0.15 cubic metres (5 cubic feet) encountered during clearing and grubbing operation.
- .8 Dispose of cleared and grubbed material in an approved off site dump location. No on site burning or burying of grubbed material will be allowed.
- .9 Do not clear or grub existing trees, landscape plant beds, miscellaneous plant material and their associated root areas that have been identified on the contract drawings or marked in the field by the Owner's Representative or Contractor to remain.

3.2 Finished Surface

- .1 Finished grade of the areas that have been cleared and grubbed shall be left generally smooth and level and suitable for immediate rough grading operations.

END OF SECTION 31 11 00

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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 excavate and backfill for all landscape paved areas, footings, walls, etc. indicated on contract drawings.
- .2 The work shall include but is not limited to the following areas:
 - .1 Excavation of subgrade
 - .2 Grading operations to attain sub grade design grades
 - .3 Import and placement and compaction of granular fill materials
 - .4 Compaction testing
 - .5 Removal and disposal of excess material off site

1.3 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Aggregates and Granular Materials | Section 02 41 14 |
| .2 | Cast-In-Place Concrete | Section 03 33 00 |
| .3 | Hot Mix Asphalt Paving | Section 32 12 16 |
| .4 | Precast Concrete Unit Paving | Section 32 14 13 |

1.4 Reference Standards

- .1 Contractor is responsible for complying with all current Work Safe BC requirements for site safety related to the scope of work in this section. This includes but is not limited to protection of personnel and site safety procedures related to open excavation.
- .2 All work under this section shall conform to the requirements of the American Society for Testing and Materials (ASTM), Standards as referenced herein.

1.5 On and Off Site Construction Maintenance

- .1 Contractor shall be responsible for implementation, maintenance, and decommissioning of vehicle wheel wash facility. Decommissioning of wheel wash facility includes but is not limited to fill and regading of affected area to the satisfaction of the Owner's Representative.

- .2 Contractor shall be responsible for cleaning of adjacent municipal streets, private streets and driveways affected by vehicle movements on site or to and from the site.
- .3 Contractor shall be responsible for implementing and maintaining dust control measures for all on site activities of this section. Dust control measures shall meet all local bylaws and regulations.

1.6 Site Access

- .1 The Contractor shall be responsible for ensuring that there is minimal disruption of vehicle and pedestrian traffic flow on adjacent existing roads during work of this section.
- .2 The Contractor shall be responsible for providing warning signs, flashing lights, flag people barricades, etc. to ensure vehicle and pedestrian movement associated with the site or adjacent to the site meets all applicable municipal, provincial or federal requirements.

1.7 Protection

- .1 Prior to commencing any excavation work the contractor shall establish the location of any existing active buried utility or service lines, including service entry points. Mark these locations clearly on site to prevent accidental disturbance during the work.
- .2 Any utility or service which is presently in use, or not established as abandoned but which must be moved or otherwise disturbed, shall be referred to the utility or service company concerned so that they may advise on, co-ordinate, and/or inspect necessary operation for relocation.
- .3 Costs incurred by any disturbance of existing active utilities and service lines, not called for under the contract documents, shall be borne by the Contractor.
- .4 Any damage done including settlement or collapse to existing active services caused by inadequate measures taken by the Contractor to prevent such disturbances shall be rectified immediately by the Contractor at no cost to the Owner.
- .5 The Contractor shall protect all adjacent structures and surfaces including but not limited to roadways and sidewalks from damage, direct or incidental as a result of work of this section.
- .6 The Contractor shall make good all damages to adjacent structures and surfaces including but not limited to roadways and sidewalks as a result of work of this section to the satisfaction of the Owner's Representative.

1.8 Deposits

- .1 The Contractor shall at no cost to the Owner shall obtain all damage and/ or crossing deposits required by the municipal, provincial, federal or utility to carry out the work of this section.

1.9 Tests and Approvals

- .1 The Contractor shall at no cost to the Owner and as part of the work of this section perform, or cause to be performed, all tests, inspections and approvals.
- .2 Should the test, inspection or approval require a representative sample of the material or workmanship the Contractor shall at no cost to the Owner supply the labour and materials necessary to provide the sample or test.
- .3 Should the test or inspection indicate that the material or work completed does not conform to the specifications the Contractor shall at no cost to the Owner promptly remove this work, dispose of it off site and re-execute it in accordance with the Contract Documents. The remedial work shall include retesting as required to establish conformance with the Contract Documents.

1.10 Submittals

- .1 Prior to the start of work for this section the Contractor shall submit the following to the Owner's Representative for review;
 - .1 Sieve analysis of granular material
 - .2 Source for supply of all materials (source shall be used throughout duration of project). Should a change of material source be proposed during work; provide samples and sieve analysis from proposed source.
 - .3 Company name, address and contact information for material testing company.
 - .4 Confirm in writing to the Owner's Representative that he/she has verified the locations of all underground services.
 - .5 Obtained in writing and submitted to the Owner's Representative at no Cost to the Owner permission from adjacent property owners and/or municipality to carry out work beyond the property limits of this contract if required to carry out the work of this section.
 - .6 Notify the Owner's Representative for on site review of sub grade preparation work forty-eight (48) hours prior to commencement of import, placement and grading operations.

PART 2: PRODUCTS

2.1 General

- .1 Review and approvals by a Geotechnical Engineer engaged by the Contractor shall be signed and sealed and submitted to the Owner's Representative prior to use of this material.

2.2 Native Material Fill

- .1 To be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for purposes of payment if it is approved by The Owner or The Owner's Representative. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.
 - .2 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.
 - .1 Review and approvals by a Geotechnical Engineer engaged by the Contractor shall be signed and sealed and submitted to the Consultant prior to use of this material.
- 2.3 Pit Run Gravel:** To be well graded granular material, substantially free from clay lumps, organic matter and other extraneous material, screened to remove all stones in excess of maximum diameter specified in material description, e.g. (300mm Pit Run Gravel, 200mm Pit Run Gravel, 100mm Pit Run Gravel). Recycled concrete free from contaminated and other extraneous material, conforming to the specified gradations may be used as pit run gravel. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.
- 2.4 Crushed Granular Sub-base:** To be 75 mm (3") crushed gravel minus, clean, free of organic material. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.
- 2.5 Granular Base:** To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.
- 2.6 River Sand:** River sand to be free of organic material, salt and foreign objects. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

PART 3: EXECUTION

3.1 Excavation

- .1 All excavation and waste discharge permits shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.

- .2 Grade to elevations and dimensions indicated on contract documents or required by the work of this section or related sections.
- .3 Ensure that work of this section provides sufficient space to permit erection of forms, site elements and miscellaneous elements of related sections.
- .4 Excavation shall to ensure that the placement of fill materials are minimized.
- .5 Contractor shall phase his operation so that a stable slope at the edge of excavation is maintained all times. Where sloping of the sides of excavations are not possible the Contractor shall implement appropriate safety measures in accordance with current WCB of BC requirements.
- .6 During excavation, stockpile material suitable for backfill in a neat manner and sufficient distance from the trench to avoid slides and cave-ins.
- .7 All excavated materials not required or suitable for backfill shall be removed and wasted as indicated or as directed. Grade as required to prevent surface water from flowing into trenches or other excavations. Remove any accumulated water by pumping or other approved method.
- .8 All exposed excavation faces shall be protected from weather with appropriate tarps or plastic sheeting as soon as possible after being cut.
- .9 Remove all boulders, rock and stones larger than 150 mm (6") in diameter from excavated surfaces encountered during excavation. Fill cavities created with crushed granular base material compacted to 95% Modified Proctor Density.
- .10 Bottom of excavation to be level, free from loose material and debris.
- .11 Protect excavations against freezing. Frozen areas shall be thawed and protected from further frost until subsequent work has been completed.
- .12 All necessary precautions shall be taken to preserve all materials outside the required excavations in an undisturbed condition.
- .13 Costs incurred as a result of deterioration caused by activities or neglect of the Contractor or and fill required for over excavation as a result of action by the contractor are the responsibility of the contractor.

3.2 Placement of Granular Fill Material

- .1 Prior to the backfill operation of site excavation ensure the following actions have been completed:
 - .1 Concrete foundation walls and footings shall have reached specified strength unless otherwise approved by the Owner's Representative.
 - .2 All backfill materials shall have been inspected and approved by the Geotechnical Engineer.
 - .3 Each component of the backfill operation shall have been inspected and approved to by the Geotechnical Engineer at the time of placement.
 - .4 Compaction density tests shall have been completed and tests results reviewed and approved by the Geotechnical Engineer.

- .2 Place crushed granular sub-base in maximum 300 mm (1'-0") lifts to depths indicated on drawings. Compact each lift to 95% Modified Proctor Density.
- .3 Place granular base in maximum 150 mm (6") lifts to depths shown on the drawings. Compact each lift to 95% Modified Proctor Maximum Density.
- .4 Place all native material fill in uniform 300 mm (1'-0") compacted lifts to depths indicated on drawings. Compact each lift to 95% Modified Proctor Density.
- .5 Ensure that granular fill material is placed to the full width of the excavation, in uniform lifts, shaping each lift to smooth, even contours.
- .6 Ensure the placement and compaction of crushed granular sub-base and granular base does not segregate or degrade the aggregate.
- .7 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.
- .8 Mechanical compaction equipment shall be used with extreme caution to prevent any undue pressure on foundation work. Do not use motorized compaction equipment directly adjacent to foundation or retaining walls.
- .9 Where backfill is required on both sides of foundation walls it shall be placed and compacted simultaneously on both sides of the wall.
- .10 All sub grade whether disturbed or undisturbed, shall be compacted to 95% Modified Proctor Density.
- .11 Soft areas or areas that do not meet specified compacted densities shall be over excavated and filled with compacted crushed granular base as required to obtain the specified compaction density.

3.3 Grading Subgrade and Granular Fill

- .1 Site sub grade shall be shaped to lines and elevations indicated on contract drawings.
- .2 Finished surface of sub grade and granular fill material shall have no irregularities exceeding 10 mm (3/8") when checked with a 3 M straight edge placed in any direction. Correct all sub grade and granular fill surface irregularities by loosening and adding or removing sub grade or granular fill material until surface is within specified tolerance. Correcting sub grade deficiencies by manipulating granular fill material is not acceptable.
- .3 Shaping of sub grade shall ensure uniform slope transitions with rounded, smooth profiles between changes in elevations
- .4 Ensure that sub grade preparation allows for depth of granular fill and finished materials as indicated on contract drawings.

3.4 Dewatering

- .1 All excavation and waste discharge permits shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Pump or otherwise continuously remove all water that has accumulated in excavation during the progress of the Work.
- .3 Do not divert water onto adjacent property.
- .4 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.

3.5 Cleaning

- .1 Clean up and remove from the site, as the work proceeds any debris and waste material or rubbish resulting from the work of this section.
- .2 Transport all surplus excavated materials, fill materials, and debris off site to an approval disposal area.

END OF SECTION 31 23 10

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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 protect existing trees on site, adjacent properties, and on adjacent road right-of-way and sites as indicated in the contract documents, including but not limited to:
 - .1 Survey and layout for locations of protective barriers.
 - .2 Installation, maintenance, adjustment during construction, and final removal of protective barriers and signs.
 - .3 Pruning as approved by the Owner's Representative including hand excavation and root pruning.
 - .4 Watering, fertilizing, and all other measures directed by the Owner's Representative as required to maximize the health and prospects for survival of the trees.

1.3 Related Work

- .1 Clearing and Grubbing Section 31 11 00
- .2 Growing Medium Preparation and Placement Section 32 91 13

1.4 Reference Standard

- .1 City of Vancouver Tree Protection By-Law. (***OR CITY OF VANCOUVER TREE PROTECTION BY-LAW 7347 OVERRIDDEN BY SPECIFICATIONS STATED HEREIN.***)
- .2 International Society of Arboriculture standards.
- .3 ANSI A300 Tree Pruning Guidelines

1.5 Definitions

- .1 The "Tree Protection Area" (T.P.A.) shall be established on site under the direction of the Owner's Representative. It must be demarcated on site and fenced off from all impacts of construction. The T.P.A. is defined as the "dripline", which is a line drawn vertically to the ground from the furthest horizontal extent of the canopy branches as measured around the full circumference of the tree. Minor adjustments may be required to this rule to meet site species/specific conditions. Confirm T.P.A. on site with Owner's Representative. In addition to the T.P.A. definition the following shall be minimum distances for protection barrier fencing from the trunk.

| Diameter at height of 140cm (cm) | Minimum distance of protection barrier fencing from trunk (cm) |
|----------------------------------|--|
| 10 | 60 |
| 20 | 120 |
| 30 | 180 |
| 40 | 240 |
| 50 | 300 |
| 80 | 480 |
| 100 | 600 |

- .2 Excavation, soil stabilizing measures, shoring (if necessary) and related work shall be planned and executed such that no excavation or other construction activities occur within the Tree Protection Area. A variance may be obtained from the Board provided that the location, materials and methods are approved and supervised by a Owner's Representative.
- .3 No Owner approvals for root pruning beyond the limits of the T.P.A. are required. All severed or fractured roots over 2cm in diameter outside the T.P.A. are to be neatly cut back a min of 5 cm above damage with a clean, sharp tree pruning saw.

1.6 Qualifications

- .1 All pruning operations shall carried out or under the direction of an I.S.A. Certified Arborist using clean sharp pruning tools,

1.7 Quality Assurance

- .1 Inspection: The Contractor shall give at least forty-eight (48) hours notice to the Owner's Representative of the timing for root pruning, branch pruning, installation of protective barrier, and all other tree protection measures. The protective barrier shall be accurately located on site, prior to starting any hand excavation or root pruning. The Park Board Arborist shall do or supervise all root pruning, branch pruning, etc. within the tree protection zone. The Park Board Arborist shall be present when all work is being done along the line of the protective fence.

- .2 Where requested, all root pruning and branch pruning shall be done to recognized arboriculture industry standards by an I.S.A. Certified Arbourist or Tree Surgeon under direct supervision of the Owner's Representative.
- .3 Severed or fractured roots to be neatly cut back.

PART 2: PRODUCTS

2.1 Protective Barrier

- .1 ***Protective Barrier shall be a 1.2m high chain link fence (standard chain link fence or temporary construction fencing) to be securely installed, plumb, and securely fixed in the approved positions. Posts, minimum 40mm diameter galvanized steel posts minimum 1.8m lengths. Posts maximum 2.4m o.c.***
- .2 ***Orange plastic web snow fencing, 1.2m high "Tenax", as supplied by Ronco Sales Ltd., or pre-approved equal. Posts, minimum 75mm dia. or square wood posts or steel "Tee-Bar" posts minimum 1.8m lengths. Posts maximum 2.4m o.c.***

2.2 Tree Protection Area Signs

- .1 Tree Protection Area signs shall be signs at least 900mm x 450mm, on painted plywood or other acceptable weather resistant material, stating:

TREE PROTECTION AREA, DO NOT REMOVE OR MOVE FENCE DURING
CONSTRUCTION:
No Dumping No Burning
No Storage No Cutting
No Machinery No Toxic Substances (paint, solvents, fuel, oils)
TO REPORT VIOLATIONS PHONE: 604-257-8400

2.3 Water, Fertilizers, Miscellaneous

- .1 Water, fertilizers and miscellaneous materials shall be as specified in other sections of the specification and as directed by the Owner's Representative.

2.4 Stakes and Fasteners

- .1 Wood Stakes: 38 x 89 ACQ treated wood or No. 1 grade cedar stakes.
- .2 Metal Stakes: 50mm diameter schedule 40 galvanized steel pipe or 1.8 (6'-0") long studded or drilled T Posts.
- .4 Zip Straps: 140mm (5.5") long, black, nylon lock straps.
- .5 Drain Tile: 150mm (6") diameter Schedule 40 PVC (polyvinyl chloride) perforated pipe conforming to ASTM D 1784.

- .6 Burlap: 10 ounce, untreated, woven, natural jute based burlap.

2.5 Fill Materials

- .1 Type 1 Fill: Clean, angular, crusher run natural stone, free from shale, clay, friable materials, roots and vegetable matter, and conforms to the following gradations:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 50mm | 100 |
| 20mm | 95 - 100 |
| 13mm | 75 - 90 |
| 10mm | 57 - 83 |
| No. 4 | 37 - 61 |
| No. 16 | 12 - 32 |
| No. 32 | 8 - 23 |
| No. 200 | 5 - 10 |

- .2 Type 2 Fill: Clean river pump sand and gravel material, free from silt, clay, loam, friable, or soluble materials and vegetable matter.
- .3 Type 3 Fill: Approved premixed growing medium per Section 32 91 13
- .4 Clear Stone: Shall consist of clean, round, washed stone. Acceptable material includes 10 mm (3/8") rock conforming to the following gradations.

| Sieve Size | Percent Passing (10mm) |
|------------|------------------------|
| 14mm | 100 |
| 10mm | 85 - 100 |
| 5mm | 10 - 30 |
| 2.5mm | 0 - 10 |
| 1.25mm | 0 - 5 |

PART 3: EXECUTION

3.1 Protective Barrier Fence Erection

- .1 Before starting site work, install a clearly visible continuous protective barrier fence at the approved lines for the "Tree Protection Area" (T.P.A.) (locations as shown on Drawings). Maintain this barrier until Substantial Performance and remove from the site at that time. Support snow fencing on steel posts driven vertically into the ground, at 2.4m on centre, or as otherwise approved by the Owner's Representative.

3.2 Tree Protection Area Signs

- .1 Install Tree Protection Area signs as specified on the protective barrier fence. For large areas, install a minimum of four signs, one each side of the T.P.A. Signs shall be well

secured by 'Zap Strap' or similar method and shall be maintained in place until Substantial Performance.

- .2 Take all measures necessary to prevent the following activities within tree protection areas except as authorized by the Owner's Representative.
 - .1 Storage of materials or equipment.
 - .2 Stockpiling of soil or excavated materials.
 - .3 Burning of any kind.
 - .4 Excavation or trenching.
 - .5 Cutting of roots or branches.
 - .6 Travel of equipment or vehicles.
 - .7 Disposal or spillage of toxic matter.

3.3 Root Pruning

- .1 Before the start of any machine excavation, hand excavate along the established limit of excavation and prune all roots along the line. Cuts shall be clean, using approved arboriculture practice using clean, sharp pruning tools.
- .2 Trees to be transplanted shall be root pruned as directed by the Owner's Representative.

3.4 Branch Pruning

- .1 Do not prune any retained tree to compensate for reduction of roots unless specifically instructed by the Owner's Representative.

3.5 Watering And Fertilizing

- .1 Retained trees shall be watered thoroughly and deeply, as necessary to supplement rainfall to maintain plant turgidity without prolonged saturation of the root zone. The method, amount and frequency of watering shall be as recommended by the Owner's Representative. **SPEC NOTE: TAILOR WATER SCHEDULE SPECIFIC TO PROJECT:** Suggested Summer Watering Schedule: The T.P.A. is to be watered via sprinkler, soaker hose, or by tank with a watering wand at least three times per week during June, July, August, and September or as directed by the Owner's Representative.
- .2 Fertilize Retained Trees to stimulate regeneration of lost roots and foliage. Fertilization program only as recommended by the Owner's Representative.

3.6 Excavation Around Trees and Shrubs

- .1 Excavation within drip line of trees shall be in strict accordance with those areas indicated on the contract documents or as directed by the Owner's Representative.
- .2 Excavation for New Construction within Drip Line of Tree(s):

- .1 Hand excavate to minimize damage to root systems.
- .2 Use narrow tine spading forks to probe and comb soil to expose roots.
- .3 Relocate roots into backfill areas whenever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking.
- .3 Utility trenching Within the Drip Line of a Tree(s):
 - .1 Tunnel under and around roots by hand digging.
 - .2 Do not cut main lateral roots.
 - .3 Cutting of smaller roots that interfere with installation of new work shall be done with clean, sharp pruning tools.
- .4 Roots encountered immediately adjacent to the location of new construction that are not readily maneuvered to beyond the excavation area shall be cut 150mm (6") back from new construction.
- .5 Protection of Exposed Roots: Do not allow exposed roots to dry out prior to placement of permanent cover. Provide one of the following temporary remedial measures:
 - .1 Provide temporary earth cover using Type 3 fill.
 - .2 Pack with four (4) layers of wet, untreated burlap. Maintain dampness.
- .6 Temporarily support and protect exposed roots from damage until permanently relocated and covered with backfill. Water backfill around roots to eliminate voids and air pockets.
- .7 When directed by the Owner's Representative, pruning operations may include the removal of limbs to restore natural shape or reduce the area of the crown of the tree(s) or shrub(s). No crown pruning shall be undertaken without the consent of the Owner's Representative.
- .8 Trees and shrubs to remain are to be thoroughly watered as required to maintain a healthy condition throughout the construction period. Contractor to document all watering operations and submit to the Owner's Representative one (1) copy of documentation at substantial performance.

3.7 Raising Grade Around Existing Trees

- .1 DO NOT RAISE GRADES within or adjacent to the tree protection zone unless authorized by Owner's Representative.
- .2 Drain Tile Installation: Install drain tile on existing grade as follows:
 - .1 Layout drain tile in a spoke like arrangement consisting of eight (8) horizontal lines radiating out from the trunk of the tree to the limit of branch spread. Horizontal line to be approximately 150 mm (6") from base of trunk.
 - .2 Slope drain tile at a minimum of 1% away from trunk of the tree to the limit of branch spread. Connect ends of each of the spokes laterally around the perimeter of the tree to form a continuous, uninterrupted circle.

- .3 Install vertical drain tile at each end of each spoke. Vertical drain tile to extend to proposed finished grade (vertical drain tile provides a means of aeration and watering).
- .4 Owner's Representative to review drain tile installation prior to backfill operation.
- .3 Drain Tile Backfill:
 - .1 Type 1 Fill: place a minimum of 150mm (6") cover around perimeter of drain tile.
 - .2 Type 2 Fill: place a Type 2 Fill to minimum depth of 150mm (6") over the Type 1 Fill.
 - .3 Type 3 Fill: place Type 3 Fill in 150 mm (6") lifts to raise grade specified elevations. Ensure allowance is made for depth of growing medium.
 - .4 Fill vertical drain tiles with Clear Stone. Ensure Clear Stone are flush with top of drain tile.

3.8 Lowering Grade Around Existing Trees

- .1 DO NOT LOWER GRADES within or adjacent to the tree protection zone unless authorized by Owner's Representative.
- .2 Lowering Grade:
 - .1 Carefully excavate by hand from limit of drip line of branch spread to proposed grade until the specified gradient has been achieved.
 - .2 Re bury or prune and remove roots as per the instructed by the Owner's Representative.
 - .3 Construct a growing medium dike at dripline to retain water. Dike to be constructed at each individual tree location unless instructed otherwise by Owner's Representative.
- .3 Excavation Through Root Area: If excavation through root area is required, excavate around roots by hand.

3.9 Surplus Material

- .1 Remove surplus material from site and dispose of at approved disposal area.

END OF SECTION 32 01 56

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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.
- .3 The intent of this specification is to define the materials and work required by the Contractor to ensure that installed plant materials successfully adapt to the project site in order to obtain the desired effect from the planting while reducing the rate of failure and replacement.

1.2 Description

- .1 Supply all products, labour, equipment, and services necessary to maintain the entire landscape area indicated in the contract documents for the ***maintenance period of two (2) full years [to confirm with Owner's Representative before tender]***, beginning on the date of the Certificate of Substantial Performance.

1.3 Related Work

- | | | |
|----|---------------------|------------------|
| .1 | Plants and Planting | Section 32 93 10 |
| .2 | Growing Medium | Section 32 91 13 |
| .3 | Hydraulic Seeding | Section 32 92 21 |
| .4 | Sod Lawn | Section 32 92 23 |

1.4 Reference Standards

- .1 Work shall meet or exceed the standards and practices outlined in the CLSA Canadian Landscape Standard.
- .2 Signs attached to temporary construction fences and walkway shall meet the standards outlined in the City of Vancouver Sign By-Law Guide.
- .3 Canadian Fertilizer Code. All fertilizers shall comply with the Canadian Fertilizer Code.
- .4 Municipal, District, Provincial and Federal legislation and requirements which may restrict or prohibit certain activities such as the application of herbicides and pesticides.

1.5 Qualifications

- .1 All work of this Section shall be carried out by fully experienced and licensed maintenance contractors with current membership standing in the British Columbia Landscape & Nursery Association (BCLNA). Contractor to have at least 5 years minimum experience working on projects of similar size and scope. Written proof of experience may be requested by Owner's Representative for submission.
- .2 Pesticide/Herbicide/Fungicide and other chemical handling and application shall be done only by applicators holding current certification under the B.C. Pesticide Control Act.

1.6 Work Included

- .1 Maintaining the planted areas and the entire landscape area in a weed free condition.
- .2 Fertilizing as specified in this Section.
- .3 Disease and insect control as required to maintain plants in a disease and problem insect free condition.
- .4 Pruning as specified in this Section.
- .5 Replacement of dead or diseased plants.
- .6 Watering as specified in this Section.
- .7 Turf management; Lawn mowing, edging and trimming (aeration, topdressing and power raking) as specified in this Section.
- .8 Protection of the landscape area as necessary.
- .9 Litter (including leaf litter) removal from the entire landscape and paved areas.
- .10 Soil testing as required to determine fertilizer requirements.
- .11 Planting of seasonal annuals and bulbs.
- .12 Maintain all pedestrian paved surfaces (including city sidewalk immediately adjacent to the project site) in a clean condition.
- .13 Fall winterization/Spring Start-up of the automatic irrigation system.

1.7 Work Not Included

- .1 Sweeping and cleaning of roadways and parking lots (**except for leaves and landscape debris**).

1.8 Warranty

- .1 The work of this Section is intended to provide conditions under which the Warranty requirements of Sections 32 92 23 Sod lawn, 32 93 10 Plants and Planting, 32 92 21 Hydraulic Seeding can be met through the proper care of grass, plants and seeded areas. The requirements of the Warranty shall be the responsibility of this Contractor.

1.9 Equipment

- .1 Equipment shall be suited to the work at hand and shall be in good working condition. All appropriate safety devices shall be in place and functioning to current WorkSafeBC requirements.
- .2 All equipment shall be kept clean to prevent spread of diseases. Cutting equipment shall be kept sharp and well adjusted.

1.10 Documentation

- .1 The contractor shall maintain a log book of all establishment maintenance operations carried out and shall make the log book available to the Owner's Representative for inspection upon request, as may be reasonably required. **Lack of information shall infer non-compliance with the Work of this Section and payment(s) will be adjusted accordingly by the Owner's Representative.**
- .2 The contractor shall submit with each monthly invoice for Work of this Section, a report stating the dates when maintenance staff were on site, the operations carried out and documentation of any conditions requiring attention beyond the Scope of this Section. A sample report is included at the end of this Section.

1.11 Protection and Preservation

- .1 Take all precautions necessary to protect all trees, shrubs and other plant material; underground and above ground site services, curbs, paving and other services including the irrigation system on and surrounding the contract site against any damage resulting from the work of this Section. Reinstall to original condition if damaged by the contractor, his employees, suppliers, sub-trades or equipment throughout the duration of the contract.

1.12 Scheduling

- .1 Schedule work on site in accordance with weather, soil and plant conditions and use of the site.
- .2 Work shall be carried out year-round.
- .3 Do each operation continuously and complete within a reasonable time period.
- .4 Maintenance personnel shall attend the site during the morning of the first normal working day of each week during the maintenance period. Work at this time shall include litter pick up and disposal, monitoring of moisture in growing medium, and reporting of any damage, deterioration or other conditions requiring attention.

1.13 Inspection/Notification

- .1 The contractor or his authorized representative shall be present during all required inspections.

- .2 In general, execution involves weekly inspections at least during the growing period (May 1 to October 15) and at least monthly inspections during the remainder of the establishment period, with maintenance operations scheduled on the basis of conditions observed at each inspection.
- .3 Make a written request ten (10) working days before the end of the establishment maintenance period for final inspection.
- .4 At the time of final inspection, all plants and planted areas shall be in the condition specified, all remedial work or replacements shall be complete and all plants shall be healthy and vigorous.
- .5 Notify the Vancouver Park Board of any physical changes and or discrepancies which may affect the implementation of the contract as specified herein or which may endanger any employee of the Contractor, Vancouver Park Board or any member of the general public.
- .6 Provide minimum three (3) days notification in writing prior to application of any chemical vegetation or pest controls. Ensure notices are posted for public safety in entire area of application three (3) days prior and for five (5) days after.

1.14 Payment

- .1 Payment shall consist of equal monthly instalments over the maintenance period.
- .2 Labour shall be designated separately from materials. All billing for materials; mulch, fertilizer, sand or other materials shall be submitted with receipts of original purchase.
- .3 An up to date log book will be submitted of work done, indicating areas of work, materials used and dates of performance in support of the monthly billing. The log book shall document the development and condition of plant material as well as preventative and/or corrective measures required which are clearly outside the Contractor's present scope/responsibility. **Failure to submit the log book in support of the billing will result in a failure to process the payment and may result in non-payment if work cannot be substantiated by the Vancouver Park Board.**

1.15 Penalties

- .1 If some or all of the work is not performed according to the specifications, the Vancouver Park Board may, after 5 days written notice, proceed with the required work and deduct actual costs from payments to the contractor.

PART 2: PRODUCTS

2.1 General

- .1 Product Handling

- .1 Delivery and storage shall be as required such that materials are protected against deterioration or damage as required and such that delivery and storage do not interfere with normal use of the site.

2.2 Plant Material

- .1 Plant material shall meet the requirements of Section 32 93 10 Plant and Planting, except that new plants supplied under this Section shall be sized to match existing plants of the same variety at the time of installation of new plants.
- .2 Sod or grass seed shall match the varieties installed under Section 32 92 23 Sod Lawn and 32 92 21 Hydraulic Seeding.

2.3 Water Source

- .1 If irrigation system is not available or part of the scope, the Contractor shall work with the Owner's Representative and Contract Administrator to determine the water source for the project and establish a watering system that meets the irrigation requirement on site.
[Consultant to confirm with Owner's Representative regarding water source and irrigation option before tender],
 - .1 If there is an existing water service connection on site, the Contractor may set up a temporary watering system, which include but not limited to irrigation couplers, hoses, and hose bibs, for tasks outlined in this section. The Contractor shall provide a plan for the temporary watering system in advance for Owner's Representative and Contract Administrator to review and provide approval.
 - .2 If there is no existing water service on site, the Contractor is responsible for delivering adequate water for tasks outlined in this section.

2.4 Fertilizers and Limes

- .1 Shall be the following fertilizers and limes with the following warranty of analysis and used as directed under PART 3 - EXECUTION.
 - .1 Fertilizer to meet recommendations of soil analysis provided by construction contract.
 - .2 Dolomite of lime (Agrico Spread Easy Dolomite).

2.5 Weed Control and Eradicate Chemicals

- .1 **Do not use any chemical method of insect or disease control without prior written approval of the Vancouver Park Board.** The type of herbicide and application methodology to be submitted in writing to the Owner's Representative for review and approval.
- .2 Use of herbicides, fungicides and insecticides shall conform to all current Vancouver Park Board, Municipal, Provincial and Federal Government regulations and codes.

PART 3: EXECUTION

3.1 Plant Material

.1 Watering:

- .1 Soil moisture shall be monitored continuously during the growing season.
- .2 During the growing seasons, plants shall be watered sufficiently to promote healthy root establishment and prevention of leaf wilt.
- .3 The Contractor shall manage the irrigation system and controller schedule to ensure plant survival and health for the duration of the maintenance contract.
- .4 Watering shall be done more frequently when plants are reaching the permanent wilting point. Scheduled applications of water shall be missed only when rainfall has penetrated the growing medium fully.
- .5 Ensure the automatic irrigation system is operating properly.
- .6 Apply at least 1 to 1-1/2" of water during each application.
- .7 Watering shall be such that the water penetrates the full depth of the growing medium.
- .8 If installed, monitor and adjust weir plates so the flood irrigation system is fully saturating the growing medium for wetland vegetation establishment.
- .9 If no irrigation system has been installed, water trees by hand, by soaking the root zone once a week during dry periods or once per day when temperatures exceed 25C. Water source will be as outlined in 2.2.1

.2 Weed Control:

- .1 Maintain all areas in a weed free condition.
- .2 In this specification, a "weed" is defined as any plant growing where it is not wanted. This definition includes unwanted plants in planting beds, unplanted areas and in paving. This definition also includes grass varieties that detract from the desired appearance or function of lawn areas.
- .3 Following is a list of species that are of particular concern and are to be removed immediately. Notify the Owners Representative if any of these weeds are observed:

| | |
|----------------------|----------------------|
| Convolvulus arvensis | Bindweed |
| Fallopia japonica | Knotweed |
| Polygonum cuspidatum | False Bamboo |
| Rubus procerus | Himalayan Blackberry |
| Hedera helix | English Ivy |
| Ilex sp | Holly |

- .4 Inspect landscape areas for weed growth once per week during the growing season
- .5 Remove all weeds (roots and rhizomes included), except those noted to be removed immediately, within one week of observing weed growth. Weeds are to be removed by hand pulling or digging as required to remove the complete plant structure.

- .6 Weed control procedures shall have no detrimental effect on the growth of desired plants. Mechanical methods are the preferred methodology.
- .7 Confirm with Owner's Representative if chemical or other means are to be utilized.
Do not use any chemical method of weed control without prior written approval of the Vancouver Park Board.
- .8 **All federal, provincial, regional district and municipal legislation related to the application of herbicides must be adhered to fully.**
- .9 Notification of herbicide application must be posted throughout the site three work days prior to application.
- .10 Cultivation and hoeing shall not be used to control weeds because these practices disturb the mulch layer and soil structure and do not adequately control weeds.
- .11 All disturbed mulch areas are to be restored to original conditions after weeding activities.
- .12 Mechanically cut out all grass from around tree pits/saucers to a minimum 600mm dia. to protect all trunks from damage by mowers or trimming equipment.
- .3 Volunteer Native Plants:
 - .1 As directed by the Owner's Representative, volunteer native plant species that self-propagate either through seed, rhizome or spores shall be allowed to establish and be given the same care as installed plants.
- .4 Cultivating:
 - .1 In the spring, before beginning watering, cultivate the soil surface of all planted areas including the base of all trees as shallowly as necessary to ensure penetration of water and air into the soil. Repeat as necessary for weed control and soil permeability. In addition, this operation shall be carried out at least twice per month to prevent caking of surface soil or mulch. Where and when applicable mulch should be replaced annually or when required by erosion, decay, cultivation or vandalism.
 - .2 Avoid cultivating into the root zone of plants, particularly shallow-rooted groundcovers and rhododendrons.
- .5 Pruning:
 - .1 All trees and shrubs shall be inspected for pruning at least every two months during the growing season.
 - .2 Deciduous Shrubs: Remove all dead, weak or diseased wood. Do not clip or shape shrubs - allow the shrub to develop a natural appearance.
 - .3 Trees: Remove dead branches only. All other tree pruning shall be carried out under the direction of the Owner's Representative. Trees improperly pruned and/or not pruned as directed by the Owner's Representative shall be considered as having died and shall be replaced with the same species by the contractor at no cost to the Vancouver Park Board.
- .6 Pest & Disease Control:

- .1 **Do not use any chemical method of insect or disease control without prior written approval of the Vancouver Park Board.**
 - .2 Follow a program of Integrated Pest Management using a combination of physical (hosing), cultural, biological and chemical methods chosen for the most effective, safe and economical control of pests and diseases. Minimize pesticide use except where irreversible damage would result from pest and disease infestation.
 - .3 Inspect all plants for signs of pest or disease once per week during the growing season and report any such conditions in the monthly report.
 - .4 Begin treatment for pests or diseases immediately following observation. If chemical controls are required, pesticides shall be chosen on the basis of highest effectiveness and selectivity, and least hazard to the environment.
 - .5 Pest and disease control shall be carried out by skilled operators, using methods approved under current laws and regulations.
 - .6 Use the recommended type of equipment and method of application for each chemical as recommended by the chemical manufacturer.
 - .7 All chemicals shall be mixed and applied as stated on the label of the manufacturer.
 - .8 Be extremely cautious in the mixing, handling and application of all chemicals as they may be harmful (if misused) to humans, plants, animals, etc.
 - .9 The Contractor shall be liable for any damage caused through the misuse of any plant disease and/or plant insect control method.
 - .10. **All federal, provincial, regional district and municipal legislation related to the application of insecticides must be adhered to fully.**
- .7 Mulch:
- .1 Mulches shall be maintained in the original areas and to the originally installed depths.
- .8 Fertilizing:
- .1 Two to three (2 - 3) months after the installation and initial fertilizing of plants (Section 32 93 10 Plants and Planting), or when directed by Owner's Representative, apply one application of fertilizer appropriate for the time of application and specific for lawns or planting areas at the rates recommended by an approved soil testing laboratory, based on soil test results. Apply a minimum of three applications of fertilizer per annum **for all lawn areas** - April, June and August. Apply a minimum of two applications of fertilizer per annum **for all planting areas** - March and May. Follow manufacturer's recommended application rates, if soils test not taken.
 - .2 Work the fertilizer thoroughly into the top 50mm of soil.
 - .3 Application of fertilizer to be followed by a thorough watering.

- .4 Soil Testing - examine the site to determine any areas where the plant material or lawn is performing poorly. If required and as directed by the Owner's Representative take soil samples from the affected area(s) to and approved soils testing laboratory for soils testing. Costs for such testing shall be borne by the Contractor. Determine the problem. Correct deficiencies to the soil such as poor texture, chemical residues or nutrient level or organic matter deficiencies by appropriate means as recommended by soils testing laboratory. Correct the situation at the appropriate time of year and as coordinated with the Owner's Representative.
- .9 Liming: In January within the first year after installation, lime all exterior planting and sod areas with application of dolomite lime at the rate of 10 lbs per 1000 square feet of soil surface, or as otherwise recommended by the soil testing laboratory.
- .10 Tree Support: All trees shall be protected against wind and snow damage by adequate staking, guying, tying or wrapping as conditions require.
 - .1 Guys, wire ties and stakes shall conform with Section 32 93 10 Plants and Planting.
 - .2 Supports shall be examined at every two months at least with adjustments or replacements made to prevent any abrasions, cuts or other damage to the plants including depressions in the bark.
 - 3. Contractor to remove the supports after the second growing season except for large trees as directed by the Owner's Representative.

3.2 Mowing and Trimming

- .1 Mow all lawns with a sharp reel or rotary mower when the grass reaches a height of 60mm (2-1/2 inches). Mow to a height of 40mm (1-1/2 inches); the height of the lawn between cuttings shall not exceed 60mm (2 2 inches). **Mow and trim a minimum of 32 times per annum**; weekly from April - September, three times in October, twice each in March and November. Cut as required in December, January and February advised by Owner's Representative.
- .2 Trim all edges, walks, curbs, mowing strips or planting beds at each mowing with a nylon line type power trimmer to ensure a clean straight edge.
- .3 Remove all excess grass clippings from the grass and planted areas after each mowing, sweep all paving and other surfaces clear of clippings.
- .4 Mow wildflower meadows in early spring to 4" tall (10cm), as vegetation begins to grow, and remove vegetation cuttings to limit nutrients returning to the ground. Then mow meadows again in late summer, leaving the cuttings in place for one week, prior to collecting and disposing of cuttings. This allows seed to drop and establish the following year.

3.3 Lawn Remediation

- .1 Examine the site. Correct all thin areas or bare patches caused by poor maintenance practices (or other reasons), such as improper watering, lack of fertilizer, incorrect cutting height, chemical or mechanical damage. Examination shall include review for compacted or thin areas resulting from pedestrian traffic. If required and as directed by, start an immediate program to rectify the problem(s). Remediation shall include but not be limited to the following: aeration, sanding/soiling, over seeding and fertilization.

3.4 Irrigation System

- .1 **Coordinate with requirements of Section 32 80 00 Irrigation System.**
- .2 Maintain the irrigation system in good operating condition. Check the system once per week during the operation season. Clean and adjust all sprinklers, valves, controllers, and other special components. Inspect the municipal connection details and backflow prevention devices annually as required by the City of Vancouver. Repair all damaged heads and/or other components resulting from the Contractors operations.
- .3 Test the irrigation system, flush all lateral lines and adjust heads as required for good coverage at the beginning of the growing season. Set and adjust the timing of zones several times during the season to ensure that all areas receive adequate water to supplement the natural rainfall without over watering or creating excess run-off. Adjust controller times as required to accommodate for seasonal changes in time, fertilizer application or other specifics as dictated by the Owner's Representative.
- .4 Winterize the system by blowing out all water in the irrigation system with an air compressor at the end of the growing season. Confirm exact date with Owner's Representative. Ensure all controls/power are shut-off and all pop-up type heads are in the down position.
- .5 Failure of irrigation components due to normal wear and tear, vandalism and damage by others shall be reported immediately to the Owner's Representative with an estimation of cost to repair or an instruction to contact the original irrigation subtrade to provide such a quote. Shut-off water system as required to prevent erosion damage from run-off. Water manually all landscape areas affected by loss of irrigation system until repairs have been completed. Coordinate repairs to the irrigation system immediately after damage or deterioration is noticed and the quote to repair has been approved by the Vancouver Park Board.

3.5 Cleaning of Paved Surfaces

- .1 Maintain all pedestrian paved surfaces of the project in a clean condition. Sweep or hose off all paved surfaces after completing maintenance operations.
- .2 Maintain any sports court surfaces on a weekly basis or as required and directed by Owner's Representative to ensure that leaves or other debris are removed from the court surfaces without damaging any painted or other special surfacing.

- .3 Hose or power wash the surfaces to remove any spills/staining which have occurred on an annual basis. **Ensure that any chemicals or stripping/stain removal agents have been reviewed and approved by Owner's Representative prior to commencing with this work.**

3.6 Clean Up/Litter Removal

- .1 All non-vegetative litter (eg. paper, cans, refuse) within landscape maintenance area must be collected and disposed of appropriately. Litter removal should be a routine part of every site visit.
- .2 Remove debris, equipment, materials, and waste due to work of this Section at the end of each day of work **from all landscape and pedestrian areas, including the city sidewalk immediately adjacent to the project site.**
- .3 Vegetative litter (e. fallen leaves, twigs, trimmings) must be removed from mowed areas only in a scheduled procedure before it rots or accumulates sufficiently to detract from the use or appearance of the area or damages the landscape.
- .4 Vegetative litter should be composted for re-use on site or off site where possible, or disposed of in an appropriate manner.
- .5 Keep paved surfaces clear and swept clean of debris, materials and waste from landscaping operations as required throughout the year.
- .6 Remove leaves and landscape debris from all paved vehicular roadways and parking lots.
- .7 SPRING CLEAN-UP - remove all debris from lawn areas, shrub and flower beds including vegetative debris or growing medium from all pedestrian paved surfaces. Place order for summer annuals as directed by Owner's Representative (If Applicable). Cultivate all planting beds and tree pits to requirements of 3.1.3.
- .8 FALL CLEAN-UP - Fall clean-up includes the same operations as specified for the Spring plus disposal of leaves from the entire site. Review the site weekly through the Fall and ensure operations are completed by end of November (or as dictated by Owner's Representative). Continue to inspect and clean the site as required at least once per month during December, January, and February.

3.7 Reporting Damage

- .1 While it is recognized that the Contractor is not responsible for inspecting the site for general hazards, if any dangerous or potentially dangerous situations are observed then notification shall be given immediately to the Owner's Representative, appropriate public agencies or authorities responsible for protection of the environment and for the safety of such property such as public utilities.

3.8 Sample Landscape Maintenance Report

- .1 Following is a single page sample landscape maintenance report for use in meeting the requirements of 1.6.2.

LANDSCAPE MAINTENANCE MONTHLY REPORT (sample)

Project Name/Contract No.: _____

Owner's Representative _____

Date: _____ Time: _____ Weather _____

Contractor Foreman _____

Month: _____ Size of Crew: _____

| <i>Elements</i> | <i>Work completed</i> | <i>Problems requiring attention</i> |
|--|------------------------------|--|
| BEDDING PLANTS -cultivation/weeding -fertilization -moisture content -seasonal change | | |
| SHRUBS & GROUNDCOVERS -cultivation/weeding -pest and disease -fertilization -replace dead/dying material -weed control -pruning/moisture content | | |
| TREES/ MAJOR PLANTS -pruning dead/broken branches -fertilization -replace dead/dying material -check/adjust guying/stakes -weed control -moisture content | | |
| LAWN AREAS -mowing/edge trimming -moisture content -fertilization -weed control | | |
| PAVED/GRAVELED/ BARE AREAS -general review -special maintenance/cleaning req'd. | | |
| GENERAL COMMENTS/OTHER OBSERVATIONS -irrigation system component check -irrigation winterization/start-up -overly dry or too wet conditions | | |

END OF SECTION 32 01 90

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 of hot-mix asphalt concrete paving on base and subbase(s) materials, on grade as indicated in the contract documents.
- .2 Restore all existing asphalt paving if damaged or deteriorated due to work of this Contract.

1.3 Related Work

- .1 Site Preparation and Grading Section 01 89 13
- .2 Aggregates and Granular Materials Section 02 41 14

1.4 Reference Standards

- .1 Materials, mix designs, testing and application procedures shall comply with the requirements of the British Columbia Road Builders and Heavy Construction Association Specification for Hot-Mix Asphalt Concrete Pavement, revised June 1989.
- .2 Materials, mix designs, testing and application procedures shall comply with the requirements of the (MMCD) Master Municipal Specification Section 32 12 16 Hot Mix Asphalt Concrete Paving.
- .3 Sampling Mineral Aggregates ASTM D75
- .4 Sampling Bituminous Mixtures ASTM D79
- .5 Sieve Analysis of Aggregates ASTM D136
- .6 Specific Gravity of Aggregates ASTM C127 and ASTM C128
- .7 Determination of Bitumen Content ASTM D1097
- .8 Bulk Density of Compacted Asphalt Concrete Paving Mixtures ASTM D2726
- .9 Marshall Procedures for the Preparation and Testing of Bituminous Mixtures ASTM D1559
- .10 Quantity of Bitumen Absorbed by Aggregates - "Maximum specific Gravity of Bituminous Mixtures" ASTM D2041

1.5 Phasing

- .1 See Phasing Plan (if Applicable) and note that asphalt concrete paving will be completed in portions to suit the construction schedule.

1.6 Submittals

- .1 Submit sieve analysis for grading of both base and subbase materials.
- .2 Submit hot mix asphalt design and trial mix test results to the Owner's Representative for review at least one week (7 days) **prior to** commencement of work of this Section. See Item 1.10 also.

1.7 Site Conditions

- .1 Start of work shall signify acceptance of site as satisfactory and no claim will be recognized for extra work nor any allowance made for defective work due to site conditions.
- .2 Investigate the site to verify information shown in Contract Documents. **Verify that existing grades are as shown on Drawings and notify Owner's Representative immediately of any discrepancies.**
- .3 Review existing site conditions with regard to subsurface conditions. Data on indicated subsurface conditions is not intended as representations or warrants of continuity of such conditions. Additional test borings and other exploratory operations may be made by bidders at no cost to The Board. Notify Owner's Representative prior to carrying out any such work.

1.8 Protection

- .1 Verify locations of all underground utility and drainage lines. Take all necessary precautions to protect unit precast paving, curbs, utilities and other site elements and work of other trades. Make good any damage to the satisfaction of Owner's Representative at no additional cost.
- .2 Immediately report any damage to the site or danger to persons on/near site to all concerned parties (Owner's Representative).
- .3 Prior to commencement of work of this section, erect warning signs at all locations where the public may gain entrance to the project site. Provide all necessary construction barricades as requested by Owner's Representative to protect the public from accidents occurring during construction.

1.9 Quality Assurance

- .1 Installation shall be by a main paver operator with at least 5yrs. min. experience in placing hot-mix asphalt concrete paving on projects of similar size/scope. The contractor must be prepared to advise of previous work by submission of a written list if requested by Owner's Representative.

1.10 Environmental Conditions

- .1 Do not install hot-mix asphalt concrete pavement, base, or subbase during heavy rain or snowfall, cool temperatures or other unsuitable conditions as determined by Owner's Representative. Place paving under favourable weather conditions; with temperatures exceeding 4 degrees Celsius. Base and subbase surface should be dry and stable. **Air temperature must be at least 5 degrees Celsius and rising to place asphalt mixtures. (Air temperature must be 10 degrees and rising for tennis and sport courts)**
- .2 Do not install asphalt concrete paving on frozen, wet, muddy or rutted base(s).
- .3 Examine substrates and notify Owner's Representative of any deficiencies related to compaction or incorrect grades or slopes. Ensure deficiencies are corrected prior to commencement of work of this Section.
- .4 Use Oil Soak Blotters in catch basin spillways and elsewhere as directed to avoid spilling oil into site drainage system(s) or adjacent watercourses.
- .5 Allow asphalt concrete paving to completely cure prior to washing the surface to avoid spilling oil into site drainage system(s) or adjacent watercourses.

1.11 Testing and Approvals

- .1 The Contractor shall provide Owner's Representative with min. 48 hrs. notice to arrange for inspections and compaction tests.
- .2 An independent testing agency shall be appointed and paid for by the Owner to perform sieve analysis and density testing to confirm compliance with this Specification. Test results shall be submitted directly to the Owner's Representative. Items to be tested shall include but not necessarily be limited to the following:
 - .1 Density testing of subgrade, subbase(s), base and asphalt.
 - .2
 - .3 Asphalt cores for density analysis.
Note: Additional density testing may be requested by Owner's Representative at any time after placement of base course(s)/asphalt concrete paving to confirm compliance with the contract documents. **Any additional tests will be at Owner's expense.**
- .3 Prior to commencing work of this Section, mix designs shall be submitted to Owner's Representative for approval. The contractor shall furnish sufficient evidence the proposed mix will produce satisfactory results to Owner's Representative (if requested).

1.12 Measurement And Payment (Unit Price Contracts Only)

- .1 ***Asphalt concrete paving will be measured in tonnes of asphalt concrete actually incorporated into the Work.***

PART 2: PRODUCTS

2.1 Hot-Mix Asphalt Concrete

- .1 Refer to Master Municipal Specification Section 02512 Hot-Mix Asphalt Concrete Paving and COV Supplemental Specifications to Master Municipal Specifications, current edition (COV Engineering Standards and Detail Dwgs.) for asphalt cement, aggregates and gradations, sand equivalents, abrasion, absorption, mineral fillers and all aspects of the mix design.
 - .1 Reclaimed Asphalt Pavement (RAP): Crush and screen so that 100 % of reclaimed asphalt pavement material passes the 37.5mm screen prior to mixing. Max. allowable RAP in any Mix Design will be 20% by mass. Higher percentage of RAP may be accepted by Owner's Representative if Contractor demonstrates that supplier can produce mix meeting requirements of the specification.
 - .2 **Do not change job-mix without prior approval of Owner's Representative (Engineer). If change in material source is required, Contractor shall submit new mix formula for review/approval.**

2.2 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.3 Crushed Granular Sub-base

- .1 To be 75 mm (3") crushed gravel minus, clean, free of organic material. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

PART 3: EXECUTION

3.1 Plant And Mixing Requirements

- .1 Refer to Master Municipal Specification Section 02512 Hot-Mix Asphalt Concrete Paving and COV Supplemental Specifications to Master Municipal Specifications, current edition.

3.2 Base Inspection

- .1 Prior to commencement of hot-mix asphalt concrete paving the granular base shall be inspected by Owner's Representative and the Contractor. Provide min 48 hrs. notice prior to desired paving time to allow for inspection to be scheduled. Areas of work to receive hot-mix asphalt concrete paving shall be examined and unsatisfactory conditions reported to Owner's Representative; **commencement of work shall imply acceptance of conditions**. If Owner's Representative have doubts about acceptability of the base, a Benkleman Beam Test may be ordered, and work is not to proceed until such testing has

- been approved. The contractor shall provide a loaded single axle truck with a rear axle load of 8165 kg to be used in conducting tests.
- .2 Any areas which are found to be soft or wet shall be excavated and backfilled with the granular subbase and base as specified.
 - .3 The subgrade shall be well drained. Verify that the subgrade is dry, uniform, even and ready to support subbase, base and asphalt concrete paving and the intended loads. Base course shall be examined for adequate compaction and uniform surface. The base course to be compacted to 95% Modified Proctor Density.
 - .4 Verify the gradients and elevations of the subgrade and base are correct to allow installation as per the details and meet the intended finished grades. **Notify Owner's Representative of any discrepancies prior to proceeding with installation.**

3.3 Preparation Of Subgrade And Placing Base Courses

- .1 Prepare subgrade to requirements of Section 01 89 13 Site Preparation and Grading.
- .2 Place compacted aggregate base course (on compacted sub-base course) on subgrade to finished depths as detailed.
- .3 The sub-base or subgrade as detailed shall be compacted to 95% Modified Proctor Density.

3.4 Placing And Compacting Asphaltic Concrete

- .1 Place depth of asphalt concrete to thicknesses, grades and lines as shown on the contract documents or as directed by Owner's Representative. To be placed in compacted lifts of specified thicknesses. **Arrange for and complete paving in a continuous operation, avoid delays in laying parallel strips.**
- .2 Placing Conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5 degrees Celsius and rising (10 degrees and rising for tennis and sport courts)
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees Celsius, provide additional rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt concrete when pools of standing water exist on surface to be paved, during rain or snow or when the surface is damp. Refer to 1.9 Environmental Conditions.
- .3 Lower Course: Machine place to specified compacted thickness (maximum lifts of 50mm after compaction) over compacted and graded aggregate base. Some areas may require thicker applications to fill in low spots and to ensure positive drainage.
- .4 Upper Course: Machine place to minimum specified compacted thickness (maximum lift of 38mm after compaction) over compacted lower course. Hand place/tamp as required around all site fixtures.

- .5 When asphalt concrete meets site fixtures, furnishings, concrete walls, walks or other **(note specifically)** flare the asphalt upwards around the base of fixture to ensure water drains away from the fixture and is in compliance with the overall grading and drainage plans for the Project.
- .6 Commence rolling and/or manual compaction immediately after the bearing capacity is adequate to support the required compaction equipment, without undue displacement of material or surface cracking. Rolling and/or compaction shall be carried out in compliance with the Standards noted in Item 1.3. Hand tampers may be used at all inaccessible areas. Compaction in these locations shall be to the Owner's Representative's approval.
- .7 Along building walls, curbs, gutters, headwalls, manholes and similar locations not accessible to a roller, thorough compaction shall be obtained by means of hot hand or smaller mechanical tampers before the mixture has set. At all contacts of this nature, the joints between these structures and the surfacing must be effectively tack coated with an emulsified asphalt.
- .8 The finished surface is to be smooth and rolling to allow for positive drainage of all areas.
- .9 **Notify Owner's Representative min. 48 hrs. prior to flooding to arrange for inspection.** Flood the entire asphalt concrete surface area after placement of the Lower Course Asphalt to ensure positive drainage in accordance with the grading plans. Make all necessary repairs to ensure positive drainage prior to placing the Upper Course Asphalt.
- .10 **Cutting and removal/patching type repairs are permitted in the Lower Course asphalt only. Take care to ensure that grading and drainage problems are rectified prior to placement of Upper Course asphalt. Deflecting, ponding or other surface grading problems found in the asphalt Upper Course shall be corrected by complete removal of the top lift of asphalt concrete and replacement with a new lift of Upper Course asphalt. Final repair process subject to review/approval with Owner's Representative.**
- .11 All asphalt concrete pavement edges shall have a uniform, bevelled, tidy and straight appearance. **Border planks or sawcut edges are not acceptable.**
- .12 Both Lower and Upper Course asphalt concrete joints shall be homogeneous with the rest of the surface and carefully matched for texture and elevation. All joints which are rejected by the Owner's Representative are to be cut out and redone to Owner approval. Asphalt joints to be done in accordance with the Standards referenced in Item 1.3 of this Specification.

3.5 Existing Asphalt

- .1 Repair all existing asphalt concrete that has been damaged/broken or eroded due the Work of this Contract.
- .2 Where new asphalt concrete paving abuts existing asphalt concrete paving make good all cracked, damaged or eroded areas to a distance of 600mm back from the intersection to provide a uniformly graded, smooth and solid transition with the new work.

- .3 Where existing asphalt is to be overlaid, prior to installing asphalt concrete mix, the surface shall be cleaned of loose or foreign material and tack coated in accordance with Section 02547 of the MMCD.

3.6 Performance Standard(s)/Surface Tolerances (Tennis And Sport Courts Only)

- .1 All finished asphalt concrete surfaces shall be dense, compact, free from faults or cracks and true to grades, elevations and cross falls shown. The surface shall be smooth, and shall have no readily apparent roll marks, divots or heavy oil build-up. Surface grading shall be such that the entire surface of the paved area shall be free of any standing water or birdbaths after a rainfall or test flooding (allowing for sufficient time as dictated by the Owner's Representative to allow for water to run off to the perimeter or site drainage system). **Any birdbaths holding water deeper than a five-cent coin shall be patched and leveled in accordance with recommendations of the colour coating/finishing system specified. Re-flood and test. All surface irregularities are to be repaired to Owner's Representative approval.**
- .2 All asphalt concrete paved surfaces shall have a uniform appearance. Special care shall be exercised to avoid all footprint indentations. Any areas that do not have a uniform appearance, with a tight aggregate spacing or have footprint indentations shall be repaired to Owner's Representative approval.
- .3 If asphalt concrete paving surface is a tennis or sport court the stringent surface tolerance requirements of the USTA will be strictly enforced. **Any surface irregularity with a depression greater than 3mm depth under a 3m straight edge shall be cause for rejection of the entire tennis court surface.** Repairs/resurfacing must be completed in a manner acceptable to the Owner's Representative. Repairs to tennis court surfaces shall be seamless with the adjacent surface and have a similar appearance and texture that will not result in a different shoe grip or ball bounce or compromise the application of any colour coat surface/line paint.

3.7 Finished Tolerances

- .1 Finished asphalt paving surface shall be within 6mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface shall have no surface irregularities exceeding 6mm when checked with a 3m straight edge placed in any direction (3mm in 3m for tennis and sport courts).
- .3 The final surface elevation of asphalt pavement shall be 3-7mm above adjacent drainage inlets, grates, concrete collars, concrete curbs, walks or gutters or channels after compaction/rolling to compensate for minor settling. **Confirm with the Owner's Representative.**

3.8 Thickness Tolerance

- .1 The minimum asphalt concrete pavement thickness specified herein shall mean the average compacted thickness as determined from cores taken as dictated by the Owner's Representative from random locations around the site area being paved. The Contractor is to repair the core hole locations.
- .2 The average thickness of cores shall equal or exceed the specified pavement thickness and no individual core shall be more than 5mm less than the specified thickness detailed.
- .3 Any paved surface area failing the core thickness testing criteria shall receive a minimum 12mm lift of Upper Course Asphalt.

3.9 Line Painting

- .1 Paint sports court game lines or colour coat surfaces traffic lines/symbols as detailed. Refer to Painted Pavement Markings Specification Section 09910.

3.10 Power washing

- .1 If asphalt concrete paving surface is a tennis court, then power wash entire surface of each court to remove any surface oils prior to final surface coating applications.

3.11 Site Maintenance/Adjustments And Cleaning

- .1 Correct any surface irregularities that develop or have been noted prior to completion of rolling process by first loosening the surface mix and removing or adding material as required.
- .2 If irregularities or defects remain after final compaction, remove the surface course immediately and lay new material to form a true and even surface. Compact immediately to specified density.
- .3 Surplus material shall be cleared away and removed from the work site.
- .4 Excess material remaining on the Lower Course surface shall be brushed away and removed from the work site, prior to installing the Upper Course.
- .5 After removal of excess material/debris check final elevations for conformance with the drawings.

END OF SECTION 32 12 16

Paving

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

INSTRUCTIONS FOR CONSULTANTS: Text highlighted in blue pertains to information regarding Concrete Paving – Exposed Aggregate. Delete / add as required.

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 Portland cement concrete walks with finish as indicated in the contract documents.
- .2 Work of this section includes but is not limited to the supply, testing, provision of tooled joints, and or sawcut joints curing and finishing of horizontal concrete surfaces.
- .3 Scope of this section includes all formwork, the supply and installation of reinforcing, expansion joint fillers and joint sealants, aggregate required for complete installation.

1.3 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Aggregates and Granular Materials | Section 02 41 14 |
| .2 | Concrete Forms and Accessories | Section 03 10 00 |
| .3 | Concrete Reinforcing | Section 03 20 00 |
| .4 | Cast-in-Place Concrete | Section 03 33 00 |
| .5 | Concrete Finishing | Section 03 35 00 |
| .6 | Excavation and Backfill | Section 31 23 00 |

1.4 Reference Standards

- .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- .2 CAN/CSA-A23.2, Methods of Test for Concrete
- .3 CAN/CSA-A23.4, Architectural Concrete
- .4 A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

1.5 Testing and Approval

Paving

- .1 A qualified testing agency paid by the Contractor and approved by the Vancouver Park Board shall be appointed to prepare mix designs, perform field quality tests and test and report on concrete strength.
- .2 Where tests or inspections reveal work not in accordance with the Contract requirements, the Contractor shall pay costs for additional inspections or tests required by the Owner's Representative to verify acceptability of current work.
- .3 Testing shall be carried out for slump and air content for every truckload of concrete prior to the placement of any concrete. Cast specimens for compressive strength testing at seven (7) and twenty eight (28) days (one (1) specimen tested at seven (7) days and the average of 2 specimens at 28 days) in accordance with CAN/CSA-A23.2. Test results shall be provided to the Owner's Representative for review and records.
- .4 Concrete testing will be scheduled by the Contractor. Any concrete testing conducted by the Owner does not relieve the Contractor or Concrete Supplier of the responsibility to maintain their own quality assurance programs.

1.6 On Site Mock-up

- .1 Provide an on site sample panel, 1,2M x1.2M of exposed aggregate paving complete with specified sealer for review and approval by Consultant a minimum of one (1) week prior to the start of work of this section. Sample panel shall be stored on site and used as a standard of quality, workmanship and finish for all exposed aggregate work.
- .2 Sample panels shall be constructed a minimum of ten (10) working days prior to the start of work of this section. Do not proceed with work of this section until the sample panels have been reviewed and approved by the Owner's Representative. If mockup panels are not accepted by the Owner's Representative the Contractor shall at no cost to the Owner remove unacceptable panels from the site and cast new panels for review. Sample panels to remain in place for the duration of work of this section and will be the accepted standard for review and acceptance of work.
- .3 Carry out all necessary adjustments, at no additional cost to the contract, required to provide paving to meet the specifications and/or match colour and finish of the approved sample.
- .4 Sample panels are to include full joint patterns accurately constructed to match details on contract drawings.

SPEC NOTE; revise as necessary for particular project.

1.7 Samples

- .1 Aggregate: Provide a 2 Kg sample of aggregate mix in clear plastic bag clearly labeled with the quarry location, aggregate size, project name and date for approval by Consultant a minimum of 2 weeks prior to start of work of this section.

1.8 Protection And Environmental Regulations

- .1 Meet the requirements of local building code, building bylaws and Environment Canada regulations with regard to the collection and disposal of wash water and chemicals used during the exposed aggregate process.

1.9 Protection

- .1 Provide 4 mil polyethylene sheet protection to completed work of other sections and surrounding landscape where work of this section is to be performed.

1.10 Examination

- .1 Prior to the commencement of work of this section inspect all surfaces on which the work is to be laid and ascertain that they are adequate in relationship to the preparation of work to be performed under this section. Commencement of work will signify acceptance. Report any defects to the Consultant.

1.11 Qualifications

- .1 Performance of work of this section shall only be carried out by skilled workers with a minimum of three (3) years experience in this type of work and finishing.

PART 2: PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials: Shall be in accordance with CAN/CGSB A-A23.1, Table 5, Alternative 1 of CAN/CSA-A23.1 with the following criteria specific to this Section:

- .1 Submit proposed mix designs to Owner's Representative a minimum of three (3) days prior to concrete placement.

Exposed Aggregate Concrete

| | |
|-------------------------------------|---------------------------------|
| Slump | 110mm, (4.3"), +/- 20mm, (3/4") |
| Air entrainment | 6% to 9% (10mm aggregate) |
| Maximum aggregate size | 10mm (9/16") |
| Water to Cement ration (W/C) | 0.45 max |
| Minimum 28 day compressive strength | 32Mpa |
| Exposure Class | C2 |

- .2 Aggregate Source: to be hard durable, sound, free from deleterious materials and staining qualities, washed before use. Aggregate sourced from one quarry, consistent in appearance and match sample approved by Owner's Representative.
- .3 Exposed Aggregate Rock: Clean, washed "Chilliwack" aggregate rock, as distributed by Ocean Construction Supplies Ltd., (604.261-2211), 10 mm (3/8") in diameter, mixed completely into supplied concrete mix.

2.3 Formwork Materials: As specified under Section 03 10 00.

- .1 Reinforcing Steel: As specified under Section 03 20 00.
- .2 Curing Compound: To conform to ASTM C309.
- .3 Expansion Joint Material: 13mm (1/2") Resilient, flexible, non-extruding, expansion-contraction joint filler. Cellular fibers securely bonded together, uniformly saturated with asphalt. When compressed to half of original thickness, recover to a minimum of 70 percent of original thickness. Joint filler shall conform to ASTM D1751. Acceptable suppliers include by W R Meadows ; or other pre approved equal.
- .4 Expansion Joint Sealant: Shall be self-leveling two (2) part polyurethane type, conforming to CGSB 19.24-M80, Type 1, Class B.
- .1 Approved Type: Sikaflex-2C TG NS/SL; Iso-Flex 880 GC (Self-Levelling) Sealant; Sonneborn SL2; Sternson RC-2SL; Vulkem 245; or other approved sealant.
- .2 Colour as selected by the Owner's Representative from standard range.
- .3 Primers and bond breakers as required to install the perimeter joint sealant system shall be provided in strict accordance with sealant manufacturer's recommendations.

Paving

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- .5 Form Release Agent: Non-staining type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap. Eco-Coat by W R Meadows; or other pre approved equal.
 - .6 Curing Compound: Vocomp – 20 water based curing and sealing compound by W R Meadows; or other pre approved equal.
 - .7 Bond Break Tape: Masking tape, width to suit joint size.
 - .8 Welded Wire Mesh Reinforcing: To ASTM A 185. 152x152-MW13xMW13 (6x6-W2xW2).
NOTE MW refers to the plain wire reinforcement. If you need deformed wire for some reason it is MD. Use welded wire mesh with concrete that is 150mm or thicker. Use mesh only on concrete that is going to take vehicle traffic. The mesh is intended for light duty vehicles, cars, pickups etc. If there is going to be heavy truck traffic coordinate with project structural engineer, rebar may be required.
 - .9 Release Agent: Coloured form release agent may be substituted for curing applications.
 - .10 Concrete Sealer: Clear, matt finish sealer, Fabrishield 500 or approved equal.

2.4 Crushed Granular Sub-base

- .1 To be 75 mm (3") crushed gravel minus, clean, free of organic material. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.5 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

PART 3: EXECUTION**3.1 Subgrade Preparation**

- .1 Sub grade preparation to lines and levels indicated on the Contract drawings related to finished grade. Contractor to allow for sufficient excavation to include build up and thickness of specified granular materials and finish materials.
- .2 Compact to minimum 95% Modified Proctor Density in compliance with ASTM D698 (all following references to density imply compliance with ASTM D698).

3.2 Granular Subbase and Crushed Granular Base Course

- .1 Place sub base and crushed granular base material to design grade as shown on drawings. Material to be compacted to 95 % MPD.

Paving

- .2 Where depths exceed 150 mm (6") ensure crushed granular sub base and granular sub base material are placed in 150 mm (6") lifts, compacting to 95% MPD between the placement of each lift.
- .3 Owner's Representative to review compacted crushed granular base prior to placing forms for concrete flat work or control devices for extruding equipment.

3.3 Formwork

- .1 Steel forms free from twists and warps following lines and shapes indicated on detail drawings.
- .2 Wood forms to be of select dressed lumber, straight and free from defects and thoroughly cleaned following lines and shapes indicated on detail drawings.
- .3 Flexible forms to be used for all curves less than 6.0m (20'-0"), radius, or as required to form smooth curve. Ensure transition at tangent of curve is true and smooth.
- .4 Set forms to line and grade as shown on drawings, free from waves or irregularities in line or grade.
- .5 Set special forms as required around catch basins, manholes, poles or other objects as shown on drawings.
- .6 Tolerances: Maximum horizontal deviation: 6mm (1/4")
Maximum vertical deviation: 6mm (1/4")
Maximum deflection from horizontal or vertical alignment to be 6mm in 3m (1/4" in 10'-0")
- .7 Adequately brace forms to maintain specified tolerances after concrete is placed.
- .8 Ensure forms are clean, free from extraneous material prior to the application of form release agent. Form release to be applied as per manufacturers written instructions.

3.4 Owner's Representative Review

- .1 Notify Owner's Representative a minimum of forty-eight (48) hours in advance of concrete placement for review of formwork. Owner's Representative review to include but is not limited to:
 - .1 Forms are properly set at required horizontal and vertical alignment,
 - .2 Forms are sufficiently rigid,
 - .3 Forms are clean and ready for placement of concrete.

3.5 Concrete Placement

- .1 Concrete Mix Equipment; Concrete shall be delivered to the site in transit mix trucks from a commercial batch plant that conforms to CAN/CSA-A23.1.
- .2 Concrete Placing; In accordance with CAN/CSA-A23.1. Do not place concrete during rain or on wet or frozen base.

Paving

- .3 Do not place concrete when air temperature appears likely to fall below 5 degrees Celsius (41 degrees F) within 24 hours, unless specified precautions are taken. Provide Owner's Representative with written construction process of concrete placement for work undertaken in these conditions.
- .4 Schedule concrete placement to ensure sufficient daylight hours available to permit edging and finishing. Place concrete within 1.5 hours of batching time.
- .5 Install mesh or rebar reinforcing at mid depth of concrete slab. Place concrete as per CAN/CSA -A23.1.
- .6 Moisten crushed granular base immediately prior to placing concrete.
- .7 Place concrete in forms, ensuring no segregation of aggregate. Vibrators shall be adequately powered and sufficiently intense to cause the concrete to compact readily into place. Systematically apply vibrators at such intervals that the zones of influence of the vibrator overlap. Insert the vibrator vertically into the concrete long enough to ensure that the concrete is properly compacted. Do not apply vibrator directly to the reinforcing steel or to the forms. Employ a sufficient number of vibrators so that the required rate of placement vibration throughout the entire volume of each layer of concrete is achieved. Keep one spare vibrator at site for emergency use.
- .8 Concrete to be placed in continuous operation until entire panel (expansion joint to expansion joint) or section has been completed.
- .9 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. He shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc., whether they are in his scope of work or not. Depress concrete locally around drains to facilitate drainage.
- .10 Discontinue placement at expansion, construction or isolation joints only.

3.6 Placing Concrete for Exposed Aggregate Paving

- .1 Place concrete in accordance with the lines and levels indicated on the drawings in accordance with the requirements of CAN/CSA 3-A23.1-94, Curing and Protection, including hot weather protection and cold weather protection.
- .2 Place concrete continuously between predetermined and indicated control joints and cross control joints as indicated on drawings.
- .3 Screed concrete to desired level. After screeding, wood bull float concrete. Allow concrete to set until all bleed water has evaporated.
- .4 Steel float to finish. Avoid excessive trowelling.
- .5 Expose aggregate by 'Early Wash' technique as follows:
 - .1 Screed to required elevations and tolerances, and float to smooth finish.
 - .2 Just after initial set, flood with water and brush until 4mm relief is produced throughout.

Paving

- .6 Saw cut control joints to 1/4 the slab depth. Zinc keyways are acceptable alternate to saw cuts.
- .7 Apply sealer in accordance with manufacturer's instructions and application rates. Provide two complete two coats.

3.6 Addition of Mix Water

- .1 Mix water addition shall be in strict accordance with CAN/CSA A-A23.1, clause 18.4.3. No water from the truck system or elsewhere shall be added after the initial introduction of the mixing water for the batch except when, at the start of discharge, the measured slump of the concrete is less than specified and no more than 60 minutes have elapsed from the time of batching to the start of the discharge. In this case water may be added by the producer up to an amount not exceeding 12 litres per cubic metre (2 gallons per cubic yard). The resulting concrete must satisfy the specified requirements.

3.7 Expansion Joints

- .1 Unless otherwise indicated on drawings form transverse expansion joints at both ends of curb returns and at a maximum spacing of 10m for sidewalks, at each end of driveway crossings and at tangent points on circular walk.
- .2 Extend through full depth of concrete and terminate 12 mm (1/2") below finished surface to allow for approved sealant. Apply bond break tape before applying sealant.

3.8 Pre-Molded Joint Filler and Expansion Joint Sealant for Exposed Aggregate Paving

- .1 Locate and install construction joints and pre-molded expansion joints as provided by pattern break indicate on design drawings and at junction with other surfaces. Care shall be taken to construct clean joints free from any foreign material that will impair the proper function or the material.
- .2 Unless shown otherwise, pre-molded joint filler shall extend for the full depth of the joint. Pre-molded joint filler shall terminate 12 mm below the top of the joint. Fill 12mm space with joint expansion joint sealer in accordance with the manufacturers instructions. Apply bond breaker tape before applying sealant if integrated fibreboard is used.

3.9 Control Joints

- .1 Tooled Control Joints:
 - .1 At locations indicated on contract drawings construct control joints at maximum 1.5m (5'-0") intervals.
- .2 Sawn Control Joints:

Paving

- .1 At locations indicated on contract drawings as soon as the concrete can be cut without raveling. Typically this occurs no later than sixteen (16) hours after placing. Contractor shall, through the mockup procedure satisfy himself that the typical cure time is sufficient and adjust as required to ensure joints can be cut without raveling.
- .3 Construct control joints whether saw cut or tooled to minimum 1/4 depth of concrete section at point of cut or as otherwise shown on project details.

3.10 Isolation Joints

- .1 Form isolation joints around all poles, hydrants, manholes and all structures or fixed objects located within the concrete section by using approved expansion joint material.
- .2 Form longitudinal isolation joints between sidewalk and abutting curb and gutter, abutting utility strips, abutting structures using expansion joint material.
- .3 Use expansion joint material to form isolation joints between sidewalks and abutting walls and structures.

3.11 Caulking Sealant

- .1 Caulking to be applied no earlier than fourteen (14) days after placement of concrete unless specified by the manufacturer of caulking sealant.
- .2 Ensure that all surfaces of the joint to be caulked sealed are clean and dry prior to start of caulking sealing operation.
- .3 Joint faces shall be primed, expansion joint material covered with bond break tape prior to the application of caulking sealant material.
- .4 Take all necessary precautions to ensure that primer does not stain concrete surface and that caulking sealant material is applied as per the manufacturers instructions within the confines of the joint. Clean all excess caulking from concrete surfaces.

3.12 Finishing

- .1 Pre finish surface of concrete sidewalks and utility strips to smooth surface with magnesium or wood float trowel.
- .2 The finish to concrete surfaces shall be as noted on contract drawings.
- .3 Grooves, scoring or saw cutting used for aesthetic purposes as shown on the drawings or as directed by Owner's Representative, to be marked with proper tools or saw cut to depths shown on drawings.
- .4 Finish driveway crossing, curb let downs and wheel chair ramps as shown on detail drawings.
- .5 When contract drawings indicate broom finish round edges of joints with steel edging tool to a width of 50mm (2") around perimeter of each panel or as shown and described on drawings.

Paving

- .6 Under no circumstances is concrete to be overworked by troweling, dusted with dry cement or finished with a mortar coat.
- .7 Finished surface to be as specified, match the approved mockup and to satisfaction of Owner's Representative. Sections of cast in place concrete pavement that do not conform to this specification section, do not match the mockup or are not to the satisfaction of the Owner's Representative shall be removed and replaced by the Contractor at no cost to the Owner.

3.13 Curing

- .1 Moist cure and protect concrete to CAN/CSA-A23.1, Clause 7.4, and as directed by this specification. Curing compounds for are not an acceptable substitute for exposed aggregate concrete.
- .2 Curing Blanket; completely cover concrete to be cured as soon as the concrete can bear the weight of the blanket.
- .3 Ensure curing blanket overlaps of a minimum of 150mm (6") between panels and 300mm (12") minimum overlap at edge of concrete slab and is in direct contact with concrete surface.
- .4 Thoroughly wet the curing blanket a keep saturated during the curing period with water spray fine enough to avoid damage to the concrete surface.
- .5 Contractor to ensure that curing blanket is kept wet at all times during the seven (7) day cure period.
- .6 When temperature is below 5 degrees Celsius (41 degrees F) take measures necessary to ensure that the ambient air temperature around the concrete is not less than 10 degrees Celsius (50 degrees F) for at least 72 hours. Protect from freezing for at least another 72 hours or such time as required to ensure proper curing of concrete. Admixtures are not be used for prevention of freezing.

3.14 Defective Concrete and Patching

- .1 Concrete surface to be free from open texturing, voids, and projections.
- .2 Repair of defective concrete work:
 - .1 Repair defective areas while concrete is still plastic, otherwise wait until curing is completed.
 - .2 Prior to undertaking any repairs provide the Owner's Representative with a written description of repair method complete with product data sheets.
 - .3 At the discretion of the Owner's Representative and at no cost to the Owner, the Contractor shall remove and replace concrete deemed 'defective' and 'unrepairable'.
 - .4 Defects and areas requiring repair as indicated by the Consultant
- .3 Grinding to repair imperfections and incorrect slope is unacceptable.
- .4 Patching of exposed aggregate concrete will not be allowed under this contract.

All areas deemed unacceptable by the Owner's Representative shall be removed from joint line to joint line, e.g. full panel.

3.15 Protection

- .1 Protect freshly finished concrete from dust, rain or frost by using tarpaulins or other suitable protective coverings. Keep clear of finished surface.
- .2 Place and maintain suitable barriers to protect finished concrete from equipment, vehicles or pedestrian traffic.
- .3 Provide personnel as required to prevent vandalism until concrete has set.
- .4 Do not run vehicles or construction equipment on concrete for at least 7 days or as directed by Owner's Representative.
- .5 Keep traffic that would affect and/or otherwise disturb the curing procedures off the finished exposed aggregate concrete surfaces for the full cure period of twenty-eight (28) days.

3.16 Flood Test

- .1 Immediately upon removal of the formwork of cast-in-place concrete, a flood test shall be conducted by the Contractor in the presence of the Owner's Representative to ensure proper drainage of all concrete flatwork. The flood test shall consist of the application of a volume of water sufficient to allow the visual verification of all slopes and drainage patterns and ensure that ponding does not occur. The volume of water necessary to facilitate testing and the determination of the success or failure of the flood test shall be at the discretion of the Owner's Representative.
- .2 Should the concrete not meet the grade tolerances of the Contract documents or ponding is evident after a flood test the Contractor shall at the discretion of the Owner's Representative completely remove and replace all concrete. Grinding, partial removal and patching to resolve ponding or insufficient grade is not acceptable.

3.17 Acceptance

- .1 Prior to acceptance of finished concrete the following conditions will be met;
 - .1 Owner's Representative shall have reviewed concrete batch design and test results provided by the contractor.
 - .2 Concrete shall have full 28 day cure.
 - .3 All irregular, cracked or otherwise defective sections to be removed and replaced to satisfaction of Owner's Representative. The extent of removal will be at a minimum to the nearest joint.
 - .4 All stains, marks and discolouration as a result of spills or drips shall have been removed.
 - .5 Finish of concrete matches the accepted sample panels.

Paving

3.17 Cleaning for Exposed Aggregate Paving

- .1 Promptly and as the work of this section proceeds, clean up and remove from the site all rubbish, debris, etc.
- .2 Ensure that no cementitious deposits or sprayed retarding material remains on any surface.

END OF SECTION 32 13 13.16

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

INSTRUCTIONS FOR CONSULTANTS: Text highlighted in blue pertains to information regarding Concrete Paving –Delete / add as required.

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 Portland cement concrete walks with finish as indicated in the contract documents.
- .2 Work of this section includes but is not limited to the supply, testing, provision of tooled joints, and or sawcut joints curing and finishing of horizontal concrete surfaces.
- .3 Scope of this section includes all formwork, the supply and installation of reinforcing, expansion joint fillers and joint sealants, aggregate required for complete installation.

SPEC NOTE; This section indicates a Type 1 – Broom Finish and Type 2 – Abrasive blast Finish and/or integral colour cast in place concrete. If you only have one of these edit as required. If you have both reference Type 1 and Type 2 in the materials legend on the Layout and Materials Plan.

1.3 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Aggregates and Granular Materials | Section 02 41 14 |
| .2 | Concrete Forms and Accessories | Section 03 10 00 |
| .3 | Concrete Reinforcing | Section 03 20 00 |
| .4 | Cast in Place Concrete | Section 03 33 00 |
| .5 | Concrete Finishing | Section 03 35 00 |
| .6 | Abrasive Blast Finish | Section 03 35 10 |
| .7 | Excavation and Backfill | Section 31 23 00 |

1.4 Reference Standards

- .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
- .2 CAN/CSA-A23.2, Methods of Test for Concrete
- .3 CAN/CSA-A23.4, Architectural Concrete

- .4 A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

1.5 Testing and Approval

- .1 A qualified testing agency paid by the Contractor and approved by the Vancouver Park Board shall be appointed to prepare mix designs, perform field quality tests and test and report on concrete strength.
- .2 Where tests or inspections reveal work not in accordance with the Contract requirements, the Contractor shall pay costs for additional inspections or tests required by the Owner's Representative to verify acceptability of current work.
- .3 Testing shall be carried out for slump and air content for every truckload of concrete prior to the placement of any concrete. Cast specimens for compressive strength testing at seven (7) and twenty-eight (28) days (one (1) specimen tested at seven (7) days and the average of 2 specimens at 28 days) in accordance with CAN/CSA-A23.2. Test results shall be provided to the Owner's Representative for review and records.
- .4 Concrete testing will be scheduled by the Contractor. Any concrete testing conducted by the Owner does not relieve the Contractor or Concrete Supplier of the responsibility to maintain their own quality assurance programs.

1.6 On Site Mock-up

- .1 ***Provide an onsite sample panel for each type of concrete pavement finish detailed. Sample panels to be a minimum of 2.0m x 2.0m (6.5' x 6.5') square. Sample panels are to include full joint patterns accurately constructed to match details on contract drawings.***

SPEC NOTE; revise as necessary for particular project.

- .2 ***Sample panels shall be constructed a minimum of ten (10) working days prior to the start of work of this section. Do not proceed with work of this section until the sample panels have been reviewed and approved by the Owner's Representative. If mockup panels are not accepted by the Owner's Representative the Contractor shall at no cost to the Owner remove unacceptable panels from the site and cast new panels for review. Sample panels to remain in place for the duration of work of this section and will be the accepted standard for review and acceptance of work.***
- .3 ***Carry out all necessary adjustments, at no additional cost to the contract, required to provide paving to meet the specifications and/or match colour and finish of the approved sample.***

1.7 Qualifications

- .1 Performance of work of this section shall only be carried out by skilled workers with a minimum of three (3) years experience in this type of work and finishing.

PART 2: PRODUCTS

2.1 Materials

- .1 Concrete mixes and materials: Shall be in accordance with CAN/CGSB A-A23.1, Table 5, Alternative 1 of CAN/CSA-A23.1 with the following criteria specific to this Section:
 - .1 Submit proposed mix designs to Owner's Representative a minimum of three (3) days prior to concrete placement.

SPEC NOTE; revise as necessary for particular project.

Type 1 and 2- Broom and Abrasive Blast Finish Concrete

| | |
|-------------------------------------|------------------------------|
| Slump | 80mm, (3"), +/- 20mm, (3/4") |
| Air entrainment | 5% to 8% (14-20mm aggregate) |
| Maximum aggregate size | 14mm (9/16") |
| Water to Cement ration (W/C) | 0.45 max |
| Minimum 28 day compressive strength | 32Mpa |
| Exposure Class | C2 |

- .2 Non-staining type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
- .2 Expansion Joint Material: 13mm (1/2") Resilient, flexible, non-extruding, expansion-contraction joint filler. Cellular fibers securely bonded together, uniformly saturated with asphalt. When compressed to half of original thickness, recover to a minimum of 70 percent of original thickness. Joint filler shall conform to ASTM D1751. Acceptable suppliers include by W R Meadows; or other pre approved equal.
- .3 Bond Break Tape: Masking tape, width to suit joint size.
- .4 Joint Cleaner; xylol, methyl ethyl ketone or non-corrosive type recommended by sealant manufacturer and compatible with joint filler.
- .5 Joint Primers; shall be type recommended by caulk sealant manufacturer.
- .6 Joint Sealant: Non sag, Self-leveling two (2) part polyurethane type, conforming to CGSB 19.24-M80, Type 1, Class B. Colour as selected by Owner's Representative from standard range. Acceptable products include Sikaflex-2c NS Mix TG, manufactured by Sika or preapproved equal.
- .7 Welded Wire Mesh Reinforcing: To ASTM A 185. 152x152-MW13xMW13 (6x6-W2xW2).
NOTE MW refers to the plain wire reinforcement. If you need deformed wire for some reason it is MD. Use welded wire mesh with concrete that is 150mm or thicker. Use mesh only on concrete that is going to take vehicle traffic. The mesh is intended for light duty vehicles, cars, pickups etc. If there is going to be heavy truck traffic coordinate with project structural engineer, rebar may be required.
- .8 Form Release Agent: Eco-Coat by W R Meadows; or other pre approved equal.

- .9 Curing Compound: Vocomp – 20 water based curing and sealing compound by W R Meadows; or other pre approved equal.
- .10 Curing Blanket: Non staining material capable of retaining sufficient moisture to ensure optimal wet cure conditions as per CAN/CSA-A23.1. Burlap and Poly will not be accepted. Acceptable products include;
 - .1 Ultra Cure NCF as manufactured by McTech Group Inc. (www.ultracure.net) or pre approved equal
- .11 The following materials shall not be used unless pre approved in writing by the Owner's Representative;
 - .1 Calcium chloride either as a raw material or constituent of another admixture.
 - .2 Super plasticizing admixtures

2.2 INTEGRAL COLOUR CAST IN PLACE CONCRETE *Delete this if not using colour.*
Renumber sections to suit

- .1 Integral Liquid Colour Additive; iron oxide pigment suitable for sandblasted concrete that will produce a uniform, consistent colour. Colour pigment shall be permanent, inert, stable in atmospheric conditions, sunfast, weather resistant, alkali resistant, lime proof and non bleeding. Particle size shall be 95 to 99% minus 325 mesh.
- .2 Acceptable products include; SGS Color-Flo Liquid Colors, by Solomon Colors, Springfield, Illinois, sgs@solomoncolor.com or pre approved equal.
- .3 Colour as indicated on Contract drawings. *NOTE ensure that you are referencing Colour on the drawings*
- .4 Concrete Mix: As per Cast in Place Concrete with the following criteria specific to this Section:

- .1 Integral Coloured Cast In Place Concrete:

| | |
|-------------------------|------------------------------|
| Minimum 28 Day Strength | 32 MPa |
| Slump | 75mm, (3"), +/- 20mm (3/4") |
| Maximum Aggregate Size | 19mm (3/4") |
| Exposure Classification | C-2 |
| Water Cement Ratio | 0.50 |
| Air Content | 5 – 8% |
| Exposure Class | C-2 |
| Colour Pigment Weight | Maximum 10% of Cement Weight |

Minimum cement content: 350kg/m³

- .2 Ensure that the same concrete mix design, supplier and batch plant is used throughout the duration of this project.
- .3 Water; potable in accordance with CAN/CSA-A23.1

- .4 Air Entraining Admixtures; in accordance with CAN/CSA-A266.1
- .5 Water Reducing Admixtures; in accordance with CAN/CSA-A23.2
- .6 Calcium Chloride shall not be used.

2.3 Crushed Granular Sub-base

- .1 To be 75 mm (3") crushed gravel minus, clean, free of organic material. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.4 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

PART 3: EXECUTION

3.1 Subgrade Preparation

- .1 Sub grade preparation to lines and levels indicated on the Contract drawings related to finished grade. Contractor to allow for sufficient excavation to include build up and thickness of specified granular materials and finish materials.
- .2 Compact to minimum 95% Modified Proctor Density in compliance with ASTM D698 (all following references to density imply compliance with ASTM D698).

3.2 Granular Subbase and Crushed Granular Base Course

- .1 Place sub base and crushed granular base material to design grade as shown on drawings. Material to be compacted to 95 % MPD.
- .2 Where depths exceed 150 mm (6") ensure crushed granular sub base and granular sub base material are placed in 150 mm (6") lifts, compacting to 95% MPD between the placement of each lift.
- .3 Owner's Representative to review compacted crushed granular base prior to placing forms for concrete flat work or control devices for extruding equipment.

3.3 Formwork

- .1 Steel forms free from twists and warps following lines and shapes indicated on detail drawings.
- .2 Wood forms to be of select dressed lumber, straight and free from defects and thoroughly cleaned following lines and shapes indicated on detail drawings.
- .3 Flexible forms to be used for all curves less than 6.0m (20'-0"), radius, or as required to form smooth curve. Ensure transition at tangent of curve is true and smooth.

- .4 Set forms to line and grade as shown on drawings, free from waves or irregularities in line or grade.
- .5 Set special forms as required around catch basins, manholes, poles or other objects as shown on drawings.
- .6 Tolerances:
 - a. Maximum horizontal deviation: 6mm (1/4")
 - b. Maximum vertical deviation: 6mm (1/4")
 - c. Maximum deflection from horizontal or vertical alignment to be 6mm in 3m (1/4" in 10'-0")
- .7 Adequately brace forms to maintain specified tolerances after concrete is placed.
- .8 Ensure forms are clean, free from extraneous material prior to the application of form release agent. Form release to be applied as per manufacturers written instructions.

3.4 Owner's Representative Review

- .1 **Obtain Owner's Representative's approval prior to placing concrete.**

Notify Owner's Representative a minimum of forty-eight (48) hours in advance of concrete placement for review of formwork. Owner's Representative review to include but is not limited to:

 - .1 Forms are properly set at required horizontal and vertical alignment,
 - .2 Forms are sufficiently rigid,
 - .3 Forms are clean and ready for placement of concrete.

3.5 Concrete Placement

- .1 Concrete Mix Equipment; Concrete shall be delivered to the site in transit mix trucks from a commercial batch plant that conforms to CAN/CSA-A23.1.
- .2 Concrete Placing; In accordance with CAN/CSA-A23.1. Do not place concrete during rain or on wet or frozen base.
- .3 Do not place concrete when air temperature appears likely to fall below 5 degrees Celsius (41 degrees F) within 24 hours, unless specified precautions are taken. Provide Owner's Representative with written construction process of concrete placement for work undertaken in these conditions.
- .4 Schedule concrete placement to ensure sufficient daylight hours available to permit edging and finishing. Place concrete within 1.5 hours of batching time.
- .5 Install mesh or rebar reinforcing at mid depth of concrete slab. Place concrete as per CAN/CSA -A23.1.
- .6 Moisten crushed granular base immediately prior to placing concrete.

- .7 Place concrete in forms, ensuring no segregation of aggregate. Vibrators shall be adequately powered and sufficiently intense to cause the concrete to compact readily into place. Systematically apply vibrators at such intervals that the zones of influence of the vibrator overlap. Insert the vibrator vertically into the concrete long enough to ensure that the concrete is properly compacted. Do not apply vibrator directly to the reinforcing steel or to the forms. Employ a sufficient number of vibrators so that the required rate of placement vibration throughout the entire volume of each layer of concrete is achieved. Keep one spare vibrator at site for emergency use.
- .8 Concrete to be placed in continuous operation until entire panel (expansion joint to expansion joint) or section has been completed.
- .9 The Contractor shall notify all trades sufficiently in advance to ensure that provision is made for openings, inserts and fasteners. He shall cooperate with all trades in the forming and setting of all slots, sleeves, bolts, dowels, hangers, inserts, conduits, clips, etc., whether they are in his scope of work or not. Depress concrete locally around drains to facilitate drainage.
- .10 Discontinue placement at expansion, construction or isolation joints only.

3.6 Addition of Mix Water

- .1 Mix water addition shall be in strict accordance with CAN/CSA A-A23.1, clause 18.4.3. No water from the truck system or elsewhere shall be added after the initial introduction of the mixing water for the batch except when, at the start of discharge, the measured slump of the concrete is less than specified and no more than 60 minutes have elapsed from the time of batching to the start of the discharge. In this case water may be added by the producer up to an amount not exceeding 12 litres per cubic metre (2 gallons per cubic yard). The resulting concrete must satisfy the specified requirements.

3.7 Expansion Joints

- .1 Unless otherwise indicated on drawings form transverse expansion joints at both ends of curb returns and at a maximum spacing of 10m for sidewalks, at each end of driveway crossings and at tangent points on circular walk.
- .2 Extend through full depth of concrete and terminate 12 mm (1/2") below finished surface to allow for approved sealant. Apply bond break tape before applying sealant.

3.8 Pre-Molded Joint Filler and Expansion Joint Sealant for Exposed Aggregate Paving

- .1 Locate and install construction joints and pre-molded expansion joints as provided by pattern break indicated on design drawings and at junction with other surfaces. Care shall be taken to construct clean joints free from any foreign material that will impair the proper function or the material.
- .2 Unless shown otherwise, pre-molded joint filler shall extend for the full depth of the joint. Pre-molded joint filler shall terminate 12 mm below the top of the joint. Fill 12mm space

with joint expansion joint sealer in accordance with the manufacturers instructions. Apply bond breaker tape before applying sealant if integrated fibreboard is used.

3.9 Control Joints

- .1 Tooled Control Joints:
 - .1 At locations indicated on contract drawings construct control joints at maximum 1.5m (5'-0") intervals. *SPEC NOTE; revise as necessary for particular project.*
- .2 Sawn Control Joints;
 - .1 At locations indicated on contract drawings as soon as the concrete can be cut without raveling. Typically this occurs no later than sixteen (16) hours after placing. Contractor shall, through the mockup procedure satisfy himself that the typical cure time is sufficient and adjust as required to ensure joints can be cut without ravelling.
 - .2 Construct control joints whether saw cut or tooled to minimum 1/4 depth of concrete section at point of cut or as otherwise shown on project details.

3.10 Isolation Joints

- .1 Form isolation joints around all poles, hydrants, manholes and all structures or fixed objects located within the concrete section by using approved expansion joint material.
- .2 Form longitudinal isolation joints between sidewalk and abutting curb and gutter, abutting utility strips, abutting structures using expansion joint material.
- .3 Use expansion joint material to form isolation joints between sidewalks and abutting walls and structures.

3.11 Caulking Sealant

- .1 Caulking to be applied no earlier than fourteen (14) days after placement of concrete unless specified by the manufacturer of caulking sealant.
- .2 Ensure that all surfaces of the joint to be caulked sealed are clean and dry prior to start of caulking sealing operation.
- .3 Joint faces shall be primed, expansion joint material covered with bond break tape prior to the application of caulking sealant material.
- .4 Take all necessary precautions to ensure that primer does not stain concrete surface and that caulking sealant material is applied as per the manufacturers instructions within the confines of the joint. Clean all excess caulking from concrete surfaces.

3.12 Finishing

- .1 Pre finish surface of concrete sidewalks and utility strips to smooth surface with magnesium or wood float trowel.
- .2 The finish to concrete surfaces shall be as noted on contract drawings.
 - .1 Type 1 Concrete Finish: Broom to areas indicated on contract drawings shall form light broom marks as per approved mockup perpendicular to the path of travel.
 - .2 Type 2 Concrete Finish: Abrasive blast finish to areas indicated on contract drawings as per approved mockup.

- .3 Alternate finishes as per approved mockup to areas indicated on contract drawings or if noted on contract drawings to match adjacent finish.
- .3 Grooves, scoring or saw cutting used for aesthetic purposes as shown on the drawings or as directed by Owner's Representative, to be marked with proper tools or saw cut to depths shown on drawings.
- .4 Finish driveway crossing, curb let downs and wheel chair ramps as shown on detail drawings.
- .5 When contract drawings indicate broom finish round edges of joints with steel edging tool to a width of 50mm (2") around perimeter of each panel or as shown and described on drawings.
- .6 Under no circumstances is concrete to be overworked by troweling, dusted with dry cement or finished with a mortar coat.
- .7 Finished surface to be as specified, match the approved mockup and to satisfaction of Owner's Representative. Sections of cast in place concrete pavement that do not conform to this specification section, do not match the mockup or are not to the satisfaction of the Owner's Representative shall be removed and replaced by the Contractor at no cost to the Owner.

3.13 Curing

- .1 Type 2 Concrete Finish: *SPEC NOTE; revise as necessary for particular project.*
 - .1 Moist cure and protect concrete to CAN/CSA-A23.1, Clause 7.4, and as directed by this specification. Curing compounds for are not an acceptable substitute for Type 2 concrete.
 - .2 Curing Blanket; completely cover concrete to be cured as soon as the concrete can bear the weight of moist burlap.
 - .3 Ensure curing blanket overlaps of a minimum of 150mm (6") between panels and 300mm (12") minimum overlap at edge of concrete slab and is in direct contact with concrete surface.
 - .4 Thoroughly wet the curing blanket a keep saturated during the curing period with water spray fine enough to avoid damage to the concrete surface.
 - .5 Contractor to ensure that curing blanket is kept wet at all times during the seven (7) day cure period.
- .2 Type 1 Concrete Finish: *SPEC NOTE; revise as necessary for particular project.*
 - .1 Apply curing compound as per manufacturer's written instructions.
- .3 When temperature is below 5 degrees Celsius (41 degrees F) take measures necessary to ensure that the ambient air temperature around the concrete is not less than 10 degrees Celsius (50 degrees F) for at least 72 hours. Protect from freezing for at least another 72 hours or such time as required to ensure proper curing of concrete. Admixtures are not be used for prevention of freezing.

3.14 Defective Concrete and Patching

- .1 Concrete surface to be free from open texturing, voids, and projections.
- .2 Repair of defective concrete work:
 - .1 Repair defective areas while concrete is still plastic, otherwise wait until curing is completed.
 - .2 Prior to undertaking any repairs provide the Owner's Representative with a written description of repair method complete with product data sheets.
 - .3 At the discretion of the Owner's Representative and at no cost to the Owner, the Contractor shall remove and replace concrete deemed 'defective' and 'unrepairable'.
 - .4 Defects and areas requiring repair as indicated by the Consultant
- .3 Grinding to repair imperfections and incorrect slope is unacceptable.
- .4 All areas deemed unacceptable by the Owner's Representative shall be removed from joint line to joint line, e.g. full panel.

3.15 Protection

- .1 Protect freshly finished concrete from dust, rain or frost by using tarpaulins or other suitable protective coverings. Keep clear of finished surface.
- .2 Place and maintain suitable barriers to protect finished concrete from equipment, vehicles or pedestrian traffic.
- .3 Provide personnel as required to prevent vandalism until concrete has set.
- .4 Do not run vehicles or construction equipment on concrete for at least 7 days or as directed by Owner's Representative.
- .5 Keep traffic that would affect and/or otherwise disturb the curing procedures off the finished surfaces for the full cure period of twenty-eight (28) days.

3.16 Flood Test

- .1 Immediately upon removal of the formwork of cast-in-place concrete, a flood test shall be conducted by the Contractor in the presence of the Owner's Representative to ensure proper drainage of all concrete flatwork. The flood test shall consist of the application of a volume of water sufficient to allow the visual verification of all slopes and drainage patterns and ensure that ponding does not occur. The volume of water necessary to facilitate testing and the determination of the success or failure of the flood test shall be at the discretion of the Owner's Representative.
- .2 Should the concrete not meet the grade tolerances of the Contract documents or ponding is evident after a flood test the Contractor shall at the discretion of the Owner's Representative completely remove and replace all concrete. Grinding, partial removal and patching to resolve ponding or insufficient grade is not acceptable.

3.17 Acceptance

- .1 Prior to acceptance of finished concrete the following conditions will be met;
 - .1 Owner's Representative shall have reviewed concrete batch design and test results provided by the contractor.
 - .2 Concrete shall have full 28 day cure.
 - .3 All irregular, cracked or otherwise defective sections to be removed and replaced to satisfaction of Owner's Representative. The extent of removal will be at a minimum to the nearest joint.
 - .4 All stains, marks and discolouration as a result of spills or drips shall have been removed.
 - .5 Finish of concrete matches the accepted sample panels.

3.18 Cleaning

- .1 Promptly, as the work proceeds and on completion, clean up and remove from the site any debris, waste material and rubbish resulting from work of this section.
- .2 Clean spills and excess concrete from adjacent horizontal and vertical surfaces.

END OF SECTION 32 13 13

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 precast concrete unit pavers, edge restraints, sealants and jointing sand over bedding sand, base materials, on structural slab and/or on grade as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|--|------------------|
| .1 | Site Preparation and Grading | Section 01 89 13 |
| .2 | Aggregates and Granular Materials | Section 02 41 14 |
| .3 | Cast-In-Place Concrete | Section 03 33 00 |
| .4 | Growing Medium Preparation and Placement | Section 31 91 13 |
| .5 | Subsurface Drainage Systems | Section 33 46 16 |

1.4 Reference Standards

- .1 Precast concrete pavers and methods of installation shall conform to ASTM C936-96, Standard Specification for Solid Concrete Interlocking Paving Units, including:
 - .1 Min. compressive strength 55Mpa (8000psi).
 - .2 Max. absorption 5% when tested in accordance with ASTM C140.
 - .3 Resistance of 50 freeze thaw cycles when tested in accordance with ASTM C67 or Can3-A231.2-95 Precast Concrete Pavers, including:
 - .4 Min compressive strength of 50Mpa (7250psi).
 - .5 Resistance of 50 freeze thaw cycles when tested in accordance with Can3-A231.2-M85.

1.5 Submittals

- .1 Submit sample pavers as specified to indicate colour and shape selections for the Owner's Representative approval. Colour will be selected by Owner's Representative from the manufacture's standard colour range.
- .2 Submit sieve analysis for grading of both bedding and jointing sand.

- .3 Submit sample of pea gravel (if on slab application applies).
- .4 Before proceeding with full installation of each type of paver, obtain approval from the Owner's Representative before carrying out the work.
- .5 Submit test results for compliance of unit paver requirements to CSA (or ASTM) Standards from an independent testing laboratory if requested by Owner's Representative.

1.6 On Site Mock-up

- .1 Construct a 3m x 3m (10' x 10') test panel of the typical paver pattern/layout as per typical installation described under Part 3. Obtain approval of Owner's Representative prior to proceeding with actual installation. Test panel to remain for duration of construction to serve as reference/standard of acceptable installation against which the work will be judged.

1.7 Quality Assurance

- .1 Installation shall be by an installer with at least 3yrs. Min. experience in placing concrete unit pavers on projects of similar size/scope. The contractor must be prepared to advise of previous work by submission of a written list if requested by Owner's Representative.

1.8 Site Conditions

- .1 Do not install base, sand or pavers during heavy rain or snowfall.
- .2 Do not install frozen sand.

PART 2: PRODUCTS

2.1 General

.1 Product Handling

- .1 Pavers shall be delivered to and stored at the work site on pallets, metal strapped, or shrink wrapped PVC packaged by the paver manufacturer capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.
- .2 Sand shall be protected against rain, snow, wind and standing water when stockpiled on work site by means of a temporary waterproof covering such as a plastic drop sheet or tarpaulin.
- .3 Loading on slab due to equipment and material, if necessary for work of this contract, shall not exceed the designed live loads

2.2 Laying Course

.1 Sand Course:

- .1 Shall consist of clean, sharp, fresh water sand (or manufactured from crushed rock), non-plastic, free of deleterious soluble salts and other contaminants which may cause efflorescence and reduce skid and slip resistance.
- .2 Grading of samples shall be done according to ASTM C136. Conforming to the grading requirements of ASTM C33 for Concrete Aggregates. Gradation limits as follows:

Bedding Sand - Table 1

| Sieve Size | % Passing |
|-------------------|------------------|
| (3/8") 9.52mm | 100 |
| (#.4) 4.75mm | 95 - 100 |
| (#.8) 2.36mm | 80 - 100 |
| (#.16) 1.18mm | 50 - 85 |
| (#.30) 600um | 25 - 60 |
| (#.50) 300um | 10 - 30 |
| (#.100) 150um | 2 - 10 |
| (#.200) 75um | 0 - 10 |

Alternatively, the Item # 1 Paving Sand available from City of Vancouver Kent Materials Branch is acceptable.

- .3 Grading of samples shall be done according to ASTM C136. Conforming to the grading requirements of ASTM C144 Aggregate for Masonry Mortar. Gradation limits as follows:

Jointing Sand - Table 2

| Sieve Size | Natural Sand % Passing | Manufactured Sand % Passing |
|-------------------|-----------------------------------|--|
| (#4) 4.75mm | 100 | 100 |
| (#8) 2.36mm | 95 – 100 | 95 – 100 |
| (#16) 1.18mm | 70 – 100 | 70 – 100 |
| (#30) 600um | 40 – 75 | 40 – 75 |
| (#50) 300um | 10 – 35 | 20 – 40 |
| (#100) 150um | 2 – 15 | 10 – 25 |

Alternatively, the Item # 17 Fill Sand available from City of Vancouver Kent Materials Branch is acceptable.

- .2 Pea Gravel: shall consist of clean rounded gravel, 6mm to 10mm dia., free of all deleterious materials.

2.3 Granular Base

- .1 To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.

2.4 Unit Concrete Pavers

- .1 Unit Concrete Pavers supplied by a member of the Concrete Paver Institute; local suppliers include: Abbotsford Concrete Products or Westcon Pavers and Retaining Walls. First quality conforming to manufacturer's specifications, **or pre-approved equal**. Concrete pavers may have spacer bars on each unit to maintain min. joint width. Product name/shape, overall dimensions and thickness, and colour of the paver(s) used shall be:
 - .1 ***Paver Type/Name: Paver Size and Paver Colour***
 - .2 ***Paver Type/Name: Paver Size and Paver Colour***
 - .3 ***Paver Type/Name: Paver Size and Paver Colour***

2.5 Paver Edge Restraint

- .1 PVC Paver edge restraint system designed for use with 60 mm deep pavers. Complete with 250mm-300mm galv. steel spikes. "Snap Edge" as distributed by Westcon Pavers and Walls ph. (604) 888-0555, or **pre-approved equivalent**.
- .2 Verify location, type, installation and elevations of edge restraints around the perimeter of the area to be paved.

PART 3: EXECUTION

3.1 Inspection

- .1 Areas of work to receive concrete pavers shall be examined and unsatisfactory conditions reported to the Owner's Representative; **commencement of work shall imply acceptance of conditions**.
- .2 The subgrade shall be well drained. Verify that the subgrade is dry, uniform, even and ready to support base, sand, pavers and the intended loads. Base course shall be examined for adequate compaction and uniform surface. The base course to be compacted to 95 mpd.
- .3 Verify the gradients and elevations of the subgrade and base are correct to allow installation as per the details and meet the intended finished grades. **Notify Owner's Representative of any discrepancies prior to proceeding with installation.**

3.2 Preparation Of Subgrade (For On Grade Paver Application)

- .1 Place 3/4" minus crushed gravel on compacted sub-base course or subgrade as detailed.
- .2 The sub-base or subgrade as detailed shall be compacted to 95% Modified Proctor Density.

3.3 Construction of The Sand Laying Bed (On Grade Paver Application)

- .1 The sand laying bed shall be spread evenly over the area not greater than required to receive concrete pavers in one working day. Sand shall be screeded to a level that will produce the required maximum thickness of 25mm when the pavers are placed and vibrated.
- .2 Once screened and levelled this sand laying course shall not be disturbed in any way and protected against accidental pre-compaction and rain.

3.4 Construction of Pea Gravel Laying Bed (On Slab Application)

- .1 Place pea gravel on protection board over all areas on slab to receive unit concrete pavers. Depth of pea gravel to vary to ensure drainage slopes as shown on the drawings and as detailed.

3.5 Installing Edge Restraint

- .1 Install continuous edging to manufacturer's recommended procedures, with spikes into substrates at recommended spacing. Ensure straight lines and smooth curves to the exact layout approved by Owner's Representative. Ensure that all levelling is done to suit finished grades as shown.

3.6 Installing Pavers

- .1 Ensure that pavers are free of foreign materials/manufacturer's defects before installation.
- .2 Install true to line and grade, in patterns shown on drawings and in details following manufacturer's recommended installation procedures. Finished grades shall be such that no ponding areas are created.
- .3 Joints between pavers shall be between 2-3mm (1/16"-1/8").
- .4 Fill gaps at the edges of the paved area with cut pavers or paver edge units.
- .5 Sawcut all pavers where required to fit with appropriate portable masonry type saw with a diamond blade. Fractured or broken pavers will not be accepted. **NO GUILLOTINE STYLE CUTS WILL BE ACCEPTED UNLESS DICTATED BY PAVER STYLE AND PRE-APPROVED BY OWNER'S REPRESENTATIVE.** (i.e. "tumbled style" pavers).
- .6 Sweep the entire surface of the pavers clean. Vibrate pavers into sand bedding course using appropriate low amplitude, high frequency plate type vibrator capable of 13-22KN (3000-5000lbs) force. Do not vibrate within 1m (3') of any unrestrained edges of the paving units.
- .7 Spread dry jointing sand over entire area. Sweep and vibrate into joints such that joints are filled to their full depth.

- .8 Apply sealant (if specified) to the manufacturer's recommendations after sufficient time has passed to allow efflorescence process to subside.

3.7 Site Maintenance/Adjustments and Cleaning

- .1 All work to within 1m (3') of the leading laying edge must be left fully compacted with sand filled joints at the completion of each work day.
- .2 Surplus material shall be cleared away and removed from the work site.
- .3 Excess sand or soil remaining on the paved surface shall be brushed away and removed from the work site.
- .4 After the removal of excess sand check final elevations for conformance with the drawings.
- .5 The final surface elevation of pavers shall be 3-7mm (1/8"-1/4") above adjacent drainage inlets, concrete collars, or channels after compaction/vibration to compensate for minor settling.
- .6 The final surface elevations shall not deviate more than 10mm (3/8") under a 3m(10') length straight edge.

END OF SECTION 32 14 13

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 exterior stone paving as indicated in the contract documents.
- .2 The work of this section shall include, but shall not necessarily be limited to the supply and installation of the following:
 - .1 Exterior stone pavers.
 - .2 All setting beds, mortar, reinforcing mesh, additives, grout, surface sealer and accessories required to complete paver installations.
 - .3 Joint sealant and filler at control joints in paving and at expansion joints, including perimeter joints between pavers and adjoining construction and joints around piping and other protrusions.

1.3 Related Work

- .1 Cast-In-Place Concrete Paving Seciton 03 33 00
- .2 Excavation and Backfill Section 31 23 10

1.4 Qualifications

- .1 The Subcontractor executing the work of this section shall have at least five (5) years' experience in work of similar scope and nature to that indicated and specified.
- .2 All stone paving work shall be done by an experienced Stone Paving/Tiling Subcontractor, employing skilled stone/ tile setters.

1.5 Quality Assurance

- .1 Work under this section shall conform to the Terrazzo Tile and Marble Association of Canada (TTMAC Specification Guide 09 30 00) Tile Installation Manual (current edition) Specification Guide 09300 and ANSI listed standards as a basic minimum, and as specified.

- .2 Should modifications to the Tile Installation Manual be contained herein, the modifications shall govern.
- .3 A copy of the TTMAC Tile Installation Manual shall be made available on the site for reference.

1.6 Reference Standards

- .1 The current and/or latest editions of references and standards as published by the following organizations or agencies, designated by abbreviations in this section, are all to be considered as part of this section. The work shall conform to the applicable requirements of these references and standards, unless indicated or specified otherwise, or as modified by governing codes.
 - .1 ANSI A108.5-2006 Ceramic Tile installed with Dry Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - .2 ANSI A108.10-2006 Installation of Grout in Tilework.
 - .3 ANSI A118.4-2006 Latex Portland Cement Mortar.
 - .4 ASTM C1193-09 Standard Guide for Use of Joint Sealants.
 - .5 ASTM C1515 Standard for Surface Cleaning
 - .6 ASTM D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
 - .7 CAN/CGSB-19.24-M90 Multicomponent, Chemical Curing Sealing Compound.
 - .8 CSA-A23.2-6B – Method of Test to Determine Adhesion by Tensile Load.
 - .9 BC Building Code – Current Edition
 - .10 Terrazzo, Tile and Marble Association of Canada Specification Guide 09 30 00 “Tile Installation Manual – Current Edition

1.7 Submittals

- .1 Submit to the Owner’s Representative two (2) samples of each type of stone, each type of stone finish required in the work of this contract. Sample sizes shall match unit size of specified material. All samples shall be identified as to stone name, unit size, date and supplier name.
- .2 Submit to the Owner’s Representative two (2) copies of physical test data for each stone type. Test data to include but is not limited to;
 - .1 Absorption by Weight as per ASTM C97
 - .2 Density as per ASTM C97
 - .3 Compressive Strength as per ASTM C170
 - .4 Modulus of Rupture as per ASTM C99
- .3 Submit to the Owner’s Representative documentation of orders and delivery dates so as to indicate the correct material will be delivered to the site as per required schedule.

- .4 Failure of on-site work to match approved samples will be cause for rejection of work. TheSubcontractor will be required to expedite replacement of all rejected work and make good at no additional cost to the Owner.
- .5 Submit two (2) samples of grout in colour specified to the Owner's Representative for approval. Grout samples to include two (2) copies of original product cut sheets, information sheets for all product specified.
- .6 Fully acquaint material suppliers of the requirements contained herein.

1.8 On Site Mock-Up

- .1 Construct a 4.0 sqaure Metre (43 square feet) sample mock-up of stone paving on site for review by the Owner's Representative and the appointed inspection agency. Sample mock-up shall include all joint types, finished and cured joint sealer, finishes and surface coatings as per drawings and specifications. The Owner's Representative will approve the mock-up before the balance of the work of this section proceeds. The approved mock-up shall form the basis of acceptable quality required for the remainder of the stone paving.
- .2 The approved mock-up shall form part of finished work.

1.9 Maintenance Material

- .1 Provide the Owner with extra stock of minimum of two percent (2%) of each different stone paver, size and colour installed.
- .2 Package stone pavers to ensure they are protected from the elements and can be readily loaded and unloaded without damage. Ensure packaging is clearly marked as to size, type and finish. Deliver to the Owner's representative on site and obtain a receipt for same.
- .3 Replacement stone pavers shall be undamaged. Damaged pavers shall be replaced by the Contractor at no cost to the owner.

1.10 Maintenance Data

- .1 Submit four (4) copies of TTMAC recommended maintenance procedures for stone paving included in the contract at Substantial Performance of the Work for Owner's use.

1.11 Product Delivery, Storage and Handling

- .1 Deliver all specified stone pavers, grout, setting bed material, additives, etc., to the job site with manufacturer's labels and seals intact.
- .2 Store all materials in a dry location, away from ground contact, particularly keep cementitious materials away from dampness.
- .3 Remove from the job site immediately all damaged or broken stone pavers caused by improper handling or storage.

1.12 Job Conditions

- .1 Inspect all substrate surfaces to receive stone paving. Report any unsatisfactory conditions to the Contractor. Start of work shall imply acceptance.
- .2 All materials shall be fresh, newly mixed, newly opened for start of work. Follow manufacturers recommended tests on site, to ensure proper, permanent bonds prior to continuing with work of this section. If proper, permanent bonds are not achieved notify the Owner's Representative immediately.
- .3 Ensure that conditions of temperature, humidity, traffic and usage are as per the product requirements and or TTMAC specifications which ever is the more stringent of the two.
- .4 Check all surfaces ready to receive pavers; all level, plumb, smooth, firm, free from loose particles, droppings, projections and other foreign matter and from other unsuitable conditions.
- .5 Protect adjacent surfaces until work under this section has been completed.
- .6 Erect temporary barricades to prevent damage to freshly paved areas.
- .7 Protect work of other trades as necessary from damage resulting from work of this trade.
- .8 Make good such damage, if any, at no additional cost to the Owner.

1.13 Pre-Installation Conference

- .1 Arrange for pre-installation conference with the Owner's Representative and the Stone Paving Subcontractor.
- .2 The purpose of the conference shall be to discuss coordination issues, access, hoisting and installation requirements.
- .3 Arrange for the conference to take place a minimum of two (2) weeks prior to start of installation so that coordination issues affecting the work of this section or that of other Subcontractors can be accounted for and corrected prior to any installation of materials if necessary.

1.14 Quality Assurance

- .1 The Owner shall retain a third party Field Quality inspector to review and document the installation procedures, physical and environmental conditions as they relate to day to day activities and specific requirements of the product manufacturers specifications/ installation procedures and the project specifications. The daily records shall be summarized in weekly reports provided to the Contractor for action and the Owner's Representative and the Owner for review.
- .2 Documentation will include but not limited to daily record keeping of installation observations including;
 - .1 Verification that installation conforms to details and specifications.
 - .2 Verification of specification elements including specified depths of various components, products and materials.
 - .3 Weather conditions including but not limited to temperature and weather of the day.

- .3 The Contractor at no cost to the Owner will rectify immediately any and all improper construction practices or deviations from the project specifications or manufacturers specifications/ installation requirements reported by the Field Quality inspector or noted by the Owner's Representative.

1.15 Testing and Approval

- .1 An independent inspection company will be appointed and paid by the Owner to carry out inspection of stone paving installations. The inspection company shall be present when the installation of stone paving begins and, at the discretion of the Owner's Representative or the Owner, shall make periodic inspections during application.
- .2 The appointed inspection company shall carry out delamination survey of the stone paving installation.
- .3 The survey procedure shall consist of a standard chain-drag test to detect voids under the installed stone paving units.
- .4 The chain-drag test will be carried out using a minimum of one (1) 1.0 Metre (3'-0") long section of 9.5mm (3/8" chain) that shall be dragged along the entire stone paving surface installation.
- .5 Using this method areas where the stone paving units have debonded from the mortar bed substrate, or where the mortar bed thickness over the drainage mat is thinner than adjacent areas will be detected by a change in the tonal quality given off by the chain as it is dragged across the surface.
- .6 The inspection company will prepare a scaled plan indicating the areas of apparent 'delamination' which exceed the area of one stone paving unit.
- .7 Verification of delamination; The Contractor at his expense will remove one or more stone paving units in the delamination area for further inspection by the inspection company. Upon completion of the review, at no cost to the Owner, the contractor will make repairs as recommended by the inspection company or the Owner's Representative so that the finished appearance of the repair areas match the adjacent undisturbed stone paving.
- .8 A further delamination survey will be conducted by the inspection company prior to the end of the project warranty period. The Contractor will make repairs as required by the inspection company report as indicated in this section.

1.16 Warranty

- .1 Submit a warranty in writing in the name of the Owner that stone paving furnished and installed under this section shall remain free from all defects for a period of five (5) years from the date of issuance of Substantial Performance of the Work.
- .2 This written warranty shall cover the faithful performance of the stone paver installation, including immediate correction, at no expense to the Owner and at such time as the Owner may designate, of any defects due to faulty materials or workmanship appearing within five (5) years from the date of Substantial Performance of the Work.

PART 2: PRODUCTS

- 2.1 Portland Cement:** Conform to CAN/CSA-A3000-03, Type 10; normal Portland cement; colour Grey.
- 2.2 Sand:** Conform to CAN/CSA-A23.1-04.
- 2.3 Lime:** Lime will not be added to mortar.
- 2.4 Water:** Fresh, clean, potable, free from deleterious matter, acids or alkalis.
- 2.5 Sand for Thin-Set Mortar:** Target Silica 30-30, or equivalent, washed clean and free from all dust and deleterious matter.
- 2.6 Latex Additive for Thin-Set Mortar:** Latex liquid additive at least conforming to ANSI A118.4 Minimum Quality Performance Standards.
Approved Type: Mapei Granirapid System Additive.
- 2.7 Latex Grout:** Factory prepared mixture to be used with Portland cement, and sand mortar and colouring; to produce hard, durable impervious, permanent, grouted joint. To ANSI A118.7 Standards with the following characteristics;
Minimum Compressive Strength at 28 days > 37.9 MPa (5,500 psi)
Specific Gravity (paste) 1.9 – 2.1 g/cubic cm
Colour: As noted on drawings. Approved Type: Mapei Ultracolour.
- 2.8 Waterproof Additive:** To improve waterproofness, flexibility and adhesion of grout. Approved manufacturers as specified for latex additive.
- 2.9 Grout Release:** Temporary water soluble pre grout coating.
Approved Type: Aquamix Grout Release; or preapproved sealant.
- 2.10 Surface Cleaner:** Stone cleaners capable of removing grease, rust, surface debris in preparation for surface sealer. Cleaners shall be type approved by TTMAC.
Approved Type: Aquamix Stone Deep Clean, Heavy Duty Tile and Grout Cleaner; or preapproved equal.
- 2.11 Reinforcing Mesh:** 51 mm x 51 mm x 1.6 mm dia. (2" x 2" x 1/16") galvanized wire mesh reinforcing.
- 2.12 Joint Filler:** Backer rod composed of closed cell, polyurethane foam to ASTM C 1330, Type C. For Joint widths up to 19mm (3/4") diameter of rod shall be 3mm (1/8") larger than the joint width.
Approved Type: Soneborn by BASF; or other preapproved equal.
- 2.13 Bond Break Tape:** 0.2mm (.008") thick polyethelyene tape, width compatible with joint width.
Approved Type: C R Laurence Co. CLR bond break tape; or other preapproved equal.

- 2.14 Joint Sealant:** Multi-component, premium-grade, polyurethane-based, elastomeric sealant principally a chemical cure in a non-sag consistency to CAN/CGSB-19.24-M90, Type 1, Class B. Ensure.

| | |
|--|-------------------------|
| Minimum Shore Hardness ASTM D 2240 at 14 days | 40 +/- 5 |
| Tensile Strength at break; minimum | 1.2MPa (175 psi) |
| Modulus of Elasticity – 100% Elongation | 650% |
| Tear Strength ASTM D 624) at 14 days | 17.5 N/mm (100 lbs/in.) |
| Adhesion in Peel (TT-S-00227E, ASTM C 794) at 21 days, | 5.3 N/mm (30 lb. min) |
| concrete | 0% adhesion loss |

Approved Type: Sikaflex-2c NS EZ Mix TG Sealant, manufactured by Sika; or other preapproved sealant.

Colour: As noted on drawings.

Primers and bond breakers as required to install the movement joint sealant system shall be provided in strict accordance with sealant manufacturer's recommendations.

- 2.15 Surface Sealer:** Non sheen, water based penetrating sealer.

Approved Type: Aquamix Sealer's Choice Gold; or preapproved sealant.

- 2.16 Filter Drain Mat:** Three dimensional, high impact polystyrene core and backer sheet with non woven filter cloth adhered to core.

Approved Type: L Nudrain WD/15 manufactured by Nilex Geotechnical Products Inc., Burnaby B.C., or approved equal.

2.17 Stone Paving

- .1 Stone: All stone shall be of sound stock and uniform texture, and shall be free from holes, seams, shake, clay pockets, spills, stains, starts and other defects which will impair the strength durability and appearance of the work to the following standards;

- | | | |
|----|--|--|
| .1 | Standstead Grey Granite Polycor, also available as Hardy Island may have different | |
| | Absorption by Weight ASTM C97 | 0.15% |
| | Density ASTM C97 | 2,660 Kg/cubic Metre (165.8 lbs/cu foot) |
| | Compressive Strength ASTM C170 | 186 Mpa (354,943 psi) |
| | Modulus of Rupture | 14.1 Mpa (2,047 psi) |
| | ASTM C99 | |
| .2 | Black Tusk Basalt Bedrock Granite | |
| | Absorption by Weight ASTM C97 | 0.31% |
| | Density ASTM C97 | 2,953 Kg/cubic Metre (190 lbs/cu foot) |
| | Compressive Strength ASTM C170 | 341 Mpa (49,373 psi) |
| .3 | Nero Impala This granite is from Africa | |
| | Absorption by Weight ASTM C97 | 0.10% |
| | Density ASTM C97 | 2,930 Kg/cubic Metre (182.8 lbs/cu foot) |
| | Compressive Strength ASTM C170 | 240 Mpa (34,809 psi) |
| | Flexural Strength ASTM C880 | 22 Mpa (3,190 psi) |

Modulus of Rupture ASTM C99 26 Mpa (3,770 psi)

Approved Types: Refer to Hardscape Materials Legend on Landscape drawings for the approved stone paver types, sizes, patterns, finish and supplier.

- .2 Finish Types: Flamed and Thermal finish refers to application of high temperature flame to surface area. For the purpose of this specification Thermal finish shall have a higher degree of surface variation and rustication as a result of the application of high temperature flame.

PART 3: EXECUTION

3.1 Preparation

- .1 Prepare all substrate surfaces to receive stone paving as required and as recommended by manufacturers of mortars, as required by job conditions to ensure good, permanent bonds.

3.2 Stone Paving Installation

- .1 General: Paver installation shall be in accordance with TTMAC Tile Installation Manual (Current Edition) standards and ANSI 108.5 and as follows:
 - .1 Stone Paving shall be applied over clean surfaces which are free from loose materials, dust or grease.
 - .2 Saw cut pavers to required dimensions ensuring smooth, even edges free of chipping. Where required for radius elements, drill stone pavers for proper fitting without marring pavers edges.
 - .3 Layout pavers in accordance with drawings and patterns so that the perimeter and, where feasible, all cut pavers are no less than half (1/2) the full paver size size. Using pavers from different boxes, mix the different colour nuances to obtain a uniform appearance.
 - .4 Work areas available for cutting pavers will be defined by the General Contractor. Collection,filtration and disposal of cutting and cleaning water is the responsibility of the Trade Contractor.Confirm location of Work areas with General Contractor before submitting Bid.
 - .5 All finished grouted joints shall be smooth, neatly pointed, uniform in width without voids or cracks and shall be waterproof.
 - .6 Variations in the substrate surfaces shall be evened and minimized by the mortar bed.
 - .7 Stone pavers with one or more inclusions larger than the diameter of a Canadian Toonie, 28mm (1.1") will be rejected.

- .2 Install stone pavers over filter drain mat protection to lines and patterns indicated on the Contract drawings in accordance with TTMAC Exterior Decks 325ED, Detail A, excluding membrane, using the following components:
 - .1 Reinforced mortar bed with latex additive. Minimum bed thickness to be 38 mm (1 1/2"). Mortar bed to consist of 3:1 sand and latex Portland cement mix. Reinforce mortar bed with reinforcing mesh specified. Finished tolerance of mortar bed not to exceed 6 mm (1/4") in 3.0M (10'-0"), or 2 mm (1/16") in 305 mm (1'-0").
 - .2 Remove dust and contaminants from back of each paver with a cleandamp cloth before back buttering.
 - .3 Back butter pavers with thin set mortar using a notched trowel to achieve a minimum of 95% coverage of the back of the pavers. Contact shall be evenly distributed to give full support of the paver.
 - .4 Beat pavers into fresh thin set mortar bed to ensure finished surfaces are evenly pitched to drains at slopes indicated on Contract drawings. Areas that exhibit pooling, ponding or water retention will be rejected and remedied at the Contractors expense.
 - .5 Take care to monitor and minimize lippage during installation.
 - .6 Clean excess thin set mortar from paver prior to final set.
 - .7 Finished tolerance in the true plane of the flat surface of stone shall be determined using a 1.2M (4'-0") long straight edge. Surface variation shall not exceed 1/3 the specified joint width.

3.3 Joints

- .1 Provide control joints in grid pattern indicated on Contract Drawings to the following standards unless otherwise noted on the contract drawings:
 - .1 Joints between pavers shall be 6 mm (1/4") wide maximum, with a tolerance of +/- 2 mm (1/16") unless otherwise indicated in Contract drawings.
 - .2 Control joints and expansion joints shall be 12 mm (1/2") wide maximum, with a tolerance of +/- 2 mm (1/16") unless otherwise indicated in Contract drawings.
 - .3 Ensure control and isolation joints are installed as part of the paver layout. Saw cutting the control joints after paver is in place is not permitted.
 - .4 Remove all thin set mortar from the control joints as the work progresses. Do not allow the thin set to harden the control, expansion or isolation joints.
 - .5 Cure and protect freshly installed pavers as specified by the manufacturer of the thin set mortar.

3.4 Grouting

- .1 Allow seventy-two (72) hours after installation of pavers prior to grouting. Grout shall be applied in accordance with ANSI A108.10 "Installation of Grout Tile" and the manufacturers written instructions.

- .2 Protect caulked joints during grouting to prevent grout entering joint. Do not allow the grout to harden in the control, expansion or isolation joints prior to removal. Freshly grouted pavers shall be cured and protected in accordance with the grout manufacturer's written specifications.
- .3 Clean paver surface after grout has cured. Within twenty-four (24) hours of cleaning grout from paver surface Owner's Representative to review paver installation noting deficiencies. Upon rectifying deficiencies the Contractor shall reclean the full surface area. Owner's Representative to review and indicate that the finished section of work is in general conformance with the specifications and that surface sealer can be applied. Note: cleaning and maintenance of all paver areas shall be the responsibility of the Contractor until an area is signed off by the Owner's Representative.

3.5 Surface Sealer Application

- .1 Clean surface as per manufacturers instructions ensuring all areas are clean, dry and free of existing sealers, coatings or deletrious materials.
- .2 Apply first coat surface sealer prior the grouting procedure.
- .3 Apply the second coat of sealer in accordance with the manufacturers written instruction after stone paver grouting has been completed, the finish surface has been thoroughly cleaned and Owner's Representative has reviewed the grouted surface. Ensure strict adherence to cure time, moisture content of stone pavers and ambient air temperature for all applications.
- .4 Protect all surfaces from rain, dust and dirt until sealer has fully cured.

3.6 Joint Sealer Application

- .1 Make good joints to be sealed, clean, dry, free of dust, loose mortar, as recommended by the manufacturer. Remove oils and grease using solvent-based materials such as xylol, loluol or methyl ethyl ketone for cleaning metals. Use no water base cleaners or soap detergents.
- .2 Apply joint sealant only after tests have been carried out showing there will be no staining of adjacent paver surfaces.
- .3 Joint sealant shall maintain a width to depth ration of 2:1 provided proper rubber joint filler is used.
- .4 Prime sides of joints as required by specified manufacturer's printed specifications and recommendations.
- .5 Mask adjoining work as necessary to ensure no smearing, over sealing or marking of adjacent stone paving or surfaces.
- .6 Install joint filler in accordance with manufacturer's printed directions. Ensure joint filler installation provides a void space that matches the depth of the joint indicated on drawings. Where joint depth is too shallow to accommodate joint filler ensure bond break tape is applied to bottom of joint prior to application of joint sealant.

- .7 Joint sealant materials shall be used in strict accordance with ASTM C1193 and sealant manufacturer's written instructions and shall be applied only by specially trained applicators.
- .8 All joints shall be tooled, and exposed sealed joints both taped and tooled. All joints to be sealed shall be thoroughly pretreated to ensure the full bond capabilities of the sealant. Tapes shall be removed as soon as possible after tooling.
- .9 Joint sealants, tapes, gaskets, separators, joint fillers, back-up and packing materials shall be physically and chemically compatible with each other and with adjacent materials. Items shall be installed so that they will not become dislodged during or after installation.
- .10 Protect all joint sealant from dust, dirt and debris until fully cured. Grout sealant that has been contaminated resulting in colour change or finish irregularity shall be removed and replaced by the Contractor at no expense to the Owner.

3.7 Adjust and Clean

- .1 On completion, check work and replace defective, upset or misaligned pavers.
- .2 Make good skips, voids or excess grouting. Remove all debris and excess materials from the premises, leaving it in a clean condition to the satisfaction of the Owner's Representative.
- .3 Remove all stains, dirt, excess mortar, and defacements as on all stone and glass pavers and joints.
- .4 The products to be used for cleaning the pavers shall be as recommended by the paver manufacturer and approved by the Terrazzo Tile and Marble Association of Canada.

3.8 Cleaning

- .1 At completion, remove all debris, tools and equipment as directed from the premises.

END OF SECTION 32 14 40

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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 permeable interlocking concrete pavers as indicated in the contract documents.

1.3 Related Work

- .1 Site Preparation and Grading Section 01 89 13
- .2 Subsurface Drainage Systems Section 33 46 16

1.4 Reference Standards

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A231.2, Precast Concrete Pavers.
 - .2 CSA-A23.2A, Sieve Analysis of Fine and Coarse Aggregates.
- .2 American Society of Testing Materials (ASTM)
 - .1 C 33, Specification for Concrete Aggregates.
 - .2 C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 C 979, Specification for Pigments for Integrally Coloured Concrete.
 - .4 D 698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5-lb (2.49 kg) Rammer and 12 in. (305 mm) drop.
 - .5 D 1557, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop.
 - .6 D 1883, Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
- .3 Interlocking Concrete Pavement Institute (ICPI)
 - .1 Permeable Interlocking Concrete Pavement manual.

1.5 Submittals

- .1 In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- .2 Manufacturer's drawing and details: Indicate perimeter conditions, junction with other materials, expansion and control joints, paver [layout,] [patterns,] [colour arrangement,] installation [and setting] details. Indicate layout, pattern, and relationship of paving joints to fixtures and project formed details.
- .3 Sieve analysis of aggregates for base and bedding materials per CSA A23.2A.
- .4 Soils report indicating density test reports, classification, and infiltration rate measured on-site under compacted conditions, and suitability for the intended project.
- .5 Erosion and sediment control plan.
- .6 Stormwater management (quality and quantity) calculations.
- .7 Permeable concrete pavers:
 - .1 Manufacturer's product catalogue sheets with specifications.
 - .2 [Four] representative full-size samples of each paver type, thickness, colour, and finish. Submit samples indicating the extremes of colour expected in the finished installation.
 - .3 Accepted samples become the standard of acceptance for the work of this Section.
 - .4 Laboratory test reports certifying compliance of the concrete pavers with CSA A231.2.
 - .5 Manufacturer's material safety data sheets for the safe handling of the specified materials and products.
- .8 Paver Installation Subcontractor:
 - .1 A copy of Subcontractor's current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
 - .2 Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.6 Quality Assurance

- .1 Paving Subcontractor Qualifications:
 - .1 Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
 - .2 Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
- .2 Regulatory Requirements and Approvals: [Specify applicable licensing, bonding or other requirements of regulatory agencies.].
- .3 Mock-Ups:
 - .1 Install a 2 x 2 m paver area.

- .2 Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), colour(s) and texture of the job.
- .3 This area will be used as the standard by which the work will be judged.
- .4 Subject to acceptance by owner, mock-up may be retained as part of finished work.
- .5 If mock-up is not retained, remove and properly dispose of mock-up.

1.7 Site Requirements

- .1 Do not install in rain or snow.
- .2 Do not install frozen bedding materials.

1.8 Maintenance

- .1 Extra materials: Provide [Specify area] [Specify percentage] additional material for use by owner for maintenance and repair.
- .2 Pavers shall be from the same production run as installed materials.

PART 2: PRODUCTS

2.1 General

- .1 Delivery, Storage, and Handling
 - .1 General: Comply with Division 1 Product Requirement Section.
 - .2 Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
 - .3 Deliver materials in manufacturer's original, unopened undamaged container packaging with identification tags intact.
 - .4 Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
 - .5 Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift.
 - .6 Unload pavers at job site in such a manner that no damage occurs to the product or existing construction
 - .7 Storage and Protection: Store materials in protected area such that they are kept free from mud, dirt, and other foreign materials.

2.2 Permeable Interlocking Concrete Pavers

- .1 Manufacturer: Mutual Materials, 19675 – 98 Ave, Langley, BC, V1M 2X5,
 - .1 Contact: Tel 604.888.0555, Fax 604.888.0014, www.mutualmaterials.com].
- .2 Permeable Interlocking Concrete Paver Units:

- .1 Paver Type: SF- Rima.
 - .1 Material Standard: Comply with material standards set forth in CSA A231.2.
 - .2 Colour: Granite
 - .3 Colour Pigment Material Standard: Comply with ASTM C 979.
 - .4 Size: 196x196x80.
 - .5 Average Cube Compressive Strength: 50 MPa with no individual unit under 45 MPa.
 - .6 Freeze/Thaw Deicing Salt Resistance: No greater loss of 200 g/m² of surface area after 200 freeze-thaw cycles or no great loss of 500 g/m² of surface area after 50 cycles while immersed in a 3% saline solution. Freeze-thaw testing requirements shall be waived for applications not exposed to freezing conditions.

2.3 Product Substitutions

- .1 Substitutions: No substitutions permitted.

2.4 Crushed Stone Bedding Materials

- .1 Gradation criteria

Note: D_x is the particle size at which x percent of the particles are finer. For example, D₁₅ is the particle size of the aggregate for which 15% of the particles are smaller and 85% are larger.

- .1 $D_{15} \text{ base stone} / D_{50} \text{ bedding stone} < 5$.
 - .2 $D_{50} \text{ base stone} / D_{50} \text{ bedding stone} > 2$.
 - .2 Crushed stone with 90% fractured faces, LA Abrasion < 40 per ASTM C 131, minimum CBR of 80% per ASTM D 1883.
 - .3 Do not use rounded river gravel for base or bedding materials
- Note: The following gradations in Tables 1 and 2 can be used for the crushed stone, open-graded bedding and base. Check gradations against the above criteria.

Table 1: Grading Requirements for ASTM No. 8 Bedding

| Sieve Size | Percent Passing |
|------------|-----------------|
| 12.5 mm | 100 |
| 9.5 mm | 85 to 100 |
| 4.75 mm | 10 to 30 |
| 2.36 mm | 0 to 10 |
| 1.16 mm | 0 to 5 |

Table 2: Grading Requirements for ASTM No. 57 Base

| Sieve Size | Percent Passing |
|------------|-----------------|
| 37.5 mm | 100 |
| 25 mm | 95 to 100 |
| 12.5 mm | 25 to 60 |

4.75 mm 0 to 10

2.36 mm 0 to 5

Note: Permeable bedding and base is available at Pitt River Quarries Ltd. 16101 Rannie Road, Pitt Meadows, BC, V3Y 1Z1. Dispatch: 604.777.8082, Fax: 604.521.8135, Quarry Office: 604.465.4114, Fax: 604.465.3137

2.5 Accessories

- .1 Provide accessory materials as follows:

Note: Do not use plastic edging with steel spikes to restrain the paving units.

- .1 Edge Restraints: Cast in place concrete as detailed on drawings.

PART 3: EXECUTION

3.1 Acceptable Installers

- .1 Acceptable paving subcontractors shall have at least three years minimum experience installing permeable paving systems. The contractor must be prepared to advise of previous works by submission of a written list of project references if requested by the Park Board.

3.2 Examination

Note: The elevations and surface tolerance of the aggregate base determine the final surface elevations of concrete pavers. The paver installation contractor cannot correct deficiencies in the base surface with additional bedding materials. Therefore, the surface elevations of the base should be checked and accepted by the General Contractor or designated party, with written certification to the paving subcontractor, prior to placing bedding materials and concrete pavers.

A. Acceptance of Site Verification of Conditions:

- .1 General Contractor shall inspect, accept and certify in writing to the paver installation subcontractor that site conditions meet specifications for the following items prior to installation of interlocking concrete pavers.

Note: Compaction of the soil subgrade should be to a minimum of 98% standard Proctor density per ASTM C 698 for pedestrian areas and residential driveways, and a minimum of 98% modified Proctor per ASTM D 1557 for vehicular areas. Density and moisture should be checked in the field with a nuclear density gauge or other test methods for compliance to specifications. Stabilization of the soil and/or base material may be necessary with weak or continually saturated soils, or when subject to high wheel loads. Compaction will reduce the permeability of soils. These conditions may require the use of drainpipes within open-graded bases.

- .1 Verify that subgrade preparation, compacted density and elevations conform to specified requirements.
 - .2 Verify that aggregate base materials, thickness, compacted density, surface tolerances and elevations conform to specified requirements.
 - .3 Provide written density test results for soil subgrade, aggregate base to the Owner, General Contractor and paver installation subcontractor.
 - .4 Verify location, type, and elevations of edge restraints, concrete collars around utility structures, and drainage inlets.
2. Do not proceed with installation of bedding and interlocking concrete pavers until subgrade soil and base conditions are corrected by the General Contractor or designated subcontractor.

3.3 Preparation

- .1 Verify base certified by General Contractor as meeting material, installation and grade specifications.
- .2 Verify that base is free from standing water, uniform, even, free of any organic material or sediment, debris, ready to accept bedding materials, pavers and imposed loads.
- .3 Edge Restraint Preparation:
 - .1 Install edge restraints per the drawings at the indicated elevations.

3.4 Installation

Note: The minimum slope of the soil subgrade should be 1%. Geotextile is typically placed on the compacted soil subgrade under the No. 57 open-graded base. The geotextile is applied to the bottom and sides of the excavation with overlapped joints of 0.6 m. Overlaps should follow down slope with drainage. All drainpipes, observation wells, overflow pipes, and impermeable liner (if applicable) should be in place per the drawings either prior to or during placement of the base, depending on their location. The No. 57 base is typically compacted in 100 to 150 mm thick lifts with a minimum 10 T static roller. A vibrator roller or plate may be used with the final passes with a static roller. Care must be taken not to damage drainpipes during compaction and paving. There should be at least 4 passes with no visible movement in the base material when compaction is complete. No mud or sediment can be left on the base or bedding aggregates. If they are contaminated, they must be removed and replaced with clean materials. The following provides guidance on installation of the aggregate base if included in this section:

- .1 Open-graded aggregate base
 - .1 Keep area where pavement is to be constructed free from sediment during entire job. Geotextiles, base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.
 - .2 Place geotextile on the bottom and sides of the excavated area with a minimum downslope overlap of 0.6 m.

- .3 Place and spread the [No. 57] crushed stone base without wrinkling or folding the geotextile.
- .4 Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation.
- .5 Moisten, spread and compact [No. 57] in 100 mm to 150 mm lifts with a minimum 10 T vibratory roller.
- .6 For each lift, make at least two passes in the vibratory mode then at least two in the static mode until there is no visible movement of the [No. 57] stone.
- .7 The elevation of the final surface of the [No. 57] base should not deviate more than ± 13 mm over a 3m straightedge.
- .2 Bedding layer
 - .1 Moisten, spread, and compact the [No. 8] crushed stone bedding material. Compact with a minimum [10] T static roller. Make at least [4] passes. No visible movement should occur in the base material when compaction is complete.
 - .2 The elevation of the compacted surface should not deviate more than ± 13 mm over a 3 m straightedge.
 - .3 Lay the pavers [paving slabs] in the pattern(s) and joint widths shown on the drawings. Maintain straight pattern lines.
 - .4 Fill gaps at the edges of the paved area with cut units. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit.
 - .5 Cut pavers to be placed along the edges with a double-bladed splitter or masonry saw.
 - .6 Compact and seat the pavers into the bedding material using a low amplitude, 75-90 Hz plate compactor capable of at least 22 kN centrifugal compaction force. This will require at least two or three passes with the compactor.
 - .7 Do not compact within 2 m of the unrestrained edges of the paving units.
 - .8 Remove excess aggregate by sweeping pavers clean.
 - .9 All pavers within 1 m of the laying face must be left fully compacted at the completion of each day.
 - .10 The final surface elevations shall not deviate more than ± 10 mm under a 3 m long straightedge.
 - .11 The surface elevation of pavers shall be 3 to 6 mm above adjacent drainage inlets, concrete collars or channels.

3.5 FIELD QUALITY CONTROL

- .1 After sweeping the surface clean check final elevations for conformance to the drawings.
- .2 Lippage: No greater than 3 mm difference in height between adjacent pavers.
Note: The minimum slope of the finished pavement surface should be 1%. Note: For installations on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 3 to 6 mm above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

- .3 The surface elevation of pavers shall be 3 to 6 mm above adjacent drainage inlets, concrete collars or channels.

3.6 Protection

- .1 After work in this section is complete, the General Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

END OF SECTION 32 14 43

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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 crushed granular paving as indicated in the contract documents.
- .2 The work shall include the supply and installation of granular paving as indicated, including:
 - .1 Granular Base
 - .2 Crushed Granular Paving
 - .3 Stabilizer
 - .4 Edge Restraint

1.3 Related Work

- .1 Aggregates and Granular Materials Section 02 41 14
- .2 Excavation and Backfill Section 31 23 10

1.4 Submittals

- .1 Submit a sieve analysis and a one (1) litre sample of crushed granular paving for review.
- .2 Submit product information and sample of stabilizer.

1.5 Quality Control

- .1 Prior to the start of construction provide a stake layout of all both edges of all crushed granular paving areas for review by the Owner's Representative. Stake spacing to be such that the shapes and forms of the crushed granular paving areas can be clearly seen.

1.6 Protection

- .1 Protect all work from damage and protect all property from damage arising from this contract. Take every precaution necessary to avoid damage to drainage and irrigation systems, adjacent growing medium and planting.

1.7 Site Conditions

- .1 The Contractor shall be responsible for repair of any utilities damaged in the course of work of this section.
- .2 The Contractor shall coordinate all work that crosses crushed granular paving areas to ensure that appropriate sleeves are installed prior to the start of work of this section.

PART 2: PRODUCTS

- 2.1 Crushed Granular Paving: to be 7mm crushed dust** consisting of sound, durable stone particles free from clay, organic material or other deleterious matter as per ASTM C 136. Acceptable product include but area, not limited to Lafarge Aggregate 7mm Paving Aggregate Dry or approved equal

| Sieve Size (mm) | Percent Passing |
|-----------------|-----------------|
| 9.5 | 100 |
| 4.75 | 86-94 |
| 2.36 | 59-65 |
| 1.18 | 40-46 |
| 0.600 | 29-35 |
| 0.300 | 19-25 |
| 0.150 | 12-18 |
| 0.075 | 9-11 |

- 2.2 Granular Base:** To be 19mm (3/4") crushed granular base consisting of sound, durable particles, free from clay, organic material or other deleterious matter, evenly graded. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.
- 2.3 Stabilizer:** organic base, water activated polymer that binds particles together forming a homogenous, semi porous surface conforming to ADA (American with Disabilities Act) requirements. Acceptable products include but are not limited to Stalok W/A Binder by Stabilizer Solutions, Phoenix Arizona or approved equal.
- 2.4 Edge Restraint:** Shall be manufactured from 100% recycled material, UV stable and capable or retaining curved or straight precast concrete unit paver installations. Acceptable products include; B.E.A.S.T by Brickstop as distributed by Abbotsford Concrete Products, Abbotsford, BC or approved equal.
- 2.5 Edge Restraint Spikes:** 300mm (12") long, galvanized metal spikes.

PART 3: EXECUTION

3.1 Inspection

- .1 Areas of work to receive crushed granular paving and base course shall be examined and unsatisfactory conditions reported to Owner's Representative. Commencement of work shall imply acceptance of conditions.

3.2 Preparation of Subgrade

- .1 Excavate soft and unstable areas of subgrade that cannot be compacted to standard noted, fill and compact with approved granular material.
- .2 Compact subgrade to 95% Modified Proctor Density.
- .3 Ensure subgrade is true to line and grade and allows for sufficient depth to ensure finish grade can be established as noted on plans.

3.3 Granular Base

- .1 Place granular base over sub-grade in maximum 150 mm (6") lifts compacted to 95% MPD.

3.4 Edge Restraint

- .1 Install edge restraint to the lines and grades indicated on contract documents. Ensure straight lines are consistent and true and curved lines are continuous (faceted shapes are not acceptable).

3.5 Crushed Granular Paving

- .1 Owner's Representative shall review crushed granular base prior to the placement of the crushed granular paving.
- .2 Blending Stabilizer: Prior to the placement of material, create a homogeneous mix of stabilizer and crushed granular paving material using the mix ratio recommended by the stabilizer manufacturer.
- .3 Place the homogeneous mix of stabilizer and crushed granular paving material to lines and grades indicated on the contract drawings.
- .4 Water heavily to full depth at a rate of 95 -150 litres per 900 kg (25 – 40 gallons per ton). Randomly test for water saturation during application.
- .5 Let saturated material stand for at least six (6) hours. Compact material using a 900 – 1,800kg (2-4 ton) double drum roller or 450kg (1,000lbs) single drum roller. Do not compact with any type of vibratory equipment.
- .6 Ensure surface material remains moist by applying a light mist of water as required.

3.6 Cleaning

- .1 All paved areas or adjacent surface shall be brushed clean and excess materials shall be removed from the work site and disposed of in an approved dump location.
- .2 If cracks appear in stabilized surfaces, sweep fines into crack and tamp in place.

END OF SECTION 32 15 40

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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 of the field applied painted pavement markings as indicated in the contract documents.
- .2 Includes painting of vehicular and pedestrian parking and walking surfaces, parking stall lines, speed bumps, pedestrian walkway demarcation, and specialty vehicular and bicycle traffic symbols, graphics, markings and sports court game lines.
- .3 Include in the work co-ordination of all inspections by the Owner's Representative as required to ascertain proper completion of the work.

1.3 Related Work

- .1 Site Preparation and Grading Section 01 89 13
- .2 Hot Mix Asphalt Paving Section 32 12 16

1.4 Reference Standards

- .1 Product delivery, environmental requirements, preparation of surfaces and application shall be in accordance with the applicable chapters of Canadian Painting Contractors Association/Master Painters Institute Architectural Painting Specification Manual: Ext. 2.1 Asphalt Surfaces or Ext. 3.2 Concrete Horizontal Surfaces and/or Maintenance Repainting Manuals Rex 2.1 Asphalt Surfaces or Rex 3.2 Concrete Horizontal Surfaces (CPCA/MPDA), latest editions.
- .2 A copy of the applicable chapters of the Canadian Painting Contractors Association/Master Painters Institute Architectural Painting Specification Manual and/or Maintenance Repainting Manual shall be kept on site during the duration of the painting work.
- .3 Should modifications to the standards occur in this specification, then the modifications shall govern.

1.5 Qualifications

- .1 The paint products of the paint manufacturer shall be as listed in the CPCA Manual, latest edition, under Paint Product Recommendation Section and shall be from a single source supplier/manufacturer. **Mixing of different manufacturer's products will not be allowed.**
- .2 The Painting Contractor shall have a minimum of five (5) years proven record of satisfactory performance on projects of similar size within the Painting and Decorating Trade (specifically Pavement/Concrete Marking) and shall show proof before commencement of work that he will maintain a crew of **Trades Qualified Journeymen Painters** ensuring they hold a Provincial or Interprovincial Painter & Decorator or Painting & Decorating Certificate of Qualification throughout the duration of this work.
- .3 Qualifications of Workers:
 - .1 Only competent and **Trades Qualified Journeymen Painters**, as defined by local jurisdiction, who have a Provincial or Interprovincial Painter & Decorator or Painting & Decorating Certificate of Qualification and who are thoroughly experienced with the material and methods specified, may perform Painting and Decorating (Pavement/Concrete Marking) work. Registered apprentices may be employed provided they work under the direct supervision of a Trades Qualified Journeyman Painter in accordance with trade regulations.
 - .2 General labour type activities may be performed by labourers and trades helpers who are thoroughly experienced with preparation procedures provided they work under the direct supervision of a skilled Trades Qualified Journeyman Painter.
 - .3 Individual trade certification and apprentice registration number must be presented to the Coatings and Finishes Inspector or his designated Inspector upon request. A skilled Trades Qualified Journeyman Painter shall be present at all times during the execution of the work.
 - .4 **Requests for exemption from the prescribed Qualifications of Workers noted in 1.4.3.1 thru 1.4.3.3 as they pertain to some projects must be submitted in writing to the Coatings and Finishes Inspector. Final approval on relaxation of any qualifications is at sole discretion of the Board.**
- .4 Painting inspection shall be performed by an inspector acceptable to the Owner's Representative (and MPDA inspector if applicable).

1.6 Protection:

- .1 Protect surrounding or adjoining work by adequately covering with drop sheets/localized masking or other necessary protective covering; make good any damage caused by failure to provide such protection. **Protect all painted pavement markings until dry.**

- .2 Safety: The contractor will be responsible for all aspects of job safety at the work site. All work must be carried out in a safe and workmanlike manner. All pertinent safety regulations of the Vancouver Park Board and Workers' Compensation Board of British Columbia Occupational Health and Safety Regulations shall be adhered to rigidly.
- .3 In the Field the Contractor will be responsible for ensuring adequate public safety in his work area, at all times. Post wet paint signs at newly painted areas, barrier tape, traffic cones and/or barriers around the work area to prevent public access and undue touching. No operating equipment is to be left unattended and work area is to be left in a safe, secure condition at the end of each work day.

1.7 Submittals

- .1 Submit samples/colour chips as requested from standard manufacturer's colour range as directed by Owner's Representative.
- .2 The Owner's Representative will determine all colours and patterns and issue an instruction showing where the various colours and finishes shall be applied. On site work to match selected samples. No extra allowed for repainting surfaces which do not conform with approved samples.
- .3 Submit copies of all manufacturer's product data sheets and Workplace Hazardous Material Information System (WHMIS) Material Safety Data Sheets (MSDS) of the products being used to the VPB Inspector. These recommendations will be adhered to strictly. Copies of the MSDS for all controlled products and manufacturer's product data sheets for each product used shall be kept on site and readily available upon request.

1.8 Environmental Requirements

- .1 Environmental requirements for painting shall be in accordance with applicable chapter of CPCA Specification Manual.
- .2 Paint shall not be applied in damp weather or over wet surfaces.
- .3 Ensure surface temperature of the surface to be painted is above 10 deg. C (50 deg. F) before applying any paint.
- .4 Paint should not be applied if the dew point is less than 3 deg. C (5 deg. F) below the ambient or surface temperature or when rain is imminent.
- .5 The minimum ambient drying temperatures shall be 10 deg. C (50 deg. F) and rising.
- .6 Relative humidity is 85 % maximum.
- .7 Painting in direct sunlight on a hot day can cause many adhesive failures leading to blistering, cracking or wrinkling of the paint film and will not be permitted.

1.9 Warranty

- .1 VPB require a minimum 2-year standard warranty including same on all repainted work. The contractor shall warrant unconditionally against fading, cracking, spalling, blistering, peeling and excessive wear. **This warranty extends only to failure of the painted pavement surfacing and does not cover base or asphalt/concrete failure underneath the surface.**

PART 2: PRODUCTS

2.1 General

- .1 Handling & Storage of Materials and Equipment - Field Operations:
 - .1 The location of storage areas for paint, materials and equipment shall be subject to approval by the VPB Inspector. The areas shall be kept in a neat and orderly fashion, with all waste material removed regularly and every precaution shall be taken to prevent fire. Storage areas set up by the contractor shall be designed and maintained by the contractor to safely contain any spilled materials.
 - .2 At the end of the painting contract, all materials surplus to the job shall be removed by the contractor. This includes used and unused abrasive, pallets, empty cans and other material surplus to the job requirements. The area must be cleaned to the satisfaction of the VPB Inspector.
 - .3 Throughout the progress of the contract work all waste materials must be handled and disposed of in a safe and environmentally sound manner in accordance with all applicable Municipal, Provincial and Federal regulations. Waste disposal will only be at approved and authorized disposal sites.
- .2 Product Delivery/Storage
 - .1 Product delivery and storage of materials shall be in accordance with applicable chapter of CPCA Specification Manual.
 - .2 Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, colour designation and instructions for mixing and/or reducing.
 - .3 Store paint materials at a minimum ambient temperature of 10 degrees Celsius in a well ventilated area. If stored on site, obtain approval from VPB Inspector.
 - .4 All materials and paints shall be lead and mercury free and shall have low Volatile Organic Compounds (VOC) content where possible.

2.2 Approved Materials

- .1 Paint:
 - .1 Alkyd Zone/Traffic Marking Paint to CGSB 1-GP-74M (MPI Product 32) or Ministry of Highways and Transportation approved equal. **This paint is not approved for sports court game lines.**
 - .2 Latex Zone/Traffic Marking Paint (MPI Product 97)
This paint is also approved for sports court game lines.
 - .3 Hi-Hide Plexicolor Line Paint as available from Tomko Sports Systems Inc., Richmond, B.C. **This paint is approved for sports court game lines only.**
 - .4 Colour: White or as specified by the Park Board Project Manager.
 - .5 Glass Beads: Overlay Type, to CGSB 1-GP-74M.
- .2 The paint shall be suitable for use over all types of concrete and bituminous surfaces and when applied over emulsified asphalt, it shall not cause lifting, crazing, peeling or other damage to the base.
- .3 Specialty undercoats, fillers, primers and paint systems shall be of same manufacture as the final finish coat.
- .4 All materials shall bear manufacturer's label. Materials in unidentified containers shall be removed from the site.
- .5 Materials shall be used and applied in strict accordance to manufacturer's directions and **shall be a finishing system from a single source supplier to ensure compatibility of the coating system.**

2.3 Approved Equals

- .1 All items as specified or **pre-approved** equals.

PART 3: EXECUTION

3.1 Inspection

- .1 The Painting Contractor shall inspect all surfaces prior to commencement of work. Any deficiencies shall be reported to the Inspector prior to starting work.
- .2 Commencement of work shall indicate acceptance of surfaces and job conditions.

3.2 Surface Preparation

- .1 Remove all surface contaminants such as dirt, dust, loose mortar or asphalt, loose paint, oil, grease or wax, peeling paint, water and other foreign matter from all asphalt and concrete surfaces to be painted.
- .2 Pressure wash the surface with minimum 2000 psi gas powered power washer to thoroughly clean surface.

- .3 Concrete substrates must be free of curing compounds, release agents, efflorescence and sealing compounds.
- .4 Prior to application of any coating over masonry surfaces test for alkalinity (pH test) and report results to the Park Board Coatings and Finishes Inspector.
- .5 All cracks and openings in the surface to be painted are to be chipped out as required and filled with an approved patching material. All patches shall be made flush with the adjoining surfaces and spot primed with an approved primer. All thick and sharp edges of paint build-ups shall be sanded and feathered to achieve a smooth uniform appearance to the approval of the Park Board Coatings and Finishes Inspector.
- .6 All remaining old paint shall have adequate sound adhesion.

3.3 Coating Application

- .1 Application:
 - .1 Layout the pavement markings as indicated on the Drawings (and in accordance with the rules of the applicable game). All game lines shall be taped/masked both sides and shall be sealed to the surface prior to painting to ensure straight and sharp lines. Apply two coats of paint by brush or roller. Application of paint on sports court game lines by hand held spray equipment is not permitted. Requests to apply paint on sports court game lines by airless spray or conventional spray striping machines shall be submitted in writing and may or may not be granted. No residue of tape adhesives shall be left after removal.
 - .2 Painted pavement markings shall be of uniform colour and density with sharp edges.
 - .3 All symbols and letters to conform to dimensions shown on Standard Detail Drawings.
 - .4 Do not thin paint without approval of the VPB Inspector. If approved, the coating materials shall be thinned only if necessary and then with the proper thinner as supplied by the paint manufacturer and only up to the recommended amount. Thinning shall only be done in strict accordance with the manufacturer's directions. Dilution or misuse will not be allowed.
 - .5 Apply paint at even rate in accordance with the manufacturer's recommendations.
 - .6 Unless otherwise directed by the VPB Inspector, apply paint only when the air temperature is above 10 deg. Celsius and no rain is imminent.
 - .7 Apply glass beads at rate specified in Supplemental Specifications.
 - .8 Apply other specified markings as directed by the VPB Inspector.
 - .9 Close the sport court areas to public access for a period of 24 hours minimum after painting or until the paint is sufficiently cured to accept traffic.
Paint shall be applied to a minimum dry film thickness (DFT) of 8.0-10 mils (200-250 microns DFT).
- .2 All new asphalt to be painted over must be allowed to cure for a minimum of 14 days prior to painting application.

- .3 All new concrete to be painted over must be allowed to cure for a minimum of 28 days prior to painting application.

3.4 Acceptance

- .1 Finished work shall be of approved colour, uniform in appearance, texture and sheen, smooth and free from excessive flooding, brush marks, lap marks, runs, sags or any other film defects. Any and all such defects shall be removed/repared at the Contractor's expense and made good to the satisfaction of the VPB Inspector.
- .2 **VPB require a min. 24 hrs. notice in order to schedule all inspections.** No delay claims filed by the Contractor resulting from failure to provide adequate notice of inspection required will be entertained. All aspects of this work shall be subject to inspection by the Owner's Representative or their designated inspector. Inspection/approval points shall be of a frequency sufficient to ensure adequate Quality Control in accordance with this specification and will occur throughout the duration of the Contract. The contractor must supply access to the work for the VPB Inspector. As a minimum, Inspections will occur as follows:
 - .1 After layout of painted pavement markings.
 - .2 After any required cleaning and before any finish coating application.
 - .3 After finished coat application.
 - .4 At Substantial Performance.
- .3 Independent Inspection/ Testing agencies may be engaged by the owner (VPB) for the purpose of inspecting and testing portions of the work to ensure compliance with this specification. All costs associated with such a service shall be borne by the Contractor. .4
At the discretion of the VPB Inspector, occasional small spot tests may be made with a sharp instrument to physically gauge film thickness or determine other qualities of the coating(s). Such area(s) shall be repainted at the expense of the Contractor.
- .4 Painted/Coated surfaces will be inspected and may be rejected for defects including but not limited to: sags, runs, inadequate dry film thickness, coating continuity, evidence of poor coverage at any location or any misses.
- .5 The Contractor shall carry out repair work to identified defects, omissions and handling damage in such a manner so as to produce a coating equal to or better than the original coating. Re-inspection of corrective work and all retesting costs associated shall be entirely at the expense of the Contractor.

3.5 Site Maintenance/Clean Up

- .1 The job site shall be kept in a neat, clean and orderly condition at all times during the painting process.
- .2 Spilled, splashed, and spattered paint shall be cleaned promptly. Remove cotton waste, cloths and materials that may constitute a fire hazard and place in a closed metal container and remove daily from the site.

- .3 Any damage to paving, planting or any other structures/elements due to work of this Section shall be immediately repaired at the Contractor's expense to satisfaction of VPB Inspector.
- .4 Remove and dispose of off site all surplus material, excess materials, trash, debris and waste material from the work of this Section. Dispose of all hazardous wastes to Municipal, Provincial and Federal Guidelines.
- .5 At the conclusion of the work, leave the premises neat and clean to the satisfaction of the VPB Inspector.

END OF SECTION 32 17 23.13

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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 an irrigated, drained sand playing surface as indicated in the contract documents.
 - .1 Excavate, trench and install drainage system including area drains, catch basins and all connections to existing stormwater systems.
 - .2 Supply and placement of sand.
 - .3 All testing required to verify conformance with the contract requirements.
 - .4 All site survey work by a registered B.C. Land Surveyor including provision of a signed and sealed drawing from the B.C.L.S. certifying drain line locations and elevations of inverts.
 - .5 Erection and maintenance of protective barrier fencing for duration of construction schedule.

1.3 Related Work

- | | | |
|----|-----------------------------------|---------------------|
| .1 | Site Preparation and Grading | Section 01 89 13 |
| .2 | Aggregates and Granular Materials | Section 02 41 14 |
| .3 | Landscape Maintenance | Section 32 01 90 |
| .4 | Irrigation System | Section 32 80 00 |
| .5 | Hydraulic Seeding (Hydroseeding) | Section 32 92 19.16 |
| .6 | Sod Lawn | Section 32 92 23 |

1.4 Quality Assurance

- .1 Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction, to Vancouver Park Board Standards and consistent with the good practices of the trades involved.
- .2 Testing: Where necessary, perform or arrange to be performed by an approved laboratory, testing of any materials requested by the Owner's Representative to ensure conformance with the specifications contained herein.

1.5 Job Conditions

- .1 The Landscape Subcontractor shall be held to have familiarized himself with the site and site data contained in the Contract Documents. It is expressly understood that the Owner shall not be responsible for interpretations or conclusions erroneously drawn therefrom by the Landscape Subcontractor.

1.6 Coordination/Schedule

- .1 Coordinate this work with work of other Sections, subtrades, contractors and Owner's Representative to ensure a complete installation as specified for playfield irrigation, finished seeding and all related work.

1.7 Measurement

- .1 Layout and location shall be as shown on the drawings and as described herein. Where definite locations are not obtainable from the drawings or the specifications the Contractor shall consult with the Owner's Representative before proceeding with the work. ***Do not scale drawings.***
- .2 Measurement of materials shall be in units as noted in the specifications. Measurement of time shall be in hours or fractions thereof.
- .3 Where adjustments for quality or condition are required, such adjustments shall be determined by the Owner's Representative.

1.8 Submittals

- .1 Contractor shall submit with Tender, a written estimate of the volume of sand required with the name and location of intended source of supply - Refer to Bid Form.
- .2 Pay for all costs associated with testing and / or retesting of samples. The Owner's Representative shall have 10 working days to review and approve each sample submitted. All test results submitted throughout the project shall be reported in the format shown in this specification. The review and approval process for sand shall only begin when samples are received by the Owner's Representative in the specified format. Fill in the attached form for all testing results found at the end of this section.
Submit completed Schedule A - Sand Analysis Submittal Form to the Owner's Representative.
- .3 Prior to commencing field construction, submit to the Owner's Representative a one litre sample of the proposed sand and test results from one particle size test.
- .4 Upon acceptance of a proposed sand sample based on particle size, submit a 10 litre sample of that sand to the testing laboratory for hydraulic conductivity testing. Obtain and submit compacted saturated hydraulic conductivity (15 blow) test results of that sand.

- .5 All particle size and hydraulic conductivity testing shall be performed by a certified testing agency. The Board approved particle size testing agency is Pacific Soils Analysis; Ph. 604-273-8226. The Board approved hydraulic conductivity testing agency is Metro Testing Laboratories (Burnaby) Ltd.; Ph. 604-732-2638.
- .6 Submit ten (10) additional percentage of particle size tests from the sand delivered to the site. Samples for these tests shall be taken from the first, second, third and last quarter volumes of sand delivered to the site. Results of these tests shall be presented to the Owner's Representative for approval. If any of the required tests yield unacceptable results, the delivery and installation of material shall be stopped until the unacceptable conditions are corrected and satisfactory test results are submitted to the Owner's Representative. Continue to submit samples and test results as required to demonstrate that the sand supplied meets the requirements of the specifications stated herein.
- .7 Any material installed not meeting the approved sample shall be removed and replaced with approved material at no extra cost to the Board.
- .8 10 Days prior to installation, submit a one cubic foot sample of each of the proposed drain rock and filter gravel.
- .9 If an alternative is proposed to any specified drainage components, submit sample for approval by Owner's Representative.
- .10 Prior to and as a condition of Substantial Performance the Contractor shall submit a reproducible vellum of a signed and sealed drawing from the B.C.L.S. certifying drain line locations and elevations of inverts.

1.9 Review

- .1 The Owner's Representative is to inspect and approve subgrades prior to beginning installation of subsurface drainage.
- .2 The Owner's Representative is to inspect and approve all subsurface drainage prior to placement of sand.
- .3 The Owner's Representative is to inspect and approve all finished grades.
- .4 Provide Owner's Representative with 24 hours notice to arrange inspections of each portion of the work as specified.
 - .1 Notify the Owner's Representative on completion of the work.
 - .2 Under no circumstances shall work be backfilled or otherwise covered before an inspection has been made by the Board's Representative or Owner's Representative.
 - .3 Where local or provincial code inspections are required, the Contractor shall arrange for such inspections and obtain such approvals before proceeding with the work.

1.10 Conditions for Substantial Performance

- .1 Substantial performance will be declared when:
 - .1 All conditions for Substantial Performance in the CCDC 2 contract are met.

- .2 As-built drawings have been submitted for all final grades, irrigation systems, layout and sub-surface drainage in accordance with Section 01300.
- .3 During the Substantial Performance Inspection the Contractor shall demonstrate and prove the serviceability of all systems to the satisfaction of the Board.

1.11 Acceptance

- .1 The following are conditions for acceptance and turnover of the completed playfields:
 - .1 Substantial Performance shall have been declared for the complete project.
 - .2 Grass playing fields shall have been maintained as specified for at least 90 days.
 - .3 The entire area shall have a uniform, healthy, green, dense stand of grass to the acceptance of the Owner's Representative, and all deficiencies shall have been corrected to the Board's satisfaction.
 - .4 All maintenance /fertilizer/seeding requirements shall be completed as specified in related Sections.

PART 2: PRODUCTS

2.1 General

- .1 Product Delivery Storage & Handling
 - .1 Deliver and store materials in new condition, in unopened containers and protect until installed. Deliver, handle and store pipe so as to avoid gouging, bending or cracking.

2.2 Drain Pipe

- .1 All pipes and fittings shall be polyvinyl chloride (P.V.C.) or high density polyethylene smoothwall storm sewer pipe conforming to either ASTM Standard D2729 or /CSA Standard B182.1. Perforated pipe at playfields, non-perforated where shown. Sizes as shown on drawings.
 - .1 All piping materials and accessories shall be CSA approved except as specifically noted otherwise. [The 100mm perforated PVC lateral drainpipe need not be CSA approved].
 - .2 Pipe sizes shown on the drawings are nominal inside diameters except as specifically noted otherwise.

2.3 Drainage Structures

- .1 Area Drain: Grate and frame by Dobney Foundry No. B-26B, all other components as detailed.
- .2 Catch Basins: Grate and frame by Dobney Foundry No. B19A, all other components as detailed.

- .3 Filter Gravel: The filter gravel material for the lateral field drains and the apron perimeter drain shall be rounded, clean gravel with 98% passing the 10mm sieve, 95% retained by the 4.76mm sieve and less than 2% passing the 0.1mm sieve. Crushed rock fractions shall not be included in this material. The material shall be free of organic matter, oil, grease or toxic materials.

2.4 Play Field Sand

- .1 Sand shall be pumped river sand, particles round in shape or pre-approved equal. Gradation of particle sizes shall fall within the following range ("Percent" to be reported as the mass of the particles whose size is greater than the designated sieve opening but less than the previous designated sieve opening):

| USBS Sieve Number | Sieve Size (mm) | Percent | Class |
|----------------------|--------------------|---------|------------------|
| 10 | 2.00 | 0 - 3 | Very coarse sand |
| 18 | 1.00 | 0- 7 | Coarse sand |
| 35 | 0.50 | 25-30 | Medium sand |
| 60 | 0.25 | 30-50 | Fine sand |
| 140 | 0.105 | 15-40 | Very fine sand |
| 270 | 0.053 | 10-15 | Silt & clay |

- .2 Source and sand analysis shall be submitted and approved by the Board prior to award of the Contract.
- .3 Sand shall have saturated hydraulic conductivity between 100 mm. and 300 mm. per hour (10cm/hr and 30cm/hr).
- .4 Sand shall have:
- Organic content < 0.5% by weight.
- Salt content < 0.5mm hos/cm
- pH of between 5.0 and 7.0
- .5 Available copper, zinc and manganese following acid digest test in 0.1N HC1 and shaken for 2 hour shall be less than 25 PPM when analyzed by atomic absorption spectroscopy.
- Sand shall meet the following:

- .1 Partial water retention curve as follows:
- Suction saturated zone: less than 200mm above water table
- Air intrusion value: less than 300mm of water tension
- The porosity shall be greater than 0.30 on a volumetric basis.
- .2 The sand shall be uniform in quality and will be tested throughout the run as directed by the Owner's Representative. The supplier shall be required to identify the stockpile from which the material will be supplied prior to delivery.
- .3 Any sand found to be defective shall be removed from the site at the Contractors expense and replaced with satisfactory material.
- .4 Notwithstanding the foregoing requirements, the selection of the sand material shall be at the discretion of the Owner's Representative.

- .5 Prior to acceptance of the proposed supply of sand the Contractor will carry out at the Contractors expense or have carried out by an approved laboratory the following tests on the sand material: Partial water retention curve; saturated hydraulic conductivity; salt content; pH; particle size analysis by wet sieving; and analysis for available Copper, Zinc and Manganese.
- .6 The Board reserves the right to test the quality of any sand delivered to the site for compliance with the specifications noted herein.

2.5 Snow Fence

- .1 Orange plastic web fencing and related stakes and ties, Tenax, as supplied by Ronco Sales Ltd. or Nilex Geotechnical Products Inc.

2.6 Approved Equals

- .1 All items as specified or pre-approved equals.

PART 3: EXECUTION

3.1 Workmanship

- .1 To accepted and recognized industry practices within the specific trade involved.
- .2 Employ skilled workers who are fully qualified in the type of work to be performed.
- .3 Employ certified journeymen workers where code requires or as specified.

3.2 Work Stoppage

- .1 The Board may for any reason, in particular should quality or safety of the project be compromised, order a stoppage of the work and require the Contractor to institute protective measures until conditions approve. Work will only resume once Board approval has been given.

3.3 Grading

- .1 All grades to be established with a surveyors level. Grade stakes and batter boards shall be established by surveyor level at a maximum spacing of 15M each way. Inter distances shall be checked with boning rods. Establish and maintain grid for grade determination. Grade evenly between spot elevations as shown on the drawings.

- .2 Prior to excavating or trenching the Contractor shall locate and expose all utility lines, drain pipes and other services which are within the areas of this work, and where the existing services are located less than 300mm below the proposed depth of trenching or excavation, such existing services shall be exposed by hand and adequately marked and protected prior to installation. All separation distance requirements of the local authorities having jurisdiction over the service/utility shall be observed.
- .3 Maximum grade variances shall have no surface irregularities exceeding amounts listed when checked with a 3m straight edge placed in any direction:
 - .1 Subgrade elevation: $\pm 25\text{mm}$.
 - .2 Sand bedding material for drainage pipes: $\pm 25\text{mm}$.
 - .3 Pipe inverts: $\pm 25\text{mm}$.
 - .4 Finished elevation of the field: $\pm 25\text{mm}$.
- .4 Proof roll all subgrades as described in Section 02210 of this specification (Ensure 98% S.P.D.). Test compaction at minimum six locations and as required to ascertain conformance with the Contract requirements - Refer to Geotechnical Report.

3.4 Trenching And Drain Pipe Installation

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Open excavation shall be carried out in a safe and orderly manner and in accordance with the requirements of the Workers' Compensation Act of B.C. Approved shoring shall be used where required for safe working conditions.
- .3 All trenches are to be hand or machine excavated. All trenches shall be dug on the alignment and to the depth required as shown on the drawings and as stated herein. Trenches are to be straight with uniform slopes to the bottom of all trenches.
- .4 Where the pipes are to be laid in sub-surface material the trench shall be excavated to a depth at least 100mm below the bottom of the pipe elevation or as detailed. The trench shall be backfilled with at least 100mm of sand passing a 5mm sieve and be carefully compacted by hand.
- .5 Prior to backfilling, all lines, connections and fittings shall be inspected by **(the Engineer, local Municipal Inspector - where required)** Owner's Representative where required.
- .6 Trenches shall be at least 600mm away from paving stones or other hard surfaces to avoid undermining such surface or its edge retention.
- .7 Secure pipes as required to prevent any movement when placing filter gravel and sand around the pipes.
- .8 Mark all drainage lines with long sticks and flags to avoid any equipment travelling over them. **When trucks or other heavy equipment must cross a drainage line, ensure that the crossing is adequately bridged.** Repair damage to all pipes as required and directed by Owner's Representative.
- .9 Contractor is responsible to repair all trenches which have settled below the adjacent grade for a period of one (1) year from date of Substantial Performance.

- .10 **VPB do not accept any material refuse such as pipe pieces, rags, fittings or other waste left as backfill in any trenches.**
- .11 No drainage line shall be directly over and parallel to another drainage line or service line of any other trade. Ensure minimum horizontal and vertical clearance requirements as dictated by Canadian Electrical Code for all piping installations near any electrical conduit/service.
- .12 **Perforated and Solid PVC Pipe:** place bedding, drain rock material and filter gravel and install pipe in locations shown as per details and plans. Comply with all the manufacturer's printed data and recommendations regarding pipe installation, cleaning, fitting preparation and correct joining techniques. Fill around and over the solid pipes until the trenches are even with the graded sub-grade.
- .13 All pipe inverts shall be installed within 15mm of design grades and bedded to provide uniform falls to drain structures.

3.5 Placing Sand

- .1 Place an even layer of playfield sand to required depth over prepared, compacted and drain-piped subgrade.
- .2 Rough grade smooth and even to grades as shown on the drawings and to within tolerances specified herein. Maximum grade variance shall be within specified tolerances after ninety days of natural settlement.
- .3 Monitor work consistently during sand placement to ensure that no drain pipe is displaced from its correct layout or elevation. Fine grade to eliminate all crowns and depressions. Remove all stones and foreign material greater than 25mm. Smooth out all footprints.
- .4 Grade sand surface to a uniform, smooth and level surface to the specified grades allowing for compaction. Wet and roll the sand with an approved non-vibratory roller in two directions, 90 degrees to one another. Ensure a minimum overlap of 50% between passes. Compaction to required densities specified. Add sand and re-grade as required to finish grades shown allowing for tolerances as specified herein. The maximum grade variance of the compacted finish grade of the playfield shall be maintained at ± 25 mm from the grades shown on the drawings after ninety (90) days of natural settlement.
- .5 Roll with a lightweight roller and rough rake to leave a smooth, uniform friable even surface ready for seeding.

3.6 Drainage Structures

- .1 Area Drains: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.
- .2 Lawn Basins: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.

- .3 Clean-Outs: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.

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 Trenching, laying pipe and backfilling shall be continuous so that the amount of open trenching at the end of each workday is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility marking tape to current WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structures/elements due to settlement of improperly compacted trenches shall be immediately repaired at the Contractor's expense to satisfaction of Owner's Representative.
- .4 Remove and dispose of off site all surplus material, excess excavated materials, trash, debris and waste material from the work of this Section.
Repair all damage to adjacent areas to approval of the Board.

| SCHEDULE A - SAND ANALYSIS SUBMITTAL FORM (SAMPLE) | | | | | | | |
|--|------------|-----------|-----------|------------|--------------------|----------------------|-------------------------|
| Project Name/VPB Contract No: | | | | | | | |
| Owner's Representative: | | | | | | | |
| Submission Date: | | | | | | | |
| Contractor Foreman: | | | | | | | |
| Particle Size Testing By | | | | | | | |
| GRADATION OF PARTICLE SIZES | | | | | | | |
| Date | Sample No. | #10 | #18 | #35 | #60 | #140 | #270 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| SATURATED HYDRAULIC CONDUCTIVITY | | | | | | | |
| Date | Sample No. | KSat cm/s | KSat cm/s | Ksat in/hr | Bulk Density Kg/m3 | Porosity % by Volume | Compaction No. of Blows |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

END OF SECTION 32 18 23

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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 chain link fence as indicated in the contract documents. This specification is applicable for 1.2m (4'-0"), 1.8m (6'-0"), 2.4m (8'-0") tall fences.

1.3 Related Work

- | | |
|--|-------------------------|
| .1 Concrete Forming and Accessories | Section 03 11 00 |
| .2 Concrete Reinforcing | Section 03 20 00 |
| .3 Concrete Finishing | Section 03 35 00 |

1.4 Qualifications

- .1 The prime contractor shall have a minimum of five (5) years proven record of satisfactory performance of similar size projects in the welding trade and shall show proof before commencement of work that he will maintain a crew of competent and trades qualified welders. Minimum "C" level welding ticket. When requested contractor shall provide a list of three comparable jobs, including name and location, specifying authority/Project Manager, start and completion dates and cost amount of the welding work.
- .2 Contractor (applications) bidding work shall be approved by fencing materials manufacturer or his designate.
- .3 Only competent and trade qualified welders who have a provincial or interprovincial welding certificate of qualification and who are thoroughly experienced with the material and methods specified may perform welding work. Registered apprentices may be employed provided they work under the direct supervision of a skilled trades qualified welder in accordance with trade regulations.
- .4 General labour type activities may be performed by labourers and trades helpers who are thoroughly experienced with preparation procedures provided they work under the direction of a skilled trades qualified welder.

- .5 Individual trade certification and apprentice registration number must be presented to the Welding Inspector or his designated inspector upon request. A skilled trades qualified welder shall be present at all times during the execution of the work.
- .6 The contractor shall employ and keep on the job a qualified Charge Hand or Foreman who is fully experienced in all aspects of chain link fence installation to industry standards. He shall also have a provincial or interprovincial welding certificate of qualification. He shall be responsible for all work and receive instructions from the Board's representative during the absence of the contractor. This Foreman or Charge Hand shall not be changed whilst work is in progress without the written permission of the Board or unless said Foreman leaves the employ of the contractor.

1.5 Reference Standards

- .1 Signs attached to temporary construction fences and walkway shall meet the standards outlined in the City of Vancouver Sign By-Law Guide.

PART 2: MATERIALS

2.1 Framework

- .1 All framework shall be galvanized schedule 40 structural steel pipe that meets the requirements of ASTM-A53 galvanized coating not less than 1.80 oz/s.f. (550 g/m²).

2.2 Welding rods for shielded metal arc welding (SMAW)

- .1 The electrodes used in fence construction shall be low alloy, all position type that meets CAN.CSAW/483 – M 1982 specifications.

2.3 Chain Link Fabric

- .1 Standard duty chain link fence fabric shall be minimum 9 ga. (.148") (3.76 mm) galvanized wire woven to a 2" (50 mm) diamond pattern.
- .2. Heavy duty chain link fence fabric shall be minimum 6 ga. (.192") (4.90 mm) galvanized wire woven to a 2" (50 mm) diamond pattern.
- .3 Non-climbable chain link fabric shall be minimum 9 ga (.148") (3.76 mm) galvanized wire woven to a 1" (26 mm) diamond pattern
- .4 Minimum galvanized coating on standard, heavy and non climbable fences shall be not less than 490 g/m² (1.60 oz/ft²)
- .5 All chain link fabric to have a knuckle selvage at both ends. Knuckle to be closed or nearly closed to a measurement of less than the diameter of wire. Barb finish NOT accepted even if chain link is hung with barb finish down.
- .6 All chain link fabric to be free of production oils, free of dents and bends.

.7 Diamond count for standard, heavy and non-climbable fence

| | |
|-------------------------------------|--------------|
| 4' 0" (1220 mm) standard fence | 13½ diamonds |
| 6' 0" (1830 mm) standard fence | 20½ diamonds |
| 8' 0" (2435 mm) standard fence | 27½ diamonds |
| 4' 0" (1220 mm) heavy fence | 13½ diamonds |
| 6' 0" (1830 mm) heavy fence | 20½ diamonds |
| 8' 0" (2435 mm) heavy fence | 27½ diamonds |
| 4' 0" (1220 mm) non climbable fence | 27 diamonds |
| 6' 0" (1830 mm) non climbable fence | 39 diamonds |
| 8' 0" (2435 mm) non climbable fence | 53 diamonds |

2.4 Tie Wire

- .1 All chain link fabric ties shall be new 9 ga. (.148") (3.76 mm) hard aluminium wire.

2.5 Tension Bands

- .1 All tension bands shall be industry standard hot dipped galvanized steel of a inside dimension to the post on to which they are clamped. Minimum 13 gauge in thickness and minimum ¾ in. (20 mm) width.

2.6 Tension bars

- .1 Tension bar shall be continuous (unwelded) through the fabric height, hot dipped galvanized minimum 1.2 Oz/ft² (366 g/m²) of zinc coated surface area 3/16" (5 mm) x ¾" (20 mm) x chain link fabric height. ¼" (6 mm) galvanized round bar for non-climbable fences.

2.7 Post/Rail Caps

- .1 All post/rail caps shall be galvanized pressed steel, of identical style and with an inside diameter appropriate to the pipe O.D. which they are capping. Die cast, sand cast aluminium NOT acceptable.

2.8 Rails

- .1 All standard, heavy and non-climbable chain link fences shall have a top and bottom rail. All rails shall be hot dipped galvanized schedule 40, 1 7/8 (48 mm) O.D. with a minimum zinc coating of not less than 1.8 oz/ft² (550 g/m²). All rails to be welded continuous over top of line posts.

2.9 Line Posts

- .1 All standard, heavy and non climbable chain link fences shall have hot dipped galvanized schedule 40 pipe 2 3/8" (60 mm) O.D. with a minimum zinc coating not less than 1.8 oz/ft² (550 g/m²) posts set at maximum 10' 0" (3M) centres. All line post tops to be coped to accept top rail.

2.10 Terminal Posts

- .1 All standard heavy and non climbable chain link fence terminal (end, corner and gate) posts shall be hot dipped galvanized schedule 40 pipe, 2 7/8" (73 mm) O.D. with a minimum zinc coating of not less than 1.8 oz/ft² (550 g/m²)
 - .1 Gates up to and including 5' 0" (1525 mm) wide panels to have 2 7/8" O.D. (73 mm) gate posts.
 - .2 Gates up to and including 10' 0" (3050 mm) wide panels to have 3 1/2" O.D. (89 mm) gate posts.
 - .3 Gates up to and including 15' 0" (4572 mm) wide panels to have 4 1/2" O.D. (114 mm) gate posts.

2.11 Carriage Bolts and Hex Nuts

- .1 Carriage bolts for tension bands to be galvanized steel 5/16" (8 mm) x 1 1/4" (32 mm).

2.12 Tension Wire

- .1 Tension wire shall NOT be used.

2.13 Gates

- .1 All gates to be constructed from galvanized schedule 40 pipe 1 7/8" O.D. (48 mm) with a minimum zinc coating of 1.8 oz/ft² (550 g/m²).
- .2 All corners to be mitred, ground smooth and have 2 coats of approved zinc rich primer.
- .3 Gate height and chain link fabric to match perimeter fence.
- .4 Fabric to be fastened to gate frame with tension bars and tension bands (12" (305 mm) spaces). Aluminium tie wires every 5th diamond.
- .5 Gates to be installed with Industrial Metro Fence Hinges.
- .6 Single gates to have Stelco latch and catch or approved equal.
- .7 Double gates to have industrial cane bolt and pin latch.

PART 3: EXECUTION

3.1 Concrete Footings

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 All terminal and line posts for standard, heavy and non-climbable fences shall be set in a soil formed concrete footing. Each footing to be a minimum of 12" (305 mm) diameter by 36" (915 mm) deep. All concrete to be transit mixed with a minimum 25 MPA (3500 psi). Minimum pipe burial 36" (915 mm) into concrete footings.

3.2 Joints and Welding

- .1 No fittings, other than tension bands, tension bars and dome tops shall be permitted. All joints shall be coped to a radius appropriate to the post or other member to which they are to be welded. Crimping of pipe shall NOT be permitted. All steel dome tops to be tack welded in place.
- .2 All welded joints shall be full round with the joint attaining proper penetration and professional appearance. All splashes shall be filled, chipped or rounded off. All slag shall be removed. All welded joints shall be thoroughly cleaned with Zinga solvent or equivalent and coated with two (2) coats of an approved zinc rich primer (e.g. Zinga Cold Galvanization coating to a dry film thickness of 2 mils per coat).
- .3 All welds to be approved by the owner's inspector prior to the installation of the chainlink fabric.

3.3 Draping

- .1 All chain link fabric to be continuous vertically (i.e. no multi level draping of fabric permitted).
- .2 Fabric shall be taut, level and plumb.
- .3 Face side of fabric to be determined by owner prior to installation to suit individual site requirements and conditions.

3.4 Stretching

- .1 Every straight run of fabric shall be held in tension, by tension bar at each runs start and end. At no time shall it be permitted to stretch the fabric over a post at a change of angle in fence direction.
- .2 Stretching of the fabric during installation shall be done using a tension bar properly threaded through the chain link such that the chain link is not damaged. The fence fabric shall be taut after stretching to industry standards.
- .3 Tension bars to be fastened to terminal posts with tension bands spaced evenly at maximum 12" (305 mm) centres.

3.5 Tying

- .1 Standard, heavy and non-climbable chain link fabric shall be tied every 5th knuckle to the top and bottom rails.
- .2 All ties shall be double looped at both ends where anchored to the fabric and ends shall not constitute a safety hazard. All ties shall be made with one piece of wire. Any tie that fatigue breaks shall be removed and replaced.
- .3 Fabric shall be secured to each line post every 5th vertical diamond.

3.6 Cleaning

- .1 Upon completion of work, the site shall be left clean and free of the cut-offs, staples, excess wire, pipe or other construction debris. Any ruts caused by equipment shall be filled and levelled to specified surface tolerances to the owner's satisfaction.

END OF SECTION 32 31 13

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 exterior site furniture as indicated in the contract documents.

1.3 Related Work

- .1 Cast-in-Place Concrete Section 03 33 00
- .2 Precast Concrete Unit Paving Section 32 14 13

1.4 Requirements Included

- .1 Furnish all labour, materials, equipment and services necessary to supply and install tree grates, benches, bike racks and trash receptacles.

1.5 Warranty

- .1 The Contractor hereby warrants that the Site Furnishings and their installation will remain free of defects and in good condition in accordance with the General Conditions.

1.6 Reference Standards

- .1 Signs attached to temporary construction fences and walkway shall meet the standards outlined in the City of Vancouver Sign By-Law Guide.

PART 2: PRODUCTS

2.1 Tree Grates: See Landscape Drawings for Tree Grates.

- .1 Finish: Black, electrostatic finish, to manufacturer's specifications.

2.2 Bike Racks: See Landscape Drawings for Bike Rack.

- .1 Finish: Black, electrostatic finish, to manufacturer's specifications.

2.3 Benches: See Landscape Drawings for Benches.

- .1 Finish: Black - Electrostatic Powder Coating, to manufacturer's specifications.

2.4 Trash Receptacle: See Landscape Drawings for Trash Receptacles.

- .1 Finish: Black - Electrostatic Powder Coating, to manufacturer's specifications.
- .2 Contractor will provide two, (2), extra complete lids and one, (1), extra complete liners.

2.5 Concrete Planters: As shown on Landscape Drawings.

- .1 Model SRR36, Shallow Rolled Rim Planter, 36" Diameter, as distributed by Landscape Supply Company, Burnaby, B.C., Telephone: 604.435.4842, or approved equal.
 - .1 Finish: Acid Stained, Colour: CS-16 Faded Terracotta, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.
 - .2 Sealer: Cementone Clear Sealer, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.
- .2 Model SRR24, Shallow Rolled Rim Planter, 24" Diameter, as distributed by Landscape Supply Company, Burnaby, B.C., Telephone: 604.435.4842, or approved equal.
 - .1 Finish: Acid Stained, Colour: CS-16 Faded Terracotta, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.
 - .2 Sealer: Cementone Clear Sealer, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.
- .3 Model REC40, Rectangular Planter, as distributed by Landscape Supply Company, Burnaby, B.C., Telephone: 604.435.4842, or approved equal.
 - .1 Finish: Acid Stained, Colour: CS-16 Faded Terracotta, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.
 - .2 Sealer: Cementone Clear Sealer, manufactured by L.M. Scofield Company, distributed by Universal Concrete Accessories Ltd., Burnaby, B.C., Telephone: 604.299.8551, or approved equal.

PART 3: EXECUTION

3.1 *Installation*

- .1 Tree Grates:
 - .1 Assemble and install Tree Grate Frame and Tree Grate in accordance with manufacturer's instructions.
 - .2 Touch-up damaged finishes to the acceptance of Owner's Representative.
- .2 Bike Racks:
 - .1 Assemble and install bench in accordance with manufacturer's instructions.
 - .2 Bolt to concrete footing, and, or paving, as per manufacturer's specifications with 20 mm (3/4") Galv. bolts.
 - .3 Use galvanized fittings.
 - .4 Touch-up damaged finishes to the acceptance of Owner's Representative.
- .3 Bench:
 - .1 Assemble and install bench in accordance with manufacturer's instructions.
 - .2 Bolt to concrete footing, and, or paving, as per manufacturer's specifications with 20 mm (3/4") Galv. bolts.
 - .3 Touch-up damaged finishes to the acceptance of Owner's Representative.
- .4 Trash Receptacle:
 - .1 Assemble and install trash receptacle in accordance with manufacturer's instructions.
 - .2 Bolt to concrete footing, and, or paving, as per manufacturer's specifications with 20 mm (3/4") Galv. bolts.
 - .3 Touch-up damaged finishes to the acceptance of Owner's Representative.
- .5 Concrete Planter:
 - .1 Clean and acid stain planters in accordance with manufacturer's instructions.
 - .2 Seal cured planters in accordance with manufacturer's instructions.
 - .3 Place as shown on Landscape Drawings.

END OF SECTION 32 37 00

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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 a complete automatic irrigation system as indicated in the contract documents.
- .2 The work shall but is not limited to supply, installation, testing and commissioning;
 - .1 System piping, valves, conduit, control wiring, controls, control boxes and miscellaneous equipment
 - .2 Supply of water (potable) to the irrigation system
 - .3 Moisture sensor(s), controls and miscellaneous equipment.
 - .4 Complete winterization of Irrigation system
 - .5 Complete spring start-up of Irrigation system
 - .6 Complete computer control system, hardware and software
 - .7 Complete system maintenance and operation for one year from Substantial Performance

1.3 Related Work

- | | | |
|----|--|------------------|
| .1 | Plumbing Specification | Section 22 00 00 |
| 2 | Water Utilities | Section 33 10 00 |
| .3 | Electrical Specification | Section 26 00 |
| .4 | Growing Medium Preparation and Placement | Section 32 91 13 |
| .5 | Plants and Planting | Section 32 93 10 |

1.4 Codes and Regulations

- .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 that is at variance with current regulations shall be changed to comply with the requisite authority at no cost to the Owner.
- .2 Work Safe BC regulations shall be followed.

- .3 Signs attached to temporary construction fences and walkway shall meet the standards outlined in the City of Vancouver Sign By-Law Guide.

1.5 Quality Assurance

- .1 The Contractor is responsible for the coordination with the mechanical and electrical Owner's Representative and sub-contractors as well as for coordination of all required sleeves under paved areas and through planter walls as specified.
- .2 The Contractor is to verify site measurements and irrigation coverage, and unless deficiencies are identified by the contractor and an amendment is made to the Contract Document prior to the quotation date, the Contractor accepts full responsibility to deliver the intended performance of the system at no additional cost to the Owner. If any conditions are subsequently observed on site that will impair proper and intended uniform irrigation coverage, notify the Owner's Representative as soon as possible, and inform what the impairment is and its resolution. Do not proceed with any work that would yield unsatisfactory coverage as it will not be accepted.

1.6 Qualifications

- .1 All irrigation work shall be done by a suitably experienced and qualified irrigation contractor, having trained and competent personnel for the scope of the work. Utilizing staff certified by the IIABC in disciplines as certified Irrigation Technician Level 1 or 2 and Certified Irrigation Designer.
- .2 Installation of low voltage wiring requires contractor to have low voltage electrical certificate, as certified by the BC Electrical Safety Branch.

1.7 Submittals

- .1 Maintenance Data and Operation Instructions/Manual: Prior to and as a condition of Substantial Performance, submit to the Owner's Representative three (3) copies of an operating and maintenance manual containing operational information for all operating components, cleaning and lubrication schedules, overhaul/adjustment schedules and similar maintenance operations. Each manual shall be bound in a three ring binder.
- .2 As-Built Drawings: As a condition of Substantial Performance, submit with the operating and maintenance manuals, a suitably scaled reproducible copy of the "as-constructed" installation of the system. This drawing shall be accurately drawn, showing all components of the irrigation system as installed, with clear measurements provided from identifiable reference points (in metric). As-built drawings shall include invert depths and offset measurements; all such measurements must be taken during construction.
- .3 A plasticized site plan shall be installed in the controller showing the location of each and every solenoid valve, type of valve, with identified zone number, location of the controller, DCVA, control and flow meter valve, pressure regulating valve, booster pump if installed, isolating valves and water supply – with a north reference point

All solenoid valves are to have a type 316 stainless steel tag attached, 25 mm in diameter, indicating the number of the operating zone, and all zone conductors in the controller shall be correlated with the controller program and numbered in adherence thereto.

- .4 Maintenance Devices: Submit to Owner's Representative two (2) sets of all special tools, keys, and equipment that is required to commission the system or as otherwise specified in the Contract Documents.
- .5 Commissioning: Instruct Owner's Representative in the complete operating and maintenance procedures for this system. This instruction shall include but not be limited to showing the relative timing differences between zones of different precipitation rates and a schedule of run times suggested for various weather conditions.

1.8 Site Conditions

- .1 Existing Conditions/Underground Services: The Contractor is to verify all existing services, locate all on-site utilities and underground services by hand digging or by use of an electronic toning device or M-Scope. Mark the location of all buried cables, conduits, pipes etc., and prior to any trenching. Cooperate with the Owner and utility companies to keep their respective utilities in operation. Notify Owner's Representative immediately for directions as to the procedure should any piping utilities be affected during excavation.
- .2 Site Preparation: Prior to the work of this Section, the Contractor is to carefully inspect any installed work of other trades or contractors and verify all such work is complete to the extent that this work may properly begin.
- .3 Field Measurements: Make all measurements in the field to confirm that the design meets the onsite conditions to ensure the precise fit of items in accordance with the original design and performance criteria.
- .4 Discrepancies: In the event of major discrepancies, errors or conflicts between the drawings and the actual site conditions, immediately notify Owner's Representative as to procedure before proceeding with work.
- .5 Repair to Underground Services: Repair or replace all damage to underground services caused by the work of this Contract. Damage to services that are shown on the drawings or have been brought to the Contractor's attention in the field prior to commencement or during construction of the work shall be repaired in its entirety at the Contractor's expense. (Damage to services that were clearly unforeseen/unknown of existence (provided that all reasonable measures were undertaken by the Contractor to ascertain the existence of these services) shall be repaired in accordance with the Changes clause of the General Conditions). Notify Owner's Representative of damage immediately and co-ordinate replacement or repairs through her/him

1.9 Protection

- .1 Protect existing buildings, equipment, sidewalks, landscape reference points, monuments, markers and other completed work. Make good any damage resulting from work of this Contract at no expense to the Owner.
- .2 Do not park vehicles on the site in areas where the work will be undertaken without express written consent of the Owner's Representative. Utilize only such equipment/vehicles essential for construction of the system.
- .3 Protect the work and material of all other trades from damage. Make good all damages from work of this Contract at no expense to the Owner.
- .4 The Contractor shall be responsible for work and equipment until finally reviewed, tested, and accepted by Owner's Representative.
- .5 Store materials and equipment received on site that is not immediately installed in a secure location.
- .6 Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructive material.
- .7 Trenching and other excavations for vaults, valve boxes etc. are not to be left open during non-work hours of operation unless they are protected to current WorkSafeBC Standards. Cover, mark, and/or protect as necessary all open excavations to ensure worker and public safety.

1.10 Warranty

- .1 Provide a written Warranty for all workmanship and materials for one year from date of Substantial Performance. Make all corrections, adjustments and maintenance operations required as a result of failure of the irrigation system to perform due to the work of this Section.
- .2 Manufactured products, including but not limited to irrigation heads, quick couplers, controllers, valve boxes and valves, shall be warranted as per the manufacturers' standard warranty period or a minimum of one year, whichever is greater.

1.11 Sequence

- .1 Coordinate and ensure the installation of all sleeves and irrigation piping as required under all paved surfaces and through planter walls as noted on the drawings.
- .2 The Contractor is to verify the location of the municipal water supply connection point for the automatic irrigation system. Coordinate as necessary.
- .3 The Contractor is to verify the location of the control cabinet and install a minimum 50mm PVC electrical conduit for the low voltage wires from the control cabinet to a point a minimum of 600mm below grade to the top of the PVC conduit and 1.5 meters horizontal from the control cabinet. There shall not be an in-grade junction box below the control cabinet.

1.12 Review

- .1 Prior to commencement of any work related to this irrigation project, the contractor is required to make contact with the designated Owner's Representative authorized to make project decisions.
- .2 All work is to remain uncovered for inspection of workmanship and materials. Notify Owner's Representative a minimum of forty-eight (48) hours prior to required inspections. Failure to provide such notice and closing in of un-inspected work is sufficient grounds for withholding any payments due to the Contractor. All buried work that has not been inspected and approved will have to be totally uncovered.

PART 2: PRODUCTS

2.1 General

- .1 Product Handling
 - .1 Deliver and store materials in new condition, in unopened containers and protect until installed. Deliver, handle and store pipe and fittings so as to avoid gouging, bending or cracking.

2.2 Pipe and Fittings

- .1 Mainline pipe shall be Schedule 40 polyvinyl chloride (PVC) conforming to ASTM D1784-97, D1785-96B and/or CSA B137.3-93 standards. (ASTM F441/441M-97 or CSA B137.6-96 for CPVC). It shall be extruded, virgin, high impact pipe conforming to Cell Class 12454-B, solvent weldable with belled ends, and continually and permanently marked showing manufacturer's name or trademark, type of material, pipe size and pressure rating.
- .2 Lateral line pipe shall be SDR-21 pipe. It shall be extruded, virgin, high impact pipe meeting the requirements of ASTM D2241. It shall be equal to or exceed Cell Class 12454 as defined in ASTM D1784, solvent weldable with belled ends, and continually and permanently marked showing manufacturer's name or trademark, type of material, pipe size and pressure rating.

Size and Classes as follows:

| <u>Size</u> | <u>Class</u> |
|--|-----------------|
| Lateral line pipe 19 - 25 mm. diameter | SDR-21 PVC |
| Lateral line pipe 31 -100 mm. diameter | SDR-21 PVC |
| Mainlines, any size | Schedule 40 PVC |

- .3 Plastic Pipe Fittings:
 - .1 GSR Schedule 40 PVC conforming to ASTM D-2466-97 (and F438-97 for CPVC) standards and be of the same material as the pipe. Fittings shall be designed for solvent welding to PVC pipe except where valves, risers, etc. require threaded joints.

- .2 Fittings for PVC pipe shall be 2/3 to full interference fit to ensure a fully sealed joint. Provide a minimum two (2) times depth of insert of fitting clearance between fittings to allow for repair. No exception.
- .3 All threaded connections shall be joined with minimum three (3) wraps Teflon Tape: no substitutions accepted.
- .4 Threaded nipples shall be Schedule 80 PVC and be manufactured from the same material specified for the pipe.
- .5 Threaded connections of PVC to metal shall have Male threads on the PVC and Female threads on the metal (Schedule 80 MI adapter)
- .4 Primers and Pipe Solvents: Approved type as recommended by pipe manufacturer for the temperature and conditions under which the work is being performed. Deliver in sealed containers clearly marked with name of manufacturer and lot number. Use "Wet 'R Dry" 725 Cement and "Wet 'R Dry" P-75 Primer or approved equivalent.
- .5 Sleeves: In locations noted on the drawings and sized a minimum of two (2) nominal pipe sizes larger than any irrigation lateral line to be carried and a minimum of three (3) minimal pipe sizes larger if carrying a mainline:
 - .1 Shall be cast iron piping under all designated vehicular access routes.
 - .2 Shall be Schedule 40 PVC under all other paved surfaces, through walls, and through or underneath footing walls.

2.3 Valves and Valve Boxes

- .1 Solenoid Valves: New, pristine quality valves manufactured by Rain Bird, PGA Series or pre-approved equivalent of the types indicated on the drawings and sized appropriately and according to design. Integrally regulated solenoid valves are not acceptable unless site topography deems their use necessary and specific approval by Owner's Representative has been given. Integrally regulated solenoid valves will not be considered as pre-approved equals.
 - .1 Rain Bird PRS Dial Valve Pressure Regulator shall be installed on all valves operating Toro 570Z series sprinklers.
 - .2 Rain Bird PRS Dial Valve Pressure Regulator shall be installed on all valves operating Rain Bird 5000 series sprinklers.
- .2 Quick Coupler Valves: Brass, 19 mm. installed with schedule 80 nipples, couplings (if used) and triple threaded swing joints. Install Q.C. at location shown on drawings. Accommodate Q.C. in valve box or separate enclosure, as required, and install in active, non-solenoid valved lined solenoid valved line. Ensure top of Q.C. valve is installed a maximum of 50 mm. below lid of valve box to allow easy key operation.
- .3 Isolation Valves: Cast Bronze gate valves with non-rising stems: R&W Model 280 or pre-approved alternative for 13 mm up to and including 63 mm diameter and R&W non-rising, cast iron flanges, Model 415 for 75 mm and larger diameter.

- .4 Bronze Ball Valves: Threaded hubs, Cambridge, 50mm, Model #202 NL-H7F7 or appropriate model number to suit specified diameter of Shut-Off curb stop type or pre-approved alternative.
- .5 Valve Boxes: Shall be green plastic irrigation boxes complete with captive lock bolt cover complete with S.S. bolts, sized to suit valves and other components with adequate room for operating and maintenance access:
NDS - 113 BC (14" x 19") 1-2 of 1" sized valves or 1 only of 1 ½" or 2" sized valves
NDS - 117 BC (17" x 20") up to 3 of 1" sized valves, no more than 2 of 1 ½" or 2" sized valves

2.4 Sprinkler Heads

- .1 New pristine quality heads manufactured by Rain Bird or pre-approved equivalent of the types and sizes indicated on drawings.
 - .1 Sports field/Playfield Heads: The full or part-circle sprinklers shall be Rain Bird Falcon 6504 Series plastic or approved equivalent.
 - .2 Large Open Area/Passive Lawn Heads: The full or part-circle sprinklers shall be Rain Bird 5000 Series plastic or approved equivalent.
 - .3 Small Lawn Areas/Shrub Bed Areas: The full or part-circle sprinklers shall be the fixed spray type Toro 570Z series with MPR plus spray nozzles or approved equivalent designed to provide matched precipitation rates.

2.5 Control and Common Ground Wiring

- .1 Obtain Electrical Permit for the work from Permits and Licenses, City of Vancouver.
- .2 Use insulated solid copper wire, minimum #14 AWG, TWU insulation of a type approved by the governing electrical authority and by CSA for direct underground burial, sized to suit loads, and distances. Maximum voltage loss shall be three percent (3%). Insulation colour for control/signal conductors shall be consistently applied throughout the system, and white conductor shall always be the common wire.
- .3 Confirm control wire size with the manufacturer of zone control valves to ensure wire is sized to the length of its run and in compliance with the current Canadian Electrical Code, as amended by the Province of British Columbia and the City of Vancouver.
- .4 Wire, breakers, conduits and related materials that comprise the electrical supply to the controller shall be CSA approved, and installation shall be pursuant to the Canadian Electrical Code, as amended by the province of British Columbia and the City of Vancouver. Underground installation of electrical wiring must comply with Table 53 of the CEC, Part 1.

2.6 Miscellaneous Materials

- .1 Electrical Tape: All weather, black plastic 19 mm wide, a minimum 0.1778 mm thick, or use approved equal.

- .2 Electrical Wire Splices shall be made watertight with CSA approved watertight connectors. No splicing of wires shall occur unless located in an accessible box and shown on the As-Built Drawings.
- .3 Thread Lubricant: Type manufactured for plastic to metal connections such as Teflon tape or Permatex 2.
- .4 Conductors in the Control Cabinet must all be terminated on terminal strips suitable for wire size.

2.7 Automatic Controller

- .1 Rain Bird ESP-LXME2-PRO Modular Controller with IQ 4G cartridge (no SIM card).

2.8 Cabinet for Controller

- .1 Two (2) electrical circuits rated at 15 amps 120 volts shall be installed to the Control Cabinet.
- .2 The Control Cabinet shall be CSA approved and of the type specified on the drawings, complete with approved weather proof lockable metal door and grounded by means of ground rods or plates. It must be large enough and capable of providing all necessary features for programming equipment for the irrigation system as designed.

2.9 Back Flow Preventer

- .1 Watts Series 007M1QT double check Backflow Prevention Assembly, complete with gate valves, or pre-approved equal.
- .2 All back flow preventers larger than 50 mm shall be the approved type or pre-approved equal.
- .3 All back flow prevention devices to be CSA and BCWWA approved and conform to all current Municipal cross connection control standards as applicable.

2.10 Service Vault

- .1 All back flow prevention devices larger than 50mm (2") to be located in precast concrete vaults complete with concrete bottom that shall be sized as shown on the drawings,
- .2 The vault shall be supplied by AE Precast Concrete Products or shall be a pre-approved alternative.
- .3 Vaults shall be supplied complete with double hinged, galvanize steel checker plate locking covers, with lock and hasp assembly which shall be recessed below top of lid. Lids are to extend the full length of the service vault to allow for unimpeded access into the vault. Each lid is to be a maximum weight of 27 kg each. Install service vault flush with finished grade.
- .4 The piping and valve assembly within the vault must be adequately supported and braced (minimum two (2) riser type supports and two (2) side wall supports), with adjustable supports, complete with riser, pipe clamps, galvanized metal and stainless steel bolts. Install as per provided schematic drawing.

- .5 All piping inside the vault is to be brass or type, and is to extend a minimum of 300 mm outside the vault on the downstream side and a minimum of 150 mm on the upstream side.
- .6 The top of the piping shall be 600 mm from the top of the lid. The service vault shall be filled with 25 mm drain rock to within 300 mm of the bottom of the pipe. Contractor shall install a 100 mm PVC drainpipe, complete with a backwater valve. The vertical section of the drainpipe is to be perforated and terminating with a grate that is flush with the surface of the drain rock. The drainpipe is to run (minimum of .5% slope) into a catch basin or an approved drainage system.
- .7 PVC connections to brass female thread outside the vault on the downstream side are to be made with schedule 80 PVC nipple and schedule 80 fitting.
- .8 Inside vault piping shall be brass including the triple threaded swing joints for winterizing quick coupler, or pre-approved alternative.
- .9 All piping to vault from the city service is to be type K copper or pre-approved alternative.
- .10 Alternate sized vaults will be considered on a case-by-case basis as part of the shop drawing review process.

2.11 Pressure Reducing Valve

- .1 Watts Series 223 sized to system: Range 173 KPa to 470 KPa or pre-approved alternative.

2.12 Flow Sensor and Master Valve

- .1 Flow Sensor shall be Rain Bird plastic impeller flow sensors installed to manufacturer's specifications with upstream master valve sized appropriately.
- .2 PE-39 #19 AWG shielded wire shall be installed to the controller from the flow sensor. Wire from the master valve to the controller shall be #14 AWG TWU, one of which must be white and one shall be a different colour (two total wires).

2.13 Approved Equals

- .1 All items as specified or pre-approved equivalents.
- .2 Proposed equivalents shall meet or exceed the specifications in performance, flow, pressure loss and all other important characteristics of the original equipment specified.
- .3 The alternative equipment shall be of good quality construction, with a proven record of trouble free performance and low maintenance, on projects of similar size and scope.
- .4 The proposed equivalent must be available from a local distributor with a well-stocked inventory of all readily available spare parts.
- .5 The alternative equipment must have an equivalent warranty to the original equipment specified.
- .6 Alternative equipment must be compatible with all other remaining system components and must be agreed upon by both parties to the contract.
- .7 Submission guidelines for approval of equal products must be strictly adhered to or no consideration for approval as equals will be considered.

PART 3: EXECUTION

3.1 Irrigation System Layout

- .1 Establish and coordinate exact locations of lines, valves and heads, with planting locations to avoid conflicts and damage to plants during installation. Stake locations for approval by Owner's Representative. The Contractor is to verify grades for all components.
- .2 Layout the piping and sprinkler locations with flags or short lengths of pipe, in accordance with the drawings, and obtain the approval of the Owner's Representative before proceeding. The layout shall be in accordance with the drawing. The Owner's Representative must approve alternative layouts.

3.2 Installation of Piping

- .1 The Contractor is to verify that all pipe, fittings, primers and cements are compatible for proper installation.
- .2 Obtain field assistance from pipe manufacturer/supplier as necessary to ensure correct installation and adhesive techniques are used on joints.
- .3 Do not cement pipe and fittings under wet or muddy conditions and follow the manufacturer's recommendations.
- .4 Layout the piping system in accordance with drawings. Route piping to take into account site elevation changes and to minimize low head weeping subsequent to shut down.
- .5 No irrigation line shall be directly over and parallel to another irrigation line or any other service line. Ensure minimum horizontal and vertical clearance requirements as dictated by Canadian Electrical Code for all piping installations near any electrical conduit/service.
- .6 Where possible, main supply lines may occupy the same trench as lateral sprinkler lines, provided that a minimum horizontal clearance of 150mm is maintained. Multiple lateral lines may occupy the same trench provided that a minimum of 50mm horizontal clearance is maintained and the pipes are all on the same plane.
- .7 Install pipes in long 'S' curves to allow for expansion and contraction.
- .8 Comply with all the manufacturer's printed data and recommendations regarding pipe cutting, cleaning, bevelling, deburring, fitting preparation, primer and cement application and correct joining techniques. Ensure that all joints are properly fused and bonded and that all curing times given site climatic conditions are fully observed prior to testing or charging of piping system.
- .9 Install yellow warning tape approximately 250mm above all mainline runs with low voltage wiring located below piping. Warning tape on lateral lines is not required.
- .10 Trenching:
 - .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.

- .2 Open excavation shall be carried out in a safe and orderly manner and in accordance with the requirements of the Workers' Compensation Act of B.C. Approved shoring shall be used where required for safe working conditions.
- .3 All trenches are to be hand or machine excavated. Pulling pipes is not acceptable. All trenches shall be dug on the alignment and to the depth required as shown on the drawings and as stated herein. In any event, the water main service pipe shall be buried to a depth of at least 750 mm below ground. The irrigation main and zone lines shall be buried to a depth of at least 406 mm below the surface measured to top of pipe. Trenches are to be straight with uniform slopes to the bottom of all trenches.
- .4 Where the pipes are to be laid in sub-surface material the trench shall be excavated to a depth at least 100 mm below the bottom of the pipe elevation. The trench shall be backfilled with at least 100 mm of sand passing a 5 mm sieve and be carefully compacted by hand.
- .5 Prior to backfilling, all lines, valves and fittings shall be inspected by Owner's Representative, where required.
- .6 Trenches shall be at least 300 mm away from paving stones or other hard surfaces to avoid undermining such surface or its edge retention.
- .7 Backfilling shall take place in an orderly fashion. Where the line is within an enclosed planting bed or sod lawn area and does not penetrate below the growing medium, the growing medium shall be carefully placed over the pipe and be carefully tamped by hand to achieve compaction equivalent to the surrounding area. Where the lines penetrate the native soil or sub-surface fill, backfilling to a depth of 100mm over the top of the pipe shall be carried out with sand passing a 5 mm sieve and be carefully compacted by hand.

The remainder of the backfill to finish grade shall be with suitable material, free of any rocks over 25mm in diameter and other similar materials that could damage the pipe or create unusual settling conditions.
- .8 Compact the growing medium to the same density as the native material in the trench sidewalls to prevent differential settlement.
- .9 Fill piping with water at approx. 0.172 MPa during backfill operations.
- .10 Contractor is responsible to repair all trenches which have settled below the adjacent grade for a period of one (1) year from date of Substantial Performance.
- .11 Material refuse such as pipe pieces, excess wire, rags, fittings or PVC cement canisters shall not be left as a part of backfill in any of the trenches.

3.3 Installation of Equipment

- .1 General: Install all equipment as shown in plans and details, using specified and appropriate pipes, connectors, cements, lubricants, solvents for each type of joint.

- .2 Valve Boxes: Install valves in valve boxes, allowing adequate space within boxes for proper operation/servicing of each component. Keep the valve box clean and clear of all debris that may fall into it during construction/installation. Ensure a minimum 150 mm of 19 mm drain gravel is placed in the bottom of each valve box. Additionally, ensure the following:
 - .1 The top of the valve box is to be level and flush with grade and located in shrub areas where possible.
 - .2 Valves are to be installed vertical and centred.
 - .3 Valve boxes are to be blocked (with brick or concrete pavers) so that neither blocking nor valve box rest on lateral or mainlines when supporting the weight of expected forces on the top of the box.
 - .4 Quick coupler valves to be installed within valve boxes in active, non-solenoid valved line or in specified designated solenoid valved line.
- .3 Automatic Controllers: Ensure controller(s) are located to allow for maximum viewing of the system operation. Install in location shown on drawing. If not shown coordinate location with Project Manager prior to starting work. Install at 1500 mm height to the centre of the Cabinet or as otherwise detailed at location shown. Make all connections to optimize the operation and sequencing station valves in a logical manner to expedite proper testing of all system operations.
- .4 Control Wiring: Protect control and common wiring by installing beneath irrigation mainline. Obtain approval from Owner's Representative for all wiring to be installed in separate trenching and protect with Yellow Buried Wire Warning Tape that shall be 200 mm above the wires. Leave additional 600 mm of each wire at each valve and neatly coil and wrap excess. Wrap conductors with electrical tape at 900 mm intervals. Make wire splices only in accessible valve boxes. Minimize the number of splices. As much as possible ensure that wire runs are continuous without interruption. Run control wiring from valves and connect to automatic controller. Install control wiring in a conduit that extend 1500 mm horizontally from the vertical connection point of the controller, with the horizontal portion 600 mm below grade to the top of the pipe. Electrical conduit to be a 50 mm diameter PVC with a sweep elbow from below grade to bottom of controller cabinet location. Ensure that conduit is clamped to mounting surfaces with conduit pipe clamps at 250 mm on centre spacing or as detailed.
- .5 Quick Coupler Valves: Install in valve box to allow for easy insertion and rotation of quick coupler keys, with the top of the Quick Coupler installed a maximum of 50 mm below the lid of the valve box, on Schedule 80, triple threaded swing joints and nipples to provide sufficient "give" should a hose or line be pulled.
- .6 Irrigation Heads: Install all heads on triple swing joint assemblies of the same size as the sprinkler inlet. Adjust all heads to 12 mm below finished grade for sodded lawn areas once sodded lawn has been approved by Owner's Representative.
 - .1 All sprinkler heads to be installed a minimum 50 mm away from any hard surface.

3.4 Testing

- .1 Closing in Work:
 - .1 Obtain approval from the Electrical Inspector before backfilling any section of the underground electrical installation.
 - .2 Obtain approval of Owner's Representative before backfilling any sections of the irrigation system.
 - .3 Any work closed in before inspection will be required to be re-exposed for inspection at no extra cost to the Owner. Provide 48 hours minimum notice to Owner's Representative to arrange inspections and review of pressure testing.
- .2 Testing: Upon completion of the irrigation system, arrange with the Owner's Representative to be present to observe pressure testing. Test all plastic pipe and sprinklers as follows:
 - .1 After the pipe is in place in the bottom of the trench with risers in place, cap the risers where the sprinklers will be attached and insure that all pipe, couplings and fittings are exposed.
 - .2 Apply a pressure of 0.551 MPa (80 psi) to each section, using a test pump and calibrated container. Inspect visually for leaks at couplings and fittings, cut out and replace any that leak. Maintain test pressure for two (2) hours. After replacing any defective sections, pressure test for two (2) hours and note any pressure loss.
 - .3 After approval by the Owner's Representative, backfill the pipe maintaining pressure in the line, noting any sudden drop in pressure. If there is any indication of a leak, locate the defective section and replace. Leaks shall not be repaired by patching.
 - .4 Provide written documentation that pressure testing has been completed satisfactorily, including re-testing (for 2 hours) of all defective sections. Written notice shall state the date, parties present, pressures applied and duration of pressure tests.
- .3 Flushing: after testing and prior to attaching sprinklers, flush out each section to remove any dirt accumulated.
- .4 Adjustment: Adjust the irrigation heads for optimum coverage and rate of flow, including minor adjustment in actual head locations. Set the controller operation times as dictated by Owner's Representative. The Contractor is required to balance and adjust the various components of the system to ensure the efficient operation of the system. This includes the adjustment of any pressure regulators, full and part circle radius heads, valves and adjustments to controllers.
- .5 Systems that are Substantially Complete on or after September 15th, shall be left in a winterized state as per Item 3.5. This contractor is responsible to return the following Spring at a time dictated by the Project Manager and start-up the system and perform all maintenance functions necessary to provide a fully operating system.
- .6 Coverage Test: When the irrigation system has been completed, a coverage test shall be completed in the presence of the Owner's Representative to determine if coverage of water on planted areas is complete and determine if any adjustments are required.

- .7 Controller Test: As part of the above, and prior to Final Acceptance by the Owner's Representative, the automatic controller(s) shall be set in sequence and thoroughly tested through each zone to determine if any adjustments are required.
- .8 Submit Certificate of Double Check Valve Assembly Test and Pass at the time of Substantial Completion.

3.5 Winterizing

- .1 Winterize the system for the first time with the Owner's Representative and Owner's Representative observing. Winterizing shall include all operations necessary to protect the system from freezing temperatures, including manual and solenoid valve operations to isolate vulnerable parts of the system and draining components and pipes and/or blowing water out of all pipes with compressed air.

3.6 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 Trenching, laying pipe and backfilling shall be continuous so that the amount of open trenching at the end of each workday is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility marking tape to current WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structures/elements due to settlement of improperly compacted trenches shall be immediately repaired at the Contractor's expense to satisfaction of the Owner's Representative.
- .4 Remove and dispose from the site any and all surplus material, excess excavated materials, trash, debris and waste material arising from the work of this Section.

END OF SECTION 32 80 00

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 for the supply and installation of growing medium to pond areas indicated in the contract documents.

1.3 Related Work

- | | | |
|----|-----------------------------|------------------|
| .1 | Excavation and Backfill | Section 31 23 10 |
| .2 | Plants and Planting | Section 32 93 10 |
| .3 | Subsurface Drainage Systems | Section 33 46 16 |

1.4 Reference Standards

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 CSLA Canadian Landscape Standards
 - .2 Canadian System of Soil Classification
 - .3 Canadian National Master Construction Specification, 32 91 19.13 Topsoil and Grading.

1.5 Materials Definitions

- .1 For the purpose of this specification the term "growing medium" shall mean a mixture of mineral particulates, micro organisms and organic matter which provides a suitable medium capable of supporting the intended plant growth.

1.6 Testing

- .1 Submit to the Owner's Representative a copy of growing medium analysis from a laboratory approved by the Owner's Representative. The analysis shall be of tests done on the proposed growing medium from samples taken at the supply source within three weeks immediately prior to soil placement. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the contractor. **Results of these tests shall be presented to the Owner's Representative for review BEFORE any pond growing medium delivery to site.** Pond growing medium placed prior to the review of test results by the Owner's Representative will result in rejection of pond growing medium and subsequent removal of material by the contractor at no cost to the owner.
- .2 The analysis will include measurement of percent sand, fines, (silt and clay), and organic matter to total 100%, pH, lime required to achieve pH 6.5, water soluble salts, total carbon to total nitrogen ratio, total nitrogen and available levels of phosphorus, potassium, calcium and magnesium
- .3 The analysis shall outline the testing laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed growing medium meet the requirements of this specification.
- .4 At the discretion of the Owner's Representative submit up to two additional samples at intervals outlined by the Owner's Representative of pond growing medium taken from material delivered to site. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Owner's Representative for review.
- .5 Failure to satisfy these contractual requirements could result in the contractor being required to remove unacceptable growing medium at their expense.

1.7 Submittals

- .1 Growing Medium Sample: One composite sample. Sample shall be a composite of at least three samplings from the proposed source, and shall be at least one (1) litre in volume.

1.8 Quality Control

- .1 Carry out pond growing medium preparation and placement such that the final product matches the standard established which has incorporated the recommendations for amendment by the testing laboratory.
- .2 Protect Liner, Base, and Walls, at all times.
- .3 Imported growing medium is to be free of all foreign debris and non-typical soil components including small pieces of plastic bags, plastic pieces like parts of containers or labels, dimensional lumber, metal and glass. Evidence of more than 5 pieces of foreign materials observed within the imported growing medium will result in the rejection of all of the growing medium and its immediate removal from the site.

PART 2: PRODUCTS

2.1 General

.1 Product Handling

- .1 Do not move or work growing medium or additives when they are excessively wet, extremely dry, frozen, mixed with ice and/or snow, or in any manner which will adversely affect growing medium structure. Growing medium whose structure has been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner.
- .2 Protect growing medium and additives against extreme wetting by rain or other agents, and against contamination by weeds and insects.
- .3 Deliver fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.
- .4 Stockpile materials in bulk form in paved areas and provide protection by storing under roof or tarpaulins. Take all necessary precautions to prevent contamination of component materials from wind blown soils, weed seeds and insects. Contamination of individual components may result in rejection, if used.
- .5 All growing medium will be delivered to site **premixed** from a recognized growing medium source ensuring consistency throughout the mix.

2.2 In pond Growing Medium

- .1 Growing medium shall be imported and stockpiled on site in an approved location. Stockpiling work shall be such that the soil is not damaged or contaminated.
- .2 In pond/stream Growing Medium shall be substantially free of pests, roots, wood, construction debris, undesirable grasses including crabgrass or couch grass, noxious weeds or weeds, or other foreign objects.

2.3 Fertilizer

- .1 Complete commercial synthetic slow release fertilizer meeting the requirements of the Canada Fertilizer Act, packed in water proof containers, clearly marked with the name of the manufacture, weight and analysis.
- .2 Formulation ratio: as per soil test recommendations.

2.4 Organic Material:

- .1 Submit sample prior to shipping to site:
- .2 Organic Material shall be Soil Amender, black/brown in colour, manufactured by Fraser Richmond Bio-Cycle, Richmond, B.C., or pre-approved equal.

2.5 Wood Residuals

- .1 Content of wood residuals such as Fir or Hemlock sawdust present in the growing medium shall not cause the total Carbon to total Nitrogen ratio to exceed 40 to 1. Cedar or redwood sawdust shall not be present in growing medium.

2.6 Sand

- .1 Sand will be river pump sand or pit run sand satisfying the following gradation, (dry weight basis):

| SIEVE SIZE | CLASSIFICATION | % RETAINED |
|-------------------|------------------|------------|
| No. 4 (4.76mm) | Gravel | 0% |
| No. 10 (2.0 mm) | Fine gravel | 0-5% |
| No.18 (1.0 mm) | Very coarse sand | 5-10% |
| No.35 (0.50 mm) | Coarse sand | 15-20% |
| No.60 (0.25 mm) | Medium sand | 50-75% |
| No.140 (0.105 mm) | Fine sand | 5-15% |
| No. 270 | Very fine sand | 0-2% |
| Passing No. 270 | Silt, clay | 0% |

2.7 Standard For Prepared Pond Growing Medium

- | | | |
|----|---|---|
| .1 | Texture: Particle Size Class and Properties by the Canadian System of Soil Classification. | Percent Dry Weight Mineral Fraction (%) |
| | Greater than 40mm | 0% |
| | Coarse Gravel (greater than 19mm less than 40mm) | 2-5% |
| | Gravel (greater than 2mm less than 40mm) | 5-10% |
| | Sand (greater than 0.05mm less than 2mm) | 75-85% |
| | Silt (greater than 0.002mm less than 0.05mm) | |
| | Clay (less than 0.002mm) | |
| | Fines (Clay and Silt combined) | max. 15% |
| .2 | Acidity (pH) | 6.0- 7.0 |
| .3 | Drainage: | |
| | Percolation shall be such that no standing water is visible 60 minutes after at least 10 minutes of moderate to heavy rain or irrigation. | |
| | Minimum saturated hydraulic conductivity (cm/hr) in place | 7.0 |
| .4 | Organic Content: | |
| | Percent of Dry Weight (%) | 5-10% |

PART 3: EXECUTION

3.1 Mixing Prepared Growing Medium

- .1 Screening and mixing of pond growing medium on site will be not be allowed. All growing medium is to arrive pre-mixed with the exception of additional organic matter recommended by the soil analysis that may be top-dressed and cultivated into the surface layer of the supplied growing medium.
- .2 Apply growing medium amendment at rate determined by testing laboratory's recommendations.
- .3 Mix amendments well into the depth of supplied growing medium recommended by soil analysis for growing medium and utilizing the recommended method of tillage.

3.2 Preparation

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Verify liner and granular fill have been installed
- .3 Place filter medium over entire granular fill and anchored into adjacent boulders and logs. Where fabric, seam exists ensure joint overlap of a minimum of 150 mm (6").
- .4 Extend filter medium to within 25 mm (1") of finished grade of growing medium.

3.3 Placement Of Pond Growing Medium

- .1 Place growing medium prior to filling the pond with water. Ensure growing medium is protected from erosion and damage during filling of pond.
- .2 Do not place growing medium until the Owner's Representative has reviewed subgrade.
- .3 Fill material that does not conform to the specification shall not be used.
- .4 Place prepared growing medium in compacted layers of 100 mm to 150 mm (4" to 6") in planting areas on grade.
- .5 Place growing medium to the required finished grades with adequate moisture, in uniform layers, during dry weather, over approved, dry, unfrozen sub grade where planting is indicated to the following minimum depths:
Shrub and Ground Cover areas: 450 mm (1'-6")

3.4 Weed Control

- .1 Eliminate all weeds and weed roots from growing medium.
- .2 Have method for elimination of weeds reviewed by the Owner's Representative prior to any action by the contractor.

3.5 Finish Grading

- .1 Fine grade (manually) growing medium areas to contours and elevations shown on drawings or as directed by the Owner's Representative. Eliminate rough spots and low areas to ensure positive drainage.
- .2 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.

3.6 Surplus Material

- .1 Dispose of surplus growing medium off site.
- .2 Clean all excess growing medium off walls, logs, and rocks as required.

END OF SECTION 32 91 13.33

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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. Growing medium for landscape areas includes urban agriculture beds and planters.

1.3 Related Work

- | | | |
|-----|-----------------------------------|------------------|
| .1 | Aggregates and Granular Materials | Section 02 41 14 |
| .2 | Excavation Backfill and Grading | Section 31 23 10 |
| .3 | Sod Lawns | Section 32 92 23 |
| .3a | Seeded Lawns | Section 32 92 19 |
| .4 | Plants and Planting | Section 32 93 10 |
| .5 | Subsurface Drainage Systems | Section 33 46 16 |

1.4 Reference Standards

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 CSLA Canadian Landscape Standard
 - .2 Canadian System of Soil Classification
 - .3 Canadian National Master Construction Specification, 32 91 19.13 Topsoil and Grading.

1.5 Materials Definitions

- .1 For the purpose of this specification the term "growing medium" shall mean a mixture of mineral particulates, micro organisms and organic matter which provides a suitable medium capable of supporting the intended plant growth.

1.6 Types And Locations of Growing Medium

- .1 Provide and install the following types of growing medium at the locations shown for each type:
- .2 Growing medium types:
 - .1 TYPE A On-Site/Native
 - .2 TYPE B Imported Growing Medium

1.7 Review

- .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 Vancouver Park Board.
- .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 reviewed.

1.8 Testing

- .1 Submit to the Owner's Representative a copy of growing medium analysis from a laboratory approved by the Owner's Representative. The analysis shall be of tests done on the proposed growing medium from samples taken at the supply source within three weeks immediately prior to soil placement. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the contractor. **Results of these tests shall be presented to the Owner's Representative for review BEFORE any growing medium delivery to site.** Pond/In-stream growing medium placed prior to the review of test results by the Owner's Representative will result in rejection of pond/In-stream growing medium and subsequent removal of material by the contractor at no cost to the owner.
- .2 The analysis will include measurement of percent sand, fines, (silt and clay), and organic matter to total 100%, pH, lime required to achieve pH 6.5, water soluble salts, total carbon to total nitrogen ratio, total nitrogen and available levels of phosphorus, potassium, calcium and magnesium
- .3 The analysis shall outline the testing laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed growing medium meet the requirements of this specification.
- .4 At the discretion of the Owner's Representative submit up to two additional samples at intervals outlined by the Owner's Representative of pond/in-stream growing medium taken from material delivered to site. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Owner's Representative for review.

- .5 Test reports for landscaping soils containing biosolids shall be submitted to demonstrate the finished product meets the BC Organic Matter Recycling Regulation's (OMRR) "Biosolids Growing Medium" standards; and, be supported by a documented review by a Qualified Professional as defined by OMRR

Organic Matter Recycling Regulation

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/18_2002

- .6 Failure to satisfy these contractual requirements could result in the contractor being required to remove unacceptable growing medium at their expense.

1.9 Submittals

- .1 Submit to the Owner's Representative a copy of an analysis by an approved independent soil-testing laboratory. Acceptable laboratories include; Benchmark Laboratories Nanaimo, Ltd. Nanaimo, BC (250-585-2555), Pacific Soil Analysis Inc., Richmond, BC (604.273.8226) or pre-approved equal. The analysis shall be of tests done on the proposed growing medium and additives proposed for the work from samples taken at the supply source, within three weeks immediately prior to growing medium placement. Costs of the initial analysis, and subsequent tests to ensure compliance with the specification shall be borne by the Contractor. Failure to submit soils analysis is cause for immediate rejection and possible removal of any placed growing medium.
- .2 The analysis shall include a breakdown of the following components: total nitrogen by weight, available levels of phosphorous, potassium, calcium, magnesium, soluble salt content, organic matter by weight, % sand, % fines (silt and clay) and pH value. In addition, the analysis shall clearly indicate the Project Name, Date Tested and Contractor's Name.
- .3 Submit with the above analysis, the testing laboratory's recommendations for amendments, fertilizers and other modifications to make the proposed growing medium meet the requirements of this specification.

1.10 Samples

- .1 Submit to the Owner's Representative one composite sample of each type of proposed growing medium for each different application within the project (e.g. lawns, shrubs, urban agriculture planter). Each sample shall be a composite of at least three samples from the proposed source and shall be at least one (1) litre in volume.
- .2 Urban Agriculture Growing Medium: Submit to the Owner's Representative confirmation that the organic material component of the Urban Agriculture Growing medium is derived from an organic source free of heavy metals, contaminants, animal or plant chemical additives or supplements. The confirmation shall be in the form of a letter on company letterhead or written confirmation from provincial or regulatory agency.

- .3 At the discretion of the Owner's Representative, submit up to two additional samples, including samples of proposed additives to the growing medium from material delivered to the site as required to ascertain compliance with this specification. Results of these tests shall be submitted to the Owner's Representative for approval.
- .4 After the completion of the soils analysis, a one litre sample of the completed/mixed growing medium, including all amendments shall be submitted at least twenty-one (21) days before placement of growing medium to allow for evaluation of samples and testing for noxious weed content by Owner. Owner's Representative will advise of test results.
- .5 Samples of each growing medium type shall be submitted to the Owner's Representative in zip lock plastic bags clearly marked with the date, project name, sample name and supplier name and telephone number.
- .6 Organic Material: One composite sample or each organic material type. Sample shall be a composite of at least three samplings from the proposed source, and shall be at least one (1) litre in volume.

1.11 Quality Assurance

- .1 Advise Owner's Representative of sources of growing medium to be utilized on this Project a minimum of thirty days (30) prior to starting work of this Section.
- .2 Carry out growing medium preparation and placement such that the final product matches the standard set by the samples submitted, within a range of variation that may reasonably be expected with good quality control while incorporating the recommendations for amendment by the testing laboratory.
- .3 The Vancouver Park Board may appoint an independent testing laboratory to ascertain compliance with this specification and to recommend modifications to make the growing medium meet the requirements of this specification.
- .4 Imported growing medium is to be free of all foreign debris and non-typical soil components including small pieces of plastic bags, plastic pieces like parts of containers or labels, dimensional lumber, metal and glass. Evidence of more than 5 pieces of foreign materials observed within the imported growing medium will result in the rejection of all of the growing medium and its immediate removal from the site.

PART 2: PRODUCTS

2.1 General

- .1 Product Handling
 - .1 Do not move or work growing medium or additives when they are excessively wet, extremely dry, frozen, mixed with ice and/or snow, or in any manner which will adversely affect growing medium structure. Growing medium whose structure has

- been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner.
- .2 Protect growing medium and additives against extreme wetting by rain or other agents, and against contamination by weeds and insects.
 - .3 Deliver fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.
 - .4 Stockpile materials in bulk form in paved areas and provide protection by storing under roof or tarpaulins. Take all necessary precautions to prevent contamination of component materials from wind blown soils, weed seeds and insects. Contamination of individual components may result in rejection, if used.
 - .5 All growing medium will be delivered to site **premixed** from a recognized growing medium source ensuring consistency throughout the mix.
- .2 Approved Equals
- .1 All items as specified or pre-approved equals.

2.2 On Site /Imported Soil (Type A)

- .1 On site-imported soil shall be friable "A Horizon" topsoil to the requirements of the B.C. Landscape Standard, stripped and stockpiled on site in an approved location. Stripping and stockpiling work shall be such that the soil is not damaged or contaminated. (Refer to Product Handling).
- .2 Mineral particle sizes shall be within the following ranges by weight:
100% shall pass a 10 mm (3/8") sieve.
Maximum of 10% shall pass a #200 sieve. (Silt and clay)
Soil shall be of a sandy loam or loamy sand texture containing between 3% and 15% organic matter (dry weight basis). Soil shall be virtually free from subsoil, wood including woody plant parts, weeds, stones over 30mm, pests, undesirable grasses or weeds, and seeds or parts thereof and foreign objects. Soil shall be free from crabgrass, couch grass, *Equisetum*, convolvulus or other weeds or seeds or parts thereof.
- .3 Soil shall be suitable for modification by screening and additives to meet the requirements for Screened Growing Medium (Type B as specified) except where specified and approved for use as unscreened On Site Soil (Type A).

2.3 Additives

- .1 Manure: Well rotted farm animal manure or compost, to the requirements of the BCSLA/BCLNA B.C. Landscape Standard. Animal manures and compost often have excessive levels of water-soluble salts. The growing medium shall be leached via fresh water from the irrigation system or through natural rainfall until an electrical conductivity of 3.0mmho/cm or less is achieved.

- .2 Compost: A uniform blend of natural source-separated organic materials, composted such that it is brown-black in colour and has carbon to nitrogen ratio of 25 to 1 or lower. pH 6 to 7. Substantially free from subsoil, pests, roots, wood, construction debris, undesirable grasses or weeds, and seeds or parts thereof. Free from toxic materials, crabgrass, couch grass, equisetum, weeds, and seeds or parts thereof. The Owner does not allow use of any paper fibre amended compost products. Approved Suppliers include Fraser Richmond Biocycle and Stream Organics.
- .3 Sand: Approved medium river pump sand, well washed and free of contaminants, chemical and organic matter. Gradation of particle sizes shall fall within the following range ("Percent" to be reported as the mass of the particles whose size is less than the designated sieve opening but greater than the next designated sieve opening):
- | USBS Sieve Number | Sieve Size (mm) | Percent | Class |
|-------------------|-----------------|---------|------------------|
| 4 | 4.76 | 0 - 3 | Fine gravel |
| 10 | 2.00 | 0 - 20 | Very coarse sand |
| 18 | 1.00 | 0 - 20 | Coarse sand |
| 35 | 0.50 | 60 - 80 | Medium sand |
| 60 | 0.25 | 0 - 40 | Fine sand |
| 140 | 0.105 | 0 - 4 | Very fine sand |
| 270 | 0.063 | 0 - 2 | Silt & clay |
- .4 Sand shall have a saturated hydraulic conductivity between 100 mm. and 300 mm. per hour. Test conditions shall be for saturated sand, 15 blows compaction.
- .5 Sand shall have:
- | | |
|----------------------------|-------------------|
| Organic content | < 0.5% by weight. |
| Water Soluble Salt content | < 0.5mmhos/cm |
| Ph of between | 5.0 and 7.0 |
- .6 Available copper, zinc and manganese following acid digest test in 0.1N HC1 and shaken for ½ hour shall be less than 25 PPM when analysed by atomic absorption spectroscopy.
- .7 Peat moss: Is not to be used.
- .8 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.
- .9 Dolomite Lime: Approved commercial brands for horticultural purposes, coarsely ground; containing not less than 20% calcium by weight.

2.4 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.

- .2 Generally Fertilizers must be those fertilizers specified in the soils analysis report/ recommendations. Contractor shall not make any substitutions without prior written approval from Owner's Representative.

2.5 Growing Medium (Type B)

- .1 Growing Medium shall be predominantly sand based and screened with additives and fertilizers as required to make it meet the following specifications:
 - .1 Substantially free from roots, sticks, building materials, wood chips, chemical pollutants and other extraneous materials.
 - .2 Population of plant pathogenic nematodes: maximum 1000 per litre for any single species.
 - .3 Maximum requirement of dolomite lime to required pH: 50kg/100M2.
 - .4 Salinity: maximum saturation extract conductivity of 3.0 mmho/cm @25 deg. C
 - .5 Fertility:

| | |
|-----------------------|--------------------|
| Total Nitrogen | 0.4-0.8% by weight |
| Available Phosphorous | 70-80 ppm |
| Available Potassium | 150-250ppm |
 - .6 Cation Exchange Capacity: 30-50 meq.
 - .7 Carbon to Nitrogen Ratio: max. 40:1
 - .8 pH:

| | |
|----------------|------------|
| Lawns | 6.0 to 7.0 |
| Planting Areas | 5.5 to 6.0 |
 - .9 Boron: the concentration in the saturation extract shall not exceed 1.0 ppm
 - .10 Sodium: the sodium absorption ratio (SAR) as calculated from analysis of the saturation extract shall not exceed 8.0
 - .11 Total Nitrogen shall be 0.2% to 0.6% by weight.
 - .12 Available phosphorous shall be 20-100 ppm
 - .13 Available potassium shall be 50-250 ppm.
 - .14 Tolerances: Samples of growing medium taken just before planting shall have the specified properties to within the tolerances of plus or minus 20% of the stated values, except for salinity, which shall be less than the stated limit.
 - .15 The textural properties and organic content shall be have the following composition AFTER MIXING (BY DRY WEIGHT):
- .2 For PLANTING BEDS growing medium shall consist of the following AFTER MIXING (% BY DRY WEIGHT):
 - 80- 88% round sand (>0.05mm-<2mm)
 - 3 % max silt (>0.0002mm - <0.05mm)
 - 2 % max clay (<0.002mm)
 - Total fines max 5%

12-15% organic material (refer to section 2.6 for additional information on Organic material)

pH 5 .0 to 6.0

Nutrient Content:

Nitrogen 0.2 - 0.6%

Phosphorus: 50 -150ppm

Potassium 50 - 300 ppm

C/N ratio max 25 : 1

- .3 For LAWN AREAS growing medium shall consist of the following AFTER MIXING (% BY DRY WEIGHT):

85- 92% round sand (>0.05mm-<2mm)

3 % max silt (>0.0002mm - <0.05mm)

2 % max clay (<0.002mm)

Total fines max 5%

8- 10% organic material (refer to section 2.6 for additional information on Organic material)

pH 6 .0 to 6.5

Nutrient Content:

Nitrogen 0.2 - 0.6%

Phosphorus: 50 -150ppm

Potassium 50 - 300 ppm

C/N ratio max 25 : 1

2.6 Organic Material

- .1 Organic Material (non urban agriculture):

- .1 Shall be fully composted material that does not contain cedar or redwood bark or wood, black/brown in colour.
- .2 Organic component shall not contain mushroom manure compost or mushroom starter.
- .3 Acceptable suppliers include
 - Veratec Group, Chilliwack, BC (Formerly Yardworks)
 - Harvest Power Canada Ltd., Richmond, BC (Soil Amender), (Formerly Fraser Richmond Soil and Fibre Ltd.)
 - Eco-Soil Recycling, Surrey, BC

- .2 Organic Material (urban agriculture):

- .1 Shall be derived from an organic source free of sewage biowaste, heavy metals, contaminants, animal or plant chemical additives or supplements.

- .2 The material shall be fully composted material that does not contain cedar or redwood bark or wood, black/brown in colour.
- .3 Organic component shall not contain mushroom manure compost or mushroom starter.
- .4 Acceptable suppliers include
 - Veratec Group, Chilliwack, BC (Formerly Yardworks)
 - Harvest Power Canada Ltd., Richmond, BC (Soil Amender), (Formerly Fraser Richmond Soil and Fibre Ltd.)
 - Eco-Soil Recycling, Surrey, BC
- .3 Organic Material (biosolids):
 - .1 Landscaping soils containing biosolids shall meet the BC Organic Matter Recycling Regulation's (OMRR) "Biosolids Growing Medium" standards; and, be supported by a documented review by a Qualified Professional as defined by OMRR
 - .2 Acceptable suppliers include Veratec, Chilliwack, BC (Formerly Yardworks Supply, Ltd), Harvest Power Canada Ltd. – British Columbia (Formerly Fraser Richmond Soil and Fibre Ltd.) (Soil Amender), Richmond, B.C., Eco-Soil , Langley BC, or pre-approved equal.

2.7 Construction Adhesive

- .1 PL 200 Construction Adhesive by OSI Sealants Inc. or approved equal.

2.8 Drainage Medium

- .1 Drain Rock or Torpedo Gravel: Shall consist of clean round stone or crushed rock. Acceptable material includes 19 mm (3/4") drain rock or torpedo gravel conforming to the following gradations found in 02 41 14 Aggregates and Granular Materials Section.
- .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/m² 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 B.C., or approved equal.

2.9 Filter Fabric

- .1 Needled, non-woven polypropylene mat. Nilex 4545 by Nilex Geotechnical Projects, Burnaby, B.C.

PART 3: EXECUTION

3.1 Subgrade Preparation

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Request a review of the subgrade conditions and obtain approval of the Owner's Representative to placing any growing medium.
- .3 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 Placement of growing medium implies acceptance of subgrade conditions.
 - .4 Remove debris, roots, branches stones in excess of 50mm dia. and other deleterious materials as directed by Owner's Representative.
 - .5 Remove any soil contaminated with calcium chloride, toxic materials or petroleum products.
 - .6 Remove any materials that protrude 25mm above the surface.
 - .7 Dispose of removed material off site.
 - .8 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.
- .4 Structural Slab Planting Area:
 - .1 Verify planter drains and or slab drains have been installed.

3.2 Placement of Drainage Medium – Drain Rock

- .1 Verify that architectural slab membrane, protection board, insulation, etc. has been approved by the Owner's Representative prior to the placement of drainage medium.
- .2 Place drainage medium over entire planter bottom ensuring consistent depth as per construction details.
- .3 Place filter fabric over the entire finished surface of drainage medium. Ensure seams are overlapped as per manufacturers recommendations.
- .4 Ensure filter fabric fits tight to face of planter wall. Take care during loading of growing medium to ensure filter fabric is not dislodged.

3.3 Placement of Drainage Medium – Drain Mat

- .1 Verify that architectural slab membrane, protection board, insulation, etc. has been approved by the Owner's Representative prior to the placement of drainage medium.
- .2 Place drainage medium – drain mat over entire planter bottom cut outs for slab drains. Ensure that overlap of filter cloth portion of drain mat is provided as per manufacturers recommendations. Ensure there are no gaps between drainage medium panels.

3.4 Importing Procedures for Prepared Growing Medium

- .1 **Imported Growing Medium:** Growing medium shall be imported and stockpiled on site in a location approved by the Owner's Representative.
 - .1 Carry out stock piling operation such that the growing medium structure is not compromised through compaction, vibration or other actions.
 - .2 Stock piled growing medium shall be protected from rain, drying and contaminants.
 - .3 Growing medium shall be free of subsoil, pests, roots, wood, construction debris, undesirable grasses including crabgrass or couch grass, noxious or weeds and weed seeds or parts thereof foreign objects and toxic materials. Presence of these contaminants shall be grounds for rejection of growing medium and replacement at no cost to the Owner.

3.5 Preparation For Placement Of Growing Medium On Slab

- .1 Ensure protection board is in place and verify that previous work (waterproofing, etc.) is approved prior to starting work of this Section.
- .2 Place slab drainage layer and filter fabric separator as detailed to depths shown on drawings. Lap filter fabric 150mm (6") at all seams/joints. Ensure fabric extends 150mm (6") upward inside all planter sidewalls.
Ensure that filter fabric, slab drainage protection board, etc. are not damaged or displaced during installation of growing medium.

3.6 Preparation of Growing Medium

- .1 Mixing/screening of growing medium on site is not allowed. 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:
- .2 Thoroughly mix using mechanical mixing/screening equipment the constituent growing medium components and recommended additives. Resulting mixture will have a particle size class and properties that match the requirements of this specification.
- .3 No hand mixing will be accepted unless specifically approved by the Owner's Representative.

3.7 Placing Growing Medium

- .1 Do not place growing medium until Owner's Representative has reviewed drainage medium installation.
- .2 Ensure that irrigation lines to be installed have been reviewed by the 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 Place all growing medium to the required finished grades with adequate moisture in uniform lifts of 100mm to 150mm compacted to 80MPD during dry weather, over drainage medium where planting is indicated.
- .5 Except where drawings or details show otherwise, place to the following minimum and/or maximum depths and levels (measured after initial settling of growing medium):
 - .1 Tree Planting Areas on grade maximum 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. Undisturbed soil below rootball to be compacted to 100MPD.
 - .3 Each tree shall have access to minimum 30m³ growing medium volume and minimum 15m³ growing medium volume per tree within connected volumes.
 - .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. The growing medium volume must have a direct relationship to the mature drip line with outward adjustment for columnar species.
 - .2 Shrub and Groundcover Areas on grade 450mm (18") minimum depth.
 - .3 Low or High Traffic Lawn Areas on grade 250mm (10") minimum depth.
 - .4 Urban Agriculture 450mm (18") or to within 25mm or 1" of the top of the planter.
- .6 If subgrade/subsoil drains rapidly increase soil depths as directed by Owner's Representative to ensure adequate moisture retention.
- .7 On slab depth of growing medium to achieve finished grades in all cases. Growing medium depths are not to exceed maximum allowed for by the structural engineer. Voiding, sand fill or additional growing medium may be used where required build-up over the drainage layer exceeds the required minimum depths stated above.
 - .1 For Lawn Areas Flush with adjacent surfaces after initial settlement.
 - .2 For Planting Areas As detailed on drawings. Crown all planting beds.
 - .3 Refer to drawings for top of slab and finished elevations, as applicable.
- .8 Crown or slope for positive surface drainage as shown on the drawings.

3.8 On Site Application of Amendments

- .1 Ensure minimum 7 days separation time between the application of any lime treatment or fertilizers and plant material installation.
- .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 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 line 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.

3.9 Finish Grading

- .1 Manually fine grade growing medium installation to contours and elevations shown on drawings or as directed by Owner's Representative. Tolerance for finish grading to be 5mm.
- .2 Eliminate rough spots and low areas to ensure positive drainage.
- .3 Finish Grade of growing medium shall be 25 mm (1") from finished elevation of adjacent curb or planter wall unless otherwise noted on drawings
- .4 Leave surface smooth, uniform, firm against deep foot printing, with a fine loose texture.

3.10 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 the Owner's Representative with a written methodology outlining of weed removal seven (7) days prior to starting weed removal operations.

3.11 Mulching

- .1 Place mulch over all growing medium except grass areas. Moisten uniformly and spread to a consistent settled depth of 50mm in tree and shrub planting areas, 25mm in ground cover areas.

3.12 Acceptance

- .1 Owner's Representative will inspect and test growing medium and determine acceptance of material as placed, depth and finish grading prior to any planting or sodding operations commencing.
- .2 Approval of placed growing medium subject to additional soil test analysis if requested. Costs for additional testing of placed growing medium shall be at the Contractor's expense.

3.13 Cleaning

- .1 All excess materials and other debris resulting from growing medium preparation and placement operations shall be disposed of off site.
- .2 Ensure all discolouration 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 the Owner's Representative.

END OF SECTION 32 91 13

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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 structural growing medium as indicated in the contract documents.

1.3 Related Work

- .1 Excavation, Backfill and Grading Section 31 23 10
- .2 Plants and Planting Section 32 93 10
- .3 Subsurface Drainage Systems Section 33 46 16

1.4 Reference Standards

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 CSLA Canadian Landscape Standards
 - .2 Canadian System of Soil Classification
 - .3 Canadian National Master Construction Specification, 32 91 19.13 Topsoil and Grading.

1.5 Definitions

- .1 For the purpose of this specification the term "growing medium" shall mean a mixture of mineral particulates, micro organisms and organic matter which provides a suitable medium capable of supporting the intended plant growth.

1.6 Testing

- .1 Submit to the Owner's Representative a copy of a structural growing medium analysis and an analysis of its components from a laboratory approved by the Owner's Representative. The analysis shall be of tests done on the proposed structural growing medium from samples taken at the supply source within two weeks immediately prior to structural growing medium placement. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the contractor. **Results of these tests shall be presented to the Owner's Representative for review BEFORE any structural growing medium delivery to site.** Structural growing medium placed prior to the review of test results by the Owner's Representative will result in rejection of structural growing medium and subsequent removal of material by the contractor at no cost to the owner.
- .2 Components:
 - .1 Growing Medium: The analysis of the growing medium shall include break down of the following components: particle size class and properties, total nitrogen by weight, available levels of phosphorus, potassium, calcium, magnesium, soluble salt content, organic matter by weight, and pH value.
 - .2 Rock: Provide the manufacturers analysis of loose & rodded unit weight, bulk specific Gravity and absorbency, stone dimension. Provide a percent pore space analysis defined as follows: $(1 - \text{rodded unit weight} / \text{bulk specific gravity}) \times 100$
- .3 The analysis shall outline the testing laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed structural growing medium meet the requirements of this specification.
- .4 At the discretion of the Owner's Representative submit up to two additional samples (cost to be borne by the contractor) at intervals outlined by Owner's Representative of structural growing medium taken from material delivered to site. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Owner's Representative for review.
- .5 Failure to satisfy these contractual requirements could result in the contractor being required to remove unacceptable growing medium at their expense.

1.7 Submittals

- .1 Submit to the Owner's Representative samples of the following materials:
 - .1 Crushed Stone: .5 kg (1 lb)
 - .2 Growing Medium: .5 kg (1 lb)
- .2 Structural Growing Medium Sample: One (1) composite sample. Sample shall be a composite of at least three (3) samplings from the proposed source or, and shall be at least one (1) litre (one (1) quart) in volume.

1.8 Quality Assurance

- .1 Carry out structural growing medium preparation and placement such that the final product is within 2% of the standard established which has incorporated the recommendations for amendment by the testing laboratory.
- .2 Imported growing medium is to be free of all foreign debris and non-typical soil components including small pieces of plastic bags, plastic pieces like parts of containers or labels, dimensional lumber, metal and glass. Evidence of more than 5 pieces of foreign materials observed within the imported growing medium will result in the rejection of all of the growing medium and its immediate removal from the site.

PART 2: PRODUCTS

2.1 General

- .1 Product Handling, Delivery and Storage
 - .1 Do not move or work growing medium or additives when they are excessively wet, extremely dry, frozen, mixed with ice and/or snow, or in any manner which will adversely affect growing medium structure. Growing medium whose structure has been destroyed by handling under these conditions will be rejected and shall be replaced by the contractor at no cost to the owner.
 - .2 Protect growing medium and additives against extreme wetting by rain or other agents, and against contamination by weeds and insects.
 - .3 Deliver fertilizer and other chemicals in manufacturer's original containers. Protect against damage and moisture until incorporated into the work.
 - .4 Stockpile materials in bulk form in paved areas and provide protection by storing under roof or tarpaulins. Take all necessary precautions to prevent contamination of component materials from wind blown soils, weed seeds and insects. Contamination of individual components may result in rejection, if used.
 - .5 All growing medium will be delivered to site **premixed** from a recognized growing medium source ensuring consistency throughout the mix.

2.2 Materials

- .1 **Imported Structural Growing Medium:** Growing medium shall be imported and stockpiled on site in an approved location. Stockpiling work shall be such that the soil is not damaged or contaminated.
- .2 Structural Growing medium shall be free of subsoil, pests, roots, wood, construction debris, undesirable grasses including crabgrass or couch grass, noxious or weeds and weed seeds or parts thereof foreign objects and toxic materials.
- .3 Fertilizer:

- .1 Complete commercial synthetic slow release fertilizer meeting the requirements of the Canada Fertilizer Act, packed in water proof containers, clearly marked with the name of the manufacture, weight and analysis.
- .2 Fertilizer Formulation Ratio: as per soil test recommendations.
- .4 Lime: Coarse (unless noted otherwise), ground dolomite limestone containing minimum 85% of total carbonates.
- .5 Organic Material: submit sample prior to shipping to site:
- .1 Organic Material shall be Soil Amender, black/brown in colour, manufactured by Fraser Richmond Bio-Cycle, Richmond, B.C., or pre-approved equal.
- .6 Wood Residuals: Content of wood residuals such as Fir or Hemlock sawdust present in the growing medium shall not cause the total Carbon to total Nitrogen ratio to exceed 33: 1. Cedar or redwood sawdust shall not be present in growing medium.
- .7 Soil Binder – Stabilizer; manufactured by Stabilizer Solutions Inc., Phoenix Arizona. Distributed by Sport Turf Inc., Abbotsford, BC. (ph. 604.850.7857). **Or**, Hydrogel; potassium propenamide copolymer Hydrogel as manufactured by Gelscape, Amereq Corp., (ph. 1.800.832.8788).
- .8 Sand: hard, sharp, granular, river pump sand, well washed and free of contaminants, chemical and organic matter. Particle sizes by weight:
- | SIEVE SIZE | CLASSIFICATION | % RETAINED |
|-------------------|------------------|------------|
| No. 4 (4.76mm) | Gravel | 0% |
| No. 10 (2.0 mm) | Fine gravel | 0-5% |
| No.18 (1.0 mm) | Very coarse sand | 5-10% |
| No.35 (0.50 mm) | Coarse sand | 15-20% |
| No.60 (0.25 mm) | Medium sand | 50-75% |
| No.140 (0.105 mm) | Fine sand | 5-15% |
| No. 270 | Very fine sand | 0-2% |
| Passing No. 270 | Silt, clay | 0% |
- .9 Crushed Structural Stone: 70 mm (3"), highly angular crushed stone free of large flat surfaces. contaminants, chemical and organic matter. As supplied by Lafarge Aggregates, Ward Road Quarry, Abbotsford, B.C.; Product Code: 3680, or pre-approved equal.
- .1 Particle shape ratio: 2: 1: 1
- .2 Particle size by weight:
- | SIEVE SIZE | PERCENT PASSING |
|--------------|-----------------|
| 70mm(3") | 100 |
| 60mm(2 1/2") | 5-10 |
| 50mm(2") | 0 |
- .10 Structural Growing Medium: uniform mixture of crushed stone, growing medium and soil binder combined to the following proportions:
- | MATERIAL | % UNIT OF WEIGHT |
|----------------|-------------------|
| Crushed Stone | 77-78% dry weight |
| Growing Medium | 22% dry weight |

| | |
|----------------|--|
| Soil Binder | 0.05% (1.5 kg / m ³ finished material) Or |
| (Hydrogel) | 0.03% (0.9 kg / m ³ finished material) |
| Total Moisture | 10% (includes water in other ingredients) |

2.3 Standard For Growing Medium Component of Structural Growing Medium

(%Dry Weight) Structural Soil

| | | |
|----|--|-----------------------|
| .1 | Particle Size Class and Properties | |
| | Sand (Larger than 0.05mm and smaller than 2.0mm) | 60 - 70% |
| | Silt (Larger than 0.002 mm and smaller than 0.05mm) | 7-15% |
| | Clay (Smaller than 0.002mm) | 7-12% |
| | (Maximum Clay and Silt Combined) | 28% |
| | Organic Material Content | 10 - 15% |
| | (Particle size in Percent (%) of Dry Weight) | |
| .2 | Acidity (pH): | 5.5 - 6.5 |
| .3 | Salinity: Maximum saturation extract conductivity: 3.0 millihos/cm at 25 degrees C. | |
| .4 | Cation exchange: | 30 - 50 meq. |
| .5 | Carbon to nitrogen ratio: | maximum 33:1 |
| .6 | Hydraulic Conductivity: Minimum saturated hydraulic conductivity 5.0 - 7.0 cm/hour in place. | |
| .7 | Fertility: | |
| | Total nitrogen | 0.4 - 0.8% by weight. |
| | Available phosphorus | 70 - 80 ppm |
| | Available potassium | 150 - 250 ppm |

PART 3: EXECUTION

3.1 Mixing Structural Growing Medium

- .1 Structural growing medium is to be prepared using appropriate measuring, mixing and shredding equipment of sufficient capacity and capability to assure consistent mixing ratios.
- .2 Maintain adequate moisture content during the mixing process. The contractor shall periodically monitor the amount of moisture present in the growing medium at the mixing site.
- .3 Mixing Procedure with Front End Loader
 - .1 Spread 200mm (8") to 300 mm (12") of crushed stone on a flat asphalt or concrete paved surface.
 - .2 Spread a consistent amount of soil binder over the crushed stone.
 - .3 Spread a specified amount of growing medium over the soil binder/crushed stone.

- .4 Structural growing medium amendments as per the growing medium analysis shall be added and thoroughly mixed with the growing medium prior to start of batching operations.
 - .5 Blend the entire amount by turning using a front-end loader or other suitable equipment until a consistent blend is achieved.
 - .6 Addition of water during the blending and turning process shall be carefully monitored to ensure required moisture content is not exceeded. Delay application of water for ten (10) minutes prior to successive applications.
 - .7 Mixing should produce a material within 1% of the optimum moisture level for compaction.
- .4 If the mixture dries out and separates at any time during the mixing, storing, transport or placement process, the structural growing medium should be wetted and re-mixed.

3.2 Planting Trench Preparation

- .1 All trench preparation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Scarify and or break up and loosen existing sub grade and compacted gravel areas to a minimum depth of 200 mm (8") to allow for proper drainage in all planting areas and tree pits.
- .3 Place perforated PVC subsurface drain line to grades noted on plans as per Section 02712. Ensure sub grade is sloped to allow positive flow of subsurface water to subsurface drain.

3.3 Placement of Structural Growing Medium

- .1 Owner's Representative to review sub grade prior to the placement of structural growing medium.
- .2 Ensure that irrigation lines to be installed have been reviewed by the Owner's Representative prior to the placement of growing medium.
- .3 Place prepared structural growing medium in 150 mm (6") lifts compacted to a minimum of 95% MPD in tree pits and planting trenches indicated on drawings. Do not over compact structural growing medium. Operate compaction equipment over structural growing medium the minimum number of passes required to achieve specified compaction. Delay compaction for a minimum of 24 hours if moisture content in structural growing medium exceeds maximum allowable. Protect structural growing medium during delays with plywood or plastic.
- .4 Place structural growing medium ensuring adequate moisture, in uniform layers, **during dry weather**, over approved, dry, unfrozen sub grade where planting is indicated to the following minimum depths:
Trees pits and trenches: 1000 mm (3'-0") or as otherwise indicated.

- .5 Structural growing medium to be placed such that the finished grade elevation allows for the required build up for pavement base material and pavement thickness to finished grade.
- .6 Protect structural growing medium from all contamination that will alter the particle distribution or make up of the mix with plastic or plywood cover.

3.4 Placement of Filter Medium

- .1 Place filter medium over entire Structural Growing Medium layer ensuring joint overlap of a minimum of 150 mm (6").

3.5 Weed Control

- .1 Eliminate all weeds and weed roots from growing medium prior to start of mixing operations.
- .2 Have method for elimination of weeds reviewed by Owner's Representative prior to any action by the contractor.

3.6 Finish Grading

- .1 Structural growing medium to be placed such that the finished grade elevation allows for the required build up for pavement base material and pavement thickness to finished grade.
- .2 Leave surface smooth, uniform, with a maximum of 50 mm (2") in 3.0m (10'-0") deviation in gradient plane.

3.7 Protection of Material

- .1 DO NOT WASH ADJACENT PAVING AREAS, HARD SURFACES OR LANDSCAPE AREAS UNTIL FINISH PAVING HAS BEEN INSTALLED OVER STRUCTURAL GROWING MEDIUM.

3.8 Surplus Material

- .1 Dispose of surplus growing medium not required for fine grading and landscaping off site.

END OF SECTION 32 91 21.03

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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 seeded lawn as indicated in the contract documents.
- .2 The work of this section shall include, but shall not necessarily be limited to the supply, installation and maintenance of the following:
 - .1 Fine grade growing medium
 - .2 Seeded lawn
 - .3 Maintenance of seeded areas until Final Acceptance

1.3 Related Work

- .1 Irrigation Section 32 80 00
- .2 Growing Medium Section 32 91 13

1.4 Reference Standards

- .1 BC Landscape Standard, latest edition.

1.5 Quality Assurance

- .1 Contractor to provide seed analysis that will include but is not limited to;
 - .1 Analysis of seed mixture
 - .2 Percentage of pure seed
 - .3 Year of production
 - .4 Date when tagged and location
 - .5 Percentage germination
 - .6 Name and address of distributor.
 - .7 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 seed supply to change during the construction a written request must be provided to the Owner's Representative 48 hours in advance. The request is to be followed up by submission of proposed seed supplier and substitution seed analyses for Owner's Representatives review prior to the start of supply to the site.
- .3 All seed shall be delivered and stored in original containers in enclosed storage facility protected from the damage, weather, insects and rodents.

1.6 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 or growing medium is detained and cleaned prior to discharge from site.

1.7 Site Conditions

- .1 Examine site prior to the commencement of work to verify surface preparation is complete and has been accepted by the Owner's Representative.

1.8 Warranty

- .1 The Contractor hereby warrants that the sod 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 as a result of failure of all products in this section.
- .2 The Owner reserves the right to extend Contractor's warranty period and responsibilities for one (1) additional year if, at end of the initial warranty period the leaf development and growth of the seeded areas is not sufficient to ensure future survival.

PART 2: PRODUCTS

- 2.1 **Grass Seed:** Certified Canada No. 1 Grade to Government of Canada, Seeds Regulations and having minimum germination of 75% and minimum purity of 95%. See drawings for seed mix specification.
- 2.2 **Water:** Potable, free of impurities that would inhibit sod growth. Contractor to ensure adequate water is available to maintain seeded areas during germination and in a vigorously growing, healthy state until Final Acceptance of work of this section.

- 2.3 Fertilizer:** Complete synthetic, slow release fertilizer. Type and application shall be as required by the growing medium analysis report.
- 2.4 Wood Posts:** 38mm (1/12") x 38mm (1/12") x 1.5m (5'-0") No. 1 Grade or better Hem/Fir, untreated wood.
- 2.5 Binder Twine:** Hemp based multiple strand string.
- 2.6 Flagging Tape:** 30mm wide (1.875"), biodegradable ribbon tape made of non woven cellulosic material, colour; red, as distributed by Freedom Supply Company www.dag-ny.com, 1.800.263.0635 or approved equal.

PART 3: EXECUTION

3.1 Preparation of Surfaces

- .1 Scarify existing sub grade to 100mm (4") depth over entire area to receive growing medium and seed.
- .2 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).
- .3 Place growing medium to a depth of 300mm (12") when compacted to 80%MPD. Compaction of growing medium to 80% MPD will not leave deep foot impressions when walked.
- .4 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 Owner's Representative.
- .5 Prior to the broadcast of seed Owner's Representative to review fine grading of growing medium. Review includes grades, growing medium depth and condition of finished surface. Subsequent to the Owner's Representative review and at no cost to the Owner the Contractor shall re-grade/add growing medium and make adjustments as directed by Owner's Representative.

3.2 Seeding

- .1 Seeding operations shall be carried out in the following calendar seasons;
 - .1 Spring (April 1st to June 15th)
 - .2 Fall (August 15th to September 30th).

- .3 Seeding shall not take place during periods of rain, freezing and/or abnormally hot and dry weather.
- .2 Seed Application: Seed rates as per seed manufacturers recommendations.
 - .1 Sow seed during calm weather with wind speeds less than 8 kph (5 mph), using wheeled or hand held rotary broadcaster.
 - .2 Sow half of required amount of seed in one direction and remainder at right angles.
 - .3 Carefully incorporate seed into top of growing medium with light chain harrow or wire rakes to a minimum depth of 6mm (1/4") as seeding operation progresses or within one (1) hour after seeding
 - .4 Immediately after seed application roll seeded area with 90kg (200 lb.) water ballast type lawn or agricultural roller. If seeded area becomes wet due to rain suspend rolling operations until area has dried to the point where growing medium will not adhere to the surface of the roller.
- .3 Watering Operation: Apply water with fine spray to avoid seed wash out. Watering procedure shall ensure penetration of minimum 50mm (2") into growing medium and be at sufficient duration and intervals to keep growing medium evenly moist during germination and grow in period.
- .4 The Contractor is to carry out at no cost to the Owner, reseed operations at two (2) week intervals where germination has failed or wash outs have occurred.
- .5 Perimeter Protection: All seeded areas shall be surrounded by a 900 mm high barrier made up of the following components:
 - .1 Wood posts placed at 1.8Metres (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 Final Acceptance of seeded area by Owner's Representative. Upon acceptance remove perimeter fence and dispose of off site.
- .6 Seeded areas that have 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 reseeding as required.

3.3 Maintenance

- .1 Begin maintenance at time of planting and continue for a minimum of fifty-five (55) days after Substantial Completion or until Acceptance, whichever is greater.
- .2 Contractor is to notify the Owner's Representative in writing forty-eight hours (48) prior to stopping maintenance operations.

- .3 Maintenance shall follow the BC Landscape Standard, current edition, Level 2 'Groomed'. Over and above this maintenance protocol the Contractor shall monitor the application of water to the seeded areas and ensure that watering procedures are continuous.
 - .1 Apply water with fine spray to avoid seed wash out. Watering procedure shall ensure penetration of minimum 50mm (2") into growing medium and be at sufficient duration and intervals to keep growing medium evenly moist during germination and grow in period.
 - .2 Monitor watering on a regular interval to ensure that watering operations are not causing wash out of seeded area. Should wash outs occur as a result of watering or rain fall re and re wash out, reseed and continue maintenance and watering procedures.
- .4 Grass Cutting: After the 'first' cut of seeded areas grass cutting operations shall be carried out on a weekly (seven day) basis until Final Acceptance by Owner's Representative.
 - .1 First cut of seeded areas shall occur when a uniform grass height of 75mm (3") has been attained. First cut shall be to a height of 64 mm (2.5").
 - .2 Continue regular weekly cutting at a height of 50mm (2") until Final Acceptance.
 - .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 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.
- .6 Seeded lawn areas 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.

3.4 Acceptance

- .1 Conditions for Final Acceptance of Seeded areas:
 - .1 Seeded areas are vigorously growing, well established with a thick, dense and healthy green appearance.
 - .2 Seeded areas are do not have any eroded or wash out areas, bare or dead spots and are free of invasive and/or noxious broadleaf weeds and grasses.
 - .3 No surface growing medium is visible when established seeded areas have been cut to height of 50mm (2")
 - .4 Seeded areas have been cut at least two (2) times a minimum of (7) days apart.
- .2 Areas seeded after September 30 will be not be reviewed for Final Acceptance until April 30th the next year.

END OF SECTION 32 92 19

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 plants by hydroseeding to all areas identified or disturbed by the work of this contract.

1.3 Related Work

- | | | |
|----|-----------------------|------------------|
| .1 | Landscape Maintenance | Section 32 01 90 |
| .2 | Irrigation | Section 32 80 00 |
| .3 | Growing Medium | Section 32 91 13 |
| .4 | Plants and Planting | Section 32 93 10 |

1.4 Reference Standards and Requirements of Regulatory Agencies

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 CSLA Canadian Landscape Standards
 - .2 British Columbia Standard for Turfgrass Sod
 - .3 British Columbia Weed Control Act
 - .4 Canada Seed and Fertilizer Act
 - .5 Canada Pest Control Products Act

1.5 Submittals

- .1 Submit dealer warranty statements of composition of the mixture and the percentages of purity and germination of each variety of grass seed.
- .2 Submit the original seed containers which clearly identify the manufacturer's warranty of seed analysis.
- .3 Submit completed Schedule A - Application Record to the Owner's Representative.
- .4 Provide all product data for seed, mulch, tackifier and fertilizer as required and as requested by the Owner's Representative.

- .5 Submission in writing if requested by Owner's Representative fourteen (14) days prior to commencing Work of this Section:
 - .1 Size of truck slurry in litres.
 - .2 Amount of material to be used per tank based on size of slurry tank.
 - .3 Number of tank loads required per hectare to achieve specified slurry mixture per hectare.

1.6 Protection

- .1 Protect all seeded areas against trespassing and from damage at all times until Acceptance. If any seeded areas are damaged, they shall be repaired as required to satisfaction of Owner's Representative.
- .2 Comply with COV pesticide/herbicide control regulations regarding application of herbicides to control noxious weeds. Ensure all manufacturer's recommendations regarding application are strictly adhered to.

1.7 Testing and Approvals

- .1 Notify Owner's Representative at least forty-eight (48) hours before installing seed for inspection of finished grades. Do not hydroseed until grades are approved by Owner's Representative.
- .2 Obtain approval in writing from the Owner's Representative for application of any chemical vegetation controls. Comply with applicable federal, provincial and municipal legislation and regulations.

1.8 Conditions for Acceptance

- .1 The conditions for acceptance of hydroseeded lawn areas and for turning over the hydroseeded areas to the Vancouver Park Board for subsequent maintenance are:
 - .1 Substantial Performance for the entire project shall have been declared.
 - .2 Hydroseeded lawn areas shall have been maintained as specified for a min. of 55 days. Hydroseeded lawn shall be mown as specified (to a height of 38mm) no more than two days before inspection for Acceptance.
 - .3 The hydroseeded lawn shall be uniformly healthy, in a vigorous growing condition, representative of a dense stand of grass, with all deficiencies corrected to the approval of the Owner's Representative. Lawn shall have no evidence of noxious weeds.
- .2 Inspection and Acceptance by the Board: Notify the Owner's Representative at least 48 hours in advance to schedule inspection of the entire landscape ready for Acceptance. Acceptance by the Board will only be given provided Maintenance as per Item 3.4 has been carried out and other Conditions of Item 1.8 have been met.

1.9 Time of Seeding

- .1 The seeding shall be done during periods which are most favourable for the establishment of a healthy stand (of grass) and at times designated by the Board in accordance with the construction schedule and activities and coordinated with the local weather conditions.
- .2 No seeding shall be done when the soil is frozen, covered by frost or when there is standing or flowing water on the site, nor if the wind speed is greater than 5 km/h.
- .3 The seeding operations shall be completed before September 30, of the calendar year.

1.10 Warranty

- .1 All workmanship and materials covered under Work of this Section shall be warranted for a period of ONE (1) full year from the date of Substantial Performance.

PART 2: PRODUCTS**2.1 General**

- .1 Product Handling
 - .1 All grass seed, hydraulic mulch fertilizers and related materials shall be stored in a dry, weatherproof storage place and shall be protected from damage by heat, moisture, rodents or other causes until time of use. Care shall be taken that labels and other identification(s) are not removed or defaced in any fashion.

2.2 Fertilizer

- .1 Granular Fertilizer: Standard approved brands delivered in original containers, bearing manufacturer guaranteed analysis, dry and free-flowing, organic base, conforming to the applicable Provincial Fertilizer Laws, not less than 19% Nitrogen, 19% Phosphoric Acid and 19% Potash (19-19-19), or as otherwise required based on growing medium test results and time of application.
- .2 Slow-Release Fertilizer: Prills designed to release nutrients over a period of months. Agriform 16-7-12 plus iron or equivalent.

2.3 Grass Seed

- .1 Shall be fresh, clean, new crop certified Canada #1 or better seed, in accordance with Government of Canada "Seeds Act", with a minimum germination of 75% and a minimum purity of 97%. Supplied in standard containers with the following information provided: suppliers name and address, lot number/year of production, net weight (mass), names and percentages of individual seed species and percentage of pure seed. Composed of the following varieties in the proportions and testing the minimum percentages of purity and germination indicated:
 - 10% Common Kentucky Bluegrass

25% Common Creeping Red Fescue

25% Common Chewings Fescue

40% Turf Type Perennial Ryegrass

As supplied and mixed by: a recognized, pre-approved seed distributor acceptable to the Owner.

SPEC. NOTE: TAILOR SPECIES MIX SPECIFIC TO THE PROJECT, CONSIDER GROWING MEDIUM, MAINTENANCE/FERTILIZATION, IRRIGATION, LOCATION.

- .2 Areas into which any other varieties of seed have been introduced will not be accepted. The Owner reserves right to test seed for purity and germination rate.

2.4 Mulch

- .1 Hydroseeding Mulch: Hydroseeding solution shall contain a mulch of dry virgin wood cellulose fibre specifically designed for hydraulic seeding, containing no growth or germination inhibiting factors, and dyed green with a water activated non-toxic dye for visual metering during application; "Ecofibre" as manufactured by Canfor or pre-approved equivalent. In addition:
- .1 The Owner does not accept any mulches made from recycled materials such as paper, saw dust, cardboard or pulp residue.
 - .2 Mulch shall be capable of dispersing in water to form a homogeneous slurry and remaining in such a state when agitated or mixed with other specified materials. In addition it shall be capable of forming an absorptive mat ground cover allowing water percolation into underlying growing medium.
 - .3 It shall be free of weeds and other foreign material and shall be supplied in packages bearing the manufacturer's label clearly indicating weight and product name.

2.5 Tackifier

- .1 M-Binder (Mesh Organic Soil & Mulch Binder)

2.6 Water

- .1 Clean potable water (as supplied by Municipality) free of any impurities which would inhibit germination or otherwise adversely affect growth or be harmful to the environment.

2.7 Weed Control

- .1 Manual weed control is the preferred method in COV and may be the only permitted methodology. Confirm with Owner's Representative. If chemical vegetation control is permitted, use herbicides of type and at an application rate as required to achieve the desired control. Use only standard commercial herbicide products registered for sale and use in Canada under the Pest Control Products Act. Do not use herbicides containing sodium chlorate unless specifically authorized by the Owner's Representative. Do not use

herbicides containing 2, 4, 5,-T in public areas or where there is a possibility of contaminating ditches draining to irrigation or potable water and only as permitted by the COV.

2.8 Approved Equals

- .1 All items as specified or pre-approved equals.

PART 3: EXECUTION

3.1 Soil Preparation

- .1 Grades:
 - .1 Areas to be seeded shall be at grades shown at the time of seeding, free of “humps and hollows”. Crown or slope for surface drainage and eliminate all low spots or depressions. Ensure that growing medium is placed to required depths and tolerances as specified and detailed in the Contract Documents and spread evenly over the approved subgrade. Ensure the growing medium is firm against footprints, loose in texture and free of all stones, roots, branches etc as required under Section 02920 Growing Medium Preparation and Placement.
 - .2 Restore all areas to be seeded that are misshapen or eroded to specified condition, grade, slope as directed just prior to seeding. Minor adjustment and refinement of finish grade to be made as directed by Owner's Representative.
 - .3 Obtain Owner's Representative's approval of finish grading prior to proceeding.
 - .4 Ensure smooth finish on all surfaces and finished grades as shown on the drawings and as specified herein.
- .2 Clearing: Remove all weeds, briars, debris and other refuse and deleterious materials which may be detrimental to the growth of the grass.
- .3 Cultivation: as required to minimum depth of 100mm.
- .4 Moisture: ensure areas to be seeded are moist to minimum depth of 150mm before seeding.

3.2 Application

- .1 Apply with equipment designed for hydraulic seeding, a uniform solution in water of:

| | |
|-------------------|---|
| Seed as specified | 24.4kg/1000 square meters |
| Fertilizer | Type and Rate as required by soil testing analysis. |
| Fibre Mulch | 250kg/1000 square meters |
| Tackifier | Not required on flat areas or slopes up to 25% 6 kg/1000 sq. meters on slopes from 26%-35%. (increase to 8 kg/1000 sq. meters on slopes greater than 35%) |

- .2 Ensure uniform distribution of the solution over the entire area, with adequate discharge pumps, hoses and gun nozzles.
- .3 Take precautions to protect planting beds, walks, roads, buildings and other site features such as signs, guardrails, fences, and utilities against spraying with the solution. Thoroughly clean any surface which is sprayed with the solution where not intended to the satisfaction of the Owner's Representative.
- .4 Do not perform work under adverse field conditions such as wind speeds over 5 km/h, frozen ground or ground covered with snow, ice or standing water
- .5 Apply seed in a uniform workmanlike and continuous fashion until completed. Seed which has been in the hydraulic seeder more than 2 hours shall be considered dead and must be replaced.
- .6 Submit completed Schedule A - Application Record to the Owner's Representative on a daily basis.
- .7 No vehicular traffic will be permitted on areas to be seeded. All unreachable work or work under difficult control conditions shall be completed with use of hoses.
- .8 Ensure a minimum overlap of 450mm between applications to form uniform surfaces.

3.3 Supplementary Fertilizer Application

- .1 Prior to Acceptance, at a time approved by the Owner's Representative, apply fertilizer formulation as recommended for the season at manufacturer's recommended rates evenly to all sodded areas. Water thoroughly.

3.4 Maintenance

- .1 Begin maintenance at time of planting and continue for a minimum of fifty-five (55) days after Substantial Performance or until Acceptance, whichever is greater. Perform maintenance of the hydroseeded areas from time of seeding (date of installation) to date of Acceptance by the Board. Work to include: watering, cultivation, fertilizing, cutting, weeding, and all other measures necessary to ensure germination and development of a uniform, dense, healthy stand of grass.
- .2 Begin maintenance immediately after installation and continue until Acceptance by the Board of all hydroseeded lawn areas. Maintenance shall consist of all measures necessary to keep lawn healthy, in a vigorous growing condition and all other measures necessary to ensure germination and development of a uniform, dense, healthy stand of grass. Maintenance shall include, but shall not be limited to the following:
 - .1 Mowing shall be carried out at regular intervals as required to maintain grass at a maximum height of 60mm. (2-1/2"). Not more than 1/3 of the blade shall be cut at any one mowing. Edges of lawn areas shall be neatly trimmed. Heavy clippings shall be removed immediately after mowing and trimming.

- .2 Watering shall be carried out when required and with sufficient quantities to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
- .3 Rolling shall be carried out when required to remove any minor depressions or irregularities.
- .4 Weed control shall be carried out when the density of weeds reaches 10 broadleaf weeds or 50 annual weedy grasses per 37 sq. M. (400 square feet).
- .5 Weed control, whether manual or chemical, shall reduce the density of weeds to zero. If chemical, apply in strict accordance with the manufacturer's recommendations and to the standards specified herein.
- .6 Any seeded areas showing deterioration or bare spots shall be repaired immediately. All areas shall be top dressed and over seeded with a seed mix matching the original seed mix.
- .7 All seeded areas shall be adequately protected with warning signs, temporary wire, twine or mesh fences as dictated by Owner's Representative. Fencing shall be maintained in good condition to provide a continuous barrier until Acceptance. Except as otherwise required by the work of this Contract, the fencing shall be removed from the site upon Acceptance/Assumption by the Owner.

3.5 Cleaning

- .1 Remove from the site all surplus materials and other debris resulting from seeding operations.
- .2 Flush all walks, pavement and any area surface sprayed with solution clean to the satisfaction of the Owner's Representative.

SCHEDULE A - HYDROSEED APPLICATION RECORD (SAMPLE)

| | | | |
|------------------------------------|-------|--------------------|-------|
| Project Name/Owner's Contract No.: | _____ | | |
| Owner's Representative | _____ | Weather Conditions | _____ |
| Date: | _____ | | |
| Contractor Foreman: | _____ | Size of Crew: | _____ |
| Month: | _____ | | |

| <i>Time</i> | <i>Load No.</i> | <i>Seed Mix/ Flower Mix</i> | <i>Fertilizer</i> | <i>Mulch</i> | <i>Tackifier</i> |
|-------------|-----------------|---------------------------------|-------------------|--------------|------------------|
| | | | | | |
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END OF SECTION 32 92 21

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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 plant material as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|-----------------------|------------------|
| .1 | Landscape Maintenance | Section 32 01 90 |
| .2 | Irrigation | Section 32 80 00 |
| .3 | Growing Medium | Section 32 91 13 |
| .4 | Sod Lawn | Section 32 92 23 |

1.4 Quality Assurance

- .1 All materials and work shall conform to the latest edition of the following standards or as otherwise specified:
 - .1 CNTA (Landscape Canada) Canadian Standards for Nursery Stock – Current Edition
 - .2 CSLA/ Canadian Landscape Standard – Current Edition
 - .3 Perennial Plant Association Standards for herbaceous perennial plants
 - .4 ANSI A-300 Tree Pruning Guidelines
 - .5 Urban Tree Foundation/ISA Guideline Specifications For Nursery Tree Quality, current version
- .2 Imported growing medium is to be free of all foreign debris and non-typical soil components including small pieces of plastic bags, plastic pieces like parts of containers or labels, dimensional lumber, metal and glass. Evidence of more than 5 pieces of foreign materials observed within the imported growing medium will result in the rejection of all of the growing medium and its immediate removal from the site.

1.5 Source Quality Control

- .1 Seven (7) days prior to the Owner's Representative 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.
- .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 Owner's Representative shall make one (1) visit to source nursery for review of plant material for entire project.
 - .3 If review in more than one location becomes necessary, the Contractor shall reimburse the Owner's Representative for the additional time required at the current hourly rates of the Staff personnel.
 - .4 Shipping of plant material to project site shall not proceed until Owner's Representative has reviewed the plant material at the source nursery.
 - .5 All plants are subject to review and may be rejected for failure to comply with this specification at any time until Acceptance. Immediately replace rejected material and remove from the site at no cost to the Owner.
 - .6 Trees required for the work **must be reviewed and tagged by the Owner's Representative at (the place of growth) before being dug.** Inspection and tagging at the place of growth shall not affect the right to reject such trees on or after delivery thereof to the site.
 - .7 Plants required for the work **must be reviewed by the Contractor before being prepared for delivery.** Inspection shall not affect the right to reject such plants on or after delivery thereof to the site.
 - .8 **Plants arriving on site must be reviewed by the Owner's Representative prior to off-loading.** Provide minimum 48 hours notice to schedule review.
 - .9 The Contractor or his authorized representatives shall be present during all required reviews as specified or as may be required.
- .4 Plant Material Review at Project Site
 - .1 All plant material shall be reviewed at the project site by the Owner's Representative prior to planting.
 - .2 Plant material that is rejected by the Owner's Representative 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, but not limited to, Horsetail and Morning Glory.
- .7 Plant material grown or supplied in Fabric Containers are not acceptable.

1.6 Submittals

- .1 Confirmation Plant List
 - .1 Contractor shall provide in writing to the Owner's Representative 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.
- .2 Prior to the review of plant material by the Owner's Representative 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. The documentation submitted shall include but is not limited to the nurseries CNCI Clean Plants certification number.
- .3 Substitutions
 - .1 Contractor shall provide in writing to the Owner's Representative a minimum of seven (7) days prior to review of plant material at the source nursery a list of proposed substitutions for review.
 - .2 Substitutions in plant material will not be considered unless written proof is submitted thirty (30) days prior to scheduled installation stating a specified plant cannot be obtained within the specified area of search.
 - .3 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, plant size and calliper of trees to be substituted.
 - .4 Upon submission of such proof, a proposal will be considered for using the nearest equivalent size or variety with an equitable adjustment of the Contract price.
- .4 Planting Schedule
 - .1 Contractor shall provide in writing to the Owner's Representative upon award of the Contract a detailed planting schedule outlining dates and duration of planting operations.

- .2 Revisions to the Planting Schedule as a result of delays of any kind shall be submitted to the Owner's Representative in a timely manner prior to the start of planting operations.
- .5 Composted Mulch: Contractor to submit a one (1) litre sample of Composted Mulch to the Owner's Representative for review prior to shipment to the site.
- .6 Prepared Growing Medium: Contractor to submit a one (1) litre sample of the Prepared Growing Medium to the Owner's Representative for review prior to shipment to the site.
- .7 Antidesiccant: Contractor to submit three (3) copies of manufacturer product data and specification for Owner's Representative review.

1.7 Acceptance

- .1 The conditions for Acceptance of landscape areas and for turning over the landscape areas to the Owner for subsequent maintenance are:
 - .1 Growing medium quality, fertility levels, depths and surface grading have been completed to the requirements of Section 32.91.13.
 - .2 Plant quantities, sizes, quality and locations are as shown in the Contract Documents or as otherwise approved by the Owner's Representative.
 - .3 Substantial Performance for the complete project shall have been declared.
 - .4 All plants shall be installed at the correct elevation relative to finished grade, healthy, in a vigorous growing condition and established to the satisfaction of the Owner's Representative.
 - .5 Trees will be assessed for acceptance only when in leaf, and not when in a dormant state.
 - .6 All deficiencies with regard to landscape work shall have been rectified.
 - .7 All trees are staked where required.
 - .8 **Landscape areas shall have been maintained for at least 55 days.** All planted areas are free of all visible weeds and substantially free from underground weed seeds or parts thereof, to the requirements of Section 32 01 90 Landscape Maintenance (as Applicable).
 - .9 Mulch has been placed as required. All areas not to receive mulch are in a cultivated, loose, friable condition where water can freely permeate the surface.
- .2 The date of Acceptance shall be as determined by the Owner's Representative base upon the Inspection for Acceptance. Contractor shall request inspection for Acceptance, giving at least 48 hours notice.

1.8 Warranty

- .1 Replace for a period of two (2) years after Substantial Performance of the project, all unsatisfactory plant material **and continue to replace such plant material until the replacement is acceptable to the OWNER'S REPRESENTATIVE**, at no cost to the Owner. This warranty will apply to all plant material, whether supplied by Contractor or Owner.
- .2 This warranty is based on adequate maintenance by the Owner after Acceptance. The Contractor will not be responsible for plant loss due to extreme climatic conditions such as abnormal freezing temperatures or hail which occur after Acceptance. The Contractor shall be responsible for plant loss due to inadequate acclimatization of plants for their planted location.
- .3 Adequacy of acclimatization and existence of extreme climatic conditions shall be as determined by an **independent Owner's Representative** on the basis of plant variety, location, recorded temperatures for the locale, time of planting and other factors pertinent to the situation.

1.9 Plant Material Replacements

- .1 The Contractor shall remove from the site and immediately replace any plant material that has been determined by the Owner's Representative to have died or failed to grow in a satisfactory manner during the warranty or maintenance period.
- .2 The Contractor shall extend the warranty on this replacement plant material for two (2) years from the date of replanting.
- .3 The Contractor shall continue such replacement and warranty of plant material until the Owner's Representative has determined that the 'Conditions for Final Acceptance' have been met.

1.10 Permits

- .1 Obtain and pay for all permits required for the work, including such permits as may be required for planting and related work on municipal property (e.g. street trees).

1.10 Warranty

- .1 All workmanship and materials covered under Work of this Section shall be warrantied for a period of two (2) full years from the date of Substantial Performance.

PART 2: PRODUCTS

2.1 General

- .1 Area of Search: Area of search for specified plant material shall include the Lower Mainland of British Columbia, Vancouver Island, Washington and Oregon States, except as noted on the plant list.
- .2 Provenance: All plant material used on this project shall be hardy in this climate. Plant types have been selected with this as a criterion. This Contractor shall guarantee that plant material supplied has equal provenance, i.e.: it is developed from cuttings or seeds collected in an area of similar climatic characteristics. Submit proof of equal provenance to Owner's Representative upon request.
- .3 Plants or seeds purchased for Park Board projects are to be free of neonicotinoid ("neonics") or other nicotinic Acetylcholine receptor agonists. Pesticides covered by this specification include but are not limited to clothianidin, dinotefuran, flupyradifurone, imidacloprid, thiamethoxam, sulfoxaflor, thiacloprid, and acetamiprid."

2.2 Plant Material

- .1 Plant material shall be of the sizes and quantities as shown in plant lists on Landscape Drawings and shall be nursery grown unless specifically described as "collected". **All "non-specimen" plantings specified in the Plant List(s) are specified according to the Canadian Nursery Trades Association Canadian Standards for Nursery Stock and the BCLNA Standard for Container Grown Plants.**
- .2 In particular, plant material shall conform to the following CNTA Standards:
 - .1 "Nursery stock shall be true to name, type and form and representative of their species or variety. In addition, they shall be of the size and grade and quality stated".
 - .2 "Quality shall be normal for the species when grown under proper cultural conditions viable, substantially free from pests and disease, and undamaged".
 - .3 "Roots shall not be subject to long exposure to drying winds, sun or frost, between digging and delivery".
 - .4 Root balls and soil in containers shall be free from pernicious perennial weeds."
 - .5 Roots shall be transplanted, or root pruned at least once within the year prior to planting.
 - .6 Take precautions during digging, handling, and shipping of plant material to avoid injury to plants and root systems.
 - .7 Plants for use when symmetry is required shall be matched as nearly as possible.
 - .8 Plants shall not be pruned prior to delivery.
 - .9 All plants shall be measured when the branches are in the normal position. Measurements shall be as set out in the BCLNA Standard for Container Grown Plants. Calliper of trees shall be measured 12 inches above the ground.
 - .10 Trees shall have straight trunks with a single leader intact. There shall be no abrasion of the bark and no fresh cuts of limbs over 1-1/4" that have not completely calloused over.

- .11 Where trees are to be in a formal arrangement or occur in consecutive order, they shall be carefully measured as to height and spread and tagged with a number before delivery to the site. These trees shall be correspondingly identified on plan to assure symmetry and expeditious handling.
- .12 Plants larger in size than specified in the itemized plant list may be used if approved; but the use of larger plants shall not increase the Contract price. If the use of larger plants is approved, the ball of earth or spread of roots shall be increased in proportion to the size of the plant.
- .13 The size specified is the size of plant required at the time of delivery to the construction site. Sizes shown are minimum sizes.
- .3 Container dimensions shall be as defined in the B.C. Landscape Standard 1997 Edition.

2.3 Tree Ties

- .1 Flat woven polypropylene material. 20 mm (3/4") wide, 544 Kg. (1200lb), break strength. Arbor Tie by Deep Root or approved equal. Submit sample for approval to protect bark or other types approved by the Owner. Generally, they shall be of a material that will not damage the bark. Tree tie material shall be at least 25mm (1") 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.

2.4 Burlap

- .1 Shall be untreated, free from toxic contaminants and of sufficient strength to hold the rootball in a compact, stable mass that does not move relative to the main stem(s) of the tree or shrub.

2.5 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.

2.6 Water

- .1 potable and free of minerals that are detrimental to plant growth.

2.7 Composted Mulch

- .1 9mm (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.

2.8 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.

2.9 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.

2.10 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.

2.11 Stakes and Stake Fasteners

- .1 **Fir, standard or better, 75mm x 75mm x 3000mm long.** Stake fasteners shall be hot dipped galvanized or stainless steel.

2.12 Flagging Tape

- .1 30mm (13/16") wide 'Red' PVC flagging tape by Identi-Tape, Boulder, CO or approved.

PART 3: EXECUTION

3.1 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 the Owner's Representative. Plants planted before or after any stipulated dates will be rejected. **Tree planting is not permitted between June 30th and September 30th regardless of irrigation. Shrub, ground cover planting or sodded or seeded lawn installation between June 30th and September 30th is not accepted unless the project is irrigated.**
- .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.

3.2 Planting Schedule

- .1 All planting operations shall be done in a timely manner in accordance to 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 Owner's Representative with up dates to the schedule as required throughout the planting process.

3.3 Delivery

- .1 Dig and handle all plant material in a manner suitable for each species to prevent injury to or removal of fibrous roots. All plant material delivered with broken or loose root balls or containers will be rejected by the Owner's Representative and replaced by the Landscape Contractor at no additional cost to the Owner.
- .2 Take precautions to avoid burning of plants by sun or wind during handling and transporting.
- .3 Keep root balls and container soil moist prior to delivery by covering with bark mulch, wet straw or soil and water as required to ensure moist root balls.
- .4 Coordinate the delivery of plant materials with work of other trades and other site activities.
- .5 Off load the plant materials at the site as designated by the Owner's Representative.
- .6 All plant material shall be acclimatized to the final location before delivery and planting. The Contractor will be held responsible for plant losses caused by inadequate acclimatization.

3.4 Plant Layout

- .1 Locate plants according to the Planting Plan for approval of plant location and orientation. Notify the Owner's Representative, giving 48 hours notice, when plant layout will be ready for review. At this time the Owner's Representative may make adjustments in plant locations and orientation prior to planting.
- .2 Stake location of all major trees for approval to positioning. Notify the Owner's Representative at least 48 hours before planting of major trees. **The Owner's Representative must be present** during planting of major trees to ensure proper orientation and location.
- .3 Anti-desiccant shall be applied only as directed by the Owner's Representative. Application of anti-desiccant shall be in accordance with manufacturer's instructions.
- .4 Coordinate planting operations with other trades and project schedule.

3.5 Excavation

- .1 Existing Utilities; 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 For all trees, excavate tree pits with vertical sides, depth to be of sufficient size to contain root ball, min 600mm x 10m² surface area of growing medium or as detailed, directed by Owner's Representative.

- .3 Scarify the sides of tree pits.
- .4 **Test all tree pits for poor drainage as directed by Owner's Representative.** Fill each tree pit with a minimum of 20 litres (5 gallon) of water. Water should freely drain through subsoil within ten (10) minutes. If poor drainage or percolation is encountered report this condition immediately to the Owner's Representative for acceptable remedial measures. Measures such as auguring holes through the impervious layers and backfilling with approved clean rounded drain rock or sand, raising the planting grade, or adding dedicated drain lines connected to the subsurface drainage system will be considered.
 - .1 Notify Owner's Representative 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.
- .5 Protect bottom of tree pit(s) against freezing.
- .6 Ensure tree pits and plant beds are kept well drained and free of contaminants and construction debris.
- .7 Excavate hole in growing medium sufficient to receive root ball. Excavation of the subgrade below the root balls of trees shall be only as necessary to permit the bottom of the root ball to sit on undisturbed material or compacted fill such that the top of the root ball remains at the proper finished grade. Disturbed subgrade or fill below the root ball shall be compacted to prevent settlement of the tree after planting. Remove excess material from the site.
- .8 Remove excavated subsoil material from site or use on site in an approved manner. Obtain prior approval from Owner's Representative.

3.6 Planting Procedure

Plants and Trees

- .1 Planting operations shall be carried out under conditions that are conducive to healthy, vigorous growth of plant material.
- .2 Planting operations shall not be carried out when the growing medium is frozen, mixed with ice and/or snow, saturated or compacted to levels that exceed this specification.
- .3 Plant material shall be planted vertical, straight and plumb at locations staked in field and or noted on landscape plans.
- .4 Ensure orientation of plant material will give best appearance in relation to views from adjacent buildings, roads, walks or use areas.
- .5 Install all plants at height grown in Nursery. Allow for settling of the growing medium after planting. The grade that the plant was grown in the nursery shall be used as the indicator for proper growing medium and plant elevation relationship. Top of root ball elevation shall match the elevation of adjacent growing medium elevation.
- .6 Plants shall be set plumb in the planting beds or in the centre of the pits, except where the plant's character requires variation. Obtain approval from Owner's Representative.

- .7 Backfill around root ball with prepared growing medium, tamping and watering to ensure firm support for the plant and eliminating all air pockets around the root ball. Ensure water penetration into the root balls during planting procedures.
- .8 Remove all string, rope, burlap and other restricting elements out to the perimeter of the root ball. Cut all wire basket handles flush with the top ring or fold back down into the planting hole. Do not remove wire baskets. Ensure no wires from the basket protrude into the top 100mm of the growing medium.
- .9 Ensure a 150mm (6") deep saucer around all trees for the full width of the planting pit.

3.7 Fertilizer Application

- .1 Place fertilizer as per recommendations of soil analysis and to requirements of Section 32 91 13.

3.8 Tree Stabilization

- .1 Stake and Tie trees immediately after planting if specified and only as directed by the Owner's Representative. Trees damaged as a result of delayed staking shall be replaced.
- .2 Trees shall stand plumb on completion of this operation.
- .3 Stakes and ties shall be installed such that injury to bark will not occur.
- .4 Ensure guy pins and stakes are placed out beyond the root ball. Trees that have had root balls penetrated by guy pins and stakes will be rejected.
- .5 Tie one (1) to two (2) flagging tape flags to all guy wires at a height that is clearly visible.

3.9 Tree Trunk Protection

- .1 Trees in lawn areas shall have trunk protection.
- .2 Place tree trunk protection around base of tree trunk as per manufacturer instructions.
- .3 Trees 100mm (4") calliper or less shall have one protector. Do not interlock ends of tree protector.
- .4 Trees greater than 100 mm (4") calliper shall have a minimum of two interlocked protectors. Do not interlock outside ends.

3.10 Tree Rings

- .1 Trees in lawn areas shall have 750mm (30") tree rings cut around the base of each tree. The tree rings shall be true circles centered on the trunk of the tree.
- .2 Have sod removed and area mulched as per specifications.
- .3 Trees in seeded areas shall have 750mm (30") tree rings cut around the base of each tree once seeded areas have been accepted by the Owner's Representative. The tree rings shall:
 - .1 Be true circles centered on the trunk of the tree.
 - .2 Have grass removed and area mulched as per specifications.

3.11 Pruning

- .1 Prune trees and shrubs after planting only as directed by Owner's Representative.
- .2 Prune only as directed by Owner's Representative.
- .3 Tree pruning is to be performed in accordance with the best practices published on the International Society of Arboriculture's (ISA) website (www.treesaregood.org).
- .4 Branch removal should be limited to necessary clearance pruning for public and electrical safety and the removal of dead, diseased, and/or defective wood to improve tree health and/or structure.
- .5 Street trees are to be pruned and maintained in accordance with Illuminating Engineering Society of North America (IES) standards for Roadway Lighting.
- .6 Each shrub planted shall be pruned to preserve the natural character of the plant and in a manner appropriate to its requirements in the landscape design.
- .7 All soft wood sucker growth and all broken or badly bruised branches shall be removed with a clean cut.
- .8 All pruning shall be done with proper, sharp pruning tools. All pruning cuts to be made protecting the branch collar.
- .9 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.
- .10 Do not damage the branch collar.
- .11 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.
- .12 Do not remove minor twig branches along the main structural branches.

3.12 Applying Mulch

- .1 Prior to the application of composted mulch.
 - .1 Reset all plants that have settled so that relationship of nursery grade of root ball to finish grade of growing medium is as per specification.
 - .2 Manually remove all weeds and weed roots from root balls and adjacent growing medium.
 - .3 Remove all deleterious material and debris from planting areas.
 - .4 All fine grading is complete, the growing medium is loose and friable.
 - .5 The Owner's Representative 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.

3.13 Planting Maintenance

- .1 Begin planting maintenance at time of planting. The planting maintenance under this section shall continue for a minimum of fifty-five (55) days after Substantial Completion or until Acceptance, whichever is greater, when there is no landscape maintenance contract included for the project.
- .2 The planting maintenance under this section shall continue only until Substantial Completion, when there is a landscape maintenance contract included for the project. The landscape maintenance contract starts on the date of Substantial Completion, refer to 32 01 90 Landscape Maintenance specification for details.
- .3 If for any reason the Contractor elects, on their own without the written consent of the Owner's Representative to suspend maintenance operations they are to provide the Owner's Representative written notice of such action. Any damages or requirement for the replacement of plant material that as a result of the suspension of maintenance operations shall be the borne by the Contractor at no cost to the Owner.
- .4 Maintenance of plant material includes but is not limited to watering at intervals sufficient to maintain healthy, vigorous growth, weeding of beds and tree pits, cultivating of growing medium, pruning, treatment of insects, moulds, fungi or disease to the Level 2 "Groomed" as per the Canadian Landscape Standards or as directed by Owner's Representative.
- .5 Plant material shall be deep watered at least once per day when temperatures exceed 25 degrees Celsius (77 degrees F).
- .6 Contractor to ensure adequate moisture in plant root zone prior to winter freeze-up.
- .7 Ensure tree guards, stakes, flagging tape on tree guy wire and tree ties are kept secure, taught and in proper repair.

3.14 Finish Grading

- .1 All planted areas and all growing medium shall be fine graded after placing to the finished elevations and contours as detailed and specified herein. Surfaces shall be true to intended grades, smooth, uniform, and firm against deep foot printing, with a fine loose surface texture. Ensure all rough spots and low areas are eliminated to ensure positive surface drainage. Adjust grades to accommodate for mulch as specified/detailed.

3.15 Cleaning

- .1 All excess materials and other debris resulting from planting operations shall be removed from the job site.
- .2 Flush all walks and paved areas and rake all lawn areas clean to the satisfaction of the Owner's Representative.

END OF SECTION 32 93 10

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 sod lawn as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|-----------------------|------------------|
| .1 | Landscape Maintenance | Section 32 01 90 |
| .2 | Irrigation | Section 32 80 00 |
| .3 | Growing Medium | Section 32 91 13 |
| .4 | Plants and Planting | Section 32 93 10 |

1.4 Reference Standards

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 CSLA Canadian Landscape Standard
 - .2 British Columbia Standard for Turfgrass Sod
 - .3 British Columbia Weed Control Act
 - .4 Canada Seed and Fertilizer Act
 - .5 Canada Pest Control Products Act

1.5 Submittals

- .1 Guaranteed analysis of the grass mixture and purity of sod. Submit sample of sod prior to installation. Submit soil analysis of sod growing medium with sod sample.

1.6 Testing and Approvals

- .1 Notify Owner's Representative at least forty-eight (48) hours before installing sod for review of finished grades and sod

- .2 Obtain approval in writing from the Owner's Representative for application of any chemical vegetation controls. Comply with applicable federal, provincial and municipal legislation and regulations.

1.7 Acceptance

- .1 The conditions for acceptance of sodded areas and for turning over the sodded areas to the Vancouver Park Board for subsequent maintenance are:
 - .1 Total Performance of the Work (per CCDC2, Supplementary Conditions) for the entire project has been declared.
 - .2 Sod shall be mown as specified no more than two days before inspection for Acceptance.
 - .3 Sod shall be uniformly healthy, dense, in a vigorous growing condition, rooted into the underlying soil and shall show no signs of yellowing. There shall be no gaps showing between adjacent rolls of sod.
 - .4 Sod shall have no evidence of noxious weeds.
- .2 Inspection and Acceptance by the Board: Notify the Owner's Representative at least 48 hours in advance to schedule inspection of the entire landscape ready for Acceptance.

1.8 Protection

- .1 Protect all sodded areas against trespassing and from damage at all times until Acceptance. If any sodded areas are damaged, they shall be repaired as required by the Contractor.
- .2 Comply with COV pesticide/herbicide control regulations regarding application of herbicides to control noxious weeds. Ensure all manufacturer's recommendations regarding application are strictly adhered to.

1.9 Warranty

- .1 All workmanship and materials covered under Work of this Section shall be guaranteed for a period of two (2) full years from the date of Substantial Performance.

PART 2: PRODUCTS

2.1 General

- .1 Product Handling
 - .1 During shipping, storage and installation, protect sod against drying, to the requirements of the B.C. Standard for Turfgrass Sod.

2.2 Fertilizer

- .1 Fertilizer shall be **as recommended for season of application** (as per industry standards).

2.3 Lime

- .1 Dolomite Lime: Shall be finely and uniformly ground containing not less than 90% calcium carbonate.

2.4 Sod

- .1 Sod:
 - .1 Suitability: All turfgrass sod shall be suited to the locality, site conditions and intended function of each project or area.
 - .2 Sod shall be nursery grown turfgrass sod, true to type, conforming to the B.C. Standard for Turfgrass Sod. **"Non-Netted" Sod, only will be accepted by the Owner.**
 - .3 The quality grade of sod (based on B.C. Standard for Turfgrass Sod) shall be **No. 1 Premium Grade grown on a screened alluvial sand base, cultivated on a sterilized soil base to ensure a weed free product.** The maximum fines (silt and clay) in the alluvial sand base to be no more than 1% by weight.
 - .4 Approved turf products includes:
 - .1 Anderson Sod Farms "Pro Sport"
 - .5 Submit sieve analysis for turf farm sand if requested by Owner's Representative.
- .2 The grass mixture in sod shall be suited to the location and intended use and shall be as described in the B.C. Standard for Turfgrass Sod unless otherwise specified. Standard grass mixture requirements for **general purpose areas shall be** in the following approximate proportions:

| | |
|------------------------------|-----|
| Kentucky Bluegrass | 50% |
| Perennial Turf Type Ryegrass | 50% |
- .3 Weed Control: **Manual weed control is the preferred method in COV and may be the only permitted methodology.** Confirm with Owner's Representative. If chemical vegetation control is permitted, use herbicides of type and at an application rate as required to achieve the desired control. Use only standard commercial herbicide products registered for sale and use in Canada under the Pest Control Products Act.

2.5 Approved Equals

- .1 All items as specified or pre-approved equals.

PART 3: EXECUTION

3.1 Fertilizer

- .1 Apply fertilizer at manufacturers' recommended rates. Ensure equal distribution. Mix into top 50 mm. (2") of growing medium by discing, raking or harrowing. **Application of fertilizer shall be within 48 hours of laying sod.**

3.2 Liming

- .1 Add limestone as required to ensure pH 6.0 to 6.5. Mix into full depth of growing medium. Coordinate with soils analysis.

3.3 Subgrade Preparation and Finishing

- .1 **Obtain approval of Owner's Representative of subgrade and growing medium prior to laying any sod.** Ensure that growing medium is placed to required depths and tolerances as specified and detailed in the Contract Documents and spread evenly over the approved subgrade. Ensure the growing medium is firm against footprints, loose in texture and free of all stones, roots branches etc as required under Section 02920 Growing Medium Preparation and Placement.
- .2 Ensure smooth finish on all surfaces and finished grades as shown on the drawings and as specified herein.
- .3 Grades:
 - .1 Areas to be sodded shall be at grades as shown at the time of sodding, less an allowance for the thickness of the sod.
 - .2 Restore all areas to be sodded which are misshapen or eroded to original specified condition, grade and slope as directed just prior to sodding. Minor adjustment and refinement of finish grade to be made as directed by the Owner's Representative.
 - .3 Crown or slope for surface drainage and eliminate all low spots or depressions.
 - .4 Obtain approval of finish grading from the Owner's Representative prior to proceeding.
 - .5 The Owner does not allow sod laying on any slopes steeper than 4:1.
- .4 If the surface of the growing medium is dry, lightly moisten the growing medium immediately prior to laying sod.

3.4 Sod Laying

- .1 Use full rolls where possible. No bits or sod remnants are allowed.
- .2 Lay sod in rows with ends staggered. Butt all sections closely. Do not overlap or allow gaps wider than 2mm between sections. Top of sod to be flush with adjacent walking surfaces.
- .3 Protect new sod from heavy foot traffic during laying. Place planks or plywood if necessary to prevent damage. **Lay within 24 hours after delivery to prevent deterioration. Any sod laid after the 24 hour period will be rejected.**

- .4 Lay sections on slopes at right angles to the direction of the slope. Stake sod into place with wood stakes driven flush with the surface in any locations having slopes steeper than 3:1. Interval spacing on stakes shall not exceed 500mm. Prior to pedestrian traffic being allowed onto the sod, and only after the sod is well rooted into the growing medium, pegs or stakes shall be removed or driven to an elevation 50mm below the finished surface.
- .5 Cut sod where necessary only with sharp tools.
- .6 Water thoroughly to penetrate the full depth of the growing medium as specified.
- .7 When sod has dried sufficiently, roll with 113kg. (250lb.) roller to obtain smooth uniform surface and ensure a good bond between soil and sod.
- .8 **(AS APPLICABLE)** Erosion control netting shall be installed in sodded areas where required, erosion control mesh or netting shall be placed and secured with stakes or staples set firmly into the ground to a minimum depth of 150mm. Spacing of stakes or staples shall be adequate to ensure complete anchorage of the sod to the ground.
- .9 Sodded or seeded lawn installation between June 30th and September 30th is not accepted unless the project is irrigated (this may include a temporary irrigation system or watering truck).

3.5 Maintenance

- .1 Begin maintenance at time of planting and continue for a minimum of fifty-five (55) days after Substantial Completion or until Acceptance, whichever is greater. Maintenance shall consist of all measures necessary to keep grass healthy, in a vigorous growing condition and well rooted into the underlying soil. Maintenance shall include, but shall not be limited to the following:
 - .1 Mowing shall be carried out at regular intervals as required to maintain grass at a maximum height of 60mm. (2-1/2"). Not more than 1/3 of the blade shall be cut at any one mowing. Edges of sodded areas shall be neatly trimmed. Heavy clippings shall be removed immediately after mowing and trimming.
 - .2 Watering shall be carried out when required and with sufficient quantities to prevent grass and underlying growing medium from drying out.
 - .3 Rolling shall be carried out when required to remove any minor depressions or irregularities.
 - .4 Weed control shall be carried out when the density of weeds reaches 10 broadleaf weeds or 50 annual weedy grasses per 37 sq. M. (400 square feet).
 - .5 Weed control, whether manual or chemical, shall reduce the density of weeds to zero. **If chemical apply in strict accordance with the manufacturer's recommendations and to the standards specified herein.**
 - .6 Any sodded areas showing deterioration or bare spots shall be repaired immediately. All areas showing shrinkage due to lack of watering shall be top dressed and seeded with a seed mix matching the original seed mix.

- .7 All sodded areas shall be adequately protected with warning signs and fencing as directed by Owner's Representative. Fencing shall be maintained in good condition to provide a continuous barrier until Acceptance. Except as otherwise required by the work of this Contract, the fencing shall be removed from the site upon Acceptance.

3.6 Supplementary Fertilizer Application

- .1 Prior to Acceptance, at a time approved by the Owner's Representative, apply fertilizer formulation **as recommended for the season** at manufacturer's recommended rates evenly to all sodded areas. Water thoroughly.

3.7 Cleaning

- .1 All excess materials and other debris resulting from sodding operations shall be removed from the job site.
- .2 Sweep and flush all walks and paved areas clean to the satisfaction of the Owner's Representative.

END OF SECTION 32 92 23

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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 temporarily relocate, maintain, return and replant existing trees and shrubs as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|-----------------------|------------------|
| .1 | Clearing and Grubbing | Section 31 11 00 |
| .2 | Maintenance | Section 32 01 90 |
| .3 | Growing Medium | Section 32 91 13 |
| .4 | Plants and Planting | Section 32 93 10 |

1.4 Warranty

- .1 Warranty shall apply only to labour, workmanship, and materials. Tree and shrub survival shall not be included in this warranty.

1.5 Reference Standard

- .1 ANSI A300 Tree Pruning Guidelines
- .2 City of Vancouver Tree Protection By-Law

PART 2: PRODUCTS

2.1 Wire Baskets

- .1 Baskets shall be eight (8) gauge or better weld wire, cone shaped in diameters to match dug root ball sizes 1200 mm (4'-0") and greater.

2.2 Burlap:

- .1 Burlap for containing roots and soil shall be heavy weight Hessian burlap.

2.3 Anti-Desiccant

- .1 Wax-like emulsion to provide film over plant surfaces, reducing evaporation but permeable enough to permit transportation. "Wilt-Proof" or pre-approved equal.

2.4 Tree Ties:

- .1 Arbour Tie by Deep Root, or pre-approved equal. Flat woven polypropylene material 20 mm wide, 544 Kg (1200 lb.) break strength tree tie.

2.5 Tree Guy Anchors:

- .1 Anchors shall be buried, 100 mm (3") diameter steel disc, screw-in type.

2.6 Stakes

- .1 Fir, standard or better, 75mm x 75mm x 3000mm, long.

2.7 Mechanical tree digger:

- .1 Mechanized-digging equipment to be hydraulic spade type.
- .2 Digger shall be suitable size to produce an earth ball, which complies with the current B.C.N.T.A. and C.N.T.A. standards.

PART 3: EXECUTION

3.1 Pre-Digging And Planting Holes

- .1 Pre-dig holes to receive trees with the mechanical tree digger at locations noted on the Landscape Drawings or as marked by Owner's Representative in field. Ensure Owner's Representative has reviewed proposed tree locations prior to digging.
- .2 Insure that the top elevation of the relocated root ball is 50 mm (2") above the existing surrounding grade for pre dug holes. Confirm that the existing grade is the final finished grade.

3.2 Tree Digging Procedure

- .1 Lift root balls from hole with tree digger. Place wire baskets, lined with burlap, in hole.
- .2 Replace root ball into wire basket lined hole and tie basket to ball with heavy rope/twine.
- .3 Ensure tree trunk and branches are not injured by wire basket ties or rope.

3.3 Shrub Digging Procedure

- .1 Root ball shall be a minimum of 450 mm (18") in diameter for shrubs up to 1.2 metres (4'-0") height and spread. Shrubs greater than 1.2 metres (4'-0") increase diameter of root ball 50 mm (2") for every 200 mm (8") of height and spread.
- .2 Use a clean, sharp spade to dig around the perimeter of the shrub to form a rootball with a diameter as noted in 3.03.1 to a minimum depth of 350 mm (14").
- .3 Shrubs that cannot be moved to new location on site will have their root balls contained with burlap and located in the temporary on site nursery.

3.4 Delivery To Site

- .1 Protect trunk, branches and root ball from abrasion and damage during loading, unloading and transplanting operations.
- .2 Cover trees and root balls with tarpaulins to minimize drying during transportation operations.
- .3 Coordinate location for unloading and temporary stockpile on site.

3.5 Watering

- .1 Construct saucer around each tree with a berm of growing medium approximately 150 mm (6") higher than the top of the root ball, 1200 mm (4'-0") from the base of trunk of the tree to facilitate watering.
- .2 Water each relocated tree and shrub to ensure deep and thorough saturation of root ball.

3.6 Temporary Storage of Plant Material On Site

- .1 Coordinate shipping and relocation of plant material on site or from nursery with 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 of planting stock with rope or wire which 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 shrubs by the trunk or branches. Plant material only to be moved by lifting the rootball or container.
- .8 Remove broken and damaged roots with clean cuts using sharp pruning shears.

.9 Temporary Storage of Plant Material on Site:

- .1 Heel-in all trees, shrubs and miscellaneous plant material that cannot be planted immediately.
- .2 Insure temporary heel - in area is shaded and protected from the wind.
- .3 Provide sufficient water at regular intervals to ensure health of plant material.
- .4 Plant material to be spaced to insure branches do not touch and sufficient air movement can be maintained around trees and shrubs.
- .5 Material to heel-in relocated trees and shrubs.

3.7 Pruning

- .1 Prune only as directed by Owner's Representative.
- .2 All Pruning to be completed by an I.S.A. Certified Arborist using proper sharp Arborist's tools.

3.8 Guying Relocated Trees

- .1 Use wood stakes only if requested by Owner's Representative.
- .2 Staking system to incorporate buried anchors or stakes and Arborknot as per manufacturer's instructions to achieve a straight, secure tree. Coordinate type of staking system with Owner's Representative.

3.9 Maintenance

- .1 Begin maintenance at time of planting and continue for a minimum of fifty-five (55) days after Substantial Completion or until Acceptance, whichever is greater.
- .2 **The Owner's Representative is to notify the Owner's Representative in writing forty-eight hours (48) prior to stopping maintenance operations.**
- .3 Maintain tree ties until completion of contract or until directed by the Owner's Representative or owners representative to be removed.

3.10 Cleaning

- .1 Clean up immediately any growing medium or debris spilled onto pavement.
- .2 Remove all materials and other debris resulting from tree relocation operations from job site.
- .3 Backfill and re-grade tire ruts and other disruptions to existing surfaces as a result of tree moving operations.

END OF SECTION 32 96 43

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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 a completely operating drainage system as indicated in the contract documents.

1.3 Related Work

- | | | |
|----|-----------------------------------|------------------|
| .1 | Site Preparation and Grading | Section 01 89 13 |
| .2 | Aggregates and Granular Materials | Section 02 41 14 |
| .3 | Plumbing | Section 22 00 00 |
| .4 | Excavation and Backfill | Section 31 23 10 |
| .5 | Growing Medium | Section 32 91 13 |
| .6 | Plants and Planting | Section 32 93 10 |

1.4 Submittals

- .1 Record Drawings: Submit a suitably scaled reproducible copy of the "as-constructed" condition of the system. This drawing should be professionally drawn or produced with the use of computer-aided drafting/design (CADD) where possible. All components of the subsurface drainage system shall be shown as installed with clear measurements provided from an identifiable reference point.
- .2 Submit one graphic sieve analysis of the proposed bedding material and a one litre sample of the proposed drain rock.
- .3 If an alternative is proposed to any specified drainage components, submit samples and or manufacturer's data sheets for approval by Owner's Representative.

1.5 Protection

- .1 Protect existing buildings, equipment, sidewalks, landscape reference points, monuments, markers and other completed work. Make good any damage resulting from work of this Contract at no expense to the Board.

- .2 Do not park vehicles on the site in areas where the work will be undertaken without express written consent of the Board. Utilize only such equipment/vehicles essential for construction of the system.
- .3 Trenching and other excavations for vaults, valve boxes etc. are not to be left open during non-work hours of operation unless they are protected to current WorkSafeBC Standards. Cover/mark/protect, as necessary, all open excavations to ensure public safety.

1.6 Site Conditions

- .1 Existing Conditions/Underground Services: Verify the existence and location of all on site utilities/underground services by hand digging or use of an electronic toning device or M-Scope. Mark the location of all buried cables, conduits, pipes etc. **prior to any trenching.** Cooperate with the Board and utility companies to keep their respective utilities in operation. Notify Owner's Representative immediately for directions as to the procedure should any piping utilities be encountered during excavation.
- .2 Site Preparation: Prior to the work of this Section, carefully inspect any installed work of other trades or contractors and verify all such work is complete to the extent that this work may commence properly.
- .3 Field Measurements: Make all measurements in the field and adjust the design to meet the on site conditions to ensure precise fit of items in accordance with the original design.
- .4 Discrepancies: In the event of a major discrepancy, errors or conflicts between the drawings and the actual site conditions, immediately notify Owner's Representative as to procedure before proceeding with work.
- .5 Repair to Underground Services: Repair all damage to underground services caused by the work of this Contract. Damage to services that are shown on the drawings or have been brought to the Contractor's attention in the field prior to commencement or during construction of the work shall be repaired in entirety at the Contractor's expense. Damage to services that were clearly unforeseen/unknown of existence (provided that all reasonable measures were undertaken by the Contractor to ascertain the existence of these services) shall be repaired in accordance with the Changes clause of the General Conditions. Notify Owner's Representative of damage immediately.

PART 2: PRODUCTS

2.1 Drain Pipe

- .1 Perforated Pipe: 100mm dia. **CSA** SDR-35 Rigid Perforated Drain Pipe.
- .2 Solid Pipe: 250 mm dia. SDR 35 Rigid Non Perforated Drain Pipe.
- .3 All pipes and fittings that are polyvinyl chloride (PVC) must conform to CSA B182.1-96M.

2.2 Drainage Structures

- .1 Area Drains: **The Park Board does not accept any plastic (PVC) drains or drainage**

structures. Area drains should be designed for outdoor use, complete with square bolt-down cast iron or bronze grate and sediment bucket. Product to be heavy-duty grade and by Zurn, or pre-approved equivalent. All area drains shall be sized for area and to be a minimum of 8 inches square.

- .2 Lawn Basins/Catch Basins: Precast concrete barrels, lids and riser rings to ASTM C478 complete with galvanized steel rungs (where specified), sized to suit application and a minimum diameter of 600 mm. As supplied by Ocean Construction Supplies **or pre-approved equivalent.** Cast Iron grate and frame by Dobney Foundry (typical, No. B26 B grate and frame for 600 dia. precast concrete barrels, or equivalent).
- .3 Drain Rock: To consist of clean round stone or crushed rock. Refer to the 02 41 14 Aggregates and Granular Materials Section for specified gradations.
- .4 Filter Gravel: Shall be bird's-eye clean gravel with 98% passing the 7.5mm (5/16") sieve, 95% retained by the 4.76 sieve and less than 1% passing the 2.36mm sieve. The material will be clean free of organic, oil, grease or toxic materials.

2.3 Filter Fabric

- .1 The Owner does not incorporate filter fabric in its subsurface drainage systems.

2.4 Clean-Outs

- .1 Clean-outs are required all drain lines.
- .2 Cleanouts need to be installed on all drain lines at a standard interval of 30-35 m O.C.

2.5 Approved Equals

- .1 All items as specified or pre-approved equivalents.

PART 3: EXECUTION

3.1 Inspection and Layout

- .1 Provide Owner's Representative 48 hours advance notice for inspection and approval of all subgrade prior to placing drain lines. Report any unsatisfactory conditions to Owner's Representative.
- .2 Layout the piping and drainage structure locations with flags or stakes and obtain the Owner's Representative's approval before proceeding. The layout shall be in accordance with the drawing(s). Route piping to take into account site elevation changes and locate drainage structures to maximize run-off collection. Alternative layouts shall be approved by Owner's Representative and indicated on the Record Drawings.
- .3 Coordinate exact locations of lines, clean-outs and structures, with planting locations to avoid conflicts and damage to plants during installation. Stake locations for approval by Owner's Representative. Verify grades for all drainage components.
- .4 Closing in Uninspected Work:

- .1 Obtain approval of Owner's Representative before backfilling any sections of the subsurface drainage system.
- .2 Any work closed in before inspection will be required to be exposed for inspection at no extra cost to the Owner.

3.2 Installation Specification

- .1 All excavation shall be undertaken in accordance with the City of Vancouver's Policy and Standard Operating Procedure- Soil and Excavation Water Contamination Management.
- .2 Area Drains: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.
- .3 Lawn Basins: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.
- .4 Clean-Outs: Excavate as required and perform all inlet and outlet connections as per drawings and or manufacturer's recommended installation methods. Backfill with drain rock and install as per details.
- .5 Trenching and Drain Pipe Installation:
 - .1 Open excavation shall be carried out in a safe and orderly manner and in accordance with the requirements of the Workers' Compensation Act of B.C. Approved shoring shall be used where required for safe working conditions.
 - .2 All trenches are to be hand or machine excavated. All trenches shall be dug on the alignment and to the depth required as shown on the drawings and as stated herein. Trenches are to be straight with uniform slopes to the bottom of all trenches.
 - .3 Where the pipes are to be laid in sub-surface material the trench shall be excavated to a depth at least 100 mm below the bottom of the pipe elevation or as detailed. **The tops of pipes are to be a minimum of 500 mm (20 in) below the final grades.**
 - .4 Prior to backfilling, all lines, connections and fittings shall be inspected by Owner's Representative where required.
 - .5 Trenches shall be at least 600mm away from paving stones or other hard surfaces to avoid undermining such surface or its edge retention.
 - .6 Backfilling shall take place in an orderly fashion. Place drain rock material to the full width of the trench bottom, with minimum bedding depth to be 100 mm. Shape bed true to grade to provide continuous, uniform bearing surface for pipe. After pipe is in place, backfill to allow for a minimum of 200 mm of drain rock over the surface of the pipe. Place a uniform 75 mm of bird's eye gravel on top of drain rock. The remainder of the backfill to finish grade shall be with growing medium free of rocks and other unsuitable materials that could damage the pipe or create unusual settling conditions.

- .7 Compact the growing medium to the same density as the native material in the trench sidewalls to prevent differential settlement.
- .8 Contractor is responsible to repair all trenches which have settled below the adjacent grade for a period of one (1) year from date of Substantial Performance.
- .9 **The Owner does not accept any material refuse such as pipe pieces, rags, fittings or other waste left as backfill in any trenches.**
- .10 No drainage line shall be directly over and parallel to another drainage line or service line of any other trade. Ensure minimum horizontal and vertical clearance requirements as dictated by Canadian Electrical Code for all piping installations near any electrical conduit/service.
- .11 **Perforated and Solid SDR Pipe:** Place bedding and/or drain rock material and install pipe in locations shown as per details and plans. Comply with all the manufacturer's printed data and recommendations regarding pipe installation, cleaning, fitting preparation and correct joining techniques.
- .12 All pipe inverts shall be installed within 15mm of design grades and bedded to provide uniform falls to drain structures.

3.3 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 Trenching, laying pipe and backfilling shall be continuous so that the amount of open trenching at the end of each workday is minimized. Any open trench or other excavations shall be barricaded and marked with high visibility marking tape to current WorkSafeBC requirements.
- .3 Any damage to paving, planting or any other structures/elements due to settlement of improperly compacted trenches shall be immediately repaired at the Contractor's expense to satisfaction of Owner's Representative.
- .4 Remove and dispose of off site all surplus material, excess excavated materials, trash, debris and waste material from the work of this Section.

END OF SECTION 33 46 16

INSTRUCTIONS FOR CONSULTANTS: Edit this document in Microsoft Word using 'TRACK CHANGES'. Text in bold and italics is to be edited to suit the project specific conditions. Turn off bold and italic formatting for the final approved document and delete this note.

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 Furnish all labour, materials equipment and services necessary to supply and install High Density Polyethylene Geomembrane Pool Liner as shown on the landscape drawings and specified herein.

1.3 Related Work

- .1 Shop Drawings and Product Data Section 01 33 23
- .2 Excavation and Backfill Section 31 23 10

1.4 Reference Standards

- .1 Install High Density Polyethylene Geomembrane Pool Liner shall conform to the following ASTM Standards:
 - .1 D 638 Standard Test Method for Tensile Properties of Plastics
 - .2 D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheet
 - .3 D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
 - .4 D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 - .5 D 1603 Test Method for Carbon Black in Olefin Plastics
 - .6 D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - .7 D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - .8 D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - .9 D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
 - .10 D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics

- .11 D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

1.5 Submittals

- .1 The contractor shall furnish the following sample and product data, in writing, to Engineer prior to installation of the geomembrane material: Resin Data shall include the following.
 - .1 Certification stating that the resin meets the specification requirements (see Section 2.01).
 - .2 Geomembrane Roll Statement certifying no reclaimed polymer is added to the resin (product run may be recycled).
 - .3 300x300 mm (12"x12") sample of material clearly marked with material type and thickness.
- .2 The Contractor shall furnish the following information to the Engineer prior to installation:
 - .1 Installation layout shop drawings
 - .1 Must show proposed panel layout including field seams and details
 - .2 Must be approved by Engineer prior to installing the geomembrane
 - .2 Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 - .3 Installer's Geosynthetic Field Installation Quality Assurance Plan
- .3 The contractor shall submit the following to the Engineer upon completion of installation:
 - .1 Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 - .2 Material and installation warranties
 - .3 As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.6 Qualifications

- .1 Manufacturer
 - .1 Geomembrane shall be manufactured by the following:
 - .2 GSE Lining Technology, Inc., or approved equal
 - .3 Manufacturer shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.
- .2 Installer
 - .1 Installation shall be performed by one of the following installation companies (or approved equal)
 - .1 Western Tank and Lining Ltd (800-551-4355).
 - .2 GSE Approved Dealer/Installers
 - .2 The Contractor shall have a minimum of two (2) years experience installing HDPE geomembrane.

- .1 The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
- .2 The Contractor shall provide a minimum of one Master Seamer for work on the project. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.7 Warranty

- .1 Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
- .2 Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

PART 2: PRODUCTS

2.1 General

- .1 Delivery, Storage And Handling
 - .1 Labeling - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
 - .1 Manufacturer's name
 - .2 Product identification
 - .3 Thickness
 - .4 Length
 - .5 Width
 - .6 Roll number
 - .2 Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
 - .3 The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
 - .1 Level (no wooden pallets)
 - .2 Smooth
 - .3 Dry
 - .4 Protected from theft and vandalism
 - .5 Adjacent to the area being lined
 - .6 Materials are to be handled so as to prevent damage.

2.2 Geomembrane material shall be smooth/textured polyethylene geomembrane as shown on the drawings.

2.3 Resin

- .1 Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
- .2 Natural resin (without carbon black) shall meet the following additional minimum requirements:

| Property | Test Method ⁽¹⁾ | HD |
|------------------------------|----------------------------|------|
| Density [g/cm ³] | ASTM D 1505 | 0.93 |
| Melt Flow Index [g/10 min.] | ASTM D 1238 (190/2.16) | ≤1.0 |
| OIT [minutes] | ASTM D 3895 (1 atm/200°C) | 100 |

¹ GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

2.4 Geomembrane Rolls

- .1 Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
- .2 Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
- .3 All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in Section 2.01.2, and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
- .4 Smooth surfaced geomembrane shall meet the requirements shown in the following table for the following material:

Minimum Values for Smooth Black-Surfaced HDPE Geomembranes

| Property | Test Method ⁽¹⁾ | |
|---------------------------------|----------------------------|----------|
| Thickness, mil (mm) | ASTM D 5199 | |
| Minimum Average | | 60 (1.5) |
| Lowest Individual Reading | | 54 (1.4) |
| Density, g/cm ³ | ASTM D 1505 | 0.94 |
| Carbon Black Content, % | ASTM D 1603, modified | 2.0 |
| Carbon Black Dispersion | ASTM D 5596 | Note 2 |
| <i>Tensile Properties:</i> | ASTM D 638 | |
| <i>(each direction)</i> | Type IV, 2 ipm | |
| Strength at Yield, lb/in (kN/m) | | 130 (23) |
| Strength at Break, lb/in (kN/m) | | 243 (43) |
| Elongation at Yield, % | (1.3" gauge length) | 13 |
| Elongation at Break, % | (2.0" gauge length) | 700 |

| | | |
|--------------------------------------|-----------------------|-----------|
| Tear Resistance, lb (N) | ASTM D 1004 | 42 (187) |
| Puncture Resistance, lb (N) | ASTM D 4833 | 119 (530) |
| Notched Constant Tensile Load, hours | ASTM D 5397, appendix | 400 |
| Oxidative Induction Time, min. | ASTM D 3895 | 100 |

1 Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

2 Only near spherical agglomerates are considered. 9 of 10 views shall be Category 1 or 2. No more than one view Category

.5 Extrudate Rod or Bead

- .1 Extrudate material shall be made from same type resin as the geomembrane.
- .2 Additives shall be thoroughly dispersed.
- .3 Materials shall be free of contamination by moisture or foreign matter.

2.5 Equipment

- .1 Welding equipment and accessories shall meet the following requirements:
 - .1 Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.
 - .2 An adequate number of welding apparati shall be available to avoid delaying work.
 - .3 Power source capable of providing constant voltage under combined line load shall be used.

PART 3: EXECUTION

3.1 Geomembrane Installation

- .1 Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- .2 Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- .3 Installation of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - .1 Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar, protected equipment bucket).
 - .2 Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.
 - .3 Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.
 - .4 Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.

- .5 Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- .4 Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.2 Field Seaming

- .1 Seams shall meet the following requirements:
 - .1 To the maximum extent possible orient seams parallel to line of slope, i.e., down and not across slope.
 - .2 Minimize number of field seams in corners, odd-shaped geometric location and outside corners. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
 - .3 Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the ENGINEER and INSTALLER.
 - .4 Align seam overlaps consistent with the requirements of the welding equipment being used. Provide a minimum of 150mm (6") overlap at seams.
- .2 During Welding Operations, provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- .3 Extrusion Welding
 - .1 Hot-air tack adjacent pieces together using procedures that do not damage geomembrane.
 - .2 Clean geomembrane surfaces by disc grinder or equivalent.
 - .3 Purge welding apparatus of heat-degraded extrudate before welding.
- .4 Hot Wedge Welding
 - .1 Welding apparatus shall be a self-propelled device equipped with an electronic controller that displays applicable temperatures.
 - .2 Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.
 - .3 Protect against moisture build-up between sheets.
- .5 Trial Welds
 - .1 Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
 - .2 Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
 - .3 Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
 - .4 Cut four, one-inch wide by six-inch long test strips from the trial weld. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

- .5 Trial weld specimens shall pass when the results shown in Table 3 are achieved in both peel and shear test.
 - .1 The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
 - .2 The break is ductile.
- .6 Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
- .7 No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

Table 3: Minimum Weld Values for Smooth HDPE Geomembranes

| Property | Test Method | 60 (1.5) |
|--|-------------|----------|
| Peel Strength (fusion), ppi (kN/m) | ASTM D 6392 | 98 (17) |
| Peel Strength (extrusion), ppi (kN/m) | ASTM D 6392 | 78 (14) |
| Shear Strength (fusion & ext.), ppi (kN/m) | ASTM D 6392 | 121 (21) |

- .6 Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- .7 Defects and Repairs
 - .1 Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 - .2 Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.3 Field Quality Assurance

- .1 MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- .2 Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.

3.4 Field Testing

- .1 Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - .1 Vacuum Testing: Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
- .2 Air Pressure Testing
 - .1 Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

- .3 Other approved methods.
 - .1 Destructive Testing (performed by ENGINEER with assistance from INSTALLER)
 - .1 Collect destructive test samples at a frequency of one per every 1500 lineal feet of seam length.
 - .2 Test locations will be determined after seaming.
 - .3 Exercise Method of Attributes as described by GRI GM-14 (Geosynthetics Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.
 - .2 Sampling Procedures are performed as follows:
 - .1 INSTALLER shall cut samples at locations designated by the ENGINEER as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - .2 ENGINEER will number each sample, and the location will be noted on the installation as-built.
 - .3 Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
 - .4 Cut a 2-inch wide strip from each end of the sample for field-testing.
 - .5 Cut the remaining sample into two parts for distribution as follows:
 - .1 One portion for INSTALLER, 12-inches by 12 inches
 - .2 One portion for the Third Party laboratory, 12-inches by 18-inches
 - .3 Additional samples may be archived if required.
 - .6 Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - .7 INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
 - .8 Repair and test the continuity of the repair in accordance with these Specifications.
 - .3 Failed Seam Procedures
 - .1 If the seam fails, INSTALLER shall follow one of two options:
 - .1 Reconstruct the seam between any two passed test locations.
 - .2 Trace the weld to an intermediate location at least 10 feet minimum or to where the seam ends in both directions from the location of the failed test.
 - .2 The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10 feet long.
 - .3 If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - .4 If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.5 Repair Procedures

- .1 Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- .2 Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- .3 INSTALLER shall be responsible for repair of defective areas.
- .4 Agreement upon the appropriate repair method shall be decided between ENGINEER and INSTALLER by using one of the following repair methods:
 - .1 Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 - .2 Abrading and Re-welding- Used to repair short section of a seam.
 - .3 Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 - .4 Capping- Used to repair long lengths of failed seams.
 - .5 Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
 - .6 Remove the unacceptable seam and replace with new material.
- .5 The following procedures shall be observed when a repair method is used:
 - .1 All geomembrane surfaces shall be clean and dry at the time of repair.
 - .2 Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
 - .3 Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- .6 Repair Verification
 - .1 Number and log each patch repair (performed by ENGINEER).
 - .2 Non-destructively test each repair using methods specified in this Specification.

3.6 Measurement and Payment

- .1 Payment for geomembrane installation will be as per contract unit price per square metre, as measured parallel to liner surface, including designed anchor trench material and is based upon net lined area.
- .2 Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers.
- .3 Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.
- .4 Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the Engineer.

END OF SECTION 33 47 13.13

APPENDIX A

CITY OF VANCOUVER AND PARK BOARD

SUSTAINABILITY INITIATIVES

VanPlay, Vancouver's Parks and Recreation Services Master Plan

<https://vancouver.ca/parks-recreation-culture/vanplay-parks-and-recreation-strategy.aspx>

VanPlay represents a strong commitment to equitable delivery of excellent parks and recreation opportunities in a connected, efficient manner which celebrates history of the land, place, and culture. The suite of VanPlay documents provides a 100-year vision, 25-year outlook, and 10-year implementation plan. They will assist the day-to-day operations of the Park Board by providing; strategies to respond to increased and changing demand for parks and recreation services; a comprehensive parks and recreation policy framework to advance health, wellness, and social inclusion; and methods for prioritizing the development and renewal of parks and recreation facilities and amenities.

Vancouver Park Board Strategic Plan

<http://vancouver.ca/files/cov/park-board-strategic-plan-presentation-20120627.pdf>

The Vancouver Park Board is in the process of updating its strategic plan that describes the long term vision for the parks system. The document focuses on four key directions: Parks and Recreation for All, Leadership in Greening, Engaging People, and Excellence in Resource Management. These directions are informed by the Park Board mission and provide structure for the Park Board vision: "To be leaders in parks and recreation by connecting people to green space, active living and community."

Capital Plan

<http://vancouver.ca/your-government/get-involved-with-the-parks-capital-plan.aspx>

The City of Vancouver's capital plan is a four-year financial plan for investments in city infrastructure. All City services, from parks and community facilities, to streets, sidewalks and water. Each plan cycle focuses on key priorities that support prosperity, environment and people. In development of each capital plan the city seeks to sustain financial health by providing good value for property taxes and user fees, while meeting the priority needs of the community over the long term; maintaining a long track record of good fiscal management; and developing strategic partnerships.

Climate Change Adaptation Strategy

<http://vancouver.ca/green-vancouver/climate-change-adaptation-strategy.aspx>

Vancouver City Council has adopted a comprehensive climate change adaptation strategy to ensure that Vancouver remains a livable and resilient city in the face of climate change. The landmark strategy recommends nine primary actions and over 50 supporting actions that the City of Vancouver can take to incorporate climate change adaptation measures into new projects and daily operations for all City business. These actions guide the way we build and maintain City streets, sewers, building infrastructure, parks and greenspaces to ensure they are resilient to climate change.

Climate Emergency Action Plan

<https://vancouver.ca/green-vancouver/vancouvers-climate-emergency.aspx>

Vancouver City Council adopted the Climate Emergency Action Plan that puts Vancouver on track to reduce our carbon pollution by 50% by 2030, in alignment with the findings of the United Nations Intergovernmental Panel on Climate Change to limit global warming to 1.5°C. The plan builds on Vancouver's previous climate plans and focuses on cutting carbon pollution from its biggest local sources - burning fossil fuels in our vehicles (37%) and in our buildings (57%).

Vancouver's Healthy City Strategy

<http://vancouver.ca/people-programs/healthy-city-strategy.aspx>

Vancouver's Healthy City Strategy is a long-term, integrated plan for healthier people, healthier places, and a healthier planet. The strategy aligns with other key priorities of the City, and is based on a framework that identifies the building blocks of a healthy city for all. It is comprised of a series of goals that consider affordable housing, healthy food systems, social services and active living.

City-wide Integrated Rainwater Management Plan

<http://vancouver.ca/home-property-development/citywide-integrated-stormwater-management-plan.aspx>

The City-wide Integrated Rainwater Management Plan treats Vancouver's abundant rainwater as a resource, and provides tools to reduce the demand for potable water by encouraging beneficial reuse, restore the role of urban watersheds, support urban and natural ecosystems and provide clean water.

Vancouver Bird Strategy

<http://vancouver.ca/parks-recreation-culture/vancouver-bird-strategy.aspx>

The Vancouver Bird Strategy looks to provide conditions for native birds to thrive in Vancouver. With this strategy, by 2020 Vancouver will be a world leader in supporting a rich and diverse group of native birds year-round. This requires the protection, enhancement, and creation habitats for a diversity of native birds, the reduction of threats to birds in the urban environment, the enhancement of access to nature for residents and visitors to Vancouver, and an increased awareness of the importance of birds and their needs to the community.

Vancouver's Biodiversity Strategy

<https://vancouver.ca/files/cov/biodiversity-strategy.pdf>
Biodiversity is the richness of plant and animal species, their habitats, and the ecological processes that sustain them. Biodiversity includes Vancouver's marine and terrestrial ecosystems. The strategy aims to increase the amount and quality of Vancouver's natural areas to support biodiversity and increase access to nature.

Vancouver's Urban Forest Strategy

<http://vancouver.ca/home-property-development/urban-forest-strategy.aspx>

The vision of the Urban Forest Strategy is to protect, plant, and manage trees to create a diverse, resilient, and beautiful urban forest on public and private lands across the city. Vancouver's urban forest includes every tree in our city – on streets, in parks, public spaces, and back yards. The strategy targets an increase in the urban forest canopy to 22% by 2050, restore or enhance 25 ha of natural areas by 2020, and double street tree density in below average blocks of the DTES and Marpole neighbourhoods by 2030.

Local Food Systems Action Plan

<https://vancouver.ca/parks-recreation-culture/local-food-action-plan-update.aspx>

Park Board Commissioners approved the updated Local Food System Action Plan. The vision of this 5-year plan is to move toward a sustainable, just, and decolonized local food system. The Park Board and partners aim to do this by making space for Indigenous food sovereignty, increasing equitable access to food assets and services, and by working towards food system resiliency as part of climate action.

Metro Vancouver Ecological Health Action Plan

<http://www.metrovancouver.org/services/regional-planning/conserving-connecting/about-ecological-health/Pages/health-action-plan.aspx>

The Ecological Health Action Plan looks at how to maintain and improve the health of the region's ecosystems. The Action Plan identifies short and medium-term actions that can be taken in four broad areas that fall within Metro Vancouver's mandate: Advancing the regional green infrastructure network, supporting salmon in the cities, supplementing ecosystem services, and reducing toxics. Based on these areas, the Action Plan suggests 12 projects that will provide social and environmental benefits and contribute to broader ongoing efforts by other groups in the region.

Transportation 2040: Cycling Network for All Ages and Abilities (AAA)

<http://vancouver.ca/files/cov/transportation-2040-plan.pdf>

Transportation 2040 is a long-term strategic vision for the city that will help guide transportation and land use decisions, and public investments for the years ahead. One goal contained in the strategy, the Cycling Network for All Ages and Abilities (AAA), aims to make cycling safe, convenient, comfortable and fun for people of all ages and abilities. Key design traits of this approach that are of concern for parks include physical separation from motor vehicles, traffic calming measures, safe intersections and crossings with good visibility, pavement markings that draw attention to potential conflict zones, amenities like bike bumps and foot rests, and allowing other modes like cargo bikes and skateboards to share the route.

