REVISED AGENDA - SPECIAL VICTORIA CITY COUNCIL

Thursday, April 12, 2018, 5:30 P.M.
Council Chambers, City Hall, 1 Centennial Square
Located on the traditional territory of the Esquimalt and Songhees People

Council is committed to ensuring that all people who speak in this chamber are treated in a fair and respectful manner. No form of discrimination is acceptable or tolerated. This includes discrimination because of race, colour, ancestry, place of origin, religion, marital status, family status, physical or mental disability, sex, sexual orientation, gender identity or expression, or economic status. This Council chamber is a place where all human rights are respected and where we all take responsibility to create a safe, inclusive environment for everyone to participate.

I. NEW BUSINESS

J. ADJOURNMENT

Memo

Wastewater Treatment Project
Treated for a cleaner future

TO: Jas Paul, Assistant Director Engineering and Public Works, City of Victoria

FROM: Dave Clancy, Project Director, CRD Wastewater Treatment Project

DATE: April 5, 2018

SUBJECT: **Capital Regional District – Wastewater Treatment Project City of Victoria Licence Obligations – 50% Design Proposal**

1. Purpose

The purpose of this memo is to present the City of Victoria with the 50% Design Proposal for the Clover Point Pump Station Building exterior and Public Realm Improvements, and the Clover Forcemain and Cycle Track alignment in accordance with the licence agreements between the Capital Regional District ("CRD") and the City of Victoria ("City").[1]

2. Introduction

The Wastewater Treatment Project is being built to meet the provincial and federal regulations for treatment of the Core Area's wastewater by December 31, 2020 and consists of three main elements:

1. **McLoughlin Point Wastewater Treatment Plant**: Located at McLoughlin Point in Esquimalt, the treatment plant will provide tertiary treatment to the Core Area's wastewater. Tertiary treatment is one of the highest levels of treatment available and produces a higher quality of effluent than secondary treatment.

2. **Residuals Treatment Facility**: Residual solids from the wastewater treatment plant will be piped to the Residuals Treatment Facility at the Hartland Landfill, where they will be turned into what are known as "Class A" biosolids. These biosolids are a high quality by-product treated such that it is safe for further use.

3. **Conveyance System**: The conveyance system refers to the "pumps and pipes" of the Wastewater Treatment Project. This system will carry wastewater from across the Core Area to the treatment plant. It will also send residual solids from the wastewater treatment plant to the Residuals Treatment Facility.

The Wastewater Treatment Project is being funded by the Government of Canada, the Government of British Columbia, and the CRD.

3. Project Background

The Wastewater Treatment Project (the "Project") will provide the CRD's Core Area with tertiary treatment of wastewater that meets both provincial and federal wastewater regulations. The communities to be

[1] On February 22, 2017, the City and CRD entered into two licence agreements; one associated with the Clover Point Pump Station entitled "Licence of Occupation – Clover Point Pump Station", and the other associated with the Clover Forcemain entitled "Licence of Occupation – Dallas Road Forcemain".

serviced by this Project include the City of Victoria, City of Langford, City of Colwood, District of Oak Bay, District of Saanich, Township of Esquimalt, Town of View Royal, and the Songhees and Esquimalt Nations.

Provincial Municipal Wastewater Regulations (MWR) under the Environment Management Act came into effect in 2012 to "protect public health and the environment". The MWR prescribes the minimum standards of municipal wastewater quality for marine water, fresh water or groundwater discharge.

Federal Wastewater System Effluent Regulations under the Fisheries Act establish effluent quality performance standards. The objective is to decrease the level of deleterious and harmful substances discharged through wastewater effluent. Facilities with discharge effluent quality not equivalent to or better than the secondary treatment performance standards (such as Macaulay Point and Clover Point) are required to upgrade to conformance prior to December 31, 2020.

In May 2016, the CRD established the Core Area Wastewater Treatment Project Board ("Project Board") to administer the Project. The CRD asked the Project Board to review the wastewater treatment issues and, by September 2016, recommend to the CRD and senior levels of government a plan to comply with the law and to preserve senior government funding.

In September 2016, the CRD Board approved the Wastewater Treatment Project, as recommended by the Project Board. The Wastewater Treatment Project meets all of the goals that were established for the Project Board by the CRD:

- meet federal requirements for secondary treatment by 2020[2] ;
- minimize costs to residents;
- optimize opportunities for resource recovery;
- reduce greenhouse gas emissions; and
- add value to the surrounding community and enhance livability of neighbourhoods.

The Wastewater Treatment Project Board has appointed a Project Team to manage the execution of the Project.

4. City of Victoria – Technical Working Group

The Project Team and the City of Victoria ("City") have established a Technical Working Group ("TWG") to provide a forum to ensure accurate technical information is available to City staff as project planning and construction proceeds, and to ensure technical issues are raised, discussed and addressed and, where possible, to coordinate municipal works with project construction.

The kick-off meeting for the TWG was held on April 24, 2017. The primary purpose was to review the Project with City staff, outline the scope of the facilities within the City, and identify the key touch-points between the City and the Project. There have been a number of TWG meetings since the kick-off meeting to review items such as establishing procedures to satisfy the obligations in the various licence agreements between the City and the CRD. A number of separate meetings were also held to review the Design Proposals and the 50% Design Proposals for the Clover Point Pump Station Building exterior and Public Realm Improvements, as well as the alignment of the Clover Forcemain and Cycle Track.

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[2]The federal regulations require the region's sewage undergo secondary treatment by December 31, 2020. The McLoughlin Point Wastewater Treatment Plant is designed to go further and will provide tertiary treatment for all wastewater flows from the Core Area. Tertiary treatment is one of the highest levels of treatment available and produces a higher quality of effluent than secondary treatment.

The CRD WTP's Esquimalt and Songhees Liaisons have also participated in the TWG to review the 30% Design Proposals and the 50% Design Proposals in order to provide a meaningful opportunity for the Nations to contribute to the development of the Project. The CRD has also commenced working with the Esquimalt and Songhees Nations and the City on the incorporation of Indigenous art into the Public Realm Improvements at the Clover Point Pump Station and along the Cycle Track.

The Project Team will continue to hold regular meetings with the TWG throughout the course of the Project.

5. Clover Pump Station

The Clover Point Pump Station will be upgraded and expanded as part of the Wastewater Treatment Project. The existing station pumps sewage directly into the ocean. The expanded pump station will pump wastewater to the McLoughlin Point Wastewater Treatment Plant for tertiary treatment and provide bypass pumping to the existing outfall during storm events.

The CRD WTP Team held a competitive procurement, via a Request for Proposals process, to secure the design-builder for the Clover Point Pump Station. The procurement phase included two confidential collaborative meetings with each of the shortlisted design-build proponents. In accordance with the terms of the licence agreement, the City participated in these meetings to allow for their review and comment on each proponent's design proposal for the exterior of the Building and the Public Realm Improvements. Proposals were received in August 2017 and the contract was awarded to Kenaidan Contracting Ltd ("Kenaidan") in November 2017.

The following sections summarize the obligations related to design of the Clover Point Pump Station, as defined in the licence agreement between the City and CRD. It also presents Kenaidan's 50% Design Proposal for the Building exterior and Public Realm Improvements.

5.1 Licence Agreement (Clover Point Pump Station)

On February 22, 2017, the City and CRD entered into a licence agreement associated with the Clover Point Pump Station entitled "Licence of Occupation – Clover Point Pump Station". The agreement allows the CRD to install, entrench, construct, expand, upgrade, operate, maintain, repair, replace and relocate the existing wastewater pumping station. Under the agreement, the CRD agreed to:

- construct the Public Realm Improvements upon the Licence Area and the surrounding lands, including a Public Plaza, a Bike Node, two (2) public washrooms, intersection improvements at Clover Point Road and Dallas Road, new connecting walkways and pedestrian pathways, site furnishings, wayfinding signage, and landscaping.

The licence agreement also set out certain obligations associated with the design development process, payment of fees and public consultation. These requirements are summarized below, together with the disposition of each (in italic font):

- present to City Council, in a public meeting, the Design Proposal for the exterior of the Building and the Public Realm Improvements, and amend the Design Proposal as it relates to the Public Realm Improvements in accordance with any recommendations of City Council. *The CRD presented the Design Proposal to the City of Victoria at the Committee of the Whole on December 14, 2017 and the City approved the Design Proposals. Amendments resulting from City Council's recommendations have been incorporated into the 50% design, as summarized in Section 8.0.*

- hold three (3) Design Workshops at the 30%, 50% and 90% design completion stages for City staff and CRD to work collaboratively on development and finalization of the design details related to the exterior of the Building and design of the Public Realm Improvements. *The CRD has held the 30% and 50% Design Workshops with City staff. The Design Proposal was amended to address comments received during the Workshops. The CRD is committed to holding the 90% Design Workshop with City staff, which is tentatively scheduled for April 2018.*

- invite the Songhees and Esquimalt Nations to nominate a representative to participate in the Design Workshops to provide meaningful opportunities to consider the Songhees and Esquimalt Nation's input in final design of the exterior of the Building and the Public Realm Improvements. *The CRD invited the Songhees and Esquimalt Liaisons to participate in the 30% and 50% Design Workshops. The Songhees Liaison participated in the 30% and 50% Design Workshops, and the Esquimalt Liaison participated in the 50% Design Workshop. The CRD is committed to inviting the Songhees and Esquimalt Nations to participate in the 90% Design Workshop.*

- at the 50% design stage, present the design to City Council at a public meeting and to the Fairfield Gonzales Community Association in a separate presentation, and amend the 50% Design Proposal as it relates to the Public Realm Improvements in accordance with any recommendations of City Council. *The CRD presented the 50% design to the Fairfield Gonzales Community Association on January 11, 2018. Public feedback, as well as the related amendments to the design, are summarized in Section 8.0 of this memo. The CRD intends to present the 50% Design Proposal to City Council at the Committee of the Whole on April 12, 2018.*

- submit the final design of the exterior of the Building and the Public Realm Improvements for City staff approval. *The CRD WTP is committed to submitting the final design for City staff approval. The final design is scheduled to be ready for City staff approval in April 2018.*

- provide the City with a one-time payment of $75,000 for the maintenance of the public washrooms to be constructed as part of the Public Realm Improvements. *Payment will be provided by the CRD upon completion of the Public Realm Improvement in accordance with the terms of the licence agreement.*

- provide the City a one-time payment of $100,000 toward the construction of additional capital improvements by the City. *Payment will be provided after the Design Workshop at the 90% completion stage and upon receipt of a report from City staff that outlines the community's feedback and the final improvements to be implemented by the City, all in accordance with the licence agreement.*

- provide the Director of Engineering with a public engagement plan outlining how the CRD will manage inquiries, complaints and correspondence from the public. *The CRD WTP is committed to providing the Director with a public engagement plan.*

Additionally, the licence agreement sets out certain design requirements for the Pump Station, including a conceptual plan for the Building exterior, as well as a concept plan and design guidelines for the Public Realm Improvements. These design requirements are included in Appendix "A". The Public Realm Improvements, as defined in Clause 7.1 of the licence agreement, are summarized below.

- construct and install the Public Plaza to be accessible to pedestrians and cyclists and replace the existing public parking lot located above the existing pump station;
- construct and install the Bike Node;
- interpretative signage and wayfinding signs at the Public Plaza;
- two replanted grassed open spaces to the west and east of the Public Plaza;

- install, as part of the Public Plaza, street furniture and bicycle facilities including benches, bike racks, a bike rack for maintenance and repair, and a drinking fountain;
- install a public washroom with two gender neutral washrooms, including all necessary sanitary sewer, electrical, and water connections;
- construct intersection improvements at Clover Point Road and Dallas Road;
- construct a pedestrian path from Dallas Road alongside Clover Point Road and connecting to the existing Clover Point Path; and
- construct a new connecting walkway and bike path across Clover Point Road to the Dallas Road/Ross Bay Seawalk.

5.2 Design Proposal

This section presents the design basis for the Building exterior and Public Realm Improvements associated with the Clover Point Pump Station, as proposed by Kenaidan. Drawings illustrating the design of the Building exterior and Public Realm Improvements are included in Appendix "B".

5.2.1 Existing Conditions and Site Usage

The current Pump Station is well blended into the landscape and covered with a gently sloped grassed area. Several memorial benches have been located on prominent spots within this grassed area. The grassed area ends along the east end of the facility at the top of a structural wall featuring a beautiful natural stone finish. A small parking lot is currently in place just east of the intersection of Dallas Road and Clover Point Road. Currently there are no pathways on site and pedestrians generally walk down the Clover Point Park Road on the west side and around the base of the facility using the Dallas Road Waterfront Trail to the east. The site is heavily used by pedestrians from the surrounding neighbourhood, as well as users of Clover Point and the Waterfront Trail. Worn pedestrian "desire line" paths are evident across the grassed area.

5.2.2 Design Approach

In addition to the Building exterior and Public Realm Improvements outlined in the licence agreement, the Kenaidan team proposes further landscape improvements that they feel greatly improve the existing site experience, the efficiency of the surrounding pedestrian networks and the site safety for the future users of this popular vantage point. Key to all design decision making is the overall vision, and its resulting design strategies for the Building exterior and Public Realm Improvements.

The Vision: Creation of a memorable destination public space designed to a level reflective of its prominent location in the city.

Design of the Building and Public Realm Improvements focus on:

UNIQUE CONTEXT	Respond in a sensitive and complementary way to the site's unique coastal edge-context.
NEIGHBOURHOOD INTEGRATION	The design will respect and enhance its neighbourhood interface.
MOBILITY	The design will create an enhanced public realm that provides multiple opportunities for pedestrians and cyclists, as well as being universally accessible.
GREAT CONNECTIONS	The design will focus on creating connections that are responsive to current and planned pedestrian and bicycle routes.

AUTHENTICITY	The design will celebrate the rich cultural heritage of the **Songhees** and **Esquimalt Nations**. Additionally, appropriate local materials will be used and opportunities for local art expression will be examined.
VITALITY SUSTAINABILITY	The public realm design will prioritize environmental sustainability and material performance.

From observations of the existing site, it is apparent that pedestrian routes (desire lines) have been worn into the ground as steep trails from the Dallas Road car park, down the grassy bank to the Seawalk below. Recognizing the intent to further invite people to this point of prospect, the Kenaidan team felt it necessary to go beyond the minimum design guidelines in the licence agreement and provide trail improvements that offer safe, universally-accessible routes to the lower Ross Bay Seawalk.

As this new trail traverses the site to connect with the existing ramp and stairs and also to connect with the proposed washroom, the opportunity arose to reinstate the current informal viewing area that exists above the facility, with a new improved and safer lookout area at this newly created pedestrian node. The design that arose out of these concepts is further described in Section 5.2.4.

5.2.3 Design Objectives

Key objectives of the design approach are summarized below.

1. Respond to client and project requirements
    - construct a 'Viewing Plaza' adjacent to the Dallas Road intersection and in proximity to the existing car park location
    - furnish plaza space with benches and drinking fountain
    - provide other specified park furnishings, such as trash/recycling receptacles in coordination with City Parks' staff
    - confine bike use to designated routes by way of bollard and/or signage
    - construct intersection improvements at the Clover Point Road and Dallas Road intersection
    - construct a Bike Node (with a bicycle maintenance station and bike racks), west of the improved intersection, and continue the Pedestrian/Bike path south, on the westerly side of Clover Point Road to the Clover Point Park Path
    - construct a new Pedestrian/Bike path across Clover Point Road to the Ross Bay Seawalk
    - locate public washroom facility in a safe, visually prominent and universally-accessible area
    - maintain unobstructed views from higher vista points

2. Respond to site conditions, and make the site safe for all users
    - provide pedestrian connections where existing park-user desire lines are apparent (noticeable "goat trails" traversing site)
    - design these routes with the appropriate slopes and materiality and with guardrails where building code requires (locate these routes and guardrails to achieve the objective of improving site safety)
    - provide a safe viewing area in combination with the improved pedestrian connections
    - match the existing stone-faced retaining walls when building the new retaining wall system that flanks the lower seawall walkway, and repair the existing wall and stonework where necessary

3. Minimize design interventions and potential site impacts and employ sustainable practices
    - minimize the use of singular purpose site furnishings, integrate site design elements where possible, such as retaining walls being designed also as seating elements

- pathway surface treatments should be permeable such as crushed fines and permeable unit pavers in plaza spaces
- proposed or altered topography should match or enhance the existing site and context
- select soft and hardscaping materials to minimize maintenance costs
- use locally sourced materials where possible

5.2.4 Proposed Design

The design, as presented in Appendix “B”, represents the Kenaidan team’s interpretation of the guidelines and objectives in the context of this very special site. The building expansion has been incorporated underneath a varied and vibrant public realm design.

The proposed design is highlighted by the provision of three prominent public gathering areas. The primary viewing plaza is located on the eastern side of Dallas Road and Clover Point Park Road. The design features in this area include permeable concrete brick pavers, four benches offering views out to Ross Bay, a drinking fountain and protective leaning railing.

The second plaza area, on the west side of the Dallas Road and Clover Point Road intersection, is seen as a transition area between the cycle track and new pedestrian sidewalk. The plaza also features permeable concrete pavers, bike racks and a bicycle “maintenance kitchen”.

The third plaza is a lower plaza gathering area that provides built-in concrete wall edge seating at the intersection of the multiple pathway connections. The surface of this area and adjacent walkways will be high permeability compacted granular. There will also be another protective leaning railing along the ocean side edge of this area.

The pathway system has been designed to ensure multiple connection points with the surrounding existing pathway networks including Dallas Road, the Dallas Road Waterfront Trail along Ross Bay and the Dallas Road Waterfront Trail through Clover Point Park.

The new public washroom has been strategically placed toward the south end of the pump station area at the intersection of a new pathway connection between Clover Point Park and the Waterfront Trail along Ross Bay. The washroom has been designed with the safety and security of users in mind, and features two universally-accessible gender neutral washrooms and associated amenities.

The landscape treatment will be a shaping and creation of grass areas to respond to the hillside location and where possible, provide specific mounding to soften and integrate the new washroom into the landscape.

6. Clover Forcemain and Cycle Track

The Clover Forcemain will convey wastewater from the Clover Point Pump Station to Ogden Point. The forcemain will have a total length of approximately 3.4 km from the Clover Point Pump Station to the harbour crossing at Ogden Point.

The CRD engaged Stantec to prepare an indicative design of the Clover Forcemain and Cycle Track. The CRD then engaged Kerr Wood Leidal (“KWL”) to review the indicative design, prepare detailed design documents, and be responsible for fulfilling Engineer of Record duties as defined by the Association of Professional Engineers and Geoscientists of British Columbia. The indicative design was completed in July 2017. KWL has completed their review of the alignment for the Forcemain and Cycle Track, and advanced design of the works to the 50% stage.

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The following sections summarize the obligations related to design of the Cycle Track and the alignment of the Clover Forcemain, as defined in the licence agreement between the City and CRD. It also presents KWL's 50% Design Proposal.

6.1 Licence Agreement

On February 22, 2017, the City and the CRD entered into a licence agreement associated with the Clover Forcemain entitled "Licence of Occupation – Dallas Road Forcemain". The agreement allows the CRD to install, entrench, construct, operate, maintain, repair and replace one or more systems of sanitary sewer works, i.e. the Clover Forcemain. Under the agreement, the CRD agreed to

- construct a Cycle Track connecting Clover Point to Dock Street in accordance with the conceptual plans and Design Guidelines in the licence agreement

The licence agreement also set out certain obligations associated with the design development process, payment of fees and public consultation. These requirement are summarized below, together with the disposition of each (in italic font):

- present the alignment of the Forcemain and Cycle Track and the Design Proposal to City Council in a public meeting prior to the commencement of detailed design and amend the Design Proposal in accordance with any recommendations of City Council. *The CRD presented the Design Proposal to the City of Victoria at the Committee of the Whole on December 14, 2017 and the City approved the Design Proposals. Amendments resulting from City Council's recommendations have been incorporated into the 50% design, as summarized in Section 8.0.*

- hold three Design Workshops at the 30%, 50% and 90% design completion stages for City staff and CRD to work collaboratively on development and finalization of the design details related to the Cycle Track. *The CRD has held the 30% and 50% Design Workshops with the City. The Design Proposal was amended to address comments received during the Workshops. The CRD is committed to holding the 90% Design Workshop with City staff, which is tentatively scheduled for April 2018.*

- invite the Songhees and Esquimalt Nations to nominate a representative to participate in the Design Workshops to provide meaningful opportunities to consider the Songhees and Esquimalt Nations' input in the final design of the Cycle Track. *The CRD invited the Songhees and Esquimalt Liaisons to participate in the 30% and 50% Design Workshops. The Songhees Liaison participated in the 30% and 50% Design Workshops, and the Esquimalt Liaison participated in the 50% Design Workshop. The CRD is committed to inviting the Songhees and Esquimalt Nations to participate in the 90% Design Workshop.*

- at the 50% design stage, present the design and alignment of the Cycle Track and alignment of the Forcemain to City Council at a public meeting and to the James Bay Neighbourhood Association and the Fairfield-Gonzales Community Association in a separate presentation, and amend the 50% Design Proposal with any recommendations of City Council. *The CRD presented the 50% design to the James Bay Neighbourhood Association and the Fairfield Gonzales Community Association on January 10, 2018 and January 11, 2018 respectively. Public feedback, as well as the related amendments to the design, are summarized in Section 8.0 of this memo. The CRD intends to present the 50% Design Proposal to City Council at the Committee of the Whole on April 12, 2018.*

- submit the final design and alignment of the Cycle Track for City staff approval. *The CRD WTP is committed to submitting the final design for City staff approval. The final design is scheduled to be ready for City staff approval in April 2018.*

- provide the Director of Engineering with a public engagement plan outlining how the CRD will manage inquiries, complaints and correspondence from the public. *The CRD WTP is committed to providing the Director with a public engagement plan.*

Additionally, the licence agreement set out certain design requirements for the Forcemain and Cycle Track, including conceptual drawings of the alignment for the Forcemain and Cycle Track along Dallas Road, as well as the design guidelines for the Cycle Track. These design requirements are included in Appendix "C" of this memo.

6.2 Forcemain Alignment

The CRD engaged Stantec to prepare an indicative design of the Clover Forcemain. In developing the indicative design, Stantec evaluated route options, selected a preferred route for the forcemain, developed the basis of design, prepared indicative design alignment drawings, and presented a construction cost estimate. CRD then engaged KWL to review the indicative design, prepare detailed design documents, and be responsible for fulfilling Engineer of Record duties as defined by the Association of Professional Engineers and Geoscientists of British Columbia. The scope of KWL's work includes a technical review of geotechnical factors affecting the indicative design.

To review the indicative design, KWL assembled an interdisciplinary team with expertise in the fields of conveyance system design, geotechnical engineering, terrain analysis, marine construction, environmental analysis, and civil engineering. In reviewing the indicative design, extensive consideration was given to the geotechnical aspects of the design, as well as schedule, cost, archaeological, environmental, and community impacts.

The KWL team agreed with the selection of Dallas Road as the recommended corridor for the Clover Forcemain. The KWL team also concluded that the Forcemain can be designed, constructed and operated in the Dallas Road alignment without affecting the Dallas Road Bluffs and without the bluffs affecting the Forcemain. More information regarding how KWL reached this conclusion is included Section 7.0.

The following provides a general description of the alignment for the Clover Forcemain. The proposed alignment conforms to the alignment that was defined in the licence agreement for the Dallas Road (Clover) Forcemain. The alignment was established in consultation with City staff, and it was selected to avoid environmental impacts, such as mature trees, and archaeological impacts.

Clover Point Pump Station to Circle Drive. The Forcemain commences at the Clover Point Pump Station. The proposed alignment within this section runs under the Cycle Track, and under the grassed boulevard immediately south of Dallas Road. In the vicinity of Circle Drive, the alignment shifts south of Dallas Road to follow an existing utility corridor that runs through a vegetated area south of Dallas Road.

Circle Drive to Government Street. Along this stretch, the Forcemain will be located in the travelled portion of Dallas Road. From Circle Drive to the Douglas Street intersection, the pipe will be situated under the eastbound lane of Dallas Road. Through the Douglas Road intersection, the proposed alignment shifts to the north side of Dallas Road to avoid the mature trees in the southern boulevard. There is a global high point along the forcemain in this area that will require an air valve chamber and odour control facilities. Consistent with the standards for the overall Project, any air that accumulates at this location will be treated to levels that will not be discernable to the public. Between Paddon Avenue and Government Street, the alignment moves southerly to the boulevard of Holland Point Park. Utility relocates will be required in this stretch, particularly between the Douglas Road intersection and Government Street.

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Government Street to Lewis Street. The proposed alignment runs under the Cycle Track and is located adjacent to the south side of Dallas Road, running under the boulevard of Holland Point Park.

Lewis Street to Dock Street. At Lewis Street, the Forcemain moves into the eastbound lane of Dallas Road, and is offset to the north of the Cycle Track. The proposed alignment from Lewis to Dock Streets remains within the eastbound lane of Dallas Road to maintain a safe setback from the James Bay Seawall. Existing storm and sanitary sewers will need to be relocated in this segment of the Forcemain.

Dock Street to Ogden Point. Through this stretch, the proposed alignment of the Forcemain is within the eastbound lane of Dallas Road. A valve chamber will be located within Ogden Point, complete with odour control facilities that will treat any air that may accumulate in the forcemain to levels that will not be discernible to the public. The alignment has been selected to mitigate impacts on the mature trees that line both side of Dallas Road. Additional details regarding impacts on trees can be found in Section 6.3.5, as well as the Arborist Report. The proposed alignment extends through previously recorded archaeological site DcRu-75, which is a multicomponent site including shell midden, earthwork features, steaming pits, fire altered rock, lithics, faunal remains, and burials. The site also includes human remains that have been reburied near the corner of Dallas Road and Montreal Street – and construction of the forcemain will not disturb or impact the reburial site.

6.3 Cycle Track

The cycle track will extend from Dock Street to Clover Point along the south side of Dallas Road, with physical separation from motor vehicles and also separation from pedestrian sidewalks or paths. This section presents the design basis for the Cycle Track alignment, as proposed by the KWL team.

6.3.1 Design Objectives

Key objectives of the design approach are:

- meet requirements per the Licence of Occupation
- safety for all users
- adhere to Victoria's Official Community Plan; recognize that in the transportation hierarchy the priority is pedestrians highest, followed by cyclists, then motorists (in order from transit, commercial vehicles, to finally single occupancy vehicles).
- provide a continuous cycling facility that is suitable for all ages and abilities

6.3.2 Design Criteria

In addition to the cycle track specifications, design criteria for all roadway features are a consideration to ensure appropriate accommodation of all users and modes as part of the design. The following are the design criteria used for establishing the cycle track alignment.

Cycle track width:

- 3.0m minimum (typical). Absolute minimum of 2.5m in short-segment pinch points.

Buffer width between cycle track and road:

- Desirable minimum: 1.0m (or 1.5m min. for treed landscaping)
- Limited width / pinch-point areas: 0.6m adjacent to moving vehicles, 0.75m adjacent to parked cars

On-street parking:

- 2.5m a suitable width for a typical parking lane

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Drive lanes with buses:

- 3.3m minimum where accommodating buses (typical)

Sidewalks:

- 1.5m minimum is typical in Victoria; 1.8m – 2.0m preferred

6.3.3 Design Constraints

In some areas the available width is constrained, which may require deviation from preferred criteria dimensions or alterations to alignments of sidewalks, the cycle track, on-street parking (width or angle of parking), and/or road lanes. Specific design constraints include:

- north curb line is to remain undisturbed, where possible; this is the effective design limit for incorporating the design elements (cycle track plus south sidewalk, drive lanes, and on-street parking).
- south side constraints vary by segment. Specific constraints include:
    - Seawall (limiting available space) between Dock St and Lewis St.
    - Large mature trees adjacent to Dallas Road between Government St and Paddon Ave.
    - Space limitations at Paddon Avenue, between the north side of the road and retaining wall / concrete railing as well as the Dallas Road bluffs.
    - Space limitations at Douglas Street and the Dallas Road bluffs.
    - Above ground utilities (e.g. light standards, fire hydrants).

6.3.4 Proposed Alignment

The following provides a general description of the alignment for the Cycle Track. Drawings illustrating the 50% design and alignment for the Cycle Track are included in Appendix "D".

Dock Street to San Jose Avenue. In this section the Cycle Track is adjacent to the existing south sidewalk that abuts the seawall. This section has limited width overall, and dimensions meet the recommended minimum design criteria for all features (1.8m sidewalk, 3.0m cycle track, 0.8m buffer, 3.3m drive lanes, 2.5m parking). Modifications are required to the current parking arrangement and layout on the south side of Dallas Road to accommodate the Cycle Track. Options to mitigate parking impacts were considered with the City and are addressed in Section 6.3.5.

Boyd Street to Menzies Avenue. This section has two Cycle Track alignment zones: the seawall section west of Lewis Street, and a Holland Point Park section east of Lewis Street.

In the seawall section, the Cycle Track is adjacent to the existing south sidewalk that abuts the seawall. This section has limited width overall, and dimensions meet the minimum recommended design criteria for all features (1.8m sidewalk, 3.0m cycle track, 0.8m buffer, 3.3m drive lanes, 2.5m parking). Modifications are required to the current parking on the south side of Dallas Road. Options to mitigate parking impacts were considered with the City and are addressed in Section 6.3.5.

In the park section, the Cycle Track will abut a pedestrian sidewalk. The alignment is contained off-street in the existing boulevard area; there is no change to the road cross section in this area. The sidewalk is 1.5m, the cycle track is 3.0m, and the buffer is 2.25m.

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South Turner Street to Government Street. This section is within Holland Point Park west of Government Street and adjacent to Harrison Yacht Pond east of Government Street. The cycle track will abut a pedestrian sidewalk. The alignment is contained off-street in the existing boulevard area; there is no change to the road cross section in this area. The sidewalk is 1.5m wide, the cycle track is 3.0m and the buffer is generally 2.5m wide, except it is 1.0m along the angled parking frontage and 0.6m wide in certain areas where required to avoid trees.

There are two trees adjacent to Harrison Yacht Pond and four large mature trees at the east end of this section. The horizontal alignment of the cycle track and sidewalk has been adjusted in this area to preserve these trees.

Paddon Avenue to Douglas Street. In this section, there are typical alignment segments and two segments with space limitations: one at Paddon Avenue and one at Douglas Street.

In the typical segments, the cycle track will abut a relocated pedestrian sidewalk. The alignment is contained off-street in the existing boulevard area; there is no change to the road cross section in these areas. The sidewalk is 1.5m wide, the cycle track is 3.0m and buffer is generally 1.0m wide, but 0.6m wide in certain areas where required to avoid trees.

At Paddon Avenue, there is limited width and a geotechnical constraint that prohibits placement of fill on the bluffs to widen the road to accommodate the Cycle Track. Additionally, a stand of trees immediately east of the east end of the concrete railing has been identified for preservation. Therefore, the cycle track alignment through this section encroaches onto Dallas Road, which requires shifting of the drive lanes of Dallas Road to the north. This necessitates modifications to the parking through the pinch point area, which has been given careful consideration in the overall design development to mitigate parking loss. A short section adjacent to the trees just east of Paddon Avenue requires narrowing the cycle track to 2.7m wide, with a 0.6m buffer and 3.3m drive lanes.

At Douglas Street, there is also limited width and the same geotechnical constraint. The cycle track alignment encroaches slightly onto Dallas Road, which requires a slight shift of the drive lanes. However no loss of on-street parking is anticipated in this area due to the available width and current parking extents. A minimum of 1.5m sidewalk, 3.0m cycle track, and 1.0m buffer are maintained in this section along with drive lane widths that exceed minimum criteria values.

East of Douglas Street, the cycle track alignment follows a route further south from Dallas Road through the brush area, in order to avoid the large mature trees that abut the south curb of Dallas Road. The pedestrian path alignment shifts south and away from the cycle track at this point as well (and remains separated from the cycle track alignment all the way east to Clover Point).

East of Douglas Street / Beacon Hill Park. In the west section, the cycle track alignment is through the brush south of Douglas Street. At the east end, immediately beyond the mature trees, the cycle track approaches the south edge of Dallas Road, and is separated from the roadway and existing on-street perpendicular parking. At the easterly limit of this section, the alignment encroaches into the existing angled parking to avoid a treed area. This will necessitate modifications to the parallel parking for a portion of the area, which has been given careful consideration in the overall design development to mitigate parking loss.

Circle Drive to Cook Street. The alignment is generally away from Dallas Road in this section and does not impact the roadway. It veers south and follows a utility corridor between two treed areas. A connection will be provided to the Circle Drive cycle track.

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Cook Street to Clover Point Pump Station. The alignment is offset from Dallas Road in this section and follows the forcemain alignment up to Clover Point. At the east end the design will tie into the Clover Point Pump Station site design.

6.3.5 City of Victoria Design Considerations

There are a number of design considerations that require direction from City staff. The following is a summary of these design considerations.

Parking Impacts. The Cycle Track alignment presented at the Committee of the Whole in December 2017 identified the need for modifications to parking along the James Bay Seawall, and sections of Dallas Road between Paddon Avenue and Douglas Street. Based on feedback from Council, the CRD WTP Team and City staff worked together to mitigate parking loss, including development of options to retain angle parking on Dallas Road from Dock Street to Lewis Street. This led to an assessment of the following three (3) options:

- Option 1: Parallel parking;
- Option 2: Angle parking (at 45 degrees) with bulges at four intersections; and
- Option 3: Angle parking (at 45 degrees) with bulges at two intersections.

The Cycle Track alignment presented at the Committee of the Whole in December 2017 was based on Option No. 1. In accordance with the terms of the Licence Agreement, the design was based on fitting the Cycle Track within the existing Dallas Road pavement structure. As a result, it was necessary to convert the existing angled parking along the James Bay Seawall to parallel parking.

Based on feedback from City Council at the December 2017 Committee of the Whole, City staff and the CRD WTP Team developed two additional options to mitigate the parking impacts associated with Option No. 1. Both options allow the angle parking along the James Bay Seawall to be retained, with Option 2 including curb extensions for pedestrian crosswalks at four intersections and Option 3 including curb extensions for pedestrian crosswalks at two intersections. Both options require widening of Dallas Road to maintain the existing parallel parking on the north side of street. The widening is limited to the existing grassed boulevard between the curb and sidewalk on the north side of Dallas Road.

The CRD WTP Team, working with City staff, developed concept drawings showing the parking arrangements for each of the three options. In January 2018, the CRD WTP presented the three options to the James Bay Neighbourhood Association and the Fairfield Gonzales Community Association.

The City has provided a report to Council to quantify the parking impacts related to the Cycle Track alignment. It is expected that Council will consider the City report at the April 12, 2018 Committee of the Whole, and that the recommended option will be established as a result of the meeting. The CRD will advance the recommended option in the 90% design.

Tree Impacts. The alignment of the Cycle Track runs through the brush, south of Dallas Road, at two locations, generally across from: (1) the Douglas Street intersection, and (2) Camas Circle Drive. This alignment was selected to avoid large, mature trees that are immediately adjacent to Dallas Road, and it is the same alignment that was selected as the design basis in the Licence Agreement. The alignment of the Clover Forcemain remains within the north side of Dallas Road through the Douglas Street intersection, and it follows the Cycle Track alignment through the brush across from Camas Circle Drive.

As part of design development, KWL was required to assess the impacts that the Cycle Track and Forcemain alignment may have on the trees along Dallas Road. The arborist report, which is included in

Appendix "E", supports the recommended alignment for the off-road section of the Cycle Track through the Douglas Street intersection and Camas Circle Drive.

Cycle Track Lighting. The design specifications, as set out in the Licence Agreement, indicate that the lighting along the Cycle Track should be designed to mitigate public safety concerns and incorporate Crime Prevention through Environmental Design (CPTED) principles.

Currently, the existing lighting along Dallas Road does not meet CPTED principles, which requires the lighting to provide facial recognition at a distance of 10 metres. KWL has estimated that approximately 300 additional lights, at a spacing of 10 m, would be required along the Cycle Track alignment to meet CPTED requirements. Installing lighting to CPTED requirements along the entire length of Dallas Road could increase light pollution to levels that may be unacceptable to the City and/or the public. As such, it may be more effective to provide lighting in the two areas where the Cycle Track shifts away from the road.

The level of lighting along the Cycle Track is at the City's discretion, and the CRD WTP Team is prepared to implement the lighting requirements as recommended by the City.

Pedestrian Connectivity and Safety. The Licence Agreement includes requirements to incorporate safety improvements for pedestrian crossings, linkages to existing crosswalks and connections to the Dallas Road waterfront pathway. It also stipulates the need to incorporate site furnishings, including a bike rack and bench, a minimum of six key intersections. The CRD WTP, working together with City staff, have assessed the requirements for pedestrian crossings and safety as summarized in Appendix F. The requirements for pedestrian connectivity and safety, including the location of crosswalks, is at the City's discretion, and the CRD WTP Team will implement the requirements as recommended by the City.

Barrier Fencing. The Licence references that barrier fencing shall be placed between off-leash dog areas and the Cycle Track. One option that KWL presented to the City (at the 50% Design Workshop) includes the use of split rail fence and/or dense, low-maintenance shrubs to provide separation at key locations along the Cycle Track, with the remaining areas being left open for access. This option, which is shown in Appendix G, forms the basis of the 50% Design Proposal. The requirement for barrier fencing is at the City's discretion, and the CRD WTP Team will implement the barrier fencing as recommended by the City.

7. Geotechnical Assessment (Dallas Road Bluffs)

The City of Victoria, at the May 11, 2017 Council meeting, passed the following resolution related to Dallas Road Waterfront Geotechnical Monitoring.

> *Put in place risk mitigation measures to protect the Dallas Road Bluffs during construction including but not limited to:*
>
> *a. Assembling an interdisciplinary team to study and address the protection of the bluffs.*
>
> *b. As part of the detailed design of the conveyancing, include a plan for the preservation of the bluffs.*
>
> *And that the Project Board report out to the public at one of their regular community meetings, to the JBNA and to Victoria City Council on the measures outlined.*

In response, the Project Board and Project Team committed to the following:

> *Geotechnical investigations and monitoring will take place along Dallas Road with an enhanced focus on the shoreline and bluffs prior to, during and after the construction of the Clover Point Forcemain and*

related pipework. The geotechnical investigations will include a series of test holes drilled along the pipe alignment to establish existing geological conditions and to collect samples for laboratory testing and use in establishing geotechnical design parameters for the pipe and bluff stability analysis. The geotechnical monitoring will include the installation of instruments near the bluffs and along the pipe alignment. Recordings from these instruments will be used to monitor conditions during the construction and post-construction phase of the project.

The design process for the conveyance system from Ogden Point to Clover Point (the Clover Forcemain) has begun. It includes the development of an indicative design and a final design. Stantec, as the owner's engineer, will undertake the indicative design. Another qualified engineering firm (which we will call the 'Second Engineering Firm') will review the indicative design and prepare the final design. Both firms will have input into the undertaking of, and access to the outcome of, geotechnical investigations and monitoring outlined above.

Specifically, the Project Team will competitively-procure the Second Engineering Firm to review the indicative design and prepare the final design. This firm will have expertise in the fields of geotechnical, terrain analysis, environmental and civil engineering. The firm will be provided with the indicative design and the results of the geotechnical investigations undertaken to-date, and will be responsible for reviewing that work as part of developing the final design. They will also be responsible for fulfilling the duties of Engineer of Record as defined by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). Professional members of the firm and their qualifications will be noted as part of their work.

As part of their scope of work, the Second Engineering Firm will prepare a plan to mitigate any impacts on the bluffs during construction. As noted, this plan will include post-construction monitoring for 12 months following completion of construction.

Reports detailing the results of the geotechnical investigations and the indicative alignment will be complete in the fall of 2017. The Project Team will report on these to the public at one of their regular community information meetings, to the James Bay Neighbourhood Association and to Victoria City Council. Results will also be posted on the Project website.

In keeping with the requirements of the May 11, 2017 resolution to report out to City of Victoria Council, the following summarizes the progress that the Project Team has made regarding the plan outlined above.

1. Geotechnical investigations have been undertaken along Dallas Road with an enhanced focus on the shoreline and bluffs. The geotechnical investigations included:
   - twenty four (24) boreholes drilled along the forcemain alignment, with samples sent for laboratory testing;
   - three (3) slope inclinometers (one near Paddon Avenue, and two near Douglas Street); and
   - one (1) standpipe piezometer with two nested groundwater monitoring wells near Douglas Street.

   The results of the geotechnical investigations were used to establish existing geological conditions and geotechnical design parameters for the pipe and bluff stability analysis.

   In preparation for geotechnical monitoring during and after construction of the Clover Forcemain, instruments have been installed near the bluffs and along the pipe alignment. Recordings from these instruments will be used to monitor conditions during the construction and post-construction phases of the Project.

2. Design of the Clover Forcemain has been advanced. As laid out above, the design process includes development of an indicative design by Stantec, as the owner's engineer, and a final design by a second engineering firm.

   The Project Team has competitively-procured a design engineering team led by Kerr Wood Leidal (KWL) to undertake the responsibilities of the second engineering firm: namely, to review the indicative design, prepare the final design, and be responsible for fulfilling the duties of the Engineer of Record as defined by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC).

3. The KWL team has assembled an interdisciplinary team with expertise in the fields of geotechnical, terrain analysis, environmental, and civil engineering. The KWL team has completed a geotechnical assessment of the Clover Forcemain. The assessment included a review of the indicative design and the results of the geotechnical investigations undertaken to-date, as well as a number of previous studies and technical reports.

   The KWL team agreed with selection of the Dallas Road alignment, and their geotechnical assessment concluded that the Forcemain can be designed, constructed and operated in the Dallas Road alignment without having an adverse environmental or geotechnical impact on the bluffs (and without the bluffs affecting the Forcemain). The KWL team has conducted supplement geotechnical investigations and analysis to inform the detailed design, which include:
   - five (5) sonic test holes were drilled along key areas of the Forcemain alignment including two (2) at the James Bay Seawall, and one (1) each at Paddon Avenue, Douglas Street, and in Beacon Hill Park across from Cook Street.

   Details of the geotechnical assessment were documented in the KWL report entitled "Clover Forcemain Geotechnical Summary", which is included in Appendix "H" of this memo. The report includes also includes a summary of the credentials and qualifications of the KWL interdisciplinary team of experts.

4. The KWL report outlining the results of the geotechnical assessment of the Clover Forcemain alignment, including the geotechnical investigations to-date, was posted to the Project website on November 27, 2017.

   The Project Team reported the results of the geotechnical assessment to the public at the November 27, 2017, January 10, 2018, and January 11, 2018 community meetings.

The Project Team remains committed to completing the following:

1. Geotechnical monitoring along Dallas Road with an enhanced focus on the shoreline and bluffs during and after the construction of the Clover Forcemain, including post-construction monitoring for twelve (12) months following completion of construction.

2. As part of finalizing the design, the KWL led team will prepare a plan to mitigate any impacts that construction may have on the bluffs. KWL will monitor the construction contractor's adherence to the plan.

8. Consultation and Feedback

The licence agreements for the Clover Point Pump Station and the Dallas Road Forcemain identified specific requirements for presentation to the City Council, as well as consultation with the James Bay Neighbourhood Association and the Fairfield Gonzales Community Association including:

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- present the Design Proposal to City Council in a public meeting prior to commencement of detailed design, and amend the Design Proposal in accordance with any recommendations of City Council.
- at the 50% design stage, present the design to City Council at a public meeting, and to the James Bay Neighbourhood Association and the Fairfield Gonzales Community Association in a separate presentation, and amend the 50% Design Proposal with any recommendations of City Council.

This section summarizes the consultation undertaken by the CRD WTP Team and the feedback received. It also includes a summary of the amendments that were incorporated into the 50% Design Proposal.

8.1 City Council Public Meeting

On December 14, 2017, the CRD WTP attended the City of Victoria Committee of the Whole to present the Design Proposal for the Clover Point Pump Station Building exterior and Public Realm Improvements, and the Dallas Road Forcemain alignment and Cycle Track design and alignment. The Committee received the report from the CRD WTP and passed the following motion:

1. *That Council receive the report for information.*
2. *That Council request that the CRD Project team work with staff to:*
   a. *soften the interface between the lower foreshore walkway at Clover Point and the loading bays / retaining walls, recognizing the context of a waterfront park;*
   b. *improve the quality of materials / design of the lower foreshore walkway, so that it presents and functions effectively as a pedestrian walkway in a waterfront park;*
   c. *report back on the current parking demand on Dallas Road from Dock Street to Lewis Street*
3. *That Council direct staff to refer the plan to the Active Transportation Advisory Committee.*

The CRD considered items 2a, 2b and 2c from the Committee's motion and the following amendments were incorporated into the 50% Design Proposal.

Summary of Council Recommendations and Design Amendments

Committee Recommendation	Design Amendments
a. *soften the interface between the lower foreshore walkway at Clover Point and the loading bays / retaining walls, recognizing the context of a waterfront park;* b. *improve the quality of materials / design of the lower foreshore walkway, so that it presents and functions effectively as a pedestrian walkway in a waterfront park;*	The Design Concept for the Clover Point Pump Station set out in the licence agreement included a Gathering / Dismount Area for the Cycle Track, and a Viewing Plaza with benches. In addition to these licence requirements, the 50% Design Proposal includes: a. provision of a Lower Plaza Viewing and Rest Area that softens the hardscaping of the pump station; b. trails and pathways to connect the gathering areas in the upper plaza with the lower foreshore walkway to integrate the pump station with the waterfront park; c. screening of loading bays in a manner to provide a consistent exterior finish along the east facing portion of the pump station; and d. modifications to the lower retaining wall to reduce the massing and profile to recognize the context of a waterfront park.
c. *report back on the current parking demand on Dallas Road from Dock*	The CRD WTP Team worked with City staff and developed two options that would retain the angle

Committee Recommendation	Design Amendments
Street to Lewis Street	parking on Dallas Road from Dock Street to Lewis Street. Both options require widening of Dallas Road (within the grassed boulevard between the curb and sidewalk) to maintain the existing parallel parking on the north side of the street. The City has provided a report to Council to quantify the parking impacts. It is anticipated that Council will consider the City staff report at the April 12, 2018 Committee of the Whole, and establish the preferred option. The CRD WTP Team will implement Council's preferred option.

8.2 Community Consultation

The Wastewater Treatment Project held a community consultation from January 10 – 31, 2018 regarding the proposed design for the Clover Point Pump Station Building exterior and Public Realm Improvements, and the Dallas Road (Clover) Forcemain alignment and Cycle Track design and alignment.

Notification of opportunities to participate in the consultation included:

- **Invitation Mail Drop**: mailed to 13,097 residents and businesses in James Bay and Fairfield Gonzales in advance of the consultation period.
- **Invitation Emails and Notification to Stakeholders**: 259 stakeholders who had signed up for the Project distribution list were notified of the engagement and opportunities for participation by email.
- **Project webpage**: dedicated project webpages provided information about the project, and how to provide feedback. Consultation materials were available throughout the consultation period.

8.2.1 Consultation Participation

There were a total of approximately 630 participant interactions during the community consultation:

- 280 people attended two community meetings that were open to the public
- 346 completed feedback forms were received (304 online, 42 hardcopy); and
- 4 open ended submissions were received (2 hardcopy, 1 email and 1 phone call)

8.2.2 Community Meeting Key Results

As part of the consultation, the CRD WTP held two community meetings in Victoria. Below are the key themes:

Meeting	Key Themes
James Bay Neighbourhood James Bay New Horizons Wednesday, January 10, 2018	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were divided in their support and opposition of the cycle path.

7:00 p.m. – 9:00 p.m. Approximately 150 participants	• Participants were interested in safety and accessibility measures of the cycle path. • Participants expressed concerns for vegetation, as well as mature trees along the cycle path and forcemain alignment.
Fairfield Gonzales Community Cook Street Village Activity Centre Thursday, January 11, 2018 7:30 p.m. – 9:30 p.m. Approximately 130 participants	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were interested in the cycle path, especially safety for cyclists. • Participants wanted to learn more about off-leash dog areas and fencing. • Participants were interested in accessible parking spaces for residents with mobility needs.

A feedback form was distributed at these meetings that participants could hand in or mail to the CRD Project office at their convenience. The feedback form was also posted to the Project website from January 10 - 31, 2018.

8.2.3 High-Level Feedback Form Results

The following is a high level summary of the public feedback received from the consultation process. The full Consultation Feedback Report is included in Appendix I.

1. **Please indicate your level of agreement with the overall proposed design of the Clover Point Pump Station building exterior.**

Strongly Agree	43%
Somewhat Agree	32%
Neither Agree Nor Disagree	17%
Somewhat Disagree	3%
Strongly Disagree	5%

2. **Please indicate your level of agreement with the overall design of the public space improvements at Clover Point.**

Strongly Agree	42%
Somewhat Agree	32%
Neither Agree Nor Disagree	11%
Somewhat Disagree	8%
Strongly Disagree	8%

3. **Please indicate your level of agreement with the design and alignment of the proposed cycle path.**

Strongly Agree	49%
Somewhat Agree	10%
Neither Agree Nor Disagree	4%
Somewhat Disagree	10%
Strongly Disagree	28%

4. **Parking Options for Dallas Road between Dock Street and Lewis Street. Please indicate your preferred parking option by ticking the appropriate box:**

Option 1 (parallel parking)	15%
Option 2 (angled parking, four curb extensions, improved pedestrian and cycle connectivity)	44%
Option 3 (more angled parking, two curb extensions, less pedestrian and cycle connectivity)	41%

8.2.4 Design Amendments

The following is a summary of public feedback that was specifically related to the design of the Clover Point Pump Station Building exterior and Public Realm Improvements and the Dallas Road (Clover) Forcemain alignment and Cycle Track design and alignment. The summary also identifies the design amendments that were incorporated into the 50% Design Proposal.

Summary of Public Feedback and Design Considerations

Public Feedback	Design Considerations
Participants expressed concern about parking loss for residents, seniors, and people who come from outside Victoria	The CRD WTP Team and City staff have worked to develop two options that maintain angle parking to mitigate parking loss. It is expected that the preferred option will be established at the April 12, 2018 Committee of the Whole. CRD WTP Team will implement Council's preferred option.
Participants offered various suggestions regarding design of Clover Pump Station Building exterior and Public Realm Improvements, including:	
• The pump station exterior should blend with the site and the surrounding area (and avoid use of concrete or brick)	The 50% Design Proposal includes modifications to lower the retaining wall to reduce the massing and profile to better blend the exterior with the site and the surrounding area. The modifications reduce the use of concrete and stone.
• The pump station facility should be designed so people can see inside	The 50% Design Proposal is based on the Design Concept that was included in the licence agreement. The Design Concept was based on maintaining the architectural finish of the existing pump station in order to better blend one exterior into the site and surrounding area. Modifications to allow people to see inside the pump station would require a significant structural retrofit and is not feasible.
• Provide ramps connecting the two levels of the pump station	The trails and pathways connect to the existing ramps that connect the upper plaza level with the lower foreshore walkway. Spatial limitations prohibit ramps in closer proximity to the pump station.
• Washroom design improvements, e.g. location should be more convenient (less tucked away), locked at night/monitored, add more	The design requirements for the washroom were established by the City in the licence agreement. The 50% Design Proposal, including the number of washrooms, is based on input from the City. The design includes security

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Public Feedback	Design Considerations
washrooms	features, such as a roll down shutter to lock up the washroom night. The location, as defined in the licence agreement, was selected to minimize visual impacts and sightlines from Dallas Road. Moving the washroom to a more prominent location is not considered feasible, as it would necessitate revisions to the vision for public space improvements presented in the 50% Design Proposal (and 74% of the public agreed or strongly agreed with the proposed design).
• Continue the walking path around the end of Clover Point	Walkway improvements outside the limits of the Clover Point Pump Station were not contemplated in the design requirements in the licence agreement, but could be considered by the City as part of the additional capital improvements.
• Add architectural or landscaping features, such as public art or native plants and signage, e.g. First Nations historical and archaeological significance, bird/plant information	The scope of the Public Realm Improvements includes landscaping features, such as public art and signage. The CRD WTP Team is working with the Songhees and Esquimalt Liaisons to develop these features. Refer to Section 9.0.
• Move viewing plaza and other amenities further away from Dallas Road	Locations for the viewing plaza and other amenities were set out in the licence agreement to integrate and enhance the connectivity between the existing trails and pathways at Clover Point and the Public Realm Improvements. Moving the viewing plazas and other amenities is not considered feasible, as it would necessitate revisions to the vision for public space improvements presented in the 50% Design Proposal (and 74% of the public agreed or strongly agreed with the proposed design).
Participants offered various cycle path and cycling amenities suggestions, including:	
• No concrete curbs/barriers on the cycle path or use painted lines to delineate cycle path	The 50% Design Proposal includes roll-over curbs. Consideration could be given to using painted lines to delineate the cycle path. The CRD WTP Team will implement the treatment recommended by City staff in development of the 90% design.
• Provide additional bike racks	The number of bike racks were defined in the licence agreement. Consideration could be given to providing more bike racks. The CRD WTP Team will implement the treatment recommended by City staff in development of the 90% design.
• Provide wider cycling lanes	The width of the proposed cycling lanes comply with the applicable design criteria. Wider cycling lanes would require a widening of Dallas Road, which is not recommended as it would result in a loss of green space.

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Public Feedback	Design Considerations
• Continue the cycle path to connect into community corridors, e.g. James Bay or beyond Dock Street to Ogden Point	The geographical limits of the cycle path were defined in the licence agreement. Extending the cycle path beyond these limits to connect into community corridors could be considered by the City as part of the additional capital improvements.
• Include traffic calming measures such as lowering the speed limit, narrowing lanes, or adding speed bumps	The inclusion of traffic calming measures was not specifically considered in the licence agreement. Traffic calming measures could be considered by the City as part of the additional capital improvements.
• Have pedestrian controlled traffic lights at crosswalks for safety (in particular at Douglas and Dallas Roads)	Signalized traffic lights at pedestrian crosswalks was not considered in the design requirements that were established in the licence agreement. Signalized traffic lights could be considered by the City as part of the additional capital improvements.
• Provide elephant feet crosswalks for cycling and walking paths	The number of crosswalks were established as part of the 50% Design Proposal. The treatment of these crosswalks is at the discretion of the City. The CRD will implement the treatment recommended by City staff in development of the 90% design.
Participants offered various suggestions regarding design and amenities, including:	
• Comments on off-leash dogs with some concerned about off leash dogs in general, and others noting possible conflicts with the fencing, walking path or cycle path	The 50% Design Proposal is based on providing split rail fence and/or dense, low-maintenance shrubs to provide separation at key locations along the Cycle Track, with the remaining areas being left open for access. The requirement for barrier fencing is at the City's discretion. The CRD WTP Team will implement the barrier fencing as recommended by City staff in development of the 90% design.
• Fencing suggestions, such as provide gaps at intersections and ensure that it does not obstruct view	The 50% Design Proposal is based on providing split rail fence and/or dense, low-maintenance shrubs to provide separation at key locations along the Cycle Track, with the remaining areas being left open for access. The requirement for barrier fencing is at the City's discretion. The CRD WTP Team will implement the barrier fencing as recommended by City staff in development of the 90% design.

9. First Nations and Public Art Considerations

The licence agreements for the Clover Point Pump Station and Clover Forcemain included requirements that provide a framework for engagement of the Songhees First Nation and Esquimalt First Nation, as well as opportunities to incorporate public art in consultation with the City's artist and aboriginal artist in residence, as follows:

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- **Clover Point Pump Station Licence Agreement**: *"Consider the inclusion of public art in consultation with the City's artist and aboriginal artist in residence";* and

- **Dallas Road (Clover) Forcemain Licence Agreement**: *"The City and CRD wish to recognize and celebrate the heritage and culture of the Songhees First Nation and the Esquimalt First Nation. The Cycle Track will complement this desire by, where respectful and appropriate, considering the Songhees First Nation and the Esquimalt First Nation heritage and culture in the Cycle Track, more specifically in the exterior design of the site furnishings".*

In order to recognize and celebrate the heritage and culture of the Esquimalt First Nation and the Songhees First Nation, the CRD WTP has engaged the Esquimalt and Songhees Liaisons in the planning and development of the work. This engagement has included Esquimalt and Songhees Nation participation in design workshops, as well as through other avenues such as the bi-weekly Songhees and Esquimalt Liaisons meetings with CRD WTP staff. It has also included engagement of the City's artist and aboriginal artist in residence.

As a result of this engagement process, a number of themes and ideas have been brought forward, including:

- Any art, signage or exterior design details should align with and build on the Na'Tsa'Maht Unity Wall at Ogden Point;

- Linking Ogden Point and Clover Point through Esquimalt and Songhees art and wayfinding signage is desirable; and

- Wayfinding signage should align with the City of Victoria signage where possible (e.g. wayfinding signs with Lekwungen place names).

The CRD, the Esquimalt and Songhees Liaisons and the City of Victoria will continue working together to develop these themes, and incorporate various features, including public art, that help share the story of the Lekwungen people in a respectful and appropriate manner.

10. Next Steps

April 2018 to June 2018

Key activities include:

1. CRD presents, at the Committee of the Whole, the 50% Design Proposal for the exterior of the Clover Point Pump Station Building, the Public Realm Improvements, the Dallas Road (Clover) Forcemain alignment, and alignment of the Cycle Track, which will reflect input received from the community associations (per Clauses 11.4 and 11.5 and 9.4 and 9.5 of the Clover Point Pump Station and Dallas Road (Clover) Forcemain licence agreements, respectively).

2. CRD to proceed with detailed design of the exterior of the Clover Point Pump Station Building, the Public Realm Improvements, and the Clover Forcemain alignment and Cycle Track.

3. CRD hosts the 90% Design Workshop with City staff and First Nations' representation (per Clause 11.2 and 11.3 and 9.2. and 9.6 of the Clover Point Pump Station and Dallas Road (Clover) Forcemain licence agreements, respectively).

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4. Final acceptance, by City staff, of the exterior of the Clover Point Pump Station Building and the Public Realm Improvements (per Clauses 6.8 and 11.6 of the licence agreement).

5. Final acceptance, by City staff, of the Clover Forcemain alignment and design and alignment of the Cycle Track (per Clauses 9.1 and 9.7 of the licence agreement).

6. The CRD provides the City of Victoria’s Director of Engineering a public engagement plan prior to commencing construction that outlines how the CRD will manage inquiries, complaints, and correspondence from the public that are directed to the City regarding the Project.

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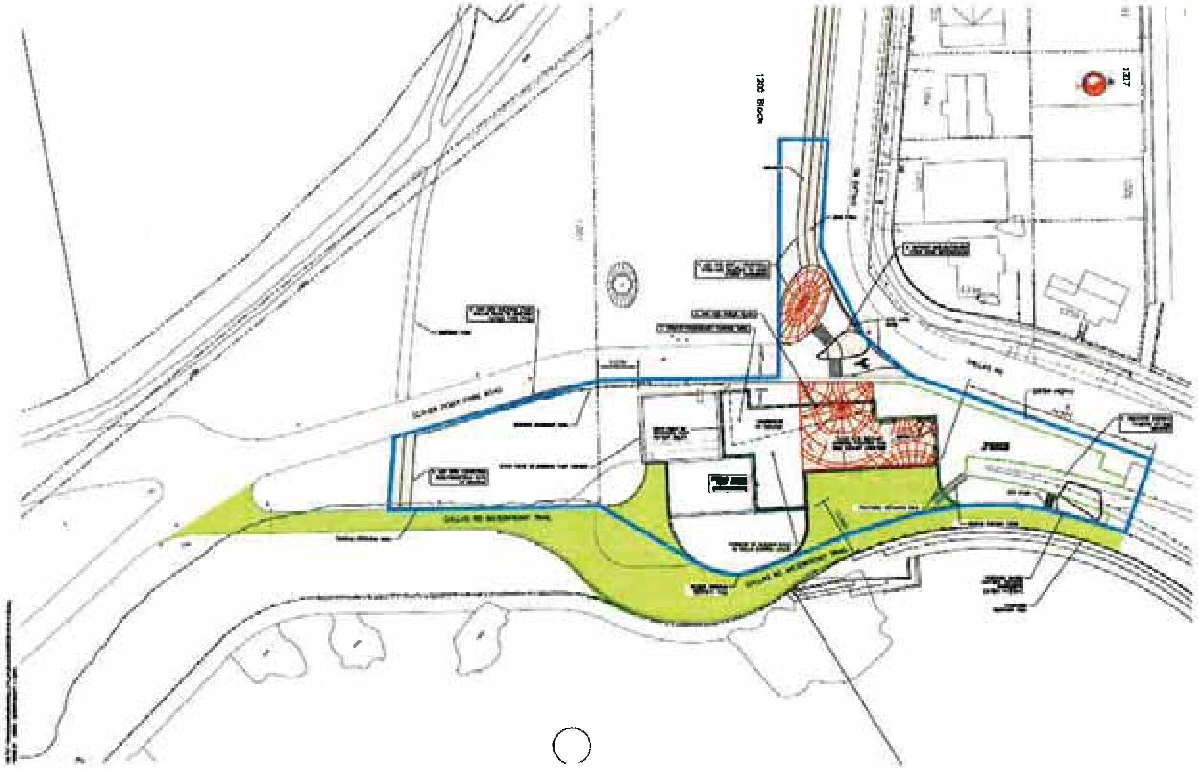
Schedule "B"

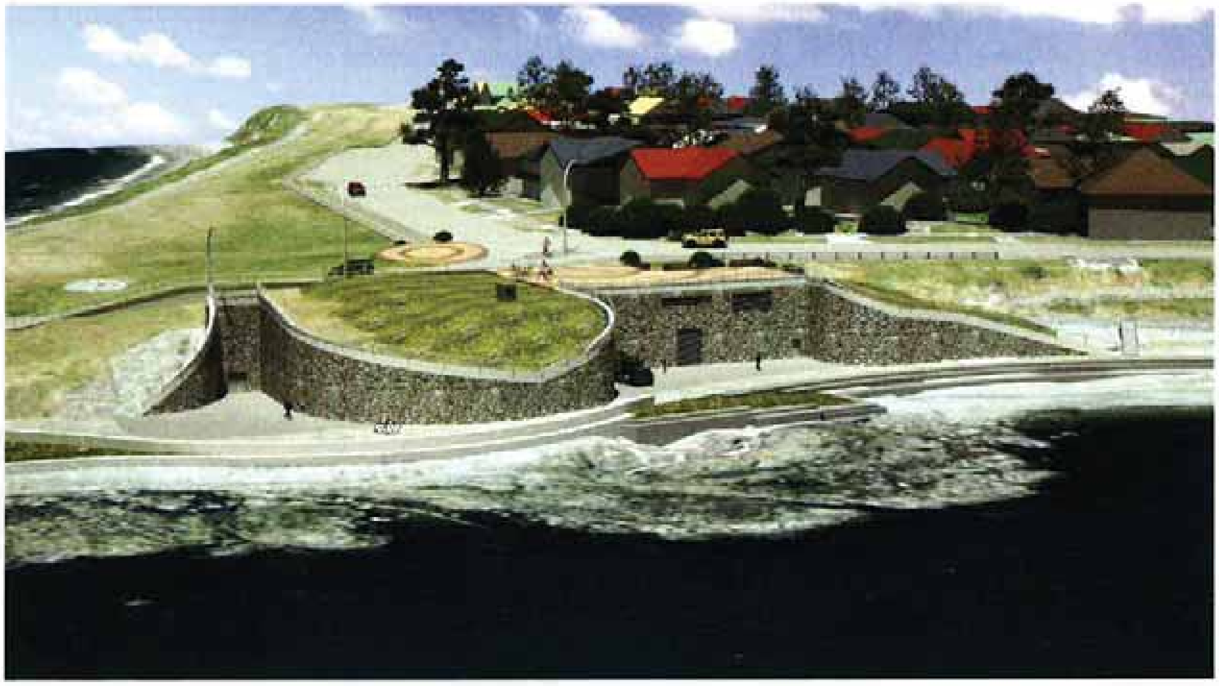
The Works (conceptual only)

Schedule "C"
The Lands



Schedule "D"

Conceptual Plan of the Public Realm Improvements



Schedule "E"

Design Guidelines for the Public Realm Improvements

The City's vision is that:
Clover Point Park should be reimagined as a "special place" of arrival and gathering and should acknowledge and reflect that the location is:

- the proposed beginning/terminus of the Trans Canada Trail and will form part of a future network of nationally significant "special places"
- a part of the Salish Sea Marine Trail
- a part of the federal Victoria Harbour Migratory Bird Sanctuary.

Public Realm Improvements

The public realm improvements will complement the City's vision by:

- functioning as a regional destination for multiple users to enjoy waterfront views, with a "rest area" linking to the proposed bikeway ("Cycle Track") and Ross Bay Greenway.
- encouraging architectural elements that contribute to creating a visual identity for the site, and include distinctive features, such as seating, or lighting.
- considering low cost of maintenance and weather resistance as important factors.
- recognizing and celebrating the heritage and culture of the Songhees First Nation and the Esquimalt First Nation.
- where respectful and appropriate, considering the Songhees First Nation and the Esquimalt First Nation heritage and culture in the Public Realm Improvements, more specifically in the development of public art, associated signage, and any additional exterior design of Public Realm Improvements that the parties may agree upon.

Site Furnishings and Amenities

- Pavement will be concrete, brick or pavers.
- All landscaping will be low maintenance, with no or low long term irrigation requirements.
- The design of the public realm improvements will include at minimum:
  - 4 benches
  - 2 garbage cans (in-ground cans to be installed where feasible)
  - 1 interpretive sign
  - 2 bicycle racks
  - 1 bicycle kitchen (i.e. a maintenance stand similar to those along Capital Regional District's Regional Trails)
  - 1 water fountain
- All site furnishings should be consistent in design, style and quality as the City's current Park's standard.

Public Art

- Consider the inclusion of public art in consultation with the City's artist and aboriginal artist in residence.

Bikeway and Pathway Connectivity

- The location is a key connecting point to bikeways and pathways, including the pathway along Clover Point Park towards Beacon Hill Park, and Ross Bay Greenway (combined bikeway and pathway).
- The final design will link these existing bikeways and pathways with the Cycle Track along Dallas Road, maintain pedestrian and cycling flows along Clover Point Road, and, minimize conflicts between existing park users and users of the Cycle Track and Public Realm Improvements.
- A gathering/dismount area for the Cycle Track will be incorporated on the west side of Clover Point Road at Dallas Road.
- Bike amenities will be included on the east side of Clover Point Road, near the new washroom, and upgraded pump station facility.

Public Washroom

- The washroom facility will contain two gender neutral, universally accessible single use washrooms, each with a sink, toilet, urinal and electric hand dryer and a mechanical/janitors room. The total building will have an approximate footprint size of 3.5m x 8.5 m.
- In determining washroom location, existing view sheds will be a consideration. Building form and massing need to minimize impacts to the views from public vantage points along Dallas Road, Clover Point Road, and from the water.
- The washroom must be distinctive in appearance, yet the function is integrated into the site's topography and overall landscape design.
- Proposed location and building design must respond to public safety considerations and consider Crime Prevention Through Environmental Design (CPTED) principles and the need for lighting.
- High-quality materials will be used for the exterior design, and interior finishes.
- Building will be constructed to LEED Silver at minimum and should strive for LEED Gold.

Universal Access

- Universal access (i.e. wheelchair access) will be provided to all plazas and washrooms.
- Pathways will be universally accessible wherever possible to City standards.

Construction Specifications

- To provide pedestrian priority over vehicle movements and reduce vehicle speeds, the intersections improvements at Dallas and Clover Point Road are to be constructed as a standard driveway crossing, consistent with the City's Subdivision and Development Servicing Bylaw No. 12-042.
- Intersection improvements, roadways, sidewalks, landscaping and any other works or services must be designed and constructed in accordance with the requirements and specifications in the City's Subdivision and Development Servicing Bylaw No. 12-042.

Appendix “A”

Clover Point Pump Station – Licence of Occupation
Excerpts re: Design Concept and Design Guidelines

Appendix "B"

Kenaidan Contracting Ltd – 50%Design Proposal
Clover Point PS – Building Exterior and Public Realm Improvements

Wastewater Treatment Project

Clover Point Pump Station and Clover Forcemain 50% Design Proposal

March 2018

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KENAIDAN   wsp   CRD Making a difference...together

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

FIGURE 1 – CONCEPT PUBLIC REALM PLAN

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

FIGURE 2– VIEW TOWARDS THE SOUTHWEST

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

FIGURE 3 – VIEW TOWARDS THE NORTH

KENAIDAN

wsp

CRD
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CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

FIGURE 4 – VIEW TOWARDS THE SOUTH

Pavement will be permeable concrete brick pavers on two upper plazas and crushed fines on the lower plaza and walkways

The sidewalk along Clover point Road with be C.I.P Concrete

The design of the public realm improvements will include :

- 4 benches
- 2 garbage cans
- 1 interpretive sign (Lekwungen)
- 2 bicycle racks
- 1 bicycle maintenance kitchen
- 1 water fountain with refill station and dog dish
- Galvanized Steel Bollards as appropriate

"Lawn Areas" will be appropriate native hydroseed mix
Camas planting around vent

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Concrete Sidewalk

Crushed Aggregate

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

PUBLIC REALM MATERIALS


Galvanised Pipe Railing


Galvanised Bollard


Concrete Unit Pavers

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

PUBLIC REALM MATERIALS

City of Victoria Bench – Prototype Bench Frame

Bike Rack

Bike Maintenance Stand

PUBLIC REALM SITE FURNISHINGS

Bottle Filling Station & Fountain
with Pet Bowl

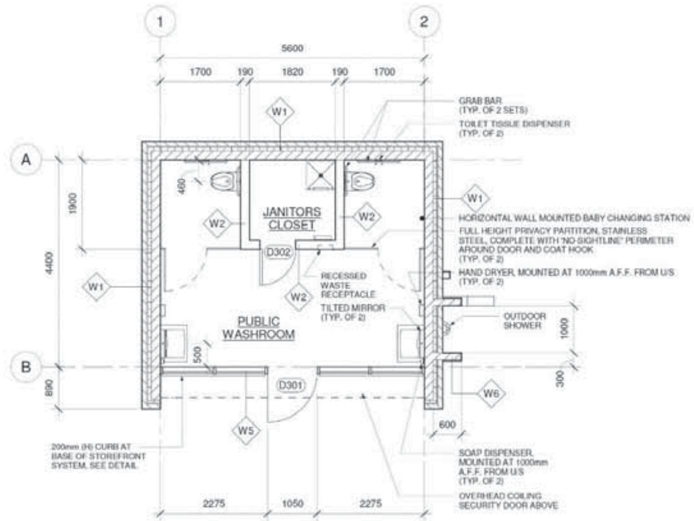
Litter Receptacle

In-Ground Litter Receptacle

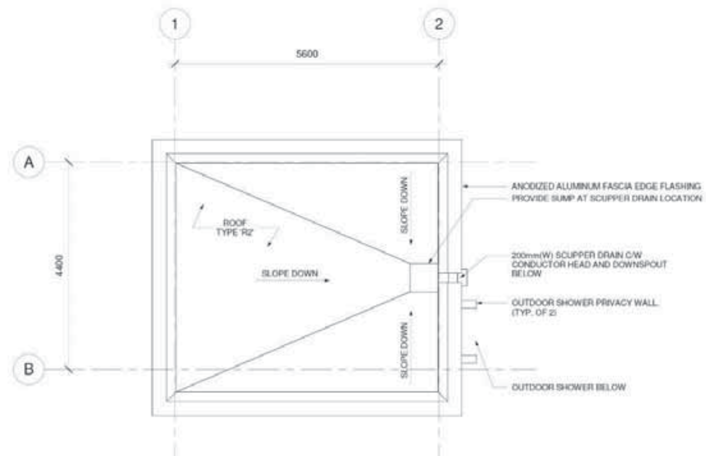
CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

PUBLIC REALM SITE FURNISHINGS



FLOOR PLAN
1 : 50

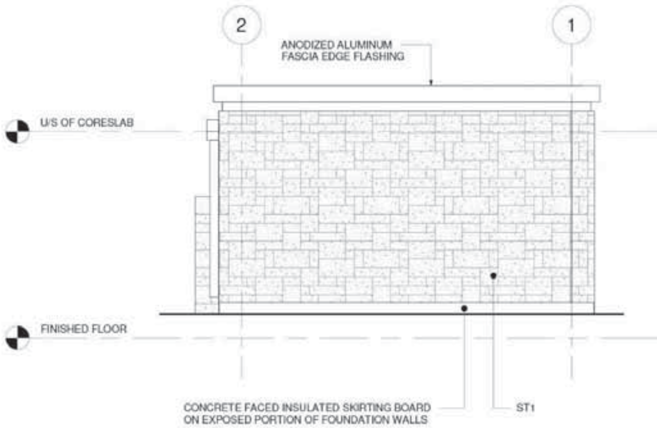


ROOF PLAN
1 : 50

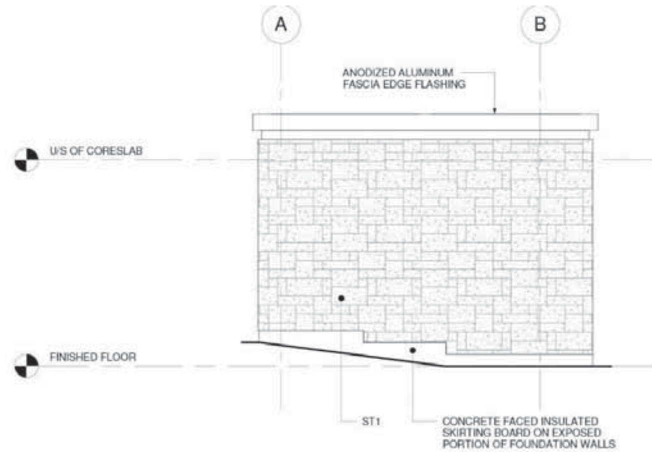
CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

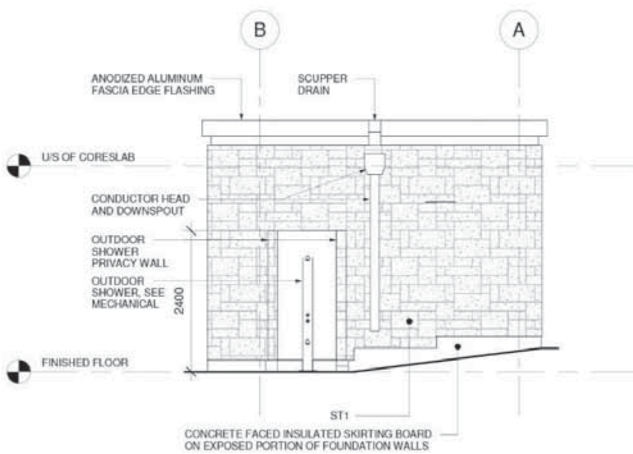
PUBLIC WASHROOM



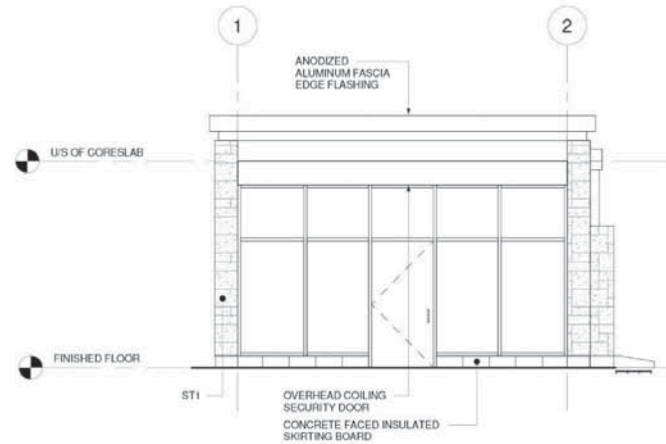
NORTH ELEVATION
1 : 50



WEST ELEVATION
1 : 50



EAST ELEVATION
1 : 50



SOUTH ELEVATION
1 : 50

CLOVER PUMP STATION

City of Victoria 50% Design Proposal – March 2018

PUBLIC WASHROOM

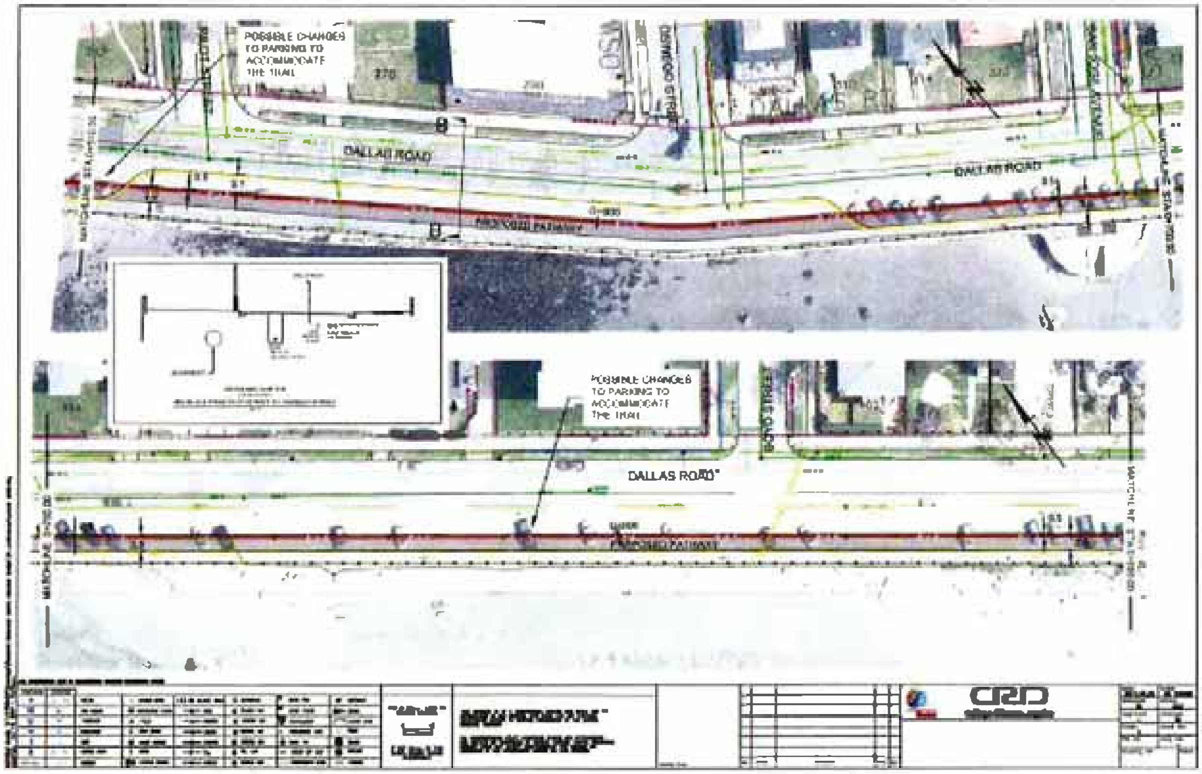
Appendix "C"

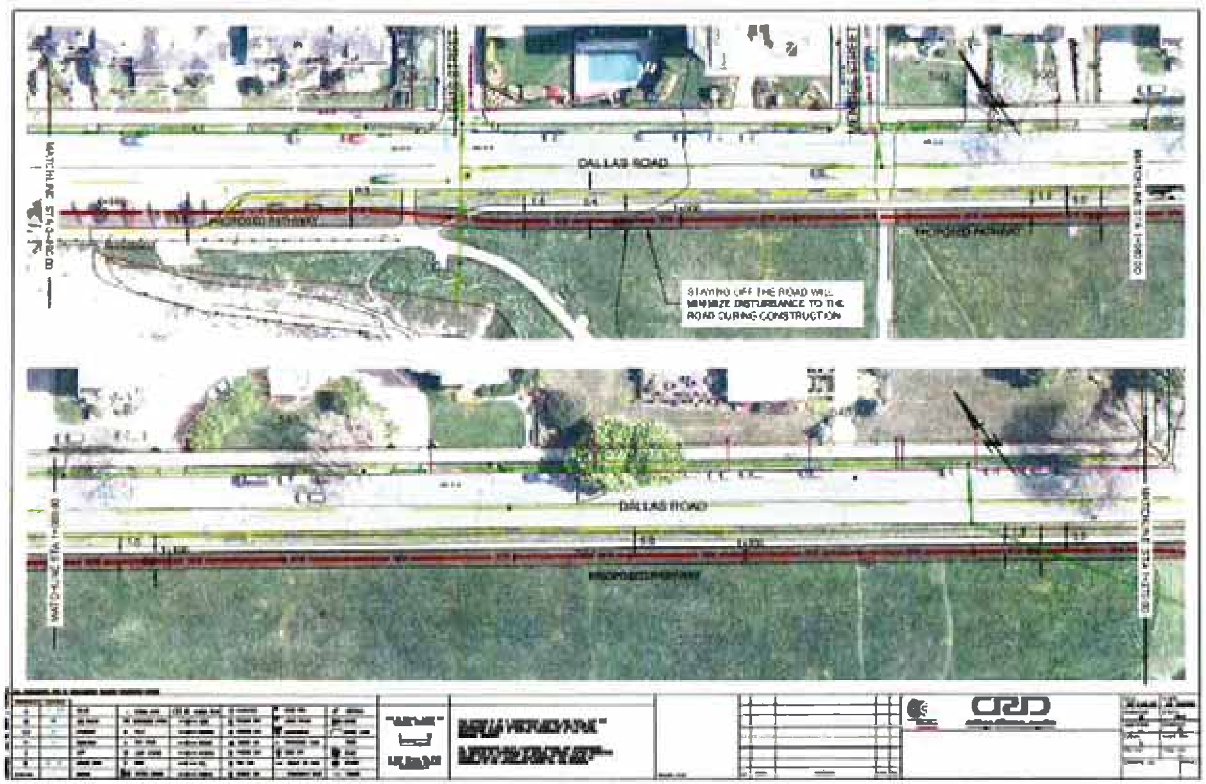
Dallas Road Forcemain Licence of Occupation
Excerpts re: Design Concept and Design Guidelines

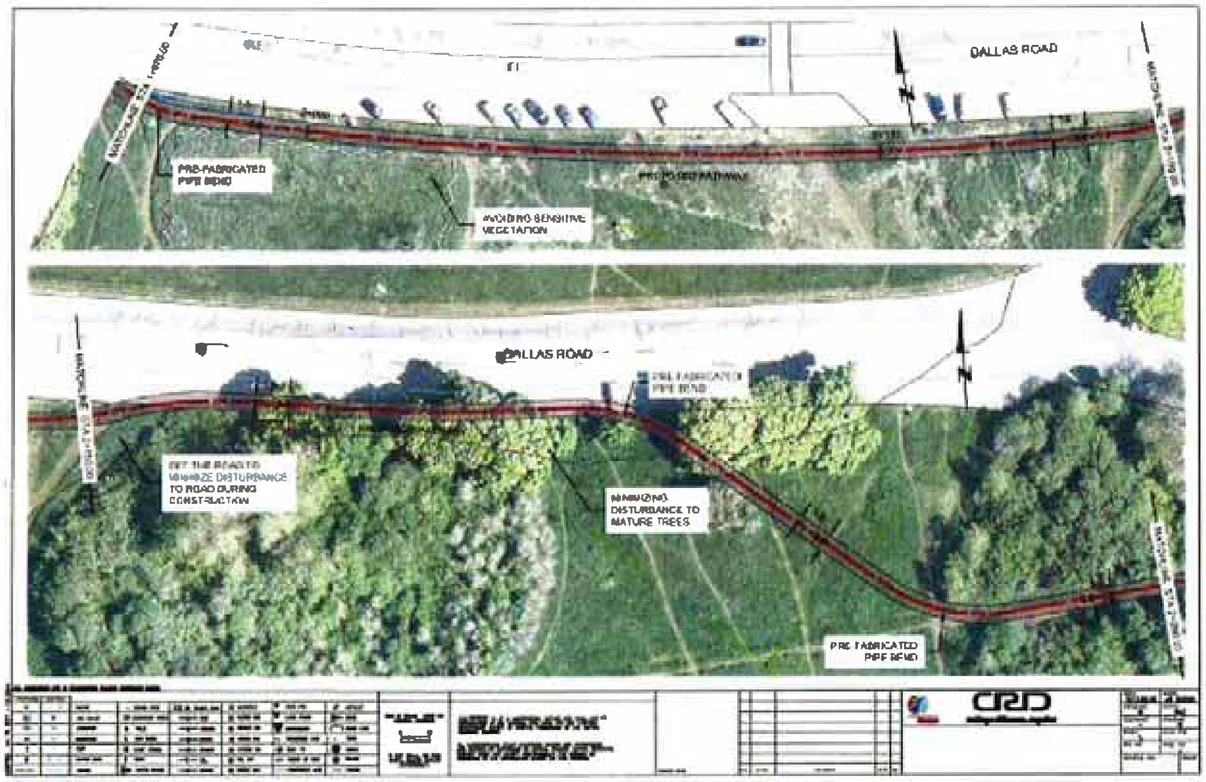
Schedule "B"

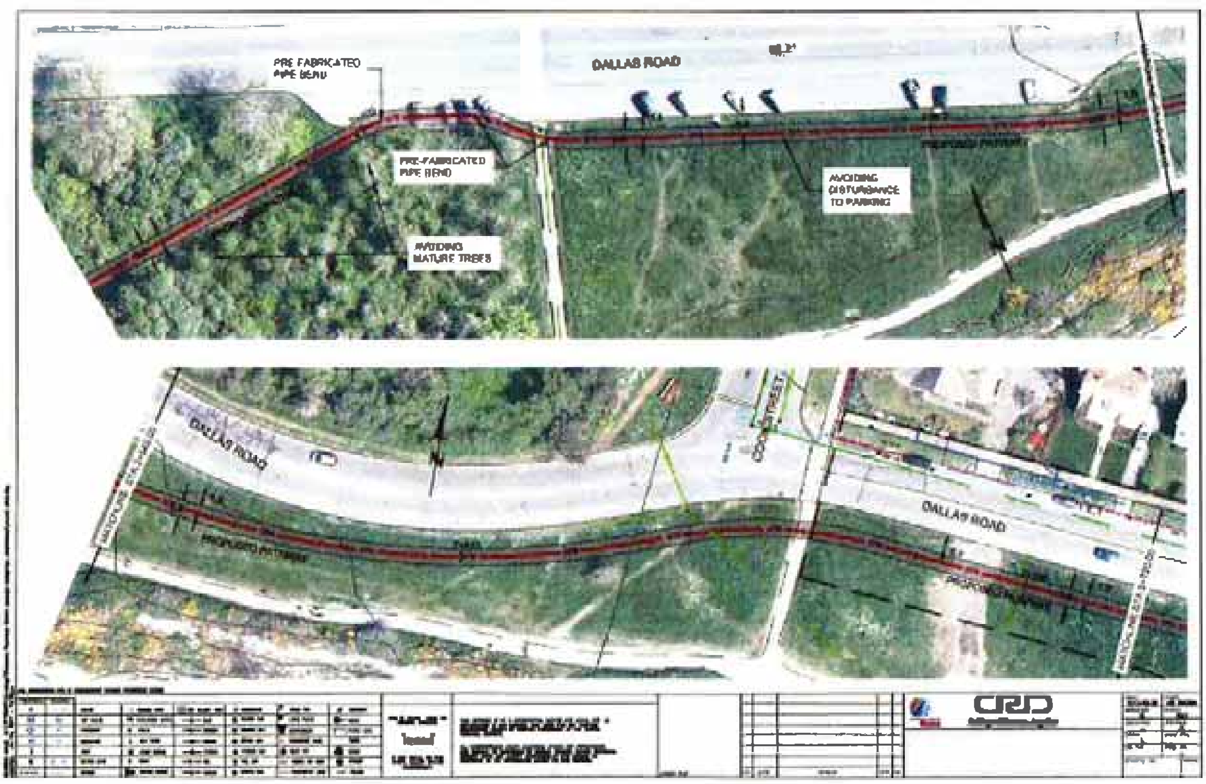
Conceptual Drawings of the Works

JUNE 2013 VICTORIA


POSSIBLE CHANGES TO PARKING TO ACCOMMODATE THE TRAIL
DALLAS ROAD
PROPOSED PATHWAY
DALLAS ROAD
POSSIBLE CHANGES TO PARKING TO ACCOMMODATE THE TRAIL
BOYD STREET
DALLAS ROAD
PROPOSED PATHWAY
CRD


DALLAS ROAD
PROPOSED PATHWAY
STAYING OFF THE ROAD WILL MINIMIZE DISTURBANCE TO THE ROAD DURING CONSTRUCTION
DALLAS ROAD
PROPOSED PATHWAY
CRD


DALLAS ROAD
PRE-FABRICATED PIPE BEND
PROPOSED PATHWAY
AVOIDING SENSITIVE VEGETATION
DALLAS ROAD
PRE-FABRICATED PIPE BEND
MINIMIZE DISTURBANCE TO ROAD DURING CONSTRUCTION
MINIMIZING DISTURBANCE TO MATURE TREES
PRE-FABRICATED PIPE BEND
CRD


PRE-FABRICATED PIPE BEND
DALLAS ROAD
PRE-FABRICATED PIPE BEND
PROPOSED PATHWAY
AVOIDING DISTURBANCE TO PARKING
AVOIDING MATURE TREES
DALLAS ROAD
COOK STREET
DALLAS ROAD
PROPOSED PATHWAY
CRD

Appendix "D"

Kerr Wood Leidal 50% Design Proposal
Dallas Road Cycle Track Alignment

Appendix D

1:500 0 5 15 25m

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DRAWN	B. SOCH	DATE	2018.01.08
SCALE HORIZONTAL	1:500	CHECKED	M. JACOBSON
SCALE VERTICAL		APPROVED	

CLOVER FORCEMAIN

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 10+320 TO STA 10+700

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
CFM-001R	CF-G00-C-702	1	2

Appendix D

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SCALE VERTICAL	APPROVED

CLOVER FORCEMAIN

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 10+700 TO STA 11+080

CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G00-C-703 | ISSUE 2 | SHT. No. 2 OF 2

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CLOVER FORCEMAIN

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 10+320 TO STA 10+700

CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G00-C-702 v2 | ISSUE 1 | SHT. No. 2 OF

Appendix D

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DRAWN B. SOCH	DATE 2018.01.08
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SCALE VERTICAL	APPROVED

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 10+700 TO STA 11+080

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
CFM-001R	CF-G00-C-703 v2	2	2

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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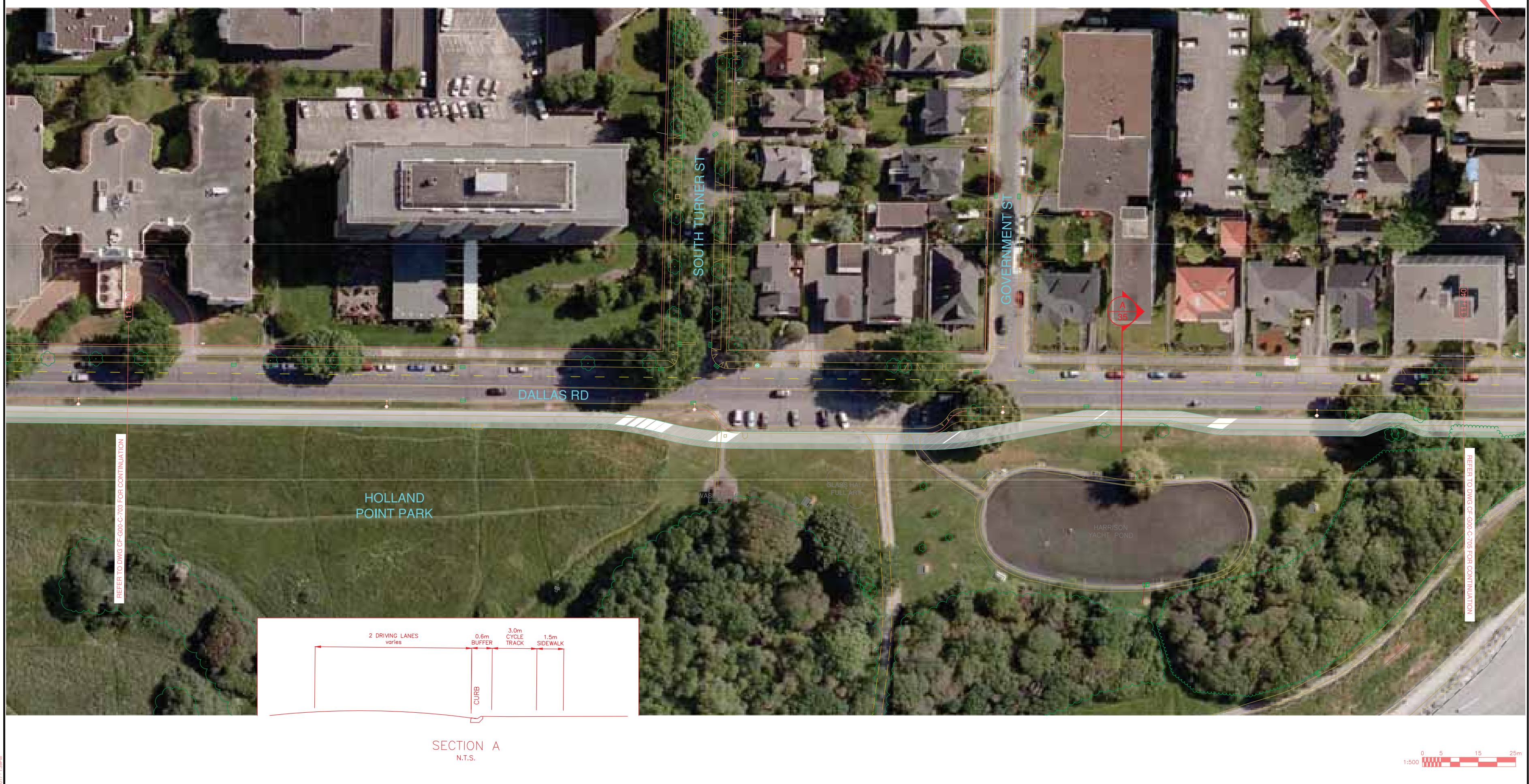

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Capital Regional District	Wastewater Treatment Project			
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SCALE VERTICAL		APPROVED		
CLOVER FORCEMAIN				
A	2017.12.08	PRELIMINARY ISSUED FOR 50% REVIEW		
DALLAS ROAD CYCLE TRACK ALIGNMENT STA 11+080 TO STA 11+440				
CONTRACT NUMBER	CFM-001R	DRAWING NUMBER	CF-G00-C-704	
ISSUE		SHT. No.	35 OF 40	

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DRAWN B. SOCH	DATE 2017.12.08
SCALE HORIZONTAL 1:500	CHECKED M. JACOBSON
SCALE VERTICAL	APPROVED

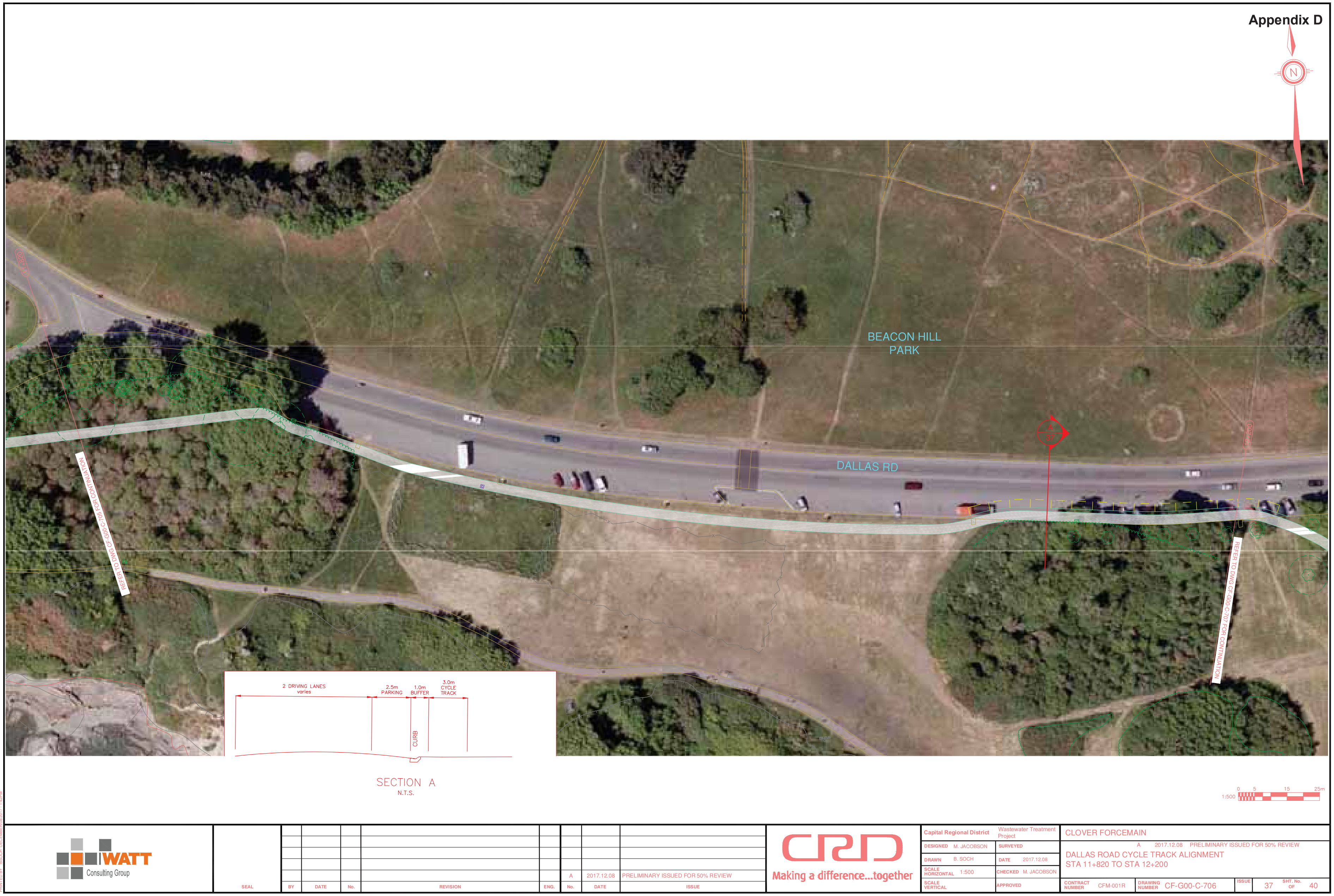
CLOVER FORCEMAIN

A 2017.12.08 PRELIMINARY ISSUED FOR 50% REVIEW

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 11+440 TO STA 11+820

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
CFM-001R	CF-G00-C-705		36 OF 40

Appendix D



N
BEACON HILL PARK
DALLAS RD
REFER TO DWG CF-G00-C-707 FOR CONTINUATION
REFER TO DWG CF-G00-C-705 FOR CONTINUATION
2 DRIVING LANES varies
2.5m PARKING
1.0m BUFFER
3.0m CYCLE TRACK
CURB
SECTION A
N.T.S.
1:500
0 5 15 25m
WATT Consulting Group
SEAL
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No. DATE ISSUE
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Wastewater Treatment Project
DESIGNED M. JACOBSON
SURVEYED
DRAWN B. SOCH
DATE 2017.12.08
SCALE HORIZONTAL 1:500
CHECKED M. JACOBSON
SCALE VERTICAL
APPROVED
CLOVER FORCEMAIN
A 2017.12.08 PRELIMINARY ISSUED FOR 50% REVIEW
DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 11+820 TO STA 12+200
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G00-C-706
ISSUE
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Capital Regional District — Wastewater Treatment Project

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CLOVER FORCEMAIN

A 2017.12.08 PRELIMINARY ISSUED FOR 50% REVIEW

DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 12+200 TO STA 12+580

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.	OF
CFM-001R	CF-G00-C-707		38	40

Appendix D


WELLINGTON AVE
LINDEN AVE
DALLAS RD
CAMBRIDGE ST
MARLBOROUGH ST
REFER TO DWG CF-G00-C-709 FOR CONTINUATION
REFER TO DWG CF-G00-C-707 FOR CONTINUATION
2 DRIVING LANES varies
3.6m BUFFER
3.0m CYCLE TRACK
CURB
SECTION A
N.T.S.
1:500
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Capital Regional District
Wastewater Treatment Project
DESIGNED M. JACOBSON
DRAWN B. SOCH
SCALE HORIZONTAL 1:500
SCALE VERTICAL
SURVEYED
DATE 2017.12.08
CHECKED M. JACOBSON
APPROVED
CLOVER FORCEMAIN
A 2017.12.08 PRELIMINARY ISSUED FOR 50% REVIEW
DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 12+580 TO STA 12+960
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G00-C-708
ISSUE
SHT. No. 39 OF 40
A 2017.12.08 PRELIMINARY ISSUED FOR 50% REVIEW
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Appendix D

CLOVER POINT
DALLAS RD
MOSS ST
HOWE ST
WELLINGTON AVE
13+000
12+960
REFER TO DWG CF-G00-C-708 FOR CONTINUATION
SECTION A
N.T.S.
2 DRIVING LANES varies
6.7m PARKING
2.0m BUFFER
3.0m CYCLE TRACK
CURB
Capital Regional District
Wastewater Treatment Project
CLOVER FORCEMAIN
DALLAS ROAD CYCLE TRACK ALIGNMENT
STA 12+960 TO STA 13+217.63
PRELIMINARY ISSUED FOR 50% REVIEW
CF-G00-C-709
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Appendix "E"

Kerr Wood Leidal 50% Design Proposal
Arborist Report for Dallas Road Cycle Track
and Clover Forcemain Alignment

Memo

Wastewater Treatment Project
Treated for a cleaner future

TO: File

FROM: Ken Madill, P. Eng., CRD WTP Engineering Manager

DATE: March 8, 2018

SUBJECT: Capital Reginal District Wastewater Treatment Project
City of Victoria Licence Obligations – 50% Design Proposal
Dallas Road (Clover) Cycle Track & Forcemain – Arborist Report

Purpose

The purpose of this memorandum is to provide a summary of the Talbot Mackenzie & Associates arborist report (attached) for the Dallas Road (Clover) Cycle Track and Forcemain.

Background

Kerr Wood Leidal Ltd. retained Talbot Mackenzie & Associates to provide arborist services associated with the Dallas Road (Clover) Cycle Track and Forcemain. The scope of services included:

1. a visual inspection of the tree resources along the alignment of the Cycle Track and Forcemain, between Clover Point and Ogden Point;
2. an assessment of impacts and mitigation options and recommendations for locating the Cycle Track and Forcemain within the Dallas Road Corridor;
3. specific recommendations for the alignment of the Cycle Track and Forcemain at three key locations along Dallas Road, including: (1) from Niagara Street to Dock Street, (2) at the foot of Douglas Street, and (3) at the foot of Camas Circle;
4. identification of trees that may be adversely impacted by the recommended alignment for the Cycle Track and Forcemain, as well as mitigation measures; and
5. preparing a report to document the findings.

Alignment Recommendations

The report includes specific recommendations for the alignment of the Cycle Track and Forcemain in three key areas, including:

1. Dallas Road from Niagara Street to Dock Street. The report included an assessment of options to mitigate impacts to the large, mature trees on both sides of Dallas Road. The report recommends that the Forcemain should be installed as close to the south side of Dallas Road as possible (approximately in the centre of the westerly lane of Dallas Road).

2. Dallas Road at Douglas Street. The assessment considered alternative Cycle Track alignments to mitigate potential impacts to tree resources (the Forcemain alignment does not impact trees in this area). The report recommends that the Cycle Track follow the

alignment as set out in the LIcence Agreement, i.e. through the trees and brush south of Dallas Road. The recommended alignment preserves the trees along the south side of Dallas Road, which were determined to be of greater value than the trees and shrubs south of Dallas Road.

3. Dallas Road at Camas Circle. Alternative alignments for the Cycle Track and Forcemain were considerd to mitigate impacts to tree resources. The report recommends following the alignment as set out in the Licence Agreement, i.e. through the trees and brush south of Dallas Road. The recommended alignment avoids all of the root impacts to the large boulevard elms, which is preferred to retaining the trees within the vegetated area.

Summary of Tree Resources

The following is a summary of tree resources impacted by the recommended alignment for the Cycle Track and Forcemain:

- a total of 104 trees were inventoried along the route of the Cycle Track and Forcemain;
- sixteen (16) trees will be removed to accommodate the Cycle Path and Forcemain;
- one (1) tree will be removed due to open decay in the lower trunk from a large “tear-out” injury;
- six (6) trees will be relocated as a means to mitigate impacts associated with the Cycle Track and Forcemain;
- impacts to eighteen (18) trees will be mitigated by constructing a raised, permeable bike path (at Douglas Street and Camas Cirle); and
- the retention status of twelve (12) trees will have to be determined in the field, during construction, by exposing the root structure.

Attachment(s):

Clover Forcemain Tree Preservation Plan (Talbot Mackenzie & Associates

Talbot Mackenzie & Associates
Consulting Arborists

CLOVER FORCEMAIN

TREE PRESERVATION PLAN

PREPARED FOR: Kerr Wood Leidal
Consulting Engineers
201-3045 Douglas Street
Victoria, BC V8T 4N2

PREPARED BY: Talbot, Mackenzie & Associates

Graham Mackenzie
ISA Certified # PN-0428A
TRAQ – Qualified

Noah Borges – Consulting Arborist
ISA Certified # PN-8409A

Michael Marcucci – Consulting Arborist
ISA Certified # ON-1943A
TRAQ – Qualified

DATE OF ISSUANCE: March 8, 2018

Box 48153 RPO - Uptown Victoria, BC V8Z 7H6
Ph: (250) 479-8733
Fax: (250) 479-7050
Email: tmtreehelp@gmail.com

1.0 Introduction

1.1 Scope of Assignment: Provide arborist services to visually inspect the tree resource between Clover Point and Ogden Point, discuss with and advise Kerr Wood Leidal on options for locating the proposed forcemain between Niagara St and Dock St, and prepare a report identifying the trees that may be adversely impacted by the preliminary design of the service location, bike path, and relocation of water, storm drain, and sanitary sewer mains. The report will also outline measures to mitigate these impacts and ensure safe working conditions.

1.2 Methodology: Using the preliminary design attached, we reviewed the locations that need to be excavated to install the proposed forcemain and bike path. We visually examined and reviewed the potential impacts on the trees within and adjacent to the defined work areas, and have listed these trees in the attached Tree Resource spreadsheet. Information such as tree species, DBH (1.4m), crown spread, critical root zone (CRZ), health, structure, relative tolerance to construction impacts, pruning recommendations, and retention viability were included in the inventory. The trees with their associated identification numbers were labelled on the Site Plans. Where trees had existing metal tags affixed to their trunks, those tag numbers were used for identification.

Based on the plans provided, it is our understanding that the forcemain will have a diameter of approximately 1.2m and will be installed at a depth of about 1m. Based on discussions with Kerr Wood Leidal, it is our understanding that installing the forcemain will require 5.5-6m wide trenches in most areas (including cut slopes) and trenches for the relocation of water, storm, and sewer mains will be 3m wide. The potential impacts we have identified in this report are based on these measurements.

1.3 Limitations: No exploratory excavations have been conducted by us and therefore the depth and makeup of the base layer of the roadway is unknown. This makes it difficult to predict whether roots will be encountered underneath the roadway during excavations and what the impact will be on the trees. Therefore, the severity of health and structural impacts that we have predicted may vary significantly from the actual extent of root loss during excavation.

1.4 Potential Impacts: The impacts on the tree resource may include:

- Pruning to remove limbs and stems that conflict with machine or equipment access
- Root loss during excavation required for the installation of the forcemain
- Compaction of soils within the root zones of the adjacent trees
- The removal of trees and shrubs for site access or to facilitate the construction work

2.0 Key Areas

2.1 Dallas Rd (Niagara St to Montreal St)

Dallas Rd between Niagara St and Montreal St is approximately 9m wide. The base of the trees on the east boulevard are approximately 0.5m east of the curb, while those on the west boulevard are separated by a sidewalk, approximately 1.5-2m from the curb. A 4-6m wide trench will be required for installation of the forcemain, likely resulting in roots from trees on both boulevards being encountered, though this is uncertain (the area may have been previously disturbed or root growth may be limited due to the relative impermeability of the road surface).

Only two trees on the west boulevard are by-law protected (80cm DBH or greater): NT 80 and NT 81. Eight of the eleven trees on the east boulevard are protected: NT 85-NT 87 and NT 89-NT 93. All but one tree (Austrian Pine NT 66, at the south end of the west boulevard) are Rock Elms. These elms are not native to British Columbia and commonly spread through self-seeding and root suckering. The trees along the fence line west of the road have germinated this way.

Recommendations:

Elms typically exhibit moderate to high tolerance to urban conditions, including root disturbance from construction-related activities, and usually have extensive root systems. Given that it is uncertain whether roots from these trees extend underneath the roadway, in our opinion, it would be prudent to limit potentially significant impacts to only the west boulevard trees (NT 66-NT 79). The trees on the east boulevard are generally larger and in better health and structural condition than the trees on the west boulevard, which have been “Y-pruned” for utility line clearance.

The trench, therefore, should be located as far west as possible to minimize the likelihood of encountering large roots from the east boulevard trees. If the trench is restricted to the roadway, the health impacts to the west boulevard trees and whether they remain viable to retain should be evaluated at the time of excavation. We anticipate, however, that large, critical roots will be severed, which will have severe health and structural impacts. If the trench does not encroach within 4m of the base of the east boulevard trees, it is likely there will only be a minor health impact to these trees. In our opinion, situating the trench in the middle of the roadway would likely result in significant impacts to trees on both boulevards.

2.2 Dallas Rd at Douglas St

The proposed alignments within the attached plans necessitate the removal of several small Rock Elms and one poorly structured Horsechestnut (#881) and Scouler’s Willow (NT 36). Excepting #871, the boulevard Rock Elms will likely only sustain minor root impacts as a result of excavation, which will occur at the north side of Dallas Rd, approximately 6m away. Large roots from tree #871 are likely to be encountered during excavation, as the edge of the trench will be approximately 2.5m away. We do not anticipate, however, that the tree will have to be removed. Based on our discussions with KWL, an 8-10m wide clearing will be required for construction of the bike path through the “invasive species area” for truck and machine access, which we estimate will require the removal of 30-40 trees (including 20-50cm DBH Scouler’s willows, 5-20cm DBH Rock elms, as well as smaller shrubs).

Five of the boulevard elms are by-law protected (#866-868, #870-871). They are, however, spreading through self-seeding and root suckering south of the road where they are outcompeting species native to Victoria’s coastal bluff ecosystem as well as native trees in the transition area between the cliffs and the road, including Scouler’s Willows and Garry Oaks. There are numerous signed restoration areas with barrier fencing along the bluffs near this site.

Alternative Options:

If both the forcemain and bike path were located along the south curb of Dallas Rd and through the “invasive species area”, we anticipate that additional large trees would be significantly impacted (Image #1).

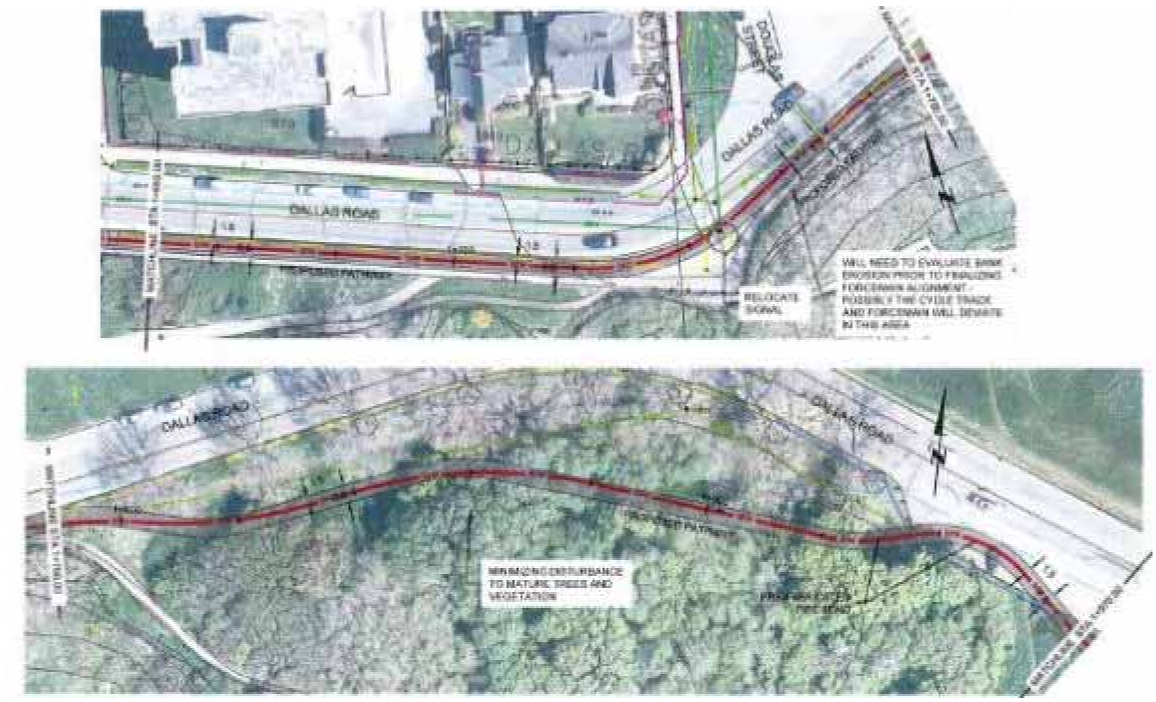

Image #1: Alternative Option 1 for forcemain and bike path alignment at Douglas Rd.

Roots from boulevard Rock Elms #864-867 and #871 would likely be encountered, including potentially critical roots from Elm #864, which could necessitate its removal (it is located approximately 2m from the proposed north edge of excavation). Horsechestnut #880 would also likely require removal. Further, this would eliminate the possibility of constructing a raised, permeable bike path to retain roots from trees adjacent to the bike path that would not require removal, but whose critical root zone overlaps with the bike path footprint (e.g. Elms #864-866, #871, and #880). Some of the smaller trees designated as removals given the designs within the attached plans may be able to be retained in this scenario (NT 35-NT 41).

Locating the forcemain on the north side of Dallas Rd and the bike path inside the south curb of Dallas Rd would result in the removal of the boulevard Rock Elms (#864-871), all of which are large, mature trees. The trees are self-seeding and contributing to the spread of young saplings towards the coastal bluffs but provide extensive canopy cover and will take several decades to replace. Small Rock elms and Scouler’s willows in the “invasive species area” would be retained with this design.

Recommendation:

In our opinion, the value of the mature boulevard trees greatly exceeds the trees and shrubs that will require removal if the forcemain and/or bike path were to run through the “invasive species area”. Removing the boulevard elms will not prevent the spread of the smaller Rock Elms in the “invasive species area”, which will continue to spread through root suckering.

Therefore, we recommend following the current design as shown in the attached plans, as it provides the best option for minimizing the likelihood of large, healthy trees sustaining significant health impacts. Where trees can be retained within the “invasive species area” but have their critical root zones overlap with the bike path footprint, the preservation of roots should be considered. We recommend a raised, permeable surface be constructed over the root systems of trees to be retained (see “Bike Path” section below for details). If possible, limiting the width of the required clearance through the densely vegetated area is recommended (e.g. 6-8m).

2.3 Dallas Rd at Camas Cir

The proposed forcemain and bike path alignments within the attached plans provides an opportunity to retain several large, healthy trees located on the boulevard (Horsechestnuts NT 27 and 28 and three large Rock Elms #884, #886-887). Given an 8-10m wide clearance for construction of the bike path, several small Trembling aspens will require removal (NT 2-NT 4, NT 7-NT 8, NT 12-NT 15, NT 17, NT 26), as well as additional pruning of Scouler’s willows. Excavation for the forcemain trench will be approximately 2m from Apple #888. Large, structural roots are likely to be encountered, which may significantly impact the health of the tree.

It is our understanding that the current design would require relocating a section of a storm drain main to a densely vegetated area several metres south of the proposed forcemain between trees NT 3 and NT 14. We estimate approximately ten trees, all of which are Trembling Aspens (5-20cm DBH), as well as smaller shrubs would be impacted, some of which would require removal.

Alternative Options:

Shifting the forcemain and bike path alignments to the south curb of Dallas Rd would result in the removal of several large trees: #886-887, #884, and NT 94, all of which are within 3m of the curb. They all have structural concerns but are in good to fair health. It does not appear that these specific elms (potentially a different species of elm than Rock Elm) have begun to spread through self-seeding and/or root suckering. In our opinion, given their contribution to canopy cover and the time it would take to replace trees of this size, these larger boulevard elms are more valuable to retain than the smaller aspens and willows.

Similarly, shifting only the forcemain to within the roadway (there is no space for a bike path) would only minimally lessen impacts to the aspens and willows within the densely vegetated area, as a large clearing would still be necessary for truck and machine access.

Recommendation:

In our opinion, avoiding all root impacts to the large boulevard elms is preferential to retaining the trees within the densely vegetated area, which include small Trembling Aspens, which are not native to Vancouver Island, and Scouler's Willows, many of which have poor structure. As excavation for the forcemain will be wider than the bike path, constructing a raised bike path above critical roots will only be necessary where the bike path and forcemain diverge (e.g. for trees NT 27 and NT 28) (see "Bike Path" section below for details).

If possible, limiting the width of the required clearance through the densely vegetated area is recommended. Root disturbance to additional aspens and willows (NT 11, NT 16, NT 18-NT 25) could likely be avoided if the trench were reduced to 6-8m.

3.0 Observations: The installation of the proposed forcemain as shown on the plans provided will occur exclusively on municipal property, either along the roadway or boulevard. There are several large boulevard trees that may be significantly impacted by excavation, though in many cases this depends on whether roots from these trees extend underneath the roadway.

4.0 Recommendations: In order to install the proposed forcemain efficiently and minimize any potential impacts to the existing trees and landscapes, we propose the following course of action:

Prior to work commencing:

- Review each section of the project with the foreman and the project arborist
- Identify the best access routes for machinery, and identify any tree that may have to be removed, temporarily relocated or may be impacted
- Review with the foreman which trees require pruning or need to be removed to facilitate the construction activity
- Identify any areas where excavation must be supervised by the project arborist

Ideally, the project arborist should be on site to monitor all excavations within the critical root zones of the trees identified in this report and root prune where the removal of roots is necessary. However, considering the scale and timeline of these projects, as a general rule, roots less than 5cm in diameter can be pruned by the crews back to undamaged tissues. If roots larger than 5cm in diameter are encountered or are expected to be encountered, the arborist should be contacted to supervise the excavation and review the extent of root pruning required for that tree.

The trees that have the potential to be significantly impacted or where their retention status is listed as 'To be Determined' (as indicated in the attached Tree Resource Spreadsheet) should have the project arborist on site to supervise the excavation. During excavation, the arborist can make a field decision to determine where root pruning will be necessary, what the resulting impacts will be to the tree and assess whether the tree should be removed or retained.

The required crown pruning of trees and shrubs should be completed prior to the start of construction and done by an ISA Certified Arborist or to ANSI A300 pruning standards.

5.0 Summary of Tree Resource: 104 trees were inventoried. The trees most likely to be significantly impacted are large boulevard trees, primarily Rock Elms and Horsechestnuts.

Trees to be Removed (red on site plan):

- Sixteen (16) trees are located within or immediately adjacent to the proposed forcemain trench or within the bike path footprint: **NT 02-NT 04, NT 07-NT 08, NT 12-NT 15, NT 17, NT 26, NT 35-NT 39, and NT 41**.

- **Horsechestnut #881:** The bike path will pass directly adjacent to the tree. We recommend the tree be removed due to the open decay in the lower trunk from the large tear-out injury.

- **Trees NT 46-NT 47:** These two boulevard trees are within the 3m wide trenches that will be required to relocate the water main between Olympia Ave and Government St.

- **Horsechestnut NT 56**: This tree is located approximately 1.5m from the edge of trench. Measured below the codominant unions, the tree has a diameter of 185cm. In its current location, the required excavation for installation of the forcemain will result in a significant number of critical roots severed, likely necessitating the tree’s removal. Impacts can be minimized and the tree retained if the trench is shifted southward by several metres, closer to the Harrison Yacht Pond (e.g. at or near the edge of the tree’s dripline). The forcemain will not be able to be located outside the tree’s critical root zone (estimated at 18.5m), but health and structural impacts will be mitigated if fewer critical roots within the tree’s root plate are severed. Exploratory digging can be performed by an arborist to determine a distance where the tree’s health will not be significantly impacted.

- **Trees NT 52-NT 55** are recently planted, small diameter trees that can likely be transplanted prior to excavation. The proposed location of the forcemain will require excavation immediately adjacent to their trunks, resulting in significant root loss.

Trees with Retention Status ‘To be Determined’ (blue on site plan):

- We estimated that excavation will occur within 2m of trees **NT 05-NT 06 and NT 09-NT 10.** At this distance, excavation will likely encounter large structural roots, significantly impacting the health and/or stability of these trees. Therefore, we recommend their final retention status be determined at the time of excavation.

- **Apple #888** will likely incur significant root loss. We estimate excavation will occur 2m from the base of the tree. Depending on the number and size of roots encountered, it may require removal. The tree will also require clearance pruning for excavation machinery, though this will not significantly impact the health of the tree.

- **Windswept Horsechestnut NT 45:** Excavation for the forcemain will occur approximately 1m from the base of the tree. Depending on whether roots extend underneath the roadway, this could result in significant health and/or structural impacts. The bike path is proposed to bifurcate around this tree. To avoid severing critical roots, we recommend ‘floating’ the bike path atop them (see ‘Bike Path’ section below for details).

- **Trees NT 48 and NT 51:** We estimate the edge of excavation for the proposed relocation of a sanitary sewer will occur between 1 and 1.5m from the base of the trees. If large, structural roots are severed at this distance, the tree will likely require removal. We cannot be certain that roots extend underneath the roadway, however, and recommend the tree's retention status be determined at the time of excavation.

- **Elm NT 61** is located approximately 2m from the edge of excavation. There is no retaining wall north of the tree, as is the case with trees NT 59-NT 61. As elms typically exhibit aggressive and extensive root growth, we anticipate a large number of roots will be encountered and the tree may have to be removed.

- **Elm NT 65** is approximately 2m from the edge of the proposed excavation to relocate a sanitary sewer main at the intersection of Dallas Rd and Montreal St. The tree has a DBH of 89cm. Depending on whether roots extend underneath the roadway, several large, structural roots may be encountered.

An arborist should be on site to supervise excavation within the critical root zone of all of these trees to determine whether they can be retained based on the number and size of roots encountered. All non-critical roots should be pruned back to sound tissue by the arborist to encourage rapid wound compartmentalization and root regrowth, and to reduce wound surface area.

Trees with Minor Impacts (green on site plan):

- **Trees NT 11, NT 16, NT 20-NT 21, NT 24, NT 27, NT 29-NT 34, #864-870, NT 42-NT 44, NT 49-NT 50, NT 58-NT 60, and NT 62-NT 63:** These trees are not likely to be significantly impacted by installation of the proposed forcemain, though roots may be encountered during excavation. In most cases, excavation will occur several metres (generally 4-7m) from the bases of the trees within the roadway. If roots larger than 5cm are encountered, an arborist should be contacted to root prune and review the extent of the impact to the tree's health and stability.

<u>Bike Path</u>

If construction of the new bike path requires excavation to bearing soil within its footprint and roots are encountered in this area, the health and/or stability of the following trees could be significantly impacted: **NT 27-NT 34, #871, #880, #864-866, NT 45, and NT 48-NT 51**. If tree retention is desired, a raised permeable bike path should be constructed in the areas where it crosses through the critical root zone of the trees (see attached specifications).

The objective is to avoid root loss and to instead raise the driveway and its base layer above the roots. This may result in the grade of the "floating" bike path being up to 30cm above the existing grade (depending on how close roots are to the surface and the depth of the paving material base layers). It may also mean that some of the A horizon soil layer (rich in organic material and roots) will be left intact below the paving. To allow water to drain into the root systems below, where possible, we also recommend that the bike path be made of a permeable material instead of concrete or asphalt.

Clearance Pruning

Trees NT 19-NT 20, NT 22-NT 25, #888, NT 28, NT 31, NT 40, and #880 will likely require clearance pruning. Large, leaning limbs from fallen Scouler's willows (NT 19-NT 20, NT 22-NT 23, and NT 25) will have to be removed, but in our opinion, the health of the trees will not be significantly impacted. If the forcemain is shifted southward, away from **Horsechestnut NT 56**, and the tree can be retained, clearance pruning will likely be required if excavation occurs within the tree's dripline.

Road Re-alignments (Parking Bulges)

Elm NT 57 is located approximately 3-4m from the location of a proposed parking bulge. Assuming excavation to a depth of 45-60cm will be required, we anticipate numerous roots will be encountered which should be pruned back to the edge of excavation by the project arborist. Health impacts on this tree will be compounded by the excavation occurring within the roadway for the relocation of a sanitary sewer main, approximately 3.5m away. Despite these impacts, we anticipate the tree can be retained.

Please do not hesitate to call us at (250) 479-8733 should you have any further questions. Thank you.

Yours truly,

Talbot Mackenzie & Associates
ISA Certified Consulting Arborists

Encl. 8-page tree resource spreadsheet, 13-page site plan with trees, 1-page floating bike path specifications

Disclosure Statement

Arborists are professionals who examine trees and use their training, knowledge and experience to recommend techniques and procedures that will improve their health and structure or to mitigate associated risks.

Trees are living organisms, whose health and structure change, and are influenced by age, continued growth, climate, weather conditions, and insect and disease pathogens. Indicators of structural weakness and disease are often hidden within the tree structure or beneath the ground. It is not possible for an Arborist to identify every flaw or condition that could result in failure or can he/she guarantee that the tree will remain healthy and free of risk.

Remedial care and mitigation measures recommended are based on the visible and detectable indicators present at the time of the examination and cannot be guaranteed to alleviate all symptoms or to mitigate all risk posed.

Clover Forcemain
Tree Resource Spreadsheet

Tree ID	Common Name	Latin Name	DBH (cm)	Crown Spread (m)	CRZ (m)	Health	Structure	Relative Tolerance	Root prune (S: Significant, M: Minor)	Remove (Y: Yes, TBD: To be Determined, T: Transplant)	Canopy Clearance Prune (Y: Yes, P: Possible)	Remarks and Recommendations	By-Law Protected
NT 01	Big Leaf Maple	*Acer macrophyllum*	38, 23	6	6.0	Fair	Fair/poor	Moderate	S	-	-	2m from trench. Stunted growth form	N
NT 02	Trembling Aspen	*Populus tremuloides*	28	6	3.0	Fair	Poor	Good	-	Y	-	Within trench. Significant decay in trunk	N
NT 03	Trembling Aspen	*Populus tremuloides*	14	2	1.5	Poor	Poor	Good	-	Y	-	Within trench. Topped at 3m	N
NT 04	Trembling Aspen	*Populus tremuloides*	24, 21	6	3.5	Fair	Fair/poor	Good	-	Y	-	Within trench. Large stem significantly decayed	N
NT 05	Trembling Aspen	*Populus tremuloides*	20	4	2.0	Fair	Fair	Good	S	TBD	-	2m from trench.	N
NT 06	Trembling Aspen	*Populus tremuloides*	15	4	1.5	Fair	Fair	Good	S	TBD	-	2m from trench.	N
NT 07	Trembling Aspen	*Populus tremuloides*	22, 19	5	3.5	Fair	Poor	Good	-	Y	-	Within trench	N
NT 08	Trembling Aspen	*Populus tremuloides*	12	4	1.0	Fair	Fair	Good	-	Y	-	Within trench	N
NT 09	Trembling Aspen	*Populus tremuloides*	24	4	2.5	Good	Good	Good	S	TBD	-	1-2m from trench.	N
NT 10	Trembling Aspen	*Populus tremuloides*	22	4	2.0	Good	Good	Good	S	TBD	-	1-2m from trench.	N
NT 11	Trembling Aspen	*Populus tremuloides*	27	5	2.5	Good	Good	Good	M	-	-	3-4m from trench.	N
NT 12	Trembling Aspen	*Populus tremuloides*	14	4	1.5	Good	Good	Good	-	Y	-	Within trench	N
NT 13	Trembling Aspen	*Populus tremuloides*	14, 14	5	2.0	Good	Fair/poor	Good	-	Y	-	Within trench	N
NT 14	Trembling Aspen	*Populus tremuloides*	14	4	1.5	Good	Good	Good	-	Y	-	Within trench	N

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NT 15	Trembling Aspen	*Populus tremuloides*	10	4	1.0	Good	Good	Good	-	Y	-	Within trench	N
NT 16	Trembling Aspen	*Populus tremuloides*	20	5	2.0	Good	Good	Good	M	-	-	2-2.5m from trench.	N
NT 17	Trembling Aspen	*Populus tremuloides*	10	4	1.0	Good	Fair	Good	-	Y	-	Within trench	N
NT 18	Trembling Aspen	*Populus tremuloides*	14, 14	5	2.0	Good	Fair	Good	S	-	-	2m from trench.	N
NT 19	Scouler's Willow	*Salix scouleriana*	20, 20, 20	12	5.5	Fair	Poor	Moderate	S	-	Y	2m from trench. Two leaning stems require removal	N
NT 20	Scouler's Willow	*Salix scouleriana*	15, 15	8	3.0	Fair	Fair/poor	Moderate	M	-	Y	3m from trench. Remove leaning stem for machine clearance	N
NT 21	Trembling Aspen	*Populus tremuloides*	13	4	1.5	Good	Good	Good	M	-	-	2m from trench.	N
NT 22	Scouler's Willow	*Salix scouleriana*	Multistem	6	-	Fair	Fair	Moderate	-	-	Y	3m from trench. Remove leaning stems for machine clearance	N
NT 23	Scouler's Willow	*Salix scouleriana*	Multistem	6	-	Fair	Fair	Moderate	-	-	Y	3m from trench. Remove leaning stems for machine clearance	N
NT 24	Trembling Aspen	*Populus tremuloides*	11, 11, 7	4	2.0	Good	Fair	Good	M	-	P	2m from trench. Possible clearance pruning	N
NT 25	Scouler's Willow	*Salix scouleriana*	30, 30, 20	10	7.0	Good	Poor	Moderate	-	-	Y	4m from trench. Remove leaning stems for clearance	Y
NT 26	Trembling Aspen	*Populus tremuloides*	25	8	2.5	Good	Fair	Good	-	Y	-	Within or adjacent to trench.	N
888	Apple	*Malus spp.*	44, 31	9	7.5	Good	Fair	Moderate	S	TBD	Y	2m from trench. Cavity in smaller stem	Y
NT 27	Horsechestnut	*Aesculus hippocastanum*	94, 52	14	12.5	Good	Fair/poor	Good	M	-	-	7m from bike path.	Y

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NT 28	Horsechestnut	*Aesculus hippocastanum*	82	17	8.0	Good	Poor	Good	S	-	Y	3m from trench. bike path within CRZ	Y
NT 29	Horsechestnut	*Aesculus hippocastanum*	29	8	3.0	Good	Fair	Good	M	-	-	4m from trench. bike path within CRZ	N
NT 30	Horsechestnut	*Aesculus hippocastanum*	105 below unions	16	10.5	Good	Fair/poor	Good	M	-	-	3m from bike path	Y
NT 31	Horsechestnut	*Aesculus hippocastanum*	100	20	10.0	Good	Poor	Good	M	-	P	6m from trench	Y
NT 32	Horsechestnut	*Aesculus hippocastanum*	43	10	4.5	Good	Fair	Good	M	-	-	2.5m from bike path	N
NT 33	Horsechestnut	*Aesculus hippocastanum*	56, 46, 43	15	11.0	Good	Fair/poor	Good	M	-	-	4m from trench. Tridominant, included bark. Cavity	Y
NT 34	Horsechestnut	*Aesculus hippocastanum*	126	18	12.5	Good	Poor	Good	M	-	-	4m from trench. Codominants, included bark. Cavity	Y
NT 35	Rock Elm	*Ulmus thomasii*	Multistem	6	2.0	Good	Fair	Moderate	-	Y	-	Within bike path. 6 stems with approx. 15cm DBH	N
NT 36	Scouler's Willow	*Salix scouleriana*	50, 37	12	8.5	Good	Fair/poor	Moderate	-	Y	-	Both stems leaning over bike path.	Y
NT 37	Rock Elm	*Ulmus thomasii*	16	4	2.0	Good	Fair	Moderate	-	Y	-	Within bike lane	N
NT 38	Rock Elm	*Ulmus thomasii*	14	4	1.5	Good	Fair	Moderate	-	Y	-	Within bike lane	N
NT 39	Rock Elm	*Ulmus thomasii*	14	4	1.5	Good	Fair	Moderate	-	Y	-	Within bike lane	N
881	Horsechestnut	*Aesculus hippocastanum*	106	15	10.5	Fair	Poor	Good	-	Y	-	6m from trench. Next to bike path. Recommend removal due to open decay in trunk from large tearout injury	Y
NT 40	Horsechestnut	*Aesculus hippocastanum*	Multistem	6	3.0	Fair	Poor	Good	-	-	Y	1m from bike path. 5+ trees in clump 10-30cm DBH. At least 3 stems require removal	N

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NT 41	Rock Elm	*Ulmus thomasii*	12	3	1.5	Good	Good	Moderate	-	Y	-	Within bike path.	N
880	Horsechestnut	*Aesculus hippocastanum*	117	19	11.5	Good	Fair/poor	Good	-	-	Y	2m from bike path. Lower limb pruning required. Codominants with included bark	Y
871	Rock Elm	*Ulmus thomasii*	91	19	11.0	Good	Fair	Moderate	S	-	-	2.5m from trench. 3.5m from bike path. 50cm trunk wound. Codominant at 5m. Large pruning wound	Y
870	Rock Elm	*Ulmus thomasii*	96	20	11.5	Good	Fair	Moderate	M	-	-	7m from trench.	Y
869	Rock Elm	*Ulmus thomasii*	78	20	9.5	Good	Fair	Moderate	M	-	-	6m from trench.	N
868	Rock Elm	*Ulmus thomasii*	85	20	10.0	Good	Fair	Moderate	M	-	-	6m from trench.	Y
867	Rock Elm	*Ulmus thomasii*	109	20	13.0	Good	Fair	Moderate	M	-	-	6m from trench. Large pruning wound	Y
866	Rock Elm	*Ulmus thomasii*	89	20	10.5	Good	Fair/poor	Moderate	M	-	-	6m from trench. Extended endweighted limb. Bike lane within CRZ	Y
865	Rock Elm	*Ulmus thomasii*	69	20	8.5	Good	Fair/poor	Moderate	M	-	-	6m from trench. Extended endweighted limb. Bike lane within CRZ	N
864	Rock Elm	*Ulmus thomasii*	76	20	9.0	Good	Fair	Moderate	M	-	-	6m from trench. Bike lane within CRZ	N
NT 42	Rock Elm	*Ulmus thomasii*	72	20	8.5	Good	Fair	Moderate	M	-	-	4m from trench.	N
NT 43	Rock Elm	*Ulmus thomasii*	83	20	10.0	Good	Fair	Moderate	M	-	-	4m from trench.	Y
NT 44	Rock Elm	*Ulmus thomasii*	101	20	12.0	Good	Fair	Moderate	M	-	-	4m from trench.	Y
NT 45	Horsechestnut	*Aesculus hippocastanum*	Multistem	12	6.0	Good	Poor	Good	S	TBD	-	1m from trench. Bike lane on both sides	N

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NT 46	Rock Elm	*Ulmus thomasii*	92	24	11.0	Good	Fair	Moderate	-	Y	-	2.5m from forcemain trench. Within trench for water main relocation.	Y
NT 47	Hedge Maple	*Acer campestre*	80	12	9.5	Good	Fair/poor	Moderate	-	Y	-	3m from forcemain trench. Within trench for water main relocation.	Y
NT 48	Horsechestnut	*Aesculus hippocastanum*	84	16	8.5	Good	Fair	Good	S	TBD	-	1.5m from trench for sanitary sewer main relocation. Bike path adjacent	Y
NT 49	Sycamore Maple	*Acer pseudoplatanus*	58	10	7.0	Good	Fair	Moderate	M	-	-	Next to bike path	N
NT 50	Sycamore Maple	*Acer pseudoplatanus*	60	10	7.0	Good	Fair	Moderate	M	-	-	Next to bike path	N
NT 51	Horsechestnut	*Aesculus hippocastanum*	71, 44	16	9.5	Good	Fair/poor	Good	S	TBD	-	1-1.5m from trench for sanitary sewer main relocation. Bike path adjacent. Wounds at base	Y
NT 52	Little Leaf Linden	*Tilia cordata*	7	2	1.0	Good	Good	Moderate	S	T	-	Next to trench and bike path	N
NT 53	Horsechestnut	*Aesculus hippocastanum*	15	4	1.5	Good	Fair	Good	S	T	-	Next to trench and bike path	N
NT 54	Horsechestnut	*Aesculus hippocastanum*	15	4	1.5	Good	Fair	Good	S	T	-	Next to trench and bike path	N
NT 55	Little Leaf Linden	*Tilia cordata*	6	2	0.5	Good	Good	Moderate	S	T	-	Next to trench and bike path	N
NT 56	Horsechestnut	*Aesculus hippocastanum*	185 below unions	20	18.5	Good	Fair/poor	Good	-	Y	-	1.5m from trench. Recommend trench further south. Wounds at base	Y
NT 57	Rock Elm	*Ulmus thomasii*	66	16	8.0	Good	Fair	Moderate	S	-	-	from edge of trench for sewer relocation. 3m from edge of new road bulge. Wound at base. Large pruning wound.	N
NT 58	Rock Elm	*Ulmus thomasii*	59	20	7.0	Good	Good	Moderate	M	-	-	2m from trench. Separated by retaining wall	N
NT 59	Rock Elm	*Ulmus thomasii*	51	14	6.0	Good	Good	Moderate	M	-	-	2m from trench. Separated by retaining wall	N

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Clover Forcemain
Tree Resource Spreadsheet

Tree ID	Common Name	Latin Name	DBH (cm)	Crown Spread (m)	CRZ (m)	Health	Structure	Relative Tolerance	Root prune (S: Significant, M: Minor)	Remove (Y: Yes, TBD: To be Determined, T: Transplant)	Canopy Clearance Prune (Y: Yes, P: Possible)	Remarks and Recommendations	By-Law Protected
NT 60	Rock Elm	*Ulmus thomasii*	46	14	5.5	Good	Fair	Moderate	M	-	-	2m from trench. Separated by retaining wall	N
NT 61	Rock Elm	*Ulmus thomasii*	74	14	9.0	Good	Fair	Moderate	S	TBD	-	2m from trench.	N
NT 62	Rock Elm	*Ulmus thomasii*	66	20	8.0	Good	Fair	Moderate	M	-	-	5m from forcemain trench. 3-3.5m from edge of trench for sewer relocation.	N
NT 63	Rock Elm	*Ulmus thomasii*	66	20	8.0	Good	Fair	Moderate	M	-	-	5m from forcemain trench. 3-3.5m from edge of trench for sewer relocation.	N
NT 64	Rock Elm	*Ulmus thomasii*	95	24	11.5	Good	Fair	Moderate	S	-	-	5m from forcemain trench. 3-3.5m from edge of trench for sewer relocation.	Y
NT 65	Rock Elm	*Ulmus thomasii*	89	24	10.5	Good	Fair	Moderate	S	TBD	-	5m from forcemain trench. 2m from edge of trench for sewer relocation. Large pruning wound at 3m. Wound at base	Y
NT 66	Austrian pine	*Pinus nigra*	63	8	6.5	Good	Fair/poor	Good	-	-	-		N
NT 67	Rock Elm	*Ulmus thomasii*	76	14	9.0	Fair	Fair	Moderate	-	-	-		N
NT 68	Rock Elm	*Ulmus thomasii*	79	25	9.5	Good	Good	Moderate	-	-	-		N
NT 69	Rock Elm	*Ulmus thomasii*	75	25	9.0	Good	Fair	Moderate	-	-	-		N
NT 70	Rock Elm	*Ulmus thomasii*	66	16	8.0	Good	Fair	Moderate	-	-	-		N
NT 71	Rock Elm	*Ulmus thomasii*	46	14	5.5	Fair	Fair/poor	Moderate	-	-	-		N
NT 72	Rock Elm	*Ulmus thomasii*	54	14	6.5	Fair	Fair/poor	Moderate	-	-	-		N
NT 73	Rock Elm	*Ulmus thomasii*	65	16	8.0	Good	Fair/poor	Moderate	-	-	-		N

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NT 74	Rock Elm	*Ulmus thomasii*	66	16	8.0	Good	Fair/poor	Moderate	-	-	-		N
NT 75	Rock Elm	*Ulmus thomasii*	48	14	6.0	Fair	Fair/poor	Moderate	-	-	-		N
NT 76	Rock Elm	*Ulmus thomasii*	36	10	4.5	Fair/poor	Fair/poor	Moderate	-	-	-		N
NT 77	Rock Elm	*Ulmus thomasii*	44	12	5.5	Fair/poor	Fair/poor	Moderate	-	-	-		N
NT 78	Rock Elm	*Ulmus thomasii*	48	12	6.0	Fair	Fair/poor	Moderate	-	-	-		N
NT 79	Rock Elm	*Ulmus thomasii*	Multistem	5	5.5	Fair	Fair	Moderate	-	-	-	12 large stems 30-45cm DBH	N
NT 80	Rock Elm	*Ulmus thomasii*	81	19	9.5	Good	Good	Moderate	-	-	-		Y
NT 81	Rock Elm	*Ulmus thomasii*	88	20	10.5	Good	Good	Moderate	-	-	-		Y
NT 82	Rock Elm	*Ulmus thomasii*	54	14	6.5	Good	Good	Moderate	-	-	-		N
NT 83	Rock Elm	*Ulmus thomasii*	63	16	7.5	Good	Fair	Moderate	-	-	-		N
NT 84	Rock Elm	*Ulmus thomasii*	56	14	6.5	Good	Fair/poor	Moderate	-	-	-		N
NT 85	Rock Elm	*Ulmus thomasii*	88	25	10.5	Good	Fair	Moderate	-	-	-	Large pruning wound	Y
NT 86	Rock Elm	*Ulmus thomasii*	91	25	11.0	Good	Good	Moderate	-	-	-		Y
NT 87	Rock Elm	*Ulmus thomasii*	88	20	10.5	Good	Fair	Moderate	-	-	-		Y

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Clover Forcemain
Tree Resource Spreadsheet

Tree ID	Common Name	Latin Name	DBH (cm)	Crown Spread (m)	CRZ (m)	Health	Structure	Relative Tolerance	Root prune (S: Significant, M: Minor)	Remove (Y: Yes, TBD: To be Determined, T: Transplant)	Canopy Clearance Prune (Y: Yes, P: Possible)	Remarks and Recommendations	By-Law Protected
NT 88	Rock Elm	*Ulmus thomasii*	71	18	8.5	Good	Fair	Moderate	-	-	-	Large pruning wounds	N
NT 89	Rock Elm	*Ulmus thomasii*	93	20	11.0	Good	Fair	Moderate	-	-	-	Large pruning wounds. One has secondary fruiting body	Y
NT 90	Rock Elm	*Ulmus thomasii*	88	20	10.5	Good	Fair	Moderate	-	-	-		Y
NT 91	Rock Elm	*Ulmus thomasii*	83	20	10.0	Good	Good	Moderate	-	-	-		Y
NT 92	Rock Elm	*Ulmus thomasii*	108	25	13.0	Good	Fair	Moderate	-	-	-	Slight lean	Y
NT 93	Rock Elm	*Ulmus thomasii*	115	25	14.0	Good	Fair	Moderate	-	-	-	Cavities in limb over road and main codominant union	Y
886	Elm	*Ulmus spp.*	107	18	10.5	Fair	Fair/poor	Good	-	-	-	1.5m from curb. Previously reduced significantly. Large tear-out injury on main stem	Y
887	Elm	*Ulmus spp.*	54	16	5.5	Fair	Poor	Good	-	-	-	3m from curb. Leaning, suppressed	N
884	Elm	*Ulmus spp.*	~150	20	15.0	Fair	Fair/poor	Good	-	-	-	1.5m from curb. Large cavity on main stem with potential internal decay	Y
NT94	Scouler's Willow	*Salix scouleriana*	53	14	6.5	Fair	Poor	Moderate	-	-	-	2m from curb. Prostrate growth	N

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SCALE: N.T.S.

SCALE: 1: 000

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							B	2018.01.08	50 DESIGN SUBMISSION	

Capital Regional District		CLOVER POINT FORCEMAIN	
DESIGNED S. FRETWELL	SURVEYED	LOCATION PLAN	
DRAWN M. ROTA	DATE 01.05/2018		
SCALE HORIZONTAL AS SHOWN	CHECKED C. KRISTIANSEN		
SCALE VERTICAL N/A	APPROVED	CONTRACT NUMBER CFM-001R	DRAWING NUMBER CF-G-00-C-001 · ISSUE B · SHT. No. 1 OF 78

CAD FILE : O:\0200-0299\283-372\501-Drawings\a_Prod ction_Dwgs\283-372_CF-G-00-C-001-CoverPage_CloverForcemain.dwg
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DRAWING INDEX

SHEET NO.	DRAWING NUMBER	DRAWING TITLE
1	CF-G-00-C-001	LOCATION PLAN
2	CF-G-00-C-002	DRAWING INDEX & LEGEND
3	CF-G-00-C-003	GENERAL ARRANGEMENT
4	CF-G-00-C-004	GENERAL NOTES
5	CF-G-00-C-010	GEOTECH
6	CF-G-00-C-020	CONSTRUCTION LAYDOWN SHEET 1
7	CF-G-00-C-021	CONSTRUCTION LAYDOWN SHEET 2
8	CF-G-00-C-022	CONSTRUCTION LAYDOWN SHEET 3
9	CF-G-00-C-023	CONSTRUCTION LAYDOWN SHEET 4
10	CF-G-00-C-024	CONSTRUCTION LAYDOWN SHEET 5
11	CF-G-00-C-100	PLAN AND PROFILE STA. 10+000 TO STA. 10+320
12	CFG-00-C-101	PLAN AND PROFILE STA. 10+320 TO STA. 10+700
13	CF-G-00-C-102	PLAN AND PROFILE STA. 10+700 TO STA. 11+080
14	CFG-00-C-103	PLAN AND PROFILE STA. 11+080 TO STA. 11+440
15	CF-G-00-C-104	PLAN AND PROFILE STA. 11+440 TO STA. 11+820
16	CF-G-00-C-105	PLAN AND PROFILE STA. 11+820 TO STA. 12+200
17	CF-G-00-C-106	PLAN AND PROFILE STA. 12+200 TO STA. 12+580
18	CF-G-00-C-107	PLAN AND PROFILE STA. 12+580 TO STA. 12+960
19	CF-G-00-C-108	PLAN AND PROFILE STA. 12+960 TO STA. 13+211
20	CF-G-00-C-200	SECTIONS
21	CF-G-00-C-201	SECTIONS
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25	CF-G-00-C-300	TYPICAL CROSS SECTIONS
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27	CF-G-00-C-302	GAS VALVE & ODOUR CONTROL
28	CF-G-00-C-400	STORM SEWER STA. 10+628.7 TO STA. 10+913.3
29	CF-G-00-C-401	STORM UTILITY RELOCATE
30	CF-G-00-C-402	STORM UTILITY RELOCATE
31	CF-G-00-C-403	STORM UTILITY RELOCATE
32	CF-G-00-C-404	STORM UTILITY RELOCATE
33	CF-G-00-C-405	STORM UTILITY RELOCATE
34	CF-G-00-C-500	SANITARY SEWER STA. 10+288.3 TO STA. 10+480
35	CF-G-00-C-501	SANITARY SEWER STA. 10+480 TO STA. 10+746.1
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DRAWING INDEX

SHEET NO.	DRAWING NUMBER	DRAWING TITLE
38	CF-G-00-C-600	WATERMAIN STA. 10+397.97 TO STA. 10+526.78
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41	CF-G-00-C-702	DALLAS ROAD CYCLE TRACK ALIGNMENT
42	CF-G-00-C-703	DALLAS ROAD CYCLE TRACK ALIGNMENT
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55	CF-G-00-C-716	DALLAS ROAD CYCLE TRACK ALIGNMENT
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57	CF-G-00-C-718	DALLAS ROAD CYCLE TRACK ALIGNMENT
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61	CF-G-00-C-803	ELECTRICAL
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78	CF-G-00-C-909	LANDSCAPE DESIGN

NOTE:
INDICATES DRAWING PART OF FUTURE SUBMISSION

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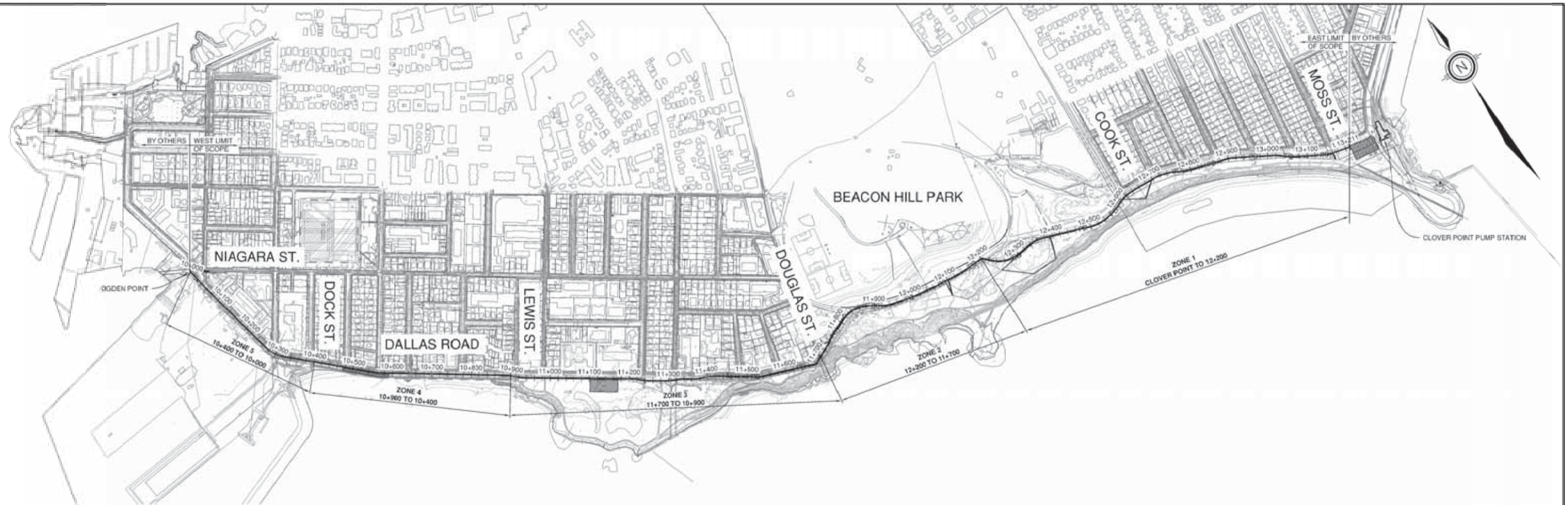
Capital Regional District	Wastewater Treatment Project	CLOVER POINT FORCEMAIN	
DESIGNED S. FRETWELL	SURVEYED		
DRAWN M. ROTA	DATE 2018.01.05	DRAWING INDEX & LEGEND	
SCALE HORIZONTAL 1:500	CHECKED C. KRISTIANSEN		
SCALE VERTICAL 1:100	APPROVED	CONTRACT NUMBER CFM-001R	DRAWING NUMBER CF-G-00-C-002 ISSUE B SHT. No. 2 OF 78



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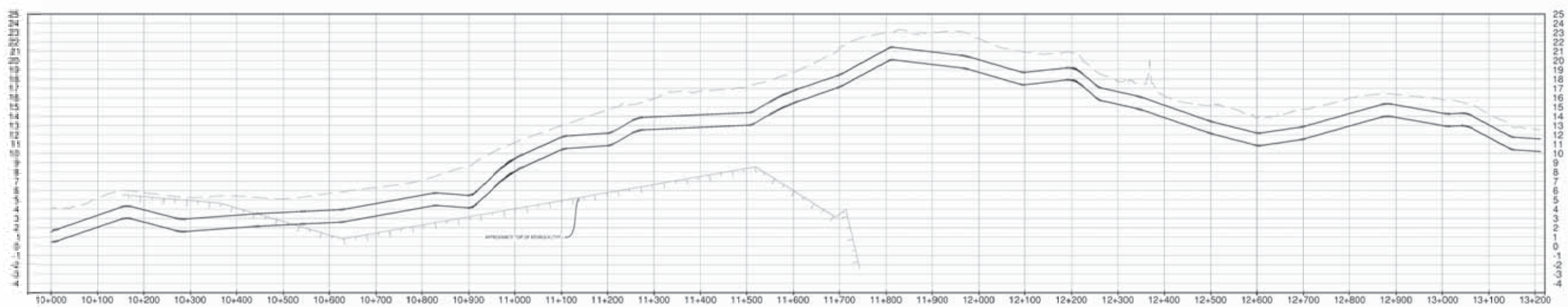

PROFILE
SCALE: 1:5000 H 1:250 V

1:5000 0 50 150 250m
1:500 0 5 15 25m

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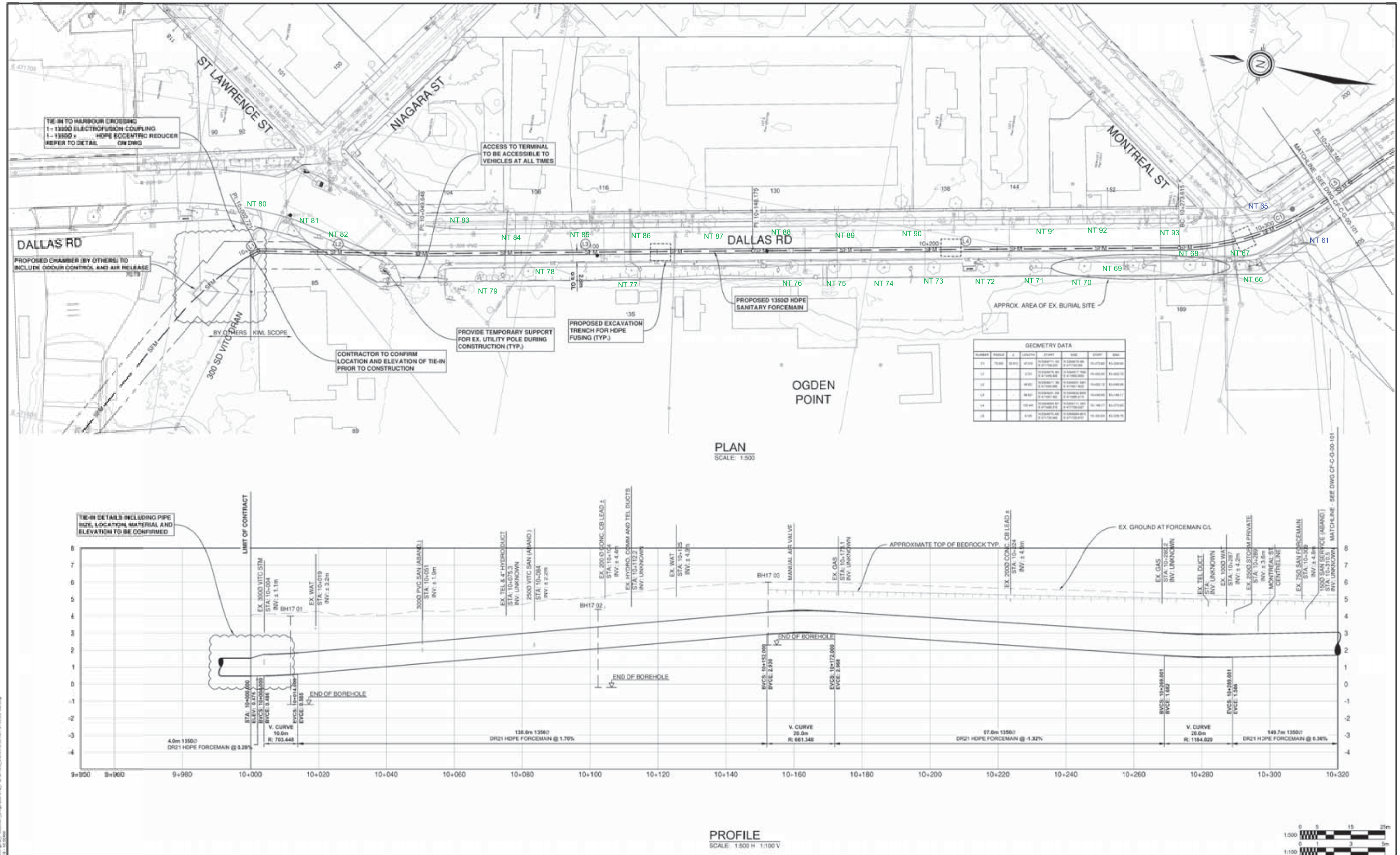
Capital Regional District	Wastewater Treatment Project	CLOVER POINT FORCEMAIN
DESIGNED S. FRETWELL	SURVEYED	
DRAWN M. ROTA	DATE 2018.01.05	GENERAL ARRANGEMENT
SCALE HORIZONTAL 1:5000	CHECKED C. KRISTIANSEN	
SCALE VERTICAL 1:500	APPROVED	CONTRACT NUMBER CFM-001R · DRAWING NUMBER CF-G-00-C-003 · ISSUE B · SHT. No. 3 OF 78



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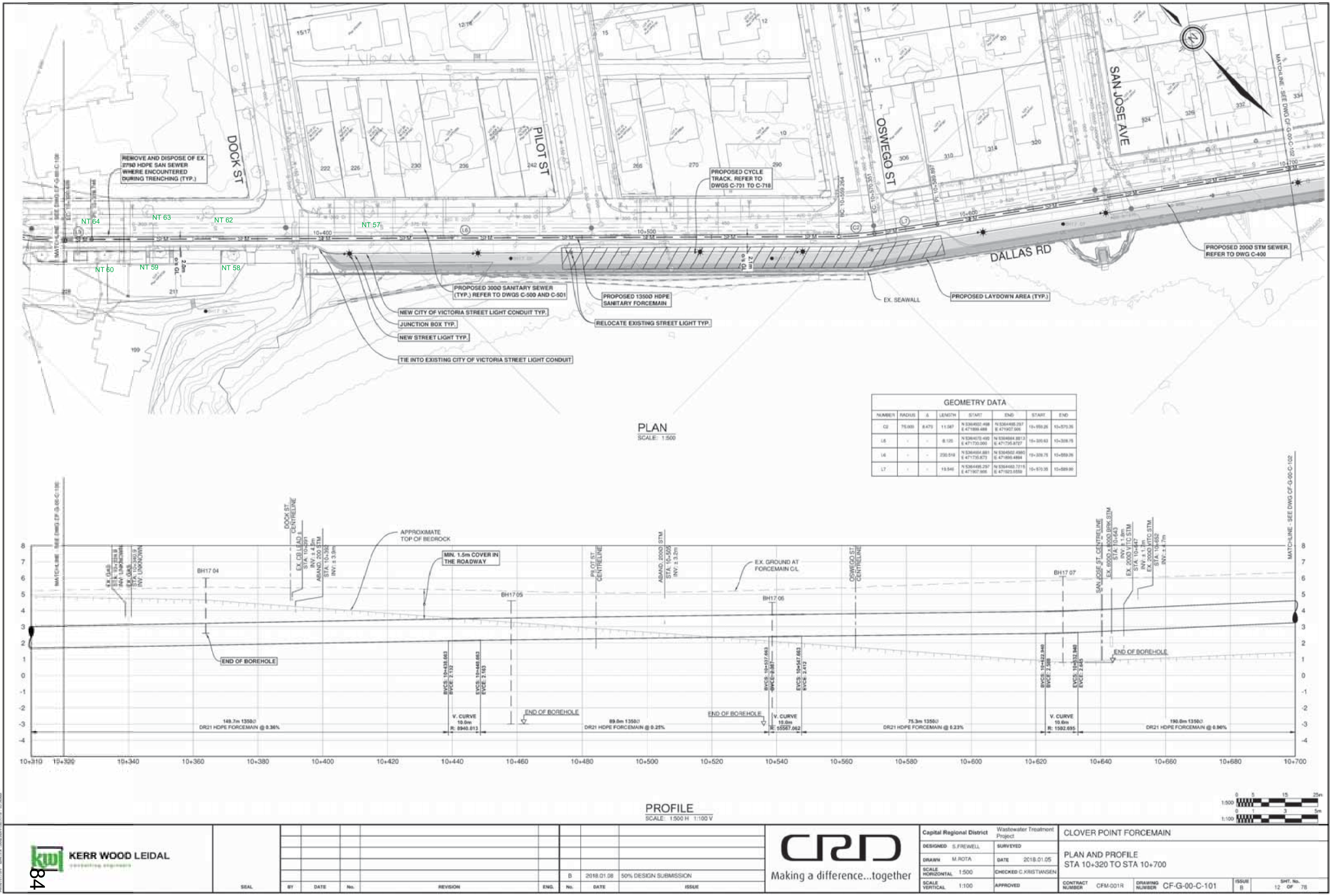
DESIGNED	S. FRETWELL	SURVEYED	
DRAWN	M. ROTA	DATE	2018.01.05
SCALE HORIZONTAL	1:500	CHECKED	C. KRISTIANSEN
SCALE VERTICAL	1:100	APPROVED	

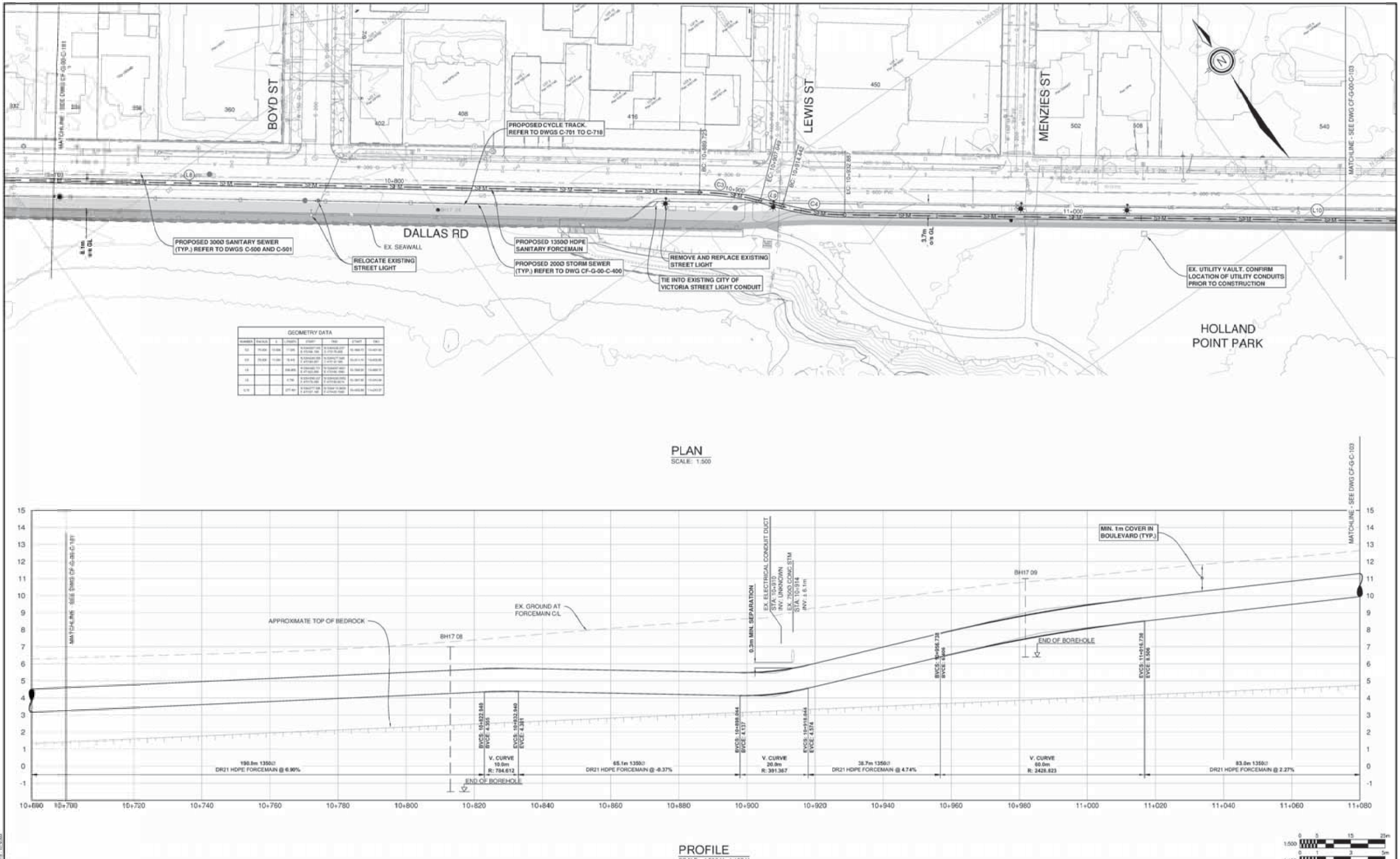
CLOVER POINT FORCEMAIN

PLAN AND PROFILE
STA 10+000 TO STA 10+320

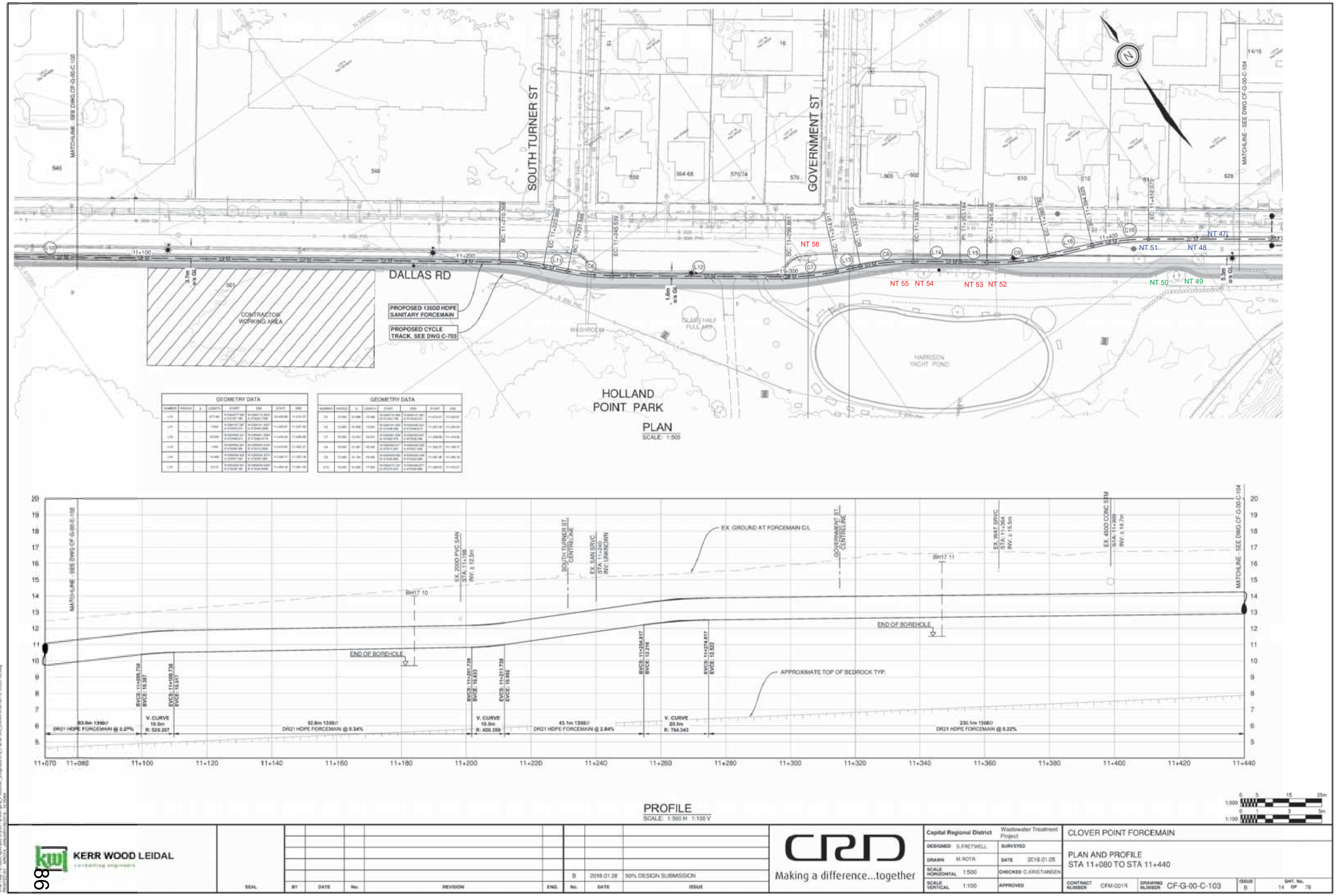
CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G-00-C-100 | ISSUE B | SHT. No. 11 OF 78



DOCK ST
PILOT ST
OSWEGO ST
SAN JOSE AVE
DALLAS RD
REMOVE AND DISPOSE OF EX. 275Ø HDPE SAN SEWER WHERE ENCOUNTERED DURING TRENCHING (TYP.)
PROPOSED CYCLE TRACK. REFER TO DWGS C-701 TO C-718
PROPOSED 200Ø STM SEWER. REFER TO DWG C-400
PROPOSED 300Ø SANITARY SEWER (TYP.) REFER TO DWGS C-500 AND C-501
PROPOSED 1350Ø HDPE SANITARY FORCEMAIN
NEW CITY OF VICTORIA STREET LIGHT CONDUIT TYP.
JUNCTION BOX TYP.
NEW STREET LIGHT TYP.
TIE INTO EXISTING CITY OF VICTORIA STREET LIGHT CONDUIT
RELOCATE EXISTING STREET LIGHT TYP.
EX. SEAWALL
PROPOSED LAYDOWN AREA (TYP.)
NT 64
NT 63
NT 62
NT 57
NT 60
NT 59
NT 58
2.0m o/s GL
2.1m o/s GL
GEOMETRY DATA
PLAN
SCALE: 1:500
APPROXIMATE TOP OF BEDROCK
MIN. 1.5m COVER IN THE ROADWAY
EX. GROUND AT FORCEMAIN C/L
BH17 04
BH17 05
BH17 06
BH17 07
END OF BOREHOLE
DOCK ST CENTRELINE
PILOT ST CENTRELINE
OSWEGO ST CENTRELINE
SAN JOSE ST CENTRELINE
V. CURVE 10.0m R: 8940.013
V. CURVE 10.0m R: 55567.062
V. CURVE 10.0m R: 1502.695
149.7m 1350Ø DR21 HDPE FORCEMAIN @ 0.36%
89.0m 1350Ø DR21 HDPE FORCEMAIN @ 0.25%
75.3m 1350Ø DR21 HDPE FORCEMAIN @ 0.23%
190.0m 1350Ø DR21 HDPE FORCEMAIN @ 0.96%
PROFILE
SCALE: 1:500 H 1:100 V
KERR WOOD LEIDAL
B 2018.01.08 50% DESIGN SUBMISSION
Making a difference...together
Capital Regional District
Wastewater Treatment Project
DESIGNED S.FREWELL
DRAWN M.ROTA
DATE 2018.01.05
CHECKED C.KRISTIANSEN
SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:100
CLOVER POINT FORCEMAIN
PLAN AND PROFILE
STA 10+320 TO STA 10+700
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G-00-C-101
ISSUE B
SHT. No. 12 OF 78



KERR WOOD LEIDAL consulting engineers	CRD Making a difference...together	CLOVER POINT FORCEMAIN
B — 2018.01.08 — 50% DESIGN SUBMISSION	Capital Regional District — Wastewater Treatment Project	PLAN AND PROFILE STA 10+700 TO STA 11+080
	DESIGNED S.FRETWELL; DRAWN M.ROTA; DATE 2018.01.05; SCALE HORIZONTAL 1:500; SCALE VERTICAL 1:100; CHECKED C.KRISTIANSEN	CONTRACT NUMBER CFM-001R; DRAWING NUMBER CF-G-00-C-102; ISSUE B; SHT. No. 13 OF 78



DALLAS RD
SOUTH TURNER ST
GOVERNMENT ST
HOLLAND POINT PARK
PLAN
SCALE: 1:500
HARRISON YACHT POND
CONTRACTOR WORKING AREA
PROPOSED 1350Ø HDPE SANITARY FORCEMAIN
PROPOSED CYCLE TRACK. SEE DWG C-703
WASHROOM
GEOMETRY DATA
NT 47
NT 48
NT 49
NT 50
NT 51
NT 52
NT 53
NT 54
NT 55
NT 56
BC: 11+210.368
EC: 11+223.966
BC: 11+231.568
EC: 11+245.539
BC: 11+298.881
EC: 11+314.917
BC: 11+322.370
EC: 11+338.715
PI: 11+353.184
BC: 11+361.456
EC: 11+380.782
BC: 11+394.525
EC: 11+412.073
3.7m o/s GL
1.6m o/s GL
5.3m o/s GL
PROFILE
SCALE: 1:500 H 1:100 V
EX. GROUND AT FORCEMAIN C/L
APPROXIMATE TOP OF BEDROCK TYP.
BH17 10
BH17 11
END OF BOREHOLE
EX. 200Ø PVC SAN STA: 11+198 INV: ± 12.5m
SOUTH TURNER ST. CENTRELINE
EX. SAN SRVC STA: 11+240 INV: UNKNOWN
GOVERNMENT ST. CENTRELINE
EX. WAT SRVC STA: 11+364 INV: ± 15.5m
EX. 450Ø CONC STM STA: 11+399 INV: ± 14.7m
BVCS: 11+099.738 BVCE: 10.387
EVCS: 11+109.738 EVCE: 10.517
V. CURVE 10.0m R: 520.207
BVCS: 11+201.738 BVCE: 10.833
EVCS: 11+211.738 EVCE: 10.992
V. CURVE 10.0m R: 400.350
BVCS: 11+254.817 BVCE: 12.216
EVCS: 11+274.817 EVCE: 12.522
V. CURVE 20.0m R: 764.343
92.8m 1350Ø DR21 HDPE FORCEMAIN @ 0.34%
43.1m 1350Ø DR21 HDPE FORCEMAIN @ 2.84%
230.1m 1350Ø DR21 HDPE FORCEMAIN @ 0.22%
MATCHLINE - SEE DWG CF-G-00-C-102
MATCHLINE - SEE DWG CF-G-00-C-104
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consulting engineers
CRD
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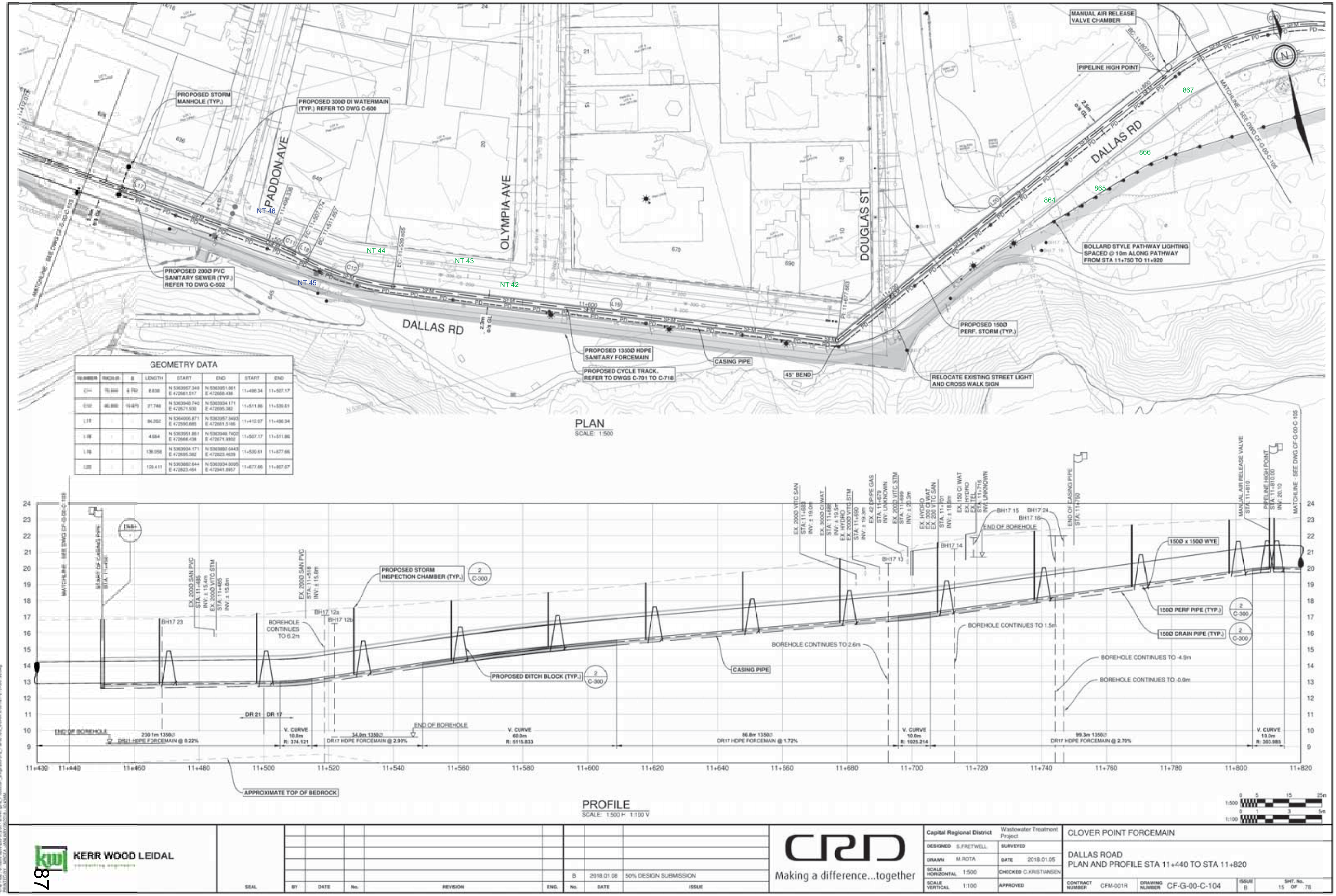
Capital Regional District
Wastewater Treatment Project
DESIGNED S.FRETWELL
SURVEYED
DRAWN M.ROTA
DATE 2018.01.05
SCALE HORIZONTAL 1:500
CHECKED C.KRISTIANSEN
SCALE VERTICAL 1:100
APPROVED
B 2018.01.08 50% DESIGN SUBMISSION
CLOVER POINT FORCEMAIN
PLAN AND PROFILE
STA 11+080 TO STA 11+440
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G-00-C-103
ISSUE B
SHT. No. 14 OF 78

86


PLAN
SCALE: 1:500
DALLAS RD
PADDON AVE
OLYMPIA AVE
DOUGLAS ST
MANUAL AIR RELEASE VALVE CHAMBER
PIPELINE HIGH POINT
PROPOSED STORM MANHOLE (TYP.)
PROPOSED 300Ø DI WATERMAIN (TYP.) REFER TO DWG C-606
PROPOSED 200Ø PVC SANITARY SEWER (TYP.) REFER TO DWG C-502
PROPOSED 1350Ø HDPE SANITARY FORCEMAIN
PROPOSED CYCLE TRACK. REFER TO DWGS C-701 TO C-718
CASING PIPE
45° BEND
PROPOSED 150Ø PERF. STORM (TYP.)
RELOCATE EXISTING STREET LIGHT AND CROSS WALK SIGN
BOLLARD STYLE PATHWAY LIGHTING SPACED @ 10m ALONG PATHWAY FROM STA 11+750 TO 11+920
GEOMETRY DATA
PROFILE
SCALE: 1:500 H 1:100 V
PROPOSED STORM INSPECTION CHAMBER (TYP.)
PROPOSED DITCH BLOCK (TYP.)
150Ø x 150Ø WYE
150Ø PERF PIPE (TYP.)
150Ø DRAIN PIPE (TYP.)
BOREHOLE CONTINUES TO 6.2m
BOREHOLE CONTINUES TO 2.6m
BOREHOLE CONTINUES TO 1.5m
BOREHOLE CONTINUES TO 4.9m
BOREHOLE CONTINUES TO 0.9m
END OF BOREHOLE
END OF CASING PIPE STA: 11+750
MANUAL AIR RELEASE VALVE STA: 11+810
PIPELINE HIGH POINT STA: 11+810.00 INV: 20.10
230.1m 1350Ø DR21 HDPE FORCEMAIN @ 0.22%
34.8m 1350Ø DR17 HDPE FORCEMAIN @ 2.98%
86.8m 1350Ø DR17 HDPE FORCEMAIN @ 1.72%
99.3m 1350Ø DR17 HDPE FORCEMAIN @ 2.70%
APPROXIMATE TOP OF BEDROCK
KERR WOOD LEIDAL
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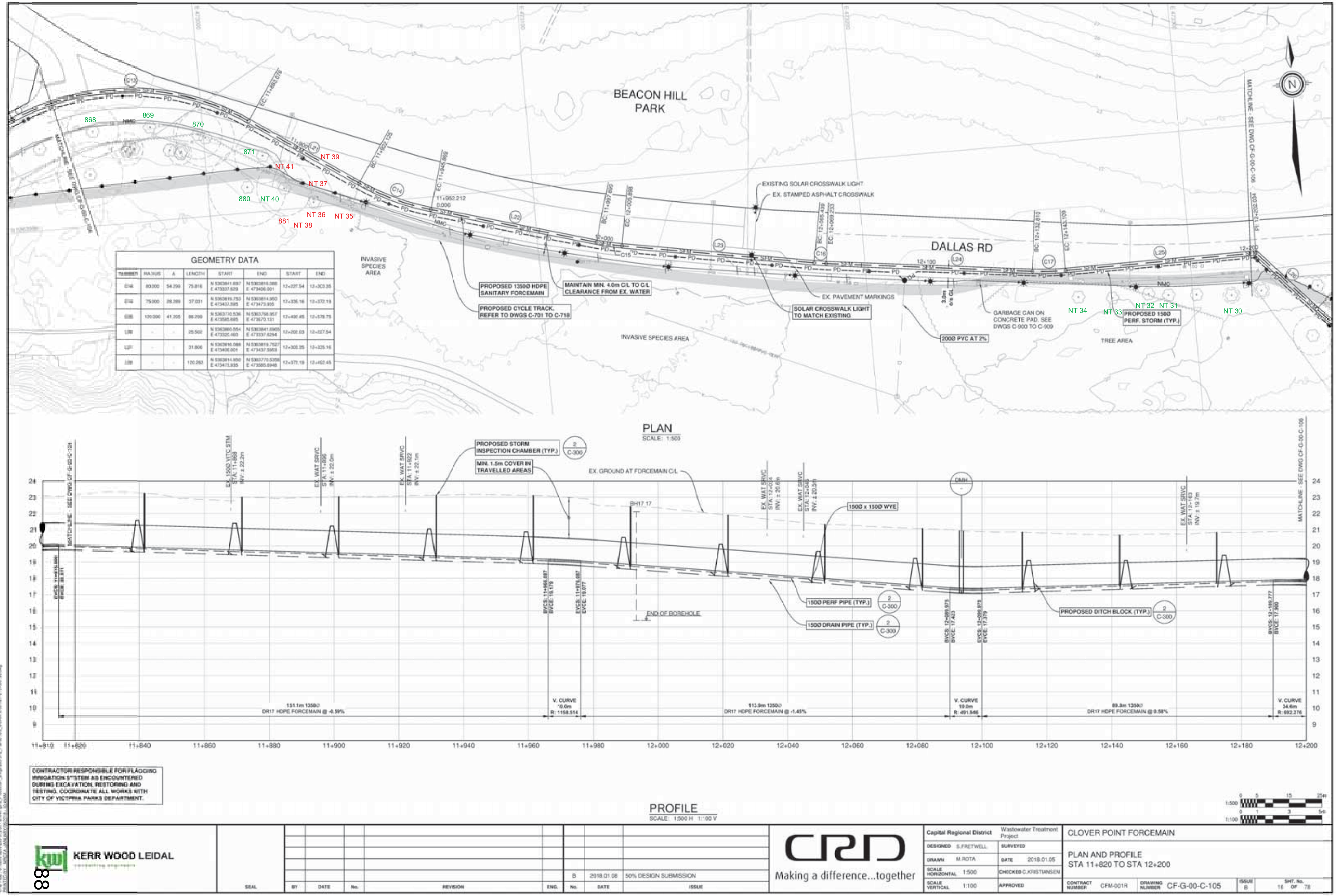
Capital Regional District
Wastewater Treatment Project
CLOVER POINT FORCEMAIN
DALLAS ROAD
PLAN AND PROFILE STA 11+440 TO STA 11+820
DESIGNED S.FRETWELL
DRAWN M.ROTA
DATE 2018.01.05
CHECKED C.KRISTIANSEN
SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:100
B 2018.01.08 50% DESIGN SUBMISSION
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G-00-C-104
ISSUE B
SHT. No. 15 OF 78



BEACON HILL PARK
DALLAS RD
GEOMETRY DATA
INVASIVE SPECIES AREA
TREE AREA
EXISTING SOLAR CROSSWALK LIGHT
EX. STAMPED ASPHALT CROSSWALK
PROPOSED 1350Ø HDPE SANITARY FORCEMAIN
PROPOSED CYCLE TRACK. REFER TO DWGS C-701 TO C-718
MAINTAIN MIN. 4.0m C/L TO C/L CLEARANCE FROM EX. WATER
EX. PAVEMENT MARKINGS
SOLAR CROSSWALK LIGHT TO MATCH EXISTING
200Ø PVC AT 2%
GARBAGE CAN ON CONCRETE PAD. SEE DWGS C-900 TO C-909
PROPOSED 150Ø PERF. STORM (TYP.)
PLAN
SCALE: 1:500
PROPOSED STORM INSPECTION CHAMBER (TYP.)
MIN. 1.5m COVER IN TRAVELLED AREAS
EX. GROUND AT FORCEMAIN C/L
150Ø x 150Ø WYE
150Ø PERF PIPE (TYP.)
150Ø DRAIN PIPE (TYP.)
PROPOSED DITCH BLOCK (TYP.)
END OF BOREHOLE
151.1m 1350Ø DR17 HDPE FORCEMAIN @ -0.59%
113.9m 1350Ø DR17 HDPE FORCEMAIN @ -1.45%
89.8m 1350Ø DR17 HDPE FORCEMAIN @ 0.58%
CONTRACTOR RESPONSIBLE FOR FLAGGING IRRIGATION SYSTEM AS ENCOUNTERED DURING EXCAVATION, RESTORING AND TESTING. COORDINATE ALL WORKS WITH CITY OF VICTORIA PARKS DEPARTMENT.
PROFILE
SCALE: 1:500 H 1:100 V
KERR WOOD LEIDAL
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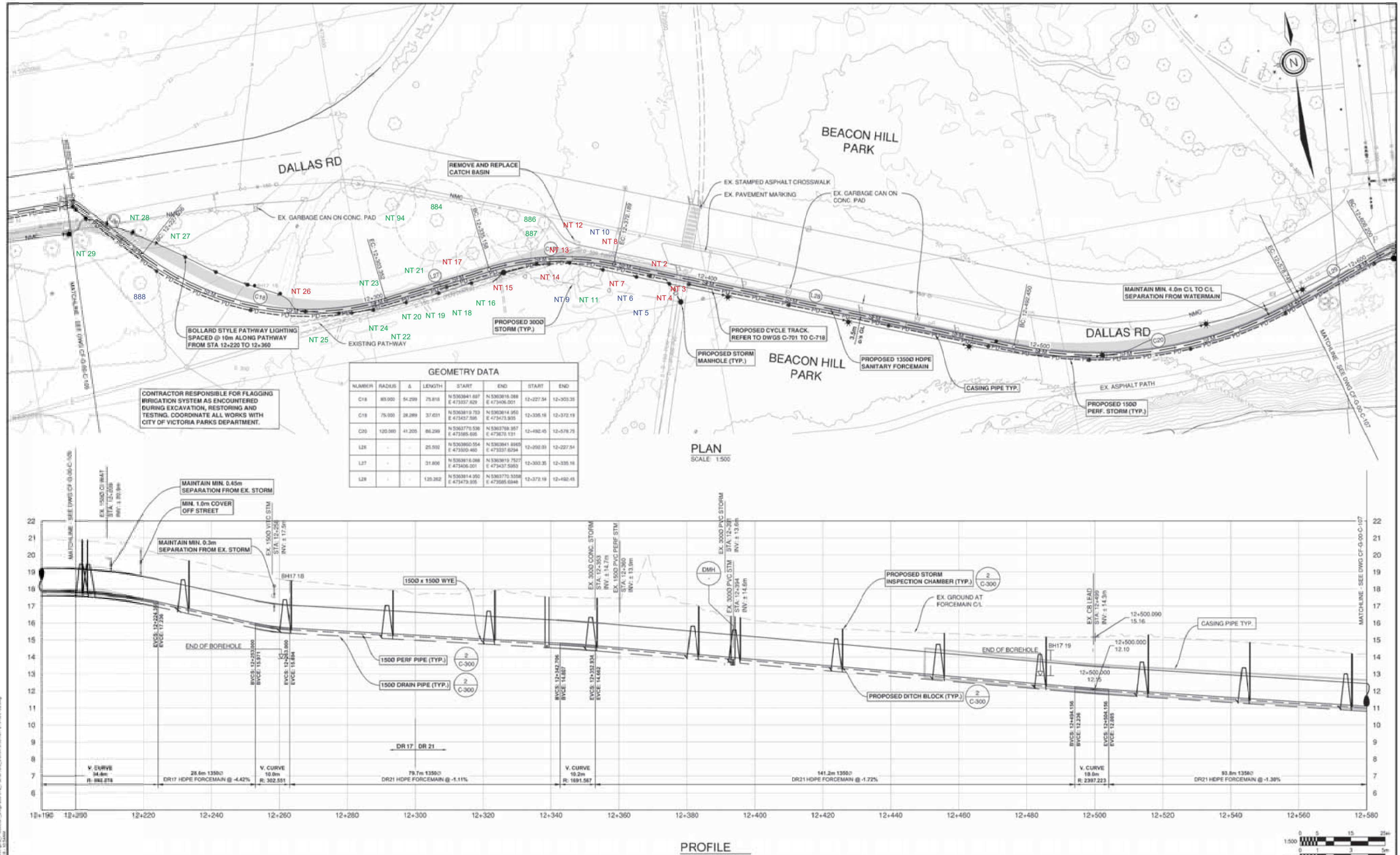
Wastewater Treatment Project
CLOVER POINT FORCEMAIN
PLAN AND PROFILE
STA 11+820 TO STA 12+200
B 2018.01.08 50% DESIGN SUBMISSION
DESIGNED S.FRETWELL
DRAWN M.ROTA
DATE 2018.01.05
CHECKED C.KRISTIANSEN
SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:100
CONTRACT NUMBER CFM-001R
DRAWING NUMBER CF-G-00-C-105
ISSUE B
SHT. No. 16 OF 78



GEOMETRY DATA

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C18	80.000	54.299	75.818	N 5363841.697 E 473337.629	N 5363816.088 E 473406.001	12+227.54	12+303.35
C19	75.000	28.289	37.031	N 5363819.753 E 473437.595	N 5363814.950 E 473473.935	12+335.16	12+372.19
C20	120.000	41.205	86.299	N 5363770.536 E 473585.695	N 5363768.957 E 473670.131	12+492.45	12+578.75
L26	-	-	25.502	N 5363860.554 E 473320.460	N 5363841.6965 E 473337.6294	12+202.03	12+227.54
L27	-	-	31.806	N 5363816.088 E 473406.001	N 5363819.7527 E 473437.5953	12+303.35	12+335.16
L28	-	-	120.262	N 5363814.350 E 473479.935	N 5363770.5358 E 473585.6948	12+372.19	12+492.45

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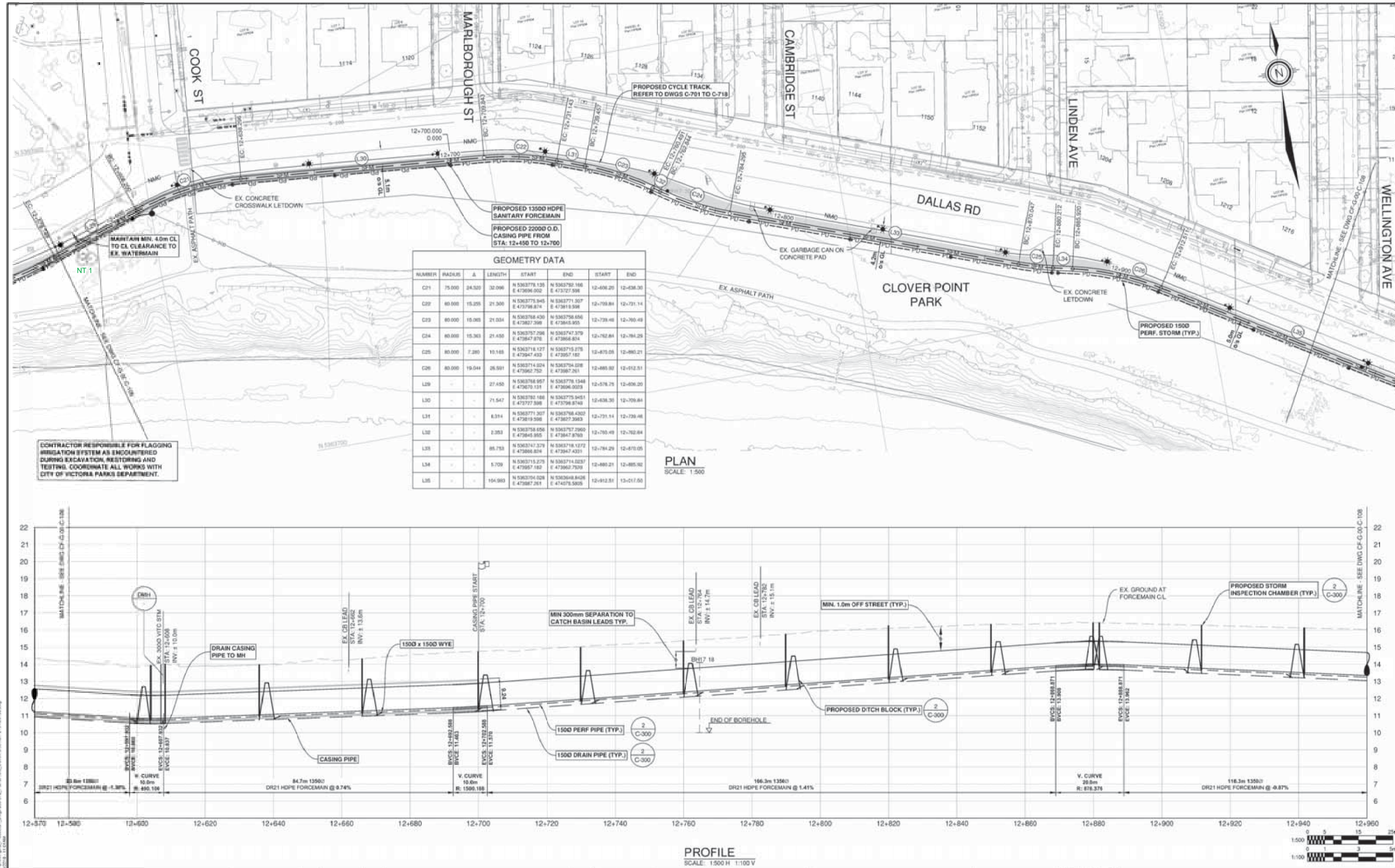
DESIGNED S.FRETWELL | SURVEYED
DRAWN M.ROTA | DATE 2018.01.05
SCALE HORIZONTAL 1:500 | CHECKED C.KRISTIANSEN
SCALE VERTICAL 1:100 | APPROVED

CLOVER POINT FORCEMAIN

PLAN AND PROFILE
STA 12+200 TO STA 12+580

CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G-00-C-106 | ISSUE B | SHT. No. 17 OF 78



GEOMETRY DATA

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C21	75.000	24.520	32.096	N 5363778.135 E 473696.002	N 5363792.166 E 473727.598	12+606.20	12+638.30
C22	80.000	15.255	21.300	N 5363775.945 E 473798.874	N 5363771.307 E 473819.598	12+709.84	12+731.14
C23	80.000	15.065	21.034	N 5363768.430 E 473827.398	N 5363758.656 E 473845.955	12+739.46	12+760.49
C24	80.000	15.363	21.450	N 5363757.296 E 473847.876	N 5363747.379 E 473866.824	12+762.84	12+784.29
C25	80.000	7.280	10.165	N 5363718.127 E 473947.433	N 5363715.275 E 473957.182	12+870.05	12+880.21
C26	80.000	19.044	26.591	N 5363714.024 E 473962.752	N 5363704.028 E 473987.261	12+885.92	12+912.51
L29	-	-	27.450	N 5363768.957 E 473670.131	N 5363778.1348 E 473696.0023	12+578.75	12+606.20
L30	-	-	71.547	N 5363792.166 E 473727.598	N 5363775.9451 E 473798.8740	12+638.30	12+709.84
L31	-	-	8.314	N 5363771.307 E 473819.598	N 5363768.4302 E 473827.3983	12+731.14	12+739.46
L32	-	-	2.353	N 5363758.656 E 473845.955	N 5363757.2960 E 473847.8760	12+760.49	12+762.84
L33	-	-	85.753	N 5363747.379 E 473866.824	N 5363718.1272 E 473947.4331	12+784.29	12+870.05
L34	-	-	5.709	N 5363715.275 E 473957.182	N 5363714.0237 E 473962.7520	12+880.21	12+885.92
L35	-	-	104.993	N 5363704.028 E 473987.261	N 5363648.8426 E 474079.5805	12+912.51	13+017.50

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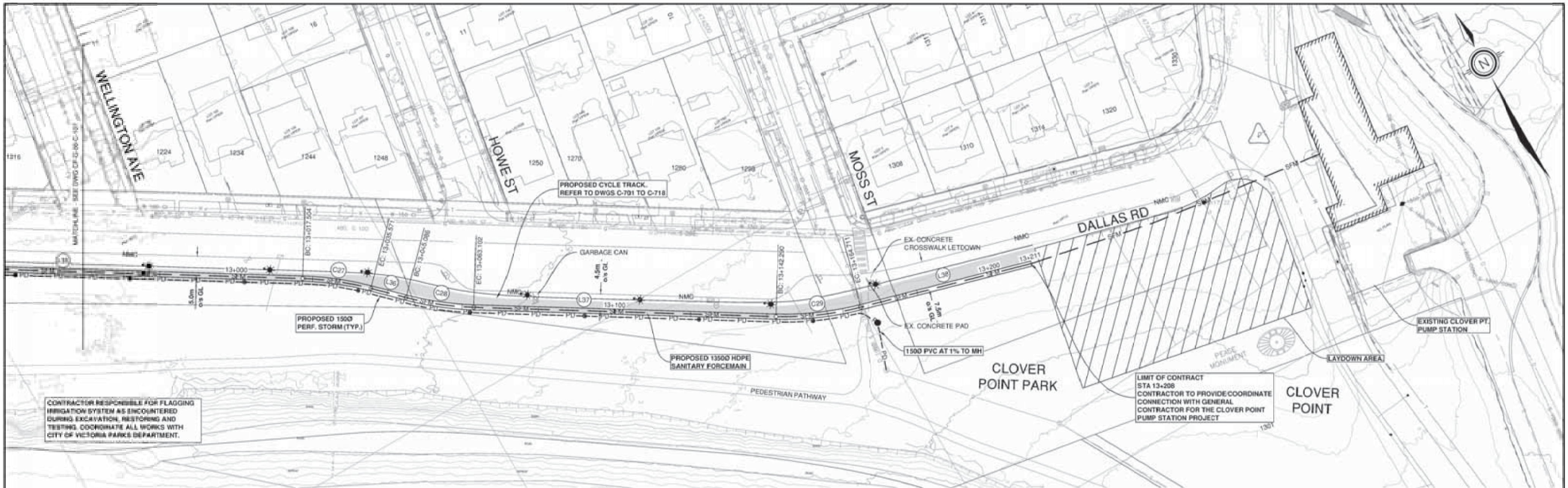
CLOVER POINT FORCEMAIN

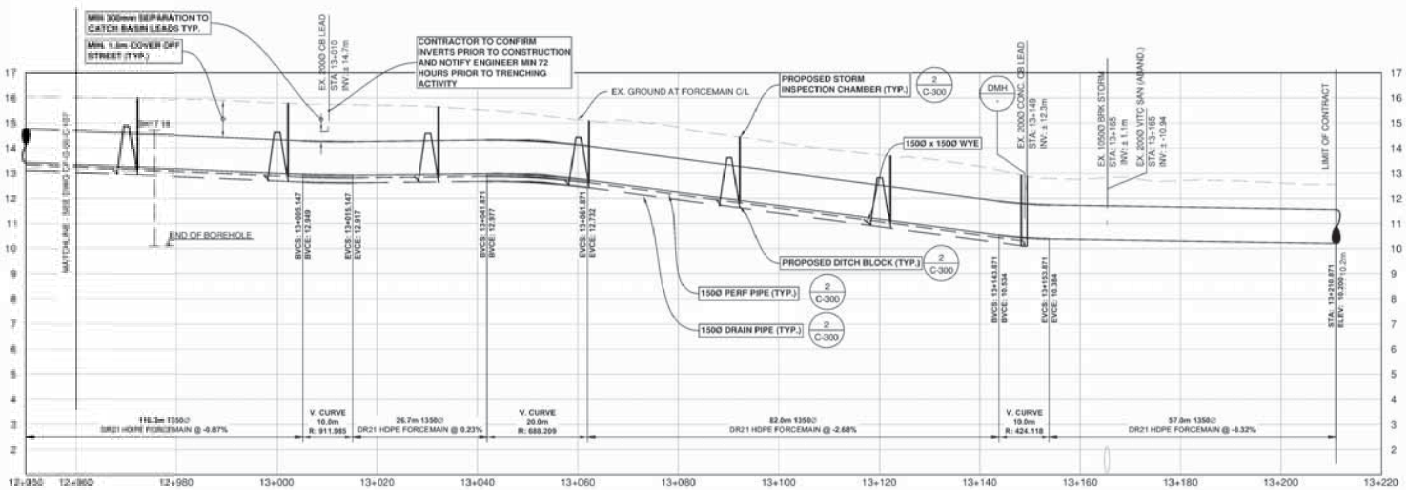
PLAN AND PROFILE
STA 12+580 TO STA 12+960

DESIGNED	S.FRETWELL	SURVEYED	
DRAWN	M.ROTA	DATE	2018.01.05
SCALE HORIZONTAL	1:500	CHECKED	C.KRISTIANSEN
SCALE VERTICAL	1:100	APPROVED	

CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G-00-C-107 | ISSUE B | SHT. No. 18 OF 78



PLAN
SCALE: 1:500



PROFILE
SCALE: 1:500 H 1:100 V

GEOMETRY DATA

NUMBER	RADIUS	Δ	LENGTH	START	END	START	END
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C28	80.000	12.903	18.016	N 5363631.012 E 474097.522	N 5363619.895 E 474111.650	13+045.09	13+063.10
C29	80.000	16.058	22.421	N 5363578.230 E 474178.991	N 5363569.241 E 474199.451	13+142.29	13+164.71
L36	-	-	9.515	N 5363637.699 E 474090.752	N 5363631.0119 E 474097.5217	13+035.57	13+045.09
L37	-	-	79.188	N 5363619.895 E 474111.650	N 5363578.2298 E 474178.9906	13+063.10	13+142.29
L38	-	-	46.177	N 5363569.241 E 474199.451	N 5363556.7546 E 474243.9084	13+164.71	13+210.89

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B	2018.01.08	50% DESIGN SUBMISSION

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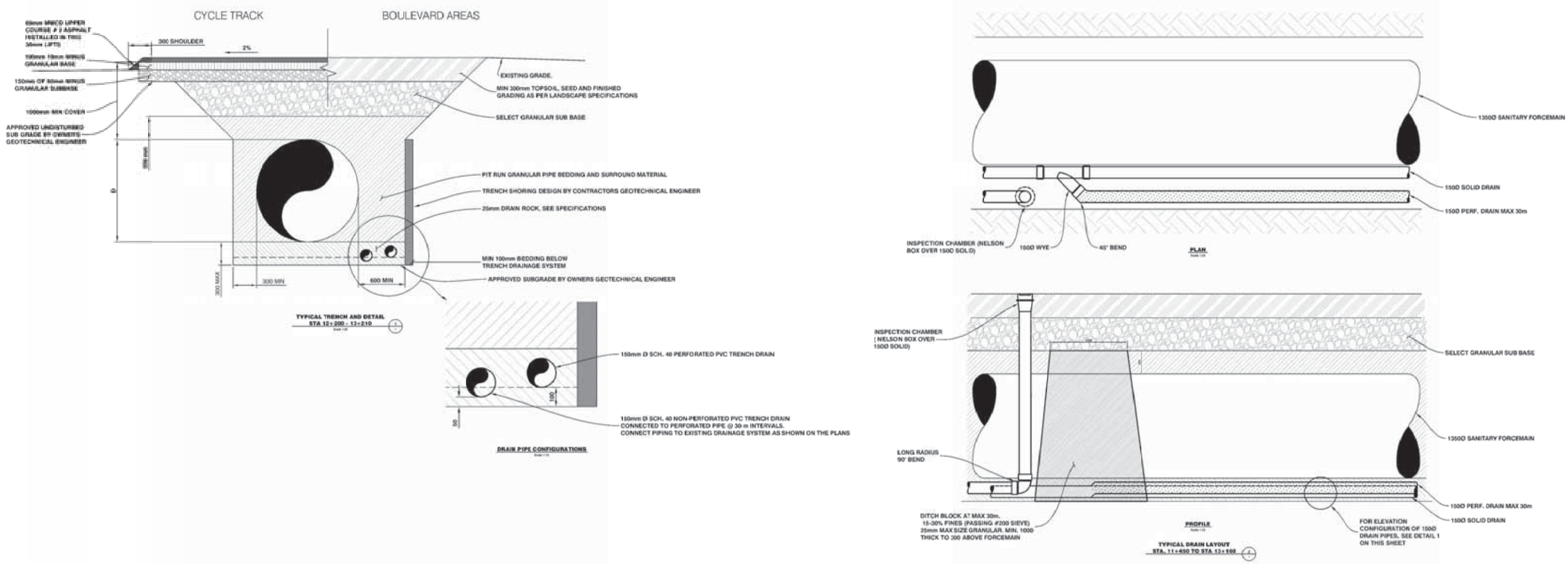
DRAWN M.ROTA | DATE 2018.01.05
SCALE HORIZONTAL 1:500 | CHECKED C.KRISTIANSEN
SCALE VERTICAL 1:100 | APPROVED

CLOVER POINT FORCEMAIN
PLAN AND PROFILE
STA 12+960 TO STA 13+211

CONTRACT NUMBER CFM-001R | DRAWING NUMBER CF-G-00-C-108 | ISSUE B | SHT. No. 19 OF 78



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SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE
						B	2018.01.08	50% DESIGN SUBMISSION

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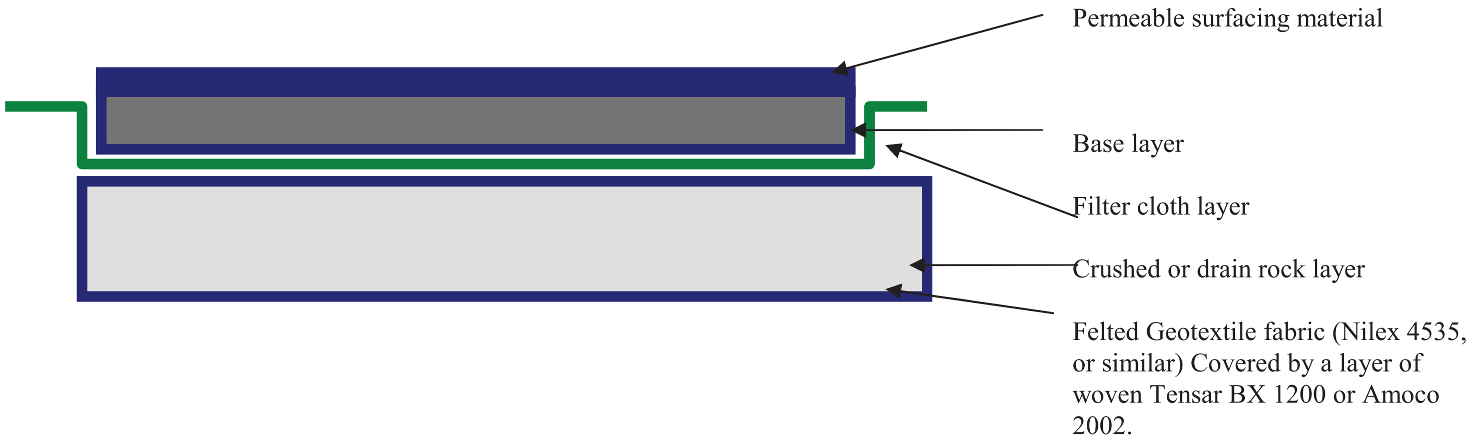
Capital Regional District	Wastewater Treatment Project
DESIGNED R.RUTHERFORD	SURVEYED
DRAWN E.NEIL	DATE 2018.01.05
SCALE HORIZONTAL 1:500	CHECKED C. KRISTIANSEN
SCALE VERTICAL 1:500	APPROVED

CLOVER POINT FORCEMAIN

DALLAS ROAD
TYPICAL CROSS SECTIONS & TRENCH DETAILS

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
CFM-100	CF-G-00-C-300	B	30 OF 83

Diagram – Site Specific Floating Driveway, Parking and Sidewalk Areas



Specifications for Floating Driveway and Parking Areas

1. Excavation for driveway or parking area construction must remove the sod layer only, where they encroach on the root zones of the protected trees

2. A layer of medium weight felted Geotextile fabric (Nilex 4535, or similar) is to be installed over the entire area of the critical root zone that is to be covered by the paving. Cover this Geotextile fabric with a layer of woven Amoco 2002 or Tensar BX 1200. Each piece of fabric must overlap the adjoining piece by approximately 30-cm.

3. A 10cm layer of torpedo rock, or 20-mm clean crushed drain rock, is to be used to cover the Geotextile fabric.

4. A layer of felted filter fabric is to be installed over the crushed rock layer to prevent fine particles of sand and soil from infiltrating this layer.

5. The bedding or base layer and permeable surfacing can be installed directly on top of the Geotextile fabric.

Appendix "F"

Kerr Wood Leidal 50% Design Proposal
Dallas Road Cycle Track – Pedestrian Connectivity and Safety

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Victoria, BC V8T 1Z4
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MEMORANDUM

To: Colin Kristiansen – Kerr Wood Liedal

From: Mitchell Jacobson, M.Sc., P.Eng

Our File #: 2249.B01

Project: Clover Force Main

Date: March 7, 2018

RE: Dallas Road Crosswalks and Six Key Intersections

This memo addresses a review of Dallas Road crosswalks as well as the identification of six key intersections along the corridor for the Clover Forcemain project. The memo is separated into Part 1) Crosswalk Review, and Part 2) Location of Six Key Intersections.

1.0 CROSSWALKS REVIEW

At the formal 50% design review meeting, the City of Victoria requested a review of crosswalks along Dallas Road, including a summary of existing crosswalks, an assessment of options, and recommendations for new crosswalks. This memo outlines the review approach, methodology, and recommendations.

The review is based on the Transportation Association of Canada's (TAC) *Pedestrian Crossing Control Guide (2012)*. This methodology provides consistency across jurisdictions throughout the country, and is based on current best practices.

Note that detailed pedestrian counts at existing crosswalks and at all cross streets (where new crosswalks may be considered) were not available at the time of this review. Therefore, making full recommendations as to the need and justification for crosswalks was not possible, and this review is considered a high-level review to identify existing suitability and candidate locations.

Also note that per BC's *Motor Vehicle Act*, all intersections are legal crosswalks unless there is specific traffic control to the contrary. This means that an intersection is a crosswalk even if no markings, signage, or flashers are in place. This review is in consideration of enhanced crosswalks only (e.g. signage, markings, flashing beacons, etc).

The risk of installing crosswalks where not warranted is that drivers may become complacent if they never encounter pedestrians, and this complacency may be exacerbated if there is a high frequency of unwarranted marked/signed crosswalks. Therefore ensuring a consistent and warranted approach can assist in creating a safe crosswalk system for the corridor.

EXISTING CROSSWALKS

There are eight existing crosswalks along Dallas Road through the cycle track study area (Dock St to Clover Point). All of the crosswalks feature zebra markings and crosswalk signs (no flashing beacons). They are:

- Dock St (side mounted + overhead signs)
- Oswego St (side mounted signs)
- Menzies St (side mounted signs)
- Douglas St (side mounted + overhead signs)
- Beacon Hill Crosswalk 1 - west of Camas Circle (side mounted signs)
- Beacon Hill Crosswalk 2 - east of Camas Circle (side mounted signs)
- Cook St (side mounted signs)
- Moss St (side mounted signs)

The existing crosswalks are spaced from 200m and 700m apart, with the longest separation being Menzies St to Douglas St (700m), Cook St to Moss St (550m), and Oswego St to Menzies St (400m).

Typical Side Mounted Sign Configuration on Dallas Rd (Menzies St shown)

Typical Side + Overhead Mounted Sign Configuration on Dallas Rd (Douglas St shown)

CORRIDOR CROSSWALK REVIEW

REVIEW APPROACH

The need for and design of crosswalks is a function of a number of elements (roadway traffic volumes and speed and the resulting crossing opportunities, pedestrian volumes / crossing demand, and desire lines / neighbourhood connectivity). The TAC guide provides a warrant approach using these elements to identify 1) candidate locations, and 2) crosswalk treatment selection. Required data includes vehicular volumes (volume/day), pedestrian crossing volume (average hourly), system connectivity / desire line, spacing from nearest traffic control, as well as roadway laning and posted speed limit.

Per TAC, recommended minimum spacing between crosswalks (or a crosswalk and nearest traffic control device such as a signal) is from 100m to 200m, depending upon the municipality. The City of Victoria does not have a specific adopted spacing standard, however the general approach is more frequency in high pedestrian environments (specifically the downtown core) and greater spacing outside the downtown area (such as along Dallas Rd). For this review, the 200m spacing threshold was used.

REVIEW OF CROSSWALKS ALONG DALLAS ROAD

To conduct a complete assessment, both daily vehicular counts and hourly intersection pedestrian counts are required. Ideally the intersection pedestrian counts are supplemented with midblock counts as this may represent pedestrians that could shift crossing location if a crosswalk was located nearby.

Although daily volumes are available from the City's VicMap application, detailed pedestrian counts at existing crosswalks and at all cross streets (where new crosswalks may be considered) were not available at the time of this review. Therefore, making full recommendations as to the need and justification for crosswalks was not possible.

Usage in this area is highest in the summer season and would be the best period to assess empirical crosswalk demand.

Therefore, the review proceeds only on the basis of available elements, specifically:

- Vehicular Volume on Dallas Road
- Crosswalk spacing
- Desire Lines

Volume Review

The existing daily traffic volume along Dallas Road ranges from approximately 6,500 vehicles/day (near the seawall), to 7,200 vehicles/day near Holland Point Park, to 6,750 between Cook St and Clover Point. All of these volumes exceed the minimum threshold for considering a crosswalk (which is 1,500 vehicles/day).

In terms of design, for two-lane roads with daily volumes between 4,500 and 9,000, with posted speed limits of 50 km/h or less, a ground mounted 1 (GM1) level of crosswalk control would be warranted[1]. GM1 consists of side mounted signs and zebra crosswalk markings. All existing crosswalks are GM1 except at Dock St and Douglas St, which are GM2 (with overhead signs as well). Although GM2 may not be warranted per traffic volumes, they can still be considered if a safety review identifies the need (such as limited sight lines or particularly high pedestrian volumes). At Douglas St, sight lines are limited, while at Dock St there are potentially very high volumes of unfamiliar tourist pedestrians (due to Ogden Point and cruise ships), and thus GM2 is considered appropriate in these locations.

Crosswalk Spacing Review

As noted above, the existing crosswalk spacing is between 200m and 700m, with three sections of spacings at 400m or more. This exceeds the TAC recommended minimum spacing of 200m. From a spacing perspective, the existing crosswalks are suitably separated from each other.

The segments with spacings of 400m or more could accommodate an additional crosswalk without exceeding recommended spacings. These locations are:

- Between Menzies St and Oswego St
- Between Menzies St and Douglas St
- Between Cook St and Moss St

[1] TAC *Pedestrian Crossing Control Guide, Table 1: Decision Support Tool – Treatment Selection Matrix*

Desire Line Review

In addition to pedestrian volume considerations, pedestrian desire lines and/or system connectivity is a consideration that can help identify candidate crosswalk locations.

In consideration of existing crosswalks:

- Dock St – access to/from Ogden Point Breakwater (**is a desire line**)
- Oswego St – this road crosses James Bay, provides neighbourhood connectivity to Seawall (**is a desire line**)
- Menzies St – this road crosses James Bay and connects to James Bay Square (**is a desire line**)
- Douglas St - road connects to downtown, to Mile Zero statue, to Beacon Hill Park (**is a desire line**)
- Beacon Hill Crosswalk 1 – connects pedestrian trail on north side of Dallas Road to park on south side (**is a desire line**)
- Beacon Hill Crosswalk 2 – connects pedestrian trails on either side of Dallas Road (**is a desire line**)
- Cook St - road connects to Cook St Village and to pedestrian trail to south (**is a desire line**)
- Moss St - road is a north-south through road through Fairfield neighbourhood, and on south side of Dallas Rd the crosswalk connects to north-south trail south of Dallas Rd (**is a desire line**)

Therefore all existing crosswalks are considered viable locations, however pedestrian volumes are not known and should be considered as part of any full review, even considering the above high-level consideration.

Per the spacing review, three segments could also be considered for new crosswalks:

<u>1) Between Menzies St and Oswego St</u>

These crosswalks are spaced 400m apart. Boyd St is located 200m between these intersections. This street provides north-south connectivity between the seawall and the James Bay neighbourhood (as the road extends north to Niagara Avenue). Therefore **Boyd St is a candidate** crosswalk location.

<u>2) Between Menzies St and Douglas St</u>

These crosswalks are spaced 550m apart. There are three intersections between these roads that would maintain a 200m crosswalk separation: South Turner St, Government St, and Paddon

Ave. These three intersections are spaced within 200m of each other so only one location would potentially be a candidate.

Of these, Government St is the strongest desire line. It connects to the north-south trail to the south (near Harrison Yacht Pond), and to the north connects through James Bay to downtown. South Turner St does provide a direct desire line to a trail to the washrooms south of Dallas Rd but is not as strong of a desire line north of Dallas Rd. Paddon Avenue provides the least connectivity to the neighbourhood, and the narrow geometry at Dallas Rd as part of the cycle track design does not permit a proper pedestrian waiting area on the south side of Dallas Rd. Therefore **Government St is a candidate** crosswalk location.

3) Between Cook St and Moss St

These crosswalks are spaced 700m apart. There are two intersections between these roads that would maintain a 200m crosswalk separation: Linden Ave, and Wellington Ave. These two intersections are spaced within 200m of each other so only one location would potentially be a candidate.

Of these, Linden Ave is the strongest desire line. Both provide connectivity into Fairfield but Linden Ave provides a continuous route through the neighbourhood all the way to Fort St (whereas Wellington Ave terminates at May St). However, neither road connects to a pathway on the south side. It is not generally appropriate to install crosswalks without a receiving pedestrian facility. Therefore, no candidate crosswalk location is identified at this time for this section of road. In the future, if a north-south pathway were to be provided south of Dallas Rd then Linden Ave may be a crosswalk candidate location.

CROSSWALKS ACROSS CYCLE TRACK

Wherever there is a sidewalk or pedestrian path connection across the cycle track, there should be a crosswalk across the cycle track, with zebra markings and signage (reduced size, similar to those used along the Pandora Avenue Cycle Track).

CROSSWALK REVIEW CONCLUSIONS

A crosswalk review for the Dallas Road Corridor was conducted, however pedestrian volumes were not available at the time of the review. Therefore the following conclusions are considered a preliminary high level review and do not represent specific crosswalk recommendations, but rather a general assessment of appropriateness of existing crosswalks and potential candidate crosswalk locations. The review is in consideration of enhanced crosswalks (e.g. those with markings, signs, and/or other features).

The existing crosswalks were found to be appropriate in terms of road volume, crosswalk spacing, and desire lines. The existing signage and markings are also appropriate.

Three segments were identified where additional new crosswalks could meet spacing requirements (between Oswego St & Menzies St, between Menzies St & Douglas St, and between Cook St & Moss St). Based on a further review of spacings and desire lines, Boyd St and Government St were identified as potential candidate crosswalk locations. Should a north-south pedestrian path be installed south of Dallas Rd, then Linden Ave could also be a candidate crosswalk location (but is not considered a candidate at this time).

CROSSWALK RECOMMENDATIONS:

- Consider Boyd St and Government St as candidate crosswalk locations. It is recommended to conduct pedestrian counts (per TAC guide requirements) at these intersections in the summer (as well as adjacent intersections and midblock areas) to establish demand and actual need for a crosswalk in these locations. Further safety review should also be conducted at that time to identify appropriate crosswalk design (GM1 or GM2).
- Apply cyclist-scale crosswalk zebra markings and signs across the cycle track at any sidewalk or pedestrian pathway crossings

2.0 LOCATION OF SIX KEY INTERSECTIONS

The License of Occupation states that "The Cycle Track must incorporate a bike rack and a bench at a minimum of six locations at key intersections." The following intersections have been selected:

- Dock Street (2 Benches)
- Menzies Street (Bench & Bike Rack)
- Yacht Pond Washroom (Bike Rack)
- Paddon Street Overlook (2 Benches & Bike Rack)
- Beacon Hill Crosswalk 1 (Bench & Bike Rack)
- Cook Street (2 Bike Racks)

The location of the six key intersections, along with existing and candidate crosswalk locations, is shown in the attached **Figure 1**.

It is important to note that not all of these intersections are vehicular. As the key intersections relate directly to the placement of pedestrian and cyclist amenities (bench and bike rack), intersections between the Cycle Track and existing pedestrian pathways have also been considered.

Key intersections have been selected based on connectivity, desire lines, the proximity to existing furnishings, and the availability of space for a bench and bike rack. Not all important streets have been selected as Key Intersections. For example, the intersection at Douglas Street was not included, as this location does not provide connection to other areas within the Park (no need for bike racks) and already contains benches. Likewise, the intersection at Oswego Street was excluded as it does not provide adequate space for furnishings. Another important intersection that was excluded is Moss Street, due to its proximity to the pedestrian and cyclist amenities proposed for the Clover Pump Station project.

While the License of Occupation calls for one bench and one bike rack at each intersection, the design team is proposing to place double benches or bike racks in some locations, and to leave out either a bike rack or bench in others. The total number of bike racks and benches remains the same (6 each). The information for each key intersection below provides the rationale for the proposed placement of these site furnishings.

Dock Street (2 benches)
Dock Street is important to the overall Cycle Track, as it represents the western boundary of the project. It is also connected to popular pedestrian spaces including Ogden Point. The west corner of the seawall has a small pocket of space within which two benches will fit. While a bike rack

would also be a useful amenity in this key intersection, the design team favours the placement of 2 benches in an ‘L’ shaped configuration in order to encourage a more sociable, pedestrian-focused atmosphere at this location.

Alternately, the benches could be placed in the boulevard directly north-west of the seawall. This location would provide an unobstructed view to the ocean and would be adjacent to turf and the Ogden Point Sundial.

Menzies Street (bench & bike rack)
A bench and bike rack are proposed at Menzies Street, as this intersection contains a crosswalk leading to the Dallas Road Waterfront Trail and the Holland Point Shoreline Trail. Alternately, this Key Intersection could be installed at Lewis Street, which provides better access to the pedestrian trails and is adjacent to the sea wall. However, Lewis Street lacks a crosswalk.

Yacht Pond Washroom (bike rack)
A bike rack is proposed at the Yacht Pond Washroom, so that Cycle Track users can safely lock their bicycles while using the facility. Many benches are already installed around the Harrison Yacht Pond.

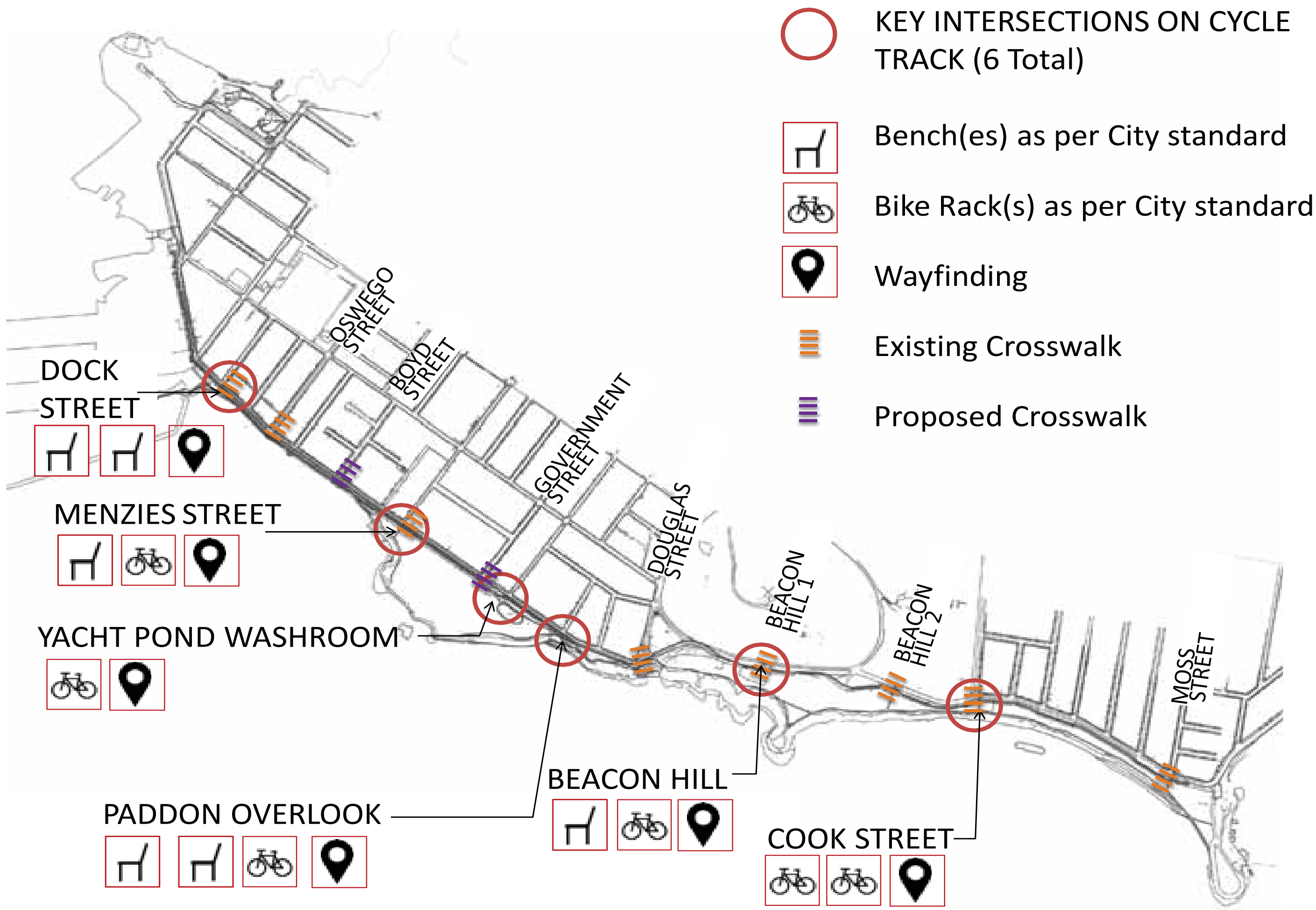
Paddon Street Overlook (2 benches & bike rack)
The retaining wall at Paddon Street offers excellent views of the ocean, and this location also connects well to the beach via the Holland Point Shoreline Trail. The design team proposes to place the two benches and bike rack in the flatter area between Paddon Avenue and Olympia Avenue. This will provide a place to lock up bicycles for those wishing to head closer to the water, while providing a sociable seating space with fantastic views for anyone needing a rest.

Beacon Hill Crosswalk 1 (bench & bike rack)
This location was selected as it provides pedestrian connection to the Beacon Hill Loop, and is far from existing bench locations. Alternately, this key intersection could be placed at Beacon Hill Crosswalk 2, which leads to the World’s Tallest Totem Pole path.

Cook Street (2 bike racks)
The Cook Street intersection provides important connections to trails within Beacon Hill Park, The Dallas Road Waterfront, and to Cook Street Village. It was thought that this location would be a popular stopping point for many Cycle Track users, and has thus been assigned two bike racks. It was not thought that benches were required at this location, as there are currently many benches nearby along the Dallas Road Waterfront Trail.

Sincerely,
Watt Consulting Group

Mitchell Jacobson, M.Sc., P.Eng.
Senior Transportation Engineer



SCALE: N.T.S

KERR WOOD LEIDAL
consulting engineers

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

CRD
Making a difference...together

Capital Regional District			
DESIGNED	R.RUTHERFORD	SURVEYED	-
DRAWN	E.NEIL	DATE	2018-03-01
SCALE HORIZONTAL	N.T.S	CHECKED	-
SCALE VERTICAL	-	APPROVED	-

CLOVER POINT FORCEMAIN

FIGURE 1
EXISTING SIDEWALK, CANDIDATE SIDEWALK, AND KEY INTERSECTION LOCATION PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
CFM-001R	-	- 1	1 OF 1

Appendix "G"

Kerr Wood Leidal 50% Design Proposal
Barrier Fencing between Cycle Track and off-Leash Dog Park

Murdoch de Greeff INC
Landscape Architects

200-524 Culduthel Road
Victoria BC V8Z 1G1
p. 250.412.2891
f. 250.412.2892

File No: 117.27
March 6, 2018

Discussion Memorandum: Barrier Fencing

TO: Peter Lutzmann
Central Regional District Wastewater Treatment Project

FROM: Murdoch de Greeff Landscape Architects

As per the licence of occupation, the Clover Force Main design team considered barrier-fencing for dog off-leash areas along the Cycle Track. This Discussion Memorandum is meant to be reviewed along with Figure 5: Barrier Fencing Location Plan, from the 50% Design Presentation to Council.

Location of Barrier Fencing

Continuous Barrier

A continuous barrier along the entire dog off-leash area was deemed undesirable, as the dog barrier would also function as a barrier between pedestrians and the waterfront. Furthermore, this barrier would interfere with views to the ocean for visitors of the Park as well as for nearby residents.

Barriers at Crosswalk Intersections

The project team recommend that barrier be used at intersections with crosswalks. These locations pose a greater risk of user conflicts, and it is deemed desirable to reduce the likelihood of off-leash dogs entering these spaces. Barriers at crosswalk intersections also create an opportunity to further separate pedestrians from cyclists, potentially improving the overall safety of these crossings. The barrier must be designed so that it will not impede key site lines at crossings and intersections.

Barriers West of Cook Street

The license of occupation specifies the consideration of barrier-fencing east of Cook Street. The Design Team felt there were two other locations where barrier-fencing would be a valuable addition.

The first is an area directly east of Cook Street where Dallas Road aligns near the bluffs, narrowing the space available for Park users. This space is also part of the dog off-leash zone, and the limited width creates the potential for greater conflicts between cyclists and off-leash dogs. This location is bordered by dense vegetation on the north side of Dallas Road. The addition of a barrier will not impact existing views to the water.

The second additional location suggested for a barrier is a small area west of Camas Circle, where an existing patch of forest reduces sight lines between the cycle track and adjacent open space. The design team recommends adding a barrier in this location to keep dogs and people away from this ‘blind spot’.

Types of Barrier Fencing

Chain Link

Although chain link fencing would be an effective method of keeping dogs separated from the Cycle Track, this option was deemed undesirable by the design team as it does not seem appropriate to the project setting. Chain link fencing would reduce views and appear unsightly in the landscape.

Split Rail Fence

Split rail fencing is highlighted by the design team as a suitable material for barrier fencing. Split rail fence is currently used throughout Beacon Hill Park and Clover Point Park, and its use as an off-leash barrier would tie into the existing character of the landscape. Split rail fencing is used successfully as a dog barrier in Alexander Park.

Snowberry and Nootka Rose

The design team is also recommending using snowberry (*Symphoricarpos albus*) and nootka rose (*Rosa nutkana*) hedges as dog barriers. These hedges would be used in alternation and in conjunction with the split rail fence, creating a range of design options suitable to the specific needs for sightlines and character at the locations discussed above. The plant species are proposed because they are native, form dense hedges that remain below typical eye-height, are low-maintenance, and can often be established without irrigation. These plant species are abundant in the project area, and form habitat for many wildlife species.

Best regards,

Scott Murdoch

Registered Landscape Architect

BARRIER FENCE AT DOG OFF-LEASH

PROPOSED BARRIERS AT HIGH-CONFLICT AREAS

PLANTINGS/SPLIT RAIL FENCE AT POINTS OF CONFLICT

KERR WOOD LEIDAL
consulting engineers

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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Capital Regional District			
DESIGNED	R.RUTHERFORD	SURVEYED	-
DRAWN	E.NEIL	DATE	2018-03-01
SCALE HORIZONTAL	N.T.S	CHECKED	-
SCALE VERTICAL	-	APPROVED	-

CLOVER POINT FORCEMAIN

FIGURE 5
BARRIER FENCE AT DOG OFF-LEASH AREA

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
CFM-001R	-	-	1 OF 1

Appendix "H"

Geotechnical Assessment and Investigation Reports

MEMORANDUM

Clover Forcemain Geotechnical Summary

Prepared for

Capital Regional District

November 27, 2017

KERR WOOD LEIDAL
consulting engineers

THURBER ENGINEERING LTD.

ch2m

Contents

Figures

Introduction

This memorandum summarizes geotechnical conditions along the Dallas Road alignment of the Clover Forcemain, reviews geotechnical conditions affecting design of the forcemain, and outlines the next steps for geotechnical work required to complete detailed design. This memorandum is based on Kerr Wood Leidal Consulting Engineers' (KWL) review of the indicative design prepared by Stantec Consulting Ltd (Stantec), results of geotechnical investigations and reference reports, information presented at meetings with Capital Regional District (CRD) and Stantec staff, and a site reconnaissance.

The KWL team concluded that with refinement of the indicative design, the Dallas road alignment is suitable for construction of the Clover Forcemain from a geotechnical perspective and that the forcemain can be constructed and operated without an adverse effect on the Dallas Road Bluffs and James Bay Seawall.

1.1 Project Background

The Clover Forcemain is an essential part of the CRD Wastewater Treatment Project, which will convey and treat wastewater from the CRD Core Area. On September 14, 2016, the CRD Board approved the Wastewater Treatment Project, including the proposed Clover Forcemain.

The Clover Forcemain will convey wastewater from the Clover Point Pump Station to Ogden Point. The alignment of the proposed Clover Forcemain is shown in Figure 1-1. At Ogden Point the forcemain will connect to the Harbour Crossing project, which consists of a pipe crossing under the entrance to the Victoria Harbour and conveying wastewater from the Clover Forcemain to the McLoughlin Point Wastewater Treatment Plant. The Clover forcemain will have a total length of approximately 3.4 km from the Clover Point Pump Station to Ogden Point.

CRD engaged Stantec to prepare an indicative design of the Clover Forcemain. In developing the indicative design, Stantec evaluated route options, selected a preferred route, developed the basis of design, prepared detailed alignment drawings, and estimated construction costs. CRD then engaged KWL to review the indicative design, prepare detailed design documents and be responsible for fulfilling Engineer of Record duties as defined by the Association of Professional Engineers and Geoscientist of British Columbia (APEGBC).

Figure 1-1 shows the alignment of the Clover Forcemain as developed by the indicative design.

CRD obtained a Licence of Occupation from the City of Victoria for the Clover Forcemain on February 22, 2017. CRD was granted a non-exclusive licence of occupation to install, entrench, construct, operate, maintain, and repair the forcemain. Construction of the Clover Forcemain will include mitigation of environmental, geotechnical, and archaeological impacts, as well as construction of a cycle track along Dallas Road from Clover Point to Dock Street.

This memorandum summarizes the geotechnical aspects of the Dallas Road alignment affecting design.

Figure 1-1. Clover Forcemain Location Map and Site Considerations

1.2 Project Objectives

CRD developed the following objectives for the Clover Forcemain Project:

- Provide for safe construction and operation.
- Completion by March 2020 to allow for commissioning of the wastewater system to comply with federal law for secondary treatment by December 31, 2020.
- Convey 162 megalitres per day of wastewater from the proposed Clover Point Pump Station to the Harbour Crossing project at Ogden Point.
- Remain operational during and following a seismic event.
- Preserve the integrity of the sensitive ecosystem of the Dallas Road Bluffs.
- Mitigate construction and operational risks associated with environmentally sensitive areas, including those in close proximity to the Dallas Road Bluffs.
- Assess and mitigate risks associated with registered archaeological sites in proximity to forcemain.
- Address geotechnical challenges, including those associated with construction and operation of a forcemain in close proximity to the Dallas Road Bluffs and the Dallas Road Seawall. This includes possible impacts of the forcemain on the Bluffs and Seawall and possible impacts of the Bluffs and Seawall on the forcemain.
- Minimize construction and operational impacts to high-use areas by community users and tourists.
- Minimize total cost to regional taxpayers (including capital and life cycle costs).

1.3 Design Criteria

To implement the objectives established by CRD for the Clover Forcemain, Stantec developed the following design criteria:

- Seismic design loading is based on recurrence interval of 1 in 975 years and includes tsunami impacts and the effects of sea level rise
- Pipe material will be high density polyethylene (HDPE) with a dimension ratio of DR21
- Design for velocities no lower than 0.9 metres per second and not exceeding 1.5 metres per second.
- Where open cut construction is used, provide a minimum depth of cover of 1.0 metre

1.4 KWL Team Qualifications

Stantec prepared an indicative design for the Clover Forcemain. KWL has been engaged to complete the design of the forcemain. The scope of KWL's work includes a review of geotechnical factors affecting Stantec's indicative design.

KWL assembled an interdisciplinary team with expertise in the fields of conveyance system design, geotechnical engineering, terrain analysis, marine construction, environmental analysis, and civil engineering. On September 8, 2017, the KWL team, Stantec, and CRD Program Management Office staff held a workshop to review the entire Clover Forcemain along Dallas Road from Clover Point to Ogden Point, with a focus on assessing and refining design of the forcemain. Extensive consideration was given to the geotechnical aspects of the design, as well as schedule, cost, archeological impacts, environmental impacts, and community impacts.

The qualifications of the team are shown in Table 1-1.

Table 1-1
KWL Team Qualifications

Company	Relevant Qualifications	Member	Role/Specialty	Years of Experience	Degrees
Kerr Wood Leidal	Extensive familiarity with the Dallas Road Bluffs, including preparation of a conservation plan for the bluffs that considered vegetation impacts, geotechnical assessments, climate change impacts and an archaeological overview.	Colin Kristiansen, P. Eng.	Project Manager	26	BASc, MBA
		Dave Murray, P.Eng.	Civil Engineering Specialist	28	BSCE, Dip. Civil
CH2M Hill	Expertise in design of large diameter forcemains with specialists in seismic design and resiliency of large diameter forcemains including ground improvements and trenchless technology.	Joe Broberg, P.Eng. (1)	Large Diameter Forcemain Specialist	43	BSCE, MSCE, MBA
		Donald Anderson, P.E.	Seismic Specialist	43	BSCE, MSCE, PhD, D.GE
		Andrew Finney, P.Eng	Trenchless Technology	24	BSCE, MSCE
Thurber Engineering	Geotechnical specialists having extensive local experience that includes the Dallas Road Bluffs, with specialists in the field of slope stability and terrain hazard assessments.	Stephen Bean, P.Eng.	Geotechnical Specialist	31	BASc, M.Eng
Plan Dynamics Ltd.	Environmental specialists, having extensive local experience in terrestrial and aquatic habitat, species at risk, ecology, etc.	David Harper CPESC, MCIP, RPP	Environmental Specialist	43	B.A., M.A., Ph.D.
Millennia Research	Archaeological expertise with extensive experience in local archaeological assessments and impact studies.	D'Ann Owens, (2) RPCA	Archaeology Specialist	23	BA (Hons)

(1) Joe Broberg is the Technical Review Leader.

(2) Millennia Research was retained directly by the Project Team to provide archaeological services for the Project. D'Ann Owens participated in the review of archaeological issues for the Clover Forcemain.

1.5 Previous Work

The KWL team reviewed extensive information regarding CRD's Project, indicative design of the Clover Forcemain, and geotechnical factors affecting design of the pipeline, as well as archaeological and environmental considerations. This information was reviewed during KWL's assessment and included results of previous geotechnical investigations and reference documents, meetings, and a site reconnaissance. The project team provided a summary of public feedback and comments that were considered in the preparation of this memorandum.

KWL also has extensive experience with the Dallas Road Bluffs, including preparation of a conservation plan. This plan included an overview of coastal geomorphology and past geotechnical studies, a geotechnical inspection and inventory, a detailed vegetation inventory and proposed restoration prescriptions, and a review of plant species at risk. This information was used to develop an overall bluff restoration plan which included identification of priority areas, removal of invasive species, cultivation of rare species and restoration of the bluffs with native species in a phased approach. Drainage issues and future coastal erosion protection projects were also identified including the use of beach nourishment along the Dallas Bluffs. Subsequent to the study, KWL has provided engineering design and construction services for some minor erosion sites that required immediate action, some using bioengineering solutions.

Table 1-2 provides a list of reference documents that the KWL team consulted during review of the indicative design.

Table 1-2
Reference Documents

Document Name	Date	Author
Dallas Road Shoreline Erosion Maps	1977	Thurber Consultants Ltd.
Waterfront Erosion Benchmark Study	June 10, 1997	R.D. Gillie
Quaternary Geological Map of Greater Victoria *Geoscience Map 2000-2*	2002	BC Ministry of Energy and Mines, Monahan and Levson
Vegetation, Wildlife and Habitat Evaluation Survey for Proposed Capital Regional District Wastewater Treatment Facility Sites	May 2013	TERA Environmental Consultants
Geotechnical Data Report *Core Area Wastewater Treatment Program*	April 12, 2013	Stantec Consulting Ltd.
Dallas Road Archaeological Impact Assessment *Progress Report*	2015	Millennia Research Ltd.
Licence of Occupation – Dallas Road Force Main	February 22, 2017	The City of Victoria and Capital Regional District
Seabed Pipeline Route for Clover Point Forcemain	March 13, 2017	Stantec Consulting Ltd.
Protection of Dallas Road Bluffs During Wastewater Construction Letter	May 4, 2017	City of Victoria
Wastewater Treatment Project Schedule	April 2017	Capital Regional District
Basis of Design Report *Cross Harbour Force Main*	June 26, 2017	AECOM
Scoping of Environmental Issues related to the Marine Option for a Clover Point to Forcemain Design *Project Memo*	September 18, 2017	Archipelago Marine Research Ltd (Brian Emmett)

Physical and Geological Setting

This section summarizes the physical and geological setting of the Clover Forcemain, shoreline conditions, previous geotechnical investigations and a summary of the findings of the geotechnical assessment conducted by the KWL team.

2.1 Physical Setting

The ground surface along the length of the Clover Forcemain alignment ranges from flat to moderately sloping. The west third of the alignment, between St. Lawrence Street and Boyd Street is gently sloping. The middle third of the alignment is moderately sloping. The eastern third of the alignment is gently to moderately sloping, with a minor undulation near Linden Avenue but a general decrease in ground surface elevation from Beacon Hill Park to the Clover Point Pump Station. The ground surface perpendicular to the forcemain is generally flat to gently sloping, and is at least 15 m from the edge of slopes leading down to the beach, except near the James Bay Seawall, near Paddon Avenue, and near Douglas Street. The James Bay seawall spans approximately 500 m from Dock Street to Lewis Street and has a height of approximately 6 m measured from the ground surface behind the wall to the ground surface in front of the wall. Existing underground utilities run underneath Dallas Road along much of the alignment. There is a higher concentration of utilities between Ogden Point and Beacon Hill Park near Douglas Street. Overhead power and communication lines also run along the south edge of Dallas Road near Ogden Point, between St. Lawrence Street and Montreal Street.

2.2 Geological Setting

The forcemain alignment is located at the southern tip of Vancouver Island along the Dallas Road shoreline. The geology of the area consist of bedrock overlain by glacial deposits and recent fill. The bedrock in this area consists of highly irregular, glacially scoured granitic and metamorphosed granitic rock. The rock is typically hard, with unconfined compressive strengths in the 50 MPa to 250 MPa range and is crossed with numerous joints and shears. The surface of the bedrock is very irregular and often steeply sloping with granular tills filling in the bedrock valleys. As the ice from the last glaciation retreated, it deposited a layer of dense gravelly, silty sand beneath the ice (lodgement till) and submerged layers of less dense gravelly, silty sand (ablation and flow till). These tills are exposed along much of the current Dallas Road bluffs, particularly between Holland Point and Clover Point. As the ice retreated, large quantities of rock flour were deposited that formed a thick layer of Victoria marine clay. This clay is typically near normally consolidated (grey clay) with a desiccated crust (brown clay) up to about 5 m thick that has resulted from glacial rebound. In some areas, anthropogenic fills and beach lag deposits overly the marine clay.

2.3 Shoreline along Dallas Road

The shoreline along Dallas Road consists of bedrock points and steep south facing bluffs of glacial deposits up to about 20 m high. The bluffs are subject to a number of processes including toe erosion from storm waves, rotational landslides, colluvial creep and sloughing, wind, groundwater discharge, spalling by frost action and human activity that lead to slope regression. Over the last 100 years or so the City of Victoria has attempted to reduce the rate of natural regression through the construction of seawalls, revetments, stairways, retaining walls, drainage improvements, bioremediation (vegetation), off shore reefs and other methods. These bluffs are a prominent feature of the Victoria landscape, requiring that the forcemain be designed and constructed such that the rate of natural regression is unaffected by the forcemain project, and at locations where the existing risk of bluff instability is too high, stabilized to protect the forcemain from the natural regression of the bluff.

2.4 Subsurface Investigation

In June and July 2017, Stantec drilled 24 test holes and installed three slope inclinometers and a nested standpipe piezometer to investigate the soil conditions along the proposed Dallas Road alignment. The geotechnical exploration program was designed to identify:

- Areas which may be underlain by shallow bedrock.
- Areas potentially underlain by significant amounts of fill placed for road widening or pedestrian walkways.
- Areas where the stability of existing slopes could be impacted.
- Required instrumentation for geotechnical monitoring during and after construction of the forcemain.

The geotechnical exploration work included drilling using percussive air rotary and solid stem auger techniques; sampling by means of split spoon and grab sampling; in-situ testing by means of standard penetration testing (SPT's) and dynamic cone penetration tests and laboratory testing, including moisture content, Atterberg Limits, particle size, fines content, pH, conductivity, and sulphate content testing. A copy of the geotechnical factual report is appended.

Stantec also conducted preliminary slope stability analyses and estimated seismic ground displacements to assist in the indicative design.

2.5 Analysis of Geological Data

After reviewing available geotechnical data, the KWL team confirmed that the forcemain can be designed, constructed and operated within the Dallas Road corridor without impacting the bluffs and without the bluffs impacting the forcemain. The assessment identified the following geotechnical considerations affecting design of the Clover Forcemain.

2.5.1 James Bay Seawall Stability

The James Bay Seawall was constructed in 1912. The seawall is about 6 m in height and is believed to consist of a cast-in-place concrete gravity wall structure that has undergone numerous upgrades and modifications over the last 100 years or so. The geological conditions along this section of the alignment consist of fill materials and wall backfill overlying thick marine clay deposits. The wall backfill appears to be mixed clay and granular backfill in a relatively loose state. The marine clay deposit is known to become firm to soft beneath the wall. The geotechnical risk to the forcemain in this area would be a collapse of the seawall due to a seismic event, tsunami, or excessive wave erosion (undermining).

In the opinion of the KWL team, there is a strong likelihood that the seawall will undergo significant deformation during the design seismic event. However, there is sufficient space within the Dallas Road corridor to shift the forcemain alignment far enough away from the seawall to protect the forcemain from the seawall.

2.5.2 Bluff Stability

Along the bluffs to the east of the James Bay Seawall, there are three locations (described below) that appear to create a potential risk to the forcemain from bluff instability due to the proximity of the forcemain to slopes with existing stability problems. Bluff instability from natural processes, such as seismic loading and erosion, could endanger the forcemain at these locations even though the forcemain will be designed and constructed to not affect bluff stability. At other bluff locations, the setback of the forcemain to the bluff is believed to be such that the risk of bluff instability to the forcemain is minimal , and this will be confirmed through the development of the detailed design.

At other bluff locations, the setback of the forcemain to the bluff is believed to be such that the risk of bluff instability to the forcemain is acceptable, and this will be confirmed through the development of the detailed design.

- ***Paddon Avenue*** - There is a long history of slope movement at the foot of Paddon Avenue. Since the 1950s, numerous attempts to improve the stability of this section of the bluffs have been carried out by the City. These include dumping fill over the edge of the slope, beach nourishment and various retaining walls at the base, mid-slope and crest of the slope. It appears that toe erosion has been reduced at this location; however, extensive cracking currently observed around the crest of the slope indicates that slope movement is still occurring.
- ***Douglas Street*** – At the foot of Douglas Street there is a small pocket beach named "Fonyo Beach" at the base of an oversteepened bluff. This beach has no significant toe protection and active erosion on the slope can be observed. The indicative design recommended that the forcemain be located at least 9 m away from the crest of the slope to reduce the risk of ground movements during a seismic event. Further setback beyond 9 m is recommended to protect against natural toe erosion and slope regression during the service life of the forcemain.
- ***Cook Street*** – At Cook Street, the bluff is near the proposed forcemain alignment and there is a concern about groundwater flowing along the pipe trench and adversely affecting the bluffs.

2.5.3 Presence of Granitic Rock at Ogden Point

An open trench in the Ogden Point area will encounter bedrock in some areas. The rock consists of hard, metamorphosed granitic rock which will require blasting for economic removal. The proximity to structures will require controlled blasting techniques and vibration monitoring. The proximity to structures will require mechanical removal or controlled blasting techniques and vibration monitoring. Additional investigation may be required in this area to better define the location and consistency of bedrock and the potential for poor quality fill..

2.5.4 Possibility of Liquefaction Near Ogden Point

The area of Ogden Point is known to contain large quantities of man-made fill materials used to construct the current cruise ship terminal area. These fills may extend to Dallas Road. The soils west of Dallas Road could be liquefiable and may require widespread ground improvement to protect the pipeline from flotation, settlement and lateral loading from liquefaction-induced lateral spreading. Along the current alignment of Dallas Road, only localized areas of ground improvement for liquefaction are envisaged.

2.5.5 Trench Water Management

The KWL team identified a need for design features that address management of water in the trench, including preventing uncontrolled flow of water in forcemain backfill. This will be addressed in detailed design.

Conclusions and Recommendations

The KWL Team developed the following geotechnical conclusions and recommendations:

1. **No impact on Dallas Road Bluffs** - The Clover Forcemain can be designed, constructed, and operated in the Dallas Road alignment without: affecting the Dallas Road Bluffs, and without natural forces affecting the forcemain.

2. **KWL will design solutions addressing concerns with the Dallas Road Bluffs** - KWL will develop design solutions for locations where the forcemain is near the bluffs to achieve the goals of protecting the bluffs and the forcemain. These design solutions will address refinement of the forcemain alignment within the right of way of Dallas Road and inclusion of features to manage the flow of water in the forcemain trench.

3. **James Bay Seawall** – Refinement in the alignment of the forcemain will avoid destabilizating the James Bay Seawall, and protect the forcemain from failure of the seawall.

4. **Investigations and analyses during detailed design** - Further investigations and analyses will be completed during detailed design to develop design details and refine the indicative design.

Next Steps

Additional geotechnical information and analyses will be completed during detailed design to develop design details protecting the forcemain, bluffs, and seawall at the following four locations:

- James Bay Seawall
- Paddon Avenueand specifications, and will be responsible for fulfilling
- Douglas Street
- Cook Street

Details of the geotechnical investigations are provided below. Once the investigations have been completed, KWL will prepare detailed design drawings and will be responsible for fulfilling the duties of Engineer of Record as defined by APEGBC.

The additional geotechnical information and analyses will be used to develop design details refining the indicative design to assure protection of the bluffs and seawall from construction and operation of the forcemain and to protect the forcemain from natural forces affecting the bluffs. As part of completing the detailed design, KWL will prepare a plan to mitigate impacts of construction on the bluffs, including post-construction monitoring for 12 months following completion of construction. KWL will monitor the construction contractor's compliance to that plan.

4.1 Additional Test Holes and Laboratory Tests

It is proposed to drill an additional test hole at each of the 4 sites using a track-mounted sonic drill rig. The sonic rig will be used to advance the test holes from the roadway to approximately 15 m to 20 m depth unless refusal is encountered at a shallower depth. Periodic Standard Penetration Tests (SPT) will be completed at selected depths to allow an estimate of the relative density of the soil.

Soil and groundwater conditions will be logged in the field by experienced geotechnical personnel, the sonic core will be photographed, and disturbed samples will be collected from the core and returned to a soils laboratory in Victoria. All soil samples will be subjected to routine moisture content and visual classification testing in the laboratory. Fines content (% passing 75 µm sieve) and Atterberg limit testing will be carried out on select representative samples.

4.2 Downhole Seismic Testing

Upon completion of drilling, downhole seismic testing (DST) will be conducted to provide an in-situ shear wave velocity (V_s) profile at each test hole location. A 63.5 mm (2.5" ID) PVC pipe will be grouted into each test hole location to facilitate insertion of the downhole seismic geophone. The geophone will take shear wave velocity measurements at 1 m intervals that will be used to estimate the small-strain shear modulus. The small-strain shear modulus is required to carry out a seismic site-specific response analysis (SSRA), which is used in the assessment of liquefaction potential and for numerical seismic deformation modelling.

4.3 Site-Specific Seismic Response Analysis, Limit Equilibrium Analysis, and Numerical Deformation Analysis

After drilling and laboratory testing is complete seismic assessments will be completed at each of the four areas of concern using both limit equilibrium and numerical analyses. The seismic assessment will be based on the 1 in 975 year return period earthquakes (design criteria) using seismic hazard values available from Natural Resources Canada. Seismic ground deformations will direct design of the forcemain.

Both the limit equilibrium and numerical analyses will require site-specific seismic response analyses (SSRAs) to be carried out. SSRAs will be completed based on the shear wave velocities obtained from the DSTs. The SSRAs will result in a more precise estimation of ground motion amplifications than using the factors provided in the B.C. Building Code (BCBC).

The limit equilibrium analysis will be used to quantify horizontal seismic displacements of the force main at its preferred alignment. This analysis will use the software program Slope/W to identify the critical slip surface that intersects the forcemain and the corresponding seismic slope yield acceleration at each area of concern. The slope stability models will follow the ground surfaces and subsurface soil profiles. The horizontal displacements will be estimated based on an empirical correlation to Newmark's method using the peak ground accelerations (pgas) determined from the SSRAs, slope yield accelerations and slope geometries.

The results from the limit equilibrium analysis will be used to prioritize the areas for numerical deformation analyses. A numerical deformation analyses will be performed. The numerical deformation analysis will be carried out using the earthquake time-histories obtained from the SSRAs. Deformation contours will be generated at each of the four sites. This will assist in design of the forcemain at each of the four areas of concern.

Appendix A

Geotechnical Factual Data Report – Stantec Consulting Ltd

Geotechnical Factual Data Report

Clover Point Forcemain

Prepared for:
Capital Regional District
625 Fisgard Street
Victoria, BC V8W 1R7

Prepared by:
Stantec Consulting Ltd.
500-4730 Kingsway
Burnaby, BC V5H 0C6

Project No.: 111700431

DRAFT

July 27, 2017

Revision	Description	Author		Quality Check		Independent Review	
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Sign-off Sheet

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The component of the report describing the geological setting (Section 2.2) was written by Sidney Tsang, P.Geo. The remainder of the report, including the description of the physical setting (Section 2.1), geotechnical investigation scope (Section 3.0) and description of laboratory testing (Section 4.0) was written by Christian Hajen, EIT, reviewed by Ben Huynh, P.Eng., and independently reviewed by (Uthaya) M. Uthayakumar, Ph.D., P.Eng.

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1 INTRODUCTION

1.1 BACKGROUND

Stantec Consulting Ltd. (Stantec) presents this Geotechnical Factual Data report in support of Capital Regional District's (CRD) Clover Point Forcemain project. The preliminary Clover Point Forcemain alignment is located along Dallas Road in Victoria, BC and will run approximately 3.3 km from the existing Clover Point pump station to Ogden Point. However, the extent of Stantec's scope is for about 3.2 km of the alignment. A site plan showing the preliminary alignment is presented on Drawing 1 in Appendix B. The design and construction of the Clover Point Pump Station, as well as an approximate 100 m long section of the forcemain west of the pump station, will be completed by others during a different stage. At Ogden Point, the forcemain crosses the entrance to Victoria Harbour via a subsea horizontal directional drill (HDD) to the new McLoughlin Point WWTP. The design and construction of HDD crossing and of the WWTP are currently underway, and is being completed by others.

This report describes the physical setting and geological setting of the project, outlines the scope of the geotechnical exploration completed by Stantec and presents the results of the borehole exploration work, in-situ testing, instrumentation, and laboratory testing.

For ease of understanding, Stantec has split the preliminary Clover Point Forcemain alignment into three zones represented by common soil characteristics and engineering properties based on published surficial geology mapping (Monahan and Levson, 2000). The three geotechnical zones are presented on Drawing 1, in Appendix B, and summarized as follows:

Zone 1 – Ogden Point (10+000 to 0+450 m)

Zone 2 – James Bay Seawall (10+450 to 10+900 m)

Zone 3 – Holland Point to near Clover Point (10+900 to 13+200 m)

1.2 PURPOSE AND SCOPE

The purpose of the geotechnical exploration was to obtain information on the subsurface conditions beneath the preliminary Clover Point forcemain alignment to characterize the soil conditions to support the indicative design. In addition, borehole locations were selected to target specific areas along the preliminary alignment where key geotechnical considerations/issues were identified by Stantec during our terrain assessment of the Dallas Road cliffs (Reference "Dallas Road Cliffs, Historic Foreshore Erosion Assessment" prepared by Stantec Consulting Ltd., dated May 30, 2017).

The types of test holes for the geotechnical exploration, as well as the locations and type of testing were selected based the following considerations:

- Areas which may be underlain by shallow bedrock;
- Areas potentially underlain by significant amounts of fill placed for road widening or pedestrian walkways; and
- Areas where the stability of existing slopes and could be impacted

The resulting execution strategy of the Clover Point Forcemain geotechnical exploration work consisted of the following:

- Geotechnical drilling using percussive air rotary (ODEX) and solid stem auger techniques, with sampling by means of split spoon, and grab sampling;
- In-situ testing by means of standard penetration testing (SPT's) and dynamic cone penetration tests (DCPT's);
- Installation of three (3) slope inclinometers;
- Installation of a nested standpipe piezometer; and,
- Laboratory testing, including moisture content, Atterberg Limits, particle size, fines content, pH, conductivity, and sulphate content testing.

1.3 PROJECT DESCRIPTION

Some portions of the preliminary Clover Point Forcemain alignment will be located within the existing Dallas Road roadway. The majority of the alignment will be located within adjacent grassy park areas, and asphalt paved parking areas and walkways along Dallas Road.

We understand that the Clover Point Forcemain will be 1350 mm diameter and that the pipe invert depth will generally range from 2.5 to 3.8 m below the existing ground surface. At select locations, including the Clover Point tie-in, the pipe will be founded deeper, with a pipe invert depth of up to 5.4 m below the existing ground surface.

The project chainage of the forcemain for this report begins at the west end of the alignment at 10+000 m near the intersection of Dallas Road with St. Lawrence Street, and terminates at approximately 13+220 m near Clover Point at the east end of the alignment. The chainage notation is opposite to the forcemain's flow direction, which runs from east to west. For the purpose of this report, the alignment will be described from west to east, in accordance with the chainage notation.

2.0 SITE DESCRIPTION

2.1 PHYSICAL SETTING

The ground surface along the length of the preliminary alignment ranges from flat to moderately sloping. The west third of the alignment, between St. Lawrence Street (chainage 10+000 m) and Boyd Street (chainage 10+800 m) is gently sloping, increasing in elevation from 4 m near St. Lawrence Street, to 7 m near Boyd Street along an 800 m lineal span.

The middle third of the alignment is moderately sloping, with a general increase in ground surface elevation from 7 m near Boyd Street, to 23 m in front of Beacon Hill Park (chainage 11+960) along a 1160 m lineal span.

The eastern third of the alignment is gently to moderately sloping, with a minor undulation near Linden Avenue but a general decrease in ground surface elevation from 23 m in front of Beacon Hill Park, to 13 m near the proposed Clover Point Pump Station (chainage 13+200 m) along a 1240 m lineal span.

The slope of the ground surface orthogonal to the preliminary forcemain alignment is generally flat to gently sloping, and is at least 15 m from the edge of slopes leading down to the beach, except for three spans: near the James Bay seawall, near Paddon Avenue and near Douglas Street. The James Bay seawall spans approximately 500 m from Dock Street to Lewis Street and has a height of approximately 6 m measured from the ground surface behind the wall to the ground surface in front of the wall. Based on the preliminary alignment, the forcemain would be located approximately 3.7 m behind the edge of the seawall. At Paddon Avenue and Douglas Street, the preliminary alignment would position the forcemain a distance of approximately 5 m from the edge of a slope which leads down to the beach at a slope of approximately 30 to 35 degrees, and 35 to 40 degrees, respectively.

Existing underground utilities run underneath and/or across Dallas Road along much of the preliminary forcemain alignment, but with a higher concentration of utilities between Ogden Point and Beacon Hill Park near Douglas Street. Overhead power and communication lines also run along the south edge of Dallas Road near Ogden Point, between St. Lawrence Street and Montreal Street.

2.2 GEOLOGICAL SETTING

2.2.1 Setting and Bedrock Geology

The preliminary forcemain alignment is located within the Nanaimo Lowland physiographic subdivision, a strip of low-lying country, extending along the northeast, east and southwest coasts of Vancouver Island from Sayward to Jordan River, west of Victoria (Holland 1976).

The bedrock underlying the preliminary forcemain alignment is Jurassic-age Westcoast Crystalline Complex comprising quartz diorite, tonalite, horneblende-plagioclase gneiss, quartz-feldspar gneiss, amphibolite, diorite, agmatite, gabbro, marble and metasediments, including the Wark-Colquitz Complex (Clapp 1913, Cui 2015). Bedrock outcrops along the shoreline between Finlayson Point to Holland Park. Fault-zone mylonites in the Jurassic-age gneiss have been identified on the west side of Clover Point (Johnston et al. 2013). The active Leech River Fault Zone is located approximately 5 km west of Ogden Point (Morell et al. 2017) and the Devil's Mountain Fault Zone lies approximately 2.5 km south and offshore of the Clover Point Forcemain (Barrie and Greene 2015).

2.2.2 Quaternary History

During the last major glaciation (25,000-10,000 ybp) glaciers formed in the Vancouver Island Mountains and Coast Mountains and advanced down the Strait of Georgia to southeastern Vancouver Island after 19,000 ybp. During the glacial maximum (~15,000 ybp) southern Vancouver Island was completely covered by an ice sheet that flowed south-southwesterly across Juan de Fuca Strait and deposited Cordilleran till (Alley and Chatwin 1979). As the climate began to ameliorate, deglaciation was by downwasting and southern Vancouver Island was ice-free by 12,500 ybp (Clague 1981). During this period, the coastline was depressed due to glacio-isostatic effects such that marine waters invaded lowland areas below 75 meters elevation and glaciomarine sediments were deposited (Mathews et al. 1970). However, present sea level was attained as early as 11,700 ybp at Victoria (Clague 1981).

2.2.3 Surficial Geology

Regional (1:25,000) scale surficial geology mapping of the Victoria area provides an overview of surficial materials underlying the preliminary forcemain alignment (Monahan and Levson 2000). The alignment is underlain by areas of thin soil, with bedrock near or at the surface, interspersed with deposits of Victoria Clay. Victoria Clay is a glaciomarine sediment deposited when the coastline was depressed, at the end of the last glaciation. Four distinct units were mapped underlying the preliminary forcemain alignment. These units are summarized in **Table 1**; unit descriptions are from Geoscience Map 2000-2 (Monahan and Levson 2000).

Table 1 Surficial Geology Units along the Preliminary Forcemain Alignment

Unit	Description	Project Chainage[1]
UNIT C1	VICTORIA CLAY - INTERMEDIATE BETWEEN UNITS R2 AND C2, INCLUDING UNDIFFERENTIATED AREAS This unit mainly includes areas where soil profiles typical of units R2 and C2 occur together on a scale that is not mappable with the data available. This unit also includes areas where there is greater than 5 metres of Victoria clay, but where the thickness of the lower grey clay facies is less than 3 metres.	Sta. 10+000 to Sta. 10+150
UNIT R2	AREAS WITH BEDROCK AT OR NEAR THE SURFACE - THIN SOIL COVER WITH SCATTERED BEDROCK OUTCROP Generally consists of shallow soils over bedrock. In much of Greater Victoria, this unit includes areas with less than 5 metres of Victoria Clay, mainly the brown clay facies, overlying thin older Pleistocene deposits or bedrock. Scattered outcrops occur throughout the unit, and bedrock is commonly found in the upper five metres (e.g. in utility line excavations). The thickness of older Pleistocene deposits in most places is less than a few metres, but may locally be up to 10 metres.	Sta. 10+150 to Sta. 10+500
	- UNIT R2a consists of those areas of unit R2 where thicknesses of older Pleistocene deposits between 5 and 10 metres can be mapped.	Sta. 10+800 to Sta. 11+350 Sta. 11+450 to Sta. 11+800 Sta. 12+200 to Sta. 12+600
UNIT C2	VICTORIA CLAY – THICK SOFT CLAY Areas with more than 3 metres of the grey clay facies of the Victoria clay. The thickness of the grey clay facies is commonly greater than 10 metres and locally exceeds 20 metres. In this unit, the grey clay facies is overlain by the brown clay facies, which is generally 2 to 5 metres thick. The thickness of older Pleistocene deposits underlying the Victoria clay is generally less than a few metres, but may be greater adjacent to drumlinoid ridges. The unit occupies low-lying and gently sloping ground, and where borehole data are not available, this unit is assigned to such areas below 60 metres elevation.	Sta. 10+500 to Sta. 10+800 Sta. 11+350 to Sta. 11+450 Sta. 11+800 to Sta. 12+200 Sta. 12+600 to Sta. 12+750
UNIT C3	VICTORIA CLAY – THIN CLAY OVER THICK OLDER PLEISTOCENE DEPOSITS Occurs in areas with less than 5 metres of Victoria clay overlying older Pleistocene deposits greater than 10 metres thick. It generally occurs on the upper flanks of drumlinoid ridges	Sta. 12+750 to Sta. 13+200

NOTES:

(1) For project chainage, refer to Drawings 2-1 to 2-9 in Appendix B

3.0 GEOTECHNICAL SUBSURFACE EXPLORATION

3.1 SUMMARY

Stantec carried out a geotechnical subsurface exploration for the Clover Point Forcemain between June 19 and July 4, 2017 in order to support indicative design for the routing and installation of the forcemain.

The scope of the geotechnical exploration work consisted of the following:

- Seven (7) percussive air rotary (ODEX) boreholes;
- Seventeen (17) solid-stem auger boreholes;
- Three (3) slope inclinometer casing installations;
- One (1) nested standpipe piezometer installation

Test hole coordinates were recorded with a handheld Global Positioning System (GPS) device with an accuracy of approximately +/-3 m, with additional measurements taken in the field referenced to fixed landmarks (roadway intersections, curb returns, etc.). Upon plotting the GPS coordinates onto the drawings, if substantial error was noted when compared with the additional measurements to the fixed landmarks, the test hole location was adjusted on the drawing in accordance with the additional field measurements. Test hole elevations were approximated using LiDAR elevation contours provided by the CRD, as well as a topographic survey of the preliminary forcemain alignment sub-contracted by Stantec to McElhanney Surveys. Contour lines are shown on plan drawings included in Appendix B.

Soil samples were collected from boreholes by means of grab sampling and/or split spoon sampling. Standard Penetration Tests (SPTs) or Dynamic Cone Penetration Tests were completed in the ODEX and solid-stem auger boreholes.

The auger and ODEX drilling was performed using a Mobile B54, truck-mounted drill rig. The drill rig and associated support vehicles, equipment and tooling (including the 200 psi, 300 ft^3/min ODEX air compressor) are owned and operated by Geotech Drilling Services Ltd. (Geotech Drilling), located in Delta, BC.

Full-time review of the subsurface exploration work was carried out by a Stantec geotechnical field engineer, who classified the soils encountered, recorded borehole coordinates and SPT/DCPT blow counts, and collected representative soil samples. The soil samples were returned to the Stantec geotechnical laboratory in Burnaby, BC for classification and index testing.

3.2 GEOTECHNICAL DRILLING EXPLORATION

Descriptions of the percussive air rotary (ODEX) and solid stem auger drilling methodologies used for the boreholes are provided in the following sub-sections.

Detailed borehole logs describing the soil and groundwater conditions encountered, and results of the laboratory classification and index testing are included in Appendix C.

Soil descriptions presented on the borehole logs are based on the grab samples and split spoon samples collected at discrete intervals and are in general accordance with ASTM D2487 and D2488 for the Unified Soil Classification System (USCS) and the information presented on the "Symbols and Terms Used in Borehole and Test Pit Records" in Appendix C. Where the quantity of a soil type is sufficiently small, less than 5% and 15% for fine grained (passing the No. 200 sieve) and coarse grained (retained on the No. 200 sieve) soils, respectively, it is not reported on the borehole logs, in accordance with the USCS classification method.

3.2.1 Percussive Air Rotary (ODEX) Drilling

Seven (7) percussive, downhole hammer air rotary (ODEX) boreholes were completed using 125 mm diameter steel casing. **Table 2** presents a summary of the ODEX boreholes, and includes borehole coordinates, elevations, depths, and methods for sampling and in-situ testing.

In the ODEX drilling method, an eccentric, convex drill bit covered with carbide buttons penetrates overburden and rock formations via a reciprocating, jackhammer-like action. The downhole hammer is pneumatically driven via a constant stream of air, which also lifts drill cuttings away from the drill bit and up the casing to the surface.

In general, the ODEX drilling method was used to drill select deep boreholes near Paddon Avenue and Douglas Street for slope stability analyses and for permanent casing installations (i.e., slope inclinometers and standpipe piezometer). The ability to penetrate through very dense granular material (including cobbles and boulders) to target depth (into glacial till or into the underlying bedrock) allowed successful completion of boreholes BH17-12a to BH17-14, BH17-16 and BH17-24.

Sampling of both coarse-grained soils (i.e., sands and gravels) and fine-grained soils (i.e., silts and clays) in the ODEX boreholes was completed with split spoons and occasionally via grab sampling from drill cuttings collected from the air return. Samples were placed in plastic bags and transported to the Stantec laboratory in Burnaby, BC for further classification and index testing. SPT blow counts were recorded during split-spoon sampling. Further details regarding the SPTs are provided in Section 3.3.1.

Table 2 Summary of ODEX Boreholes

Borehole ID	Project Chainage(1)	UTM Coordinates		Ground Elevation, Geodetic	Drilled Depth	Sampling Methods	In-Situ Testing	Installs
		Northing	Easting					
BH17-03	10+188	5362737	471502	6.0 m	3.7 m	Grab Sampling	None	None
BH17-04	10+380	5362561	471561	6.0 m	3.4 m	Split Spoon, Grab Sampling	SPT	None
BH17-12a	11+559	5361845	472488	17.1 m	10.9 m	Split Spoon, Grab Sampling	SPT	Slope Inclino-meter
BH17-13	11+739	5361781	472659	20.3 m	17.7 m	Split Spoon, Grab Sampling	SPT	None
BH17-14	11+760	5361793	472676	21.2 m	19.7 m	Split Spoon, Grab Sampling	SPT	Slope Inclino-meter
BH17-16	11+792	5361800	472707	22.0 m	26.9 m	Split Spoon, Grab Sampling	SPT	Slope Inclino-meter
BH17-24	11+794	5361802	472709	22.0 m	22.9 m	Grab Sampling	DCPT	Stantpipe piezo-meter

NOTES:
(1) For project chainage, refer to Drawings 2-1 to 2-9 in Appendix B

Boreholes BH17-03 and BH17-04 were originally planned as auger boreholes, but upon attempting to drill at these locations, it was discovered that a layer of concrete underlay the surficial asphalt and impeded the auger from advancing. Accordingly, the ODEX method was used to drill through the concrete and complete these two shallow boreholes.

Borehole BH17-24 was not originally planned, but was added to supplement the subsurface information near the intersection of Dallas Rd with Douglas Street via additional sampling and SPT testing, and the installation of a standpipe piezometer.

Boreholes BH17-12a, BH17-13, BH17-14, BH17-16 and BH17-24 were advanced through overburden soils and into bedrock as planned.

Due to the installation of slope inclinometer casings in boreholes BH17-12a, BH17-14 and BH17-16, a combination of cement-bentonite grout and silica sand was used to backfill these holes, which were each capped with a steel casing cover concreted to match the surrounding grade. Similarly, the standpipe piezometer at BH17-24 was backfilled using a combination of bentonite chips and silica sand, and also capped with a steel casing cover concreted to match the surrounding grade. Boreholes BH17-03, BH17-04 and BH17-13 were backfilled using a combination of drill cuttings and silica sand. Bentonite seals were placed in compliance with the BC *Groundwater Protection Regulation* at the bottom of each borehole, at 6 m intervals, and below the surficial concrete plug.

3.2.2 Auger Drilling

Seventeen (17) auger boreholes were advanced using 140 mm diameter solid-stem, continuous flight auger drill rods. **Table 3** presents a summary of the auger boreholes, and includes borehole coordinates, elevations, depths, and methods for sampling and in-situ testing.

The solid stem drilling method was used to drill the majority of the boreholes along the preliminary Clover Point Forcemain alignment. In general, auger boreholes were advanced to a depth of 4.6 m (15 ft.) or practical refusal, to evaluate the soil conditions in the vicinity of the forcemain invert. At the James Bay seawall, the auger boreholes were advanced to depths of up to 7.6 m (25 ft.) in order to determine the composition of the native soil at the approximate subgrade level immediately below the inferred foundation depth of the concrete retaining wall.

Sampling of soils from the auger boreholes was completed mostly by collection of grab samples, with occasional split spoon sampling. Grab samples and split spoon samples were placed in plastic bags and transported to the Stantec laboratory for further classification and index testing. SPT and DCPT blow counts were recorded on borehole logs and used to characterize the compactness or consistency of the soils. Further details regarding the SPTs and DCPTs are provided in Sections 3.3.1 and 3.3.2.

Table 3 Summary of Solid Stem Auger Boreholes

Borehole ID	Project Chainage(1)	UTM Coordinates		Ground Elevation, Geodetic	Drilled Depth	Sampling Methods	In-Situ Testing
		Northing	Easting				
BH17-01	10+053	5362877	471488	4.0 m	5.2 m	Split Spoon, Grab Sampling	SPT
BH17-02	10+138	5362786	471492	4.4 m	4.6 m	Grab Sampling	DCPT
BH17-05	10+496	5362476	471639	4.6 m	7.6 m	Grab Sampling	DCPT
BH17-06	10+576	5362419	471696	4.5 m	7.6 m	Grab Sampling	DCPT
BH17-07	10+666	5362363	471767	6.1 m	5.3 m	Grab Sampling	DCPT
BH17-08	10+851	5362254	471916	7.0 m	8.5 m	Grab Sampling	DCPT
BH17-09	11+020	5362155	472052	11.0 m	4.6 m	Grab Sampling	DCPT
BH17-10	11+222	5362037	472216	14.0 m	4.3 m	Grab Sampling	DCPT
BH17-11	11+388	5361943	472348	16.1 m	None (DCPT only)	None	DCPT
BH17-12b	11+564	5361842	472490	16.6 m	5.5 m (DCPT to 7.0 m)	None	DCPT
BH17-15	11+765	5361817	472672	21.9 m	1.2 m	Grab Sampling	DCPT
BH17-17	12+022	5361783	472927	22.1 m	6.7 m	Split Spoon, Grab Sampling	SPT
BH17-18	12+291	5361734	473184	18.5 m	4.6 m	Grab Sampling	None
BH17-19	12+517	5361680	473396	14.4 m	1.5 m	Grab Sampling	None
BH17-20	12+793	5361664	473665	14.1 m	4.1 m	Grab Sampling	DCPT
BH17-21	13+004	5361578	473856	14.7 m	4.6 m	Grab Sampling	DCPT
BH17-22	13+287	5361455	474106	12.3 m	4.6 m	Grab Sampling	DCPT
BH17-23	11+507	5361876	472449	16.4 m	7.2 m	Grab Sampling	DCPT

NOTES:
(1) For project chainage, refer to Drawings 2-1 to 2-9 in Appendix B

All auger boreholes were completed to their targeted depth with the exception of boreholes BH17-07, BH17-10, BH17-11, BH17-15 and BH17-19. Boreholes BH17-07, BH17-10, BH17-15 and BH17-19 were terminated prior to reaching the target depth due to auger refusal on dense granular soils, hard clay soils, cobbles or bedrock. Drilling of borehole BH17-11 was abandoned due to mechanical breakdown of the auger drill head following a successful DCPT test to target depth at this location.

Borehole BH17-23 was not originally planned, but was added in order to further evaluate the fill thickness near the intersection of Dallas Road with Paddon Avenue. Borehole BH17-12b was also not originally planned, but was added to obtain DCPT blow counts in the native soils adjacent to borehole BH17-12a.

The auger boreholes were backfilled with drill cuttings, and bentonite seals were placed in compliance with the BC *Groundwater Protection Regulation*. Boreholes completed within the existing roadways, sidewalks or parking stalls were reinstated with a concrete patch.

3.3 IN-SITU TESTING

3.3.1 Standard Penetration Testing

SPTs were performed using 50.8 mm outside diameter, un-lined split spoon samplers driven with automatic safety hammers and in general accordance with ASTM D1586. Specifically, the SPTs involved driving the split spoon sampler connected by AWJ-rods with 63.5 kg hammers, falling from a height of 760 mm. Blow counts were recorded over four 150 mm intervals during the testing. The SPT blow counts are the cumulative blows for the second and third 150 mm penetration (total 300 mm or less than 300 mm in cases of refusal for further penetration) are reported on the borehole logs in Appendix C. Split spoon samples were placed in plastic bags and transported to the Stantec laboratory for further visual classification and index testing.

SPTs were generally performed on ODEX boreholes except for the tests in two auger boreholes. The steel drill casing of the ODEX boreholes remained in the ground during the SPT testing. The two auger boreholes in which SPT testing were carried out (BH17-01 and BH17-17) remained clean and open during the test.

3.3.2 Dynamic Cone Penetration Testing

DCPTs were performed using the same automatic safety hammer for SPTs to drive a conical tip at the end of the AWJ-rod string in lieu of an open soil sampler. Unlike SPTs, a soil sample is not retrieved. Instead, the DCPT is driven until either target depth or practical refusal is encountered, thereby generating an approximate, near-continuous profile of the soil compactness/consistency. The cone has a 30 mm diameter blunt tip and tappers at 45 degrees to 60 mm diameter, followed by a sleeve length of 150 mm.

Blow counts for the DCPT were recorded in 150 mm intervals and reported in the borehole logs in terms of total blows per 300 mm penetration.

DCPTs were generally performed starting from the upper 1.5 m in the auger borehole locations prior to drilling.

3.4 INSTRUMENTATION

3.4.1 Slope Inclinometers

A total of three (3) slope inclinometers were installed at select locations along the preliminary forcemain alignment. The slope inclinometer locations were selected in areas which were considered to be in close proximity of the adjacent slopes. One (1) slope inclinometer was installed near Paddon Avenue in borehole BH17-12a, and two (2) slope inclinometers were installed near Douglas Street in boreholes BH17-14 and BH17-16. The purpose of the slope inclinometers is to establish infrastructure that will allow for the monitoring of potentially deep seated slope movements of the cliffs during and after the construction of the forcemain.

The slope inclinometer installation consisted of boring through surficial fills and overburden soils, and advancing into the underlying bedrock. The 70 mm (2.75 inch) outer diameter ABS plastic snap seal inclinometer casing was then installed within the steel drill casing. As the steel drill casing was extracted, the annulus between the slope inclinometer casing and the borehole sidewalls was backfilled with a cement-bentonite grout.

The casings for the slope inclinometers were extended into the bedrock, as presented in **Table 4**, in order to allow for reference points for lateral movements above the bedrock surface.

Table 4 Summary of Slope Inclinometers

Slope Inclinometer ID	Project Chainage(1)	UTM Coordinates		Ground Elevation, Geodetic	Top of Bedrock Elevation, Geodetic	Slope Inclino-meter Depth
		Northing	Easting			
SI17-12	11+559	5361845	472488	17.1 m	8.6 m	10.0 m
SI17-14	11+760	5361793	472676	21.2 m	4.0 m	19.0 m
SI17-16	11+792	5361800	472707	22.0 m	-2.4 m	26.0 m

NOTES:
(1) For project chainage, refer to Drawings 2-1 to 2-9 in Appendix B

The slope inclinometer casings are monitored using a Digital Inclinometer monitoring system, model IC3205, supplied by RST Instruments Ltd., Maple Ridge, BC. The RST Digital Inclinometer monitoring system consists of an inclinometer probe, a graduated cable system, and a portable readout and data storage device. For monitoring, the probe is first inserted to the bottom of the inclinometer casings, then slowly drawn upwards, with measurements taken at 0.5 m intervals. The first survey establishes the baseline readings for the casing, with subsequent monitoring intervals compared to the baseline monitoring event to reveal changes in the lateral profile if movement occurs. Readings are recorded and stored in a handheld PC and subsequently downloaded into computer software for processing. Subsequent monitoring of the inclinometers shows movement in the A-Axis (parallel to the slope face) and the B-Axis (perpendicular to the slope face).

The data from the field is collected containing the field readings for A0 (A+, or downslope), A180 (A-, or upslope), B0 (B+) and B180 (B-) by depth. The data is imported into a database and the displacement at each discrete reading depth is calculated by taking the difference between the latest reading and the base-line reading. The displacement is then summed along the length of the pipe to create a cumulative displacement graph for both the “A” and “B” axes. If lateral movement was observed below the known bedrock level, a bias correction is applied to the data.

Baseline slope inclinometer readings were collected from the three slope inclinometer casings in the days following their installation. Additional readings are required to determine the degree of movement at each borehole location. As previously noted, borehole coordinates- including those for the three slope inclinometers- were recorded in the field using a handheld GPS. We are currently awaiting surveyed coordinates of the slope inclinometer casing covers, which will be collected by a BC Land Surveyor. Additional survey readings should be collected in conjunction with each subsequent slope inclinometer reading during construction and should be the responsibility of the contractor.

3.5 STANDPIPE PIEZOMETER

At borehole BH17-24, a standpipe piezometer consisting of two nested 25 mm diameter PVC pipe casings were installed to enable groundwater level readings.

Installation details for the standpipe piezometer are presented in **Table 5** below.

Table 5 Summary of Standpipe Piezometer Installation

Standpipe Piezometer ID	Project Chainage[1]	UTM Coordinates		Ground Elevation, Geodetic	Depth of screen	Backfill Details	Water Level (meters below ground surface)		
		Northing	Easting				June 29, 2017	July 4, 2017	July 18, 2017
MW17-24_1	11+794	5361802	472709	22.0 m	Solid: 0.0 - 17.7 m Screen: 17.7 - 22.2 m	Casing: 0.0 - 0.3 m Sand: 0.3 - 4.6 m Bentonite: 4.6 - 6.1 m Sand: 6.1 - 11.0 m Bentonite: 11.0 - 13.7 m Sand: 13.7 - 22.9 m	13.1	13.1	13.9
MW17-24_2					Solid: 0.0 - 7.6 m Screen: 7.6 - 10.7 m		dry	dry	dry

NOTES:
[1] For project chainage, refer to Drawings 2-1 to 2-9 in Appendix B

Water level readings were recorded on June 29, July 4 and July 18, 2017, or three, eight and 22 days, respectively, after the completion of the well installation. The readings indicate an equilibrium water level of 13.9 m below the existing ground surface.

4.0 LABORATORY TESTING

4.1 SUMMARY

Laboratory testing was conducted on split spoon samples and grab samples obtained during the geotechnical subsurface exploration work. A summary of the laboratory testing is presented in **Table 6**.

Natural moisture content, Atterberg limits, particle size analyses tests and fines content measurements were performed at the Stantec laboratory in Burnaby, BC. Testing of pH, conductivity and sulphate content were carried at the Maxxam Analytics laboratory in Burnaby, BC.

Table 6 Summary of Laboratory Testing

Laboratory Test	Number of Test Completed
Natural Moisture Content	130
Atterberg Limits	13
Particle Size Distribution	11
Fines Content Measurement (Particles less than 0.075 mm in size, passing sieve No. 200)	38
pH Testing	6
Electrical Conductivity Testing	6
Soluble Sulphate Testing	6

4.2 LABORATORY TESTING PROCEDURES

4.2.1 Natural Moisture Content

The Natural Moisture Content (w) of soil is defined as the ratio of the mass of water contained in the pore spaces of the soil to the mass of solids in the soil, expressed as a percentage. Measurement of moisture content was performed in general accordance with ASTM D2216. Natural moisture content measurements are presented on the borehole logs in Appendix C.

4.2.2 Atterberg Limits

Atterberg limits describe the consistency and plasticity of fine-grained soils with varying degrees of moisture. Atterberg limits tests are used to determine the moisture contents at which soil behavior becomes liquid or brittle. The Liquid Limit (LL) represents the moisture content at which the soil begins to flow like a liquid, and the Plastic Limit (PL) represents the moisture content at which it ceases to be plastic and becomes brittle. Subtracting the plastic limit from the liquid limit yields the Plasticity Index (PI). The PI defines the typical range of moisture contents for a soil.

The Atterberg limits were measured using the multi-point method (Method A), described in ASTM D4318. The PI is defined as follows:

$$PI = LL - PL$$

The Liquidity Index (LI) is defined as follows:

$$LI = (w - PL)/ PI$$

Where "w" is the natural moisture content of the soil sample.

Atterberg limits test results are presented in Appendix D.1 and on the borehole logs in Appendix C.

4.2.3 Particle Size Distribution and Fines Content

Tests for particle size distribution were performed in general accordance with ASTM D421 and ASTM D422. In some cases, only the amount of material in the soil samples finer than 0.075 mm nominal diameter was measured. In these cases, testing was completed in general accordance with ASTM D1140 (Method A). Particle size distribution test results are presented in Appendix D.2, and summary of particle size and fines content test results are presented on the borehole logs in Appendix C.

4.2.4 pH, Conductivity and Sulphate Content

Testing of pH, conductivity and sulphate content for selected soil samples was completed at the Maxxam Analytics laboratory in Burnaby, BC, in general accordance with SM 22 4500-H+B, SM 22 2510 B, and SM 22 4500-SO42- E m respectively. The results are presented in Appendix D.3.

5.0 CLOSURE

This report was prepared for the exclusive use of the CRD and its agents for specific application to the Clover Point Forcemain Indicative Design Project. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Stantec.

Use of this report is subject to the Statement of General Conditions included in Appendix A. It is the responsibility of the Capital Regional District, who is identified as "the Client" within the Statement of General Conditions, and their agents to review the conditions and notify Stantec should any of them not be satisfied.

We trust that this report meets your present requirements. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

STANTEC CONSULTING LTD.

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Appendix A STATEMENT OF GENERAL CONDITIONS

Stantec

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

Appendix B DRAWINGS

LEGEND

- PROPOSED FORCEMAIN
- LOTLINE
- MAJOR CONTOUR (10 m)
- MINOR CONTOUR (2 m)
- BOREHOLE LOCATION

SCALE IN METRES

0 100 200 300 400 500

1:7500

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Sources

Project Information

Project No.:	111700431
Scale:	1:7500
Date:	2017-JUL-11
Drawn by:	G. HUYNH
Checked by:	C. HAJEN

Project Location

DALLAS ROAD
VICTORIA, BC

Client/Project

CAPITAL REGIONAL DISTRICT

CLOVER POINT FORCEMAIN
GEOTECHNICAL ASSESSMENT

TITLE

BOREHOLE LOCATION PLAN OVERVIEW

Dwg No.

1

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CLOVER POINT FORCEMAIN
GEOTECHNICAL ASSESSMENT

TITLE

BOREHOLE LOCATION PLAN
SHEET 1

Dwg No.

2-1

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GEOTECHNICAL ASSESSMENT

TITLE

BOREHOLE LOCATION PLAN SHEET 2

Dwg No.

2-2

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LEGEND

- PROPOSED FORCEMAIN
- LOTLINE
- MAJOR CONTOUR (5 m)
- MINOR CONTOUR (1 m)
- BOREHOLE LOCATION

SCALE IN METRES
0 10 20 30 40 50
1:1000

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GEOTECHNICAL ASSESSMENT

TITLE
BOREHOLE LOCATION PLAN
SHEET 3

Dwg No.
2-3

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BOREHOLE LOCATION PLAN
SHEET 4

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GEOTECHNICAL ASSESSMENT

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BOREHOLE LOCATION PLAN
SHEET 5

Dwg No.
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TITLE
BOREHOLE LOCATION PLAN
SHEET 6

Dwg No.
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GEOTECHNICAL ASSESSMENT

TITLE
BOREHOLE LOCATION PLAN
SHEET 7

Dwg No.
2-7

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GEOTECHNICAL ASSESSMENT

TITLE
BOREHOLE LOCATION PLAN
SHEET 8

Dwg No.
2-8

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CLOVER POINT FORCEMAIN
GEOTECHNICAL ASSESSMENT

TITLE
BOREHOLE LOCATION PLAN
SHEET 9

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2-9

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Appendix C BOREHOLE LOGS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate
	kips/sq.ft.	kPa	SPT N-Value
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel	Sand	Silt	Clay	Organics	Asphalt	Concrete	Fill	Igneous Bedrock	Meta-morphic Bedrock	Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PT	Piston tube sample
GS	Grab sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

▼ measured in standpipe, piezometer, or well

▽ inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_U	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE RECORD

BH17-01

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5362877
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 4.0 m
EASTING: 471488
DRILLING DATE: 06/29/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)
0	AS	ASPHALT					
	FL	FILL: grey well-graded gravel with sand		GS	1	5	
	FL	FILL: dark brown midden with high organic content - traces of sand and gravel - occasional seashell fragments					
1		- fines at 1.2 m= 19.0%		GS	2	22	
				SPT	3	16	8
2	ML	Grey SILT (ML) with sand - mottled with brown - fines at 2.0 m= 62%					
	CL	Grey lean CLAY (CL) - traces of sand and gravel - mottled with light grey and brown		GS	4	20	
3				SPT	5	18	20
4		- lower drilling resistance below 3.8 m		GS	6	21	
5				SPT	7	35	5
		End of Borehole BH17-01 at 5.2 m Target depth reached Groundwater not encountered in open borehole					
6							

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

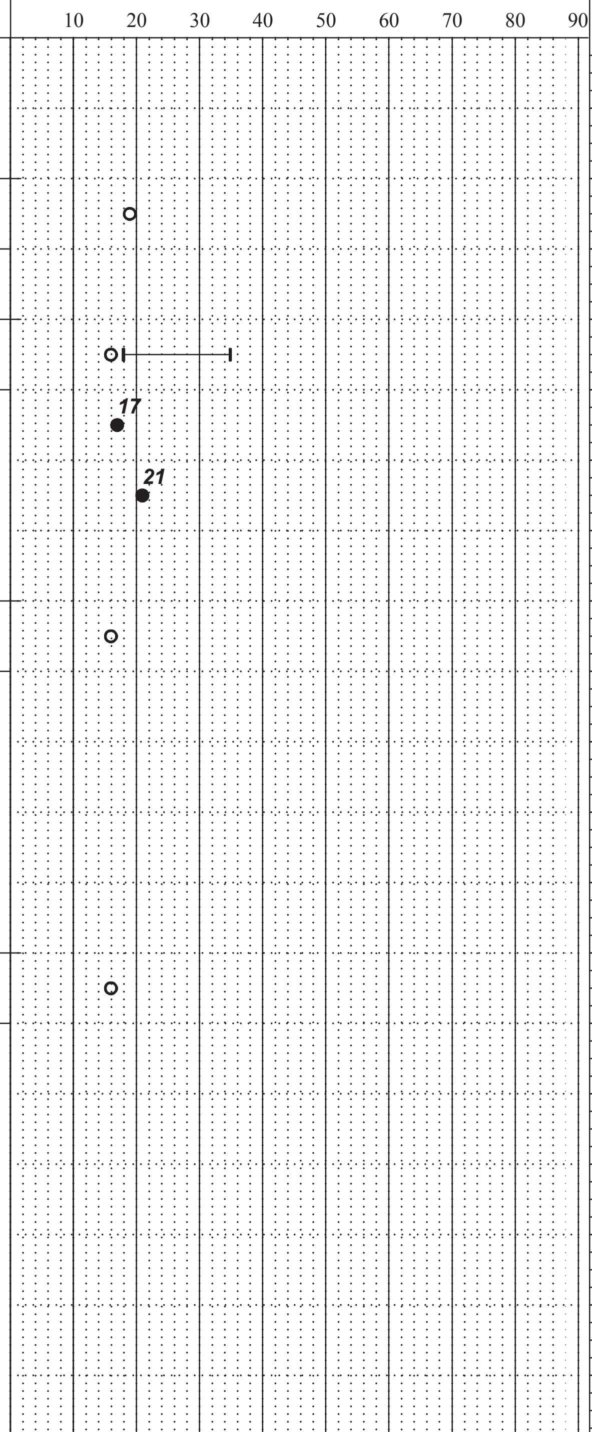
BH17-02

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362786	LOCATION	Dallas Road, Victoria, BC
ELEVATION	4.4 m	EASTING	471492
DRILLING DATE	06/28/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: MOISTURE CONTENT (%)	DEPTH (ft)
0	AS	ASPHALT					0
	CO	CONCRETE					
	FL	FILL: grey and brown mottled lean clay with sand - traces of gravel and organics - crumbly		GS	1	19	2
1	CL	Grey and brown mottled lean CLAY (CL) with sand - traces of gravel		GS	2	16	4
2		- with sand and gravel from 2.1 m to 2.7 m					6
		- traces of sand and no gravel below 2.7 m		GS	3	16	8
3							10
4				GS	4	16	12, 14
5		End of Borehole BH17-02 at 4.6 m Target depth reached Groundwater not encountered in open borehole DCPT conducted from 1.5 m to 2.1 m					16
6							18, 20

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-03

CLIENT Capital Regional District
PROJECT No. 111700431
PROJECT Clover Point Forcemain
DATUM Geodetic
NORTHING 5362737
LOCATION Dallas Road, Victoria, BC
ELEVATION 6.0 m
EASTING 471502
DRILLING DATE 06/28/2017
DRILLING CO. Geotech Drilling Ltd.
DRILLING METHOD ODEX

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0	AS		ASPHALT					0
	CO		CONCRETE					
	FL		FILL: grey well-graded gravel with sand					
	BR		Dark grey BEDROCK - advanced using ODEX hammer - angular and/or powdered cuttings observed from air return - high drilling resistance					2, 4
					GS	1		6
2								8
3					GS	2		10
			End of Borehole BH17-03 at 3.7 m Termination upon confirmation of bedrock Groundwater not encountered in open borehole					12
4, 5, 6								14, 16, 18, 20

Legend: ☐ Insitu Shear Vane (kPa); △ Pocket Penetrometer (kPa); ▣ Remoulded Shear Vane (kPa); ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-04

CLIENT: Capital Regional District — PROJECT No.: 111700431
PROJECT: Clover Point Forcemain — DATUM: Geodetic — NORTHING: 5362561
LOCATION: Dallas Road, Victoria, BC — ELEVATION: 6.0 m — EASTING: 471561
DRILLING DATE: 06/28/2017 — DRILLING CO.: Geotech Drilling Ltd. — DRILLING METHOD: ODEX

Legend: ☐ Insitu Shear Vane (kPa); ◘ Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa); 50kPa, 100kPa, 150kPa, 200kPa
W_P W W_L Moisture Content & Atterberg Limits; ● Standard Penetration Test (blows/0.3 m)
Scale: 10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
0	AS	ASPHALT						0
	CO	CONCRETE						
	FL	FILL: brown sandy silt with gravel and organics		GS	1	18		
	FL	FILL: grey well-graded sand		GS	2	8		2
1	FL	FILL: grey well-graded gravel with sand		SPT	3		28	4
2	BR	Dark grey BEDROCK - advanced through bedrock using ODEX hammer - angular and/or powdered cuttings observed from air return - high drilling resistance		GS	4			6, 8, 10
3		End of Borehole BH17-04 at 3.4 m Termination upon confirmation of bedrock Groundwater not encountered in open borehole						12, 14, 16, 18, 20

Depth (m) scale: 0, 1, 2, 3, 4, 5, 6. Depth (ft) scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

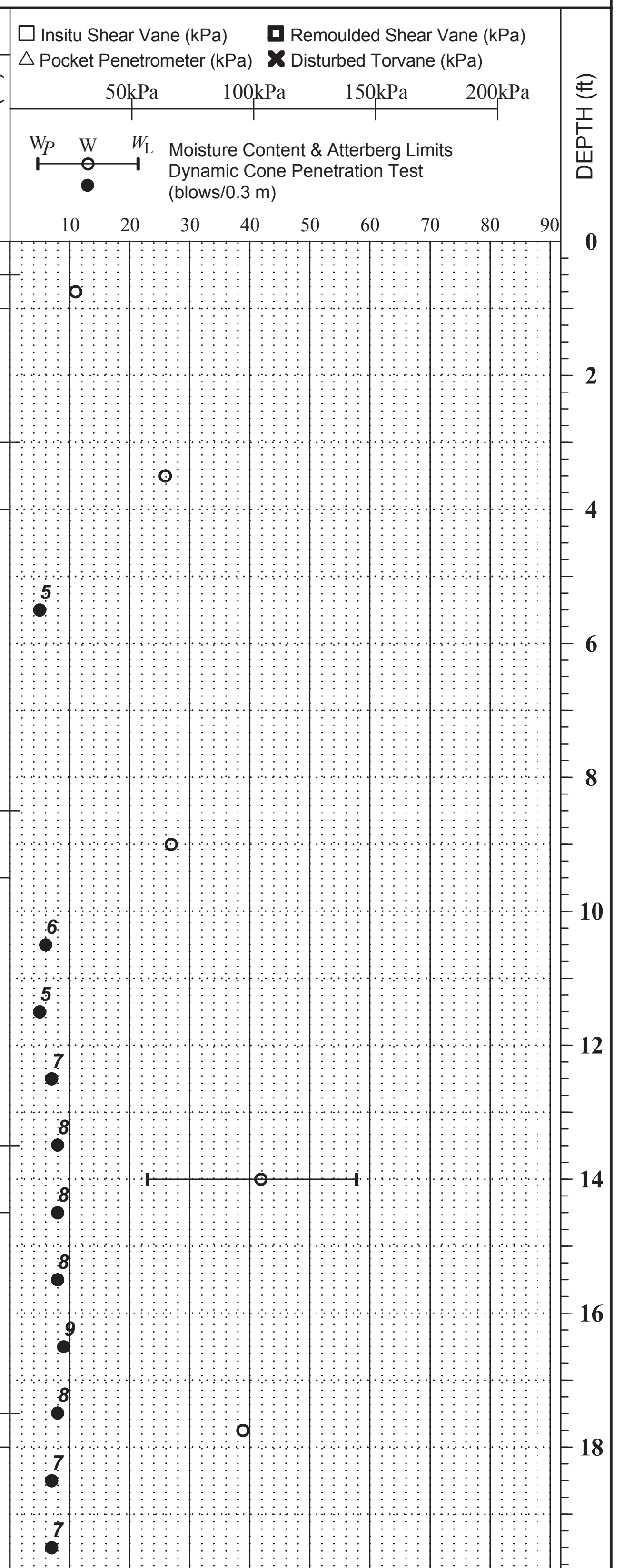
Stantec

BOREHOLE RECORD

BH17-05

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362476	LOCATION	Dallas Road, Victoria, BC
ELEVATION	4.6 m	EASTING	471639
DRILLING DATE	06/29/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT				
	FL	FILL: grey silty sand with gravel and organics		GS	1	11
	FL	FILL: grey lean clay - mottled with brown - traces of gravel and organics				
1		- fines at 1.1m= 92%		GS	2	26
2		- auger and DCPT refusal at 2.0 m on inferred boulder				
	FL	- re-drilled 1.5 m east and advanced beyond 2.0 m depth				
		FILL: dark brown silty sand - traces of gravel and organics - fines at 2.7 m= 44%		GS	3	27
3	CH	Brown-grey fat CLAY (CH)				
4				GS	4	42
		- grey below 4.6 m				
5				GS	5	39
6						



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

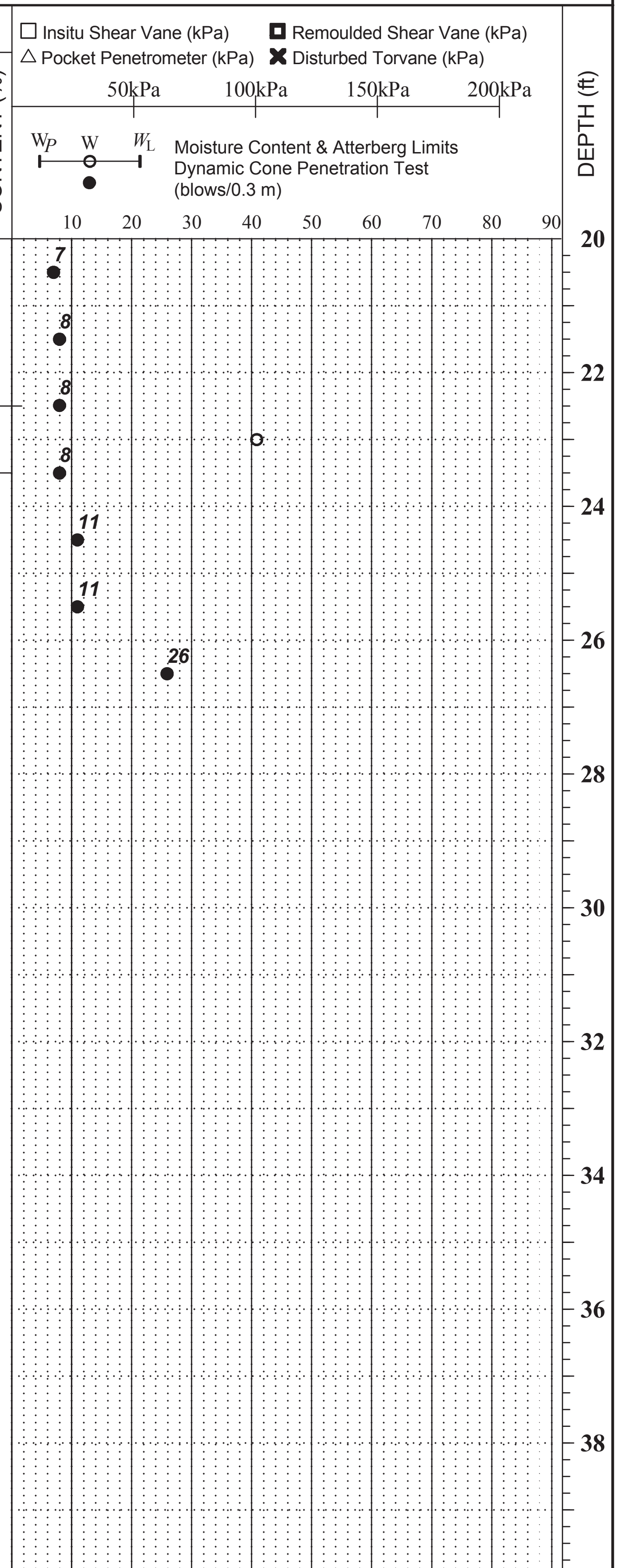
Stantec

BOREHOLE RECORD

BH17-05 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362476	LOCATION	Dallas Road, Victoria, BC
ELEVATION	4.6 m	EASTING	471639
DRILLING DATE	06/29/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
	CH		Brown-grey fat CLAY (CH)				
7					GS	6	41
			End of Borehole BH17-05 at 7.6 m Target depth reached Groundwater not encountered in open borehole DCPT conducted at 1.5 m, and 3.0 to 8.2 m				
8							
9							
10							
11							
12							



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-06

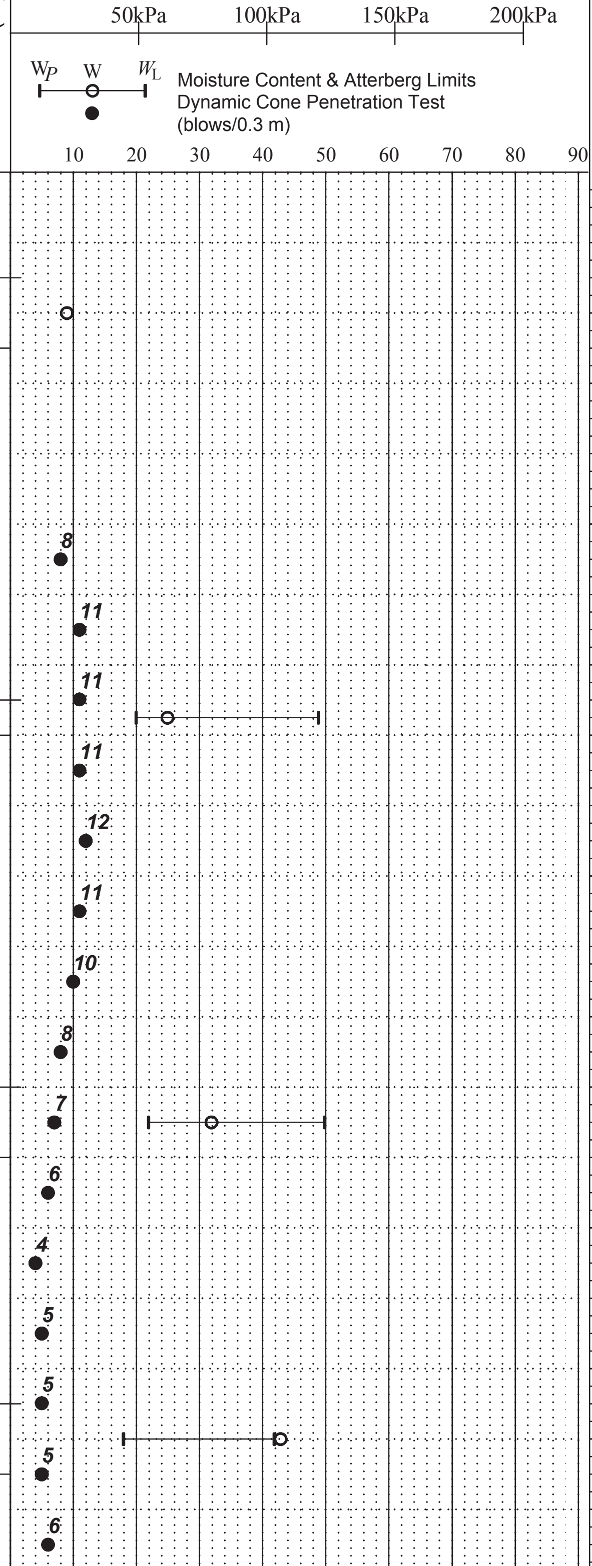
CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362419	LOCATION	Dallas Road, Victoria, BC
ELEVATION	4.5 m	EASTING	471696
DRILLING DATE	06/29/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT			
	FL	FILL: dark brown silty sand - traces of gravel and organics - fines at 0.7 m= 18%	GS	1	9
1	ML	Reddish-light brown SILT (ML) with sand			
2	CH	Grey-brown fat CLAY (CH) - DCPT conducted from 1.5 to 7.6 m	GS	2	25
4	CL	Grey-brown lean CLAY (CL)	GS	3	32
5	CL	- grey below 4.6 m	GS	4	43

Headings of the sample columns: SAMPLES; also WELL DATA, SOIL SYMBOL, DEPTH (ft).

Depth scale (m): 0, 1, 2, 3, 4, 5, 6. Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

☐ Insitu Shear Vane (kPa) ▣ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-06 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362419	LOCATION	Dallas Road, Victoria, BC
ELEVATION	4.5 m	EASTING	471696
DRILLING DATE	06/29/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
6.1–7.6	CL		Grey lean CLAY (CL)		GS	5	40	20–25
7.6			End of Borehole BH17-06 at 7.6 m Target depth reached Groundwater not encountered in open borehole DCPT conducted from 1.5 to 7.6 m					

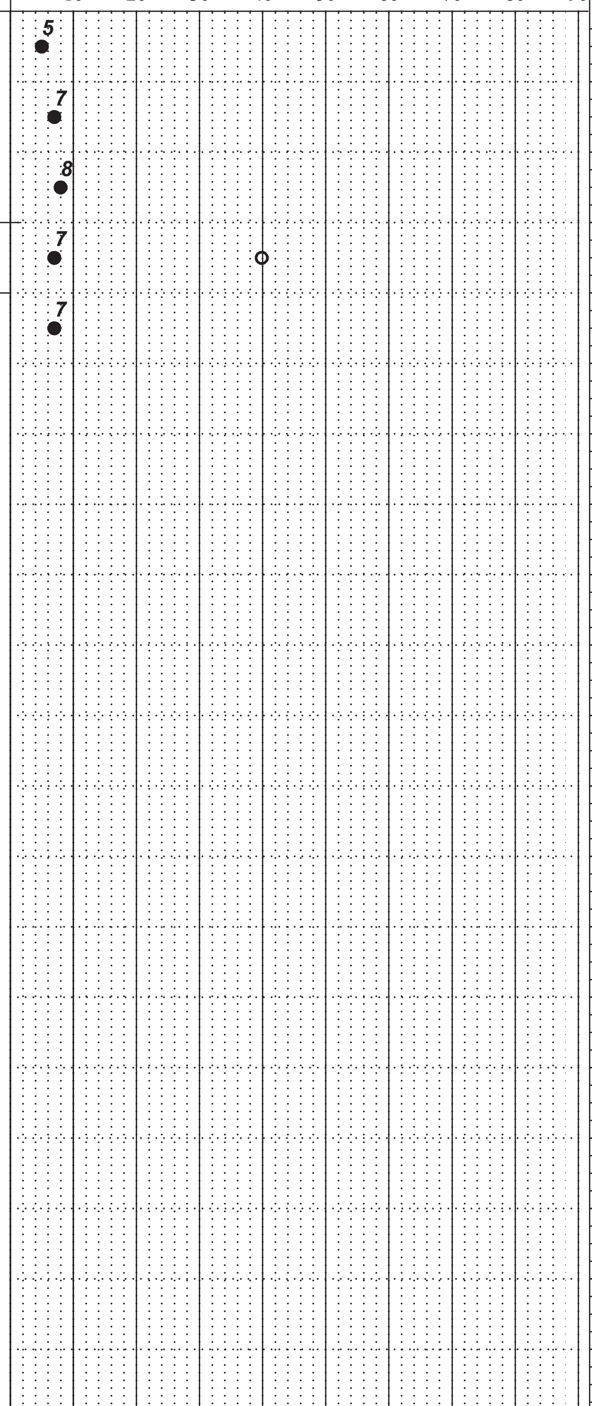
Depth scale (m): 7, 8, 9, 10, 11, 12
Depth scale (ft): 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

☐ Insitu Shear Vane (kPa) ▣ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-07

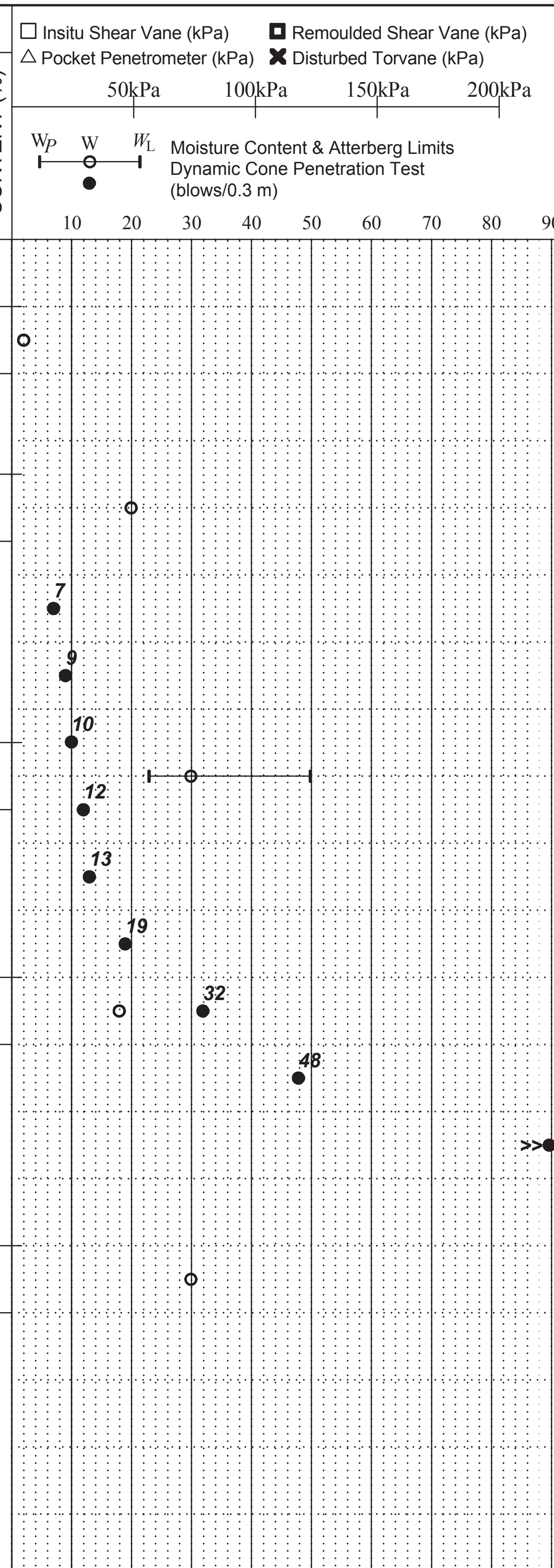
CLIENT: Capital Regional District
PROJECT No.: 111700431

PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5362363

LOCATION: Dallas Road, Victoria, BC
ELEVATION: 6.1 m
EASTING: 471767

DRILLING DATE: 06/29/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT			
	FL	FILL: grey well-graded sand with gravel	GS	1	2
	CL	Light brown sandy lean CLAY (CL) - mottled with grey and brown	GS	2	20
	CL	Grey-brown lean to fat CLAY (CL/CH) - traces of gravel from 3.4 to 4.6 m - sandy gravelly clay lens from 3.8 to 4.1 m - DCPT bouncing refusal at 4.0 m	GS GS GS	3 4 5	30 18 30
5.3		End of Borehole BH17-07 at 5.3 m Sudden auger refusal at 5.3 m Groundwater not encountered in open borehole DCPT conducted from 1.5 to 4.0 m			



DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-08

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5362254
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 7.0 m
EASTING: 471916
DRILLING DATE: 06/30/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

Legend: ☐ Insitu Shear Vane (kPa); ▣ Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa); 50kPa, 100kPa, 150kPa, 200kPa

W_P — W — W_L: Moisture Content & Atterberg Limits
●: Dynamic Cone Penetration Test (blows/0.3 m)

Scale: 10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT			
	FL	FILL: grey well-graded sand with silt and gravel	GS	1	5
	FL	FILL: brown silty sand - traces of gravel and organics - sieve at 1.7 m: gravel= 13.0%; sand= 51.4%; fines= 35.6%	GS	2	12
	FL	FILL: brown silt with sand - traces of gravel and organics - grey-brown below 5.3 m - fines at 4.1 m= 95%	GS	3	21
			GS	4	15
	CL	Grey lean CLAY (CL)	GS	5	23

Dynamic Cone Penetration Test (blows/0.3 m), top to bottom: 17, 12, 11, 8, 6, 8, 6, 3, 5, 9, 10, 15, 10, 11, 14, 15, 16, 16, 18

Depth scale (m): 0, 1, 2, 3, 4, 5, 6
Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample; SPT - Split Spoon; ST - Shelby Tube; PT - Piston Tube; CC - Continuous Core

Piezometer Backfill Type: Bentonite; Sloughed; Drill Cuttings; Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-08 cont'd

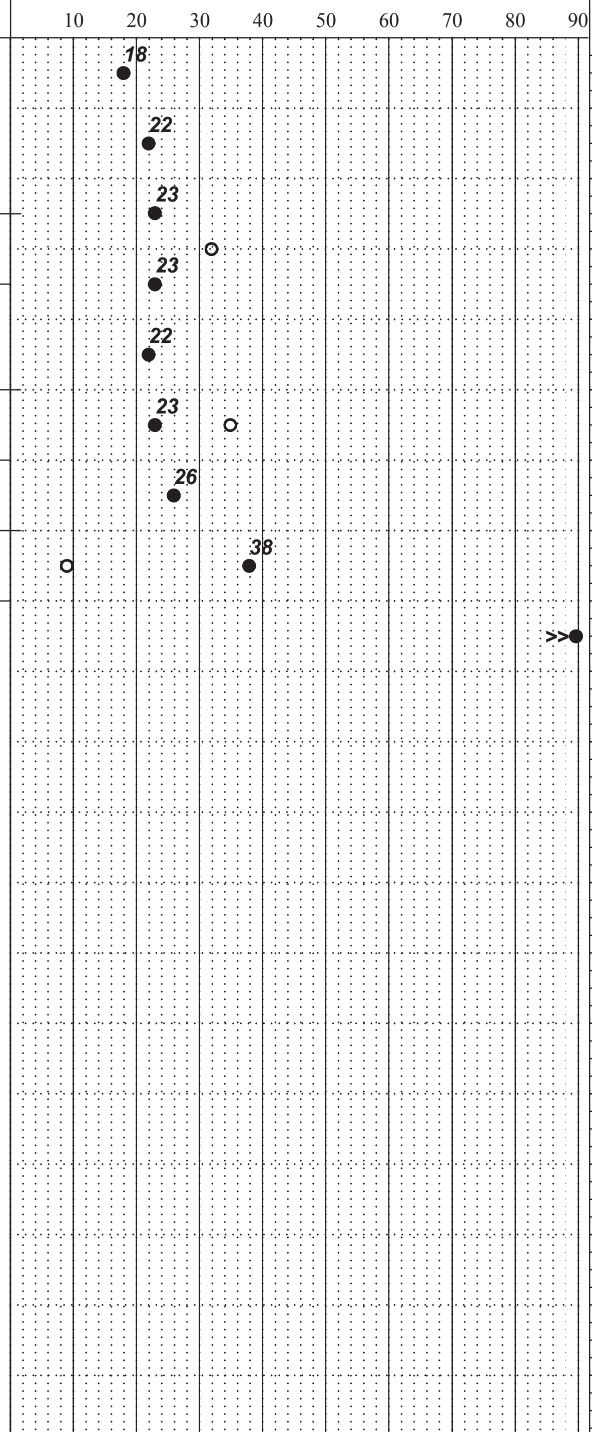
CLIENT	Capital Regional District			PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic	NORTHING	5362254
LOCATION	Dallas Road, Victoria, BC	ELEVATION	7.0 m	EASTING	471916
DRILLING DATE	06/30/2017	DRILLING CO.	Geotech Drilling Ltd.	DRILLING METHOD	Solid-Stem Auger

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
7	CL		Grey lean CLAY (CL)		GS	6	32	20–26
8					GS	7	35	
	TL		Grey sandy silt (ML) with gravel TILL - high drilling resistance		GS	8	9	28
9–12			End of Borehole BH17-08 at 8.5 m Practical auger refusal Groundwater measured at 7.3 m in open borehole DCPT conducted from 0.3 to 8.7 m DCPT refusal at 8.7 m					30–40



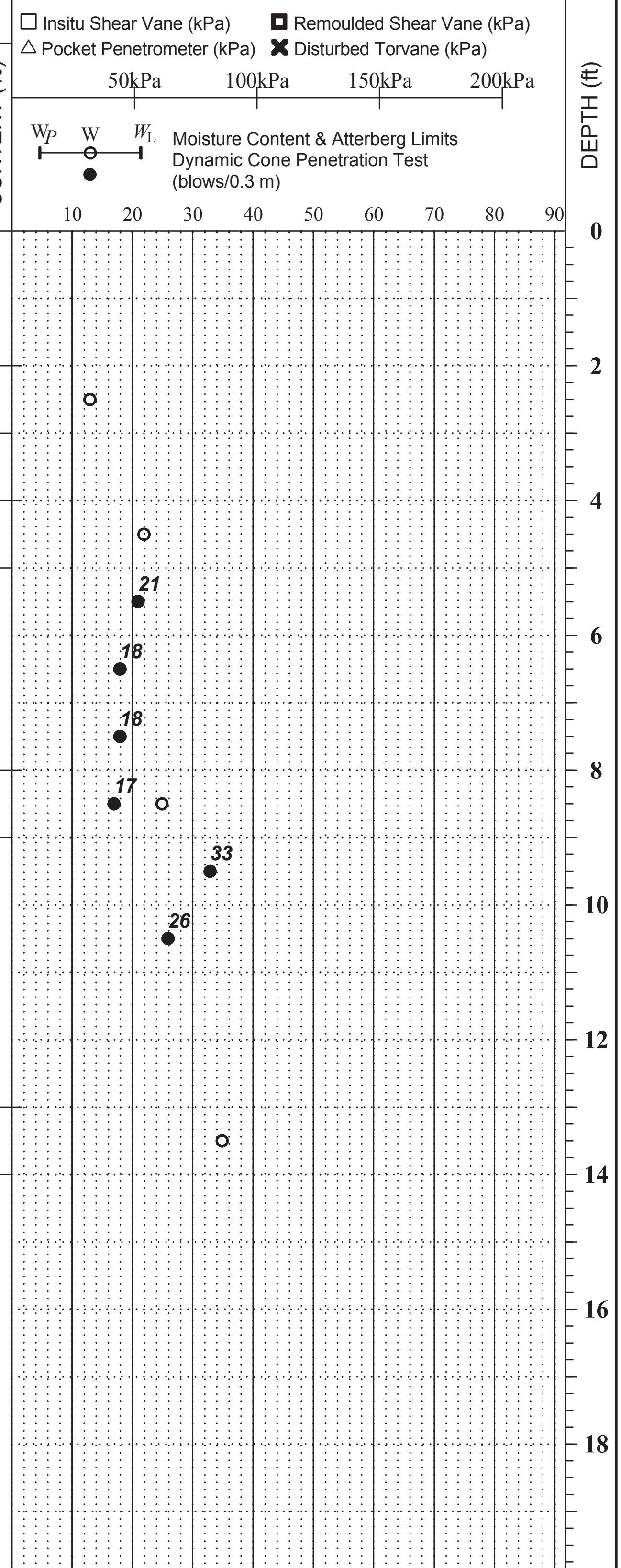
Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core	Logged by: CH	Stantec
Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand	Reviewed by: BH	
	Date: July 13, 2017	

BOREHOLE RECORD

BH17-09

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5362155
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 11.0 m
EASTING: 472052
DRILLING DATE: 06/30/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)
0	TP	TOPSOIL				
	ML	Grey and brown mottled sandy SILT (ML) with gravel		GS	1	13
1	CL	Grey-brown lean CLAY (CL) with sand - traces of gravel to 3.0 m		GS	2	22
				GS	3	25
4				GS	4	35
4.6		End of Borehole BH17-09 at 4.6 m Target depth reached Groundwater not encountered in open borehole DCPT conducted from 1.5 to 3.4 m				



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

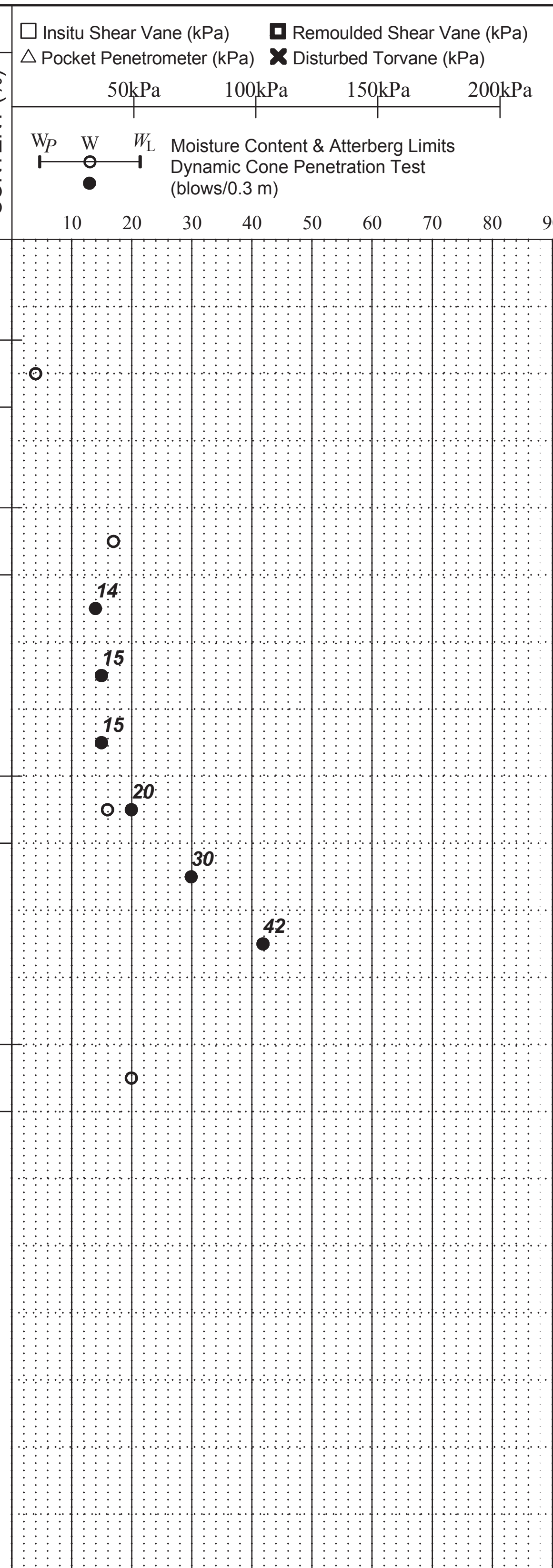
BH17-10

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5362037		
LOCATION	Dallas Road, Victoria, BC	ELEVATION	14.0 m
EASTING	472216		
DRILLING DATE	06/30/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0 – 0.3	TP	TOPSOIL				
0.3 – 0.9	SM	Brown SILTY SAND (SM) - traces of gravel		GS	1	4
0.9 – 4.3	CL	Grey lean CLAY - traces of sand		GS	2	17
		- gravelly from 1.5 m to 1.8 m				
		- traces of gravel below 1.8 m		GS	3	16
				GS	4	20
4.3		End of Borehole BH17-10 at 4.3 m Target depth reached Groundwater not encountered in open borehole DCPT conducted from 1.5 to 3.4 m				

DEPTH (m): 0, 1, 2, 3, 4, 5, 6

DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-11

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361943
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 16.1 m
EASTING: 472348
DRILLING DATE: 06/30/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: MOISTURE CONTENT (%)	DEPTH (ft)
0 – 4.6			Auger head breakdown, DCPT blow counts performed to target depth; no drilling					0 – 15
4.6 – 6			End of DCPT at 4.6 m Target depth reached					15 – 20

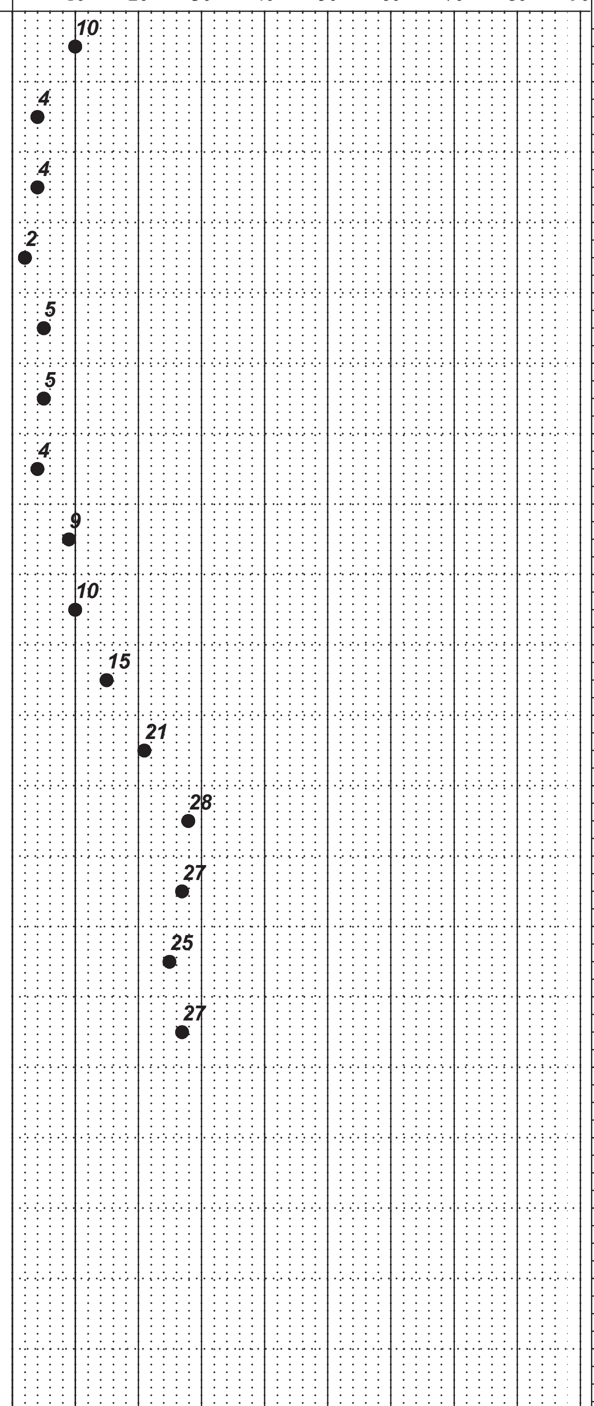
Depth (m) scale: 0, 1, 2, 3, 4, 5, 6. Depth (ft) scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

☐ Insitu Shear Vane (kPa)
▣ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa)
✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90



Sample Type: GS - Grab Sample SPT - Split Spoon
ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

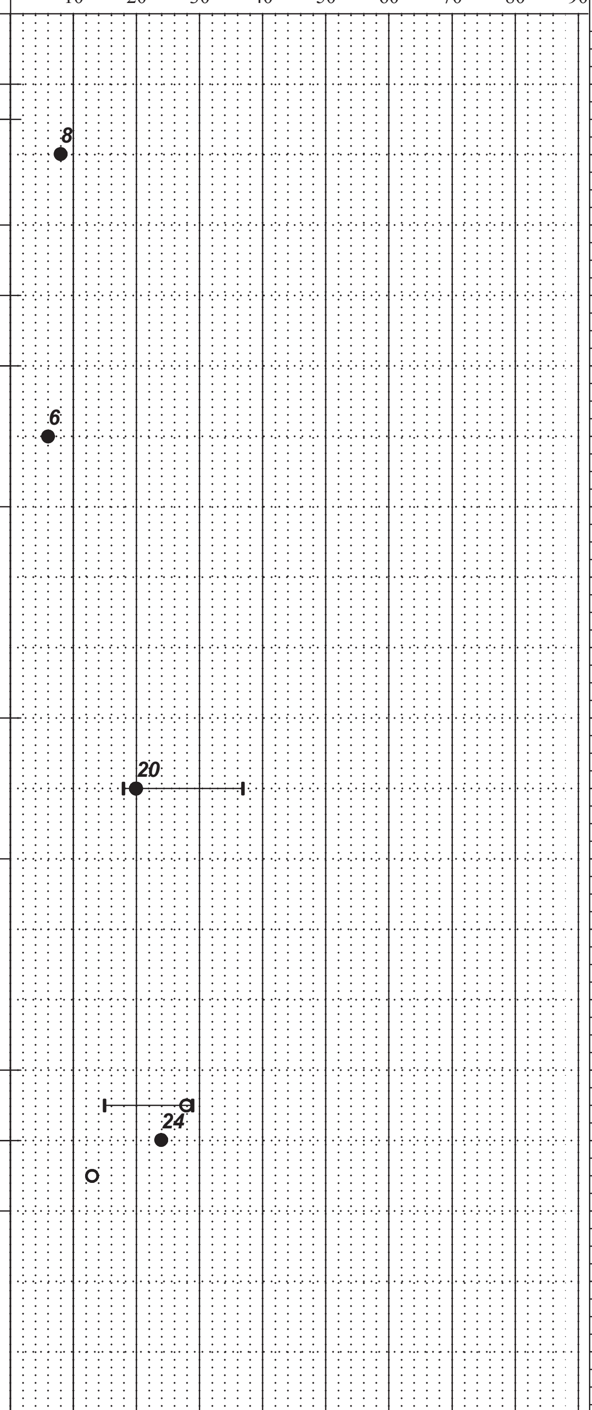
BOREHOLE RECORD

BH17-12a

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361845
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 17.1 m
EASTING: 472488
DRILLING DATE: 06/27/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
0	AS	ASPHALT			
	FL	FILL: grey-brown poorly graded gravel with sand - traces of organics	SPT	1a	
	FL	FILL: brown silt with sand - traces of organics	SPT	1b	
1	FL	FILL: dark brown to black organic soil with sand and gravel	GS	2	
2			SPT	3	
	CL	Grey-brown lean CLAY (CL) - traces of sand and gravel - grey and brown mottling			
3		- fines at 3.4 m= 85.7%	SPT	4	20
4					
		- fines at 4.7 m= 88.8% - silty sand lens from 4.9 to 5.2 m	SPT	5a	28
5			SPT	5b	13
6					

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)
10 20 30 40 50 60 70 80 90



DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-12a cont'd

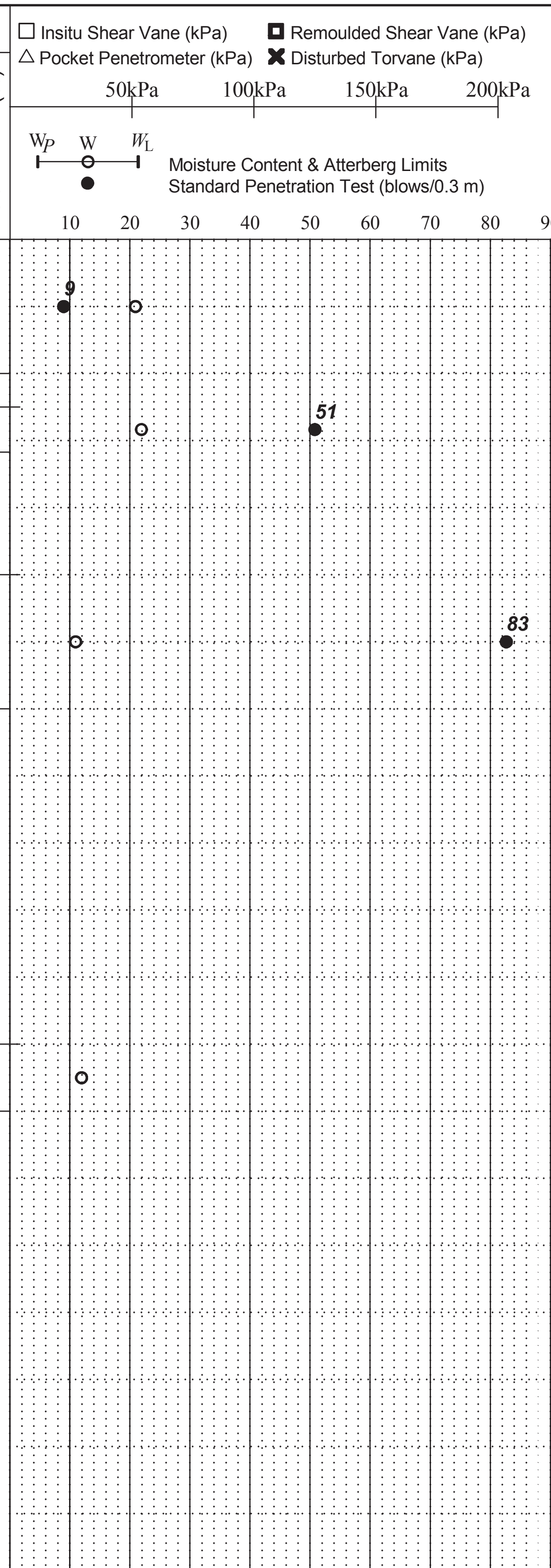
CLIENT Capital Regional District | PROJECT No. 111700431

PROJECT Clover Point Forcemain | DATUM Geodetic | NORTHING 5361845

LOCATION Dallas Road, Victoria, BC | ELEVATION 17.1 m | EASTING 472488

DRILLING DATE 06/27/2017 | DRILLING CO. Geotech Drilling Ltd. | DRILLING METHOD ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
	CL	Grey-brown sandy lean CLAY (CL)		SPT	6	21	20
7	TL	Grey silty sand (SM) with gravel TILL - sieve at 6.9 m: gravel= 20.9%; sand=47.6%; fines= 31.5%		SPT	7	22	22, 24
8				SPT	8	11	26
9	BR	Dark grey BEDROCK - advanced using ODEX hammer - angular and/or powdered cuttings observed from air return					28, 30
10				GS	9	12	32, 34
11		End of Borehole BH17-12a at 10.9 m Practical refusal Slope inclinometer installed. Casing set in bedrock Groundwater not encounterd in open borehole					36, 38
12							40



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

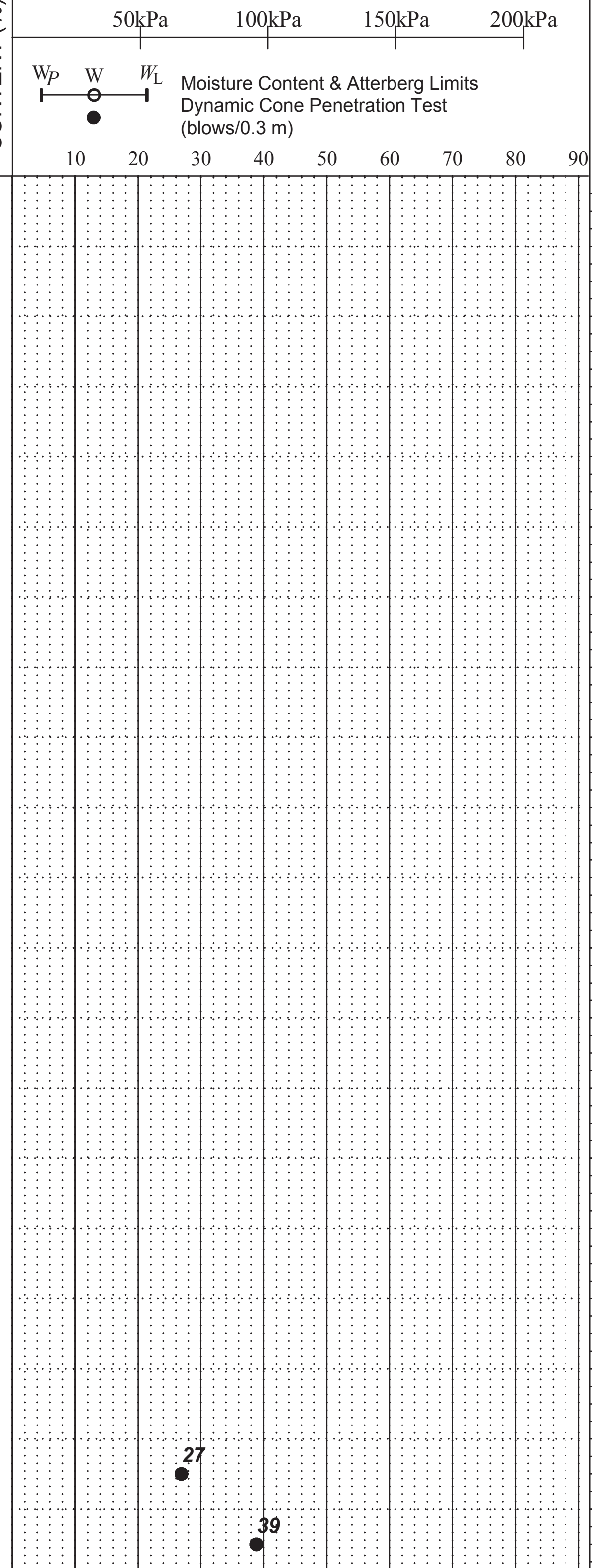
BH17-12b

CLIENT	Capital Regional District			PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic	NORTHING	5361842
LOCATION	Dallas Road, Victoria, BC	ELEVATION	16.6 m	EASTING	472490
DRILLING DATE	06/27/2017	DRILLING CO.	Geotech Drilling Ltd.	DRILLING METHOD	Solid-Stem Auger

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0			DCPT conducted from 5.5 m to 7.0 m to supplement BH17-12a					0
1								2
2								4
3								6
4								8
5								10
6								12
								14
								16
								18
								20

☐ Insitu Shear Vane (kPa) ▣ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-12b cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361842	LOCATION	Dallas Road, Victoria, BC
ELEVATION	16.6 m	EASTING	472490
DRILLING DATE	06/27/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES: TYPE	SAMPLES: NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
6.0–7.0			DCPT conducted from 5.5 m to 7.0 m to supplement BH17-12a					20–23
7.0			End of Borehole DCPT at 7.0 m Target depth reached					23

Depth scale (m): 7, 8, 9, 10, 11, 12

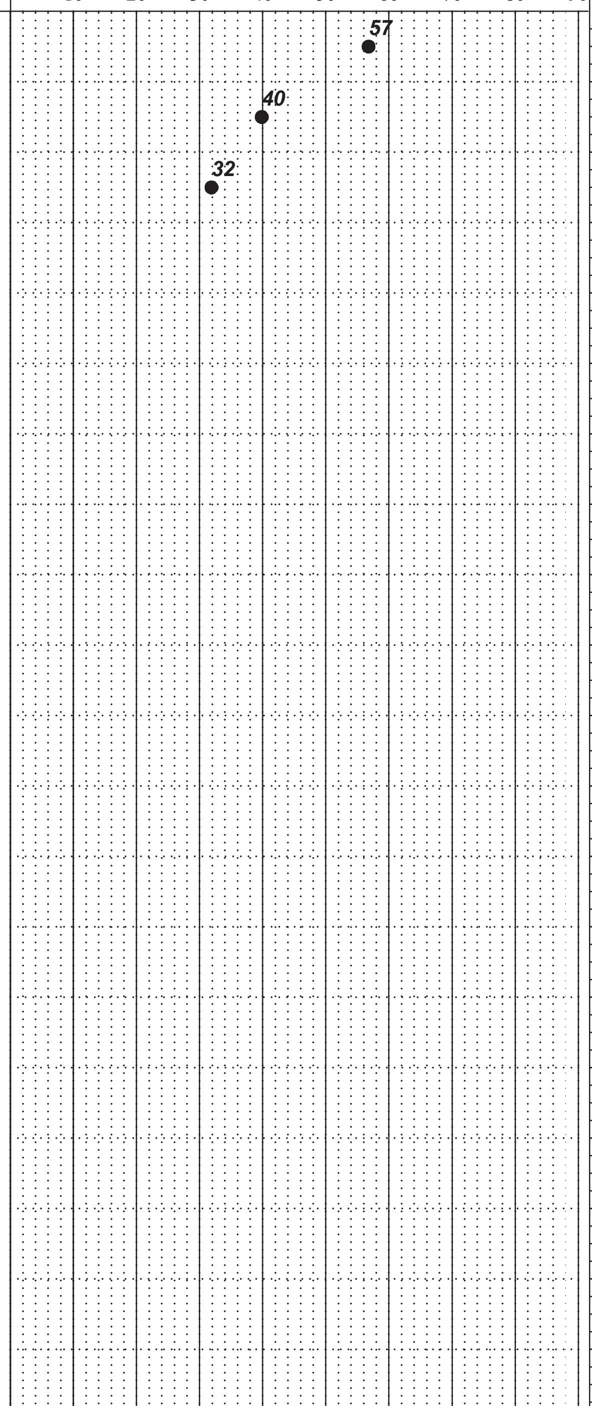
Depth scale (ft): 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-13

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361781	LOCATION	Dallas Road, Victoria, BC
ELEVATION	20.3 m	EASTING	472659
DRILLING DATE	06/19/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

Legend: ☐ Insitu Shear Vane (kPa); ◘ Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa). Scale: 50kPa, 100kPa, 150kPa, 200kPa.

W_P W W_L Moisture Content & Atterberg Limits; ● Standard Penetration Test (blows/0.3 m). Scale: 10, 20, 30, 40, 50, 60, 70, 80, 90

DEPTH (m)	USC	SOIL DESCRIPTION
0	AS	ASPHALT
	FL	FILL: grey-brown silty sand with gravel - fines at 0.5 m= 17.3%
1	FL	FILL: dark reddish brown silt with organics - traces of gravel
	FL	FILL: grey-brown well-graded sand with silt and gravel
2	CL	Light brown sandy lean CLAY (CL) - traces of gravel - mottled with grey - sieve at 3.2 m: gravel= 0.5%; sand= 39.5%; fines= 60.0%
4.5	SM	Light brown SILTY SAND (SM) with gravel - sieve at 4.7m: gravel= 15.1%; sand= 51.2%; fines= 33.7%

SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)
SPT	1		15
GS	2	10	
SPT	3	5	21
SPT	4	15	24
SPT	5	14	22

DEPTH (m): 0, 1, 2, 3, 4, 5, 6

DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-13 cont'd

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361781
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 20.3 m
EASTING: 472659
DRILLING DATE: 06/19/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

Legend: ☐ Insitu Shear Vane (kPa); Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa)

Shear strength scale: 50kPa, 100kPa, 150kPa, 200kPa

W_P W W_L — Moisture Content & Atterberg Limits

● Standard Penetration Test (blows/0.3 m)

Scale: 10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
6.1	TL	Light brown silty sand (SM) with gravel TILL - fines at 6.2 m= 48.7%	SPT	6	13	31	20
7							22–24
7.5 ⊽		- with gravel, and mottled with grey and brown below 7.5 m - sieve at 7.7 m: gravel= 20.5%; sand= 65.4%; fines= 14.1%	SPT	7	7	61	26
8							28
9		- grey-brown below 8.9 m	SPT	8	11	42	30
10							32–34
11		- grey below 10.5 m - sieve at 10.8 m: gravel= 11.7%; sand= 58.1%; fines= 30.2%	SPT	9	10	77	36
12							38–40

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-13 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361781		
LOCATION	Dallas Road, Victoria, BC	ELEVATION	20.3 m
EASTING	472659		
DRILLING DATE	06/19/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa) △ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
	TL	Grey silty sand (SM) with gravel TILL	SPT	10	10	61	40
13		- SPT at 13.6 m: gravel plug in tip of sampler	SPT	11	9	59	42, 44
14							46, 48
15, 16, 17							50, 52, 54, 56
	BR	Dark grey BEDROCK - advanced using ODEX hammer - angular cuttings observed from air return					
18		End of Borehole BH17-13 at 17.7 m Practical refusal Groundwater measured at 7.6 m in open borehole					58, 60

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-14

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361793
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 21.2 m
EASTING: 472676
DRILLING DATE: 06/20/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

Legend: ☐ Insitu Shear Vane (kPa); ◘ Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa)

Shear strength scale: 50kPa, 100kPa, 150kPa, 200kPa

W_P — W — W_L: Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)

Scale: 10, 20, 30, 40, 50, 60, 70, 80, 90

DEPTH (m): 0, 1, 2, 3, 4, 5, 6
DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

USC	SOIL DESCRIPTION
AS	ASPHALT
FL	FILL: grey-brown well-graded sand with gravel
FL	FILL: dark brown-reddish silt with organics - trace gravel
FL	FILL: dark brown-reddish silty sand with gravel
SM	Grey-brown SILTY SAND (SM) with gravel - traces of organics to 3.7 m - mottled with grey and brown - sieve at 3.3 m: gravel= 23.3%; sand= 48.4%; fines= 28.3% - traces of gravel below 4.6 m - sieve at 4.9m: gravel= 6.8%; sand= 53.8%; fines= 39.4%

TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)
SPT	1a	2	14
SPT	1b	4	
SPT	2	3	20
SPT	3	12	15
SPT	4	10	17

Sample Type: GS - Grab Sample; SPT - Split Spoon; ST - Shelby Tube; PT - Piston Tube; CC - Continuous Core

Piezometer Backfill Type: Bentonite; Sloughed; Drill Cuttings; Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-14 cont'd

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361793
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 21.2 m
EASTING: 472676
DRILLING DATE: 06/20/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

Legend: ☐ Insitu Shear Vane (kPa); △ Pocket Penetrometer (kPa); Remoulded Shear Vane (kPa); ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)
10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
	SM	Grey-brown SILTY SAND (SM) with gravel						20
	TL	Grey-brown silty sand (SM) with gravel TILL		SPT	5	6	36	22
7								24
8		- coal inclusions at 7.9 m - sieve at 7.9 m: gravel= 15.0%; sand= 56.2%; fines= 28.8%		SPT	6	10	61	26
9								28
				SPT	7	3	66	30, 32
10								34
		- traces of gravel below 10.5 m - sieve at 10.5 m: gravel= 5.5%; sand= 53.2%; fines= 41.3%		SPT	8	14	42	
11		- inferred boulder or cobble at 11.1 m based on drilling reaction						36, 38
12								40

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-14 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361793	LOCATION	Dallas Road, Victoria, BC
ELEVATION	21.2 m	EASTING	472676
DRILLING DATE	06/20/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

Legend: ☐ Insitu Shear Vane (kPa); Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa); 50kPa, 100kPa, 150kPa, 200kPa

W_P W W_L — Moisture Content & Atterberg Limits; ● Standard Penetration Test (blows/0.3 m); scale 10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
12.2–17.2	TL	Grey-brown, silty sand (SM) TILL - traces of gravel	SPT	9	5	85	40–56
			SPT	10	9	48	
17.2–18.3	BR	Dark grey BEDROCK - advanced using ODEX hammer - angular and/or powdered cuttings observed from air return - slow advancement rate					56–60

Depth scale (m): 13, 14, 15, 16, 17, 18
Depth scale (ft): 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-14 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
		NORTHING	5361793
LOCATION	Dallas Road, Victoria, BC	ELEVATION	21.2 m
		EASTING	472676
DRILLING DATE	06/20/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
19	BR		Dark grey BEDROCK - advanced using ODEX hammer - angular and/or powdered cuttings observed from air return - slow advancement rate					60, 62, 64
20			End of Borehole BH17-14 at 19.7 m Practical refusal Slope inclinometer installed. Casing set in bedrock Groundwater not encountered in open borehole					66, 68
21								70
22								72, 74
23								76
24								78, 80

Legend: ☐ Insitu Shear Vane (kPa); △ Pocket Penetrometer (kPa); ◘ Remoulded Shear Vane (kPa); ✖ Disturbed Torvane (kPa)

Scale: 50kPa, 100kPa, 150kPa, 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-15

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361817		
LOCATION	Dallas Road, Victoria, BC	ELEVATION	21.9 m
EASTING	472672		
DRILLING DATE	07/04/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0	AS		ASPHALT					0
	FL		FILL: grey-brown well-graded sand with gravel					
	ML		Grey-brown sandy SILT (ML) with gravel - very dense based on drill reaction - occasional to frequent inferred cobbles		GS	1	9	2
1			- DCPT refusal at 1.2 m					4
			End of Borehole BH17-15 at 1.2 m Practical auger refusal Groundwater not encountered in open borehole Second borehole drilled 1.2 m east of BH17-15 and encountered refusal at same depth					

Depth (m) scale: 0, 1, 2, 3, 4, 5, 6

Depth (ft) scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

>>

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-16

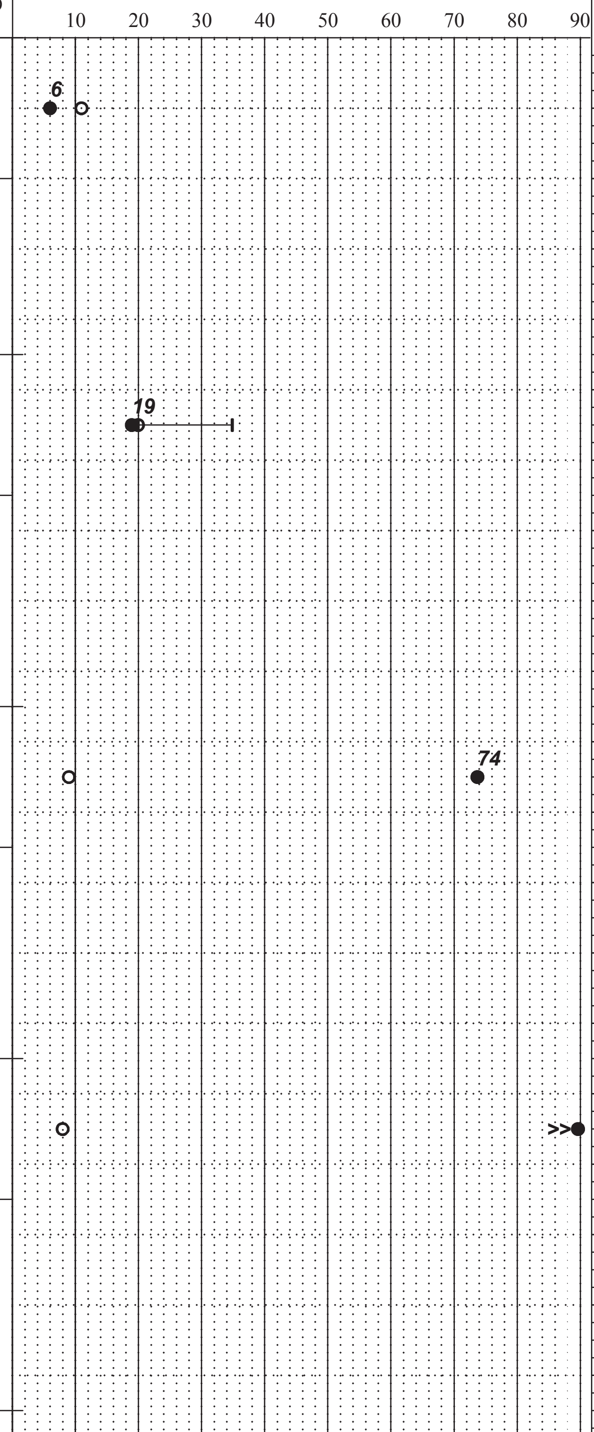
CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361800
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 22.0 m
EASTING: 472707
DRILLING DATE: 06/21/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLES: TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0 – 0.9	TP	TOPSOIL - frequent rootlets from 0.0 m to 0.3 m - trace rootlets below 0.3 m - light brown and sandy below 0.5 m		SPT	1	11	0 – 2
0.9 – 1.8	CL	Light brown lean CLAY (CL) with sand - fines at 1.7 m= 82.0%		SPT	2	20	
1.8 – 2.9	SM	Grey-brown SILTY SAND (SM) - traces of gravel - mottled with brown and grey					
2.9 – 6.1	TL	Grey-brown silty sand (SM) TILL - traces of gravel - mottled with brown and grey to 3.5 m - fines at 3.2 m= 39.4%		SPT	3	9	
				SPT	4	8	

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

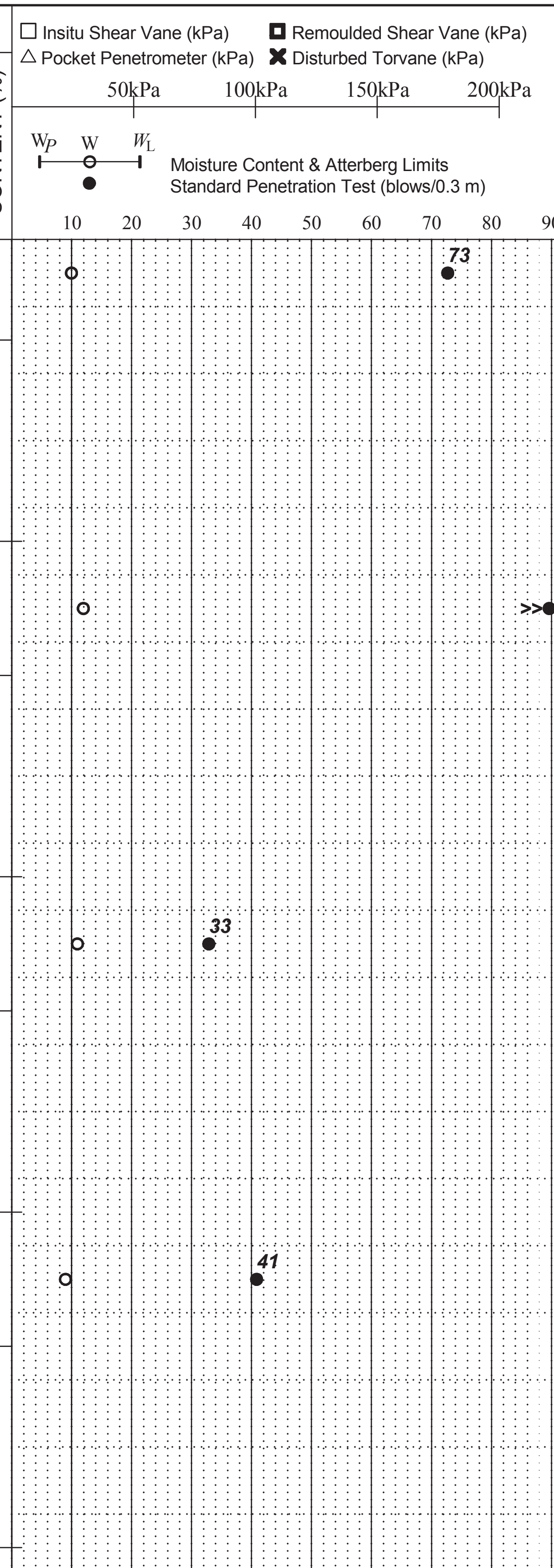
BOREHOLE RECORD

BH17-16 cont'd

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361800
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 22.0 m
EASTING: 472707
DRILLING DATE: 06/21/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)	DEPTH (ft)
6.1 – 12.2	TL	Grey-brown silty sand (SM) TILL - traces of gravel		SPT	5	10	73	20
		- SPT at 7.5 m: low recovery due to large gravel plug in spoon		SPT	6	12	>>	
		- fines at 9.3 m: 32.0%		SPT	7	11	33	
				SPT	8	9	41	40

Groundwater level symbol (∇) at approx. 7.9 m.



Sample Type: GS - Grab Sample, SPT - Split Spoon, ST - Shelby Tube, PT - Piston Tube, CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

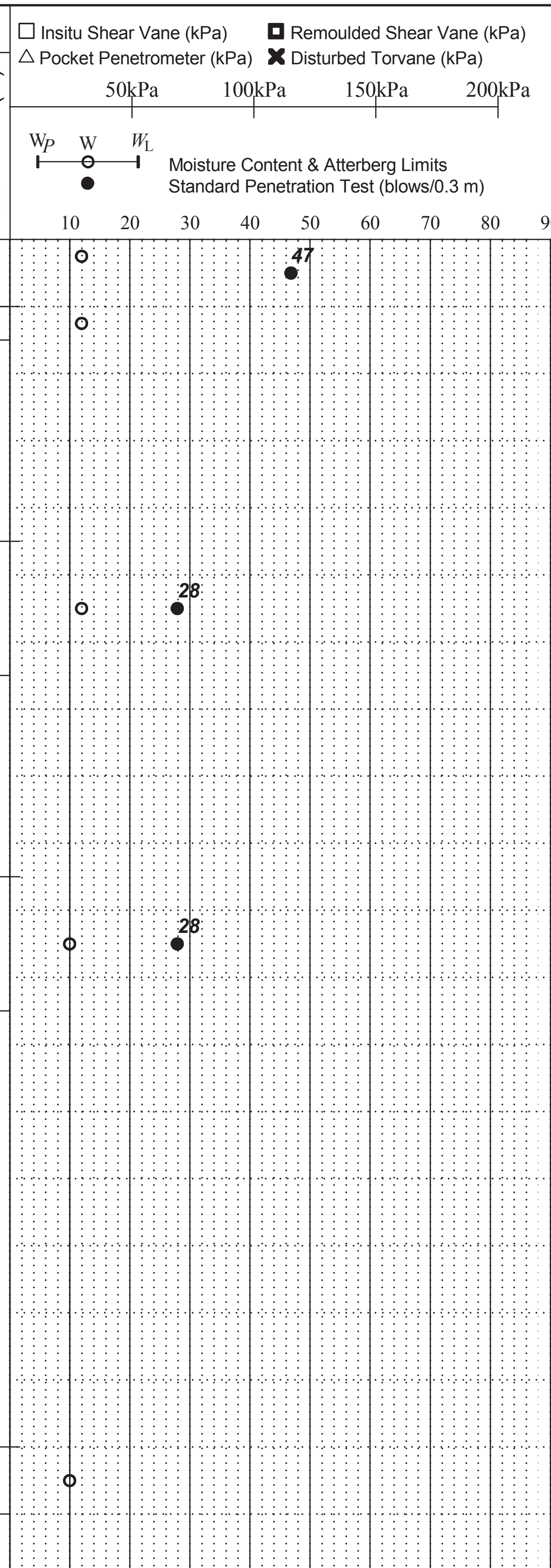
Stantec

BOREHOLE RECORD

BH17-16 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361800	LOCATION	Dallas Road, Victoria, BC
ELEVATION	22.0 m	EASTING	472707
DRILLING DATE	06/21/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)
12.0	TL	Grey-brown silty sand (SM) TILL - traces of gravel	SPT	9a	12	47
			SPT	9b	12	
			SPT	10	12	28
		- with gravel below 15.1 m - fines at 15.4 m= 36.5%	SPT	11	10	28
			GS	12	10	



DEPTH (m): 13, 14, 15, 16, 17, 18
DEPTH (ft): 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-16 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361800	LOCATION	Dallas Road, Victoria, BC
ELEVATION	22.0 m	EASTING	472707
DRILLING DATE	06/21/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)
10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES MOISTURE CONTENT (%)	DEPTH (ft)
	TL		Grey-brown silty sand (SM) with gravel TILL					60
19								62, 64
20								66, 68
21	TL		Grey sandy silt (ML) with gravel TILL					70
22								72, 74
23					GS	13	11	76
24								78, 80

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-16 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361800		
LOCATION	Dallas Road, Victoria, BC	ELEVATION	22.0 m
EASTING	472707		
DRILLING DATE	06/21/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	ODEX		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: MOISTURE CONTENT (%)	DEPTH (ft)
								80
25	BR		Dark grey BEDROCK - angular and/or powdered cuttings observed from air return - grab sample at 24.7 m obtained from ODEX air return		GS	14		82
26								84, 86, 88
27			End of Borehole BH17-16 at 26.9 m Practical refusal Slope inclinometer installed. Casing set in bedrock Groundwater measured at 7.9 m in open borehole during first day of drilling on June 21; re-measured morning of June 22 and at termination depth and found no groundwater in open borehole					90
28								92, 94
29								96, 98
30								100

Legend: ☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa) △ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-17

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361783	LOCATION	Dallas Road, Victoria, BC
ELEVATION	22.1 m	EASTING	472927
DRILLING DATE	06/23/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

Legend: □ Insitu Shear Vane (kPa); ◘ Remoulded Shear Vane (kPa); △ Pocket Penetrometer (kPa); ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits

● Standard Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)	SPT (blows/0.3 m)
0	TP	TOPSOIL				
	FL	FILL: brown well-graded sand with silt and gravel - trace organics	SPT	1	9	15
1			GS	2	7	
	CL	Grey-brown lean to fat CLAY (CL/CH) - mottled with grey and brown - traces of sand and gravel - fines at 1.4 m= 87.9%	GS	3	26	
2			SPT	4		22
			GS	5	28	
3			SPT	6	27	12
4			GS	7	27	
		- grey below 4.4 m				
5						
6			GS	8	26	

DEPTH (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-17 cont'd

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361783		
LOCATION	Dallas Road, Victoria, BC	ELEVATION	22.1 m
EASTING	472927		
DRILLING DATE	06/23/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)
10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
	CL		Grey lean to fat CLAY (CL/CH) - traces of sand and gravel		SPT	9a	30	20
	ML		Grey sandy SILT (ML)		SPT	9b	17	22
7			End of Borehole BH17-17 at 6.7 m Target depth reached Groundwater not encountered in open borehole					
								24
								26
8								
								28
9								30
								32
10								
								34
11								36
								38
12								40

Sample Type: GS - Grab Sample SPT - Split Spoon
ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-18

CLIENT	Capital Regional District			PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic	NORTHING	5361734
LOCATION	Dallas Road, Victoria, BC	ELEVATION	18.5 m	EASTING	473184
DRILLING DATE	06/23/2017	DRILLING CO.	Geotech Drilling Ltd.	DRILLING METHOD	Solid-Stem Auger

Legend: ☐ Insitu Shear Vane (kPa); △ Pocket Penetrometer (kPa); ◘ Remoulded Shear Vane (kPa); ✖ Disturbed Torvane (kPa); 50kPa, 100kPa, 150kPa, 200kPa

W_P W W_L — Moisture Content & Atterberg Limits; ● Standard Penetration Test (blows/0.3 m); scale 10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0	TP	TOPSOIL			
	FL	FILL: brown silty sand with gravel	GS	1	17
	FL	FILL: grey poorly-graded sand with silt - traces of gravel - fines at 2.4 m= 13.1%	GS	2	19
3	ML	Grey sandy SILT (ML) with gravel	GS	3	12
		End of Borehole BH17-18 at 4.6 m Target depth reached Groundwater measured at 2.7 m in open borehole			

Depth (m): 0, 1, 2, 3, 4, 5, 6. Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-19

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361680
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 14.4 m
EASTING: 473396
DRILLING DATE: 06/23/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

Legend: □ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa) △ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
Scale: 50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Standard Penetration Test (blows/0.3 m)
10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	SAMPLES NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0	TP		TOPSOIL					0
	FL		FILL: brown poorly-graded sand with silt - traces of gravel - with gravel and cobbles below 1.0 m		GS	1	5	
			End of Borehole BH17-19 at 1.5 m Practical refusal on cobbles Groundwater not encountered in open borehole					

Depth (m): 0, 1, 2, 3, 4, 5, 6
Depth (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

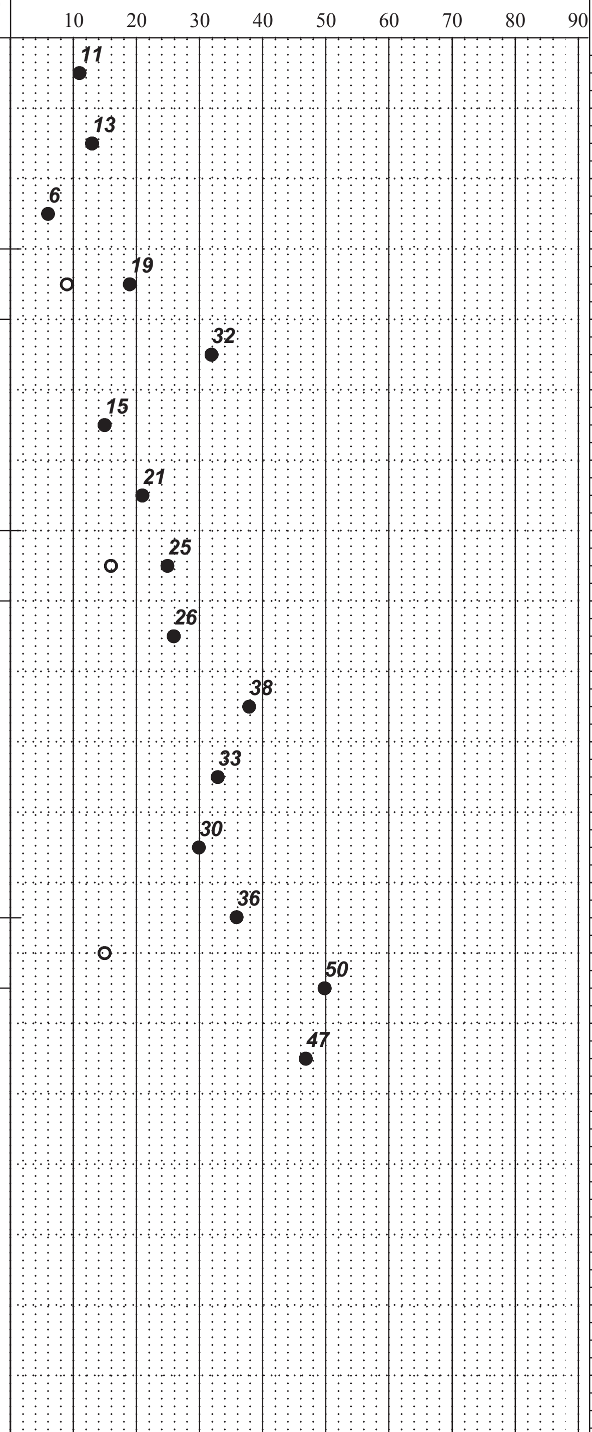
BOREHOLE RECORD

BH17-20

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361664
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 14.1 m
EASTING: 473665
DRILLING DATE: 07/04/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL DESCRIPTION	WELL DATA	SAMPLE TYPE	NUMBER	MOISTURE CONTENT (%)
0	TP	TOPSOIL				
	FL	FILL: dark brown poorly graded sand with silt and gravel - traces of organics - fines at 1.1 m= 11.1%		GS	1	9
	CL	Grey-brown lean CLAY (CL) with sand and gravel - mottled with grey and brown to 3.0 m		GS	2	16
				GS	3	15
4.1		End of Borehole BH17-20 at 4.1 m Practical auger refusal Groundwater not encountered in open borehole DCPT conducted from surface to 4.6 m				

☐ Insitu Shear Vane (kPa) ◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)



DEPTH (m): 0 1 2 3 4 5 6
DEPTH (ft): 0 2 4 6 8 10 12 14 16 18 20

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

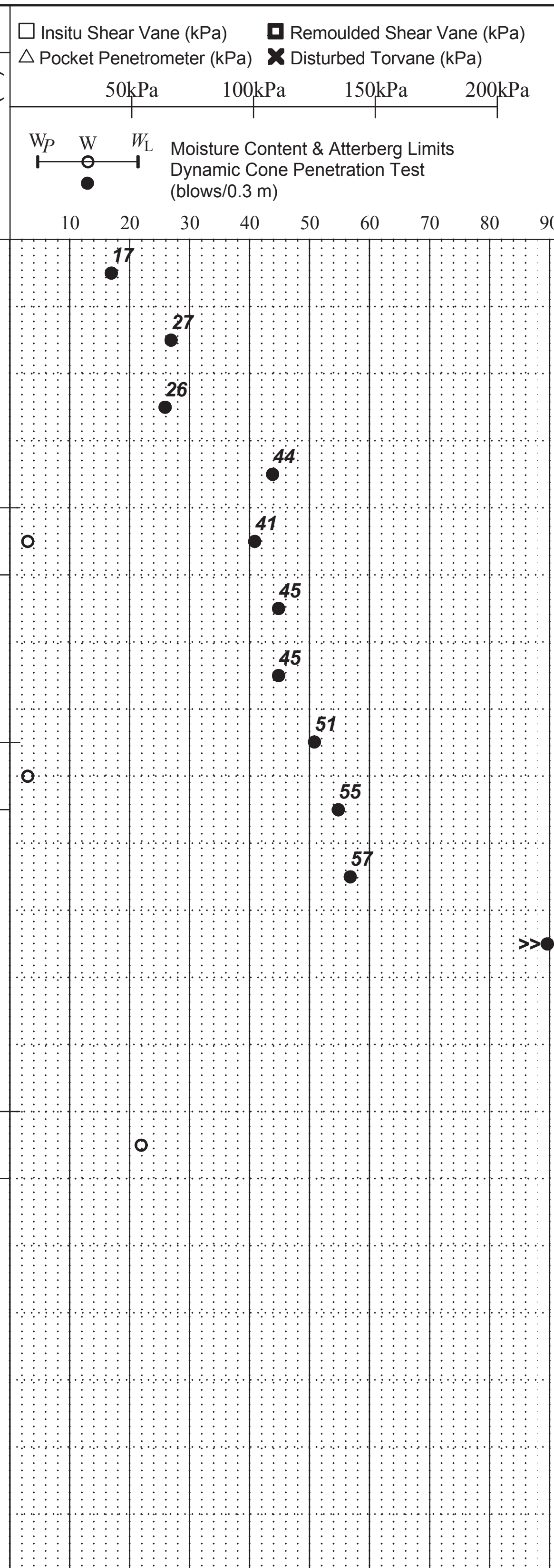
Stantec

BOREHOLE RECORD

BH17-21

CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
NORTHING	5361578	LOCATION	Dallas Road, Victoria, BC
ELEVATION	14.7 m	EASTING	473856
DRILLING DATE	07/04/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
0	TP		TOPSOIL				
	FL		FILL: brown well-graded sand with silt and gravel - frequent inferred cobbles				
1							
			- sieve at 1.4m: gravel= 44.2%; sand= 49.6%; fines= 6.2%		GS	1	3
2					GS	2	3
			- wet below 2.6 m				
3			- inferred cobble at 3.0 m - DCPT practical refusal at 3.1 m: 50 mm in 50 blows				
	CL		Grey lean CLAY (CL) - traces of sand and gravel				
4					GS	3	22
			End of Borehole BH17-21 at 4.6 m Target depth reached Groundwater measured at 2.6 m in open borehole DCPT from surface to 3.1 m				
5							
6							



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite, Sloughed, Drill Cuttings, Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-22

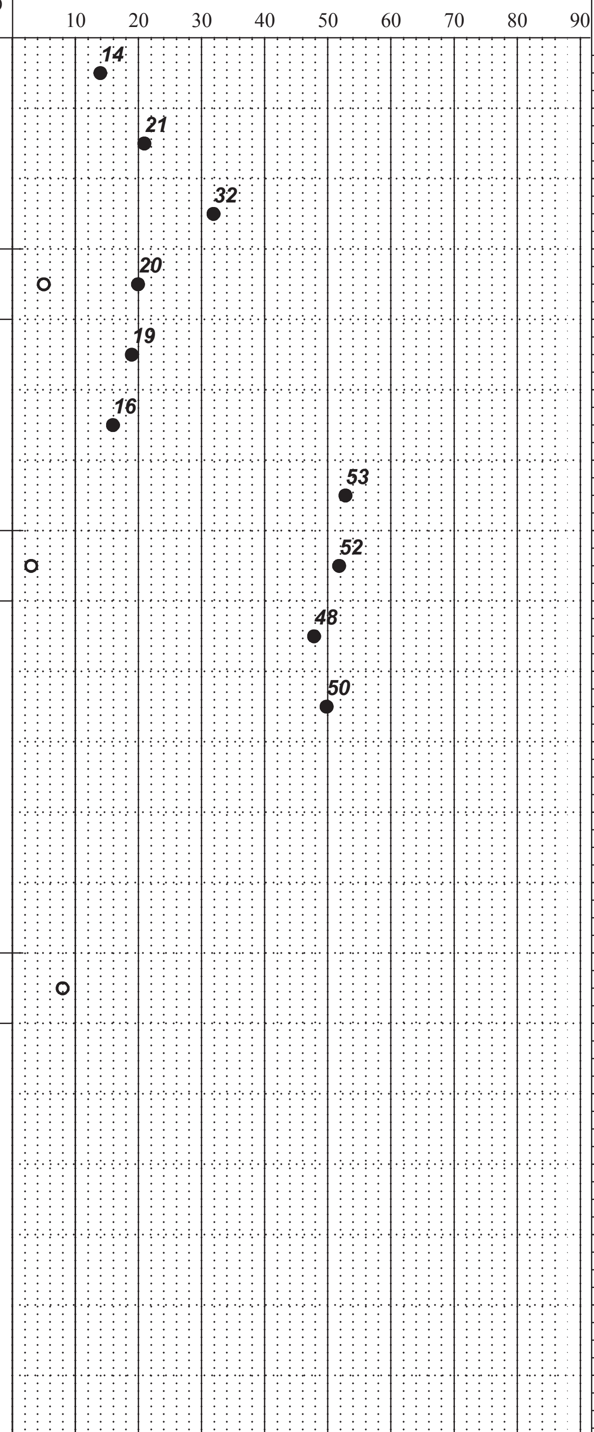
CLIENT	Capital Regional District	PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic
		NORTHING	5361455
LOCATION	Dallas Road, Victoria, BC	ELEVATION	12.3 m
		EASTING	474106
DRILLING DATE	07/04/2017	DRILLING CO.	Geotech Drilling Ltd.
DRILLING METHOD	Solid-Stem Auger		

□ Insitu Shear Vane (kPa) ▣ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	TYPE	NUMBER	MOISTURE CONTENT (%)
0 – 1.8	FL		FILL: dark brown silty sand - traces of gravel and organics - occasional inferred cobbles to 4.6 m - fines at 1.1 m= 26.9%		GS	1	5
1.8 – 3.6	FL		FILL: brown, poorly-graded sand with silt and gravel - occasional inferred cobbles - fines at 2.1 m= 10.9%		GS	2	3
3.6 – 4.6	TL		Grey silty sand (SM) with gravel TILL - high drilling resistance - occasional inferred cobbles		GS	3	8
4.6			End of Borehole BH17-22 at 4.6 m Target depth reached Groundwater not encountered in open borehole DCPT conducted from surface to 3.0 m				



Sample Type: GS - Grab Sample SPT - Split Spoon
ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

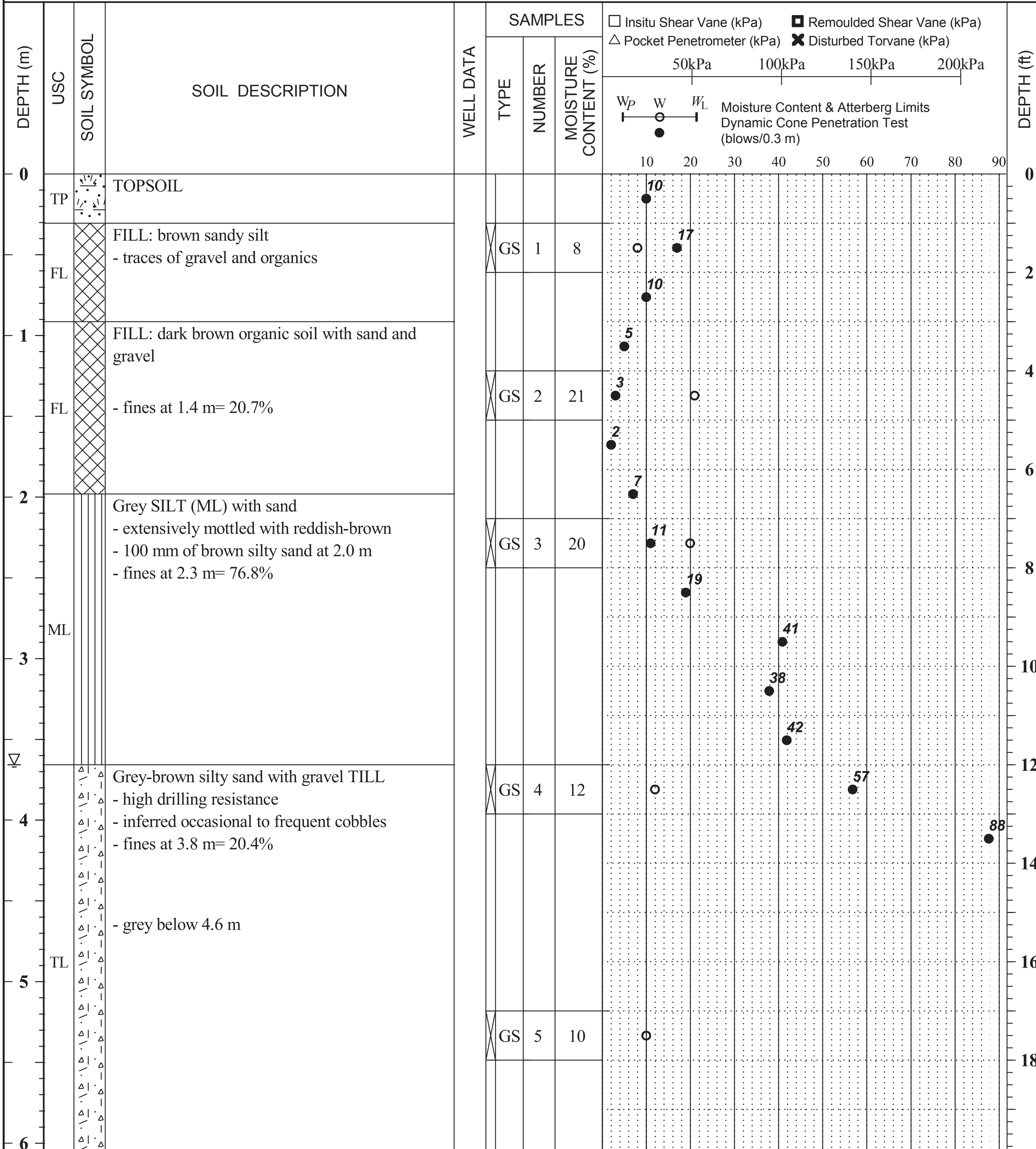
BH17-23

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361876
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 16.4 m
EASTING: 472449
DRILLING DATE: 07/04/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

USC	SOIL DESCRIPTION
TP	TOPSOIL
FL	FILL: brown sandy silt - traces of gravel and organics
FL	FILL: dark brown organic soil with sand and gravel - fines at 1.4 m= 20.7%
ML	Grey SILT (ML) with sand - extensively mottled with reddish-brown - 100 mm of brown silty sand at 2.0 m - fines at 2.3 m= 76.8%
TL	Grey-brown silty sand with gravel TILL - high drilling resistance - inferred occasional to frequent cobbles - fines at 3.8 m= 20.4% - grey below 4.6 m

SAMPLES

TYPE	NUMBER	MOISTURE CONTENT (%)
GS	1	8
GS	2	21
GS	3	20
GS	4	12
GS	5	10



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-23 cont'd

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361876
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 16.4 m
EASTING: 472449
DRILLING DATE: 07/04/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Solid-Stem Auger

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	WELL DATA	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
	TL		Grey silty sand with gravel TILL - high drilling resistance - inferred occasional to frequent cobbles		GS	6	10	20
7								22
			End of Borehole BH17-23 at 7.2 m Practical auger refusal Groundwater measured at 3.7 m in open borehole DCPT conducted from surface to 4.3 m					24
8								26
								28
9								30
								32
10								34
11								36
								38
12								40

☐ Insitu Shear Vane (kPa)
◘ Remoulded Shear Vane (kPa)
△ Pocket Penetrometer (kPa)
✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

BOREHOLE RECORD

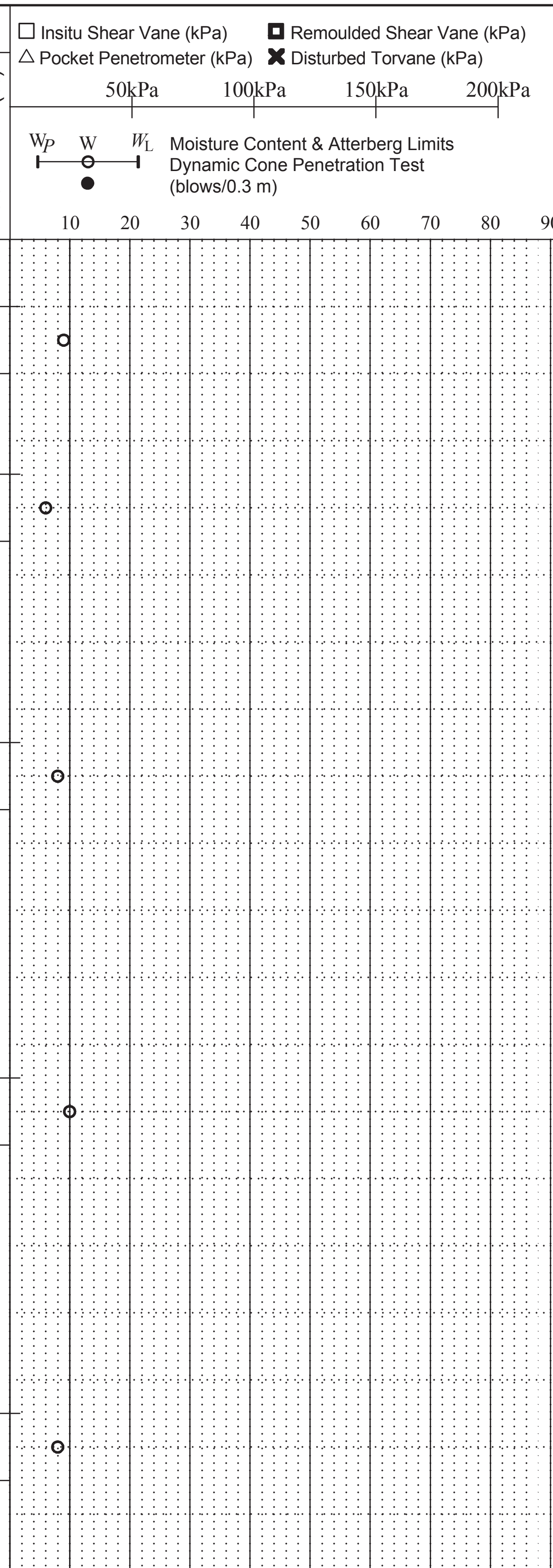
BH17-24

CLIENT	Capital Regional District			PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic	NORTHING	5361802
LOCATION	Dallas Road, Victoria, BC	ELEVATION	22.0 m	EASTING	472709
DRILLING DATE	06/26/2017	DRILLING CO.	Geotech Drilling Ltd.	DRILLING METHOD	Auger & ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
0 – 0.75	TP	TOPSOIL	GS	1	9	
0.75 – 1.5	GW	Brown well-graded GRAVEL (GW) with sand - traces of organics	GS	2	6	
1.5 – 3.0	SM	Grey-brown SILTY SAND (SM) - traces of gravel - high drilling resistance	GS	3	8	
3.0 – 6.1	TL	Grey-brown silty sand (SM) TILL - traces of gravel - high drilling resistance - fines at 4.0 m= 34.9% - with gravel below 4.6 m	GS	4	10	
			GS	5	8	

Depth scale (m): 0, 1, 2, 3, 4, 5, 6

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH

Reviewed by: BH

Date: July 13, 2017

Stantec

BOREHOLE RECORD

BH17-24 cont'd

CLIENT	Capital Regional District			PROJECT No.	111700431
PROJECT	Clover Point Forcemain	DATUM	Geodetic	NORTHING	5361802
LOCATION	Dallas Road, Victoria, BC	ELEVATION	22.0 m	EASTING	472709
DRILLING DATE	06/26/2017	DRILLING CO.	Geotech Drilling Ltd.	DRILLING METHOD	Auger & ODEX

Legend: ☐ Insitu Shear Vane (kPa) ▣ Remoulded Shear Vane (kPa) △ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)

10 20 30 40 50 60 70 80 90

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
	TL	Grey-brown silty sand (SM) with gravel TILL - high drilling resistance				20
						22
7		- fines at 7.0 m= 30.8%	GS	6	8	
						24
		- grey below 7.6 m				
8						26
			GS	7	9	28
9						30
			GS	8	11	32
10		- light grey; no gravel below 10.0 m	GS	9	10	34
11						36
						38
12						40

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

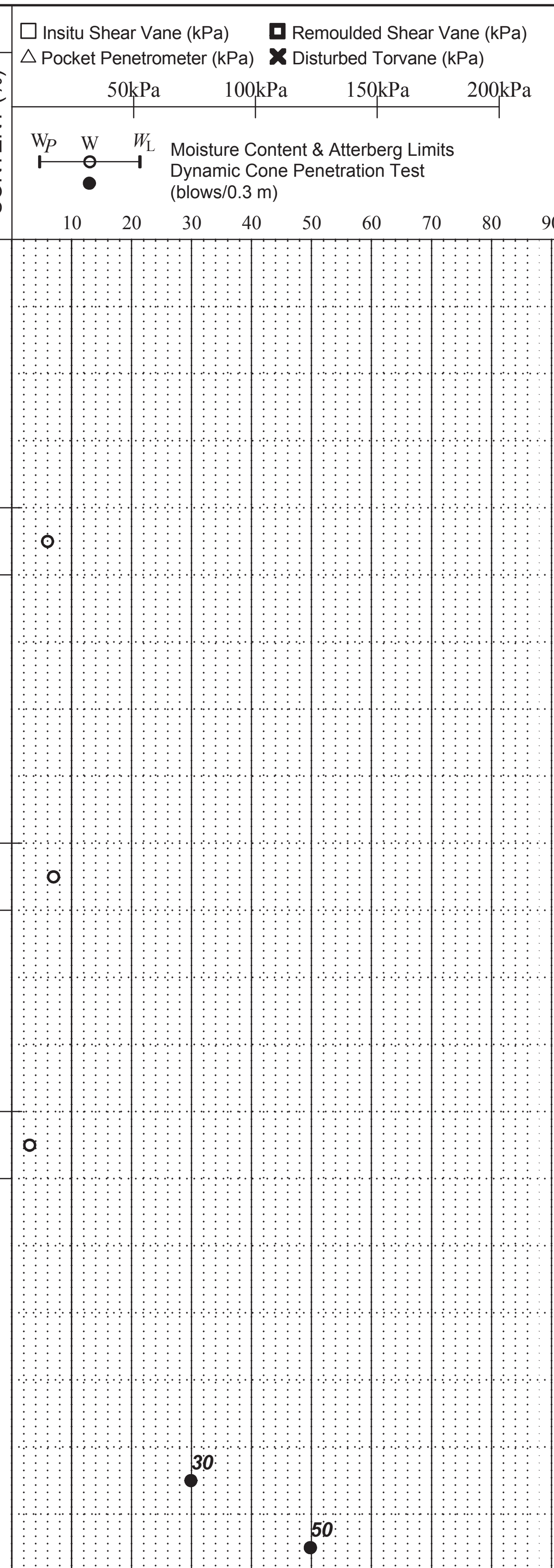
Stantec

BOREHOLE RECORD

BH17-24 cont'd

CLIENT	Capital Regional District
PROJECT	Clover Point Forcemain
LOCATION	Dallas Road, Victoria, BC
DRILLING DATE	06/26/2017
DRILLING CO.	Geotech Drilling Ltd.
DATUM	Geodetic
ELEVATION	22.0 m
DRILLING METHOD	Auger & ODEX
PROJECT No.	111700431
NORTHING	5361802
EASTING	472709

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)	DEPTH (ft)
	TL	Grey silty sand (SM) with gravel TILL - high drilling resistance				40
13	TL	Grey, poorly-graded sand with silt (SP-SM) TILL				42
		- grab sample at 13.4 m taken from ODEX air return	GS	10	6	44
14		Grey silty sand (SM) TILL - traces of gravel				46
15		- grab sample at 15.1 m taken from ODEX air return - fines at 15.1 m= 21.7%	GS	11	7	48, 50
16	TL	- grab sample at 16.3 m taken from ODEX air return	GS	12	3	52, 54
17						56, 58
18						60



Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

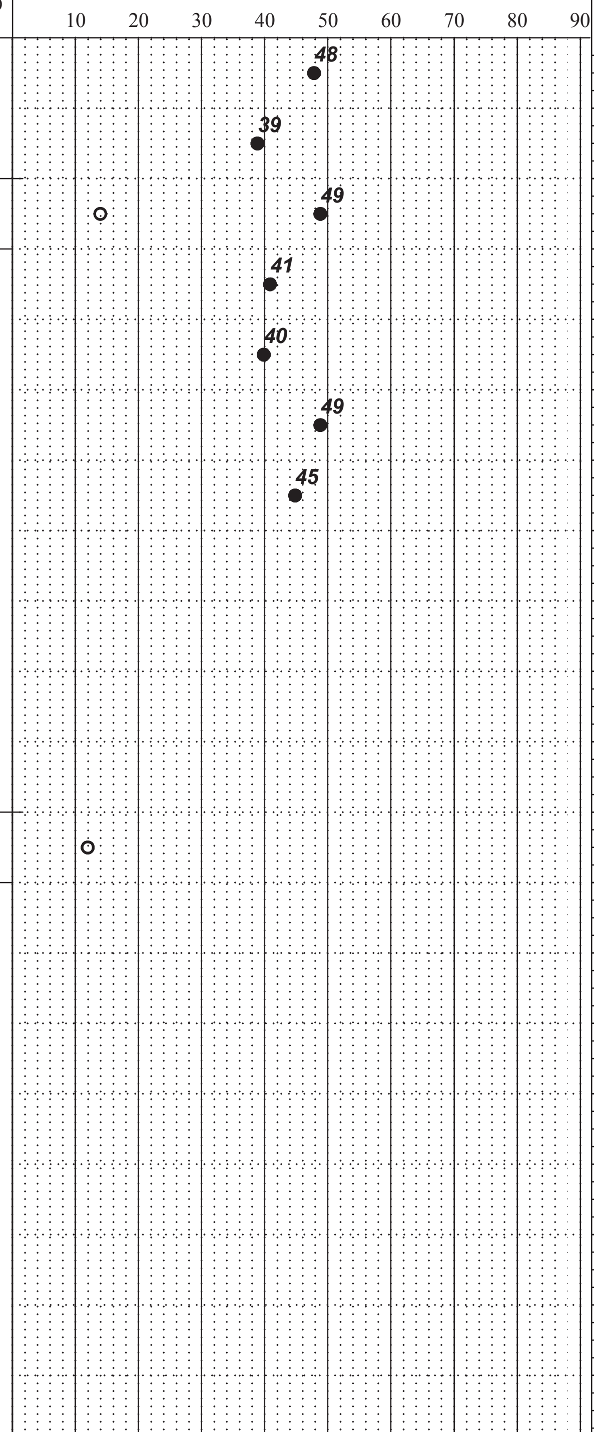
BOREHOLE RECORD

BH17-24 cont'd

CLIENT: Capital Regional District
PROJECT No.: 111700431
PROJECT: Clover Point Forcemain
DATUM: Geodetic
NORTHING: 5361802
LOCATION: Dallas Road, Victoria, BC
ELEVATION: 22.0 m
EASTING: 472709
DRILLING DATE: 06/26/2017
DRILLING CO.: Geotech Drilling Ltd.
DRILLING METHOD: Auger & ODEX

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	MOISTURE CONTENT (%)
18.3 – 22.9	TL	Grey silty sand (SM) TILL - traces of gravel			
19		- grab sample at 18.9 m taken from ODEX air return - with gravel below 18.9 m	GS	13	14
22		- grab sample at 21.8 m taken from ODEX air return	GS	14	12
22.9		End of Borehole BH17-24 at 22.9 m Target depth reached Groundwater not encountered in open borehole Drilled using auger method to 10.7 m; ODEX method below 10.7 m DCPT conducted from 17.8 to 20.4 m			

Legend: □ Insitu Shear Vane (kPa) ■ Remoulded Shear Vane (kPa) △ Pocket Penetrometer (kPa) ✖ Disturbed Torvane (kPa)
50kPa 100kPa 150kPa 200kPa
W_P W W_L Moisture Content & Atterberg Limits
● Dynamic Cone Penetration Test (blows/0.3 m)



DEPTH (ft): 60 62 64 66 68 70 72 74 76 78 80

Sample Type: GS - Grab Sample SPT - Split Spoon ST - Shelby Tube PT - Piston Tube CC - Continuous Core

Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CH
Reviewed by: BH
Date: July 13, 2017

Stantec

Appendix D LABORATORY TEST RESULTS

D.1 ATTERBERG LIMITS

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

OFFICE
4730 Kingsway
Suite 500
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LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

Sample : BH17-1 GS-4

LIQUID LIMIT

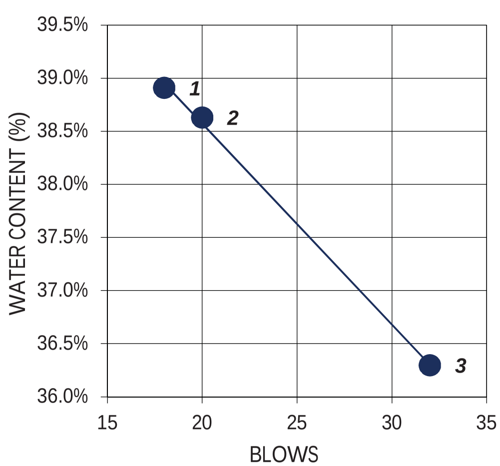
Trial	1	2	3
No. of Blows	18	20	32
Tare No.	NH-3	AB-1	AB-2
Wt. Sa. (wet+tare)(g)	45	40	38
Wt. Sa. (dry+tare)(g)	32	29	28
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	31.1	27.7	27.0
Wt. Water (g)	12.1	10.7	9.8
Water Content (%)	38.9%	38.6%	36.3%

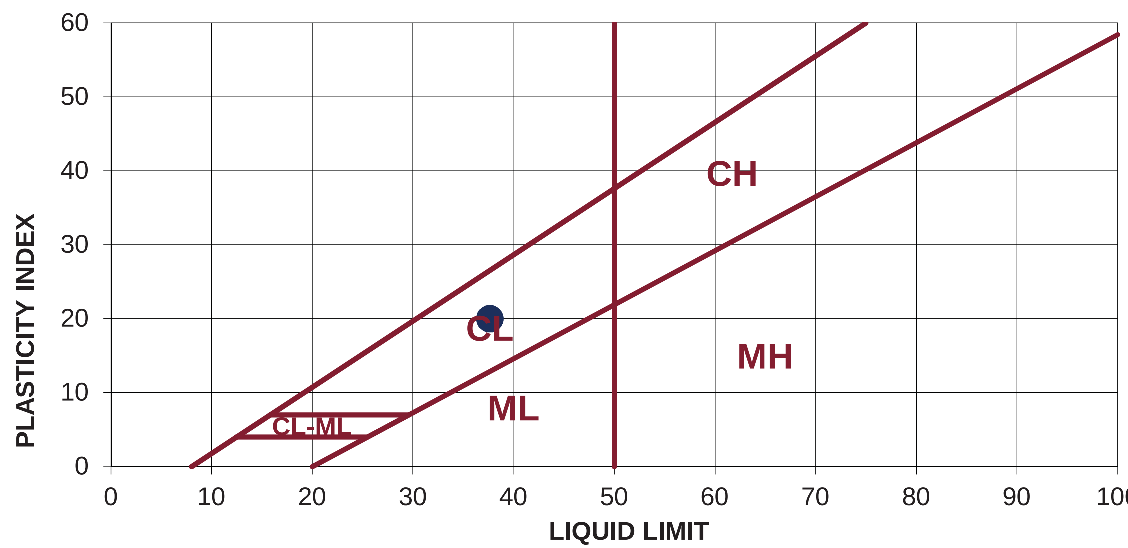
PLASTIC LIMIT

Trial	1	2
Tare No.	JK-11	NG-4
Wt. Sa. (wet+tare)(g)	21.10	21.6
Wt. Sa. (dry+tare)(g)	18.10	18.6
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	16.8	17.3
Wt. Water (g)	3.0	3.0
Water Content (%)	17.9%	17.3%

RESULTS

LL	38
PL	18
PI	20
Natural MC (%)	20.1%





Reviewed By: CH

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Atterberg Limits

ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-1 GS-6

LIQUID LIMIT

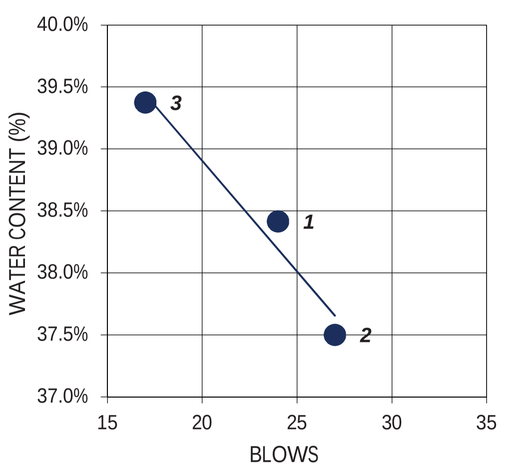
Trial	1	2	3
No. of Blows	24	27	17
Tare No.	JK-10	W-2	Z-4
Wt. Sa. (wet+tare)(g)	24	26	23
Wt. Sa. (dry+tare)(g)	18	19	17
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	16.4	17.6	16.0
Wt. Water (g)	6.3	6.6	6.3
Water Content (%)	38.4%	37.5%	39.4%

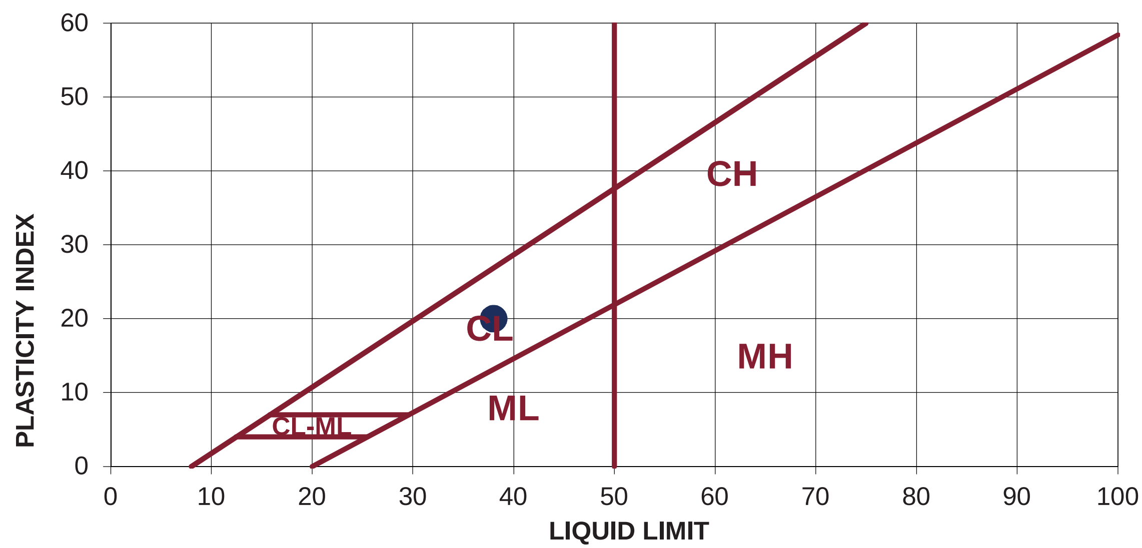
PLASTIC LIMIT

Trial	1	2
Tare No.	JW-2	JW-3
Wt. Sa. (wet+tare)(g)	23.10	21.8
Wt. Sa. (dry+tare)(g)	19.80	18.6
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	18.5	17.3
Wt. Water (g)	3.3	3.2
Water Content (%)	17.8%	18.5%

RESULTS

LL	38
PL	18
PI	20
Natural MC (%)	
20.6%	





Reviewed By: CH

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Atterberg Limits

ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-2 GS-2

LIQUID LIMIT

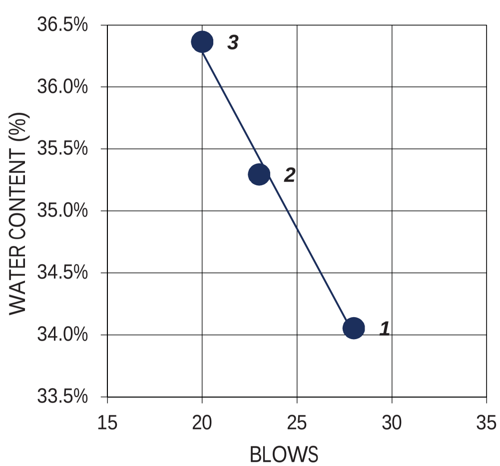
Trial	1	2	3
No. of Blows	28	23	20
Tare No.	JC-1	KJ-2	B-1
Wt. Sa. (wet+tare)(g)	26	24	27
Wt. Sa. (dry+tare)(g)	20	18	20
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	18.5	17.0	18.7
Wt. Water (g)	6.3	6.0	6.8
Water Content (%)	34.1%	35.3%	36.4%

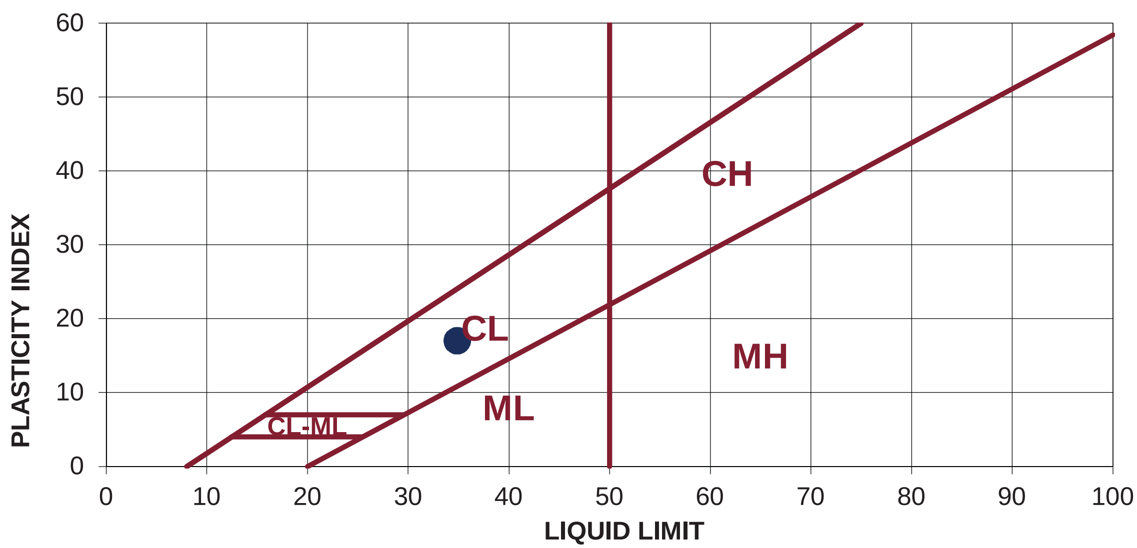
PLASTIC LIMIT

Trial	1	2
Tare No.	KJ-3	NG-4
Wt. Sa. (wet+tare)(g)	19.70	20.6
Wt. Sa. (dry+tare)(g)	16.90	17.7
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	15.6	16.4
Wt. Water (g)	2.8	2.9
Water Content (%)	17.9%	17.7%

RESULTS

LL	35
PL	18
PI	17
Natural MC (%)	16.3%





Reviewed By: CH

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 4, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-5 GS-4

LIQUID LIMIT

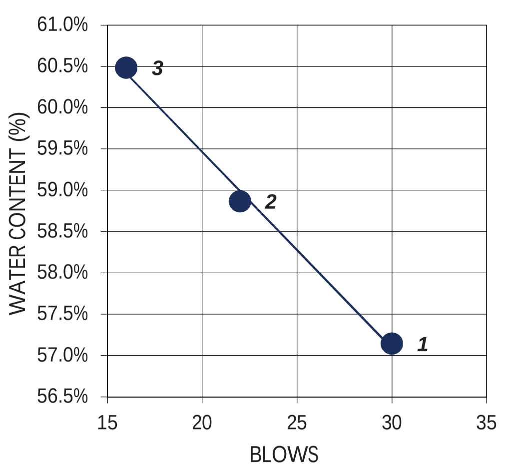
Trial	1	2	3
No. of Blows	30	22	16
Tare No.	D-1	D-3	D-2
Wt. Sa. (wet+tare)(g)	21	24	21
Wt. Sa. (dry+tare)(g)	14	15	14
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	12.6	14.1	12.4
Wt. Water (g)	7.2	8.3	7.5
Water Content (%)	57.1%	58.9%	60.5%

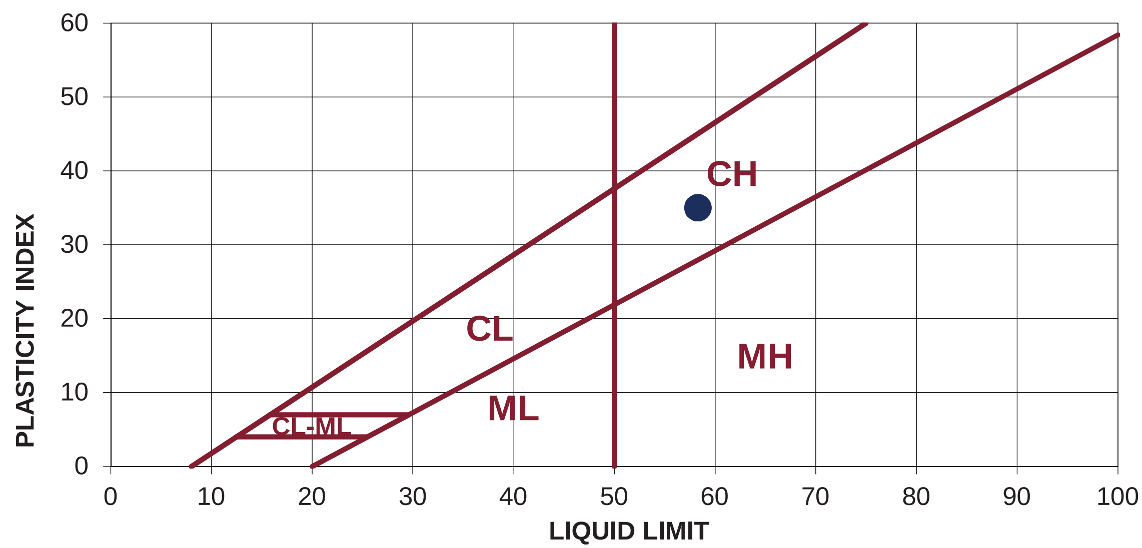
PLASTIC LIMIT

Trial	1	2
Tare No.	Z2	JN-5
Wt. Sa. (wet+tare)(g)	11.70	10.7
Wt. Sa. (dry+tare)(g)	9.70	8.9
Wt. Tare (g)	1.10	1.1
Wt. Dry Soil (g)	8.6	7.8
Wt. Water (g)	2.0	1.8
Water Content (%)	23.3%	23.1%

RESULTS

LL	58
PL	23
PI	35
Natural MC (%)	42.2%





Reviewed By: CH

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-6 GS-2

LIQUID LIMIT

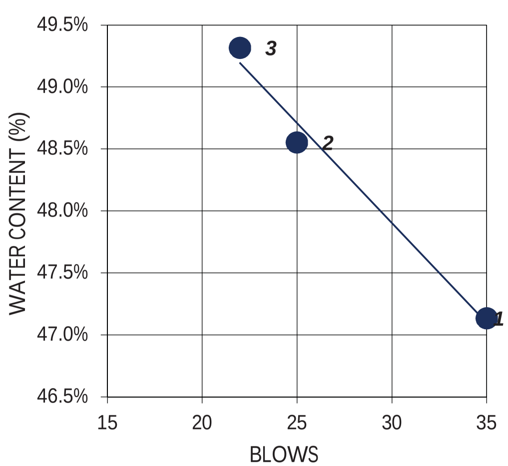
Trial	1	2	3
No. of Blows	35	25	22
Tare No.	AB-5	JK-9	JK-10
Wt. Sa. (wet+tare)(g)	24	22	23
Wt. Sa. (dry+tare)(g)	17	15	16
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	15.7	13.8	14.6
Wt. Water (g)	7.4	6.7	7.2
Water Content (%)	47.1%	48.6%	49.3%

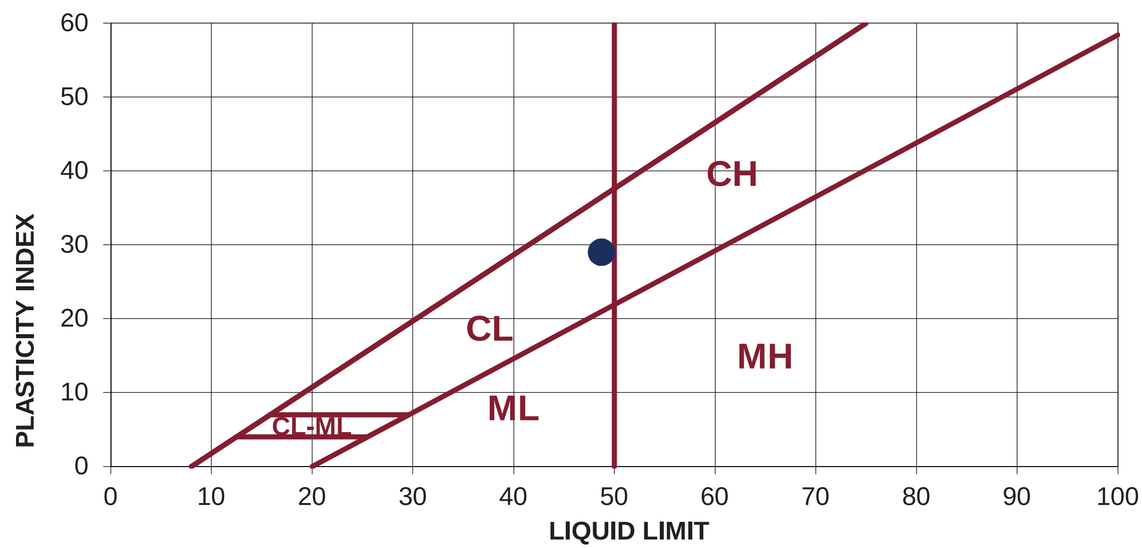
PLASTIC LIMIT

Trial	1	2
Tare No.	NG-1	KJ-4
Wt. Sa. (wet+tare)(g)	15.40	17.9
Wt. Sa. (dry+tare)(g)	13.00	15.1
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	11.7	13.8
Wt. Water (g)	2.4	2.8
Water Content (%)	20.5%	20.3%

RESULTS

LL	49
PL	20
PI	29
Natural MC (%)	
24.9%	





Reviewed By: CH

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-6 GS-3

LIQUID LIMIT

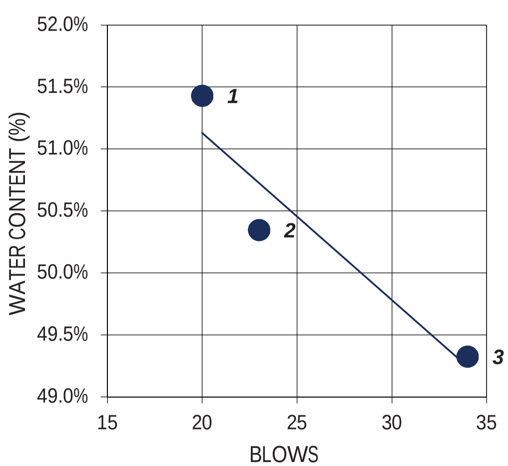
Trial	1	2	3
No. of Blows	20	23	34
Tare No.	JK-9	AB-1	JK-11
Wt. Sa. (wet+tare)(g)	23	23	23
Wt. Sa. (dry+tare)(g)	15	16	16
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	14.0	14.5	14.8
Wt. Water (g)	7.2	7.3	7.3
Water Content (%)	51.4%	50.3%	49.3%

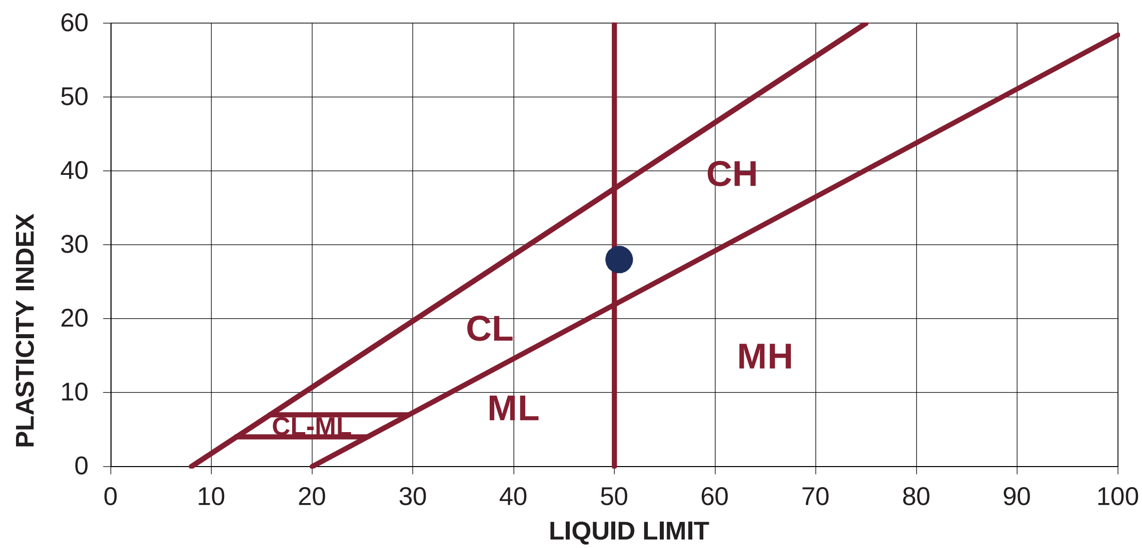
PLASTIC LIMIT

Trial	1	2
Tare No.	JW-1	AB-5
Wt. Sa. (wet+tare)(g)	20.90	21.1
Wt. Sa. (dry+tare)(g)	17.40	17.5
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	16.1	16.2
Wt. Water (g)	3.5	3.6
Water Content (%)	21.7%	22.2%

RESULTS

LL	50
PL	22
PI	28
Natural MC (%)	31.8%





Reviewed By: CH

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Atterberg Limits

ASTM D4318

Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-6 GS-4

LIQUID LIMIT

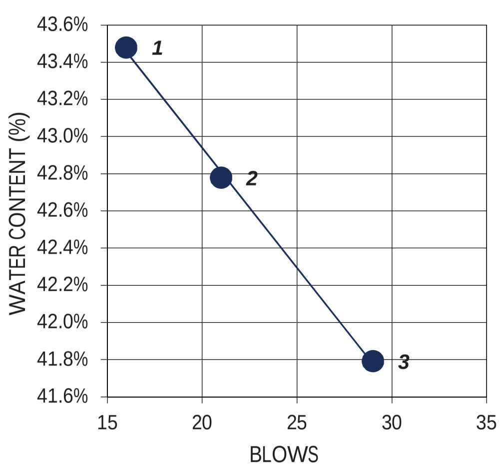
Trial	1	2	3
No. of Blows	16	21	29
Tare No.	JW-1	JW-2	JW-3
Wt. Sa. (wet+tare)(g)	28	27	20
Wt. Sa. (dry+tare)(g)	20	19	15
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	18.4	18.0	13.4
Wt. Water (g)	8.0	7.7	5.6
Water Content (%)	43.5%	42.8%	41.8%

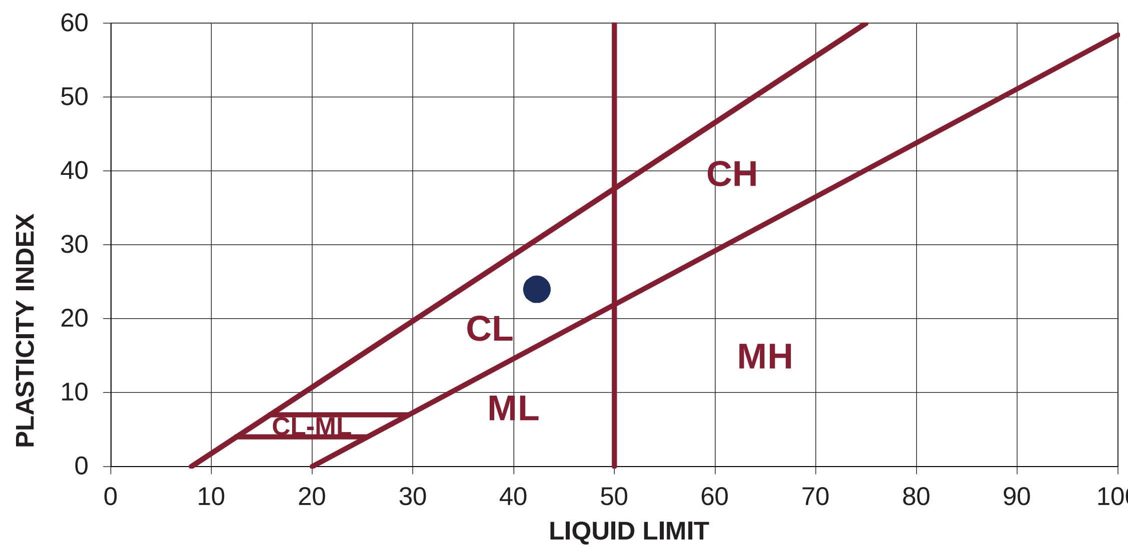
PLASTIC LIMIT

Trial	1	2
Tare No.	JK-1	J-6
Wt. Sa. (wet+tare)(g)	18.10	18.8
Wt. Sa. (dry+tare)(g)	15.50	16.1
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	14.2	14.8
Wt. Water (g)	2.6	2.7
Water Content (%)	18.3%	18.2%

RESULTS

LL	42
PL	18
PI	24
Natural MC (%)	24.9%





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Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	July 1, 2017
Date Tested:	July 11, 2017
Tested By:	JW

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Sample : BH17-7 GS-3

LIQUID LIMIT

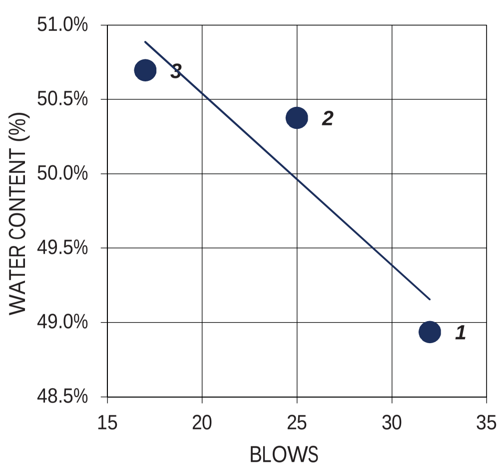
Trial	1	2	3
No. of Blows	32	25	17
Tare No.	JN-5	E2	Z1
Wt. Sa. (wet+tare)(g)	22	21	23
Wt. Sa. (dry+tare)(g)	15	14	16
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	14.1	13.3	14.4
Wt. Water (g)	6.9	6.7	7.3
Water Content (%)	48.9%	50.4%	50.7%

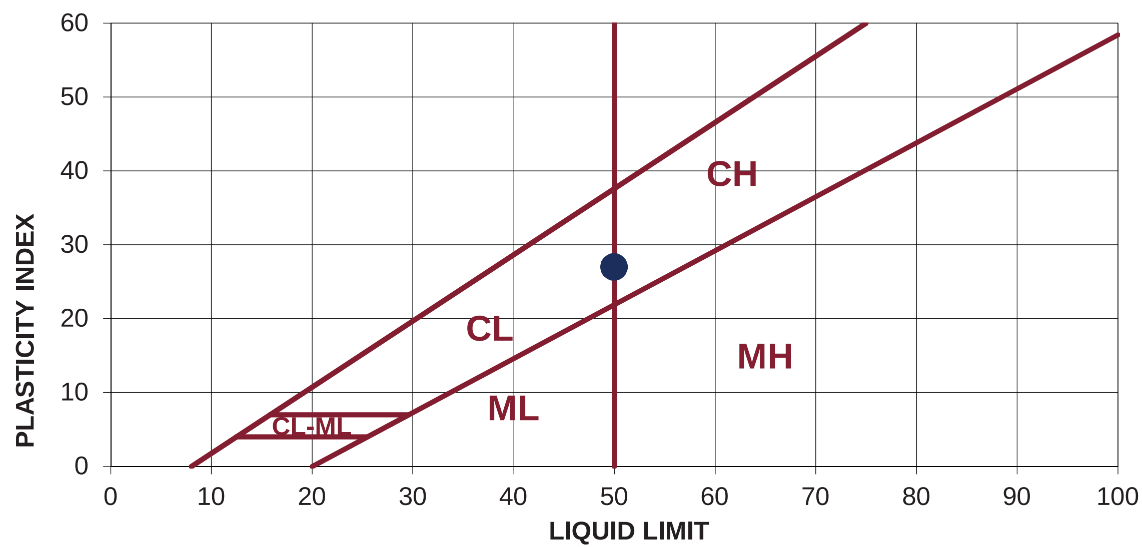
PLASTIC LIMIT

Trial	1	2
Tare No.	A10	C2
Wt. Sa. (wet+tare)(g)	11.00	7.8
Wt. Sa. (dry+tare)(g)	9.20	6.6
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	7.9	5.3
Wt. Water (g)	1.8	1.2
Water Content (%)	22.8%	22.6%

RESULTS

LL	50
PL	23
PI	27
Natural MC (%)	30.1%





Reviewed By: CH

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	June 23, 2017
Date Tested:	July 6, 2017
Tested By:	KK

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Tel: (604) 436-3014

Sample : BH12-12 SS-04

LIQUID LIMIT

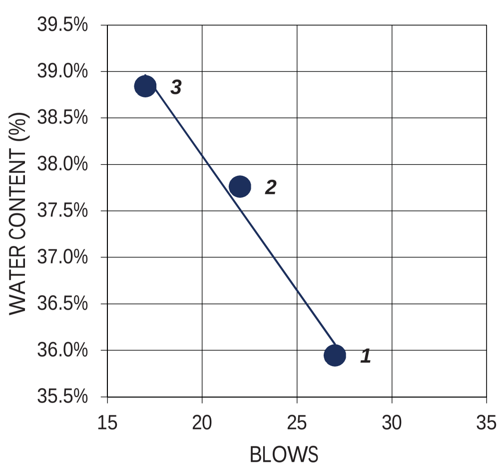
Trial	1	2	3
No. of Blows	27	22	17
Tare No.	NG-2	A4	A2
Wt. Sa. (wet+tare)(g)	31	35	32
Wt. Sa. (dry+tare)(g)	23	25	24
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	21.7	24.1	22.4
Wt. Water (g)	7.8	9.1	8.7
Water Content (%)	35.9%	37.8%	38.8%

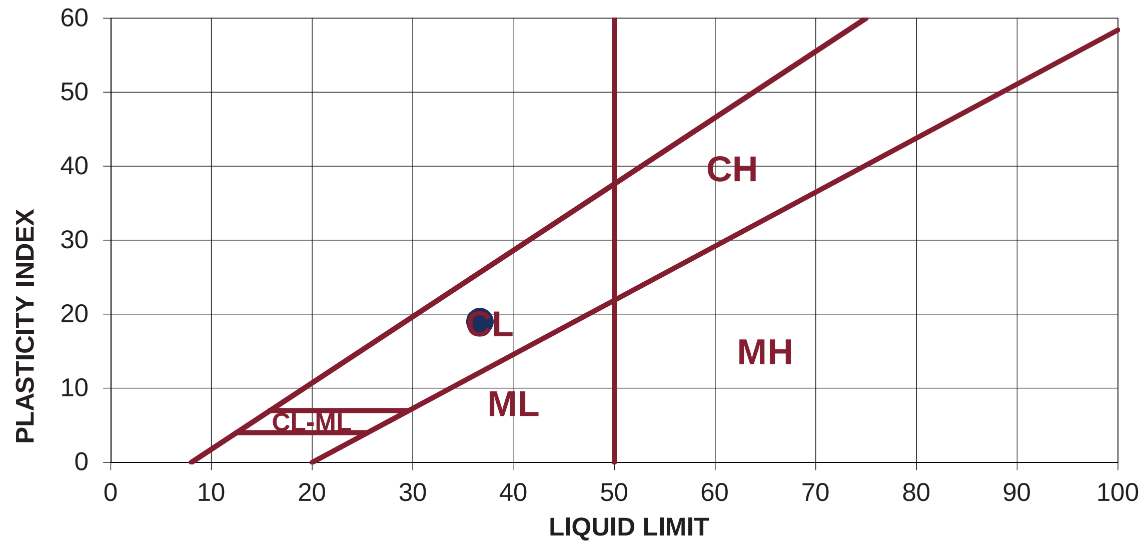
PLASTIC LIMIT

Trial	1	2
Tare No.	A28	H9
Wt. Sa. (wet+tare)(g)	13.10	11.8
Wt. Sa. (dry+tare)(g)	11.30	10.2
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	10.0	8.9
Wt. Water (g)	1.8	1.6
Water Content (%)	18.0%	18.0%

RESULTS

LL	**37**
PL	**18**
PI	**19**
Natural MC (%)	20.3%





Reviewed By: CH

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Atterberg Limits

ASTM D4318
Method A- Multi-Point

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431
Date Received: June 23, 2017
Date Tested: July 6, 2017
Tested By: KK

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Tel: (604) 436-3014

Sample : BH12-12 SS-05A

LIQUID LIMIT

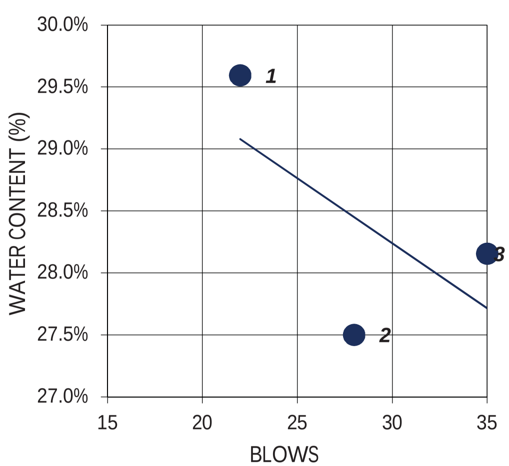
Trial	1	2	3
No. of Blows	22	28	35
Tare No.	D-1	D-2	D-3
Wt. Sa. (wet+tare)(g)	39	37	28
Wt. Sa. (dry+tare)(g)	31	29	22
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	29.4	28.0	20.6
Wt. Water (g)	8.7	7.7	5.8
Water Content (%)	29.6%	27.5%	28.2%

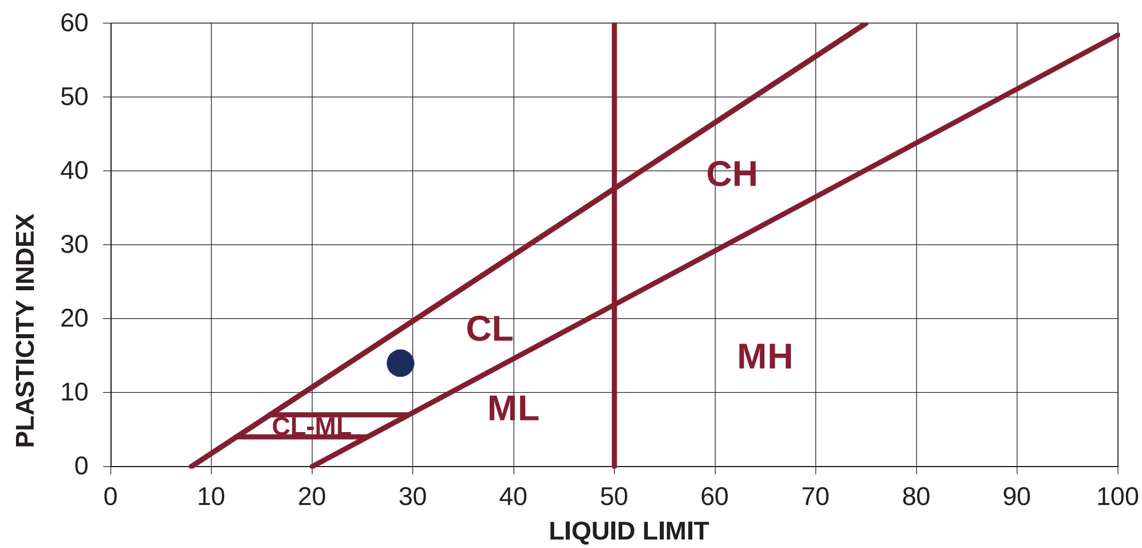
PLASTIC LIMIT

Trial	1	2
Tare No.	D-4	D-5
Wt. Sa. (wet+tare)(g)	16.30	13.7
Wt. Sa. (dry+tare)(g)	14.30	12.1
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	13.0	10.8
Wt. Water (g)	2.0	1.6
Water Content (%)	15.4%	14.8%

RESULTS

LL	29
PL	15
PI	14
Natural MC (%)	
20.3%	





Reviewed By: CH

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Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431
Date Received: June 23, 2017
Date Tested: July 4, 2017
Tested By: KK

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Sample : BH17-13 SS-04

LIQUID LIMIT

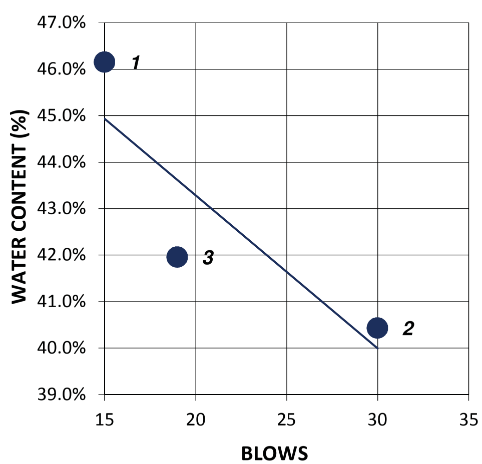
Trial	1	2	3
No. of Blows	15	30	19
Tare No.	A13	KK-7	KK-6
Wt. Sa. (wet+tare)(g)	24	34	38
Wt. Sa. (dry+tare)(g)	17	24	27
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	15.6	23.0	25.5
Wt. Water (g)	7.2	9.3	10.7
Water Content (%)	46.2%	40.4%	42.0%

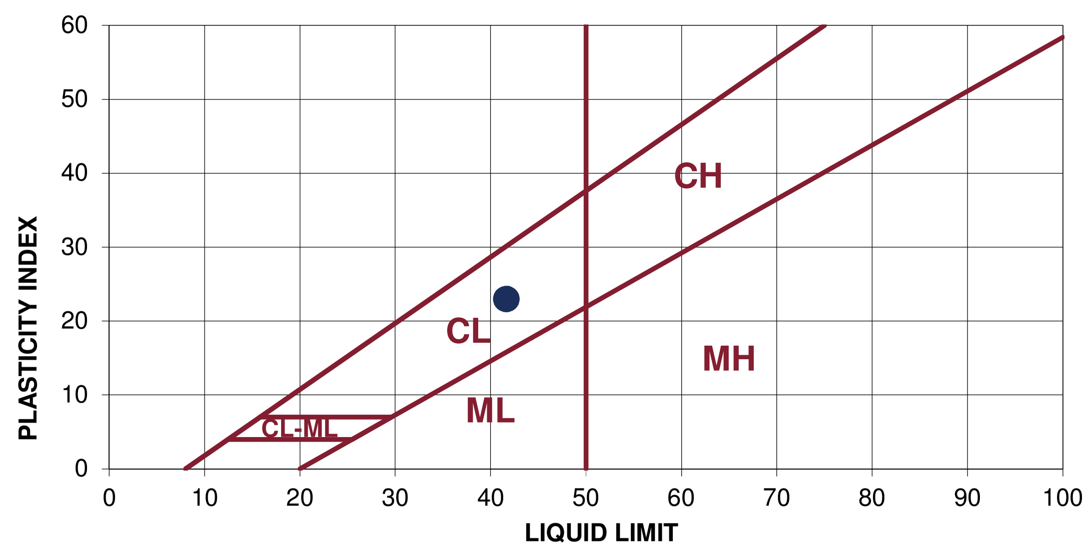
PLASTIC LIMIT

Trial	1	2
Tare No.	ZZ9	ZZ3
Wt. Sa. (wet+tare)(g)	12.70	19.3
Wt. Sa. (dry+tare)(g)	10.90	16.4
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	9.6	15.1
Wt. Water (g)	1.8	2.9
Water Content (%)	18.8%	19.2%

RESULTS

LL	42
PL	19
PI	23
Natural MC (%)	15.4%





Reviewed By: CH

Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client:	CRD
Project Name:	CRD Clover Point Forcemain
Project No:	111700431
Date Received:	June 23, 2017
Date Tested:	July 4, 2017
Tested By:	KK

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Sample : BH17-16 SS-02

LIQUID LIMIT

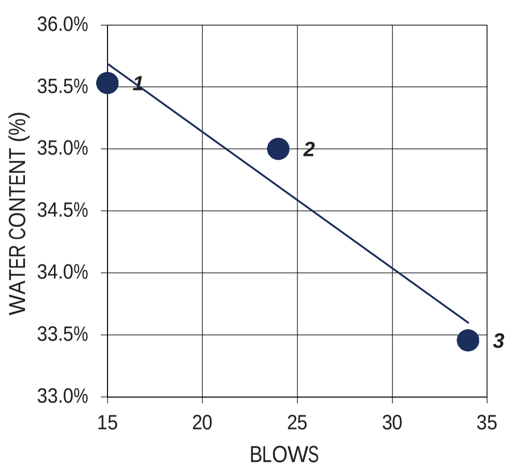
Trial	1	2	3
No. of Blows	15	24	34
Tare No.	RP1	ZZ6	ZZ4
Wt. Sa. (wet+tare)(g)	38	34	38
Wt. Sa. (dry+tare)(g)	29	25	29
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	27.3	24.0	27.2
Wt. Water (g)	9.7	8.4	9.1
Water Content (%)	35.5%	35.0%	33.5%

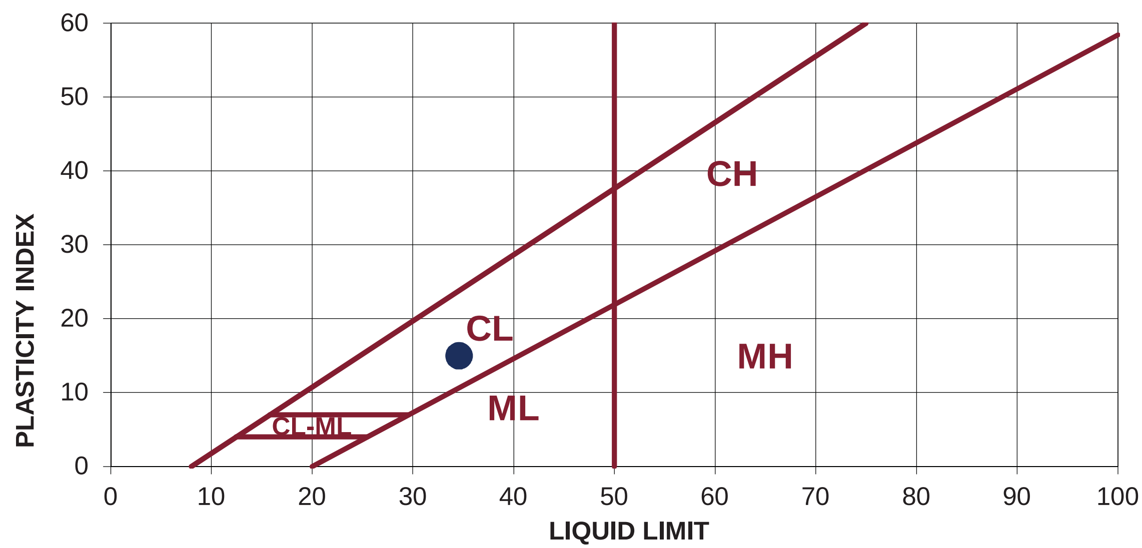
PLASTIC LIMIT

Trial	1	2
Tare No.	Z31	A12
Wt. Sa. (wet+tare)(g)	14.20	12.8
Wt. Sa. (dry+tare)(g)	12.10	10.9
Wt. Tare (g)	1.30	1.3
Wt. Dry Soil (g)	10.8	9.6
Wt. Water (g)	2.1	1.9
Water Content (%)	19.4%	19.8%

RESULTS

LL	**35**
PL	**20**
PI	**15**
Natural MC (%)	19.6%





Reviewed By: CH

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Atterberg Limits
ASTM D4318
Method A- Multi-Point

Client: CRD
Project Name: CRD Clover Point Forcemain

Project No: 111700431
Date Received: July 1, 2017
Date Tested: July 4, 2017
Tested By: JW

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Sample : BH17-17 GS-3

LIQUID LIMIT

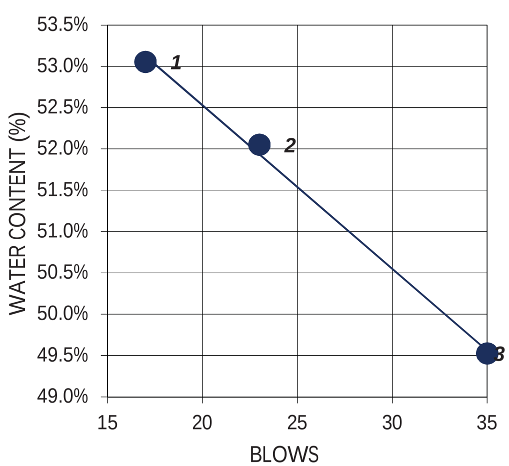
Trial	1	2	3
No. of Blows	17	23	35
Tare No.	E-1	E-2	E-3
Wt. Sa. (wet+tare)(g)	34	38	33
Wt. Sa. (dry+tare)(g)	23	26	22
Wt. Tare (g)	1	1	1
Wt. Dry Soil (g)	21.3	24.4	21.0
Wt. Water (g)	11.3	12.7	10.4
Water Content (%)	53.1%	52.0%	49.5%

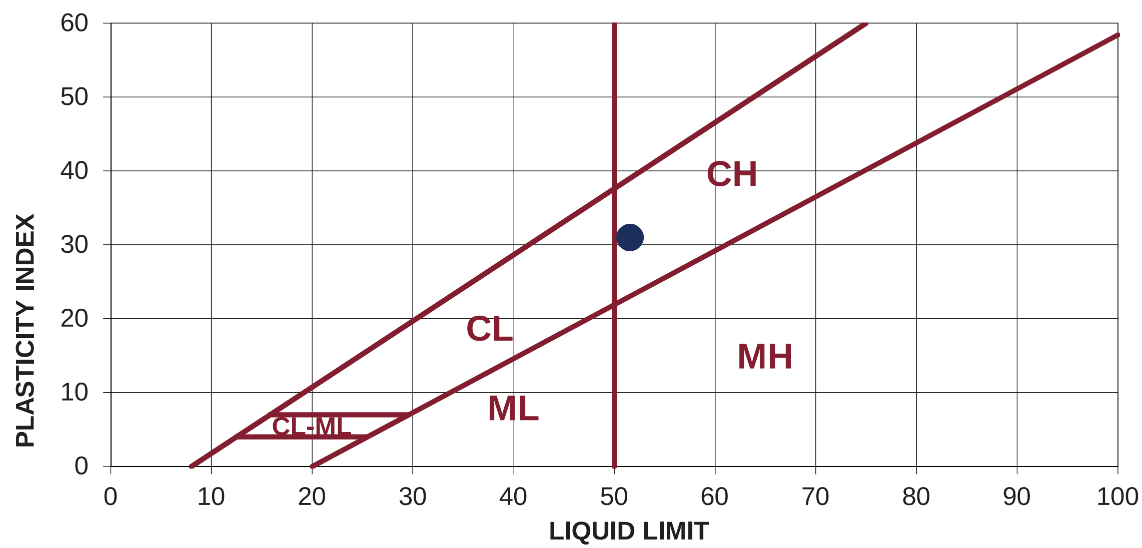
PLASTIC LIMIT

Trial	1	2
Tare No.	E4	
Wt. Sa. (wet+tare)(g)	15.70	
Wt. Sa. (dry+tare)(g)	13.20	
Wt. Tare (g)	1.30	
Wt. Dry Soil (g)	11.9	
Wt. Water (g)	2.5	
Water Content (%)	21.0%	

RESULTS

LL	**52**
PL	**21**
PI	**31**
Natural MC (%)	
26.4%	





Reviewed By: CH

D.2 GRAIN SIZE DISTRIBUTION

Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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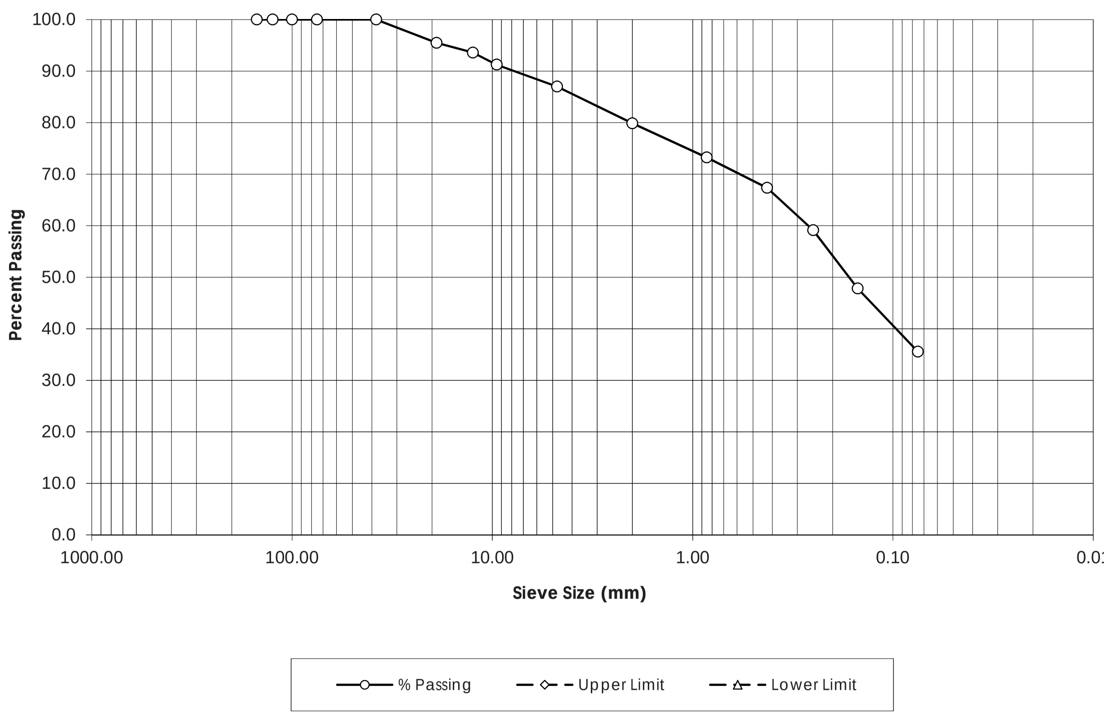
SAMPLE No.: GS-2
SOURCE: BH17-8
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	95.5	-	-
12.5	93.6	-	-
9.5	91.2	-	-
4.75	87.0	-	-
2.00	79.9	-	-
0.85	73.2	-	-
0.425	67.3	-	-
0.250	59.1	-	-
0.150	47.8	-	-
0.075	35.5	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	13.0%	D_{30}:	-
Sand:	51.4%	D_{60}:	0.2698
Fines:	35.6%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain

Project No: 111700431

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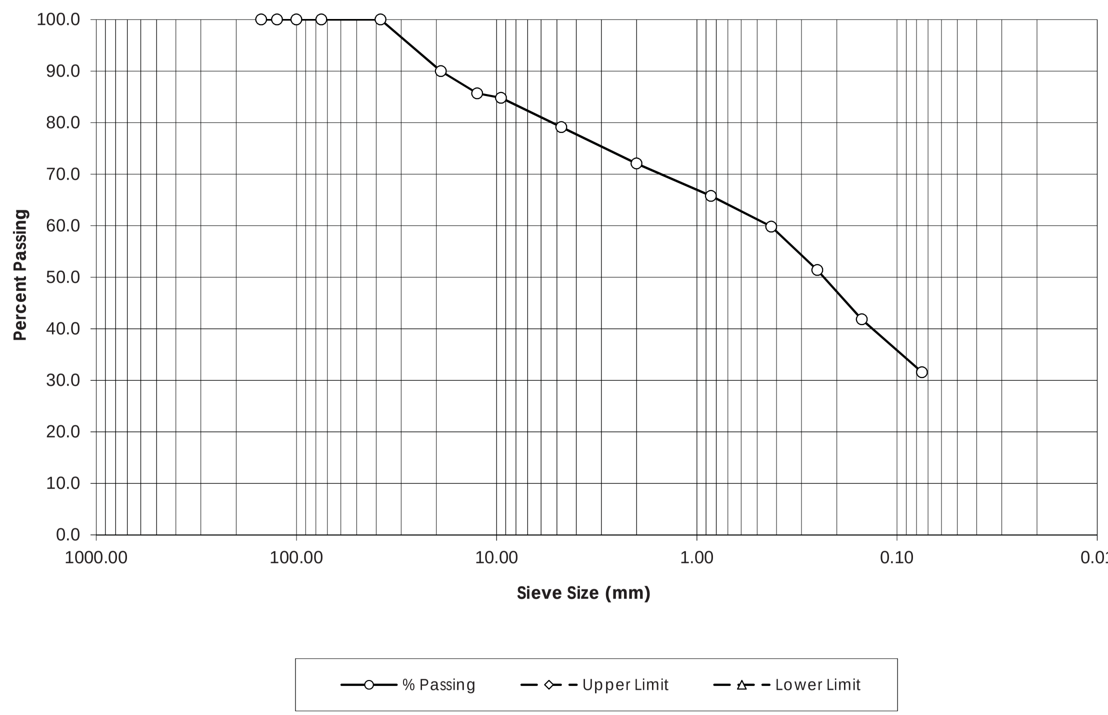
SAMPLE No.: SS-7
SOURCE: BH17-12
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND with gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	90.0	-	-
12.5	85.7	-	-
9.5	84.8	-	-
4.75	79.1	-	-
2.00	72.1	-	-
0.85	65.8	-	-
0.425	59.8	-	-
0.250	51.4	-	-
0.150	41.8	-	-
0.075	31.5	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	20.9%	D_{30}:	-
Sand:	47.6%	D_{60}:	0.4389
Fines:	31.5%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

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Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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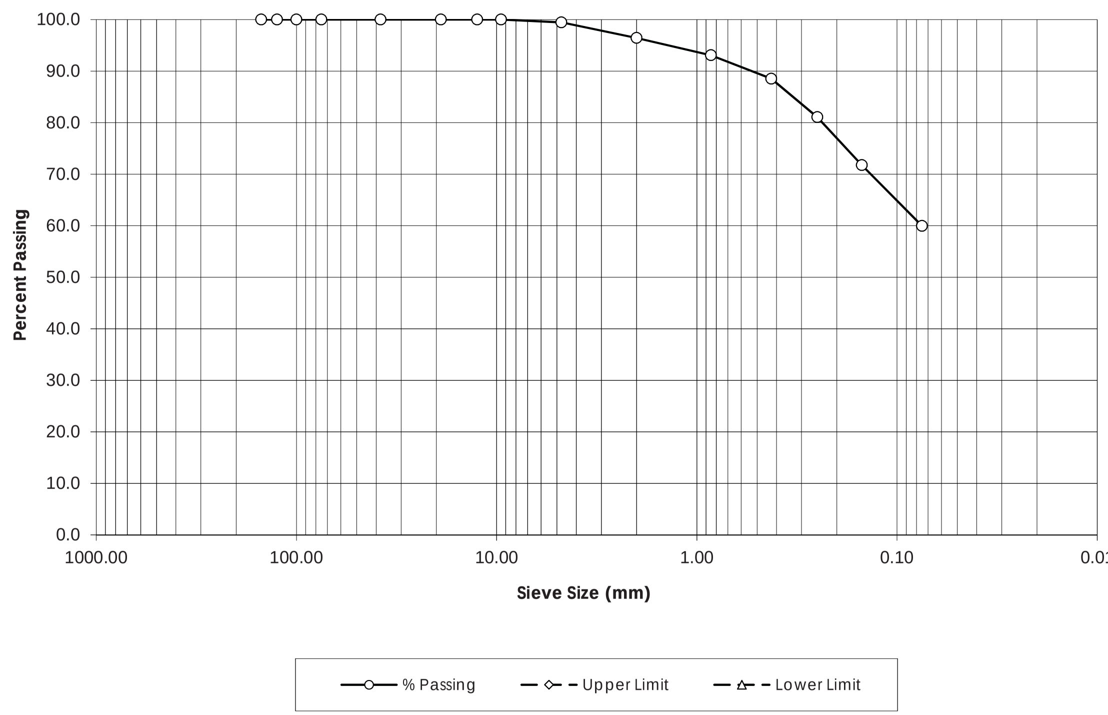
SAMPLE No.: SS-4
SOURCE: BH17-13
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: Sandy lean CLAY



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
38.0	**100.0**	-	-
19.0	**100.0**	-	-
12.5	**100.0**	-	-
9.5	**100.0**	-	-
4.75	**99.5**	-	-
2.00	**96.4**	-	-
0.85	**93.1**	-	-
0.425	**88.5**	-	-
0.250	**81.1**	-	-
0.150	**71.8**	-	-
0.075	**60.0**	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	0.5%	D_{30}:	-
Sand:	39.5%	D_{60}:	0.0753
Fines:	60.0%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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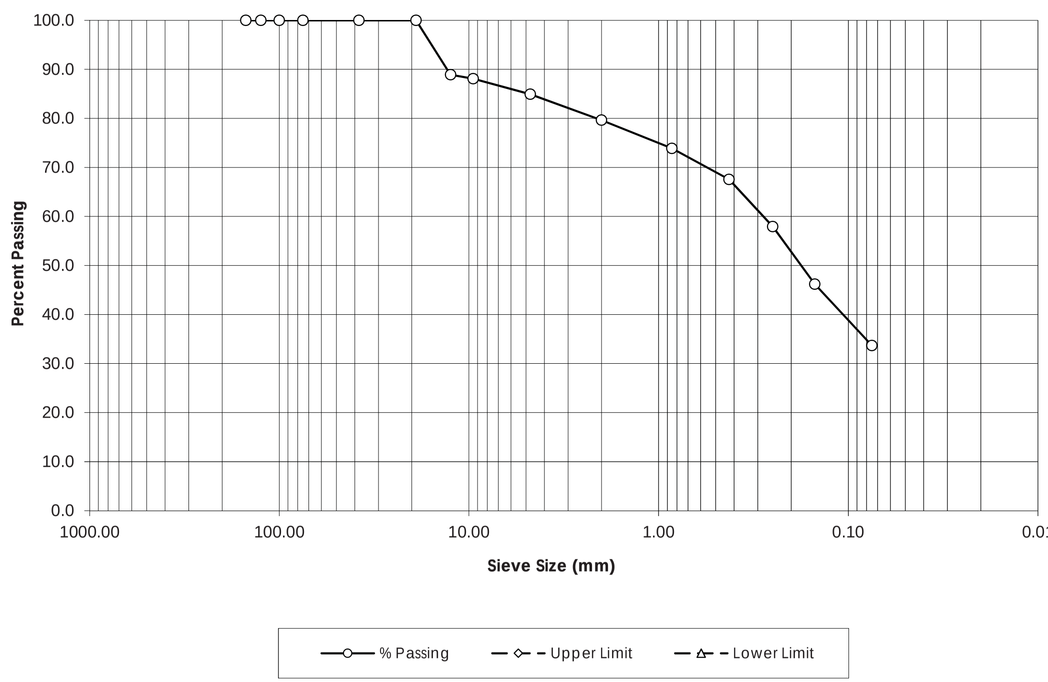
SAMPLE No.: SS-5
SOURCE: BH17-13
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND with gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	100.0	-	-
12.5	88.9	-	-
9.5	88.1	-	-
4.75	84.9	-	-
2.00	79.6	-	-
0.85	73.9	-	-
0.425	67.5	-	-
0.250	57.9	-	-
0.150	46.2	-	-
0.075	33.7	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	15.1%	D_{30}:	-
Sand:	51.2%	D_{60}:	0.2901
Fines:	33.7%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

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Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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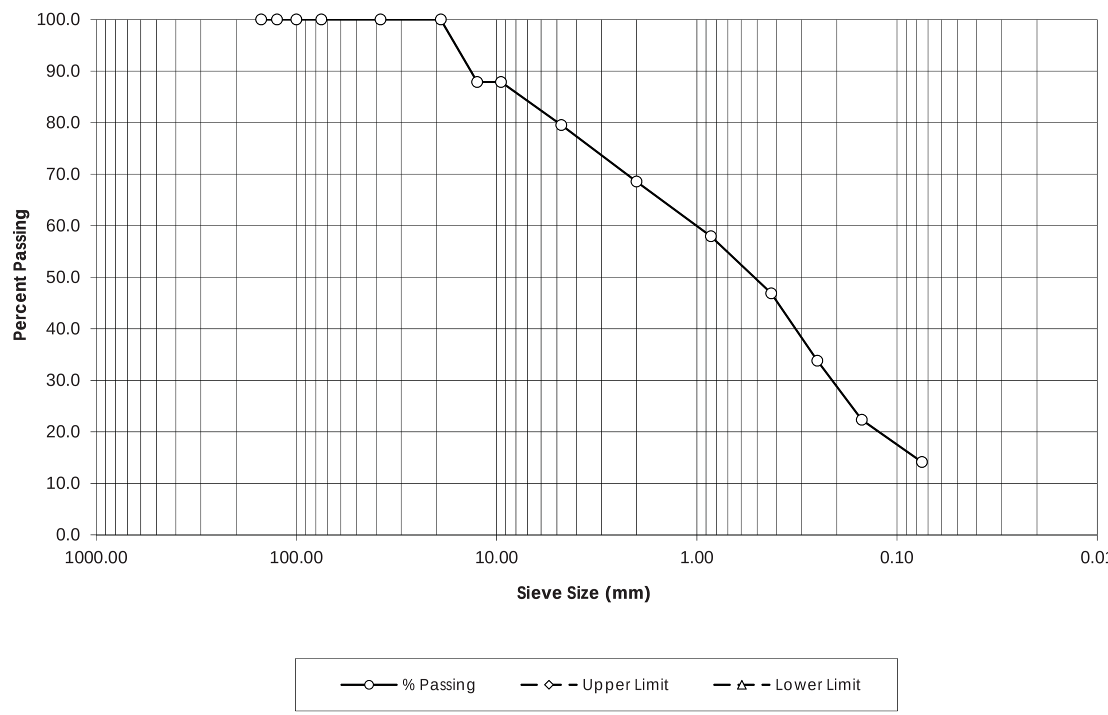
SAMPLE No.: SS-7
SOURCE: BH17-13
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND with gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	100.0	-	-
12.5	87.9	-	-
9.5	87.9	-	-
4.75	79.5	-	-
2.00	68.6	-	-
0.85	57.9	-	-
0.425	46.9	-	-
0.250	33.8	-	-
0.150	22.3	-	-
0.075	14.1	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	20.5%	D_{30}:	0.2212
Sand:	65.4%	D_{60}:	1.0892
Fines:	14.1%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

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Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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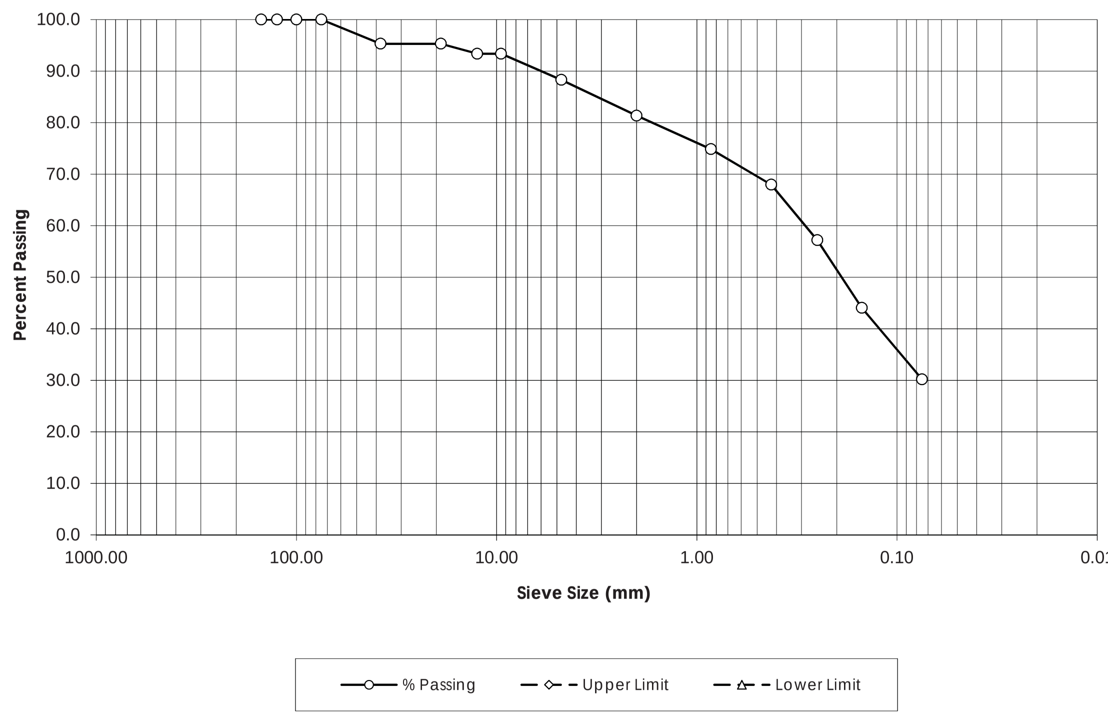
SAMPLE No.: SS-9
SOURCE: BH17-13
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	95.3	-	-
19.0	95.3	-	-
12.5	93.4	-	-
9.5	93.4	-	-
4.75	88.3	-	-
2.00	81.4	-	-
0.85	74.9	-	-
0.425	68.0	-	-
0.250	57.2	-	-
0.150	44.1	-	-
0.075	30.2	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	11.7%	D_{30}:	-
Sand:	58.1%	D_{60}:	0.2986
Fines:	30.2%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Grain S Analysis
ASTM C1

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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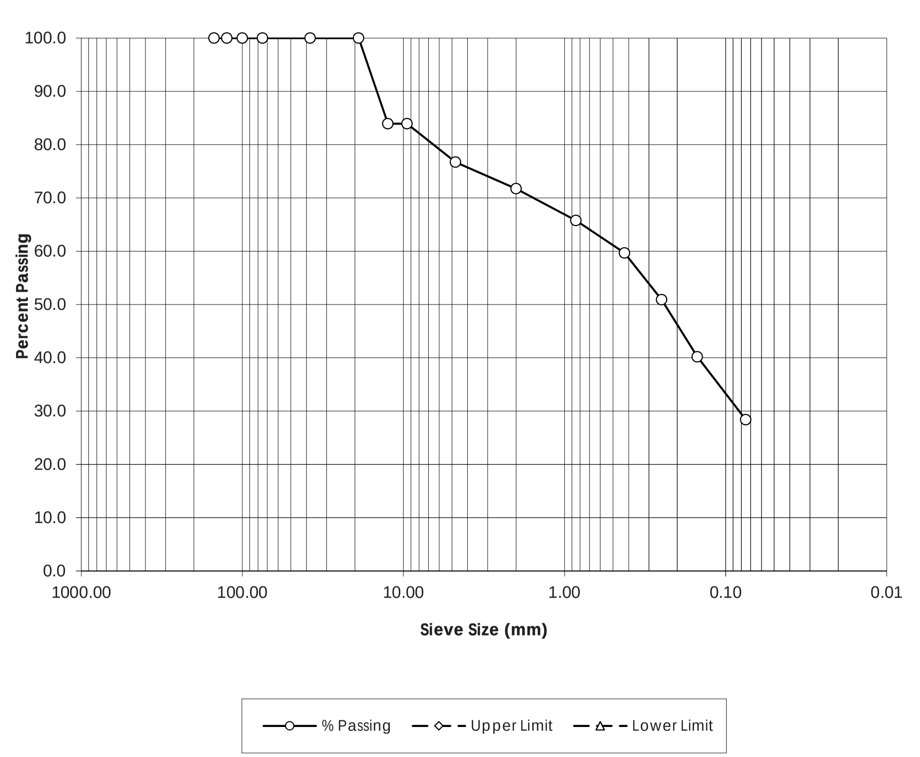
SAMPLE No.: SS-3
SOURCE: BH17-14
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND with gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	100.0	-	-
12.5	83.9	-	-
9.5	83.9	-	-
4.75	76.7	-	-
2.00	71.7	-	-
0.85	65.8	-	-
0.425	59.7	-	-
0.250	50.9	-	-
0.150	40.2	-	-
0.075	28.4	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	23.3%	D_{30}:	0.0870
Sand:	48.4%	D_{60}:	0.4481
Fines:	28.3%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Stantec

Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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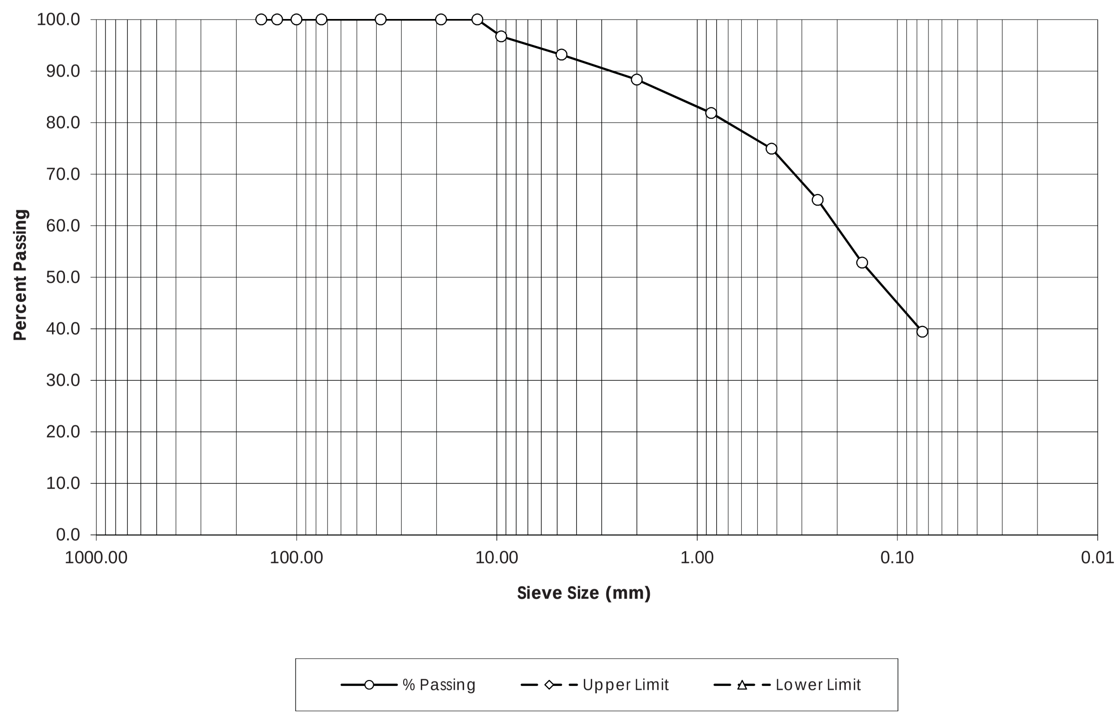
SAMPLE No.: SS-4
SOURCE: BH17-14
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	100.0	-	-
12.5	100.0	-	-
9.5	96.7	-	-
4.75	93.2	-	-
2.00	88.3	-	-
0.85	81.8	-	-
0.425	74.9	-	-
0.250	65.0	-	-
0.150	52.8	-	-
0.075	39.4	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	6.8%	D_{30}:	-
Sand:	53.8%	D_{60}:	0.2115
Fines:	39.4%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

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Grain Size Analysis

ASTM C136, ASTM C117

Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

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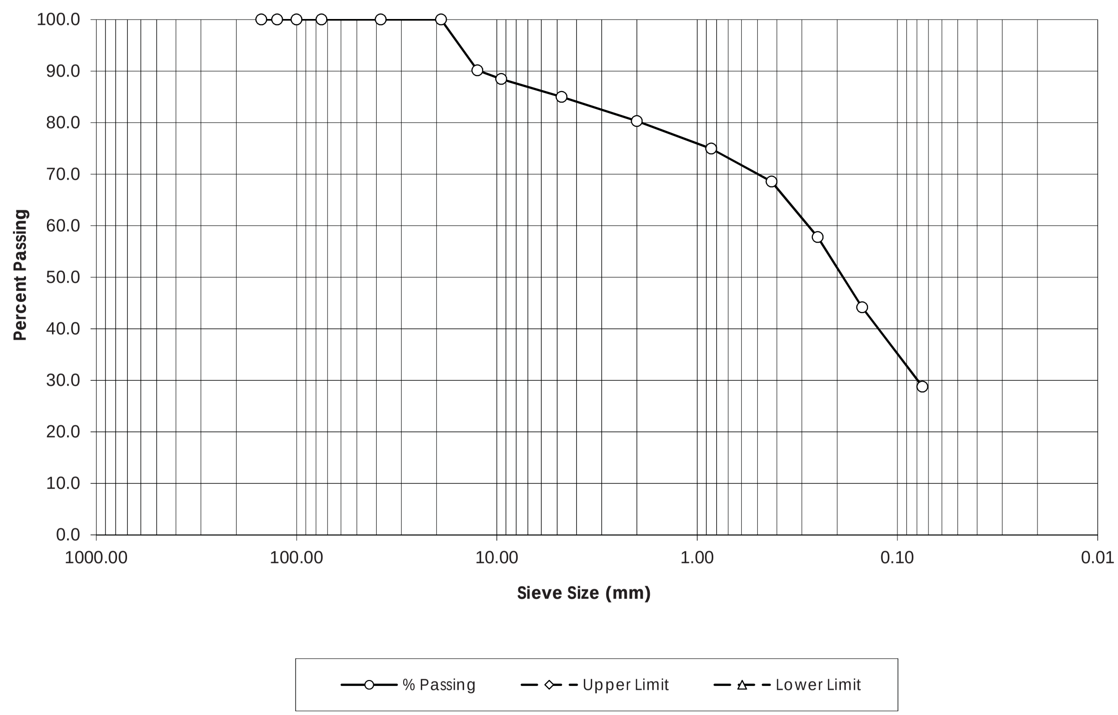
SAMPLE No.: SS-6
SOURCE: BH17-14
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND with gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	**100.0**	-	-
125.0	**100.0**	-	-
100.0	**100.0**	-	-
75.0	**100.0**	-	-
38.0	**100.0**	-	-
19.0	**100.0**	-	-
12.5	**90.2**	-	-
9.5	**88.5**	-	-
4.75	**85.0**	-	-
2.00	**80.3**	-	-
0.85	**75.0**	-	-
0.425	**68.6**	-	-
0.250	**57.8**	-	-
0.150	**44.2**	-	-
0.075	**28.8**	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	15.0%	D_{30}:	0.0823
Sand:	56.2%	D_{60}:	0.2884
Fines:	28.8%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Grain Size Analysis

ASTM C136, ASTM C117

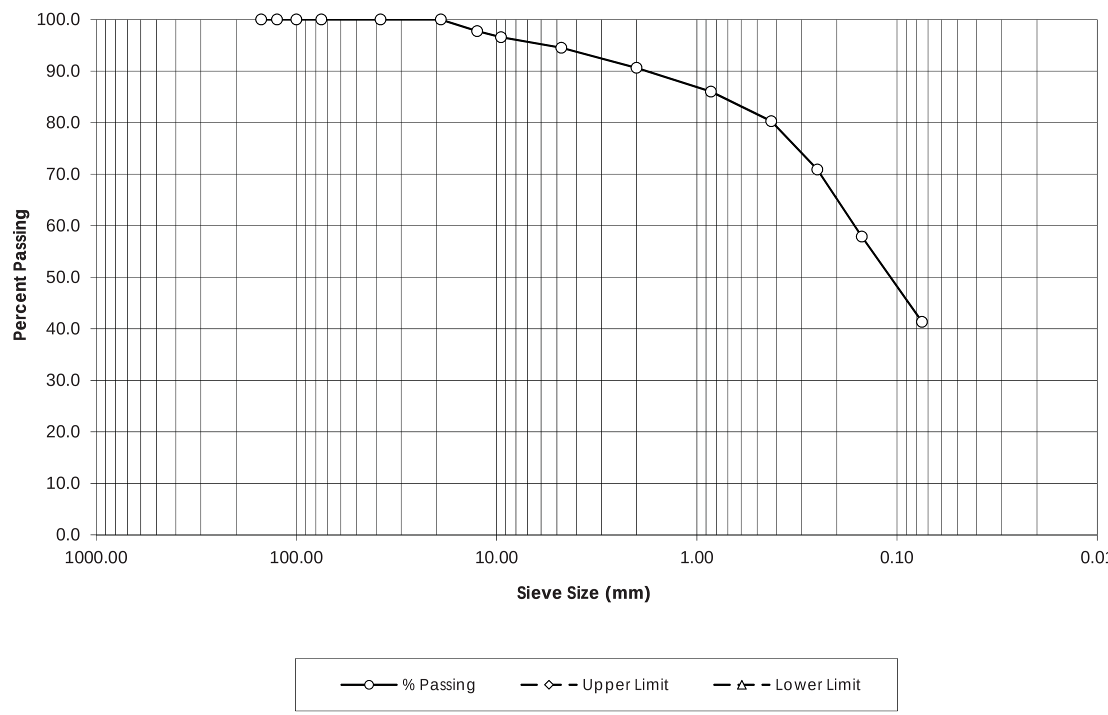
Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

OFFICE
4730 Kingsway
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: SS-8
SOURCE: BH17-14
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: silty SAND



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	100.0	-	-
12.5	97.8	-	-
9.5	96.6	-	-
4.75	94.5	-	-
2.00	90.6	-	-
0.85	86.0	-	-
0.425	80.3	-	-
0.250	70.9	-	-
0.150	57.9	-	-
0.075	41.3	-	-

Cobble:	0.0%	D_{10}:	-
Gravel:	5.5%	D_{30}:	-
Sand:	53.2%	D_{60}:	0.1677
Fines:	41.3%	C_u:	-
		C_c:	-

Comments:

Reviewed by: CH

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Grain Size Analysis

ASTM C136, ASTM C117

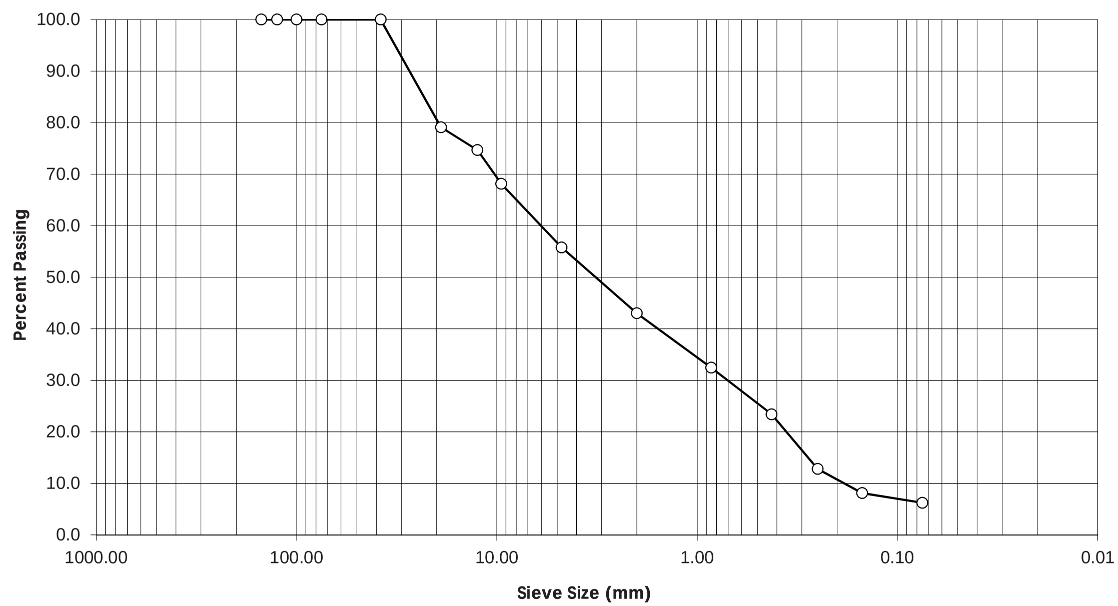
Client: CRD
Project Name: CRD Clover Point Forcemain
Project No: 111700431

OFFICE
4730 Kingsway
Suite 500
Burnaby, BC
Canada V5H 0C6
Tel: (604) 436-3014

LABORATORY
3711 North Fraser Way
Suite 400
Burnaby, BC
Canada V5J 5J2
Tel: (604) 436-3014

SAMPLE No.: GS-1
SOURCE: BH17-21
TESTED BY: JN/JW

DATE RECEIVED: July 1, 2017
DATE TESTED: July 12, 2017
SAMPLE DESCRIPTION: well-graded SAND with silt and gravel



Sieve (mm)	Sample % Passing	Specifications Lower	Specifications Upper
150.0	100.0	-	-
125.0	100.0	-	-
100.0	100.0	-	-
75.0	100.0	-	-
38.0	100.0	-	-
19.0	79.1	-	-
12.5	74.7	-	-
9.5	68.1	-	-
4.75	55.8	-	-
2.00	43.0	-	-
0.85	32.5	-	-
0.425	23.4	-	-
0.250	12.8	-	-
0.150	8.1	-	-
0.075	6.2	-	-

Cobble:	0.0%	D_{10}:	0.1958
Gravel:	44.2%	D_{30}:	0.7478
Sand:	49.6%	D_{60}:	6.4836
Fines:	6.2%	C_u:	33.11
		C_c:	0.44

Comments:

Reviewed by: CH

D.3 PH, CONDUCTIVITY AND SULPHATE CONTENT

Your Project #: 111700431
Your C.O.C. #: 08441649

Attention:James Woo

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2017/07/21
Report #: R2416435
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B757836
Received: 2017/07/13, 17:03

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity (Soluble)	6	2017/07/20	2017/07/20	BBY6SOP-00029	SM 22 2510 B
pH (Soluble)	6	2017/07/20	2017/07/20	BBY6SOP-00025	SM 22 4500-H+ B
Saturated Paste	6	2017/07/20	2017/07/20	BBY6SOP-00030	BC Lab Manual 2015
Sulphate (soluble) (soil)	6	2017/07/20	2017/07/21	BBY6SOP-00017	SM 22 4500-SO42- E m
Soluble Sulphate (SO4) Ion Calc. (mg/kg)	6	N/A	2017/07/21	BBY WI-00033	Auto Calc

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 111700431
Your C.O.C. #: 08441649

Attention:James Woo

STANTEC CONSULTING LTD
Metrotower III
Suite 500, 4730 Kingsway
BURNABY, BC
CANADA V5H 4M1

Report Date: 2017/07/21
Report #: R2416435
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B757836
Received: 2017/07/13, 17:03

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
VJ Oco, Burnaby Project Manager
Email: VOco@maxxam.ca
Phone# (604)639-8422
==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B757836
Report Date: 2017/07/21

STANTEC CONSULTING LTD
Client Project #: 111700431
Sampler Initials: CH

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		RM8872		RM8873	RM8873		RM8874		
Sampling Date									
COC Number		08441649		08441649	08441649		08441649		
	UNITS	**BH17-13, SS-04**	**RDL**	**BH17-22, GS-02**	**BH17-22, GS-02 Lab-Dup**	**RDL**	**BH17-17, GS-05**	**RDL**	**QC Batch**
ANIONS									
Soluble Sulphate (SO4)	mg/L	27	10	<10	<10	10	12	10	8702801
Calculated Parameters									
Soluble Sulphate (SO4)	mg/kg	15.7	5.8	<4.3		4.3	10.7	8.9	8694856
Soluble Parameters									
Soluble Conductivity	uS/cm	1060	1.0	165	163	1.0	130	1.0	8700722
Soluble pH	pH	6.58	N/A	7.64	7.63	N/A	7.46	N/A	8700721
Saturation %	%	57.9	N/A	42.6	42.6	N/A	89.0	N/A	8700710

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam ID		RM8875		RM8876		RM8877		
Sampling Date								
COC Number		08441649		08441649		08441649		
	UNITS	**BH17-08, GS-03**	**RDL**	**BH17-05, GS-03**	**RDL**	**BH17-02, GS-04**	**RDL**	**QC Batch**
ANIONS								
Soluble Sulphate (SO4)	mg/L	61	10	186	10	37	10	8702801
Calculated Parameters								
Soluble Sulphate (SO4)	mg/kg	41.0	6.7	120	6.4	22.9	6.1	8694856
Soluble Parameters								
Soluble Conductivity	uS/cm	613	1.0	1590	1.0	264	1.0	8700722
Soluble pH	pH	7.14	N/A	6.27	N/A	7.68	N/A	8700721
Saturation %	%	66.7	N/A	64.4	N/A	61.3	N/A	8700710

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B757836
Report Date: 2017/07/21

STANTEC CONSULTING LTD
Client Project #: 111700431
Sampler Initials: CH

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B757836
Report Date: 2017/07/21

QUALITY ASSURANCE REPORT

STANTEC CONSULTING LTD
Client Project #: 111700431
Sampler Initials: CH

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8700710	Saturation %	2017/07/20					0	%	0.017	30	107	75 - 125
8700721	Soluble pH	2017/07/20			100	97 - 103			0.13	N/A	102	97 - 103
8700722	Soluble Conductivity	2017/07/20			98	80 - 120	<1.0	uS/cm	1.2	35		
8702801	Soluble Sulphate (SO4)	2017/07/21	123	75 - 125	105	80 - 120	<10	mg/L	NC	30	116	75 - 125

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B757836
Report Date: 2017/07/21

STANTEC CONSULTING LTD
Client Project #: 111700431
Sampler Initials: CH

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Ph.D., P.Chem., Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Appendix "I"

Consultation Summary Report

Consultation Summary Report
February 2018

Wastewater Treatment Project

Community Consultation: January 10 – 31, 2018

Clover Point Pump Station building exterior and public space improvements

Clover Forcemain alignment within the Dallas Road right-of-way

Cycle path design and alignment along Dallas Road

The views represented in this summary report reflect the priorities and concerns of consultation participants. They may not be representative of the views of the public and other stakeholders because participants self-selected into the Wastewater Treatment Project Community Consultation, and therefore do not reflect a random sample.

Table of Contents

Consultation Purpose

The CRD held a community consultation from **January 10 – 31, 2018** regarding the proposed design of the following components of the Wastewater Treatment Project in Victoria:

- Clover Point Pump Station building exterior and public space improvements;
- Clover Forcemain alignment within the Dallas Road right-of-way; and
- Cycle path design and alignment along Dallas Road.

Consultation Participation

280

people attended two community meetings in James Bay and Fairfield Gonzales

346

feedback forms were received

Key Results from the Feedback Forms:

Level of agreement with the overall proposed design of the Clover Point Pump Station building exterior.

75% strongly or somewhat agree

Level of agreement with the overall design of the public space improvements at Clover Point.

74% strongly or somewhat agree

Level of agreement with the design and alignment of the proposed cycle path.

59% strongly or somewhat agree

38% strongly or somewhat disagree

Prefered option for parking on Dallas Road between Dock Street and Lewis Street.

OPTION 1: parallel parking

OPTION 2: angled parking with four curb extensions and improved pedestrian and cycling connectivity

OPTION 3: more angled parking with two curb extensions and less pedestrian and cycling connectivity

44% chose Option 2

41% chose Option 3

15% chose Option 1

Key themes from the community meetings include:

Meeting	Key Themes
James Bay Neighbourhood Wednesday, January 10, 2018 7:00 p.m. – 9 p.m. Approximately 150 participants	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were divided in their support of and opposition to the cycle path. • Participants were interested in safety and accessibility measures of the cycle path. • Participants expressed concerns for vegetation, as well as mature trees along the cycle path and forcemain alignment.
Fairfield Gonzales Community Thursday, January 11, 2018 7:30 p.m. – 9:30 p.m. Approximately 130 participants	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were interested in the cycle path, especially safety for cyclists. • Participants wanted to learn more about off-leash dog areas and fencing. • Participants were interested in accessible parking spaces for residents with mobility needs.

How input will be used

The Project Team will review and consider all input received in community meetings, online, and in written submissions, along with technical, financial, and environmental considerations. The revised proposed design will then be presented to the City of Victoria Council for their review in the Spring of 2018.

Project Background

The Wastewater Treatment Project (the Project) will provide tertiary treatment for wastewater from the core area municipalities of Victoria, Esquimalt, Saanich, Oak Bay, View Royal, Langford and Colwood, and the Esquimalt and Songhees Nations. The Project will be built so we comply with federal regulations by the end of 2020, and is being funded by the Government of Canada, the Government of British Columbia and the CRD.

Consultation Overview

The CRD Wastewater Treatment Project held a community consultation from January 10 – 31, 2018 regarding the proposed design for the:

- Clover Point Pump Station building exterior and public space improvements;
- Clover Forcemain alignment within Dallas Road; and
- cycle path design and alignment along Dallas Road.

As part of the consultation, the CRD Wastewater Treatment Project held two community meetings in Victoria:

Community	Date	Time	Location
James Bay Neighbourhood	Wednesday, January 10, 2018	7:00 p.m. – 9:00 p.m.	James Bay New Horizons, 234 Menzies Street
Fairfield Gonzales Community	Thursday, January 11, 2018	7:30 p.m. – 9:30 p.m.	Cook Street Village Activity Centre Auditorium, 380 Cook Street

A feedback form was distributed at these meetings that participants could hand in or mail to the Project office at their convenience. The feedback form was also posted to the Project website from January 10 – 31, 2018, so that members of the public could complete the form online.

Consultation Participation

There were a total of approximately 630 participant interactions during the Wastewater Treatment Project Community Consultation:

- 280 people attended two community meetings open to the public
- 346 completed feedback forms were received (304 online, 42 hardcopy)
- 4 open ended submissions were received (2 hardcopy, 1 email and 1 phone call)

Notification

Notification of opportunities to participate in the Wastewater Treatment Project Community Consultation included:

- **Invitation mail drop:** mailed to 13,097 residents and businesses in James Bay and Fairfield Gonzales in advance of the consultation period.
- **Invitation Emails and Notification to Stakeholders:** 259 stakeholders who had signed up for the Project distribution list were notified of the engagement and opportunities for participation by email.
- **Project webpage:** dedicated Project pages (https://www.crd.bc.ca/project/wastewater-treatment-project/news-and-information/public-meetings) provided information about the Project, and how to provide feedback. Consultation materials were available throughout the consultation period.

The invitation can be found in Appendix A.

Community Meeting Key Themes

The following are the key themes from the community meetings with James Bay neighbourhood and Fairfield Gonzales community.

Meeting	Key Themes
James Bay Neighbourhood Wednesday, January 10, 2018 7:00 p.m. – 9 p.m. Approximately 150 participants	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were divided in their support of and opposition to the cycle path. • Participants were interested in safety and accessibility measures of the cycle path. • Participants expressed concerns for vegetation, as well as mature trees along the cycle path and forcemain alignment.
Fairfield Gonzales Community Thursday, January 11, 2018 7:30 p.m. – 9:30 p.m. Approximately 130 participants	• Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point. • Participants were interested in the cycle path, especially safety for cyclists. • Participants wanted to learn more about off-leash dog areas and fencing. • Participants were interested in accessible parking spaces for residents with mobility needs.

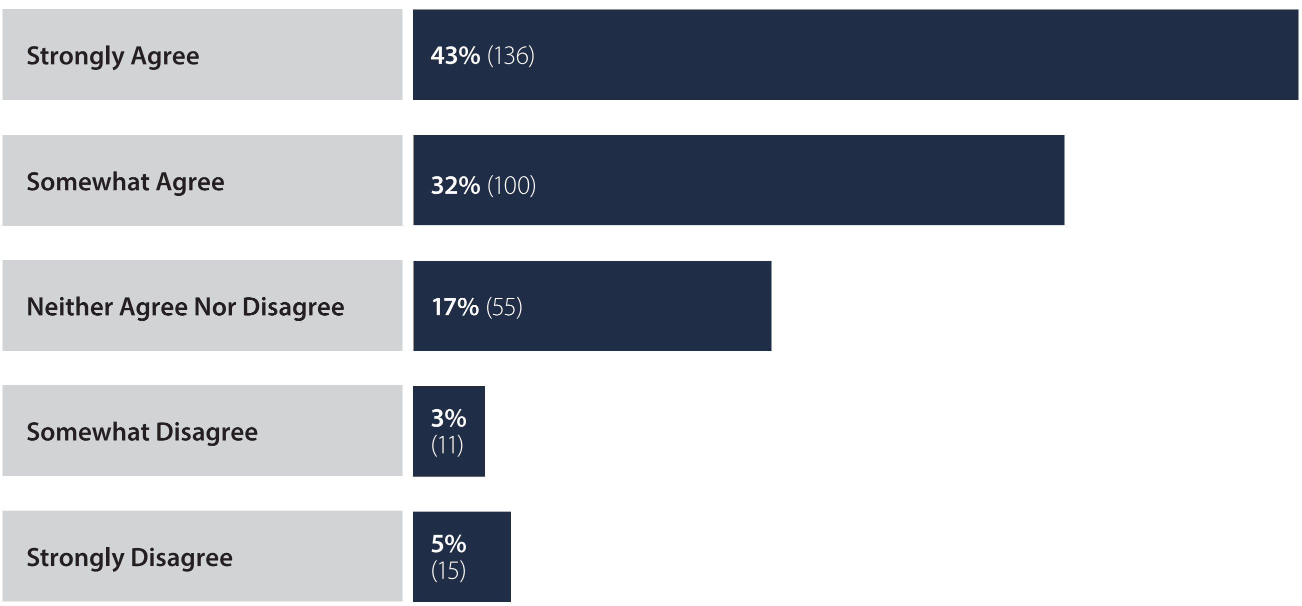
Meeting notes can be found in Appendix B.

Summary of Input – Feedback Form Results

1. CLOVER POINT PUMP STATION BUILDING EXTERIOR

Please indicate your level of agreement with the overall proposed design of the Clover Point Pump Station building exterior.

317 respondents



Note: Some totals may not add to 100% due to rounding.

Please provide any reasons you may have regarding your level of agreement.

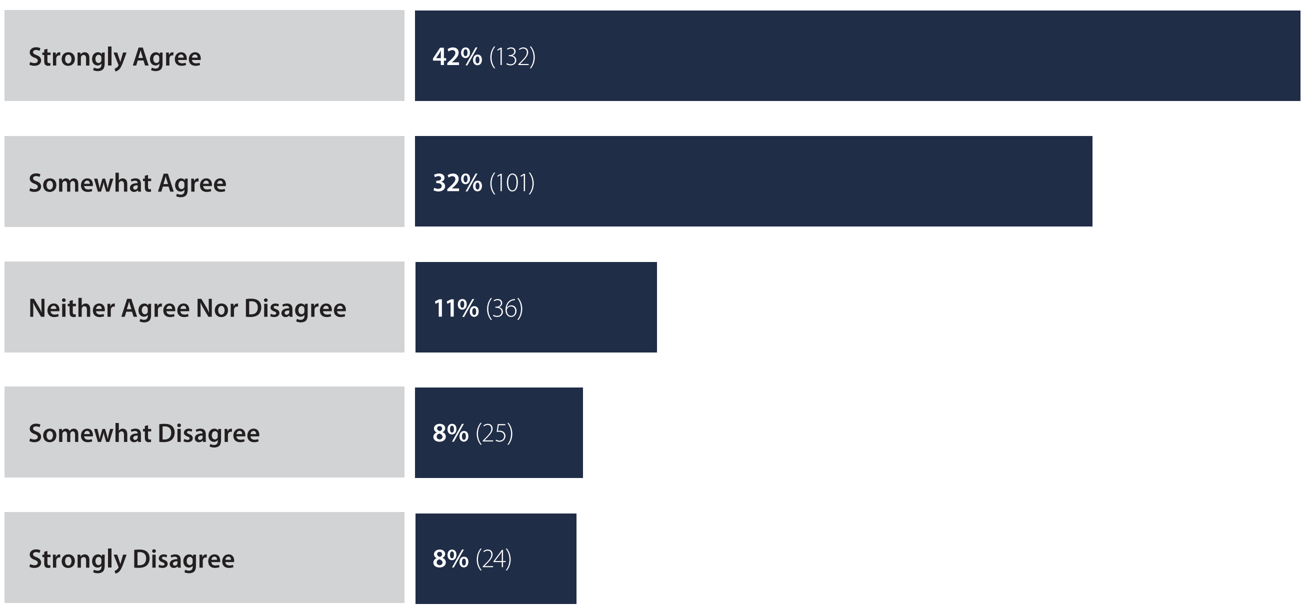
KEY THEMES FROM COMMENTS REGARDING LEVEL OF AGREEMENT	NUMBER OF MENTIONS
108 respondents	
1. Participants responded that they like the proposed design and/or use of public space.	45
2. Participants expressed concerns about parking loss at Clover Point and/or on Dallas Road for residents, seniors and people who come from outside Victoria.	15
3. Participants offered various suggestions regarding design and amenities, including: • the pump station exterior design should look more like McLoughlin Point site to blend with the surrounding area; • the use of concrete or brick looks too industrial; • the pump station facility should be designed so people can see inside; • provide ramps connecting the two levels of the pump station; and • washroom design improvements needed.	14
4. Participants expressed support for the cycle path, with various reasons given, including that it increases safety for cyclists, and children and seniors can use it.	8
5. Participants expressed concerns about the cycle path, with some stating the cycle path is not necessary, and others that the increase in cyclists in the area will cause issues for drivers and pedestrians.	8

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

2. PUBLIC SPACE IMPROVEMENTS AT CLOVER POINT.

Please indicate your level of agreement with the overall design of the public space improvements at Clover Point.

318 respondents



Note: Some totals may not add to 100% due to rounding.

Please provide any reasons you may have regarding your level of agreement.

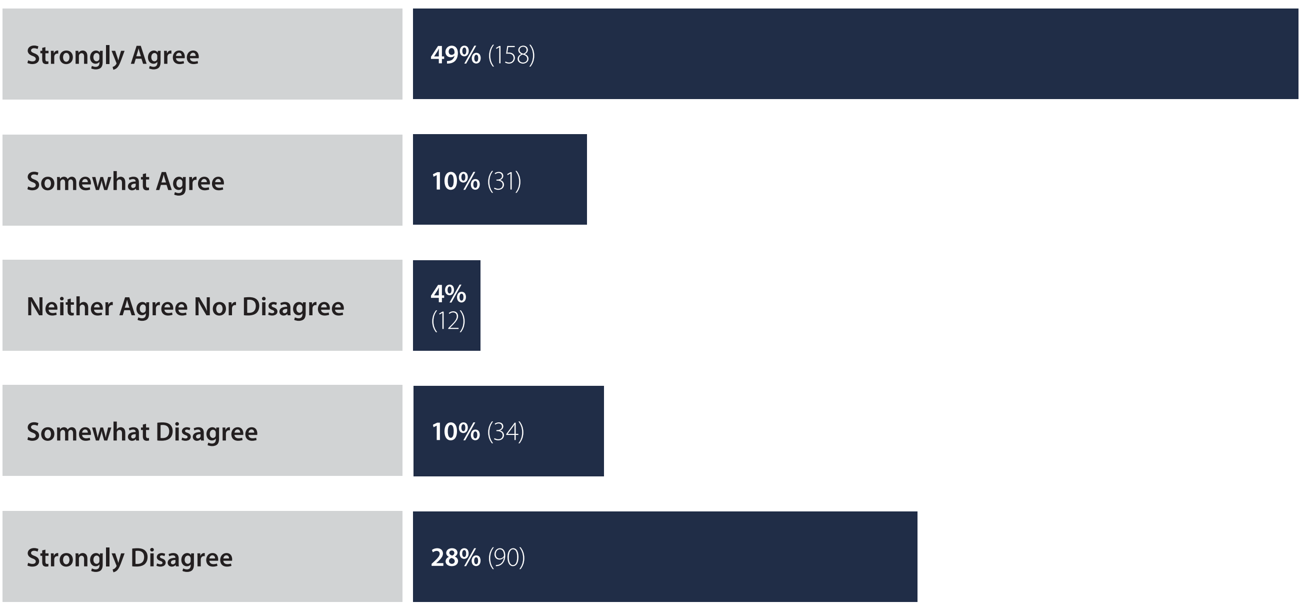
KEY THEMES FROM COMMENTS REGARDING LEVEL OF AGREEMENT	NUMBER OF MENTIONS
134 respondents	
1. Participants offered various suggestions regarding design and amenities, including: • add architectural or landscaping features, such as public art or native plants; • washroom suggestions: washroom location should be more convenient (less tucked away), or washrooms should be locked at night/monitored, or add more washrooms; • continue the walking path or cycle path around the point; • suggestions for signage, e.g. First Nations historical and archaeological significance; bird/plant information; clear signage for visitors to Clover Point; • move viewing plaza and other amenities further away from Dallas Road; and • ensure pedestrian and cyclist safety at Clover Point through design.	36
2. Participants responded that they like the proposed design and/or use of public space.	33
3. Participants expressed concerns about parking loss at Clover Point and/ or on Dallas Road for residents, seniors and people who come from outside Victoria.	29
4. Participants expressed support for the cycle path, with various reasons given, including that it increases safety for cyclists, and children and seniors can use it.	10
5. Participants offered various cycle path and cycling amenities suggestions, including: • provide additional bike racks; • provide "elephant feet" crosswalks for cycling and walking paths; and • provide wider cycling lanes.	9
6. Participants expressed concerns about the cycle path, with some stating the cycle path is not necessary, and others that the increase in cyclists in the area will cause issues for drivers and pedestrians.	6
7. Participants offered various traffic/road concerns and suggestions, including traffic calming measures, removal of car access or parking at Clover Point.	6

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

3. DESIGN AND ALIGNMENT OF THE PROPOSED CYCLE PATH.

Please indicate your level of agreement with the design and alignment of the proposed cycle path.

325 respondents



Note: Some totals may not add to 100% due to rounding.

Please provide any reasons you may have regarding your level of agreement.

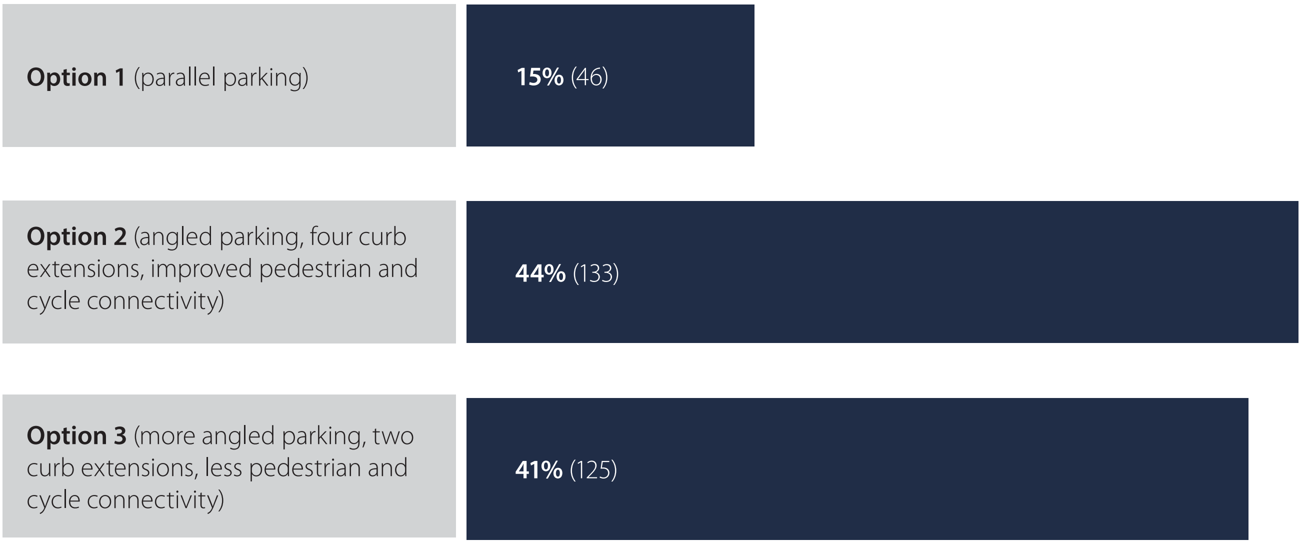
KEY THEMES FROM COMMENTS REGARDING LEVEL OF AGREEMENT	NUMBER OF MENTIONS
214 respondents	
1. Participants expressed concerns about the cycle path, with some stating the cycle path is not necessary, and others stating that the increase in cyclists in the area will cause issues for drivers and pedestrians.	67
2. Participants expressed support for the cycle path, with various reasons given, including that it increases safety for cyclists, and children and seniors can use it.	64
3. Participants expressed concerns about parking loss on Dallas Road for residents, seniors and people who come from outside Victoria.	49
4. Participants offered various cycle path and cycling amenities suggestions, including: • no concrete curbs/barriers on the cycle path; • have the cycle path with painted lines on Dallas Road; • make the cycle path wider; and • continue the cycle path to connect into community corridors e.g. in James Bay, or past Ogden Point.	41
5. Participants expressed concerns about wildlife/vegetation/green space, such as preserving trees along Dallas Road and the wooded area south of Beacon Hill Park.	17
6. Participants offered various traffic/road suggestions, including: • include traffic calming measures, such as lowering the speed limit, narrowing lanes or adding speed bumps; and • have pedestrian-controlled traffic lights at crosswalks for safety, in particular at Douglas and Dallas Road.	14
7. Participants offered various suggestions regarding design and amenities, including: • comments on off-leash dogs with some concerned about off-leash dogs in general, and others noting possible conflicts with the fencing, walking path or cycle path; and • fencing suggestions, such as provide gaps at intersections and ensure that it does not obstruct views.	8
8. Participants responded that they like the proposed design and/or use of public space.	8

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

4. PARKING OPTIONS FOR DALLAS ROAD BETWEEN DOCK STREET AND LEWIS STREET

Please indicate your preferred parking option by ticking the appropriate box:

304 respondents



Note: Some totals may not add to 100% due to rounding.

OPTION 1

Please provide any reasons you may have regarding your preference.

KEY THEMES FROM COMMENTS REGARDING PREFERENCE	NUMBER OF MENTIONS
31 respondents	
1. Participants noted that parallel parking is safer than having drivers back out of angled parking.	9
2. Participants noted that parking and vehicle traffic is not a priority; rather the design should promote other modes of transportation e.g. cycling and walking.	7
3. Participants offered various parking policy and location suggestions, including: • metering parking spots; • time limits for parking; and • creating parking between Lewis and Government.	6
4. Participants noted that this is a good option for cyclists.	5

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

OPTION 2

Please provide any reasons you may have regarding your preference.

KEY THEMES FROM COMMENTS REGARDING PREFERENCE	NUMBER OF MENTIONS
59 respondents	
1. Participants noted that this is a good option for parking.	16
2. Participants stated that this option is the best compromise.	12
3. Participants noted that this option includes better cyclist and pedestrian connectivity.	11
4. Participants noted that parking and vehicle traffic is not a priority; rather the design should promote other modes of transportation e.g. cycling and walking.	11
5. Participants noted that this is a good option for pedestrian safety.	11
6. Participants offered various suggestions, including: • walking and cycle path suggestions: “elephant feet” crosswalks for cycling and walking paths, and place the cycle track between Dallas Road and the walking path; • traffic and road suggestions: pedestrian controlled traffic lights at crosswalks and lowering the speed limit on Dallas.	7
7. Participants noted that this is a safe option for pedestrians, cyclists, motorists.	5

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

OPTION 3

Please provide any reasons you may have regarding your preference.

KEY THEMES FROM COMMENTS REGARDING LEVEL OF AGREEMENT	NUMBER OF MENTIONS
87 respondents	
1. Participants stated as much parking should be kept on Dallas Road as possible, with some noting fewer people will park in side streets and/or that it is important for tourists/seniors and others who drive to view the waterfront.	50
2. Participants offered various suggestions, including: • Walking and cycle path suggestions: combine cycling and walking path; repair walking path; widen walking path; no barriers for curb extensions for cycle path; • Traffic and road suggestions: pedestrian-controlled traffic lights at crosswalks; widen Dallas Road.	12

KEY THEMES FROM COMMENTS REGARDING LEVEL OF AGREEMENT	NUMBER OF MENTIONS
3. Participants noted that this is a good option for parking.	11
4. Participants expressed concerns about the cycle path, stating that it is unnecessary or unwanted.	8
5. Participants prefer the status quo.	6
6. Participants noted that this is a good option for pedestrian safety.	6
7. Participants offered various parking policy and location suggestions, including: • time limits for parking; • 24h residential only spots; and • residential parking on the north side of Dallas Road.	5

Note: The number of mentions may exceed the total commenting, as respondents may have commented on more than one topic.

20 respondents did not select a preferred option, but provided comments:

KEY THEMES FROM COMMENTS ASSOCIATED WITH NO PREFERRED OPTION	NUMBER OF MENTIONS
1. Participants prefer the status quo.	10
2. Participants stated as much parking should be kept on Dallas Road as possible, with some noting fewer people will park on side streets and/or that it is important for tourists/seniors and others who drive to view the waterfront.	3

ADDITIONAL COMMENTS

Please provide any additional comments you may have regarding the Wastewater Treatment Project.

KEY THEMES FROM ADDITIONAL COMMENTS	NUMBER OF MENTIONS
87 respondents	
1. Participants offered various traffic/road suggestions, including: • have pedestrian-controlled traffic lights at crosswalks; • add crosswalks at intersections of Dallas Road, including: Moss St., Cook St., Montreal St., and Douglas St.; and • some noted they want Dallas Road to be a one-way street, and others noted they do not want Dallas Road to be a one-way street.	29
2. Participants expressed concerns about the cycle path, with some stating the cycle path is not necessary, and others that the increase in cyclists in the area will cause issues for drivers and pedestrians.	26
3. Participants expressed support for the cycle path, with various reasons given, including that it increases safety for cyclists, and children and seniors can use it.	23
4. Participants expressed general support for the Wastewater Treatment Project and/or the public space improvements.	22
5. Participants expressed concerns about parking loss at Clover Point and/or on Dallas Road for residents, seniors and people who come from outside Victoria.	20
6. Participants offered various suggestions regarding design and amenities, including: • provide wider walking paths; • comments on off-leash dogs with some concerned about off-leash dogs in general, and others noting possible conflicts with the walking path and cycle path; and • mobility suggestions: have gentle grades on pathways; wide walking paths; mobility scooters permitted on the cycle path; smooth curbs from road to cycle path .	15
7. Participants offered various cycle path and cycling amenities suggestions, including: • move cycle path to the north side of Dallas Road; and • no concrete curbs/barriers on cycle path.	15
8. Participants expressed concern about construction impacts, including: • Niagara Street construction timeline and details; • potential impacts on green space; • noise at Ogden Point; • impacts to the Dallas Road walking path; and • whether insurance will cover potential construction impacts.	12
9. Participants expressed concerns about the City of Victoria's and/or the CRD's consultation process.	12
10. Participants noted they believe the undersea pipeline would have been a preferable option.	12
11. Participants responded that they like the proposed design and/or use of public space.	10

Open Ended Submissions

In addition to the feedback forms, four submissions from residents were received in hardcopy, via email and by phone.

The following are the key themes from the open-ended submissions:

THEMES	NUMBER OF MENTIONS
Concerns about the cycle path, stating that it is not necessary, there is no room for it, and it may cause conflicts with other users in the busy area i.e. pedestrians, drivers.	3
Concerns about the loss of parking on Dallas Road.	2
Support for the cycle path only from Douglas Street to Clover Point.	1
Concerns that the cycle path has not been approved by City of Victoria electorate.	1
Concerns about traffic impacts during and after construction.	1
Concerns about access for emergency vehicles, and other service vehicles.	1
Clover Point designs have too much infrastructure, would prefer more green space.	1

HOW INPUT WILL BE USED

The Project Team will review and consider all input received in community meetings, online, and in written submissions, along with technical, financial, and environmental considerations. The revised design will then be presented to the City of Victoria Council for their review in the spring of 2018.

Wastewater Treatment Project
Community Consultation
January 10 – 31, 2018

Appendix A – Community Meeting Invitations

February 2018

**Not shown full size.*
Actual print size: 8.5" x 11"

Wastewater Treatment Project
Treated for a cleaner future

WASTEWATER TREATMENT PROJECT

James Bay Meeting: Clover Forcemain and Cycle Track on Dallas Road

Wednesday, January 10, 2018

You're invited to find out more and provide input on the alignment of the Clover Forcemain (pipe) within the Dallas Road right-of-way and the design and alignment of the cycle track along Dallas Road.

JAMES BAY NEIGHBOURHOOD ASSOCIATION MEETING

January 10, 2018, 7:00pm
James Bay New Horizons,
234 Menzies Street

The Wastewater Treatment Project team will provide information and seek your input for incorporation into the final design on the following:

- Design and alignment of the cycle track along Dallas Road
- Alignment of the Clover Forcemain (pipe) within the Dallas Road right-of-way

Alignment of the Clover Forcemain within Dallas Road right-of-way

The Wastewater Treatment Project will provide tertiary treatment for wastewater from the core area municipalities of Victoria, Esquimalt, Saanich, Oak Bay, View Royal, Langford and Colwood, and the Esquimalt and Songhees Nations.

As part of the Project, the Clover Point Pump Station will be upgraded and expanded. A new pipe, the Clover Forcemain, will transport wastewater from the Clover Point Pump Station to Ogden Point, where it will connect to the cross-harbour undersea pipe to the McLoughlin Point Wastewater Treatment Plant.

Information to be presented at the meeting and an online feedback form will be available online on January 10, 2018.

For more information about the Wastewater Treatment Project, please visit **wastewaterproject.ca**, e-mail **wastewater@crd.bc.ca** or call **1.844.815.6132**.

CRD WASTEWATER TREATMENT PROJECT | JANUARY 2018

*Not shown full size.
Actual print size: 8.5" x 11"

Wastewater Treatment Project
Treated for a cleaner future

WASTEWATER TREATMENT PROJECT

Fairfield Gonzales Meeting: Clover Point Pump Station, and Clover Forcemain and Cycle Track on Dallas Road

Thursday, January 11, 2018

You're invited to find out more and provide input on the design of the public realm improvements, the design of the exterior of the Clover Point Pump Station, the alignment of the Clover Forcemain (pipe) within the Dallas Road right-of-way and the design and alignment of the cycle track along Dallas Road.

FAIRFIELD GONZALES COMMUNITY MEETING

January 11, 2018, 7:30pm
Cook Street Village Activity Centre, Auditorium, 380 Cook Street

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The Wastewater Treatment Project team will provide information and seek your input for incorporation into the final design on the following:

- Alignment of the Clover Forcemain (pipe) within the Dallas Road right-of-way
- Design and alignment of the cycle track along Dallas Road
- Design for the exterior of the Clover Point Pump Station building
- Design of the public realm improvements

Alignment of the Clover Forcemain within Dallas Road right-of-way

The Wastewater Treatment Project will provide tertiary treatment for wastewater from the core area municipalities of Victoria, Esquimalt, Saanich, Oak Bay, View Royal, Langford and Colwood, and the Esquimalt and Songhees Nations.

As part of the Project, the Clover Point Pump Station will be upgraded and expanded. A new pipe, the Clover Forcemain, will transport wastewater from the Clover Point Pump Station to Ogden Point, where it will connect to the cross-harbour undersea pipe to the McLoughlin Point Wastewater Treatment Plant.

Information to be presented at the meeting and an online feedback form will be available online on January 10, 2018.

For more information about the Wastewater Treatment Project, please visit wastewaterproject.ca, e-mail wastewater@crd.bc.ca or call 1.844.815.6132.

Wastewater Treatment Project
Community Consultation

January 10 – 31, 2018

Appendix B – Meeting Notes

February 2018

CRD Wastewater Treatment Project
James Bay Neighbourhood Association Meeting
Design and alignment of the cycle path; and alignment of the Clover Forcemain

JANUARY 10, 2018 | TIME: 7:00 PM TO 9:00PM | LOCATION: JAMES BAY NEW HORIZONS, 234 MENZIES STREET

ATTENDEES/AFFILIATION	Approximately 150 members of the public. **City of Victoria:** Jas Paul Bill Einsenhaurer Brad Dellebuur Julie Potter Leigh Campbell
CRD WASTEWATER TREATMENT PROJECT TEAM	Dave Clancy Elizabeth Scott Ken Madill Peter Lutzmann Evan Southern Christie Howatson Martina Kapac de Frias Nancy Spooner, Kirk & Co. Consulting Ltd.
WATT CONSULTING GROUP	Mitchell Jacobson
KERR WOOD LEIDAL	Colin Kristiansen
CH2M HILL INC.	Joe Broberg
THURBER ENGINEERING	Stephen Bean
WSP CANADA INC.	Bob Evans
KENAIDAN CONTRACTING LTD.	Derek Steinke
FACILITATOR	Judy Kirk, Kirk & Co. Consulting Ltd.
MEETING RECORDER	Hazel Currie, Kirk & Co. Consulting Ltd.

KEY THEMES

- Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point.
- Participants were divided in their support of and opposition to the cycle path.
- Participants were interested in safety and accessibility measures of the cycle path.
- Participants expressed concerns for vegetation and wildlife at Beacon Hill Park, as well as mature trees along the cycle path and forcemain alignment.

Project Overview

- A Wastewater Treatment Project representative provided an overview of the Project, and the consultation seeking input on the design of the Clover Point Pump Station and the alignment of Clover Forcemain and cycle path to inform the 50% stage of design.

• Wastewater Treatment Project representatives walked through the presentation.
Question and Answer
• A resident of Dallas Road expressed concerns about the potential loss of parking on Dallas Road for seniors and people with disabilities, in particular the 13 parking spots near Paddon Avenue. *A Wastewater Treatment Project representative noted that they have heard those concerns at the December 14th City of Victoria Council Meeting, and the design options are an attempt to maximize parking and meet the agreement with the City of Victoria with regards to Dallas Road and the cycle path.*
• A resident of Niagara Street expressed concerns about crosswalks near Douglas Street, and impacts on the duck pond, grass and wild flowers. They also expressed concerns about the paths cutting through Beacon Hill Park affecting trees or archeologically significant areas. They also expressed concerns about parking loss for tourists on Dallas Road.
• A resident of Michigan Street asked why the pipe was not put undersea from Clover Point to Macaulay Point. *A Wastewater Treatment Project representative noted that they have assessed the potential for an undersea pipe and the review is available online. There were three main concerns with the undersea pipe: ensuring it met the seismic design standard, significant tidal forces create concerns over the stability of the pipe during construction and operation, and a vertical profile issue, i.e. the forcemain needs a single low point and two high points at each end and to achieve that they would have to do blasting.*
• A resident expressed concerns about safety with the increase of bike rentals in the summer. They support a cycle path separated from the road and from pedestrians, and the parallel parking option.
• A community member asked if there was any consultation with First Nations people about the proposed designs. *A Wastewater Treatment Project representative stated that First Nations are engaged. The Project has liaison positions with the Esquimalt and Songhees Nations. They are part of reviews for the project and their input has been taken into account and incorporated within the designs.* • The community member noted that they would like to see that consultation with First Nations documented in the materials and presentation. They also expressed concerns about impacts to the Garry Oak ecosystem. *A Wastewater Treatment Project representative noted that the design is at the 50% stage and the criteria for design includes mitigation of any impact to mature trees along the corridor.*
• A resident expressed concerns for a large Garry Oak tree at the end of Government Street.

	A Wastewater Treatment Project representative noted that the design currently doesn't affect the tree mentioned, the alignment is curved to go between trees. The next stage of design will give a better indication of whether that remains the case.
•	A resident of Michigan Street asked whether the City of Victoria has any statistics regarding the number of cyclists that travel on Dallas Road, because they do not see many. They also noted that they see many cars at the seawall throughout the day, in particular between Lewis and Dock Street, and they would like the current angle parking to remain in that area.
•	A resident asked how many parking spots are going to be lost. *A Wastewater Treatment Project representative noted that parking numbers originally presented were based on preliminary designs. The Project Team committed to work with the City of Victoria to identify and provide the total number of parking spots along Dallas Road.* The resident also noted that they believe that the cycle path is not worth losing parking to build. They asked how the Project can afford to build a cycle path when they are asking for a budget increase of 5%, and when the cycle path will be built. They noted that they would like a referendum to see how many people support the cycle path. *A Wastewater Treatment Project representative noted that construction for the Dallas Road forcemain is expected to begin this summer to meet the December 31, 2020 deadline. The Project is predicated around meeting that federal and provincial deadline.* *A City of Victoria representative noted that the Project team will work with City staff and present updated designs reflecting feedback to council. There will be an opportunity to speak to council then. The date has not been set yet, but it will be in the spring.*
•	A resident of Government Street asked how the cycle path was included into the forcemain construction and how many parking spots will be lost at Clover Point. *A Wastewater Treatment Project representative noted that the CRD has two licence agreements with the City of Victoria. The designs presented reflect the conditions in these licence agreements, including the cycle path and other improvements. Another Wastewater Treatment Project representative noted that at Clover Point there will be no loss of parking at the bottom of the road along the foreshore.*
•	A resident of Douglas Street asked how the sidewalk curbs will look as they ride a recumbent trike. They also expressed concerns about the safety of pedestrians and cyclists at the intersection of Douglas Street and Dallas Road, as well as concerns about angled parking and drivers not being able to see cyclists as they back out. They prefer option 2 with more curb extensions for safety. *A Wastewater Treatment Project representative noted that they are now focused on the alignment and once an option is selected then they can focus on curbs, and what treatments can fit with the amount of space.*
•	A resident of Dallas Road noted that there was consultation at the Conference Centre prior to the meeting. They expressed support for the number of options presented and the cycle path.

• A resident of Marifield Avenue asked whether there was consultation with the Greater Victoria Harbour Authority to make the area flow more smoothly given how busy it is in the summer with cruise ships, buses, vehicle traffic and cyclists. *A Wastewater Treatment Project representative noted that they have a working group with the Harbour Authority and are in contact with them. However, they were not consulted on these designs, and the team will request their feedback.* The resident also noted that they would like some of the amenities in James Bay similar to Clover Point.
• A resident of Ladysmith Street asked how much the conveyance will cost from Clover Point to McLoughlin Point, because they believed that an underground treatment plant would have been more economical. *A Wastewater Treatment Project representative noted that a number of options were considered before the business case was approved in 2016. The business case reflected the preferred alternative which includes the treatment plant at McLoughlin Point, the residuals treatment plant at Hartland and the conveyance system. The conveyance costing has not been established yet, there is an ongoing competitive process and the Project will announce the result.*
• A resident of Lewis Street expressed support for the cycle path, and the options developed to keep the angled parking. They also noted that they are satisfied with the team's effort to accommodate the range of interests of community members.
• A community member asked what will happen with parking on Dallas Road near Paddon Street, and where will residents park when those spots are gone. *A Wastewater Treatment Project representative noted that on the north side there is currently on street parking, those 13 spots cannot be preserved.*
• A resident of Dallas Road expressed concerns for safety of the alignment with a set-back of 9 metres, they would prefer it to be set-back 50 metres, and asked how this can be done safely. *A Wastewater Treatment Project representative noted that Stantec, KWL and an independent team of experts have looked at the alignment and determined that it can be built. The team is doing additional geotechnical work in this area to refine the design. The forcemain will not impact the bluffs or the seawall.*
• A resident of Superior Street and Oswego Street and member of the Active Transportation Committee, noted that their study on active transportation in James Bay shows that 60% of trips are done using active transportation i.e. cycling or walking. They also noted that they cycle with their children each day but would not use Dallas Road in its current state, and people would use cycling infrastructure if it was built. They also noted that the parking congestion is caused by commuters who park on Dallas and go work downtown or at the legislature. A time limit on parking could help solve the problem.
• A resident of Ontario Street noted that the loss of parking is not equal to the safety of pedestrians and cyclists. If the cycle path gets built they will use it with their children. Currently they do not ride on Dallas Road with their children, because it is unsafe. They also

	expressed support for Option 2 as a better option for pedestrians, because the vast majority of trips in James Bay are made on foot.
•	A resident of Montreal Street asked what kind of surface is on top of the forcemain and why can't the cycle path go on top of it. *A Wastewater Treatment Project representative noted that the restoration on top of the forcemain will vary. In sections outside of the road, it will be grass or shrub. The cycle path will follow the route of the forcemain as much as possible. Restoration of the cycle path will be asphalt, but it will be different than the restoration of the road itself.* The resident asked if the forcemain will go under the road some of the time. *A Wastewater Treatment Project representative noted that there are portions where the forcemain alignment is within the road, especially near the seawall and Ogden Point.*
•	A resident of Niagara Street and Boyd Street stated that they hope that the current rusty green barriers on Dallas Road are replaced by something people can see through. They also expressed concerns about construction on Niagara Street, in particular parking and provisions for emergency vehicles, and asked what the plan was. *A Wastewater Treatment Project representative noted that there will be follow-up meetings on the topic with Niagara residents in 6-8 weeks. Three weeks ago, the team went door-to-door in order to gain information on each household's needs. The team will put in place a plan and come back to the community and address it. Emergency vehicles will always have access, and residents will be notified when meetings will take place.*
•	A resident of Menzies Street by Niagara expressed support for the cycle path to increase cyclist safety with regards to tour buses and dump trucks. They also expressed concerns for the loss of parking.
•	A resident of Dallas Road at Menzies Street asked what the construction impacts and timing will be along Dallas Road, in particular the trench for the forcemain from Clover Point to Odgen Point. *A Wastewater Treatment Project representative noted that the forcemain is a 48 inch pipe placed under about a metre or 3 feet of cover. Construction is expected to start this summer, and last until February 2020.* The resident expressed concerns about the narrow section of Dallas Road between Olympia Avenue and Paddon Street especially with horse-drawn carriages, and asked how many parking spaces are there currently in total and how many will there be after construction. *A Wastewater Treatment Project representative noted that they do not have the exact total number, but will provide a formal answer to that question.*
•	A resident of Niagara Street expressed concerns about seismic safety and would have preferred the undersea pipeline. They also proposed making Dallas Road one-way going west to east.

• A resident of San Jose Avenue expressed support for the project despite construction impacts, because they want to be a part of the solution. They also expressed support for the cycle path to ride safely with their children to Beacon Hill Park.
• A resident at Dallas Road and Dock Street expressed concerns for the safety of the conveyance pipe in the case of an earthquake.
• A resident of Niagara Street noted that they are happy to see the cycle path, but are concerned about the loss of parking for visitors. They asked if there was another option that could be developed that would accommodate cars, cyclists, and pedestrians without the loss of any parking. *A Wastewater Treatment Project representative noted that comments included on the feedback forms will be shared with the City of Victoria and will inform the finalization of the design.*
• A community member suggested that the safety of the intersection of Dallas Road and Douglas Street be improved in conjunction with the forcemain construction. They also noted that they are opposed to the idea of turning Dallas Road into a one-way street, because it would speed up traffic.
• A member of the Friends of Beacon Hill Park expressed concerns about large trees, and suggested the forcemain should be placed under the road to avoid feeder roots and preserve trees. They also suggested the cycle path be on Dallas Road rather than in the woods south of Beacon Hill Park. *A Wastewater Treatment Project representative noted that they will take that feedback into consideration when they look at options for the cycle path alignment at the intersection of Douglas Street and Dallas Road.*
• A resident of San Jose Street asked if there would be any re-charging stations for electric cars on Dallas Road or at Clover Point. *A Wastewater Treatment Project representative noted that re-charging stations are not currently in the design, but the feedback can be brought back to the city as a suggestion.*
• A resident of Dock Street asked if the parking on the north side of Dallas Road across from the breakwater would be moved onto the boulevard green space, and what will happen to the south side. *A Wastewater Treatment Project representative noted that on the north side the parking will move to the boulevard in order to maintain the width of the travel lanes, and on the south side there will be reduced overall width of the cycle path, and include angled parking.* The resident asked if two-way vehicle traffic and if sidewalks would be maintained on Dallas Road up to Paddon Street. *A Wastewater Treatment Project representative noted that with all 3 of the options, the lane widths are maintained and function with large buses. In the case of angled parking we have a wider eastbound lane, because more space is required. Sidewalks are retained up to Lewis Street, east of that the alignment is going to change in certain places to a 1.5-metre sidewalk.*

	The resident asked what the team knew about the CRD seeking volunteers to sit on the solid waste advisory committee for the revision of the solid waste management plan. *A Wastewater Treatment Project representative clarified the team is here to deliver a wastewater treatment facility and could lead them to someone who can offer an answer to that question.*
•	A resident noted that all modes of transportation should be accommodated in the plan, not just cyclists, because many people in James Bay have mobility issues. The also noted that this is a good opportunity to realign Douglas Street and Dallas Road for pedestrian safety. They asked if there would be a division between cyclists and pedestrians. *A Wastewater Treatment Project representative noted that there would be no physical barrier, but there may be a curb. The details haven't been confirmed yet.*
•	A resident of Richards Street noted that they are against the Wastewater Treatment Project, and expressed concerns about the safety of the conveyance line, loss of parking, and ensuring that the cycle path is mobility friendly.
•	A resident of Niagara Street noted that all the pedestrian crosswalks on Dallas Road should be equipped with a pedestrian activated light system.
•	A resident of Government Street and Dallas Road asked what the changes in parking would be beyond between Dock Street and Lewis Street. *A Wastewater Treatment Project representative noted that beyond Lewis there are no changes in parking.*

Fairfield Gonzales Community Meeting
Design and alignment of the cycle path; alignment of the Clover Forcemain; design for the exterior of the Clover Point Pump Station building; and design of the public space improvements

JANUARY 11, 2018	TIME: 7:30 PM TO 9:30PM	LOCATION: COOK STREET VILLAGE ACTIVITY CENTRE, 380 COOK STREET

ATTENDEES/AFFILIATION	Approximately 130 members of the public **City of Victoria:** Jas Paul Julie Potter Leigh Campbell
CRD WASTEWATER TREATMENT PROJECT TEAM	Dave Clancy Elizabeth Scott Ken Madill Peter Lutzmann Kevin Simpson Evan Southern Christie Howatson Martina Kapac de Frias
WATT CONSULTING GROUP	Mitchell Jacobson
KERR WOOD LEIDAL	Colin Kristiansen
CH2M HILL INC.	Joe Broberg
THURBER ENGINEERING	Stephen Bean
WSP CANADA INC.	Bob Evans
KENAIDAN CONTRACTING LTD.	Derek Steinke
FACILITATOR	Judy Kirk, Kirk & Co. Consulting Ltd.
MEETING RECORDER	Hazel Currie, Kirk & Co. Consulting Ltd.

KEY THEMES

- Participants expressed concerns about loss of parking spots on Dallas Road and at Clover Point.
- Participants were interested in the cycle path, especially safety for cyclists.
- Participants wanted to learn more about off-leash dog areas and fencing.
- Participants were interested in accessible parking spaces for residents with mobility needs.

Project Overview
• A Wastewater Treatment Project representative provided an overview of the Project, and the consultation seeking input on final design and alignment of the cycle path, and alignment of the Clover Forcemain, design for the exterior of the Clover Point Pump Station building, and design of the public realm improvements. • Wastewater Treatment Project representatives walked through the presentation.
Question and Answer
• A resident of Linden Avenue noted that the current pedestrian connections at Clover Point are inadequate and dangerous, and improvements to pedestrian access on Clover Point should be included in the public space improvements.
• A resident of Saanich expressed concerns about parking, and would prefer an increase in parking in the area. They also noted that they would like Dallas Road to be one-way.
• A resident of Dallas Road expressed support for the Clover Point improvements, and suggested the washroom be locked at night.
• A resident of Fairfield noted that they would like to know the current number of parking spots on Dallas Road, and support the idea of having Dallas Road one-way. They also expressed concerns about the cycle path and barrier, stating that they are unnecessary and would increase the cost of the project significantly. *A Wastewater Treatment Project representative clarified that the focus of the project is to put the forcemain along Dallas, and the cycle path is a part of the restoration as determined in the licence agreement with the City of Victoria. The alignment of the cycle path would follow the alignment of the forcemain as much as possible and this will minimize cost.*
• A resident of Howe Street noted that the dedicated lane is great for cyclists, but not the barrier for safety reasons. They asked if parking at Clover Point would be maintained, and if there would be any reduction in parking between Cook Street and Clover Point. *A Wastewater Treatment Project representative noted the circle at Clover Point will be maintained, and the construction limit is where the Pump Station is located. There will be no reduction of parking between Cook Street and Clover Point.* The resident asked if there is any intention of using this opportunity of fencing off the off-leash dog area. *A Wastewater Treatment Project representative noted it is not the case.*
• The founder of Cycling Without Age Victoria expressed support for a high-quality cycle path to allow the seniors to be a part of the community and safely take advantage of these improvements. Currently Dallas Road is not a safe route for them, and safety should be prioritized over car storage. They suggested new designations for accessible parking spaces for those who have mobility issues and need to park there, and to look at other new bylaws for parking.
• A community member expressed support for the cycle path to ride with their young family. They suggested it be safe, wide, and accessible to all ages and abilities. They also noted that compromises can be made for parking; this area should be accessible to everyone.

• A resident of Fairfield expressed support for the cycle path, in particular the increased safety for children. They noted that the options strike a balance between cyclists and those who need parking.
• A resident of Wellington Avenue asked for more details on the location of barrier fencing for the off-leash dog areas. *A Wastewater Treatment Project representative noted that the barrier fencing along Dock Street is part of the CRD licence agreement with the City of Victoria. The type of fencing is open for discussion and the team would like to hear feedback. The fencing would be the entire length of the off-leash area with an opening on the north side at the pedestrian crossing paths.* *A representative of the City of Victoria Parks Department noted that the fencing would perhaps be a low-split rail between the cycle path and the leash-optional area on the farthest north side to reduce view impacts. The fencing would only be placed in areas where it's more constrained and there are potential issues with the safety of dogs and the interaction with cyclists.* The resident asked whether that option had been rejected previously at City Council. *The representative of the City of Victoria Parks Department clarified that the option that had been rejected was a fence along the current pathway. This fence is to separate the potential conflict between dogs and cyclists.* The resident expressed concerns for the loss of parking, because it will increase the number of cars that park on residential streets. They also believe that the cycle path on Dallas is not necessary, but rather cycling connections throughout Victoria. They asked if the current crosswalks on Dallas Road will be maintained. *A Wastewater Treatment Project representative noted that the difference between Option 2 and Option 3 is the increased parking and the increased crossing opportunities for cyclist and pedestrians.*
• A resident of Oak Bay expressed support for the options presented, and the cycle path. They noted that safety should be prioritized, and every option offers sufficient parking for those who need it, and suggested increasing handicapped parking in the area.
• A community member asked why all of the options have the cycle path, and what is the difference in cost for the Project. *A Wastewater Treatment Project representative noted that the options presented i.e. the cycle path, and the public space improvements at Clover Point are a part of the licencing agreement with the City of Victoria. They are covered within the $765 million budget for the overall Wastewater Treatment Project. Costing on this particular component will not be released until the competitive bidding process is over; we are currently in the design phase.* The resident asked what magnitude seismic event the forcemain could handle.

	A Wastewater Treatment Project representative noted that all of the infrastructure is built to post-disaster requirements. Post-disaster is not measured with magnitude, because the energy of a quake depends on distance from the epicentre. The Project follows the design methodology standard for post-disaster.
•	A community member expressed concerns for the loss of parking to accommodate cyclists.
•	A resident of Lewis Street expressed support for the cycle path, noting that if the cycling infrastructure is built, people will use it. They also suggested having more parking for people with mobility challenges on Dallas Road. They asked if there were safety and flow improvements planned for the corner of Dallas Road and Cook Street, i.e. a four-way stop. *A Wastewater Treatment Project representative noted that there are no improvements in the design for the corner of Dallas Road and Cook Street; comments included in the feedback form will be shared with the City of Victoria to inform the next stage of design. Crosswalks are a city issue.*
•	A community member expressed concerns about getting dogs from cars to the off-leash dog park, in particular a low-rail split fence. They also noted that the cycle path was considered by council before the Wastewater Treatment Project.
•	A resident of Oswego Street commented that the area should be accessible to all people not just drivers.
•	A community member expressed support for the cycle path, in particular to take children riding. They asked if the cycle path lanes were narrower in option 3, and how they compare with the width of the lanes on Pandora Street. *A Wastewater Treatment Project representative noted that for Option 1, they are the same width as Pandora Street. For Options 2 and 3, the width is reduced slightly, but still above the industry minimum recommendation, and allows for the angled parking to be retained.*
•	A retired senior planner for the Province of BC expressed concerns for the loss of parking, and noted that parallel parking would hinder traffic flow. They noted that it is important for cyclists to have a separate lane, but believed the consultation was insufficient. They suggested having a one-way cycle path on Dallas Road.
•	A community member asked if the forcemain would run directly south of Dallas Road from Clover Point going west. *A Wastewater Treatment Project representative noted that the intention of the alignment is to keep off the travelled portion as much as possible. The forcemain would be to the south of Dallas Road, but as we move further west the alignment moves onto the road to protect some mature trees.*
•	A community member asked why the undersea pipe is not being considered. *A Wastewater Treatment Project representative noted that they have assessed the potential for an undersea pipe and the review is available online. There were three main concerns with the undersea pipe: ensuring it met the seismic design standard, significant tidal forces create concerns over the stability of the pipe during construction and operation, and a vertical profile issue, i.e. the forcemain needs a single low point and two high points at each end and to achieve that they would have to do blasting.*

	The community member asked if there would be changes to the seawall, and what the cycle path would cost. *A Wastewater Treatment Project representative noted that the forcemain can be built without impact to the seawall or the bluffs. The cost cannot be released yet, because there will be a competitive bidding process underway.*
•	A resident of Dallas Road suggested having narrow one-way cycle paths on each side of Dallas Road. They also noted that they would prefer curb rises rather than barriers to separate cyclists and pedestrians.
•	An employee in the seniors' home on Dallas Road requested a crosswalk between Moss Street and Cook Street, and expressed concerns that the barrier will block the view for seniors who love to watch dogs play. They also asked about construction timing and whether it would be completed in sections. They also suggested moving utilities underground and considering minimizing lighting for star gazing. *A Wastewater Treatment Project representative noted that work will begin on the pump station this month, and work is scheduled to begin on the forcemain this summer. Both have to be completed by the end of 2020. Construction on the forcemain will be done in segments.*
•	A resident near Clover Point expressed concerns over safety for young families exiting vehicles, and asked about buffers between parked cars and the cycle path. They also asked if the width of Dallas Road would be reduced in certain areas. *A Wastewater Treatment Project representative noted that the buffer is about 2 metres proposed between cars and cycle path. Dallas Road would remain the same in most areas, places that may change include in James Bay on the seawall section, and by Paddon Street and Douglas Street.*
•	A resident of Dallas Road, across from Clover Point expressed concerns about old homes and geotechnical drilling impacts. *A Wastewater Treatment Project representative noted that a geotechnical rig drilling a hole will not cause vibration that would cause cracks in an old home. If there is any blasting required, there would be a pre-condition survey, the Project would catalogue it and there would be insurance in place.* The resident asked about the communications channels for the Project. They also suggested having signage to protect Clover Point and designate the area as a park. *A Wastewater Treatment Project representative noted that there is a Project email and 24/7 phone line and Project Team members respond to all inquiries.*
•	A resident of Fairfield noted that they want pedestrians at Clover Point to have priority and right-of-way over cyclists.
•	A resident expressed concerns for the safety of pedestrians.
•	A community member asked if there were plans to replant the sea thrift along Clover Point, and suggested adding signage to indicate the archeological site on the northwest corner of Clover Point.

	A Wastewater Treatment Project representative noted that the sea thrift has been identified by environmental professionals and it will either be moved and replanted or secured during construction. There are currently no plans for signage, but the feedback will be considered.
•	A resident of Fairfield noted that they are opposed to having Dallas Road one-way because it would divert traffic to residential areas. They also suggested maximizing crosswalks and parking on Dallas Road.

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Wastewater Treatment Project

Clover Point Pump Station and Dallas Road (Clover) Forcemain 50% Design Proposal

April 12, 2018

Harbour Crossing Update





Introduction and Background

Previous Council Meeting:

- Presented Design Proposal to Council at Committee of the Whole (Dec. 14, 2017)
- Council recommendations:
    - Soften interface between Clover Point Pump Station and foreshore
    - Report back on parking capacity and options to mitigate impacts

Progress Since Last Council Meeting:

- Progressed development of the 50% design
- Amended design to incorporate Council recommendations
- Present 50% design to James Bay Neighbourhood Association (Jan. 10, 2018)
- Present 50% design to Fairfield Gonzales Community Association (Jan. 11, 2018)
- Amended 50% design to incorporate public comments

Purpose of Council Meeting:

- Present 50% Design Proposal to City Council

Presentation Team Members

Dave Clancy – Project Director, CRD Wastewater Treatment Project

Evan Southern – Director of Communications & Stakeholder Engagement, CRD Wastewater Treatment Project

Bob Evans - Lead Architect, WSP/Kenaidan Contracting Ltd.

Joe Broberg - Senior Project Manager, Jacobs/CH2M Hill

Stephen Bean - Senior Geotechnical Engineer, Thurber Engineering Ltd.

Mitchell Jacobson - Senior Transportation Engineer, Watt Consulting Group

Community Consultation

Consultation Purpose

The CRD held a community consultation from January 10 – 31, 2018

Clover Point Pump Station building exterior and public space improvements;

Clover Forcemain design and alignment within the Dallas Road right-of-way; and

Cycle path alignment along Dallas Road.

Consultation Participation

280 people attended two community meetings in James Bay and Fairfield Gonzales

346 feedback forms (online & hardcopy) submitted

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Community Consultation: Key Themes

James Bay Community

- Participants were interested in the construction and alignment of the Clover Forcemain
- Participants expressed concerns for vegetation and wildlife at Beacon Hill Park, as well as mature trees along the cycle track and forcemain alignment
- Participants expressed concerns about possible loss of parking spots along Dallas Road and at Clover Point
- Participants were divided in their support and opposition of the cycle track

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Community Consultation: Key Themes

Fairfield Gonzales Community

- Participants wanted to learn more about off-leash dog areas and fencing
- Participants were generally supportive of the cycle track, especially safety for cyclists
- Participants expressed concerns about possible loss of parking spots along Dallas Road and at Clover Point
- Participants were interested in accessible parking spaces for residents with mobility needs

Community Consultation: Results of Feedback Forms

Clover Point Pump Station Building Exterior

75% strongly or somewhat agree

Public Space Improvements at Clover Point

74% strongly or somewhat agree

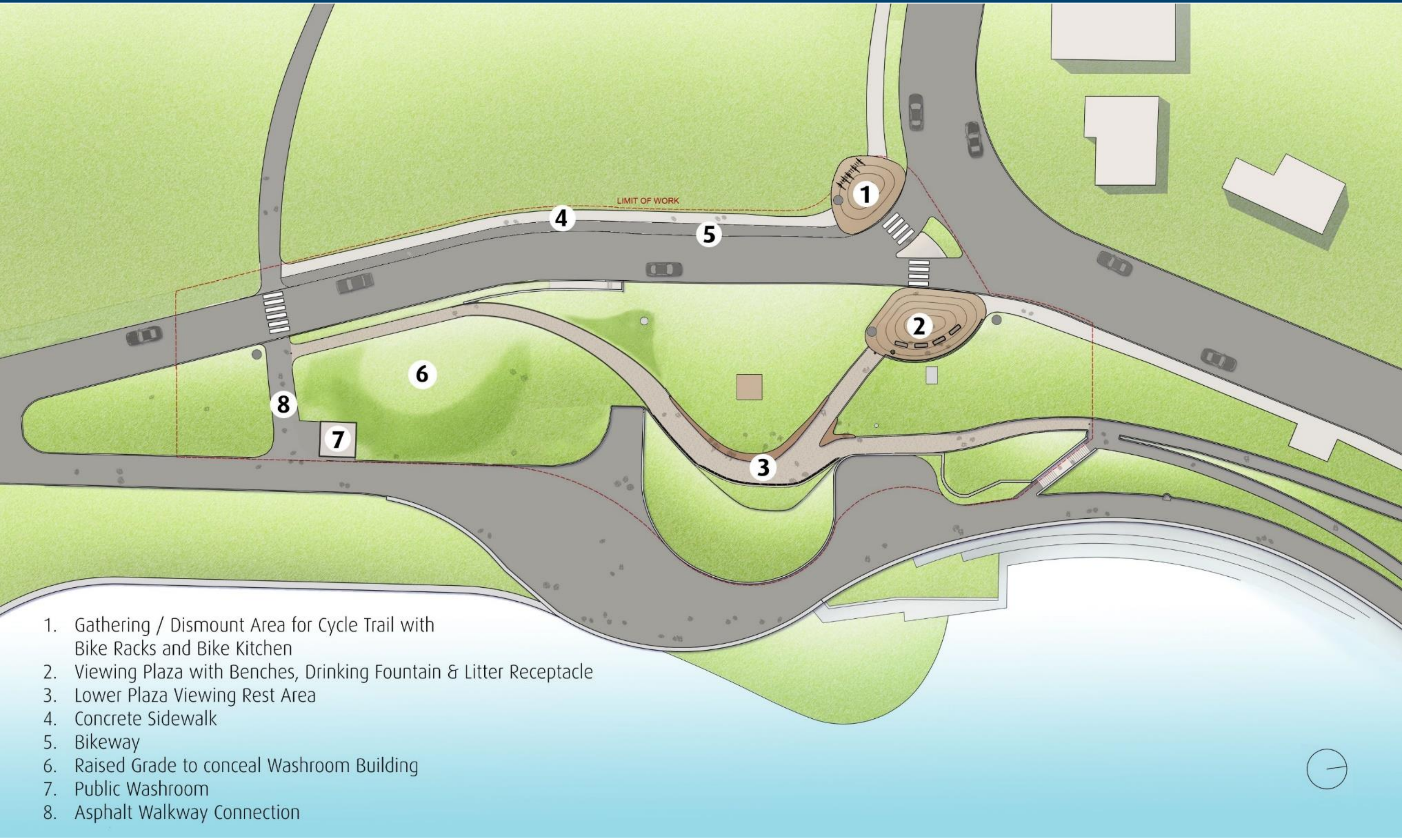
Cycle Track Design and Alignment

59% strongly or somewhat agree **38%** strongly or somewhat disagree

Community Consultation: Other Suggestions

Outside Project Scope

1. Extend public walkways around Clover Point
2. Introduce a bus stop at Clover Point
3. Change Dallas Road to one-way traffic
4. Provide traffic-controlled traffic signals at crosswalks
5. Provide additional bike racks along cycle track
6. Remove car parking at Clover Point loop
7. Extend cycle track through Ogden Point
8. Include traffic calming measures
9. Implement pay parking and / or maximum time limits for parking



CLOVER POINT PUMP STATION

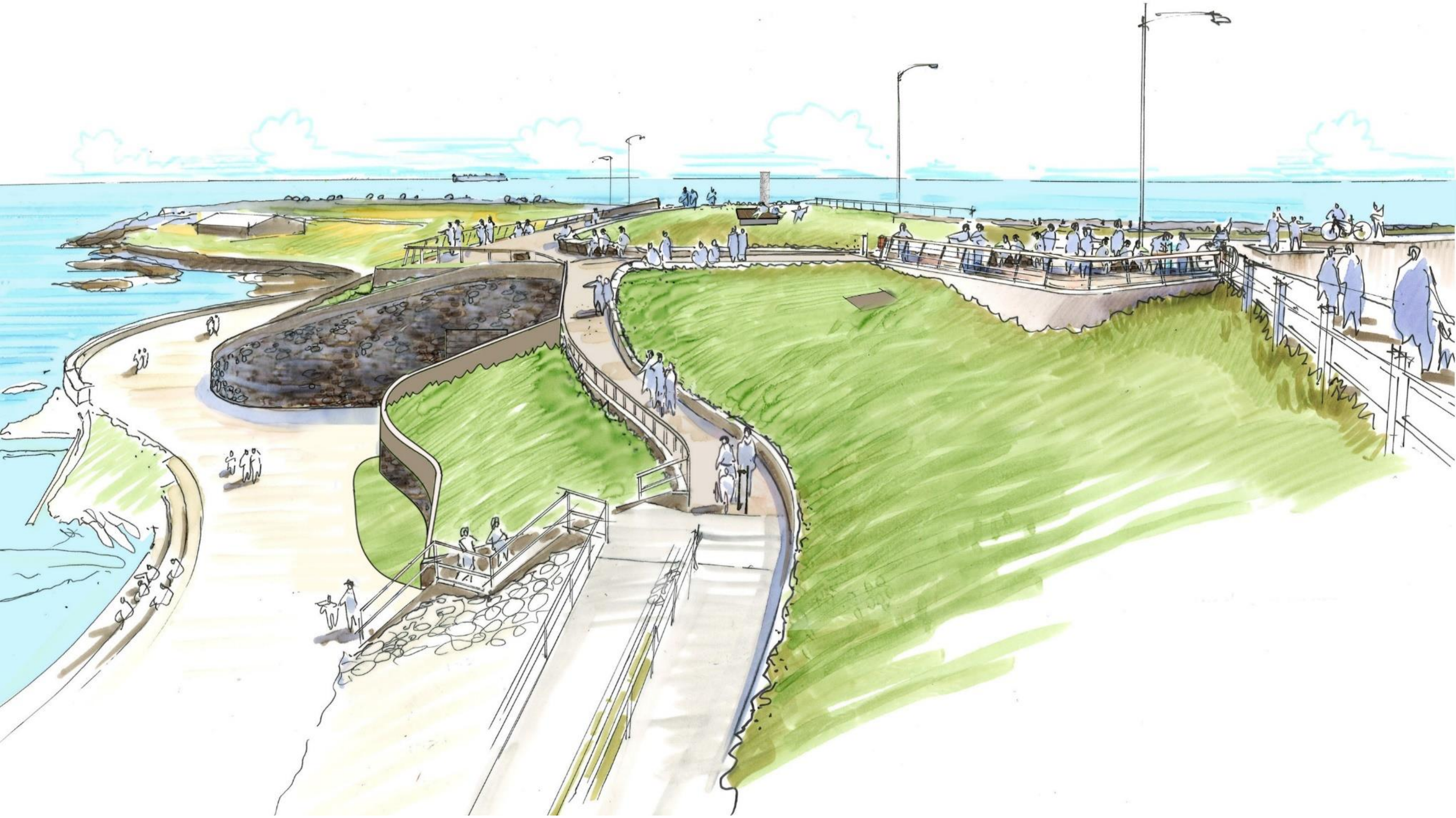
FIGURE 1 - CONCEPT PUBLIC REALM PLAN

CLOVER POINT PUMP STATION

FIGURE 2 – VIEW TOWARDS THE SOUTHWEST

CLOVER POINT PUMP STATION

FIGURE 3 – VIEW TOWARDS THE NORTH



CLOVER POINT PUMP STATION

FIGURE 4 – VIEW TOWARDS THE SOUTH

Community Consultation: Clover Point Pump Station Building Exterior and Public Realm Improvements

Suggested amendments incorporated into design include:

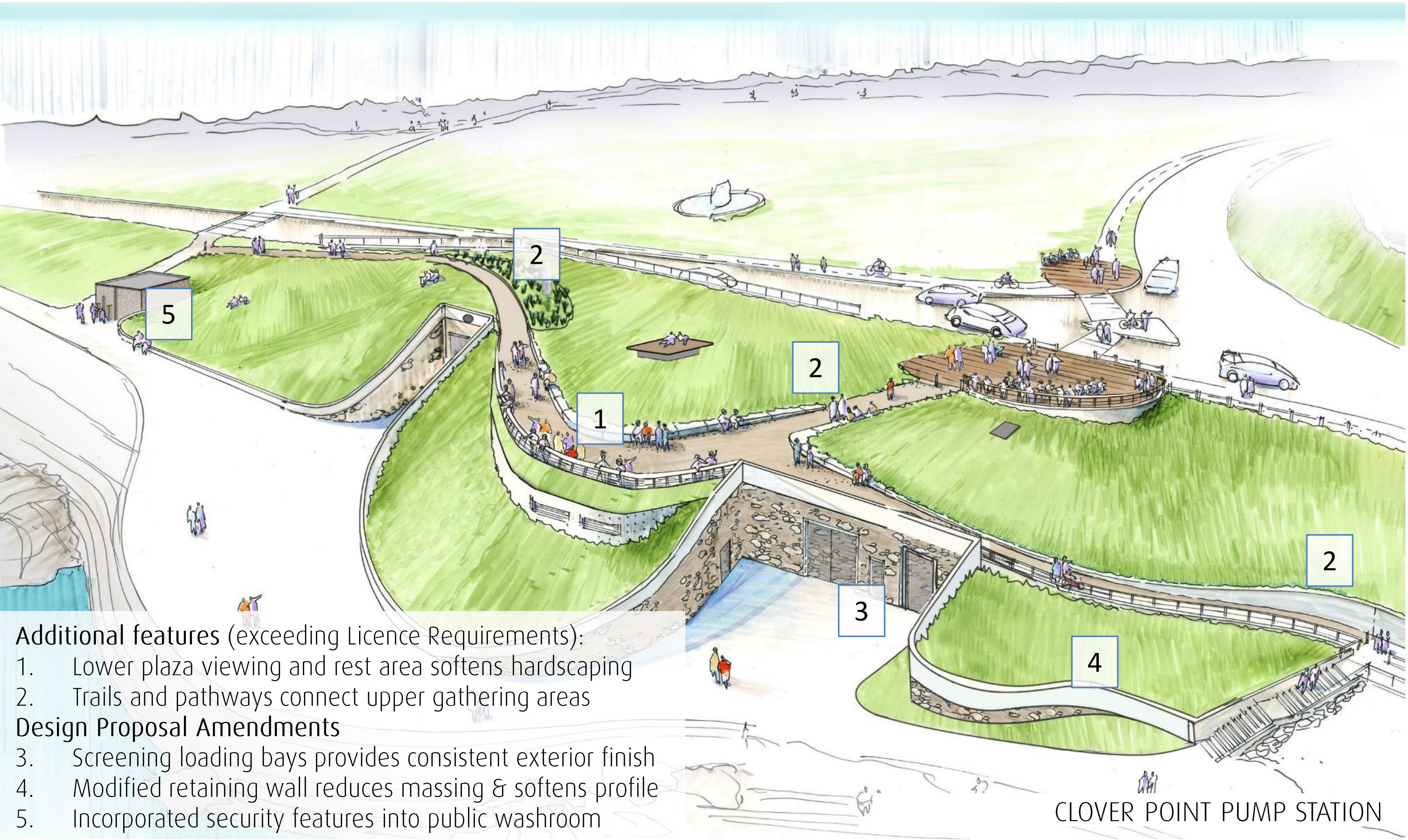
- Blend Pump Station building exterior with site and surrounding area
  - 50% Design Proposal has features which exceed Licence requirements
  - Reduced massing and profile to better blend exterior with the site
  - Modifications requiring less use of stone and concrete
- Washroom improvements (less tucked away, security and monitoring)
  - Security features incorporated , e.g. lockable, roll-down shutter
- Add architectural or landscaping features, e.g. First Nations historical significance
  - Integral part of Licence requirements and design development
  - Collaborating with Esquimalt and Songhees Liaisons and City of Victoria

Community Consultation: Clover Point Pump Station Building Exterior and Public Realm Improvements

Suggested amendments unable to be incorporated into design include:

- Building exterior modifications to see inside pump station
  - Would require significant structural retrofit (not feasible)
- Provide ramps connecting upper and lower levels of public space improvements
  - Trails and pathways connect to existing ramps
  - Spatial limitations prohibit ramps in closer proximity to pump station
- Move viewing plaza and other public amenities further from Dallas Road
  - Would require material revisions to Design Concept in Licence Agreement

Design Amendments (Council and Public Comments)



Additional features (exceeding Licence Requirements):

1. Lower plaza viewing and rest area softens hardscaping
2. Trails and pathways connect upper gathering areas

Design Proposal Amendments

3. Screening loading bays provides consistent exterior finish
4. Modified retaining wall reduces massing & softens profile
5. Incorporated security features into public washroom

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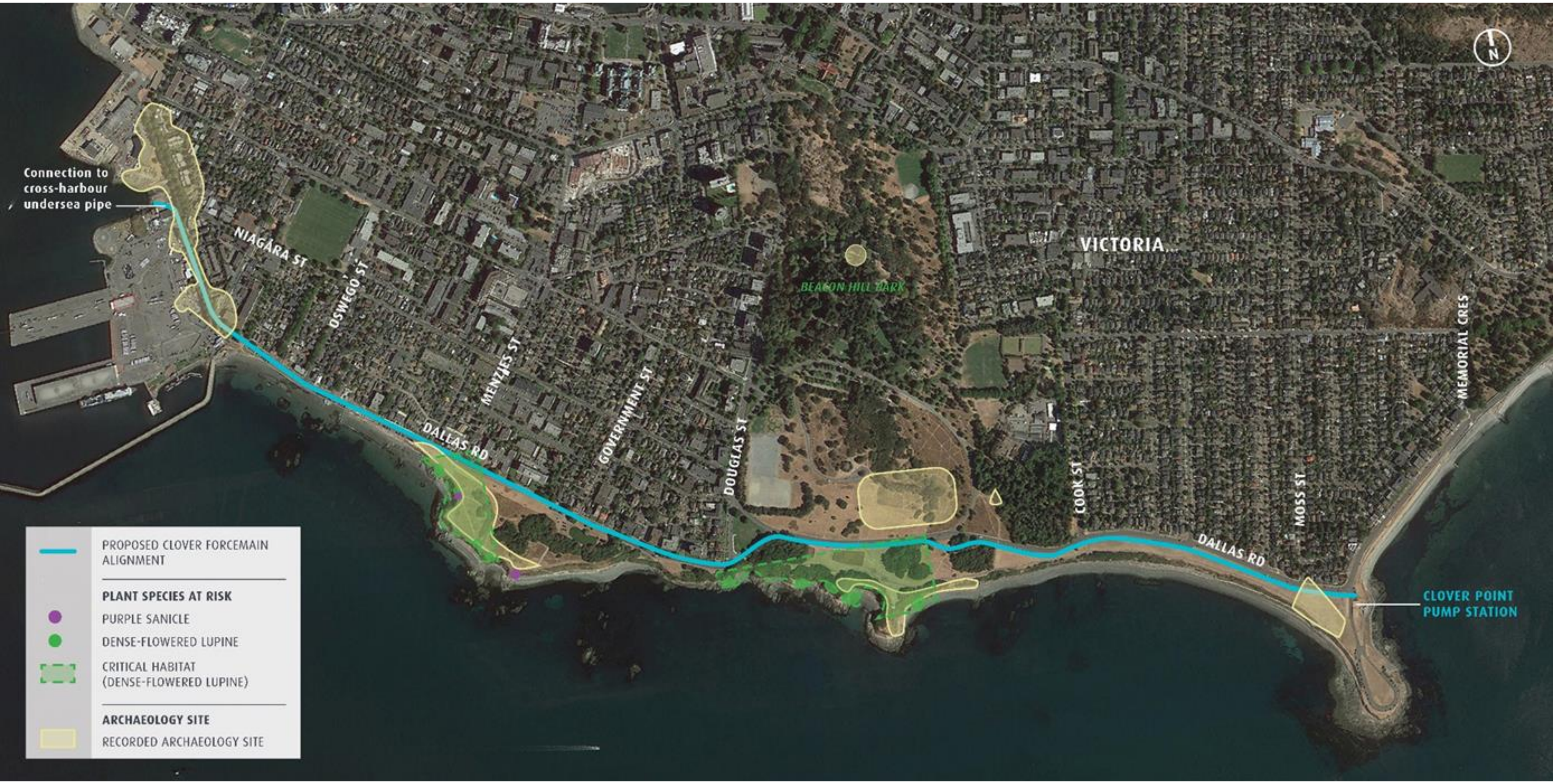
Clover Forcemain: Alignment Overview



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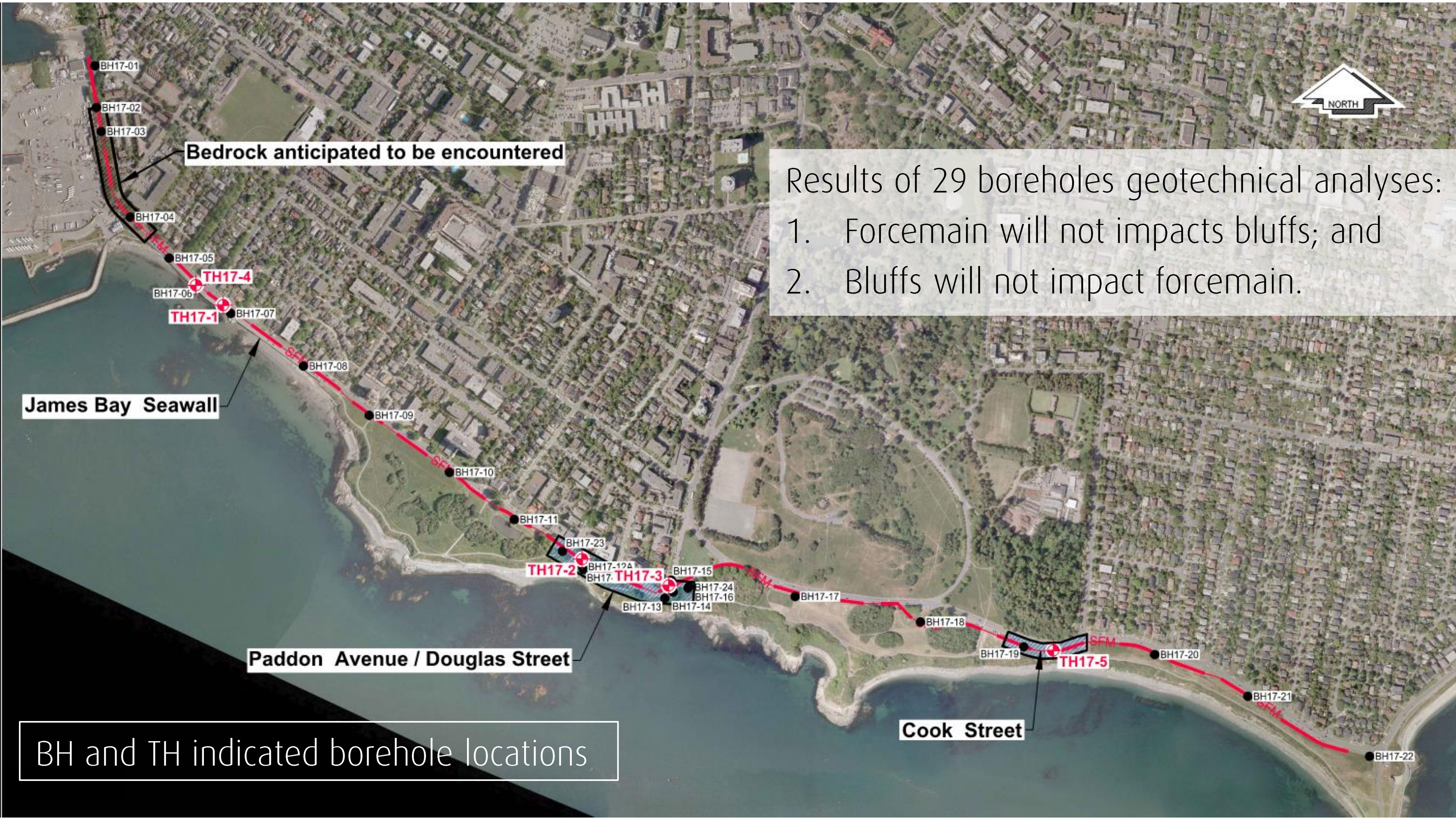
Areas of Geotechnical Interest

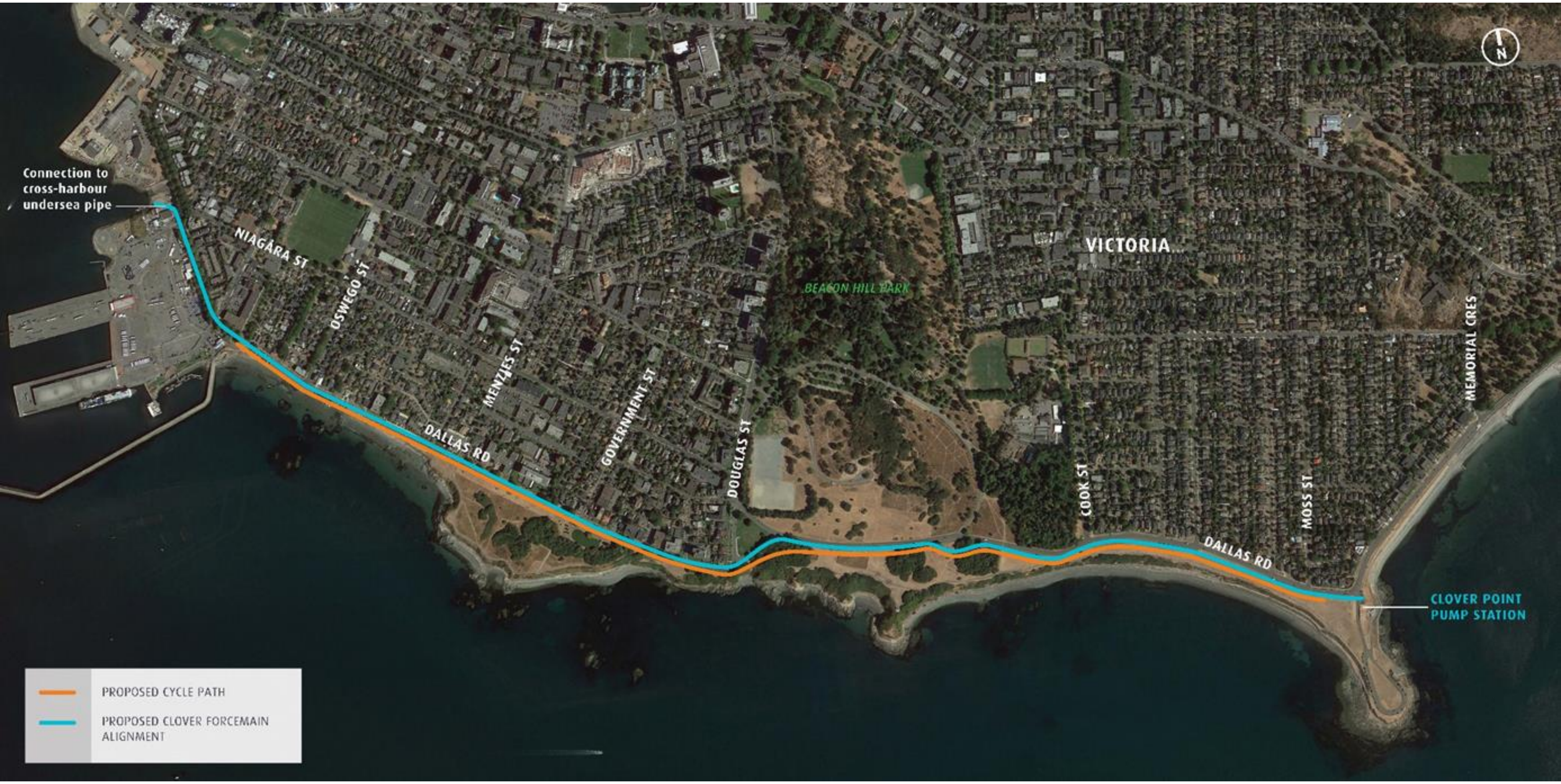


Results of 29 boreholes geotechnical analyses:

1. Forcemain will not impacts bluffs; and
2. Bluffs will not impact forcemain.

BH and TH indicated borehole locations

Cycle Track Alignment Overview



Cycle Track Design Objectives

- Meeting requirements of Licence:
  - Address public safety of all road and park users (pedestrians, cyclists, and vehicles)
  - Minimum 3.0 m wide, physically separated from Dallas Road
  - Incorporate Crime Prevention Through Environmental Design (CPTED) principles
  - Comply with Transportation Association of Canada geometric design standards
  - Incorporate safety improvements for pedestrian crossings
  - Provide linkages to existing crosswalks and connections to Dallas Road waterfront pathway
  - Constructed in a manner that minimizes loss of parking spaces
- Minimize loss of green space
- Adhere to City of Victoria's Official Community Plan
- Provide a continuous cycling facility suitable for all ages and abilities

Before

After

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Cycle Track: Camas Circle

- Alignment within an existing utility corridor
- Arborists' recommendations support alignment:
  - Maintains large mature trees near south curb
  - Removes invasive species along Cycle Track route

Cycle Track: Mile Zero

- Alignment within an existing utility corridor
- Arborists' recommendations support alignment:
    - Maintains large mature trees near south curb
    - Removes invasive species along Cycle Track route

Cycle Track: Douglas Street

- Geotechnical constraints – cannot add fill
- Spatial constraints between retaining wall & road
- Cycle Track within roadway to maintain Design Objectives

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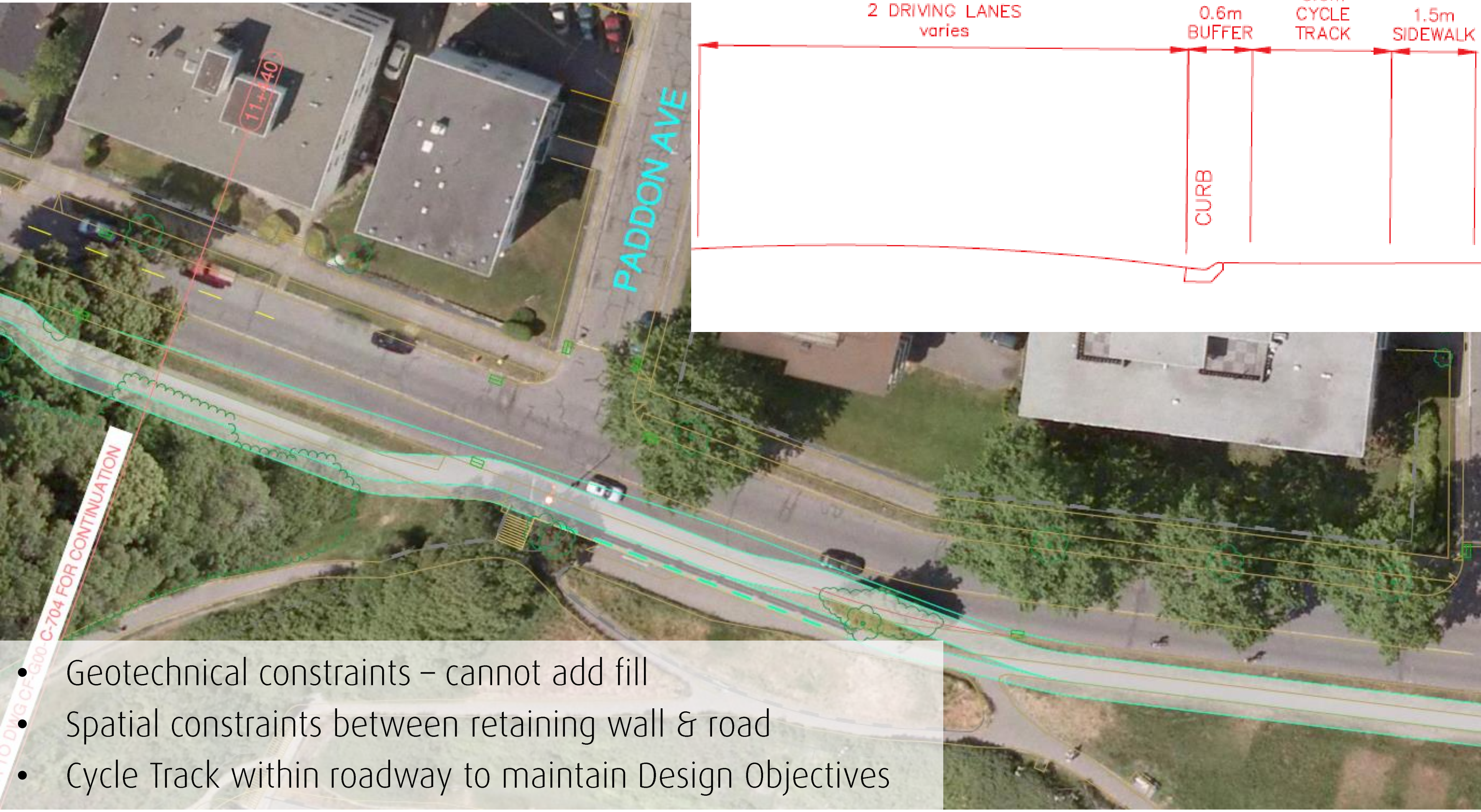
Cycle Track: Paddon Ave



- Geotechnical constraints – cannot add fill
- Spatial constraints between retaining wall & road
- Cycle Track within roadway to maintain Design Objectives

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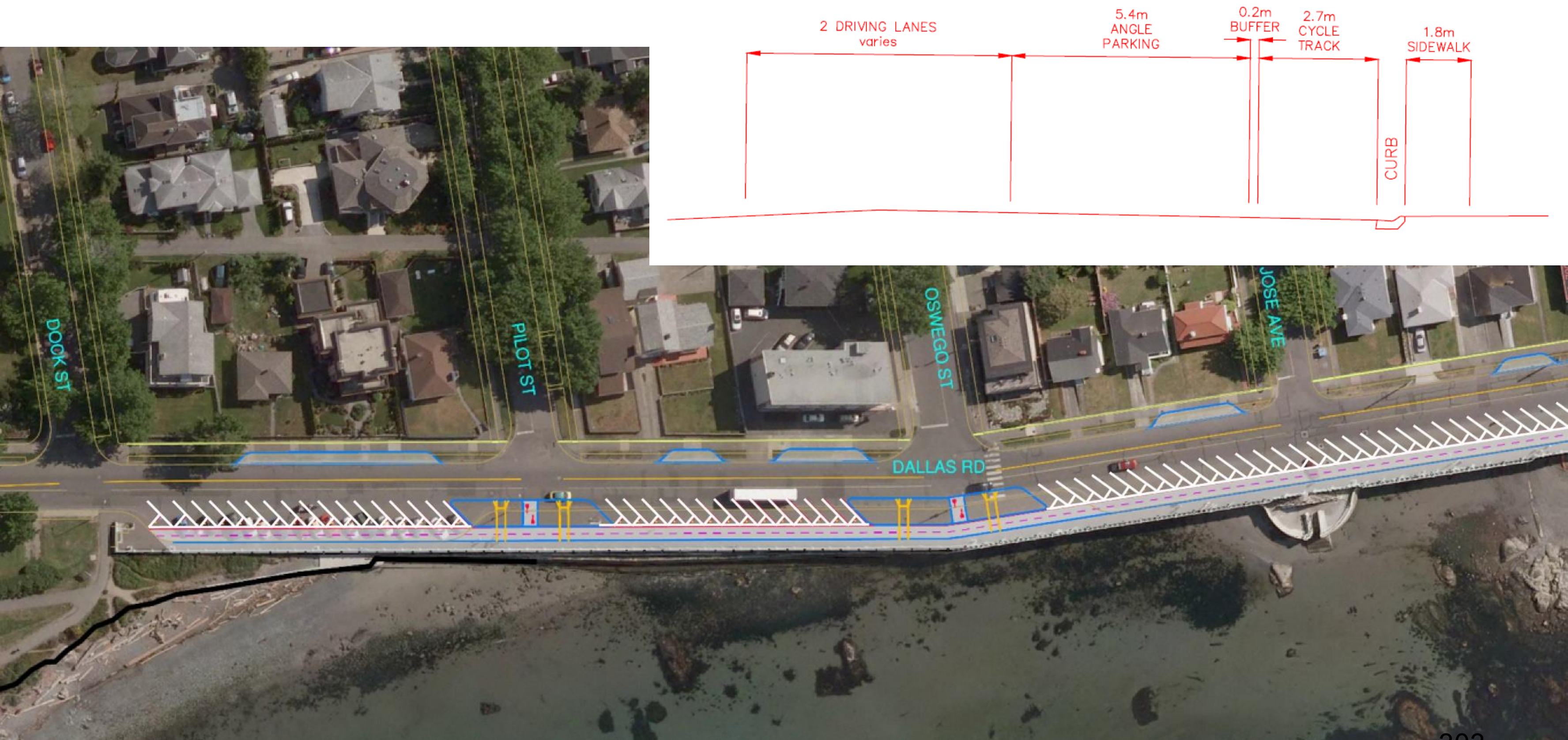
Cycle Track: Seawall Alignment (Dock St. to Lewis St.)

- Seawall is limited on south side
- North curb is north side limit
- Options developed to mitigate parking impacts



Cycle Track: Parking Options

Option 1: Parallel Parking

Cycle Track: Parking Options

Option 2: Angle Parking with Four Curb Extensions

- City estimate of total maximum parking capacity: 598 stalls (Dock St. to Clover Point)
- City estimate of total parking capacity for Option 2: 561 stalls

Cycle Track: Parking Options

Option 3: Angle Parking with Two Curb Extensions

- City estimate of total maximum parking capacity: 598 stalls (Dock St. to Clover Point)
- City estimate of total parking capacity for Option 3: 575 stalls

Community Consultation: Parking Options

Key Results from the Feedback Forms

Preferred option for parking on Dallas Road between Dock and Lewis Streets

- **15%** chose **OPTION 1**: parallel parking
- **44%** chose **OPTION 2**: angled parking with four curb extensions (provides improved pedestrian and cycling connectivity)
- **41%** chose **OPTION 3**: more angled parking with two curb extensions (provides less pedestrian and cycling connectivity than Option 2)

Proposed design basis: Option 2

- Optimizes parking, pedestrian and cycling connectivity
- Aligns with City recommendation

Community Consultation: Cycle Track Design and Alignment

Suggested amendments incorporated into design include:

- Concerns about pedestrian connectivity
  - Addressed through development of crosswalks and key intersections
- Concerns about parking loss for residents, seniors and visitors
  - Addressed through development of options to mitigate parking impacts
- No concrete curbs/barriers on cycle path (or use painted lines to delineate)
  - Design incorporates roll-over curbs
  - Consideration could be given to using line painting for delineation
  - CRD will implement City staff recommendation
- Provide elephant feet crosswalks for cycling and walking paths
  - CRD will implement treatment recommended by City staff

Suggested amendments unable to be incorporated into design include:

- Provide wider cycle lanes
  - Width of cycle lanes complies with applicable design criteria
  - Requires widening of Dallas Road, which would result in loss of green space

Cycle Track: Lighting Options

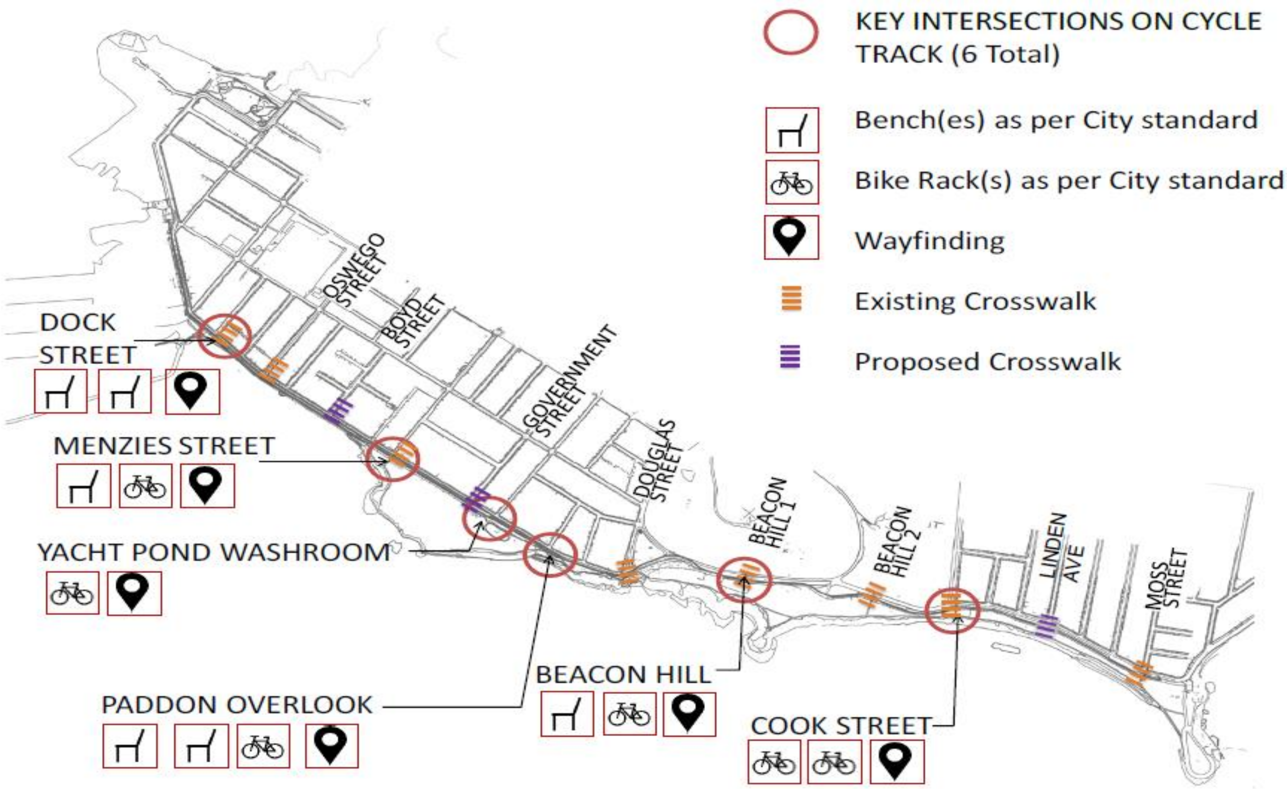
- Design Requirements:
  - Mitigate public safety concerns
  - Incorporate CPTED principles
  - CPTED: facial recognition at 10 metres
- Proposed design basis:
  - Cycle Track lighting in off-road sections only
  - Utilize solar lighting along Cycle Track
  - On street lighting Douglas to Cook Streets
  - Aligned with City recommendation

Dallas Road at Douglas Street/ Mile Zero

Dallas Road at Circle Drive

Cycle Track: Pedestrian Safety & Connectivity

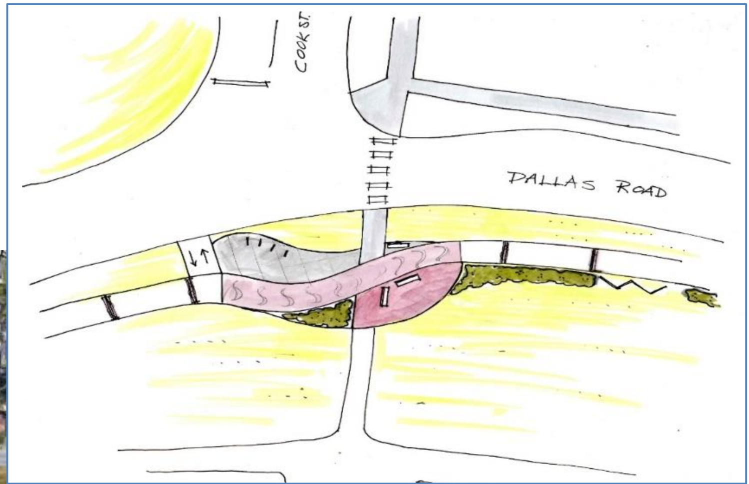
- Eight existing crosswalks from Dock Street to Clover Point
- Proposed design basis:
  - New crosswalks at Boyd, Government and Linden Streets
  - Aligned with City recommendation

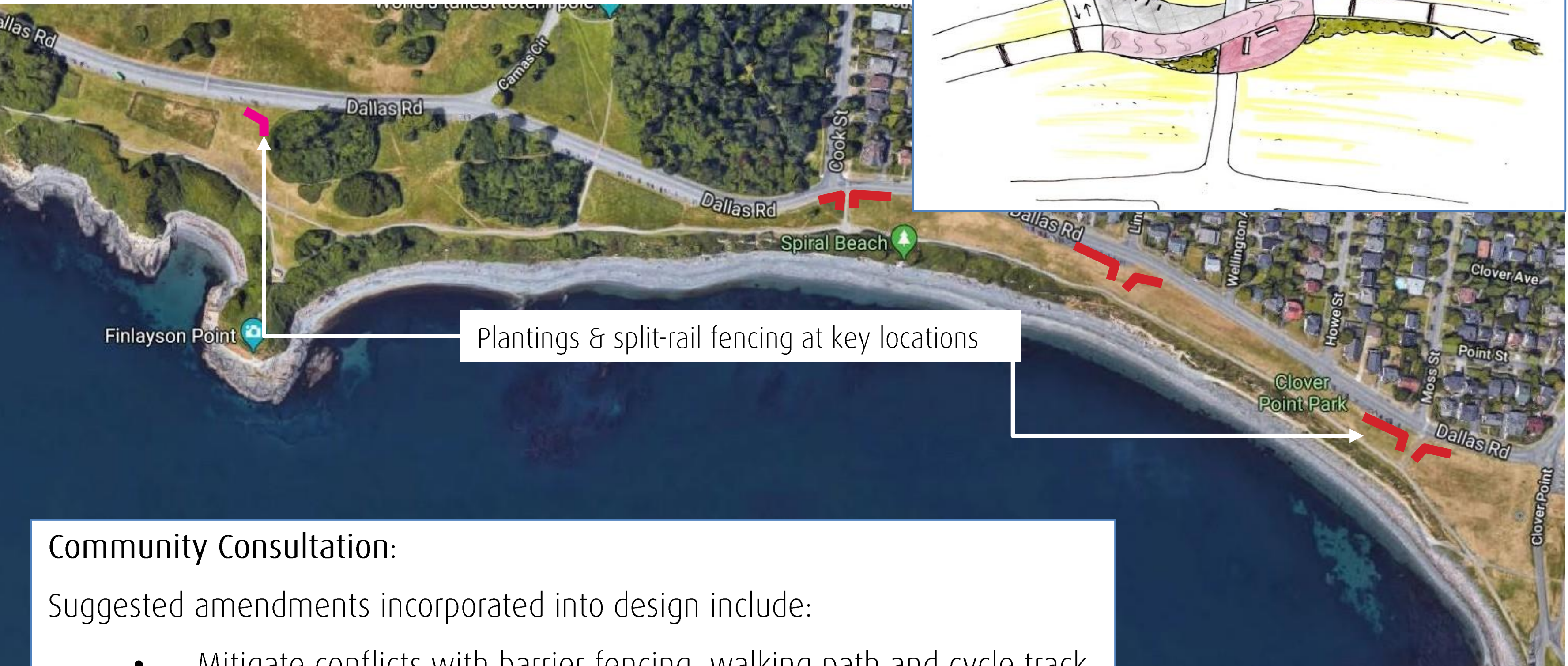


Cycle Track: Barrier Fencing

Proposed design basis:

- Plantings & split-rail fence at key locations
- Aligned with City recommendation





Community Consultation:

Suggested amendments incorporated into design include:

- Mitigate conflicts with barrier fencing, walking path and cycle track

Next Steps

April 2018 to June 2018

- CRD will amend the 50% Design Proposal in accordance with recommendations of City Council that are consistent with Design Concept
- CRD will submit final design of Building exterior and Public Realm Improvements and the Dallas Road Cycle Track alignment for City staff approval
- CRD will provide their public engagement plan to City of Victoria's Director of Engineering, before commencing construction
- CRD will select a general contractor for construction of the Clover Point Forcemain through a competitive procurement process

July 2018 to June 2020

- CRD will host a Community Information Open House, with City staff in attendance, to provide project update, and construction impacts and mitigation
- Construction of Clover Forcemain and Cycle Track, including geotechnical monitoring along Dallas Road with an enhanced focus on the shoreline and bluffs

June 2020 to June 2021

- Post-construction geotechnical monitoring (12 months) along Dallas Road with an enhanced focus on the shoreline and bluffs

Next Steps

Through 2018

CRD, the Esquimalt and Songhees Nations Liaisons and City of Victoria staff develop features that help share the story of the Lekwungen people in a respectful manner:

- Align and build on the Na'Tsa'Maht Unity Wall at Ogden Point;
- Link Ogden Point and Clover Point via Songhees and Esquimalt stories; and
- Wayfinding signage should align with the City of Victoria signage, where possible.

Through 2020

CRD ongoing engagement with Esquimalt and Songhees Nations Liaisons across the entire Project

Thank you

CITY OF VICTORIA

Committee of the Whole Report
For the Meeting of April 12, 2018

To:	Committee of the Whole	**Date:**	April 6, 2018
From:	Fraser Work, Director of Engineering and Public Works		
Subject:	Wastewater Treatment Project – Staff Review		

RECOMMENDATION

That Council:

1. Accept the CRD's 50% project design as presented, with the following additions/amendments:
   - Endorse parking configuration number two, which includes 4 curb extensions for the section of Dallas Road between Dock Street and Lewis Street, as it balances the retention of on-street parking with increased/improved pedestrian connections to the James Bay neighbourhood.
   - Endorse three new marked crosswalks be installed, at Dallas/Boyd, Dallas/Government, and Dallas/Linden
   - Endorse the proposed cycle track lighting configuration and the CRD project installation of street lighting along Dallas Road, from Douglas Street to Cook Street.
2. Direct staff to work with the CRD Project Team to finalize all remaining issues identified in this report, at the 90% stage.

EXECUTIVE SUMMARY

The CRD Wastewater Treatment Project (WWTP) is being built to meet the provincial and federal regulations for treatment of the Core Area's wastewater by December 31, 2020. The project consists of three main elements, including McLoughlin Point Wastewater Treatment Plant, Residuals Treatment Facility, and the Conveyance System

The WWTP conveyance system will be constructed within the City of Victoria, at the Clover Point Pump Station, and the Dallas Road Forcemain, and the conveyance pipe carrying residual solids from the McLoughlin Point Treatment Plant to the Residuals Treatment Facility at Hartland Landfill. The CRD / City Licence agreements are in place for Public Realm Improvements at the Clover Point Pump Station, a Cycle Track on Dallas Road, and other design and consultation obligations.

The CRD has now progressed through their required public engagement process, and have worked with City on the technical elements of the project under consideration of the various public inputs. The CRD is presenting 50% design proposals for the Clover Point Pump Station and the Dallas Road Forcemain to Committee of the Whole. Following this presentation, CRD will proceed with detailed design and tender preparations.

The 50% design includes the alignment and cycle track design and refined designs of the Clover Point Pump Station and its amenities. The parking options along Dallas road have to be balanced with the amount of right-of-way and impacts to green space. The current design will result in an overall loss of 6% of parking, but will retain angled parking along the seawall, and will also improve parking efficiency via the addition of stall markings. Green space impacts are minimized in the proposed parking configuration. Geotechnical analysis has been completed by the CRD consultant teams, and the cycle track and forcemain alignments reflect the setbacks required to minimize any future erosion/seismic risk to or from the installation. Impacts to mature trees is minimised through the cycle track and forcemain alignment, which does traverse through treed areas, away from mature trees to minimize impacts, and follows existing underground utility alignments. Additional crosswalks and street/pathway lighting is recommended as part of the project, to increase pedestrian amenities and improve vulnerable road user safety.

CRD plans to complete the tendering process as soon as possible, and begin construction in July 2018. The forcemain and pump station construction is planned to be completed by June 2020, and in service before the end of 2020. Construction planning and minimizing public disruption is also part of the licence agreement.

CRD is required to host a future 90% Design Workshop with City staff and First Nation's representation, followed by final acceptance by City staff of the Clover Point Pump Station Building, the Public Realm Improvements, Dallas Road Forcemain alignment and design, and the Cycle Track alignment. The CRD will also provide the Director of Engineering with a public engagement plan prior to commencing construction.

Finally, the CRD will host a Community Information Open House to provide project information, present the final designs, and answer questions about the project, prior to commencing construction later this year.

PURPOSE

The purpose of this report is to provide Council with the design information pertaining to the CRD Clover Point Pump Station and Dallas Road conveyance Forcemain, in order to progress to 90% design and project tender.

BACKGROUND

The CRD Wastewater Treatment Project is being constructed to meet the provincial and federal regulations for Core Area wastewater treatment by December 31, 2020. The project (see Annex A) consists of three main elements:

- McLoughlin Point Wastewater Treatment Plant
- Residuals Treatment Facility
- Conveyance System

A portion of the project's wastewater conveyance system will be completed within the City of Victoria. The Victoria components of the conveyance system include the Clover Point Pump Station and the Dallas Road Forcemain, between Clover Point and Ogden Point.

On February 22, 2017, the City of Victoria and the CRD entered into licence agreement related to the Clover Point Pump Station and the Dallas Road Forcemain.

The Clover Point Pump Station licence agreement allows the CRD to construct and maintain the facility, and sets out certain design requirements for the pump station, including a conceptual plan for the building exterior, as well as a concept plan and design guidelines for the Public Realm Improvements. This licence agreement also establishes the requirement to meet certain design and development obligations, payment of fees, and project public consultation.

A Dallas Road Forcemain licence agreement allows the CRD to construct and maintain the system of sanitary sewer works between Clover Point and Ogden Point. Under the agreement, the CRD has also agreed to construct a cycle track/bike facility along Dallas Road between Clover Point and Dock Street, and meet certain obligations associated with design development and public consultation.

The CRD presented the Design Proposal prior to commencement of detailed design, to the Committee of the Whole on December 14, 2017. The Design Proposal was also presented to the James Bay and Fairfield-Gonzales Community Associations in separate meetings (January 10 and 11, 2018). Public input from these meetings and from on-line feedback, was subsequently considered during the design refinement process.

Council's recommendations from December 2017 included the following:

- Adjustments between the lower foreshore/walkway at Clover Point and the loading bays/retaining walls,
- Materials/design improvements of the lower foreshore walkway,

- Parking considerations along Dallas Road between Dock Street and Lewis Street

Public feedback has established key themes identified in the January 2018 community meetings, including the following public considerations:

- Minimizing parking loss, on Dallas Road and at Clover Point
- Support and opposition of the cycle path
- Safety/accessibility for pedestrians, cyclists and parking
- Construction impacts to trees/vegetation on the corridor
- Off-leash dog areas/fencing

The CRD has now completed their planned phase of public engagement and design work, with inputs from City staff on the technical elements of the project. CRD has completed the 50% design phase for the Clover Point Pump Station and the Dallas Road Forcemain. With design approval at this phase, the CRD would proceed with detailed design of the Clover Point Pump Station building, the Public Realm Improvements, the Dallas Road Forcemain, and the Cycle Track.

The CRD is required to host a 90% Design Workshop with City staff and First Nation's representatives, and may proceed to construction with 90% design acceptance by City staff of the Clover Point Pump Station Building, the Public Realm Improvements, Dallas Road Forcemain alignment and design, and the Cycle Track alignment. The CRD is also required to provide the City with their public engagement plan prior to commencing construction. Finally, the CRD will host a Community Information Open House to provide project information, present the final designs, and answer questions about the project, prior to construction.

ISSUES AND ANALYSIS

The CRDs design of the Clover Point Pump Station and Dallas Road Forcemain is now at the 50% design stage, and is presented for Council's review and consideration. Several issues and considerations have shaped the design and are outlined in the following paragraphs in more detail.

Overall, the primary design issues/considerations, include the following:

- Geotechnical considerations and analysis,
- Parking impacts on Dallas Road associated with cycle track construction,
- Tree impacts along the corridor associated with construction activities,
- lighting considerations – overall safety and security lighting along cycle track and street,
- Pedestrian connectivity and safety, and
- Barrier fencing within Beacon Hill Park.

The following key project elements are examined by staff, in more detail below:

1. Clover Point Pump Station and Park;
2. Dallas Road Forcemain;
3. Dallas Road and Cycle Track Design:
4. Park and Natural Capital Impacts;
5. Niagara Street Engineering Works;
6. Other Waste Water Treatment Activities and Works;

<u>Detailed Considerations</u>

1) <u>Clover Point Pump Station and Park:</u>

a) Licence Requirements:

Under the agreement, the CRD agreed to construct the Public Realm Improvements upon the Licence Area and the surrounding lands, including a Public Plaza, a Bike Node, two (2) public washrooms, intersection improvements at Clover Point Road and Dallas Road, new connecting walkways and pedestrian pathways, site furnishings, wayfinding signage, and landscaping.

The licence agreement also set out certain obligations associated with the design development process, payment of fees and public consultation. Outstanding items include:

- A Design Workshop at the 90% design stage for City staff and CRD to work collaboratively on development

and finalization of the design details related to the exterior of the Building and design of the Public Realm Improvements.
- The CRD is also committed to inviting the Songhees and Esquimalt First Nations to participate in the 90% Design Workshop. The CRD invited the Songhees and Esquimalt First Nation Liaisons to participate in the 30% and 50% Design Workshops. The Songhees Liaison participated in the 30% and 50% Design Workshops, and the Esquimalt Liaison participated in the 50% Design Workshop.
- The CRD WTP will submit the final design of the exterior of the Building and the Public Realm Improvements for City staff approval.
- The CRD will provide the City with a one-time payment of $75,000 for the maintenance of the public washrooms upon completion of the Public Realm Improvement.
- The CRD will provide the City a one-time payment of $100,000 toward the construction of additional capital improvements by the City, after the Design Workshop at the 90% completion stage and upon receipt of a report from City staff that outlines the community's feedback and the final improvements to be implemented by the City.
- The CRD WTP will provide the Director of Engineering with a public engagement plan outlining how the CRD will manage inquiries, complaints and correspondence from the public.

The licence agreement sets out certain design requirements for the Pump Station, including a conceptual plan for the Building exterior, as well as a concept plan and design guidelines for the Public Realm Improvements. All items, noted in the Licence Agreement, are summarized below, and are included in the design:

- construct and install the Public Plaza to be accessible to pedestrians and cyclists and replace the existing public parking lot located above the existing pump station;
- construct and install the Bike Node;
- interpretative signage and wayfinding signs at the Public Plaza;
- two replanted grassed open spaces to the west and east of the Public Plaza;
- install, as part of the Public Plaza, street furniture and bicycle facilities including benches, bike racks, a bike rack for maintenance and repair, and a drinking fountain;
- install a public washroom with two gender neutral washrooms, including all necessary sanitary sewer, electrical, and water connections;
- construct intersection improvements at Clover Point Road and Dallas Road;
- construct a pedestrian path from Dallas Road alongside Clover Point Road and connecting to the existing Clover Point Path; and
- construct a new connecting walkway and bike path across Clover Point Road to the Dallas Road/Ross Bay Seawall.

b) Community Feedback:

Through the various engagement activities and feedback, the community has raised commentary on the following Clover Point Pump Station issues:
- The Pump Station exterior should blend with the site/surrounding area
- Opportunities to provide viewing of the interior of the Pump Station should be explored
- Ramps should be provided to connect the two levels of the Pump Station Public Realm
- Consider extending the walking path around the end of Clover Point
- Public Art
- Landscaping features/native plantings, and bird/plant information
- signage (First Nations)
- Relocating the viewing area/amenities from Dallas Road
- Washroom design improvements (more washrooms, more conspicuous location) and operational concerns (locked at night)

c) CRD Design/Analysis/Proposal:

The CRD design team made design amendments, altering the retaining wall to reduce massing/profile, and included a treatment to the maintenance bay doors to improve aesthetics.
The CRD WTP team is working with the Songhees and Esquimalt First Nations Liaisons to develop public art/signage features.

d) City Staff Commentary:

Pump Station:

- All items identified in the Licence Agreement have been included in the proposed Public Realm Improvements.
- Staff support the proposed modifications to the retaining wall.
- Staff support the Project Team assessment to not redesign the Pump Station building to accommodate views into the interior of the building. Providing the public with information on the inner workings of the Pump Station can be accomplished through on-site signage.
- An exhaust vent will be part of the pump station design. The CRD project team will give consideration to adding a safe and decorative exhaust cover.

Clover Point Park Amenities:

- Staff agree with the CRD Project Team that spatial limitations prohibit ramp relocations nearer the Pump Station. Relocating the public washroom to a more prominent location is also not supported, due to sightline impacts. The suggested relocation of the viewing plaza is also not supported, given the impacts to the overall design of the site.
- The City of Victoria will continue to work with the CRD and Songhees/Esquimalt representatives on public art and wayfinding/signage opportunities for this project.

Clover Point Washroom:

The proposed washroom building design has been designed to address staff input regarding safety, security, and operational requirements. Other design items specific to washroom specifications have been provided to the CRD project team and contractor, and will be finalized at the 90% stage.

Clover Point Road/Cycle Track Interface:

- The south side sidewalk on Dallas Road will be continued through the Dallas Road/Clover Point intersection, to reinforce the pedestrian right-of-way at this intersection. Design details will be finalized at the 90% stage.
- Further pathway extensions are not part of the proposed scope of work/licence agreement. Staff would consider these items in future capital budget requests.

2) Dallas Road Forcemain:

a) Licence Requirements:

The agreement allows the CRD to install, entrench, construct, operate, maintain, repair and replace one or more systems of sanitary sewer works, i.e. the Clover forcemain. Under the agreement, the CRD agreed to:

- Construct a Cycle Track connecting Clover Point to Dock Street in accordance with the conceptual plans and Design Guidelines in the licence agreement.

The licence agreement also set out certain obligations associated with the design development process, payment of fees and public consultation. Outstanding items include:

- A Design Workshop at the 90% design stage for City staff and CRD to work collaboratively on development and finalization of the design details related to the Cycle Track.
- The CRD is committed to inviting the Songhees and Esquimalt First Nations to participate in the 90% Design Workshop. The CRD invited the Songhees and Esquimalt First Nation Liaisons to participate in the 30% and 50% Design Workshops. The Songhees Liaison participated in the 30% and 50% Design Workshops, and the Esquimalt Liaison participated in the 50% Design Workshop.
- The CRD WTP will submit the final design and alignment of the Cycle Track for City staff approval.
- The CRD WTP will provide the Director of Engineering with a public engagement plan outlining how the CRD will manage inquiries, complaints and correspondence from the public.

b) Community Feedback:

The community feedback related to forcemain alignment is focussed primarily on the perceived risks that the installation could possibly increase seismic instability in specific locations. There was also some comments from the public regarding a proposed alternative alignment option for a sea-bed conveyance. All geotechnical risks have been considered, assessed and mitigated by the proposed design and/or addressed by the CRD project team and their consultants.

c) CRD Design/Analysis/Proposal:

The forcemain alignment (Annex B) was selected by the project team based on a number of considerations. Geotechnical assessments, as well as schedule, cost, archaeological, environmental, and community impacts shaped the proposed design.

The CRD initially engaged Stantec Engineering to prepare an indicative design of the Forcemain. Following completion of this work, CRD engaged Kerr Wood Leidel (KWL) to review the indicative design, and prepare detailed design documents. The scope of KWL's work also included a technical review of geotechnical factors affecting the indicative design – to do so, KWL assembled an interdisciplinary team with expertise in the fields of conveyance system design, geotechnical engineering, terrain analysis, marine construction, environmental analysis, and civil engineering.

The KWL team agreed with the selection of Dallas Road as the recommended corridor for the Clover Forcemain. The KWL team also concluded that the forcemain can be designed, constructed and operated safely in the Dallas Road alignment without affecting the Dallas Road Bluffs and without the bluffs affecting the forcemain.

The forcemain alignment is in boulevard/natural areas between Clover Point and Circle Drive, and between Government Street and Lewis Street. The forcemain will be located primarily under the travelled portion of Dallas Road, primarily to avoid mature boulevard trees, to complement existing utility alignments, and to maintain setbacks from the Dallas Road Seawall. The alignment deviates from the roadway in two main locations, to avoid mature trees, and parallel an existing City utility corridor situated between tree stands.

d) City Staff Commentary:

<u>Forcemain Alignment</u>

Staff have no objections with the proposed alignment, and will be working with the Project team as they resolve any underground utility conflicts with City sanitary, storm, and water lines, as well as with any third-party utilities prior to 90% design.

<u>Geotechnical Considerations</u>

The main staff considerations regarding forcemain alignment were related to protection of the Dallas bluffs and seawall, and minimizing conflicts with trees and existing utilities. City staff have reviewed the geotechnical analysis and report and accept the findings that construction and operation of the forcemain will not impact the bluffs; and the state of the bluffs will not impact the forcemain.

City utilities have already been installed along this alignment, in proximity to the Dallas bluffs, and have been in operation for over 70 years (see Figure 1 below).

Figure 1 – Existing Utilities at Dallas/Douglas Intersection

Stantec had originally prepared their indicative design alignment for the forcemain in 2014 based on their initial geotechnical analysis. Stantec also prepared a report on the cliffs, titled Dallas Road Cliffs - Historic Foreshore Erosion Assessment. This covered a review of past studies on the topic and made recommendations on the detailed borehole program.

In the past year, CRD had hired KWL and Thurber Engineering to review the Stantec indicative design, complete more detailed and additional bore-hole analysis, and then prepare the detailed design, as the Engineer of Record. Corporately, KWL is familiar with the condition of the Dallas bluffs, having prepared a Dallas Bluffs conservation plan for the City in 2011.

The geotechnical analysis, which included drilling 24 boreholes along the forcemain alignment, slope assessments, and groundwater monitoring wells, was expanded in 2017, as highlighted in Stantec's May 30, 2017 report to include additional geotechnical assessment at critical locations, including (1) below the intersection at Douglas and Dallas Roads, (2) between Paddon Avenue and Fonyo Beach, and (3) along the James Bay seawall.

KWL and Thurber engineering analysis (released in their November 2017 report) outlined the results from their testing. In all locations, the consultants assess that the required forcemain setbacks are achievable to reduce risk of creating additional instability in locations where erosion or seismic risks are higher. In this report, the consultant asserts that *"the team confirmed that the forcemain can be designed, constructed and operated within the Dallas Road corridor without impacting the bluffs and without the bluffs impacting the forcemain".*

Further ongoing monitoring by CRD includes installation of ground and slope monitoring controls, and monitoring during pre- and post-construction phases.

Staff are confident that the professional engineering findings have and will continue to appropriately inform the design to reduce risks to acceptable levels.

<u>Other Site Considerations</u>:
An air valve chamber/vent is required near the Douglas/Dallas intersection, at the high point of the forcemain. The final location of this vent will be determined at the 90% stage – while air treatment/odour control facilities will be in place, the objective will be to keep venting away from the Mile 0 site.

3) <u>Dallas Road and Cycle Track Design:</u>

a) Licence Requirements:
The Licence Agreement requires the CRD to construct a Cycle Track connecting Clover Point to Dock Street in accordance with the conceptual plans and Design Guidelines.

b) Community Feedback:
Feedback on the cycle track focussed on support/opposition of the cycle track, parking impacts on Dallas Road and at Clover Point, safety (for pedestrians and for cyclists), and accessibility (parking, and access across the cycle track).

c) CRD Design/Analysis/Proposal:
The CRD project team has met the terms and conditions of the design guidelines and specifications in the Licence Agreement, and have recommended solutions to address the concerns raised through discussions with City staff and the community feedback process.

d) City Staff Commentary:
<u>Cycle Track alignment:</u>
Staff concurs with the CRD's proposed cycle track alignment. Various items identified for refinement towards the 90% design stage include:

- Curb cuts/improved accessibility at all locations where the cycle track crosses pedestrian paths. Design elements at these junctions, including signs, markings, surface treatments and grade changes, will reinforce that the pedestrian movement has priority, and that cyclists on the cycle track are required to yield to pedestrians.

- Pedestrian accessibility adjacent the angled parking stalls is required, to enable easy access to sidewalks from these parking areas.
- Markings on the cycle track will follow regional trail standards, to provide consistency for users.
- Drainage design will be refined at the 90% stage to ensure the cycle track does not have ponding/low spots.

Mile 0 Location:
The project development surrounding the Mile 0 location generated feedback from community, as there is an interest within community to realign Douglas Street/ Dallas Road and Beacon Hill Park boundaries, to consolidate green space into the main portion of Beacon Hill Park.

The main consideration from staff is whether this is the appropriate time to consider redesigning this particular site. Staff assess that any redesign of this roadway would not be within scope of the CRD project due to proximity issues and would require significant planning, engagement and park/roadway design which are not achievable within current project timelines.

Re-design would require realignment of the entire section of Douglas Street between Niagara Street and Dallas Road, to provide safe motor vehicle approaches/sight lines - utilizing the existing westerly leg of Douglas Street at Dallas Road is not recommended, as sightlines for southbound left turn vehicles would be insufficient (see Figure 2 below, showing areas of concern). Staff also note that no capital work (EPW utilities upgrades, road reconstruction, or Parks Master Plan-related improvements) at this intersection is currently identified in the Financial Plan.

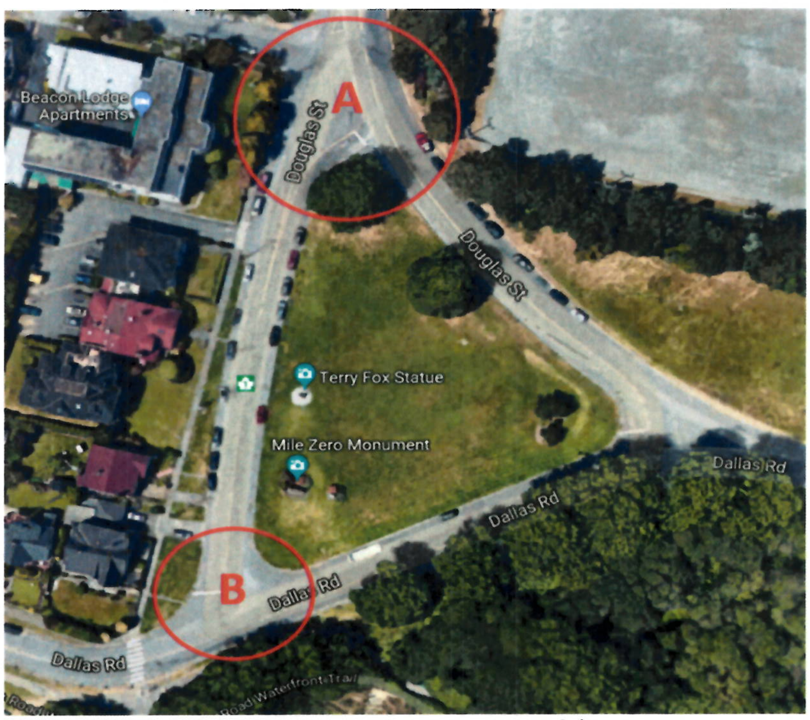


Figure 2 – Mile 0 Redesign Areas of Concern

A number of optional cycle track alignments on Dallas Road at Mile 0, including an on-street option, were also reviewed by CRD and staff. The proposed alignment was determined to be the optimal alignment, as it retains mature trees along the boulevard, triggers removal of some of the invasive species between Dallas Road and the bluffs, while creating an enjoyable route through the park separate from vehicle traffic. The on-street alignments were assessed but not progressed as narrowing, or altering the north curb on the Mile 0 frontage resulted in insufficient tracking space for buses/larger vehicles currently using Dallas Road. Any redesign of this zone would be beyond the scope of the CRD project.

Any future optimisation of Mile 0 green-space and the adjacent roadway would require extensive planning and would ideally be undertaken following further public consultation, across City departments and the public. This work is not currently part of the upcoming, defined financial planning process.

Pedestrian Connectivity/Crosswalks:
The CRD Project team included Watt Consulting Group, who reviewed the eight existing crosswalk locations using Transportation Association of Canada guidelines and warrants, to determine if they were signed/marked to the appropriate standard of intervention. The consultant confirmed the eight existing crosswalks on the corridor were appropriately signed and marked, and that no further upgrades were warranted at this time.

In addition, the consultant assessed pedestrian desire lines and crosswalk spacing, to evaluate if additional crosswalks along the corridor were appropriate. Based on their review, the team suggested 'potential candidate' crosswalks at the following locations:

- Boyd/Dallas
- Government/Dallas
- Linden/Dallas

Staff reviewed these locations, and recommend the project include installing marked crosswalks at all three locations - Boyd, Government, and Linden (see Figure 3 below).

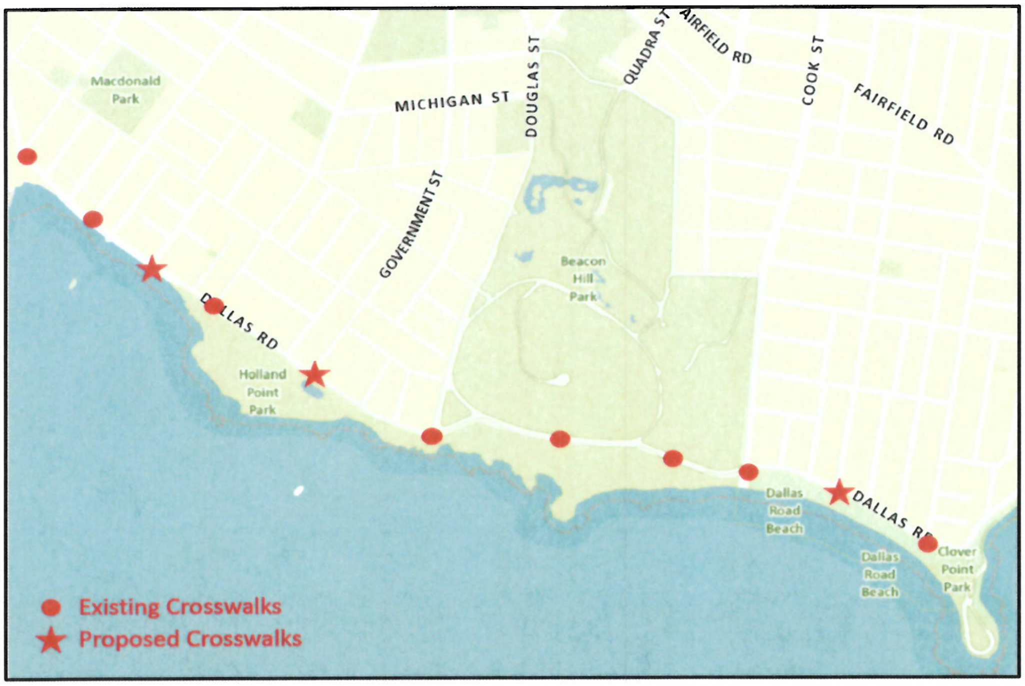


Figure 3 – Existing and Proposed Marked Crosswalks

Given that the high-level review done by the consultant did not include location-specific pedestrian volumes, estimated pedestrian activity would suggest these locations be marked at this time with zebra-style road markings, and side-mounted signs. Once in place post-construction, seasonal and updated pedestrian counts would be required to determine what, if any, upgrades may be warranted along this corridor.

Vehicle Parking:
CRD presented a forcemain and multi-use pathway alignment to Committee of the Whole in December 2017 which identified proposed parallel parking on the south side of the street between Dock Street and Lewis Street. With direction from Council, the CRD project team and City staff continued to examine project options that retained angle-parking on Dallas Road between Dock Street and Lewis Street.

The CRD presented two updated parking options to the public at its January meetings in James Bay and Fairfield (see Annex C - Parking Assessment).

Option 2 parking configuration would result in the loss of 37 of 598 parking stalls along the corridor, with the most impact (14 stalls) on the north side of Dallas Road, between Dock Street and Lewis Street. The addition of parking demarcation lines along the entire corridor, however, will improve parking efficiency and likely result in an overall parking capacity improvement, when compared to less formal parking habits currently employed (see figure in Annex C).

Staff's assessment suggest that Option 2 presents the most favorable parking configuration between Dock Street and Lewis Street, as it represents the highest level of parking retention with increased/improved pedestrian connections to the James Bay neighbourhood. Staff would also note that a few additional parking stalls may be realized as the design proceeds to the 90% stage, with clarifications provided on the exact location of bulbs/curbs on the south side of the street, and final parking bay extents refined relative to trees, utility poles, and other above-ground infrastructure in the boulevard area.

Should Council wish to lessen parking loss impacts associated with Option 2 (11 stalls between Dock Street and Lewis Street, 13 stalls between Lewis Street and Douglas Street, 13 stalls between Douglas Street and Cook Street), new parking stalls could be created by utilizing some of the adjacent green space, primarily near Lewis Street, where the angled parking bay on the south side of the street could be expanded to the east. Costs for this expansion could be minimal, as the area will have to be excavated for forcemain installation.

Re-capturing on-street parking between Lewis Street and Douglas Street is not recommended. Parking lost on the north side of the street in this area is used predominantly by residents – any parking reinstated on the south side of the street would displace green space in a narrowed portion of the park, would not be designated for resident use, and would be utilized by the general public.

Community feedback also indicated support for time limit restrictions on angled parking areas, particularly near the Ogden Point Breakwater (Dock Street to Lewis Street), to address a growing issue of long-term/employee parking in this area. Staff would recommend instituting 2-hour, 8-6, M-S parking restrictions in this area at this time, with monitoring over the next several months to determine the impacts of the change.

<u>Pathway and Street Lighting:</u>
Licence Agreement design requirements include incorporating CEPTD principles in lighting the cycle track – there was no reference to on-street lighting in the Licence Agreement. The CRD project team retained an electrical consultant to assess lighting conditions on both Dallas Road, and the proposed cycle track.

> <u>Pathway lighting</u>: Staff recommended applying the CEPTD principles to the two sections of cycle track that go through warranted areas, with decreased visibility, along the wooded areas within Beacon Hill Park (Dallas/Douglas, and near Dallas/Circle Drive). The proposed light fixture would be a 5m tall lamp standard, consistent with units currently installed throughout Beacon Hill Park.
>
> <u>Street Lighting</u>: There is currently no system of street lighting installed on Dallas Road between Douglas Street and Cook Street (only a single solar lamp standard at the mid-block crosswalk south of the Pavilion). Providing street lighting levels consistent with the remainder of Dallas Road between Ogden Point and Clover Point would enhance safety and visibility of vulnerable road and pathway users, and would require approximately 25 lamp standards (9m tall). The lamp standards would be installed on the south side of Dallas Road, and would utilize LED lighting at the appropriate wattage/design/temperature to minimize area light pollution.

There was no clear consensus from the public on the issue of lighting - community input varied from support (personal safety concerns) to opposition (dark sky/aesthetic concerns for the Beacon Hill Park frontage).

Staff recommend the project include CEPTD-specific lighting on the two sections of the proposed cycle track through wooded areas within Beacon Hill Park, and that street lighting be provided on Dallas Road between Douglas Street and Cook Street.

4) <u>Park and Natural Capital Impacts:</u>

a) Licence Requirements:
Licence Agreement requirements relative to park/natural capital impacts were specific to plaza and pathway areas, green space, and signing/wayfinding at the Clover Point Pump Station, and are captured previously in this report.

b) Community Feedback:
Community feedback relative to other green infrastructure included the retention of mature trees, limiting impacts to natural ecosystems, and comments about off-leash areas/conflicts between user groups, and fencing.

c) CRD Design/Analysis/Proposal:
The 50% Design Proposal includes a combination of split rail fencing and low plantings, to provide separation at key locations along the Cycle Track. Final details will be confirmed at the 90% stage.

d) City Staff Commentary:
Trees
The Capital Regional District has retained the services of an ISA Certified Arborist to assess potential impacts and to assist in the field during construction as required. The arborist report confirmed that routing the cycle track through the two wooded areas in Beacon Hill Park, will impact several smaller trees and native shrubs, but enable the retention of the larger, mature boulevard trees along Dallas Road.

There are 104 trees along the length of the project site. A total of 21 trees are proposed for removal, including 4 to be relocated, and 10 that were identified as needing further assessment during construction.

Trees proposed for removal include 17 small trees, located within the two wooded areas in Beacon Hill Park, along with a large Elm on the Dallas Road frontage of 640 Paddon Avenue; a Hedge Maple at 628 Dallas Road, and one large Horse Chestnut in poor condition within the wooded area south of Douglas Street.

The CRD is also proposing removal of a large Horse Chestnut tree located in the boulevard near Harrison Yacht Pond. According to the arborist report, retention of this tree is unlikely to be successful due to the construction impact.

The four trees proposed for relocation are trees that were recently planted on the boulevard near the Harrison Yacht Pond.

Parks staff also noted several other construction-related risks to be mitigated along the corridor, relating to potential root damage and tree replacement plans. These items will be reviewed and assessed with the CRD project team, as they proceed to complete the 90% design drawings.

Fencing
The Licence Agreement requires the project install barrier fencing between the off-leash dog park and the cycle track. In addition, the CRD project team propose providing separation/barrier at key access points, using a combination of split-rail fencing and low plantings. A conceptual plan was shown in the CRD presentation – detailed designs will be finalized as part of the 90% design development.

5) Niagara Street Engineering Works

Since March 5th, crews have been using Niagara Street between Dallas Road and South Turner Street to assemble the effluent pipe that will be pulled through the drill passage for the under-harbour crossing. Traffic and parking impacts on Niagara Street are being managed by the contractor assembling the pipe, who continue to liaise with residents and other affected road users. The pipe pull process is anticipated to be complete by mid-April, at which time Niagara Street will be re-opened for public use.

6) Other Waste Water Treatment Activities and Works

The Residual Solids Conveyance Line is part of the Wastewater Treatment Project. It includes two pipes along with four or five small pump stations. Though the design is not complete it is anticipated that a common trench will be used along the majority of the route. Within the City of Victoria, the proposed alignment is along Dominion Road/Hereward Road in Victoria West.

The first pipe will be approximately 250mm (10 inches) in diameter and 18.5km long, and will transport residual solids from the McLoughlin Point Wastewater Treatment Plant to the Residuals Treatment Facility for treatment. The second pipe will be approximately 350mm (14 inches) in diameter and 11.5km long, and will return the liquid removed from the residual solids during the treatment process to the Marigold Pump Station, from where it will be returned to the McLoughlin Point Wastewater Treatment Plant through the existing conveyance system.

In 2014, alignment options for the Residual Solids Conveyance Line were developed based on technical, environmental, social and economic considerations. The options were evaluated by the CRD, with input from the District of Saanich, Township of Esquimalt and City of Victoria, a preferred alignment was selected. The evaluation of the alignment has since been reviewed and validated by the Wastewater Treatment Project team in consultation with the municipalities.

Favourable considerations for the route include:

- shortest of all alignments
- power available at pump station locations
- good maintenance access
- no impact on wildlife habitat
- lowest capital, operating and maintenance costs

The Project Team held four community information open houses in November to share the alignment for the Residual Solids Conveyance Line, and feedback received is being considered, along with other technical and financial considerations, in finalizing the design.

City staff will meet in the coming weeks with the CRD project team to discuss the residuals conveyance design and plan, before it is finalized. The public has raised issues during public consultation, which include construction impacts, pedestrian amenities, and potential opportunities for improved traffic operations and management. Staff will report back to Council with final design and considerations prior to construction. Construction is planned to begin in July 2018, and is expected to take approximately two years to complete.

7) <u>First Nations Consultation and Feedback</u>

The Licence Agreement for the Clover Point Pump Station and the Dallas Road Forcemain included requirements that provide a framework for engagement with the Songhees First Nation and Esquimalt First Nation, as well as opportunities to incorporate public art, in consultation with the City's artist and aboriginal artist-in-residence. To date, this has included design workshops, First Nations/CRD WTP liaison meetings, and engagement with the City's artist and aboriginal artist-in-residence. At this time, themes and ideas are being brought forward for discussion and consideration, and the CRD, the Songhees and Esquimalt Liaisons, and the City of Victoria will continue working to incorporate various features, including public art, to share the story of the Lekwungen people in a respectful and appropriate manner.

OPTIONS AND IMPACTS

1. Adopt the 50% design and proceed to 90% design and tender process (recommended): Council could endorse the 50% design, with noted additions/amendments presented in this report, enabling the CRD to proceed to the 90% design stage. CRD would host a 90% Design Workshop with City staff and First Nation's representation, followed by final acceptance by City staff of the Clover Point Pump Station Building, the Public Realm Improvements, Dallas Road Forcemain alignment and design, and the Cycle Track alignment. The CRD would also provide the Director of Engineering with a public engagement plan prior to commencing construction.

Finally, the CRD would host a Community Information Open House to provide project information, present the final designs, and answer questions about the project, prior to commencing construction later this year.

2. Amend the 50% design in accordance with Council direction, and proceed to 90% design and tender: Council could endorse the 50% design, with additional changes beyond those noted in this report. Any further changes are required to remain within the terms of the Licence Agreements. The CRD would then proceed to the 90% design stage. CRD would host a 90% Design Workshop with City staff and First Nation's representation, followed by final acceptance by City staff of the Clover Point Pump Station Building, the Public Realm Improvements, Dallas Road Forcemain alignment and design, and the Cycle Track alignment. The CRD would provide a public engagement plan, and host a Community Information Open House, as noted above.

3. Amend the 50% design and report back to Council to review before proceeding to 90% design and tender (not recommended): Council may choose to amend the design, with a report back to Council to review any changes prior to the CRD proceeding to the 90% design stage. Any further changes are required to remain within the terms of the Licence Agreements. A process for reporting back to Council following the 50% design presentation was not contemplated in the Licence Agreement. To meet Federal Wastewater System Effluent Regulations under the Fisheries, Act, the proposed facilities are to be upgraded prior to December 31, 2020. Delays in the design and tender process may impact the CRD's ability to meet this timeline.

RECOMMENDATION

Staff recommend that Council:

1. Accept the CRD's 50% project design as presented, with the following additions/amendments:

- Endorse parking configuration number two, which includes 4 curb extensions for the section of Dallas Road between Dock Street and Lewis Street, as it balances the retention of on-street parking with increased/improved pedestrian connections to the James Bay neighbourhood.
- Endorse three new marked crosswalks be installed, at Dallas/Boyd, Dallas/Government, and Dallas/Linden
- Endorse the proposed cycle track lighting configuration and the CRD project installation of street lighting along Dallas Road, from Douglas Street to Cook Street.

2. Direct staff to work with the CRD Project Team to finalize all remaining issues identified in this report, at the 90% stage.

2015 – 2018 Strategic Plan

Objective 9: Complete a Multi-Modal and Active Transportation Network: Substantial increase in the number of trips by bicycles, with the completion of a skeletal cycling network.
Objective 11: Steward Water Systems and Waste Streams Responsibly: A sewage treatment plant is under construction.

Accessibility Impact Statement

The project incorporates accessibility features that will improve access to waterfront pedestrian walkways, areas of waterfront angle parking, and viewing plazas/walkways at Clover Point. In addition, new crosswalks proposed for the project will improve waterfront access to pedestrians in adjacent neighbourhoods.

Staff will present the updated 50% design drawings to the City's Active Transportation Advisory Committee, and the Accessibility Working Group, for feedback and input, as the design progresses to 90%.

Impacts to Financial Plan

There is no immediate impact to the Financial Plan. Future capital budget requests for pathway extensions at Clover Point may be considered in the 2019 budget process. Future operating budget for the maintenance of the public washrooms at Clover Point will be requested, as the one-time $75,000 CRD allocation is expended.

Official Community Plan Consistency Statement

Infrastructure: Goal 11(C) - Efficient and effective liquid waste management protects human health and the natural environment and makes use of resource potential.

Broad Objective 11 (e) - that waste water is managed to safeguard public health and to protect the marine environment.

CONCLUSIONS

The CRD Project Team has progressed designs for the Clover Point Pump Station Building exterior and Public Realm improvements, and the Clover Forcemain and Cycle Track alignment to the 50% stage, in accordance with the Licence Agreements between the CRD and the City of Victoria. Staff support the proposed design, with the noted additions/amendments presented in this report. To meet the December 31, 2020 deadline to meeting federal regulations regarding effluent quality performance standards, staff support the CRD proceeding to the 90% design stage at this time, followed by workshops, final City staff approvals, and open houses prior to construction, as per the Licence Agreements.

Respectfully submitted,

Brad Dellebuur, Manager
Transportation

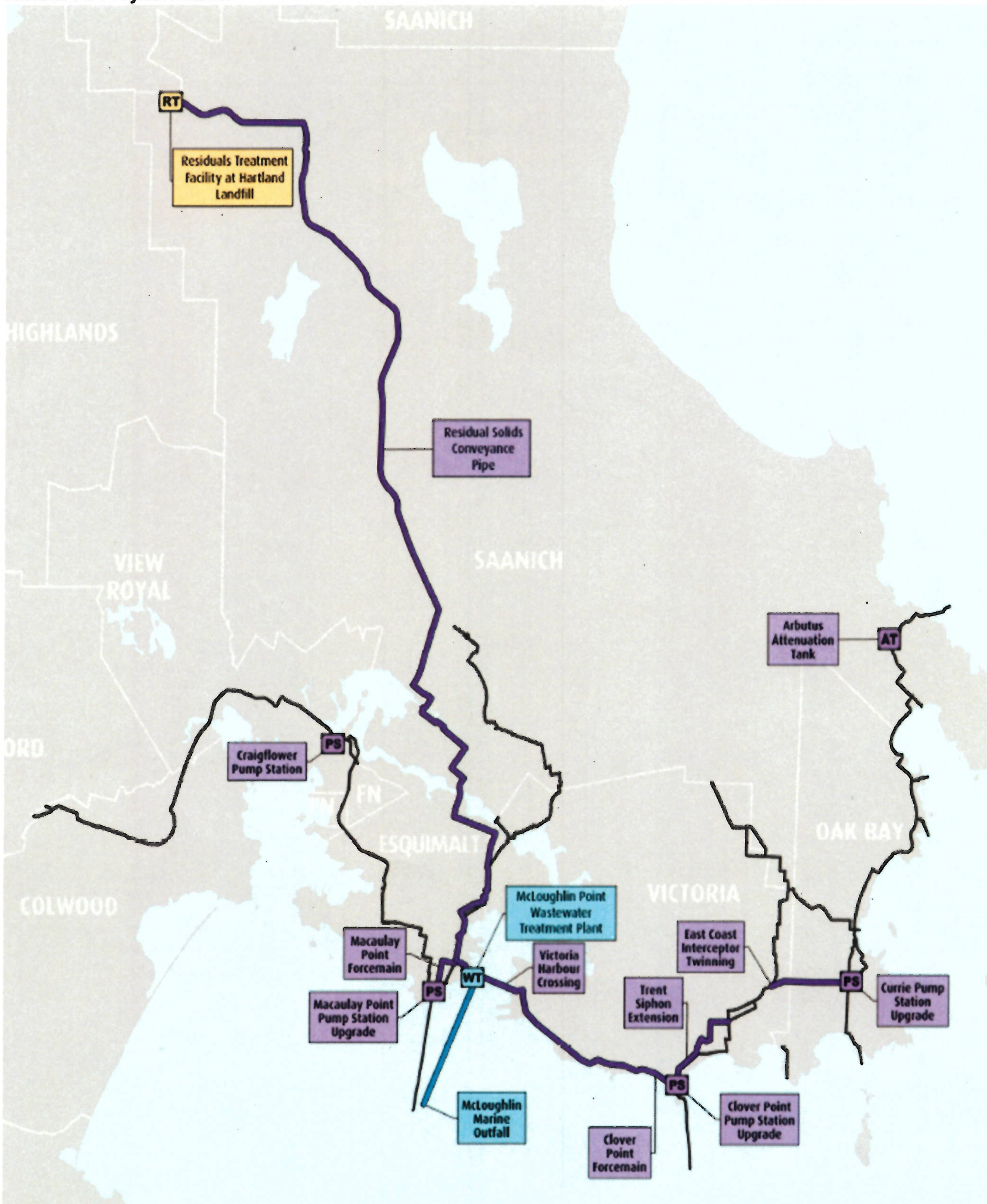
Fraser Work, Director
Engineering and Public Works

Report accepted and recommended by the City Manager: Jocelyn Jenkins

Date: April 9, 2018

Annex A: Project Limits/City of Victoria
Annex B: Forcemain Alignment
Annex C: Parking Assessment

Annex A: Project Limits



Annex B: Forcemain Alignment

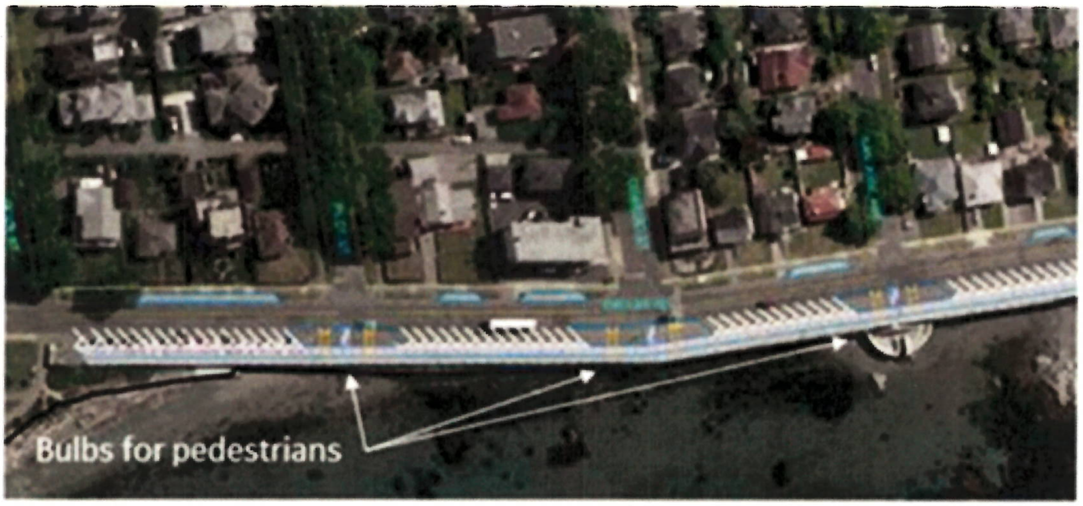
Annex C: Parking Assessment

Angled parking capacity on Dallas Road:

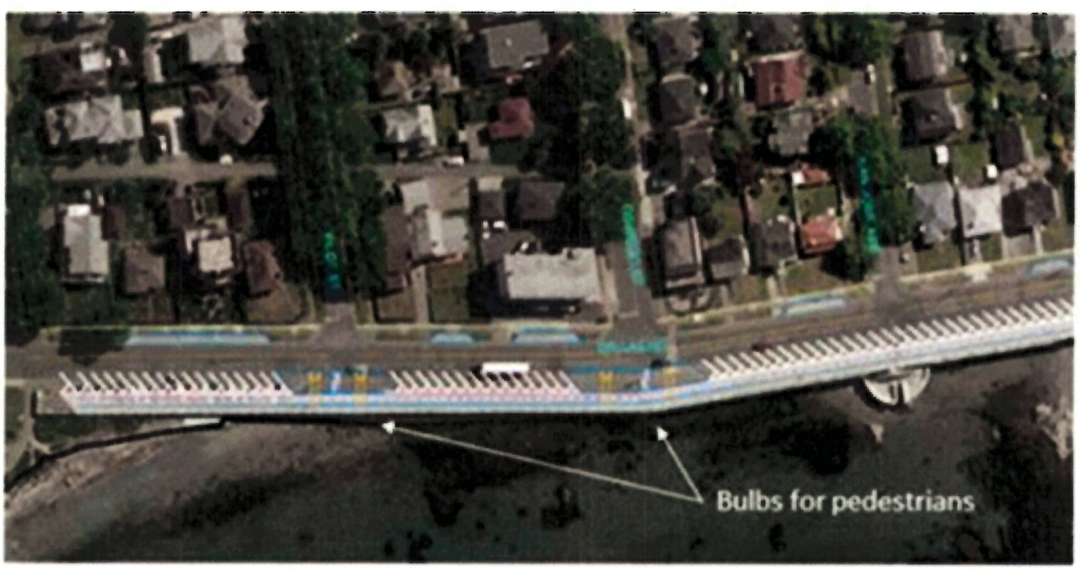
CRD presented a force-main and multi-use pathway alignment to Committee of the Whole in December 2017 which identified proposed parallel parking on the south side of the street between Dock Street and Lewis Street. With direction from Council, the CRD project team and City staff continued to examine project options that retained angle-parking on Dallas Road between Dock Street and Lewis Street.

The CRD presented two updated parking options to the public at its January meetings in James Bay and Fairfield (see below CRD materials entitled Parking Options 2 and 3).

Parking Option 2
Angle parking with four curb extensions



Parking Option 3
Angle parking with two curb extensions



Both new options seek to maintain angle parking on the south side of the street, however, would subsequently impact the design/configuration of the north side street parking, due to the limited right of way, and the requirement to minimize impacts to green space.

The Option 2 and 3 configurations would require the creation of parking bays in the existing boulevard area on the north side of the street (in blue shading, in the diagrams below) to allow for parking along this frontage.

The primary differences in the two options are:

- The number of angled parking available on the south side of the street (Option 2 – 115 spaces; Option 3 – 129 spaces)
- The number of intersections where bulbs/curb extensions are provided to shorten pedestrian crossing distances (Option 2 – bulbs/curb extensions at 4 intersections; Option 3 – bulbs/curb extensions at 2 intersections).

Attendees at the community meetings requested that the CRD project team and the City confirm the total number of parking spaces impacted by the two CRD options.

City staff has confirmed the total number of spaces by assessing what would be available if the parking lines were painted today along the corridor, under current conditions.

The table below details how many parking stalls are currently estimated (i.e. if marked) on the Dallas Road corridor between *Dock Street and Clover Point:*

Dallas Road Segment	Existing Conditions – Number of Parking Stalls based on Configuration				
	South side			**North side**	**Total**
	45°	**90°**	**parallel**	**parallel**	
Dock St - Lewis St	89	n/a	n/a	37	**126**
Lewis St - Douglas St	n/a	16	n/a	66	**82**
Douglas St - Cook St	120	n/a	23	96	**239**
Cook St - Clover Pt	40	n/a	65	46	**151**
Total	**249**	**16**	**88**	**245**	**598**

The table below provides existing parking numbers, and for the two proposed CRD options for parking between Dock Street and Lewis Street, for the entire length of the force main project on Dallas Road:

Dallas Road Segments		South side Stalls			North side Stalls	**Total**	Net change (from existing)
		45°	90°	parallel	parallel		
Dock St - Lewis St	*Existing (estimated, if marked)*	89			37	**126**	**n/a**
	Option 2 (4 curb extensions)	92			23	**115**	**-11**
	Option 3 (2 curb extensions)	106			23	**129**	**+3**
Lewis St - Douglas St	*Existing*		16		66	**82**	**n/a**
	Proposed		16		53	**69**	**-13**
Douglas St - Cook St	*Existing (estimated, if marked)*	120		23	96	**239**	**n/a**
	Proposed	92		38	96	**226**	**-13**
Cook St - Clover Pt	*Existing (estimated, if marked)*	40		65	46	**151**	**n/a**
	Proposed	40		65	46	**151**	**0**
Total	*Existing (estimated, if marked)*	249	16	88	245	**598**	**n/a**
	Option 2 (4 curb extensions)	224	16	103	218	**561**	**-37**
	Option 3 (2 curb extensions)	238	16	103	218	**575**	**-23**

Parking Demand on Dallas Road from Dock Street to Lewis Street:

Parking demand on the south side of Dallas Road between Dock Street and Lewis Street is largely influenced by the proximity of the Ogden Point breakwater and by the access to ocean views while parked at this location.

There are numerous occasions throughout the year when the parking bays at this location are reported to be at or near capacity. The capacity of parking at this location is negatively influenced by a lack of stall markings. Currently, people park informally along the area – while many drivers park their vehicles at 45 degrees, there can be wide variations in how vehicles are parked (see sample photo below, showing varying angles used to park along Dallas Road). Drivers also tend to park further away from adjacent vehicles, where there are no marked stalls.

Staff do not have recent seasonal parking counts that would define the parking usage rates along this corridor. Therefore the appropriate peak parking usage rates (i.e. summer) cannot be determined prior to the design approvals. Staff are currently estimating usage rates based on digital images, which suggest to staff that parking is often at or near capacity during the peak weather and tourist seasons.


Existing Parking Configuration/Demand

This current parking 'informality' is an inefficient way to manage limited parking capacity, and results in reaching capacity with fewer vehicles (i.e., capacity is functionally reduced).

Having uniformly marked parking stalls will improve parking efficiencies and maximize the number of vehicles that could safely use the available curb space. Based on observations and a review of aerial photos of the area taken over the past 10 years, not having the 45 degree angle stalls marked has impacted potential capacity by 10-15% (9-13 stalls on the south side of Dallas Road between Dock Street and Lewis Street, 25-37 stalls over the entire length of the force main project).

Should Council want to consider introducing new parking capacity to further offset the proposed losses, additional parking could be established by reallocating greenspace along the corridor.

Dallas/Lewis – Optional Area for Additional Parking

Parking Time Limits on Dallas Road

Feedback from the public open house events also generated suggestions to introduce time restrictions to parking on Dallas Road, including areas around the Ogden Point Breakwater, to encourage turn-over. A two-hour parking restriction, 8-6, M-F, would be considered appropriate to encourage parking turnover in this area, discourage all-day, employee parking, and still allow a reasonable amount of time to carry out activities in the general area. Staff would recommend installing these time limits on the south side of Dallas Road between Dock Street and Lewis Street following construction, and monitor/adjust as necessary.