





Daylighting Feasibility Study – Bowker Creek

ISL Engineering and Land Services

Bowker Creek Initiative c/o Capital Regional District

Final Report







Table of Contents

 1.1 Bowker Creek Watershed Renewal Initiative 1.2 Scope of Daylighting Feasibility Study 1.3 Process/Methodology 1.4 Background Documents 2.0 Bowker Creek – Existing Conditions, Opportunities and Constraints. 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 3.0 Development of Daylighting Concepts and Corridor Options	1 1 2 2 2 6 6 6 6 6 6 6 6 7 8
 1.2 Scope of Daylighting Feasibility Study 1.3 Process/Methodology 1.4 Background Documents 2.0 Bowker Creek – Existing Conditions, Opportunities and Constraints. 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	2 2 6 6 6 6 6 6 6 7
 1.3 Process/Methodology 1.4 Background Documents 2.0 Bowker Creek – Existing Conditions, Opportunities and Constraints. 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	2 2 6 6 6 6 6 6 6 7
 1.4 Background Documents 2.0 Bowker Creek – Existing Conditions, Opportunities and Constraints. 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	2 6 6 6 6 6 6 6 6
 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 6 6 6 6 7
 2.1 Existing Bowker Creek/Storm Trunk 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 6 6 6 6 7
 2.2 Existing Land Use 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 6 6 6 7
 2.3 Parks and Trails 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 6 6 7
 2.4 Environmental and Historic Sites 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 6 7
 2.5 Topography 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 6 7
 2.6 Creek/Trunk Hydraulics 2.7 Daylighting Opportunities 2.8 Daylighting Constraints 	6 7
2.7 Daylighting Opportunities2.8 Daylighting Constraints	7
2.8 Daylighting Constraints	8
3.0 Dovolopment of Daylighting Concents and Corridor Options	
DEVELOPMENT OF DAVIGITATION CONCEDIS AND CONTROL ODDIONS	9
3.1 Introduction	9
3.2 Daylighting Concepts	9
3.3 Preliminary Daylighting Corridor Alignments	12
3.4 Workshop #1 Feedback	12
4.0 Partial Daylighting Potential	13
4.1 Introduction	13
4.2 Objectives of Partial Daylighting	13
4.3 Option Development	13
4.4 Discussion	15
5.0 Creek/Trunk Hydraulics and Potential Stormwater Management Faci	ilities17
5.1 Introduction	17
5.2 Potential Stormwater Management Facilities for Detention Storage	17
5.3 Refinement of Bowker Creek MDP Hydraulic Model	18
5.4 Hydraulic Modeling Results	22
5.5 Discussion	27
6.0 Refinement of Daylighting Corridors and Concepts	29
6.1 Introduction	29
6.2 Land Acquisition Considerations	29
6.3 Parks, Trails and Recreational Facility Considerations	30
6.4 Hydraulic Considerations	32
6.5 Land Use/Architectural Considerations	32
6.6 Sequencing Considerations	33
6.7 Proposed Daylighting Corridors	33
7.0 Proposed Daylighting Concepts	35
7.1 Daylighting Cross-Sections	35
7.2 Detailed Descriptions for Each Daylighting Section	36
8.0 Next Steps/Recommendations	F.4



APPENDICES

Appendix A	MDP Excerpts
Appendix B	Shelbourne Valley Excerpts
Appendix C	Existing Bowker Creek Maps and Profiles
TABLES	
TABLES	
Table 5.1:	Assessment of Potential SWMF Sites
Table 5.2:	Hydraulic Modeling Results – University of Victoria
Table 5.3:	Hydraulic Modeling Results – Lansdowne SWMF
Table 5.4:	Hydraulic Modeling Results - Richmond School and 2661 Richmond Road SWMF24
Table 5.5:	Climate Change Analysis for Richmond School SWMF27
Table 7.1:	Right-of-Way Requirements for Various Daylighting Cross-sections35
FIGURES	
Figure 2.1:	Bowker Creek Overall Profile
Figure 3.1:	Bowker Creek 100-Year Stream Corridor Vision
Figure 4.1:	Partial Daylighting Profile
Figure 5.1:	Potential Stormwater Storage Facility - University of Victoriafollowing page 28
Figure 5.2:	Potential Stormwater Storage Facility - Lansdowne Sitefollowing page 28
Figure 5.3:	Potential Stormwater Storage Facility - Richmond School Sitefollowing page 28
Figure 5.4:	Potential Stormwater Storage Facility - 2661 Richmond Roadfollowing page 28
Figure 5.5:	Modeling Results at Haultain Street - Richmond School and 2661 Richmond Road SWMF25
Figure 5.6:	Simulated Water Level at Richmond School SWMF
Figure 5.7:	Climate Change Analysis for Richmond School SWMF – Peak Flows at Haultain Street



EXHIBITS		Following Page
Exhibit 4.1:	Partial Daylighting	16
Exhibit 7.1:	Firemans Park	50
Exhibit 7.2:	Spirit Garden	50
Exhibit 7.3:	Doncaster Green	50
Exhibit 7.4:	Shelbourne Plaza	50
Exhibit 7.5:	Suburban Roadway	50
Exhibit 7.6:	Suburban Back of Lots	50
Exhibit 7.7:	Suburban Side of Lots	50
Exhibit 7.8:	Suburban Redevelopment Back of Lots	50
MAPS		Following Page
MAPS Map 2.1:	Existing Bowker Creek	
	Existing Bowker Creek	8
Map 2.1:		8
Map 2.1: Map 2.2:	Existing Land Use	8 8
Map 2.1: Map 2.2: Map 2.3:	Existing Land Use Existing Parks and Trails	8 8 8
Map 2.1: Map 2.2: Map 2.3: Map 2.4:	Existing Land Use Existing Parks and Trails Historic/Environmental	
Map 2.1: Map 2.2: Map 2.3: Map 2.4: Map 2.5:	Existing Land Use Existing Parks and Trails Historic/Environmental Topography	
Map 2.1: Map 2.2: Map 2.3: Map 2.4: Map 2.5: Map 3.1:	Existing Land Use Existing Parks and Trails Historic/Environmental Topography Daylighting Corridor Options	
Map 2.1: Map 2.2: Map 2.3: Map 2.4: Map 2.5: Map 3.1: Map 4.1:	Existing Land Use Existing Parks and Trails Historic/Environmental Topography Daylighting Corridor Options Potential Partial Daylighting Locations	

1.0 Background

1.1 Bowker Creek Watershed Renewal Initiative

The Capital Region District (CRD), along with the municipalities of Oak Bay, Saanich and Victoria, have been developing the Bowker Creek Urban Watershed Renewal Initiative (BCI) since 2002. It includes the Bowker Creek Watershed Management Plan (BCWMP), the Bowker Creek Blueprint, and the Bowker Creek Master Drainage Plan (MDP). These documents provide the background information needed to carry out the current study, including:

- · Goals and objectives for the BCI, such as:
 - Individuals, community and special interest groups, institutions, governments, and businesses take responsibility for actions that affect the watershed;
 - Managing creek flows effectively;
 - Improve and expand public areas, natural areas, and biodiversity in the watershed; and
 - Achieve and maintain acceptable water quality in the watershed.
- Engineering data on the existing open channel and pipe segments of Bowker Creek, the hydrologic response of the watershed to a range of rainfall events (adjusted for climate change), and upstream storage needed to address the existing flooding risks.
- A 100-year vision that includes Bowker Creek daylighted from its headwaters to the ocean that incorporates green streets.

To date the BCI has had limited success in daylighting due to the lack of a defined route for daylighting and a land use planning strategy that will allow the corridor to be acquired.

1.2 Scope of Daylighting Feasibility Study

On behalf of the BCI, the Capital Region District (CRD) engaged ISL Engineering and Land Services (ISL) to undertake this daylighting feasibility study.

This study addressed the above issues by integrating engineering, parks/trails and land use planning disciplines to define the optimal corridor for daylighting. The study incorporated the principles outlined in the BCI and, more recently, in the 2017 Shelbourne Valley Action Plan. Some of the key strategies include the following:

- Utilize land use planning processes (e.g. development permit applications) as a tool to acquire land for both daylighting and stormwater storage facilities.
- · Encourage the daylighting by considering additional building height allowances as part of redevelopment.
- Pursue daylighting as part of infrastructure replacement.
- Utilize a flexible approach to achieve the daylighting of Bowker Creek, including re-routing or partially daylighting the creek.

Bowker Creek has been divided into 17 reaches, with Reaches 1 (Oak Bay) through Reach 15 (University of Victoria) on the main stem and tributary Reach 16 included in this study. Reach 17 (Bowker Creek tributary within Cedar Hill Park) was addressed in a separate study.



1.3 Process/Methodology

The study incorporated the following key tasks:

- Task 1 Assess existing creek conditions and constraints
- Task 2 Develop Daylighting Options
- Task 3 Stakeholder Workshop #1

- Task 4 Refine Daylighting Options
- Task 5 Draft Implementation Plan
- Task 6 Stakeholder Workshop #2
- Task 7 Reporting

ISL presented the findings from Tasks 1 and 2 to key stakeholders at Workshop #1 on June 7, 2019. Attendees included staff from the Capital Region District, the City of Victoria, the District of Saanich, the District of Oak Bay, the University of Victoria and the Greater Victoria School District.

During Tasks 4 and 5, ISL and the CRD held a series of meetings with the municipalities on September 11 and 12, 2019 to discuss the daylighting corridor options in detail. The feedback received during these meetings was particularly valuable in developing daylighting options that were suited to each individual municipality.

The refined daylighting options and draft implementation plan was then presented to all stakeholders on November 21, 2019 as part of Stakeholder Workshop #2.

1.4 Background Documents

Some of the key findings of the background studies are highlighted below.

1.4.1 Bowker Creek Blueprint: A 100-year Action Plan to Restore the Bowker Creek Watershed

The purpose of the Bowker Creek Blueprint was to:

- recommend watershed management policies and other stewardship actions to improve watershed health;
- · recommend reach-specific actions for each creek section; and
- provide support and information to municipalities and other land stewards to achieve the goals and objectives identified in the Bowker Creek Watershed Management Plan.

The Blueprint included:

- Recommendations for watershed management actions and supporting policy and planning approaches to advance the implementation of the BCWMP.
- Recommendations for reach-specific actions along the creek corridor that described:
 - mitigation strategies for flooding, erosion and climate change;
 - protection and restoration of riparian and aquatic habitats through site-specific actions; and
 - a multi-use greenway corridor, public greenspace, and habitat connectivity in accordance with the regional greenway system.
- Key actions for short-term implementation.
- Priorities, budget categories, and responsibilities.
- A description of the methods used to develop the plan.
- Relevant background information and data that was not already available in existing documents.
- A recommended monitoring program that would allow for adaptive management over time.

1.4.2 **Bowker Creek Master Drainage Plan**

The Bowker Creek MDP provided the basis for the hydraulic analysis for this study. Some of the key findings were as follows:

- · Bowker Creek would experience significant flooding during a 1:25 year design rainfall event, and the extent of flooding is likely to increase as redevelopment occurs within the basin.
- Upgrades to the existing pipe sections of the creek are required to limit flooding to rainfall events of 1:25 years and higher.
- Daylighting the creek is an effective way to upgrade the hydraulic capacity of Bowker Creek.
- Upgrading should be staged from downstream to upstream.
- Considerations should be given to lowering the elevation of the creek from Haultain Street to Oak Bay High
- · Stormwater management facilities (SWMF) should be considered to minimize peak flows in the downstream reaches of the creek.

The MDP and corresponding hydraulic model provided information on the existing creek and trunk to supplement the GIS data provided by the individual municipalities.

Excerpts from the Bowker Creek MDP are attached in **Appendix A**.

1.4.3 **Official Community Plans**

The Victoria, Saanich and Oak Bay Official Community Plans (OCPs) were reviewed to identify municipal policies that will influence the daylighting of Bowker Creek. Some of the key policies include:

Victoria OCP 2012

- Greenways proposed along Doncaster and Pearl.
- "Integrate Bowker Creek watershed protection and daylighting opportunities into land use planning" (Map 27).
- Establish new park space in neighbourhood spirit walk (Map 27).
- Improve pedestrian and cycling connections around and through Jubilee Hospital site (Map 27).
- Consider Bowker Creek restoration and daylighting opportunities (Map 29).
- · Create attractive, convenient pedestrian and cycling friendly environment on Doncaster between Hillside and North Dairy.

Saanich OCP 2008

- Acquire and develop park land to ensure residents have a wide range of leisure opportunities, and to preserve significant ecosystems (Page 4-25).
- Link parks and public open spaces together by trails, where feasible (Page 4-25).
- Identify future trails, footpaths, and bikeways and acquire rights-of-way or easements at the time of rezoning or subdivision, in order to create high quality pedestrian and bicycle networks throughout the community (Page 4-28).
- Pursue "day-lighting" of watercourses as part of watercourse restoration, where practical and feasible (Page 4-33).



Oak Bay OCP 2014

- Much of Bowker Creek flows as an open creek within Oak Bay, the main exceptions being where it flows
 under the tennis bubble at the Oak Bay Recreation Centre and under Fireman's Park. Some of the private
 properties along Bowker Creek extend into or across the creek. When the ownerships of these properties are
 transferred, there may be an opportunity for the District to acquire the creek bed (Page 50).
- Seven tennis courts are located in two bubbles directly behind Oak Bay Recreation Centre. Future
 consideration of the tennis bubbles is complicated by the fact that Bowker Creek flows under a portion of the
 structure. Planning for any improvements should include the potential to daylight portions of the creek
 (Page 111).

1.4.4 Shelbourne Valley Action Plan

The Shelbourne Valley Action Plan was completed by the District of Saanich in 2017. There are numerous policies in this document that directly apply to the daylighting of Bowker Creek, including:

Watersheds and Stormwater Management Policies:

- Integrate the principles and actions identified in the Bowker Creek Blueprint as part of redevelopment proposals and infrastructure replacement (4.2.3).
- Acquire key properties to facilitate the restoration of Bowker Creek, including for the purposes of daylighting sections, enhancing riparian areas, and improving stormwater management (4.2.4).
- Employ a flexible approach to achieve the daylighting of Bowker Creek, including re-routing or partially daylighting the Creek in stretches where technical constraints exist (4.2.5).
- Work cooperatively with the City of Victoria and the District of Oak Bay to develop common Development Permit guidelines or other tools to help implement the Bowker Creek Blueprint on private lands within the Bowker Creek Watershed (4.2.6).
- Support the Bowker Creek Initiative in the development of a study to assess the technical opportunities and constraints of daylighting Bowker Creek in the Shelbourne Valley (4.2.7).
- Promote daylighting or enhanced stormwater management on greenways that align with the Bowker Creek channel to reinforce the location of the Creek and create a community asset (4.2.8).
- Consider reducing streamside setbacks and removing other barriers to daylighting to acknowledge urban conditions and land use constraints in the Valley (4.2.9).
- Encourage the daylighting of Bowker Creek, by considering additional building height allowances, including up to six storeys on sites designated for apartments (4.2.10).

Parks and Open Spaces Policies:

- Acquire new park space strategically to respond to demographic changes, connect greenways, protect areas of ecological value, expand existing parks and animate the Centres and Village (5.6.1).
- Acquire new parks and publicly accessible open spaces that reflect the urban context of the Valley, provide
 amenity value in areas of higher density development, and support the overall hierarchy of walkable urban
 parks and open spaces shown in Figure 5.1 (5.6.2).
- Seek to acquire additional park space in close proximity to the core of University Centre and Shelbourne Valley Centre to support future population growth and aid their transition to more complete, people oriented Centres (5.6.3).

Walking Policies:

- Work towards achieving a connected pedestrian and cycling network with connections (roads, trails, footpaths) spaced approximately 100 metres apart (6.1.1).
- Acquire rights-of-way or easements for trails or footpaths at the time of rezoning or subdivision (6.1.2).
- Acquire walking/cycling connections, including those identified on Map 6.1, through redevelopment or property acquisition to improve overall network connectivity and complete the greenway network (6.1.3).

Greenways and Trails Policies:

- Implement the greenway and trail network as shown on Map 6.3 (6.3.1).
- Maintain flexibility in the routing of greenways to maximize potential route options based on property acquisition or opportunities presented through redevelopment (6.3.2).
- · Complete the greenways network by acquiring property, gaining access to property through easements, and improving connections to the overall mobility network (6.3.3).
- · For greenways that align with Bowker Creek seek to implement and coordinate greenway enhancements with actions identified in the Bowker Creek Blueprint (6.3.6).

Shelbourne Street Policies:

- Work towards transforming Shelbourne Street into a complete street that comfortably accommodates all modes of travel (6.6.1).
- Implement physical changes and design solutions that produce "Great Street" elements on Shelbourne Street, including a generous pedestrian realm, extensive landscaping, significant tree canopy and an improved public-private interface (6.6.2).
- · Acquire additional right-of-way, as redevelopment occurs, to achieve the following right of way widths on Shelbourne Street (6.6.5).

Excerpts from the Shelbourne Valley Action Plan are attached in Appendix B.



■ 2.0 Bowker Creek – Existing Conditions, Opportunities and Constraints

2.1 Existing Bowker Creek/Storm Trunk

The existing Bowker Creek is shown in **Map 2.1**, with the open creek sections shown in blue. The reach numbers shown in this figure are consistent with previous BCI studies including the MDP. Detailed maps of the existing creek/storm trunk are attached in **Appendix C**.

The creek/trunk profile from University of Victoria to its outlet at Oak Bay is shown in **Figure 2.1**. For piped sections, the pipe invert, obvert and ground profile are shown. For open creek sections, the creek bed and adjacent ground elevation are shown. Detailed profiles of the existing creek/storm trunk are also attached in **Appendix C**.

2.2 Existing Land Use

The current land use designation for the three municipalities is shown in **Map 2.2**. The creek/trunk is primarily within residential areas but passes through key commercial areas at Hillside Centre and along Shelbourne Street.

2.3 Parks and Trails

Existing parks and trails/greenways are shown in **Map 2.3**. The creek is open through the Bowker Creek Walkway and at Oak Bay High School in Oak Bay and in Browning Park in Saanich. It is also open along existing green space at the University of Victoria, Richmond School, BC Hydro lands, Royal Jubilee Hospital and St. Patrick's School. The only existing park locations where the creek is not open channel is at Fireman's Park in Oak Bay and at Spirit Walk in Victoria.

2.4 Environmental and Historic Sites

Known environmental remediation sites are shown in **Map 2.4**. The status of these sites, and whether or not they have fully remediated, is unknown. Environmental sensitive areas such as Mount Tolmie Park are shown in **Map 2.5**. This map also shows historic sites as identified by the municipality in which they reside. These sites need to be considered in the development of potential alignments for Bowker Creek daylighting.

2.5 Topography

The overall topography within the study area is shown in **Map 2.6**. As can be expected, the creek/trunk follows the natural topography.

2.6 Creek/Trunk Hydraulics

The creek/trunk profile from the University of Victoria to its outlet at Oak Bay are shown in **Figure 2.1**, with detailed profiles attached in **Appendix C**.

The 1:25 year and 1:100-year hydraulic grade line (HGL) profiles are also shown in these figures. These HGL are based on Scenario 1 of the MDP (existing land use, existing hydraulics). Changes in land use and climate change will result in higher creek/trunk flows and steeper HGL profiles. Hydraulic upgrading through daylighting and/or larger pipe capacity will result in higher flows but lower HGL profiles. Construction of detention storage (e.g. stormwater management facilities) will generally result in lower flows.

The detailed 1:2000 maps and profiles of the creek/trunk in **Appendix C** show existing manholes (GIS) and model nodes from the MDP hydraulic model. The pipe sizes are also shown in these figures. The pipe sizes and select trunk/creek slopes are shown in the profile figures. Pipe obvert information in the open creek sections was arbitrarily set 10 m above the invert for modeling purposes.

The creek/trunk has an average slope of 0.56%, with some localized sections of between 1% and 10%. The average bed slope, while not particularly steep, is steep enough that the creek bed is subject to erosion during moderate to high flows. The MDP did note several locations with erosion problems, refer to Figure 2-3 of the MDP (**Appendix A**).

The MDP identified four locations that have a history of flooding, including:

- · Downstream of Beach Drive.
- Fireman's Park.
- · Oak Bay Recreation Centre.
- Low lying areas upstream of Trent Street.

These flooding locations are shown in Figure 2-4 of the MDP (**Appendix A**). The reason for flooding at these locations is well documented in the MDP, along with the required hydraulic upgrades to address the flooding for up to a 1:25 year event.

The MDP proposed the following solutions to increase capacity in the creek:

- Upgrade the creek sections by widening the creek bottom.
- Upgrade the piped sections with larger pipe sections, twinning pipe sections or daylighting pipe sections (daylighting preferred).
- Deepen approximately 1km of the creek/trunk upstream of Oak Bay High School.
- Construct stormwater management facilities at multiple locations to minimize peak flows to the creek.

Potential stormwater management facilities to minimize the flooding risk are described in Section 6.0.

2.7 Daylighting Opportunities

ISL used the following opportunities to select potential corridor alignments daylighting:

- Topography low lying areas will minimize the depth to a daylighted creek, and thus the land needed for daylighting.
- Utilize municipally owned land, including vacant lots, rights-of-way and parks when possible.
- Proximity to existing sections of the creek that have been daylighted.
- Proximity to existing or planned trails and greenways to create an integrated greenway where feasible.
- Under-developed land that can be acquired by the municipality at a relatively low price.
- Under-developed land that has a high potential for redevelopment where a portion of a property could be acquired by the municipality as part of the development process.



Recent Daylighting of Bowker Creek at Oak Bay High School



The daylighting opportunities along the Bowker Creek/Trunk are shown in a series of detailed 1:2000 maps in **Appendix C**. These maps show existing parks, trails, greenways, topography and lot value. The lot values provide a good indicator of the redevelopment potential, especially when compared to applicable planning documents such as OCPs and the Shelbourne Valley Action Plan.

The Shelbourne Valley Action Plan provides an excellent reference for daylighting opportunities for the upstream portion of the creek. Refer to the following maps and illustrations in **Appendix B**:

- Map 5.1 Land Use and Building Height Designations there are several 4 and 6 story buildings allowed along the existing alignment of the Bowker Trunk.
- Map 5.10 Parks and Open Spaces.
- Map 6.1 Pedestrian Network.
- Map 6.2 Cycling Network.
- Map 6.3 Greenways and Trails.
- Various illustrations of Shelbourne Street with building setbacks, future roadway cross-sections, etc.

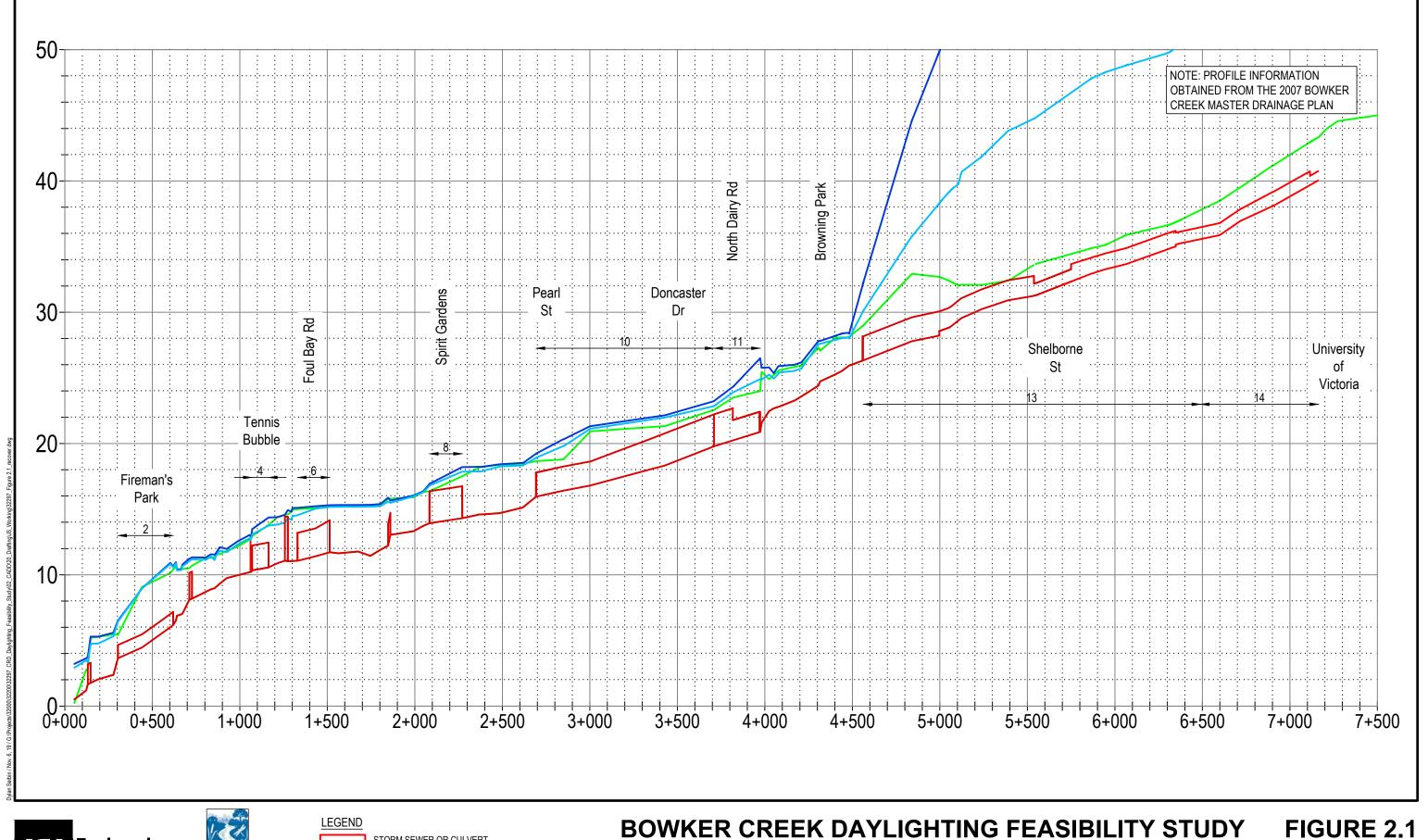
The redevelopment potential within the Shelbourne Valley is considered to be excellent. Daylighting can be incorporated into redevelopment with either the acquisition of a corridor from private property or integrating the daylighting into streetscaping within the Shelbourne Street right-of-way.

2.8 Daylighting Constraints

The following items are constraints to daylighting Bowker Creek:

- Land acquisition Bowker Creek was filled in and replaced with a storm trunk to facilitate land development; reversing this process will require a very significant land acquisition process.
- Land acquisition costs lot values within the study area are high.
- Depth of trunk at locations where the trunk is deeper, the depth and cost of excavation is greater, as is the cost of land.
- Underground and above ground utilities the study area is essentially fully developed and has an extensive network of utilities.
- Construction costs including excavation, relocation of underground/above ground utilities, retaining walls/vertical creek walls, trail construction, landscaping and in-stream works.
- Staging daylighting and/or upgrading of the creek/trunk generally needs to start at the downstream end and work upstream to avoid aggravating existing downstream flooding issues.

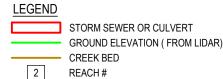
The daylighting constraints are also illustrated the series of 1:2000 maps in **Appendix C**, including topography, underground utilities, and land costs and unit land costs. The most significant underground utility constraint is sanitary sewers which are difficult to relocate as they are typically gravity pipes.



OVERALL PROFILE





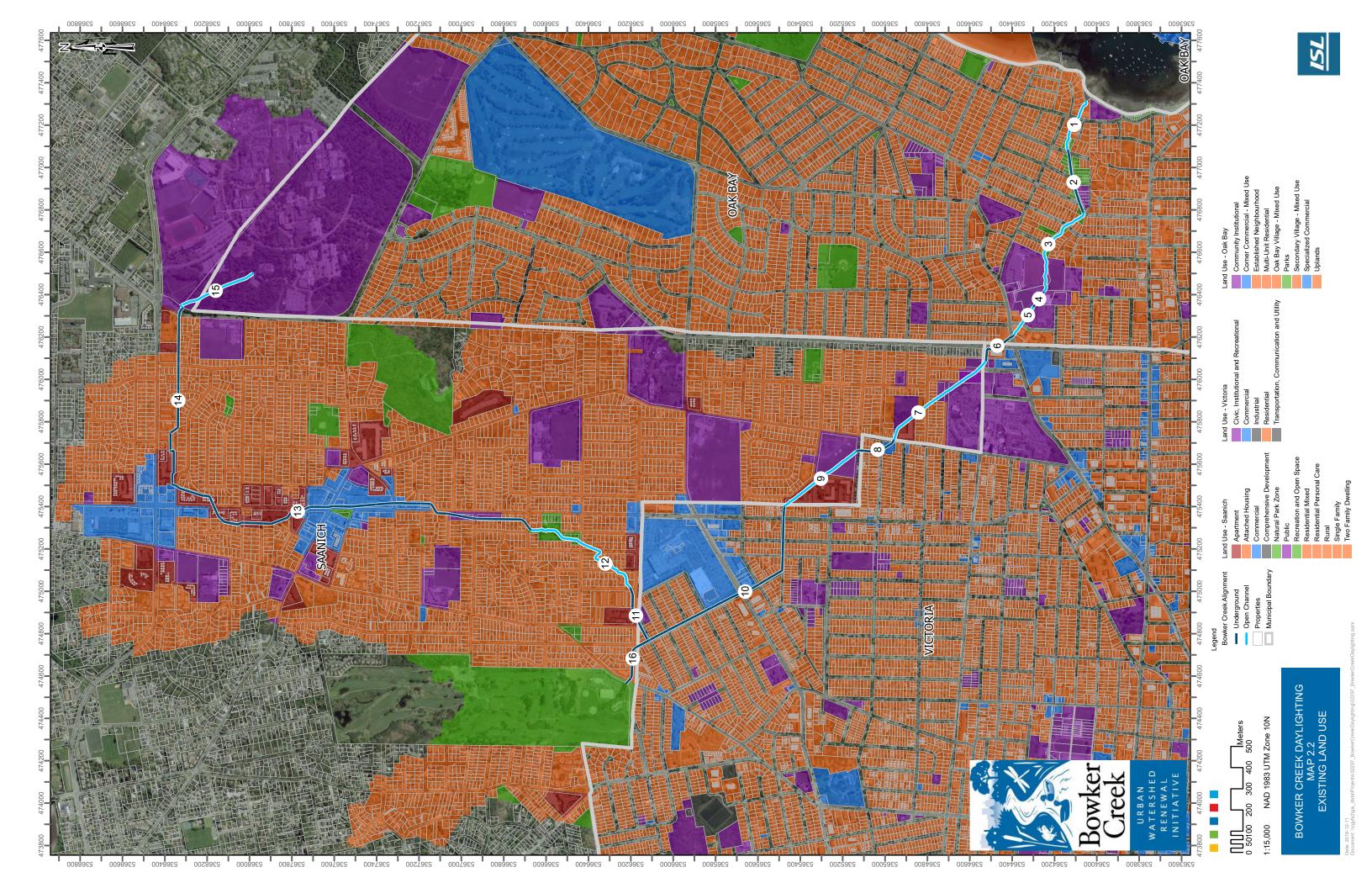


BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY

1:20000

HORZ 0 200 400 600







BOWKER CR





BOWKER CR



■ 3.0 Development of Daylighting Concepts and Corridor Options

3.1 Introduction

This section provides an overview of the daylighting concepts and corridor options that were considered during the initial stages of the study. The daylighting concepts included a wide range of potential creek cross-sections and configurations that could meet the BCl's vision for Bowker Creek. The concepts considered the recreational and environmental benefits that could be achieved with various daylighting widths and configurations.

The development of the potential daylighting corridors looked at a broad range of alignment options. The initial daylighting corridors considering the both the daylighting opportunities and constraints described in Section 2.0.

3.2 Daylighting Concepts

3.2.1 Examples from Bowker Creek

The existing Bowker Creek open reaches provide excellent examples that can apply to future daylighting concepts:

1. Natural Creek Cross-Section in a Natural Park Setting with Adjacent Pathways

This is the optimal concept for the BCI. The natural creek cross-section combined with the adjacent parkland mimics the natural creek and offers the best ecological and recreational amenity for a daylighted creek. The creek would accept all upstream flows, provide in-stream water quality treatment, and optimize biodiversity. With either a paved multi-use path or a granular walking trail, it provides recreational users the opportunity to connect with nature travelling up and down the creek. The best example of this is Browning Park in Saanich.

This concept requires a minimum width of approximately 25 m based on a creek depth of 3 m. The current width of Browning Park ranges from 25 m to more than 100 m, with the wider sections having the active recreational amenities in Browning Park (e.g. playgrounds).



Bowker Creek in Browning Park

2. Straight, Narrow Earthen Creek Cross-Section with Adjacent Parkland and Pathways

This is similar to the above except that the creek is typically straight with relatively steep side slopes. The straight alignments, combined with the steep cross-sections, indicate a constructed channel, which utilizes less land and is less expensive to construct. However, the narrow cross-section reduces its ecological and water quality benefits. Having adjacent parkland with walking trails provides similar recreational benefits. The best example of this is the former BC Hydro Lands (now referred to as 2661 Richmond Road) in Saanich and the connection to Jubilee Hospital (Haultain Street to Adanac Street).



Bowker Creek in Former BC Hydro Lands



This concept requires a minimum width of approximately 20 m based on a creek depth of 3 m. The narrowest width is immediately south of Haultain Street with a width of about 15 m, which is currently too narrow for the adjacent informal walking path.

3. Straight, Narrow Earthen Creek Cross-Section Without Adjacent Parkland or Pathways

This is similar to the above concept except it does not include adjacent parks or pathways. It provides continuous daylighted creek (except at roadway culverts) but limited biodiversity and water quality enhancement. It offers very limited recreational benefits without adjacent park space or paths. The best examples of this is the existing Bowker Creek channel immediately upstream of Trent Street and the section parallel to Townley Street downstream of Pearl Street.

This concept requires a minimum width of about 10 to 12 m based on a creek depth of 3 m.



Bowker Creek near Trent Street at St. Patrick's School

4. Retained Creek with Natural Bed and Adjacent Park and Pathways

The side slopes of a creek utilize a significant portion of the land requirements for daylighting. Use of retaining walls reduce the space needed in proportion to the retaining wall height. Unfortunately, the vertical walls limit the biodiversity, especially if the walls extend to the creek bed. This concept utilizes retaining walls to minimize the overall width, while allowing for a wider and more natural channel bed. The natural bed can improve aquatic biodiversity over a narrow earthen ditch. The walls with adjacent walkways or multi-use paths also provide access for passive recreation. Bowker Creek Park in Oak Bay is a good example of this concept. This is an excellent option in urban areas where space is limited.

This concept requires a minimum of 5 m for the retained creek plus 5 to 10 m for the adjacent pathway and park space.



Bowker Creek in Bowker Creek Park

5. Retained Creek with Narrow Concrete Bed

Where space is constrained, it may be necessary to use a retained creek with a narrow concrete bed (or similar material). This option provides little aquatic/biodiversity benefit. If an adjacent path is provided, the amenity benefit depends on depth to water from surface, the width of the retained creek and the landscaping. Bowker Creek between Bee Street and Cadboro Bay Road is an example of this. It is best suited to dense urban areas where available space is severely limited.

This concept requires a minimum of 4 m not including any adjacent walkways.

3.2.2 Bowker Creek Blueprint Vision

The Bowker Creek Blueprint provides a 100-year vision for the stream corridor. Figure 8 of the Bowker Creek Blueprint illustrates three different concepts:

- Possible vision of the Shelbourne Corridor.
- · Urban stream street.
- Natural stream in greenway/park.

This figure is attached as Figure 3.1.

3.2.3 Other Daylighting Illustrations

Images from creek daylighting projects from around the world were collected and reviewed. These ranged from highly urbanized to suburban areas, with natural creeks to partially retained and fully retained (with concrete walls). The most relevant images to Bowker Creek are shown below.



Daylighting Horse Creek, Bothell, Washington



Arcadia Creek Restoration, Kalamazoo, Michigan



Meadow Creek Daylighting, Charlottesville, Virginia



Cheonggyecheon Stream Daylighting, Seoul, Korea



Daylighting Sawmill River, Yonkers, New York



3.2.4 Partial Daylighting

It may not be practical to daylight all sections of Bowker Creek and thus the concept of partially daylighting or bifurcating the creek was considered. This concept would include the following sub-options:

- Intercepting the main creek/trunk and transferring as much of the natural creek flows as possible to a shallower "creek" or channel;
- Intercepting large contributing storm sewers and diverting part or all of the flows to a shallow channel; and
- Intercepting smaller storm flows and diverting them into bioswales.

The advantage of these options is that a partially daylighted creek is much shallower that would otherwise be with full daylighting, at about 0.5 m to 2 m below grade. It could have natural or retained sides and can be suited to the surrounding area and available space. The water quality benefits depend on the volume of water intercepted and width and vegetation in the channel.

The first two options were investigated separately and are described in Section 5 of the report. The bioswale option has previously been recommended as part of the overall BCI strategy but was not investigated further.

3.3 Preliminary Daylighting Corridor Alignments

In preparation for the June 7, 2019 stakeholder workshop, ISL developed daylighting corridor options based on the above opportunities and constraints. **Map 3.1** shows all daylighting corridor options that were considered.

The preliminary corridors were generally along or within a block or two of the existing Bowker Creek storm trunk. These preliminary alignments were selected based on the following criteria:

- Utilize potential redevelopment sites.
- Minimize the number of lots that would have to be acquired.
- Utilize low lying areas to minimize creek depth.
- · Minimize impacts on existing facilities.

The corridors were located on private lands except for road rights-of-way that are closed (e.g. Stamboul Street) or have potential to be closed or converted to a one-way roadway. The rationale for this was to maximize the available corridor width available for daylighting, and thus provide flexibility in the daylighting concept that could be utilized.

3.4 Workshop #1 Feedback

The daylighting concepts and preliminary daylighting corridors were presented to key BCI stakeholders during Stakeholder Workshop #1 on June 7, 2019. Key items from the feedback that was received during and after workshop are summarized below.

- · Acquiring all lots in an entire block will be very challenging.
- · Costs for acquiring entire lots will be prohibitive.
- Redevelopment should be used as an implementation tool.
- 100% natural would be ideal but is often not practical given the constraints.
- Examples of what daylighting can be achieved within the available right-of-way should be reviewed.
- · A fully retained creek has limited value.
- Partial daylighting should be explored in more detail.

1

Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek Watershed

Source: Bowker Creek Blueprint: A 100-year action plan to restore the Bowker Creek Watershed, Bowker Creek Initiative, 2012





IN GREENWAY/PARK

■ 4.0 Partial Daylighting Potential

4.1 Introduction

As noted in Section 3.2.4, it may not be practical to daylight all sections of Bowker Creek due to the depth of the existing storm trunk and high land acquisition costs. Thus, the concept of partially daylighting or bifurcating the creek was considered. Two partial daylighting options were investigated:

- Intercepting the main creek/trunk and transferring as much of the natural creek flows as possible to a shallower "creek" or channel; and
- Intercepting large contributing storm sewers and diverting part or all of the flows to a shallow channel.

4.2 Objectives of Partial Daylighting

Partial daylighting will not fully restore the functionality of Bowker Creek, however, several of the BCI's objectives could be achieved, including:

- · Water quality improvement.
- Environmental corridor for biodiversity.
- · Recreational amenity.

4.3 Option Development

The degree to which these objectives can be met depends primarily on the volume of stormwater runoff that can be conveyed through the partial daylighting, particularly during dry weather and small, frequent wet weather conditions.

4.3.1 Option 1: Intercepting Bowker Creek Trunk

It is feasible to intercept the Bowker Creek Trunk and divert a portion of the flows to a partially daylighted channel. This can be accomplished either by pumping low flows to the shallow channel or by using a shallow diversion pipe.

The advantage of this option is that it will provide a continuous baseflow during dry weather conditions. The observed flows in Reach 15 at the University of Victoria on September 11, 2019 is estimated to be in the order of 10 L/s. There was limited rainfall in the area in the preceding weeks, so this provides a good indication of the magnitude of baseflows.

Pump Diversion

The diversion can be made with a small pump if the focus is on baseflows only. With a pumping rate in the order of 5 to 10 L/s, a larger landscape pump (approximately 8 L/s) could be used. This size of landscape pump can operate using a conventional household plug in (less than 15 amp) and can easily pump up 5 m. The advantages of this type of pump diversion are:

- Low capital costs, especially for the pump (order of magnitude cost is \$1,000).
- Low operating costs (order of magnitude cost is \$2/day for 600W pump operating continuously).
- Would not need the 24/7 monitoring as interruptions in pump operation is not critical.
- Pumps can be installed at almost any location along the Bowker Creek trunk, as long as there is a source of power.



The disadvantages of a pump diversion are:

- Not sustainable unless powered with solar panels.
- Requires regular maintenance.
- Limits flows to base flows (unless a much more expensive pumping system is installed).

Shallow Pipe Diversion

A shallow pipe diversion is feasible where the existing Bowker Creek trunk is at a relatively steep grade. The pipe diversion would be installed at a relatively flat grade, allowing baseflows and small rainfall event flows to be diverted to the partial daylighting channel. There are three locations where the Bowker Creek/trunk is relatively steep:

- Immediately west of the University of Victoria/Gordon Head Road.
- · North of North Dairy Road.
- · Within Fireman's Park.

A plan and profile of the potential diversion pipe and corresponding partial daylighting are shown in **Map 4.1** and **Figure 4.1**. This figure also shows the base flows (in blue) through the diversion pipes and along the partially daylighted creek. The diversion pipes would have slopes in the order of 0.1% to 0.2%. As shown in **Figure 4.1**, the partial daylighting could be 1 m deep or shallower in the upstream locations. Due to the depth of the storm trunk at Fireman's Park, the partial daylighting would be about 2 m deep.

The diversion pipe could be sized for baseflow only or for smaller storm events. The minimum pipe size for a baseflow of about 10 L/s would be 150 mm diameter. Small, frequent storm events could be diverted with diversion pipes of between 300 mm and 600 mm. Diversion pipes would need to be 200 m to 400 m long or more to facilitate a 1 m deep partial daylighting.

These pipes could be constructed using either open cut or trenchless construction. Caution should be used for horizontal directional drilling construction due to existing utility crossings and the potential for sags in the diversion pipe. Sags could be filled with sediments from the creek, which would restrict the conveyance capacity of the diversion.



Doncaster Drive at Burton Avenue – Potential alignment for Partial Daylighting

4.3.2 Option 2: Intercepting Contributing Storm Sewers

This option is similar to Option 1 except that it is limited to intercepting local storm sewers or trunks, and thus would have little or no baseflow. There are local storm sewers typically drain only about 10 to 30 ha of land. There are local storm sewers with potential for a shallow, partially daylighted channel at Cedar Hill Cross Road, Church Avenue, and Cedar Avenue. These would require about 50 to 100 m of flat diversion pipes to intercept local storm drains. These storm sewers are typically 375 mm to 600 mm in diameter at 1% to 5% grade.

Based on the urban nature of most of the watershed, it is unlikely that these local storm sewer diversions would have sufficient baseflow to maintain a measurable flow in the partially daylighted channel. With very low to no baseflow, this option provides limited benefit to the BCI in terms of biodiversity or amenity apart from acting as a bioswale.

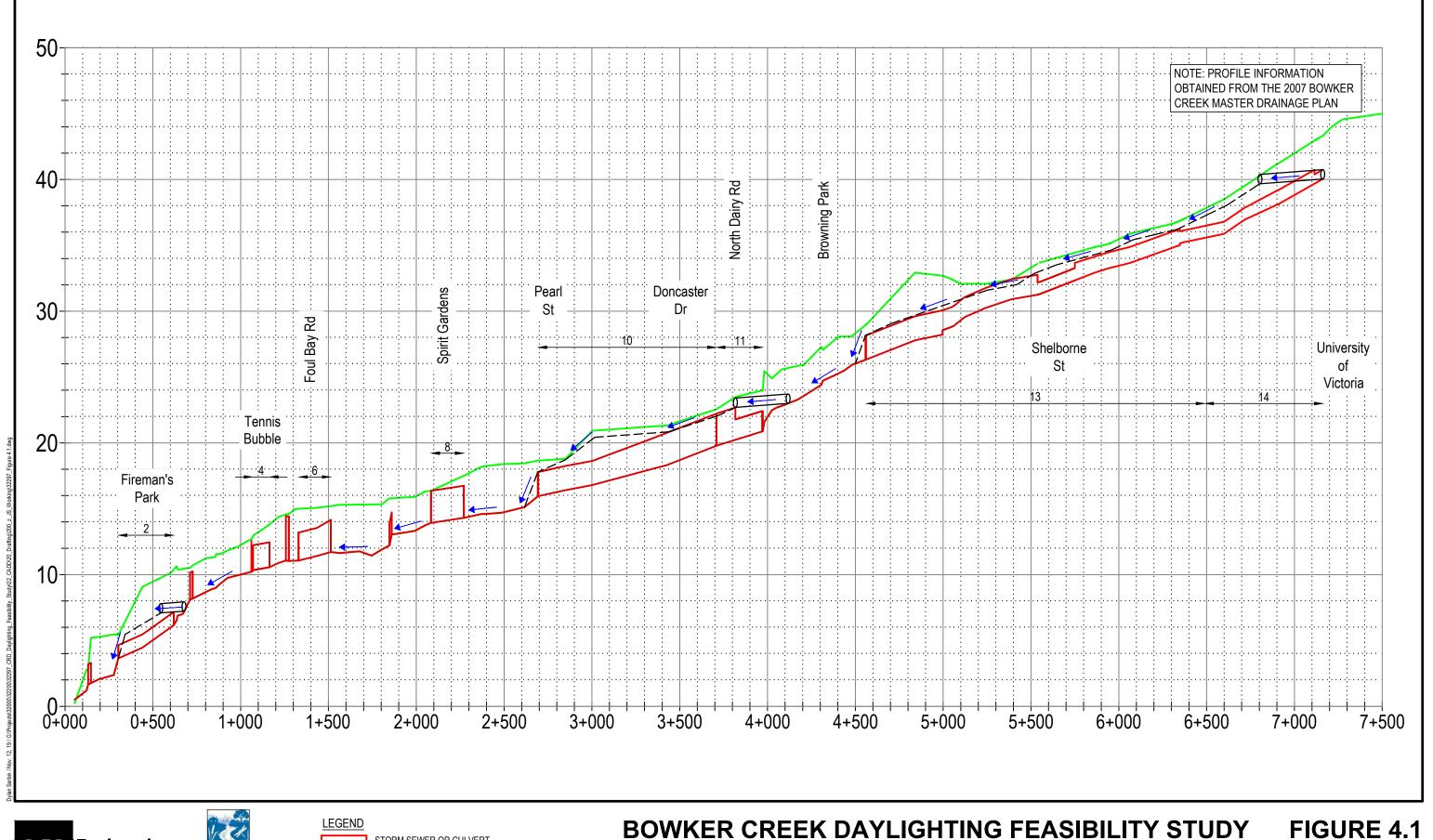
4.4 Discussion

As the benefit to the BCI of the partial daylighting concepts is generally proportionate to the volume of flow that can be conveyed (especially baseflow), the entire Bowker Creek baseflows should be diverted if possible. While the partial daylighting greatly reduces the lands required, a suitable corridor is still needed. A 4 to 6 m wide corridor is proposed, with additional width needed for adjacent sidewalk/multi-use paths. The alignment corridors investigated and proposed in Section 4 still apply, but the width of land needed would be noticeably less. An illustration of partial daylighting is shown in **Exhibit 4.1**.

Another consideration is the existing and future character of the daylighting corridors. In a suburban context such as Garnet Road, Doncaster Drive, and Pearl Street, a linear recreational corridor where the partial daylighting is integrated with greenways, low volume traffic/bike lanes and more natural landscaping could be suitable. In an urban context such as Shelbourne Street, Foul Bay Road, and Cadboro Bay Road, the partial daylighting could be integrated into streetscaping, with a pedestrian focus (move cycling to street or separate greenways).

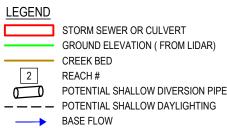


THIS PAGE LEFT INTENTIONALLY BLANK









PARTIAL DAYLIGHTING PROFILE











5.0 Creek/Trunk Hydraulics and Potential Stormwater Management Facilities

5.1 Introduction

As previously mentioned, the MDP identified four locations that have a history of flooding:

- · Downstream of Beach Drive.
- Fireman's Park.
- · Oak Bay Recreation Centre.
- · Low lying areas upstream of Trent Street.

One of the potential solutions to address the flooding risk is the construction of stormwater management facilities (SWMF). The scope of this study included a brief investigation into potential SWMF sites, including hydraulic analysis to determine the potential benefits at each possible SWMF site. It is noted that this study investigated the technical feasibility of potential SWMF sites, and that no agreements are in place with existing landowners for creating SWMFs.

5.2 Potential Stormwater Management Facilities for Detention Storage

The MDP proposed four locations for SWMF:

- · Open space east of Jubilee Hospital.
- Open space at 2661 Richmond Road (former "BC Hydro" lands).
- · Open space west of Richmond School.
- Open space in the northwest corner of the University of Victoria.

The first three sites are adjacent to Bowker Creek in the lower third of the watershed. These potential SWMF were simulated in the MDP as widened sections of the creek. These lower SWMF locations are relatively small and offer some flood relief. It is noted that as in-stream storage facilities, the hydraulics can be complex. If the outlet rates are too controlled, they can result in an increase in upstream flooding, while if they are not controlled enough the reduction in downstream flows can be minimal.

The proposed SWMF at the University of Victoria is at an ideal location, especially given the excessive HGL from the MDP (shown in **Figure 2.1**). This location is considered to be the highest priority for stormwater storage.

The District of Saanich explored the potential for storage within the Cedar Hill Golf Course in a concurrent study. The study findings indicated that there was limited opportunity to construct storage on the golf course.

ISL investigated alternate potential SWMF sites for consideration. The criteria was used to screen for potential sites included:

- · Relatively flat site.
- Current green space or under-utilized parcels.
- Relatively large site (to maximize benefit/cost).
- Relatively close to Bowker Creek/trunk.
- Captures a moderately sized portion of the watershed (refer to MDP Figure 3-1, **Appendix C** for subcatchment boundaries).

Consideration was given to Lansdowne Middle School, Cedar Hill Jr. Secondary School, Doncaster Elementary School, St. Michael's University School and Campus View Elementary School. The preliminary findings are summarized in **Table 5.1** below:



Table 5.1: Assessment of Potential SWMF Sites

Location	Potential for SWMF Site	Comments
Lansdowne	Good	Located within downstream part of large sub-catchment about 2 blocks from Bowker Creek; slight to moderate slope (2-4m drop across playing fields); large site.
Cedar Hill	Fair	Smaller sub-catchment; small site; moderate slope; 2 blocks to Bowker Trunk.
Doncaster	Poor	Smaller sub-catchment; small site, moderate to steep slope; contaminated site; 2 blocks to Bowker Trunk.
St. Michael's	Poor	Small upstream sub-catchment; small site; moderate to steep slopes; 4 blocks to Bowker Creek.
Campus View	Fair to Good	Located immediately west of UVic and could be a good alternative to storage at UVic; small site; large upstream sub-catchment; moderate slopes.

Based on the above, Lansdowne Middle School, 2661 Richmond Road, and Richmond School were investigated as a potential SWMF sites. The SWMF concept would be dual use, with the recreation fields/areas being flooding for a maximum of 24 to 48 hours once every 5 or 10 years.

5.3 Refinement of Bowker Creek MDP Hydraulic Model

5.3.1 University of Victoria Existing SWMF Model Refinement

Prior to conducting hydraulic modeling of potential SWMF, the upstream section of the hydraulic model was updated to better represent the system hydraulics. The Bowker Creek MDP hydraulic model had unrealistically high hydraulic grade lines (HGL) for the 1:25 year and 1:100-year events in the upstream reaches of the system. The HGL represents the height that water would rise to within a pressurized pipe system. However, it is not possible for the HGL to rise several metres above ground level within Reaches 13 and 14 as shown in **Figure 2.1**. There is not much detail in the MDP on how the upstream system was modeled, but it appears that the runoff hydrograph for each sub-catchment into the storm sewers which is typical for one-dimensional (1D) system modeling. The nodes were "sealed" to prevent loss of water, which allows the HGLs to rise significantly. The most accurate way to model piped storm systems with large storm events is either a two-dimensional (2D) system model or a dual drainage model (pipe/overland).

Part of the reason that the HGLs are so high is that the entire 96.6 ha UVic catchment was connected to the 600mm storm sewer at Gordon Head Drive, and thus Reach 15 was not included in the model. ISL inserted Reach 15 in the hydraulic model with the creek and forested floodplain included. This reduces the peak flow to the Gordon Head Drive storm sewer from 2.9 m³/s to 1.1 m³/s for the 1:100-year event. The model shows an overbank flooding depth of 0.15 m about 200 m wide within Reach 15, which represents the forest floor along Bowker Creek being flooded between the University Club and Gordon Head Drive during the 1:100-year event, which is possible.



Bowker Creek Reach 15 within the University of Victoria

A SWMF was inserted into the model representing a potential storage facility located in the northwest corner of the University of Victoria, refer to **Figure 5.1**. The SWMF control was set for a release rate of 5.0 L/s/ha over the 96.6 ha catchment, with a maximum discharge rate of 483 L/s (0.5 m³/s). This is slightly lower than the 530 L/s available pipe capacity of the 600 mm storm sewer crossing Gordon Head Drive (600 mm at 0.75% slope).

There were no other refinements to the existing model that could be made within the scope of this study. While the HGL in Reaches 13 and 14 are unrealistically high, the resulting flows to Reach 12 (Browning Park) may be somewhat realistic due to high overland flows along Shelbourne Street that could reach Bowker Creek south of Knight Avenue.

5.3.2 Lansdowne Middle School SWMF

The Lansdowne Middle School SWMF was modeled by diverting the 750 mm storm sewer on Lansdowne Road (about 100 m east of Shelbourne Street) to a SWMF constructed within the grass playing fields. The catchment area was split so that the lands east of Shelbourne Street and north of Lansdowne Road (about 2/3 of total catchment) was diverted to the storage, with the remainder of the catchment connecting to the Bowker Creek Trunk at Pearl Street and Scott Street. The total drainage area that can be diverted to this SWMF is estimated to be 66.6 ha.



Existing Lansdowne Middle School Playing Fields

Stored stormwater would then discharge through the existing 375 mm storm sewer on Townley Street, connecting to Bowker Creek at Pearl Avenue. The SWMF was simulated as a dry pond with a pond bottom elevation of 20.0 m. The existing 250 m long, 375 mm diameter storm sewer on Townley Street provides hydraulic constraint and a separate control structure was not added.



The Lansdown SWMF is shown schematically in Figure 5.2. Illustrations of dual use dry pond on a school site are shown below.







Illustrations of Dual Use Dry Ponds on School Sites in Edmonton

5.3.3 **Richmond School Site**

Richmond School has not been used as a full-time community school for several years; currently, it is used as a temporary school while other nearby schools are undergoing renovations. The SD61 has not committed to a long-term use for the school, but it is expected to remain in use based on current enrollment.

The site is currently divided by Bowker Creek (open channel), which runs northwest to southeast. The creek is fenced off from the school for safety reasons. The triangular parcel southwest of the existing creek was suggested as a SWMF in the MDP but was considered too small to be effective in mitigating downstream flood risks (area is a 100 m x 100 m triangle). At the south boundary of the property, the creek enters a storm sewer at Spirit Garden, a City of Victoria owned property that has a high potential for daylighting and active transportation connectivity.

The southwest section of the site is generally flat, the northeast is approximately 1-2 m higher (includes school buildings) than the southwest part. Both the southwest and northeast sections each have a soccer field and baseball backstop. The two sections are connected by an existing pedestrian bridge.

A sanitary trunk sewer runs parallel to the creek (northwest to southeast direction) which will have to be considered in the design.

The proposed concept for developing a SWMF within the existing school site is summarized below:

- The creek would be re-aligned to the southwest to increase the green space available for school playing fields.
- · The creek would be naturalized with a slight meander, boulders, woody debris, and native plant species. Flow velocities would be reduced to limit erosion potential.
- The lower portion of the SWMF would be low lying along the creek and would be inundated during frequent storm events (~2 year). This area would be fenced from the school and naturalized with suitable riparian plants.
- The green space between the re-aligned creek and the school buildings would be developed as a dual-use dry pond; it would have a net increase in green space available for playing fields; the playing fields would flood during infrequent storm events (~25 year).
- The existing bridge crossing could be maintained via a new pedestrian bridge or open bottom culvert.
- A granular walking path and multi-use path (MUP) could be constructed alongside the creek; to maintain or improve active transportation connectivity between Townley Street and Newton Street.

A concept of the Richmond School SWMF is shown in Figure 5.3. The stage-storage relationship from this configuration was inserted to the model, with the downstream trunk hydraulics used to control the flows. (Note: this SWMF was modeled as a widened creek cross-section in the MDP).

5.3.4 2661 Richmond Road Site

This site was recently acquired by the District of Saanich from BC Hydro. The District does not have official plans for the site but may select to develop part or all of the site into a park. There is strong public support for designated park use, including a community group (Kings Road Community Nature Green Space). At this time, the District has not started any park planning activities.

The site generally falls from the north to south and drops about 3 to 4 m over 200 m length. Bowker Creek is open channel running along the southwest edge of the parcel flowing in southeasterly direction. The creek is straight and runs parallel and close to the private property boundary to the southwest. The creek has steep banks that are susceptible to erosion.



The site is bordered by Kings Road to the north and Haultain Street to the south; both are dedicated as City of Victoria People Priority Greenways (west of Richmond Street). It is understood that improvements to the Haultain Street bicycle facilities are being coordinated between the City of Victoria and the District of Saanich.

The proposed concept for constructing a SWMF as part of a future park development is summarized below:

- The existing parcel would be divided into thirds:
 - the bottom (southern) third would be a low lying naturalized area along the creek that would be inundated during frequent storm events (~2 year);
 - the middle third would be turf grass for casual park use but would be inundated during infrequent storm events (~25 year); and
 - the northern third would be park space that is not part of the SWMF.
- The creek would be re-aligned at the south to provide a more natural setting; naturalize the south end with boulders and woody debris; riparian plants in lower area would be suitable for frequent inundation.
- A granular trail would be developed along the creek to connect Haultain Street to the south (connecting to
 informal path to Royal Jubilee Hospital) with Richmond Road to the west (with connection to Spirit Garden via
 existing sidewalks).
- A MUP could be constructed to improve active transportation connectivity between Haultain Street to the south and Kings Street to the north.
- Pedestrian bridges and/ or open bottom culverts may be considered to integrate the existing and proposed pathways.
- To maximize the available storage volume, it will be necessary to construct a south berm approximately 1m above the existing ground elevation. It is anticipated that some of the material excavated to create the SWMF could be reused for the berm.

A concept of the 2661 Richmond Road SWMF is shown in **Figure 5.4**. The stage-storage relationship from this configuration was inserted to the model, with the downstream trunk hydraulics used to control the flows. (Note: this SWMF was modeled as a widened creek cross-section in the MDP).

5.4 Hydraulic Modeling Results

5.4.1 University of Victoria SWMF

As outlined above, the hydraulic model incorporated both Reach 15 within UVic (with overbank storage) and a SWMF near Gordon Head Road and McKenzie Avenue. The hydraulic modeling results are summarized in **Table 5.2** below.

Table 5.2: Hydraulic Modeling Results – University of Victoria

	1:25 Year, 24 Hour Storm	1:100 Year, 24 Hour Storm
UVic Peak Runoff Hydrograph (m³/s)	2.0	2.9
Reach 15 Peak Flow (m ³ /s)	1.16	1.36
UVic SWMF Maximum Outflow (m³/s)	0.52	0.59
UVic SWMF Storage Volume (m³)	10,315	12,020
Reach 15 Overbank Flooding Depth (m)	0.05	0.15

The UVic peak runoff hydrograph is the peak runoff rate from the 96.6 ha catchment in the MDP hydrologic model. The Reach 15 peak flow represents the routing effects of inserting Reach 15 into the hydraulic model, combined with overbank storage in Reach 15. The UVic SWMF maximum outflow illustrates the routing effects with the proposed SWMF and is similar to the hydraulic capacity of the 600 mm storm sewer crossing Gordon Head Road.

These results are conceptual only as the hydrology and hydraulics at the University of Victoria are not yet well defined. The overbank flooding depth of 0.15 m for a 1:100 year storm is possible, but a more detailed assessment of the University's storm drainage system would be needed to confirm these findings. It is clear that it is possible to store the University's 1:25 year or 1:100 year runoff and discharge it to the storm drainage system at Gordon Head Road without overloading the 600 mm storm sewer. **Figure 5.1** provides an illustration of the potential SWMF in the northeast corner of UVic, but further study is needed to refine the size of the SWMF.



Potential Location for UVic SWMF

5.4.2 Lansdowne Middle School SWMF

The Lansdowne SWMF can intercept about 66.6 ha of land east of Shelbourne Street and north of Lansdowne Road. This represents approximately 65% of catchment and approximately 6.5% of the total Bowker Creek basin, so its impact will be somewhat limited. While this catchment represents a small portion of the overall watershed, it is the largest single catchment apart from UVic. The proposed SWMF has the capability to store about 6,000 m³ based on a 200 m by 300 m footprint and a 1 m deep storage.

The hydraulic modeling results are summarized in **Table 5.3**. This table illustrates that the SWMF is very effective at reducing the peak flows to Bowker Creek, with a reduction of more than 2 m³/s representing about 90% of the peak inflows. The impact on the peak flows in Bowker Creek is somewhat less due to routing effects, but it is still measurable. Further study is needed to quantify the flood risk reduction downstream.

Table 5.3: Hydraulic Modeling Results – Lansdowne SWMF

	1:25 Year, 24 Hour Storm	1:100 Year, 24 Hour Storm
Peak SWMF Inflow (m³/s)	2.5	3.9
SWMF Maximum Outflow (m³/s)	0.25	0.25
SWMF Storage Volume (m³)	21,990	39,320
Duration of Storage (flooding playing fields) (hours)	30	36
Peak Flow at Trent Street – Existing (m³/s)	18.19	21.97
Peak Flow at Trent Street – with SWMF (m³/s)	16.53	20.73
Reduction in Peak Flow at Trent Street (m³/s)	1.66	1.24

Further study is needed to determine the frequency and duration of flooding, especially for more frequent rainfall events, in order to assess the impacts on the playing fields.



5.4.3 Richmond School and 2661 Richmond Road SWMF

The hydraulic model from the MDP was obtained for the Bowker Creek Daylighting Feasibility Study and was used to assess the two potential SWMF sites. The 2-year, 25-year and 100-year storm events (24-hour duration) were simulated. A total of four scenarios were simulated:

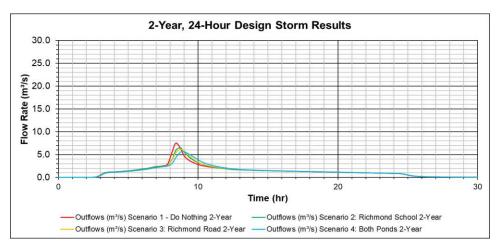
- Scenario 1: Existing (do nothing) conditions.
- Scenario 2: Richmond School SWMF only.
- · Scenario 3: 2661 Richmond Road SWMF only.
- Scenario 4: Both SWMFs operating together.

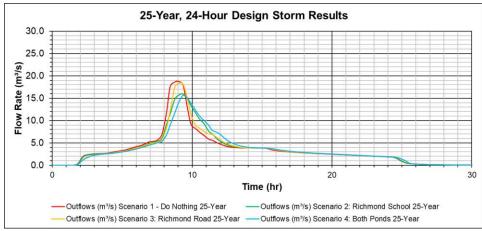
The hydraulic modeling results are shown in **Table 5.4** and **Figure 5.5** below. The impact of the Richmond School SWMF is clear with a reduction in the downstream peak flow of about 15% for all storm events, while the 2661 Richmond Road SWMF is only effective during the 2-year event. The 2661 Richmond Road SWMF also provides little or no benefit when combined with the Richmond School SWMF during infrequent storm events (25-year and 100-year).

It is noted that for the 100-year storm event, the addition of the 2661 Richmond Road SWMF to the Richmond School SWMF results in a marginally higher flow rate at Haultain Street. This is due to 2661 Richmond Road SWMF storage being full prior to the peak of the event.

Table 5.4: Hydraulic Modeling Results - Richmond School and 2661 Richmond Road SWMF

	Peak Discharge at Haultain Street (m³/s)		
	2-Year	25-Year	100-Year
Scenario 1: Do-Nothing	7.49	18.77	23.89
Scenario 2: Richmond School SWMF	6.46	15.97	20.29
Scenario 3: 2661 Richmond Road SWMF	6.21	18.30	23.68
Scenario 4: Both SWMF	5.62	15.60	20.97





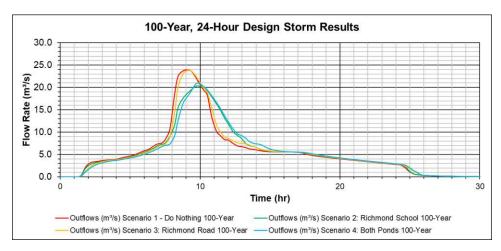


Figure 5.5: Modeling Results at Haultain Street - Richmond School and 2661 Richmond Road SWMF



5.4.4 Impact to Richmond School Playing Fields

The use of dual-use SWMF on school sites in new to greater Victoria and concerns were expressed during the project workshops about the impact of these facilities on the community's use of the playing fields. The depth and duration of flooding was simulated using the hydraulic model. The results of the analysis are shown in **Figure 5.6**. The playing fields are at an elevation of about 16.4 m, and thus would only be impacted during infrequent storm events (less than about once every two years). During infrequent storm events (25-year and 100-year), the field would be flooded for less than 24 hours. Similar results were found for the 2661 Richmond Road site. The impact of climate change (refer to Section 5.4.5 below) on the depth and duration of flooding is also shown in **Figure 5.6**.

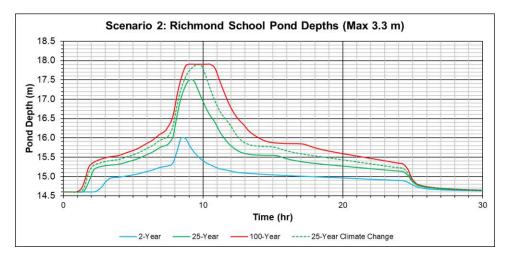


Figure 5.6: Simulated Water Level at Richmond School SWMF

5.4.5 Climate Change Consideration

Climate change is expected to increase rainfall intensity in the future, which will negatively impact existing the risk of flooding within existing stormwater drainage systems. The potential SWMF could offset the impacts of climate change through reducing the downstream discharge rates and water levels.

To assess the potential effectiveness of the SWMF of mitigating the impacts of climate change, hydraulic modeling was carried out for the Richmond School SWMF considering both existing rainfall patterns and future climate change conditions. The future climate change rainfall conditions were based on the 2100 climate change model using historical rainfall data from the Gonzalez rain gauge.

Four scenarios were considered in this analysis:

- Scenario 1: Do-Nothing (existing system hydraulics) with existing rainfall.
- Scenario 1B: Do-Nothing with 2100 Climate Change.
- Scenario 2: Richmond School SWMF with current rainfall.
- Scenario 2B: Richmond School SWMF with 2100 Climate Change.

The results are shown in **Table 5.5** and **Figure 5.7**.

Table 5.5: Climate Change Analysis for Richmond School SWMF

	25-Year Peak Discharge at Haultain Street
Scenario 1: Do-Nothing	18.77
Scenario 1B: Do-Nothing Climate Change	21.20
Scenario 2: Richmond School SWMF	15.97
Scenario 2B: Richmond School SWMF with Climate Change	17.94

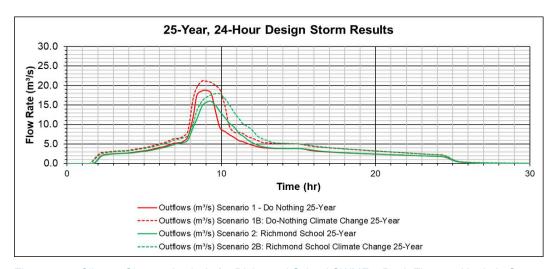


Figure 5.7: Climate Change Analysis for Richmond School SWMF – Peak Flows at Haultain Street

The hydraulic analysis illustrates that the potential Richmond School SWMF provides excellent climate change adaptation through reducing the 25-year 2100 climate change peak flow to below the current 25-year peak flows.

5.5 Discussion

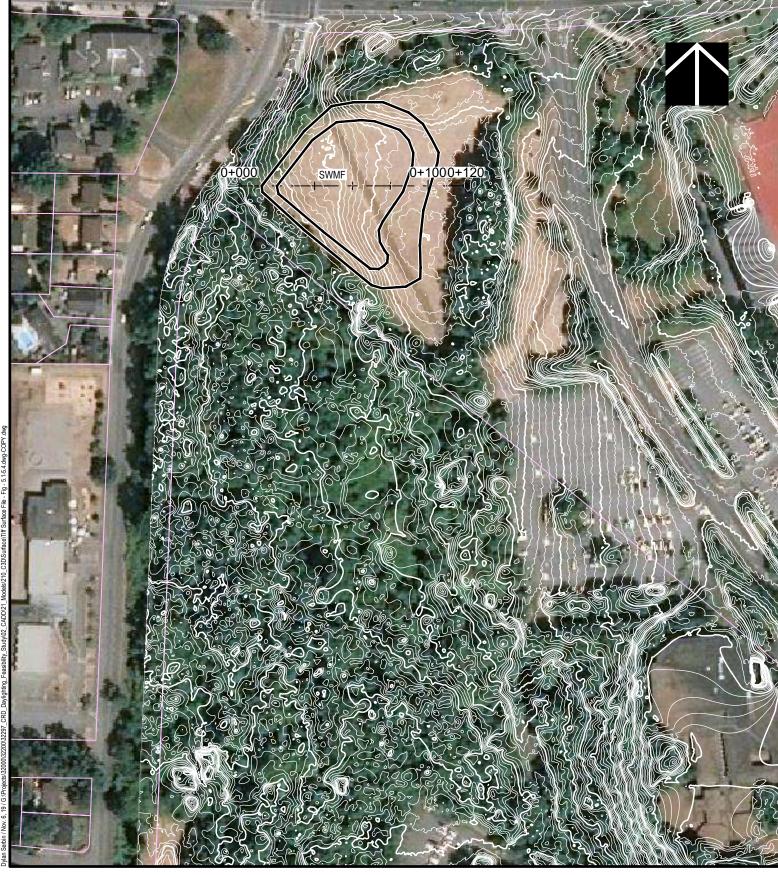
The hydraulic modeling results for the proposed University of Victoria and Lansdowne School SWMF indicate that both sites have excellent potential for reducing peak downstream flows and HGL levels. These are essentially off-stream SWMF and their downstream discharge rates can be effectively managed by increasing the available storage capacity and duration of ponding. The increased duration of ponding may be an issue for the Lansdowne School SWMF.

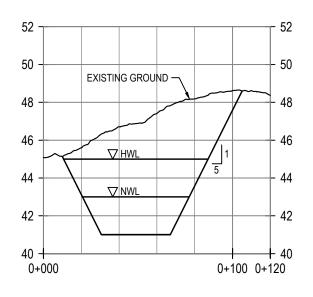
The Richmond School and 2661 Richmond Road SWMF are in-stream facilities which make them more hydraulically complex. They are both effective at reducing peak downstream flows during frequent storm events (2-year and 25-year), with the Richmond School SWMF also being effective at reducing the peak flows during less frequent (100-year) events.

More detailed study is needed for all potential SWMF sites to refine these results. The modeling results presented herein are based on refinements of the MDP model. It is noted that the MDP model has significant limitations and a more detailed hydrologic and hydraulic model should be developed prior to implementing any of the proposed SWMF.



THIS PAGE LEFT INTENTIONALLY BLANK





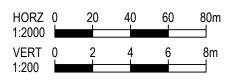


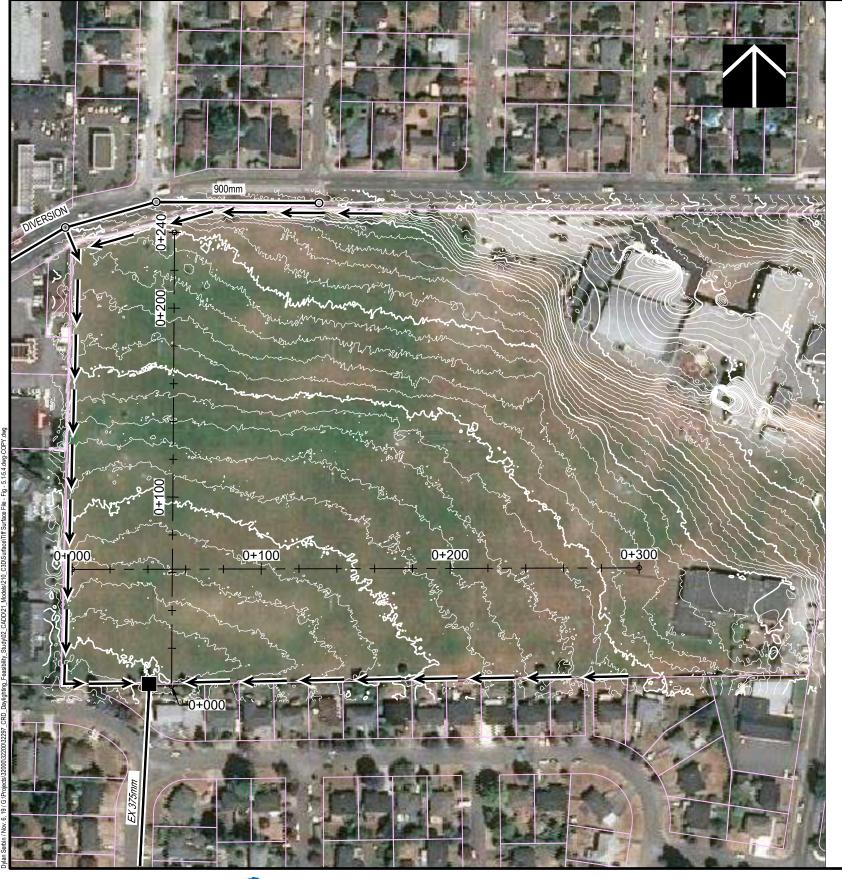


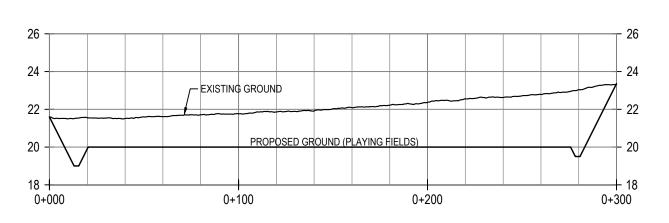
BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY

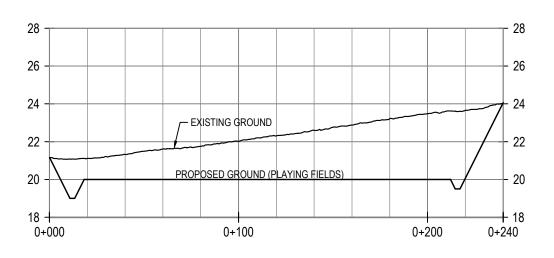
POTENTIAL STORMWATER STORAGE FACILITY UNIVERSITY OF VICTORIA





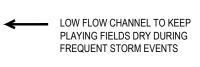








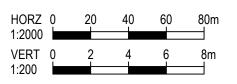


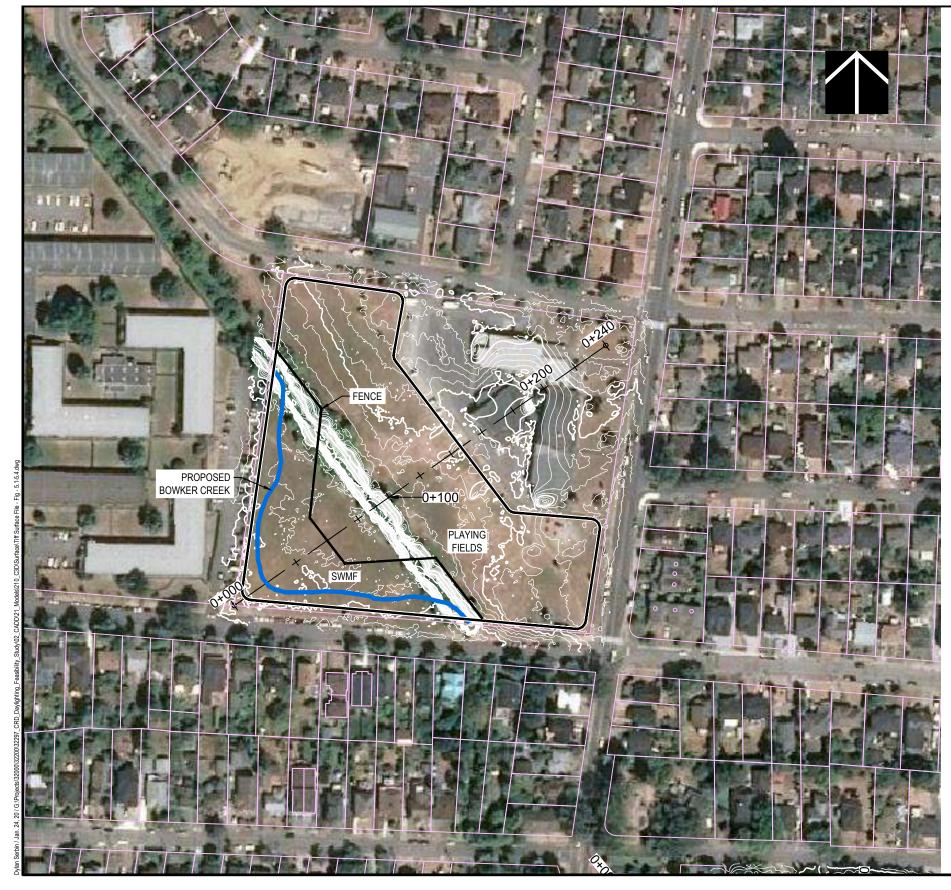


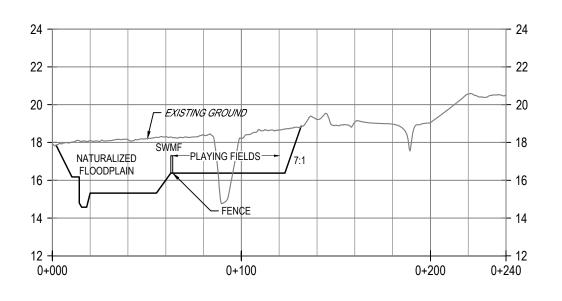
BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY

POTENTIAL STORMWATER STORAGE FACILITY LANSDOWNE SITE







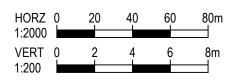


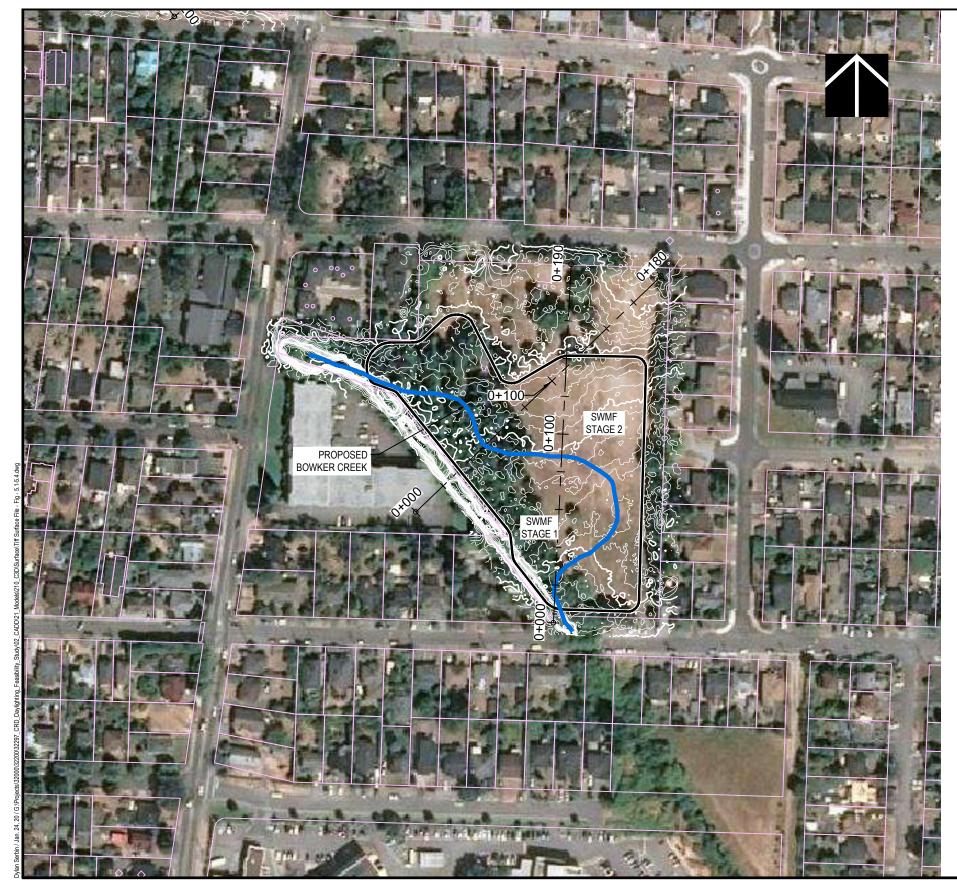


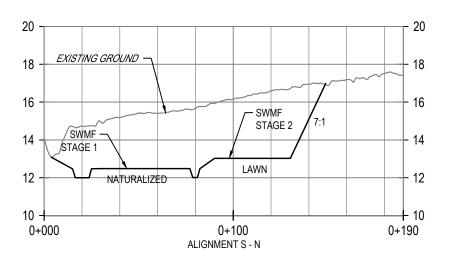
BOWKER CREEK DAYLIGHTING FEASABILITY STUDY

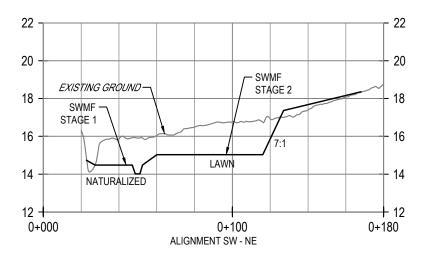
POTENTIAL STORMWATER STORAGE FACILITY RICHMOND SCHOOL SITE









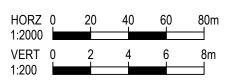




BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY

POTENTIAL STORMWATER STORAGE FACILITY 2661 RICHMOND ROAD





6.0 Refinement of Daylighting Corridors and Concepts

6.1 Introduction

The daylighting concepts and corridors were refined based on the feedback received during Stakeholder Workshop #1. In addition, a series of one on one meetings with the municipalities were held in September 2019 to brainstorm daylighting concepts that would achieve BCI objectives. Issues discussed included land acquisition strategies, redevelopment potential, partial daylighting, and alternate alignments.

6.2 Land Acquisition Considerations

As the watershed is fully developed, land acquisition is a critical consideration in daylighting Bowker Creek. Fireman's Park in Oak Bay and Spirit Garden in Victoria are the only locations where the creek is piped beneath municipal parkland. For an optimal daylighting, a right-of-way width of 15 m to 30 m is needed, preferably in close proximity to current trunk alignment. This would require in the order of 100 properties at a cost of in excess of \$100M. This is not realistic, even for a 100-year vision of the BCI.

A land acquisition strategy is needed to obtain the required land for daylighting. The strategy should recognize the market conditions and the economics of the development industry. It will also require the daylighting vision and concepts to adjust to the daylighting corridor that can be obtained over time without significant public investment.

The Bowker Creek Blueprint recommends offering greater height in exchange for right-of-way width for daylighting. The additional height offers greater revenue potential for developers; however, the economics don't work to provide more than a few meters of ROW when redeveloping single family residential to 4- to 6-storey commercial/mixed use/residential. For example, on a 40 m deep lot, giving up 10m of ROW is not economical based on the input costs (land costs, construction costs) and the revenue that can be generated in terms of net unit sales.

Several areas within the Bowker Creek catchment are not planned for redevelopment and are expected to remain as single family for at least the short term (less than 15 years) and medium term (15-40 years). Other areas have (or are currently) redeveloped with newer commercial, mixed use or residential with densities ranging from one to four storeys. Thus, future redevelopment is unlikely in the short and medium term.

The proposed strategy for acquiring the land required for daylighting is:

- Track all lots along daylighting corridor for either acquisition or for negotiating during redevelopment.
- · Exchange height for daylighting ROW.
- Acquire additional ROW width during redevelopment through negotiating.
- Require developers to provide a nominal amount of land for daylighting (typically 2-5 m) similar to roadway dedication.
- Consider relaxing setback distances and/or put daylighting on private property (with registered easement) within typical set back distances.
- Acquire lots as they come up for sale and subdivide to create a ROW for daylighting; re-sell remnant lot (shallower or narrower) to recoup most of acquisition costs.
- Develop land use policies for lot size (narrow), building floor area ratio, etc. to facilitate development of the remnant parcels (e.g. skinny homes).
- Approach homeowners directly regarding selling a ROW or easement on their property for daylighting.
- Consider revising land use plans to allow for densification along the Bowker Creek alignment (e.g. Florence St. in Oak Bay; Pearl St and Doncaster Drive in Victoria; Garnet Road in Saanich).



Implementation of these strategies should be the responsibilities of the individual municipality's planning departments, working with the BCI and the CRD.

6.3 Parks, Trails and Recreational Facility Considerations

The BCI and its partners want to integrate the daylighted creek with existing and proposed parks and trails to greenways. In some cases, existing or proposed trails are offset from the existing trunk and shifting the daylighting alignment to trail alignments on higher ground would add to the creek depth, and thus daylighting costs and/or land requirements. Most of the park and trails issues are site specific, as described below:

1. Fireman's Park

- a. To maintain the functionality of both ball diamonds, it will be necessary to shift the east diamond slightly. Rotating this diamond by about 10 degrees clockwise would provide a narrow corridor for daylighting on the north side of the diamond. This would impact the right field corner which could be rectified by acquiring a small portion of the adjacent lot on Monteith Street.
- b. Daylighting the creek at the west end of Fireman's Park may not be practical as the land is currently used for parking. The District of Oak Bay will need to prepare master plan for the park prior to, or in conjunction with, daylighting design.
- c. The fire hall building from 1938 will remain as a heritage building. Oak Bay may be looking at constructing a new fire hall within the site in future years. The defined route will be important for selecting the location of the new hall.

2. Oak Bay Recreation Centre

- a. The tennis bubble has a limited life span and daylighting the portion under the tennis bubble should be coordinated with the future replacement of this facility.
- b. The existing daylighted section adjacent to the Oak Bay Rec Centre could be improved by adding a greenway parallel to the creek. This would likely require removal of some Rec Centre parking.

3. Cadboro Bay Road to Foul Bay Road to Trent Street

- a. The Cadboro Bay Road/Foul Bay Road intersection is very busy, and Florence Street is a more suitable alignment for active transportation. Thus, daylighting along Bee Street and Florence Street should be considered.
- b. The proposed greenway would have signaled pedestrian crossings on Foul Bay Road (100 m north of Cadboro Bay) and at Cadboro Bay Road and Florence Street.
- c. The existing Bowker Trunk alignment between Foul Bay Road and Trent Street has been identified as a potential active transportation route. Additional right-of-way is needed to integrate a multi-use path with daylighting.

4. Trent Street to Haultain Street

- a. This section of Bowker Creek is currently open as a straight, narrow channel. It runs adjacent to St. Patrick's School and Royal Jubilee Hospital and has a very narrow right-of-way.
- b. There are open parcels of land north and south of Adanac Street that could be incorporated into park space, provide a corridor for multi-use pathways, and re-route the creek to a more natural, meandering alignment.

5. Haultain Street to Richmond Road (2661 Richmond Road, former BC Hydro Lands)

a. This parcel has been used informally as a park for several years and it has developed walking paths in the treed along the creek. With the District of Saanich recently acquiring the parcel, there is an excellent opportunity to enhance the land into a naturalized park with amenities like park benches and a trail network.



Informal path adjacent to Bowker Creek within 2661 Richmond Road

- b. There will be a good opportunity to connect Kings Road to Haultain Street with a multi-use pathway through the park, with connections to existing/proposed on-street pathways. Haultain Street in Saanich is an on-street cycling route and Haultain Street in Victoria ha AAA cycling facilities planned for 2020.
- c. Consideration should be given to re-routing the creek to provide a more natural (meandering) alignment.
- d. It is noted that there is an active community group investigating this space (Kings Road Community Nature Green Space).

6. Richmond Road to Newton Street

- a. If the parcel south of Kings Road can be acquired to facilitate daylighting, it may be possible to incorporate a walkway adjacent to the creek.
- b. Daylighting Bowker Creek within Spirit Garden (Kings Road to Newton Street) will adversely impact the existing park space if additional land is not acquired.
- c. The walking trail within Spirit Garden should be maintained and located adjacent to the daylighted creek. A multi-use path may not be appropriate within Spirit Garden.



Spirit Garden along existing Bowker Creek pipe alignment

7. Newton Street to Townley Street/Pearl Street

- a. At Richmond School, the creek is already daylighted but could be re-aligned to meander and offer more usable property for the school site. Alternately, the triangular parcel southwest of the creek could be developed into a naturalized stormwater management facility.
- b. A multi-use path should be developed through the Richmond School site as well as the section of the existing creek adjacent to Townley Street.

8. Townley Street/Pearl Street to Myrtle Street

a. The existing Bowker storm trunk runs parallel to an existing greenway with planned cycling investments in 2021. The greenway can be enhanced with additional right-of-way, either through land acquisition or by converting the existing roads to one-way.

9. Myrtle Street to Hillside Avenue (Doncaster Greenway)

a. The Doncaster Greenway has a narrow ROW between multi-storey commercial and residential buildings. Daylighting could provide an opportunity for a boardwalk over the creek to achieve both daylighting and active transportation connection.

10. Hillside Avenue to North Dairy Road

- a. The existing Bowker storm trunk runs parallel to an existing greenway (with cycling infrastructure) from Hillside Avenue to Clawthorpe Avenue. The greenway can be enhanced with an additional right-of-way, through either land acquisition or by converting the existing roads to one-way.
- b. The existing trunk runs along Clawthorpe Avenue and the north edge of Clawthorpe Park. There is an excellent opportunity to integrate daylighting into Clawthorpe Park.



11. North Dairy Road to Knight Avenue

- a. Bowker Creek is open in this reach, but there is limited access between North Dairy Road/Shelley Street and McRae Avenue. Additional land will need to be acquired to create a continuous multi-use path south of McRae Avenue.
- b. The section between McRae Avenue and Knight Avenue includes adjacent multi-use pathways as within Browning Park. This section provides an excellent illustration of a natural creek crosssection with an adjacent pathway in a park setting.



Multi-use Path in Browning Park adjacent to Bowker Creek

12. Knight Avenue to Gordon Head Drive

- a. Bowker Creek is piped for this 2.7 km section (Reaches 13 and 14). Unfortunately, there are no existing or proposed greenways or parks along the existing trunk alignment.
- b. There is a proposed greenway along Browning Street from Knight Avenue to north of Derby Road that is half a block to a block west of the existing trunk. This proposed greenway is about 2 to 3 m higher than the existing ground along the Bowker storm trunk, thus shifting the daylighting to this proposed greenway would be challenging.
- c. There is a proposed greenway along Garnet Road, however the roadway is narrow and slightly higher than the ground along the existing storm trunk, and thus would be challenging for daylighting.
- d. There are existing commuter cycling routes along Shelbourne Street and McKenzie Avenue, and a cycling route along Midgard Avenue connecting the University of Victoria to Shelbourne Street.
- e. Based on the existing and planned greenways and cycling routes, it will not be necessary to incorporate cycling path into the daylighting plans for this section of Bowker Creek.
- f. The District of Saanich should consider shifting some of the proposed greenways to the selected Bowker Creek alignment if sufficient corridor with is available.

6.4 Hydraulic Considerations

In developing the overall daylighting concept, the following hydraulic issues were considered:

- 1. As the creek is daylighted, the existing storm trunk should remain in place wherever possible to augment the conveyance capacity of the daylighted creek.
- 2. When the existing trunk remains in service, low to moderate flows should be directed to the creek, with a portion of the high flows directed to the storm trunk. A weir structure should be used to achieve this split in flows. The weir height would be determined based on a hydraulic analysis, but the optimal height is expected to be between about 25% and 50% of the storm trunk diameter/height.

6.5 Land Use/Architectural Considerations

The proposed daylighting concepts need to recognize the unique characteristics of each neighbourhood that it passes through. It should also be integrated with the adjacent daylighted reaches and the connected parks and trails.

Daylighting within highly urban areas, such as the proposed Shelbourne Street redevelopment, should have an urban feel. With multi-storey buildings in close proximity to an arterial roadway, the land costs will be relatively high, and the available corridor width will be narrow. The Shelbourne Valley Action Plan includes illustrations of pedestrians on wide sidewalks with treed boulevards and sidewalk cafes. Daylighting within this context should include extensive landscaping with retaining walls, handrails, etc. to bring pedestrians and café patrons in close proximity to the creek.

Daylighting within suburban residential areas needs to fit in with the adjacent low-density housing and local roadways. The daylighted creek becomes more of a route to be enjoyed while walking or cycling, and not necessarily a destination in itself.

Daylighting within existing or proposed parks should be naturalized as much as possible within the constraints of the available corridor. Daylighting within Spirit Garden should mimic the specific characteristics of the park space and will be very different from daylighting within Fireman's Park.

6.6 Sequencing Considerations

The Bowker Creek Blueprint proposes a 100-year vision for daylighting, recognizing the costs of land within the watershed and the potential for redevelopment to facilitate the needed land acquisition. Thus, the only feasible way to acquire land for daylighting is through redevelopment and purchase of partial properties as they become available.

This process will take several years, and possibly decades, to assemble parcels needed for daylighting. For this reason, long sections of daylighting on alternate alignments should be avoided. It is better to need to stay on or close to existing trunk in order to implement daylighting in reasonable stages. Thus, deviations from the existing trunk should be short and allow for tie-ins.

As specific parcels may be challenging to acquire and may take decades for full redevelopment, the BCI should consider alternate corridors and/or partial daylighting as part of the overall staging and implementation strategy. For example, partial daylighting could be implemented using a narrow corridor on municipal lands while waiting for large-scale redevelopment along the recommended alignment and concept.

6.7 **Proposed Daylighting Corridors**

Using the above considerations, ISL refined the daylighting corridor to a recommended and alternate alignment. The proposed corridors are shown in **Map 6.1**. The alignment mostly followed the existing Bowker Creek storm trunk as the trunk was generally installed at or near the low point of the watershed.

Locations where the recommended daylighting alignment deviates from the existing trunk alignment are summarized below (refer to Map 6.1):

- Reach 2 Fireman's Park shift north to minimize impact on east ball diamond.
- Reach 4 Oak Bay Recreation Centre shift to northeast to allow tennis bubble to be redeveloped close to its current location.
- Reach 6 Recommended alignment along Florence Street and lane between Florence Street and Foul Bay Road to follow the proposed greenway on Florence Street; the alternate alignment is similar to existing trunk alignment but on east side of Foul Bay Road.



- Reach 8 Shift to southwest within commercial property southwest of Richmond Road and Kings Road to accommodate daylighting and site redevelopment.
- Reach 11 Shift to lane south of Clawthorpe Avenue and along south edge of Clawthorpe Park.
- Reach 13 Shift to east side of Shelbourne Street from Cedar Avenue to Donnelly Avenue.
- Reach 13 Shift to east side of Shelbourne Street north of Mortimer Street.
- Reach 14 Shift south of multi-family parcels on McKenzie Avenue to the back of lots on Garnet Road.

Detailed descriptions of each reach are presented in Section 7.



7.0 **Proposed Daylighting Concepts**

7.1 **Daylighting Cross-Sections**

Daylighting concepts were developed considering both the land acquisition constraints and the overall objectives of the BCI such as improving public access, water quality and biodiversity. This will require the creek bed to be as wide as possible while minimizing the overall width of the daylighting corridor. A wider creek bed provides space for natural bed materials, natural vegetation below and above the water level. It will also require a nominal depth of permanent water.

The wider creek bed within a narrow corridor can be accomplished by using retaining walls of varying degrees. It is recognized that full height retaining walls severely impacts the aesthetic value of the creek as well as limiting the environmental benefit of daylighting.

A series of cross-sections illustrating the daylighting concepts are shown in Exhibits 7.1 to 7.9. These crosssections are taken at specific daylighting locations and are to scale. They were selected to illustrate both the sitespecific location as well as to represent other locations with similar conditions. The exhibits include:

- Fireman's Park (Exhibit 7.1).
- Spirit Garden (Exhibit 7.2).
- Doncaster Green (Exhibit 7.3).
- Shelbourne Plaza (Exhibit 7.4).
- Suburban roadway (Exhibit 7.5) representing Pearl Street, Doncaster Drive.
- Suburban back of lots (Exhibit 7.6) representing north of Garnet Road.
- Suburban side of lots (Exhibit 7.7) representing Emerald Place, Ansell Road and Jade Place.
- · Urban redevelopment back of lots (Exhibit 7.8), representing Shelbourne Street north of Knight Avenue; and
- Naturalized creek within park setting (Exhibit 7.9).

A comparison of the right-of-way requirements for a variety of natural and retained creek cross-sections is listed in Table 7.1 below.

Table 7.1: Right-of-Way Requirements for Various Daylighting Cross-sections

Description	Depth (m)	Sides	ROW Width (m)	Notes
Partial daylighting	0.5 –1.0	1:1	4 - 8	Exhibit 4.1
Retained wall	3 - 4	vertical	4 - 6	
Retained wall with pathway	3 - 4	vertical	6 - 10	Bowker Creek at Bee Street
Partially retained creek	3	1.5:1/ vertical	5 – 6	
Partially retained creek with path	3	1.5:1/ vertical	8 - 11	Exhibits 7.6, 7.7 and 7.8
Natural creek	3	1.5:1	10 - 12	Bowker Creek south of Haultain Street
Natural creek with path	3	1.5:1	15 - 20	Bowker Creek north of Haultain Street (2661 Richmond Road), Exhibit 7.9



7.2 Detailed Descriptions for Each Daylighting Section

The proposed daylighting corridors are shown in **Map 7.1**, which are a series of 13 individual maps at 1:2000. These maps show the following:

- Proposed and alternate daylighting alignment.
- Existing and/or proposed roadway crossings that would be piped.
- Realignment of the existing open sections of Bowker Creek.

Detailed descriptions of each reach are presented below. These descriptions should be read with the attached maps.

Map 1 Fireman's Park to Oak Bay

REACH 1: OAK BAY TO MONTEITH STREET

Oak Bay to Beach Drive

- Creek is on private property, primarily on back of lots on Somass Drive.
- BCI has identified 3 lots along Somass Drive for partial acquisition to improve the creek and/or for greenway; no changes required.

Beach Drive to Monteith Street

- Three lots on Monteith are currently municipal parkland with gardens each side of creek; no trail through site due to private property to the east.
- BCI has identified 7 lots along Cranmore Road, Beach
 Drive and Shady Lane for partial acquisition to improve the
 creek and/or for greenway; no changes required.



Mouth of Bowker Creek upstream towards Beach Drive

REACH 2: MONTEITH STREET TO MONTEREY AVENUE/ST. ANNE STREET- FIREMAN'S PARK

- The recommended alignment for daylighting is along the north edge of the park as it is avoiding the existing
 fire hall, police station and one of the two ball diamonds, with minimal impact on the second ball diamond.
 There is unused park space immediately west of Monteith north of the ball diamond as well as immediately
 south of Lulie Street.
 - There is a minimum of 15m of available corridor width immediately west of Monteith Street between the ball diamond at the edge of the park. This will allow a natural cross section to be used for approximately 40 m.
 - There is only about 5m between the ball diamond and the existing lot at 1745 Lulie Street. It is proposed to shift the ball diamond slightly (about 5-10 degrees clockwise) to create another 5m+ of space to accommodate a greenway trail and the creek. The creek would need to be retained for about 30m adjacent to the ball diamond.
 - South of Lulie Street, between the northeast ball diamond and the parking lot, there is 10 m to 20 m of available park space that can be used for daylighting and a trail. It may be necessary to move the playground to optimize the amount of natural cross-section in this area.
 - Daylighting can be extended west to St. Anne Street along the north edge of the existing parking lot, subject to finding alternate parking spaces for the park. This section of the creek would likely be a fully retained cross-section due to the impact on parking.
- It is understood that the District of Oak Bay will be reviewing the condition of the municipal buildings at Fireman's Park in the medium term and that the western edge of the park may be re-designed in the future. The parking spacing and potential for daylighting should be reviewed at that time.

- Due to the orientation of Monterey/St. Anne relative to the existing creek/storm trunk, the piped section under the creek would be relatively long. It could be shortened by refining the existing daylighted section west of Monterey Avenue.
- It may be possible to keep the existing storm trunk in service for moderate to high flow conditions and divert low to moderate flows to the daylighted channel. The open creek drops approximately 1m as it enters the storm trunk at Monterey Avenue. This would require a new weir structure and a new storm pipe under Monterey/St. Anne Street. The advantage of this is that the daylighted creek could be a metre shallower in the western park of Fireman's Park, making it easier to utilize a natural cross-section.



Bowker Creek entering storm trunk at Monterey Avenue

- There is severe erosion in the existing creek immediately east (downstream) of the storm trunk under Monteith Street. It may be beneficial to deepen the daylighted creek west of Monteith and construct a new (small diameter) culvert under Monteith to help address this erosion issue.
- To rotate the eastern ball diamond by 5 to 10 degrees and keep the current field size, it will be necessary to obtain a small portion in the northeast corner of 1718 Monteith Avenue (about 5 m x 10 m triangle).

Map 2 Monterey Avenue to Cadboro Bay Road

REACH 3: MONTEREY AVENUE TO EAST OF TENNIS BUBBLE

· This section is largely daylighted with trails and park system



Bowker Creek at Hampshire Road



Bowker Creek near Armstrong Avenue

- The section adjacent to the Oak Bay High School was recently daylighted by the BCI and is a great example
 of daylighting. It consists of a paved upper trail connecting the Oak Bay Recreation Centre to Bowker Park.
 There is also a granular trail down towards the daylighted creek.
- Alignment on west side of Monterey may need to be refined, depending on daylighting east of Monterey as noted above.
- Consider acquiring lot immediately north of creek on west side of Monterey (prone to flooding) if necessary.



REACH 4: TENNIS BUBBLE/OAK BAY RECREATION CENTRE

- There is a 100 m section of the creek that runs under the tennis bubble at the back of the Oak Bay Recreation Centre.
- Pedestrian and bicycle connectivity from Bee Street/Oak Bay Recreation Centre to Oak Bay High School daylighted section is available on the north side of the tennis bubble and through the rec centre parking lot.
- The tennis bubble is heavily used and would need to be relocated and not removed. The tennis bubble is an inflatable structure has a more limited life span than conventional buildings, so it would be preferable to daylight the creek when the existing tennis bubble has reached the end of the functional life.



Bowker Creek back of Oak Bay Recreation Centre under the tennis bubble

- It may be easier to obtain stakeholder approval for daylighting if both the existing storm trunk and the tennis bubble were both reaching the end of their functional life.
- The recommended alignment for daylighting would likely be along the north and east edges of the existing tennis bubble (and outdoor basketball court) adjacent to the existing pathway between the rec centre and the high school. This would maximize the available space for the tennis bubble and basketball court to be redeveloped.
- Alternate alignments could be considered if Oak Bay was to undertake a complete redevelopment of the Oak
 Bay Recreation Centre site. It would incorporate redevelopment of the open creek within Reach 5. This is
 likely a long term (50+ years) away, but it could become a great recreational amenity as part of a much more
 urbanized rec centre site.

REACH 5: EAST OF BEE STREET TO CADBORO BAY ROAD

- This section is currently daylighted but has limited recreational or ecological benefit due to its vertical walls and limited access to public.
- As noted above, in the long term the Oak Bay Recreation Centre may be redeveloped. This would allow the open creek to be re-designed and incorporated as an amenity for the rec centre. This could include a wider section with natural elements (e.g. boulders, logs) to be incorporated into the creek bed.
- Consideration should be given to acquiring the parcel bound by Cadboro Bay Road, Bee Street and creek (2041 Cadboro Bay Road) to allow for a wider, natural creek between Cadboro Bay Road and Bee Street. This would also facilitate the Florence Street alignment option north of Cadboro Bay Road (refer to Map 3, see below).



Bowker Creek west of Bee Street

Map 3 Cadboro Bay Road to Haultain Street

REACH 6: CADBORO BAY ROAD TO EAST OF TRENT STREET

This section is the most urbanized and likely one of the most challenging section to daylight. Two corridor options are proposed for further study, one using Foul Bay Road (current alignment), and one using Florence Street. The Foul Bay alignment is more direct, but it may not be optimal in terms of greenway connectivity due to the traffic volumes at the Cadboro Bay Road/Foul Bay Road intersection. The Florence Street alignment is recommended as it integrates with the proposed greenway.

• Recommended Alignment - Florence Street

- Acquire all or part of residential lot on west side of Foul Bay Road; existing walkway is only 3-4 m wide. The additional width needed for daylighting could be subdivided from the rest of the lot and the remnant lot sold. While it would be preferable to use the entire lot for a natural channel, there may only be support for acquiring a portion of the lot.
- Acquire part or all of the two lots between Foul Bay Road and Florence St adjacent to existing lane (sanitary sewer is within existing lane). These could be either north or south of the existing lane, but south would be preferable to minimize costs and provide a more direct connection across Foul Bay Road. Again, either a portion or the entire lot could be acquired.



Existing walkway west of Foul Bay Road along Bowker Creek piped section

- Construct daylighted creek on east side of Florence Street (homes on west side of street only have front driveways) including part of boulevard. There is about 5m from the sanitary sewer in the middle of the street to the property line on the east side, thus the creek would need to have vertical walls and railings. The vertical daylighted creek could extend in front of three single-family homes and the multi-family building on Cadboro Bay Road.
- This alignment requires a connection to Bee Street south of Cadboro Bay Road, preferably within the commercial lot bounded by Cadboro Bay Road and Bee Street.
- Traffic calming is being considered along Florence Street to restrict short cutting. This would make Florence Street a preferred greenway.
- The recommended alignment could shift if the lots west of Florence Street were to redevelop in the medium to long term.

Alternate Alignment – Foul Bay Road

- · Acquire all or part of residential lot on west side of Foul Bay Road; existing walkway is only 3-4m wide. The additional width needed for daylighting could be subdivided from the rest of the lot and the remnant lot sold. While it would be preferable to use the entire lot for a natural channel, there may only be support for acquiring a portion of the lot.
- When commercial property northeast of Foul Bay Road and Cadboro Bay Road redevelops, work with the owner to exchange additional height for a portion of land where the current trunk runs. Within a future, more urban context, it may be possible to integrate streetscaping on this commercial site with the daylighted creek, presumably with primarily vertical retained walls.
- Use the wide boulevard area between the property line and the Foul Bay roadway to daylight the creek. There is about 10 m from the property line to the edge of the cycling lane in front of these houses. The street parking along the east side of Foul Bay Road would need to be removed. Two of the three houses have front driveways which would limit the amount of daylighting. There is potential for redevelopment of these lots in the longer term which would preferable as it would consolidate the driveways and allow for more daylighting width through dedication.



REACH 7: EAST OF TRENT STREET TO HAULTAIN STREET

This section is currently daylighted and partially within public lands. The following items are noted for this reach:

- Acquire lots adjacent to creek to provide for greenway, wider (more natural) cross-section, storage, and to create alternate alignments.
- There is currently no formal pedestrian or cycling trails adjacent to the creek, but there are dirt paths:
 - southwest of the creek between Haultain Street and Royal Jubilee Hospital; and
 - northeast of the creek west of Trent Street that connects the St. Patrick's School playground with Haultain Street.
- Optimal creek realignment with greenways are shown on the map.
- Lands below ~14.5 m are subject to flooding.
- The lands between Haultain Street and Trent Street are optimal for storage; consider lowering the green space east of Adanac Street for passive storage. The available volume is generally too small to make a significant reduction in the expected flooding at Trent Street.
- Consider relocating St. Patrick's School to consolidate storage/minimize flooding risk.
- As homes on Trent Street near the creek redevelop, they should be constructed at a higher elevation to minimize their flooding risk.



Informal path along Bowker Creek between Haultain Street and Royal Jubilee Hospital

Map 4 Haultain Street to Newton Street

REACH 7: HAULTAIN STREET TO RICHMOND ROAD— "FORMER BC HYDRO" SITE

This part of Reach 7 is largely within 2661 Richmond Road (former BC Hydro) site. This site was purchased by Saanich in 2019, with the intention of developing a passive recreational park. The amount of the site that will be available as a park is dependent on funding availability in 2019-2020. Specific plans for the site would not start until 2020 at the earliest.

It is recommended that the creek alignment be adjusted to form a more natural creek layout within the future park site. The creek should be widened to allow for natural elements such as boulders and log to be placed, and a series of pools and riffles should be constructed. These changes will transform the current linear ditch into a natural daylighted creek.

It is also recommended that Saanich consider integrating storage into park design, where most of the park space would flood during major storm events.



Bowker Creek at Haultain Street



Bowker Creek within 2661 Richmond Road (former BC Hydro Lands)

REACH 8: RICHMOND ROAD TO NEWTON STREET

Richmond Road to Kings Road

- The trunk runs diagonally under an existing commercial property (currently Victoria Arthritis Centre). While this
 building is relatively new, it is only a single storey and it is in an area that is densifying with several 3-storey
 structures constructed recently. Thus, there is a good likelihood of the site redeveloping over the medium
 term.
- Redeveloping the site to 3-4-storey mixed use or commercial use could benefit from the daylighted creek, especially if the alignment was shifted to the back of the lot (south and west) as shown on Map 4.
 Developments such as cafes, medical/healing, etc. could be very compatible with a daylighted creek.
- The trunk is approximately 2.5 m deep and thus a natural creek with partial retaining walls would be possible, depending on the amount of land that the developer would be willing to give up.
- The greenway could run parallel to the creek but that could detract from the land use described above. Given the size of the parcel and the relatively short distance between Spirit Garden and the "BC Hydro" park site, it would be reasonable to use Kings Road and Richmond Road for the pedestrian/cycling connectivity.

Newton Street to Kings Road - "Spirit Garden"

- The existing trunk alignment is within Spirit Garden, a narrow section of City parkland that has granular pathways and benches. The park ranges from approximately 12 m to 18 m wide. The garden is currently maintained by a local community group.
- The existing trunk is 2.4 m by 2.4 m and is just below grade (~3 m to invert or bottom of pipe) and is located about the middle of the lots. A sanitary trunk runs parallel to the storm trunk on the east side and about 6 m below grade. A daylighted creek can have water ponding above the sanitary sewer as the risk of infiltration into the sewer is negligible as the sewer is in a casing pipe.



Spirit Garden looking south from Newton Street along existing Bowker Creek pipe alignment

- Based on the depth of the storm trunk and the available width of the lot, it is possible to daylight with some retained sides. This would leave enough room for a path on the east side but little room for gardens.
- In order to have a natural creek and have space for paths and gardens, the BCI should consider acquiring the lots immediately west of Spirit Gardens (1772 Kings Road & 1765 Newton Street). The BCI has identified lots to east for possible acquisition.
- If it is not practical to obtain additional lots, consideration should be given to landscaping the daylighting and walkway using boardwalks and partial retaining walls.
- Refer to Exhibit 7.2.
- To keep the quiet ambiance of the current Spirit Garden, it is suggested that cycling trails be routed around
 the garden. A cycling trail could be incorporated into a wider park site if the lots to the west were acquired.



Map 5 Newton Street to Doncaster Drive

REACH 9: NEWTON STREET TO PEARL STREET

This reach is daylighted and follows the narrow strip of land west of Townley as well as the Newton School site. Ways that this reach can be enhanced include:

- Acquire edge of apartment site along existing creek to enhance creek and integrate greenway trails (current creek too straight).
- Acquire triangle southwest of existing creek on Newton School site for potential storage and alternate creek alignment (identified by BCI).
- Consider acquiring Newton School site for storage (Newton School currently used for students when other schools are renovated).



Bowker Creek inlet structure on Richmond School site upstream of Spirit Garden

REACH 10: WEST OF TOWNLEY STREET TO DONCASTER DRIVE ALONG PEARL STREET

- The recommended alignment for daylighting the creek from west of Townley to Shakespeare Street is along the north side of Pearl Street. This roadway is relatively wide and has no utilities running on the north half of the rightof-way. The existing storm trunk is located approximately in the middle of the roadway. There appears to be up to 10m of available space.
- This section of roadway has very low traffic volumes and thus could be converted to a one way. It would make an excellent cycling corridor along a daylighted creek.
- Unfortunately, there are 7 driveways on the north side of the roadway for the 7 lots, which will severely limit the amount of continuous daylighted creek that can be created. Of these 7 lots, only 2 have Pearl Street as its only point of access, thus there is potential to limit the number of driveways in the future.



Pearl Street west of Scott Street – Potential for partial daylighting or daylighting with retained slopes

- The short section on Pearl Street between Shakespeare and Doncaster Drive is much narrower and there is little potential for daylighting without land acquisition. All or part of the lots would need to be acquired to facilitate daylighting.
- Overall, the potential for daylighting the creek at the depth of the existing trunk without land acquisition and/or redevelopment is considered to be fair to poor.
- It may be feasible to acquire the lots on the north side of Pearl Street, remove the driveways and garages, and reselling them as a way to improve the daylighting potential. It may also be possible to acquire multiple parcels and subdivide them so that they have access to one of the side streets (Shelbourne, Scott or Shakespeare).
- The optimal solution, which is likely be available only in the long term, is for developers to acquire the lots on
 the north side of Pearl and redevelop with high density. This would address the driveway issues but would
 also provide an opportunity to obtain additional space on the north side of Pearl Street. This should be
 addressed through future OCP updates.
- Refer to Exhibit 7.5.

Map 6 Pearl Street to Clawthorpe Avenue

REACH 10: PEARL STREET TO MYRTLE AVENUE ON DONCASTER DRIVE

- This reach will be very difficult, if not impossible, to daylight without land acquisition. The existing 2.4 m by 2.4 m trunk is approximately 5 m deep and is generally under the east side boulevard and sidewalk. The lots all have front driveways as there are no lanes.
- The recommended daylighting option is to wait for redevelopment in the area (which is expected to be long term only) and acquire space on the east side of Doncaster Drive. The lots on the east side of Doncaster Drive between Myrtle Avenue and Pearl Street are about 42 m deep (140 ft.) and thus can dedicate space along the front and still be developable.
- The City of Victoria may need to revise its redevelopment plans in this area to promote higher densities in order achieve this redevelopment.
- Without redevelopment, it may be necessary to leave this section on Doncaster as a piped section.



Doncaster Drive north of Pearl Street – Redevelopment is needed to facilitate daylighting

REACH 10: MYRTLE AVENUE TO HILLSIDE AVENUE- DONCASTER GREEN

- This section is unique in that it is on City owned land but is located between two 3-storey buildings, an apartment and a professional building. The lot is approximately 70 m long and 20 m wide and has a pedestrian walkway. The storm trunk is about 5 m deep and is adjacent to a ~7 m deep sanitary trunk.
- As a result of the limited available width and the depth of the trunk, at least part of the creek would need to have retained side slopes. The aesthetic value can be enhanced by constructing boardwalks and/or paths down closer to the creek. If space permits a wider creek bottom width, it can be naturalized with logs, boulders, etc.



Doncaster Green looking north from Myrtle Avenue along existing Bowker Creek pipe section

• Refer to Exhibit 7.3.

REACH 10: HILLSIDE AVENUE TO CLAWTHORPE AVENUE ON DONCASTER DRIVE

Two alternate corridors are proposed, the current trunk alignment along Doncaster Drive, and a potential alignment through a redeveloped Hillside Mall. Both alignments would take extensive redevelopment to fully daylight the creek. These may require updates to the City of Victoria OCP.

• Alternate Alignment – Through West Side of Hillside Mall

• The mall was recently renovated and thus this is a long term idea. The mall is spread over a large area as suburban malls were in the 1950s and 1960s. As demand for residential housing increases density in the area, it is possible that the mall will redevelop with residential towers as part of a mixed use redevelopment. If this was to happen, the value of a daylighted creek as an amenity may result in a business case for rerouting the creek through the west edge of the mall. The amenity may be a selling feature for adjacent high rise development and be part of the setback between the high density mixed use and the adjacent single family neighbourhood.



- The west edge of the mall along Shakespeare Street is about 2m higher than at the existing trunk on
 Doncaster Drive. As a result, the depth to the creek base would be 2m greater. This can be offset using a
 retaining wall between Shakespeare Street and the mall redevelopment. It is anticipated that the daylighted
 creek would be partially retained but would be naturalized as much as possible to provide aesthetic value
 to the redevelopment.
- This is a very long term strategy that may never materialize but should be considered over time in long term planning exercises. For this reason, this alignment is shown on the maps as an alternate alignment.

• Recommended Alignment - East side of Doncaster Drive

- This alignment follows the existing storm trunk and connects to Reach 16 (branch to Cedar Hill Golf Course).
- The existing trunk is beneath the east sidewalk on Doncaster Drive and/or the east parking lane. Doncaster Drive currently has a single lane plus bike lane in each direction plus parking on either the east or west side. The boulevard, sidewalk and parking lane are about 7 m wide. I narrows to about 4 m where there is no parking lane.
- The 2.4 m by 2.4 m trunk is approximately 3 m deep. Thus, the creek would need to be fully retained in order be daylighted. The sidewalk and parking lane would need to be removed.
- The quality of the daylighting could be greatly enhanced if it was possible to acquire 5 m or more off the adjacent single family lots east of Doncaster Drive. The lots abutting Doncaster Drive are only 15 m wide and thus losing 5 m would result in a very narrow lot. These lots are expected to remain as single family in the short to medium term but with greater demand for density, they could be re-zoned to a 3-storey townhouse in the long term.
- The proposed strategy would be to acquire an additional 5m on the east side of Doncaster Drive over the long term and use the additional space to daylight the creek with partially retained walls.
- A part of this section is adjacent to the Hillside Mall and due to traffic constraints, it is expected that most or all of the space for daylighting would need to come from mall property. The mall was recently renovated so this should be considered a long term strategy.
- Refer to Exhibit 7.5.

Map 7 Doncaster Drive to Browning Gyro Park

REACH 11: DONCASTER DRIVE TO SHELLEY STREET/NORTH DAIRY ROAD

- The recommended alignment for this reach is along the lane between Clawthorpe and Burton Avenues, which extends through the south edge of Clawthorpe Park and crossing North Dairy near the existing creek at Shelley Street. The existing trunk alignment on Clawthorpe has limited space (without redevelopment), driveways on both sides and utility conflicts. It also runs through a private condo site on the north side of North Dairy Road which would be difficult to daylight.
- The existing trunk could be used to accept flows from Reach 16 or the daylighting along Doncaster Drive could extend upstream to future daylighting of Reach 16.



Clawthorpe Park along existing Bowker Creek pipe section

- The recommended alignment would require acquisition of the back of the lots on the south side of Clawthorpe.
 It would also facilitate natural daylighting along the south edge of Clawthorpe Park. All or part of the lot east of the park (1655 North Dairy Road) would need to be acquired to maximize the daylighting and adjacent greenway connection to the daylighted creek and greenway on the north side of North Dairy Road.
- The daylighted section through Clawthorpe Park could look similar to the illustrated cross-section at Fireman's Park, refer to **Exhibit 7.1**.

 This alignment is along a proposed greenway connecting the Doncaster Drive greenway with Bowker Creek greenway north of North Dairy Road.

REACH 12: NORTH DAIRY ROAD/SHELLEY STREET TO BROWNING PARK

Creek is daylighted from Browning Park to Shelley Street/North Dairy Road. Property acquisitions previously identified by BCI for channel improvements and/or walkways will be important.

Trail markings would be beneficial highlighting connecting trails (Bowker signage at Shelley shows the creek but not how to connect with the trail network).



Bowker Creek at Wordsworth Street Multi-use Path

Map 8 Browning Park to Donnelly Avenue

REACH 12: BROWNING PARK TO KNIGHT AVENUE

Creek is daylighted from Browning Park to Shelley Street/North Dairy Road. Property acquisitions have been previously identified by BCI for channel improvements and/or walkways.



Multi-use Path in Browning Park along Bowker Creek

Bowker Creek in Browning Park

Pedestrian bridge over Bowker Creek in Browning Park

REACH 13: KNIGHT AVENUE TO DONNELLY AVENUE

Knight Avenue to Derby Road

- The existing trunk alignment is through the back of the existing lots on the west side of Shelbourne Street. As the ground rises fairly quickly to the east and west, it will be necessary for the daylighted creek to follow the trunk alignment.
- The Shelbourne Valley Action Plan proposes up to 4 storey redevelopments on the lots facing Shelbourne and 2-3-storey townhouses on the lots backing on to them to the west on Browning Street.
- The recommended alignment is along the back of these lots with about a 5 m dedication on each side of the
 property line to provide a 10m corridor for daylighting. The width of dedication should be reviewed to confirm
 that the remnant lots are sufficiently wide to accommodate a 4 storey structure with the required setbacks
 from Shelbourne Street.
- A 10 m easement would provide enough space for a retained creek plus a paved trail. It would also
 accommodate a more natural creek (partially retained) if the pedestrian and cycling used Browning Street as a
 greenway as currently proposed.
- Refer to Exhibit 7.8.



Derby Road to Cedar Avenue

- This section is similar to the section south of Derby Road, except that the trunk shifts closer to Shelbourne Street at the north end. It is currently a church site.
- The site is shown as institutional in the Shelbourne Valley Action Plan.
- The back of the church lot rises to the north near Cedar Avenue and is more than a meter higher than Shelbourne.
- The recommended alignment is to shift to the east within the church site, and daylight between the church building and Shelbourne Street. This would require one row of church parking to be removed. Some of this parking could be replaced by expanding the parking on the north side of the building.
- The creek would need to be fully retained at this location as there is only about 7 m available between the church building and the existing sidewalk. Development of the Shelbourne Street will affect the available space as well.
- It is noted that this section of the trunk is relatively deep at about 5m below grade at Derby Avenue.

Cedar Avenue to Donnelly Avenue

- This short section consists of two single family lots abutting Shelbourne, with the existing trunk located within the Shelbourne Street right-of-way behind the existing sidewalk.
- There is a current redevelopment proposal for this location and the District of Saanich did note in its response to the developer that the Shelbourne Valley Action Plan's policy to integrate the Bowker Creek Blueprint as part of redevelopment proposals. However, due to the depth of the trunk, the District did not believe that it would be advisable to daylight the creek in this location. Instead, staff recommend an increased boulevard for enhanced stormwater management, which would serve as a storm water channel. The proposed cross section incorporates a minimum 3.5 m wide swale with 4:1 slopes, thus the swale would be a maximum of 0.5 m deep.
- This current example illustrates the challenges of relying on narrow dedication during redevelopment to
 achieve full daylighting of the creek. To achieve full daylighting (even with retained walls), it would have likely
 been necessary for the municipality to purchase some additional right-of-way, especially in areas where the
 existing trunk is relatively deep.
- It is recommended that the alignment shift to the east side of Shelbourne Street for this section.

Map 9 Donnelly Avenue to Broadmead Avenue/Kisber Avenue

REACH 13: DONNELLY AVENUE TO BROADMEAD AVENUE/KISBER AVENUE

Donnelly Avenue to Pear Street

- The trunk shifts to the east side of Shelbourne for this section and runs along the back of 3 commercial properties. These properties appear to have been developed in the past 20-30 years and include a gas station and 1 to 2-storey commercial buildings.
- The trunk alignment is slightly lower than Shelbourne Street and thus the back of lots would be the recommended alignment for daylighting.
- Based on the approximate age and height of the buildings, it is probable that these sites will redevelop in the medium term (20 to 50 years). The Shelbourne Valley Action Plan allows for up to 4storey commercial development at this location.



Shelbourne Street looking north at Donnelly Avenue – potential for daylighting along back of these commercial buildings if they redevelop

• Daylighting should be incorporated into future redevelopment, although the municipality may need to acquire part of the daylighting width. The current lot depths are about 35 m.

Pear Street to Cedar Hill Cross Road - Shelbourne Plaza

- The trunk runs north south through the existing Shelbourne Plaza shopping centre, from about 20 m east of Shelbourne Street at the south end to adjacent to the street at the north end.
- The existing mall is one storey with surface parking along Shelbourne Street. The Shelbourne Valley Action Plan allows for redevelopment of up to six storeys of commercial or mixed-use development. Most of the existing mall appears to be 50 years old and thus redevelopment may take place sooner than other areas along Shelbourne Street, which have developed more recently. There are newer single storey commercial developments immediately south of Cedar Hill Cross Road and east of Shelbourne Street.



Shelbourne Street north of Pear Street – Existing mall can be redeveloped to 4 to 6 storeys

- This location is an excellent opportunity to integrate a daylighted Bowker Creek into a commercial/mixed-use development as an amenity. There is sufficient space to a wider daylighted creek with nominal retaining walls as the trunk is generally less than 2m deep.
- Refer to Exhibit 7.4.

Cedar Hill Cross Road to Broadmead Avenue/Kisber Avenue

- This section is very similar to the section south of Cedar Hill Cross Road (Shelbourne Plaza) with the trunk being close to Shelbourne Street and about 2m deep. The existing commercial development is single storey and is also planned for up to 6 storeys in the Shelbourne Valley Action Plan. The primary difference is that this site has been recently redeveloped and thus further redevelopment would likely be in the medium to long term.
- Daylighting should be incorporated into future (medium to long term) redevelopment, near or along the existing Bowker Trunk. Due to the proximity to Shelbourne Street, a retained creek section will be necessary.

Map 10 Broadmead Avenue/Kisber Avenue to Garnet Road

REACH 13: BROADMEAD AVENUE/KISBER AVENUE TO GARNET ROAD

Broadmead Avenue/Kisber Avenue To Christmas Avenue

- The trunk switches to the west side of Shelbourne Street for this section and runs in front of a commercial lot (Maude Hunter's Pub) and a two storey multifamily development. This site is planned for up to a 4 storey commercial or mixed use development according to the Shelbourne Valley Action Plan.
- It is proposed to daylight the creek along the existing trunk as these lots redevelop, likely over the medium term.
- The existing trunk is about 3m deep so the daylighted creek will need to be at least partially retained.



Christmas Avenue to Mortimer Street

- The trunk currently runs along the back driveway and parking area of three multi-family buildings ranging from 2 to 3 storeys. The trunk is about 3m deep and could be daylighted on its current alignment with the driveway/parking lots.
 Approximately 40 parking stalls would need to be removed to facilitate daylighting.
- At the south end, the alignment could be shifted slightly to the west to the green space adjacent to Ophir Street (1544 Christmas Avenue). It is understood that the District of Saanich recently approved a development on this lot, so this is no longer a viable option. As a result, daylighting would need to be immediately east of this lot at the back of the apartment site.



Existing parking lot south of Mortimer Street along existing Bowker Creek pipe alignment

- The central portion (south of Earlston Avenue) would require either a row of parking stalls from the apartment complex or acquiring part of a residential lot to the west (1537 Earlston Avenue).
- At the north end this section is through the middle of a large parking area which appears to be a part of the
 apartment building to the south. Shifting the daylighting to the west may be challenging based on the size of
 the parking lot. It may be possible to negotiate with the apartment owners for an easement in exchange for a
 relaxation of the parking requirements. It may also be possible to do a land swap for any nearby municipally
 owned land.
- The central and north sections would likely be retained cross-sections in order to minimize the land acquisition needed.
- It should be noted that a greenway is proposed for just west of the proposed daylighting alignment (about 2 lots west). Consideration was given to shifting the daylighting west, but the ground rises to the west and the creek would need to be about 2 m deeper than the current alignment. Thus, it is recommended that the greenway be shifted east if possible, to align with the proposed daylighting.

Mortimer Street to Shelbourne Street & Stockton Avenue

- The trunk runs behind (west of) a 3 story condo and then under another 3-storey condo before crossing Shelbourne Street near Stockton Avenue. The portion behind the existing condo is largely within a gated parking area. The Shelbourne Valley Action Plan proposes up to 4 storeys of residential development adjacent to Shelbourne Street, but this site is unlikely to redevelop in the short or medium term given the relatively new 3-storey condos that currently existing.
- Shifting the daylighting alignment to the west is not practical as the ground rises quickly in that direction. The lots east of Stockton are currently single family and are also proposed for up to 4-storey residential but are not deep enough to accommodate 4 storeys plus a dedicated easement for daylighting.
- The recommended alignment is to follow Mortimer Street to Shelbourne Drive and then the east side of Shelbourne Drive.
- The short section on Mortimer Street would need to be retained and may have to be piped as Mortimer Street is currently has bike lanes and is proposed to be a greenway.
- On the east side of Shelbourne there are 5 single family lots that appear to be 50+ years old that can be redeveloped at up to 4 storeys according to the Shelbourne Valley Action Plan. There is a very good chance that these lots will redevelop in the short term and acquiring an alignment for daylighting as part of the redevelopment is important.

Shelbourne Street and Stockton Avenue to Garnet Road East of Shelbourne

- The trunk runs under a condo building and behind another condo building in this section. These condo buildings are relatively new and are 3 storeys tall, thus are unlikely to redevelop in the short or medium term.
- The recommended alignment is along the back of the condo lots. If this is not feasible, the alternate alignment is along the front of the lots on the east side of Shelbourne Street and Garnet Road. This would require a minimum of 3-5 m land fronting Shelbourne Street and Garnet Road to be acquired. The condos are currently set back about 7 m from the sidewalk on Garnet and 9m on Shelbourne. This may require removing street parking along Garnet Road.

Map 11 East of Shelbourne Street to Ansell Road

REACH 14: EAST OF SHELBOURNE STREET TO ANSELL ROAD

- The trunk crosses Garnet Road about 100 m east of Shelbourne Street and then runs east between McKenzie
 Avenue and Garnet Road. The alignment is generally along the back of the single family lots on Garnet or the
 back of the apartment or condo properties on McKenzie. Further east, the trunk crosses between single family
 lots on Emerald Place and on Ansell Road.
- The Shelbourne Valley Action Plan allows for 4 and 6 storey mixed use and commercial along McKenzie near Shelbourne, and 4-storey residential along McKenzie east towards Emerald Place. The Action Plan proposes 2-3-storey townhouses on the back of these lots to transition to the single family lots on Garnet Road to the south. No changes are proposed for the single family lots on Garnet.
- The existing apartment and condo developments along McKenzie are fairly recent (less than 30 years old) and are close to the allowable heights in the Action Plan. The only exception is the east end towards Emerald where the existing condos are 2-storey for the entire depth of the lot. As a result, the multi-family buildings along McKenzie have a low likelihood of redeveloping in the short to medium term.
- The single family homes on Emerald Place and Ansell Road may redevelop over time if higher densities are allowed.
- The best opportunity for daylighting will likely be for the District of Saanich to acquire a 5-10 m easement along the back of the residential lots on Garnet. These lots are about 42m (140 ft.) deep and 21 m (70 ft.) wide, so there would still be a reasonably large lot remaining even with a 10m easement taken off the back. This can be done over time by having the District or the BCI acquire the lot, subdivide or register an easement, and re-sell the lot. This strategy will minimize the land acquisition costs significantly.
- The District of Saanich should consider updating its OCP to allow redevelopment of the lots north of Garnet Road as a way to facilitate Bowker Creek daylighting.
- Refer to Exhibit 7.6.
- A similar strategy is proposed for the lots on Emerald Place and on Ansell Road, except that the land
 acquisition would be the sides of the lots. Unfortunately, taking a few meters off the side of these lots would
 require the existing homes to be removed. These lots are slightly smaller but could be redeveloped as two
 storey single family lots. This may require changes to the zoning rules to allow for large single family homes
 within a narrow lot.
- Refer to Exhibit 7.7.
- The existing trunk is 3-4 m depth in this area and the daylighted creek would have to be retained or partially retained even if a 10 m wide right-of-way was available. A 10 m wide right-of-way would allow for a pedestrian/cycling trail adjacent to the creek. The benefit of a trail adjacent to the daylighted creek needs to be considered. It would be a valuable amenity, but the quality of the amenity is reduced when the total right-of-way is narrow (10 m or less) and the creek is 3-4 m deep and fully retained.



Map 12 Ansell Road to University of Victoria

REACH 14: ANSELL ROAD TO GORDON HEAD ROAD

 The section between Ansell Road and Gordon Head Drive is essentially the same as that described above from Emerald Place to Ansell Road, with newer low rise condos along McKenzie Avenue and single family homes adjacent to the trunk at Ansell, Jade Place and Gordon Head Road.

REACH 15: UNIVERSITY OF VICTORIA TO GORDON HEAD DRIVE

- Bowker Creek now originates at wetland immediately north of the University Club, draining more than half of the University of Victoria. The open creek drains northwest to Gordon Head Drive through heavily vegetated forest and wetland area. The creek enters storm trunk at Gordon Head approximately 100m south of McKenzie Avenue.
- Stormwater management should be provided immediately upstream of the connection to the stormwater sewer system on Gordon Head Drive.

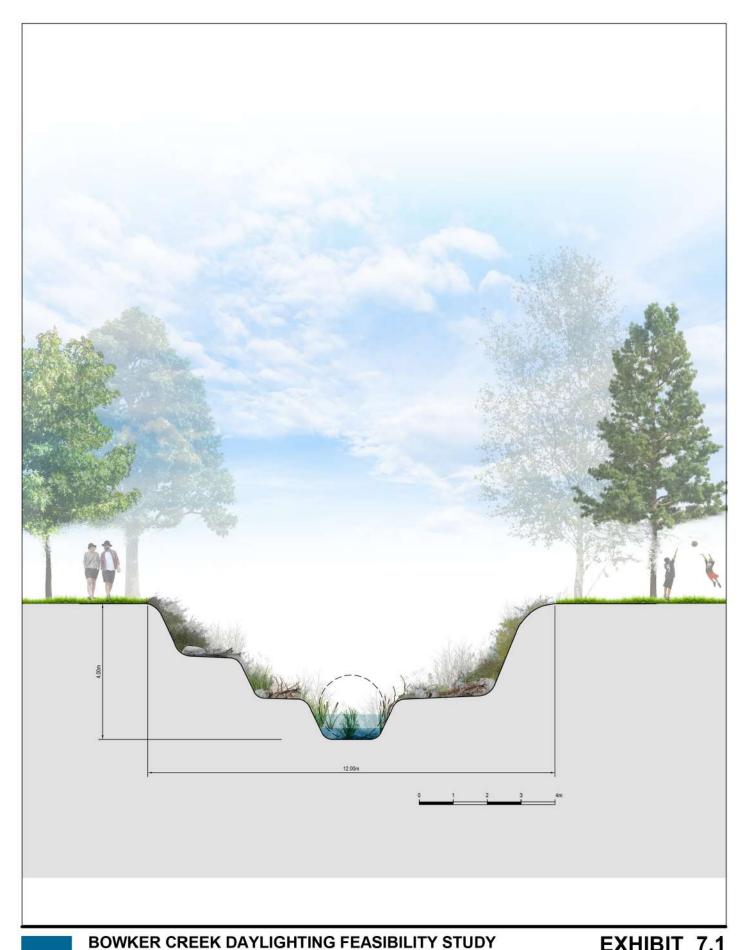


Bowker Creek in University of Victoria Campus

Map 13 Cedar Hill Golf Course to Doncaster Drive & Clawthorpe Avenue

REACH 16: CEDAR HILL GOLF COURSE TO DONCASTER DRIVE & CLAWTHORPE AVENUE

- The recommended alignment for daylighting is on the north side of North Dairy Road from Cedar Hill Road.
 There are 3 single family lots north of North Dairy that would have to be acquired, along with a multi-family
 building. About 5-10 m would need to be acquired to facilitate daylighting, either via an easement or by
 acquiring, subdividing and selling the remnant lot.
- Some local water mains and sanitary sewers may need to be relocated to facilitate daylighting, depending on the width of right-of-way obtained.
- The sub-trunk draining the golf course is about 3-4 m deep and the creek would need to be retained in order to minimize the land acquisition requirements.
- The lots on the east side of Doncaster Drive at Clawthorpe Avenue would also need to be acquired to facilitate daylighting.



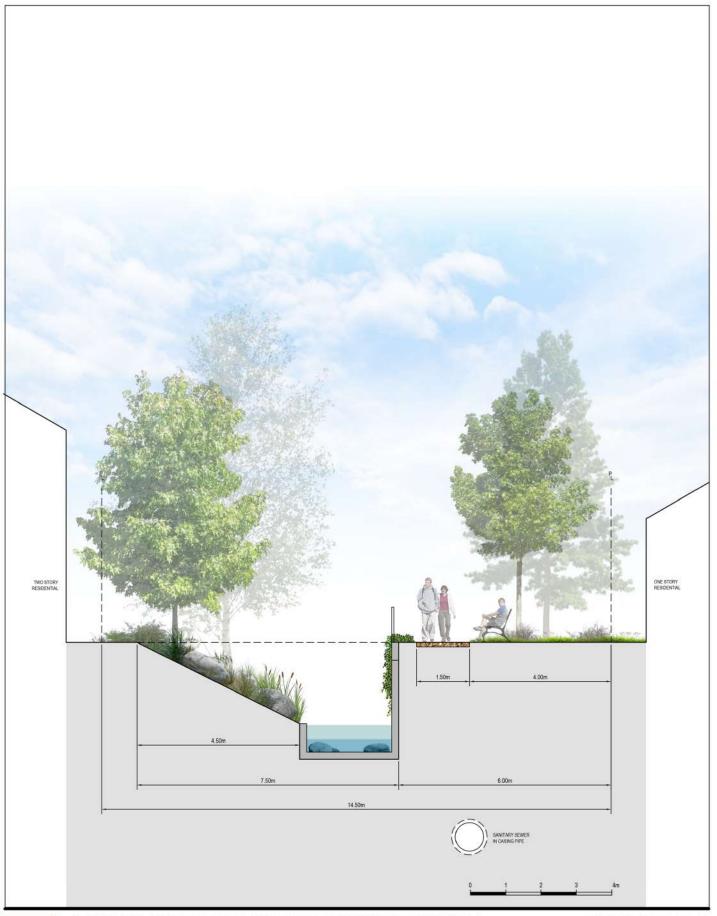


EXHIBIT 7.3

2020-02-21

BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY ILLUSTRATED CROSS-SECTIONS DONCASTER GREEN



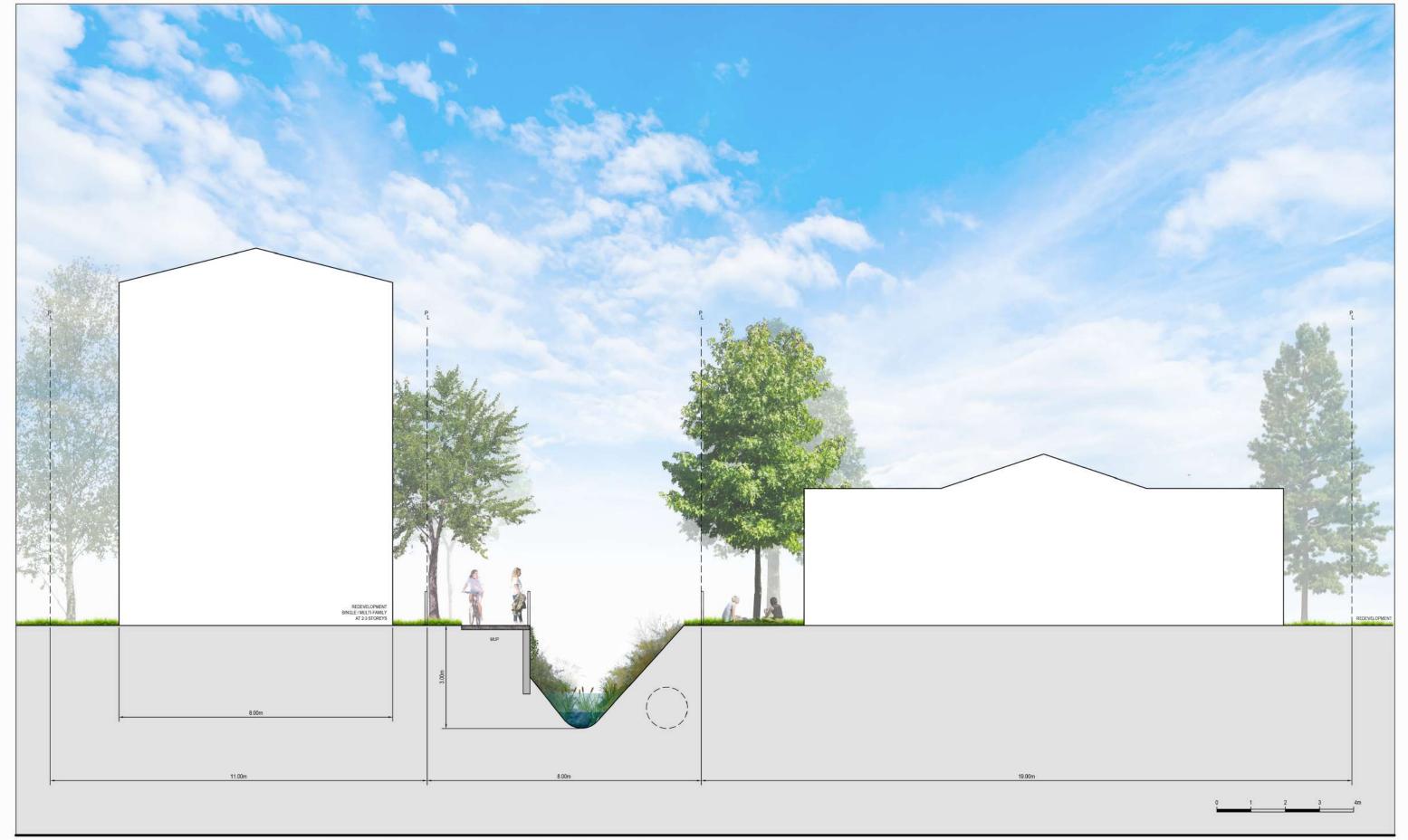




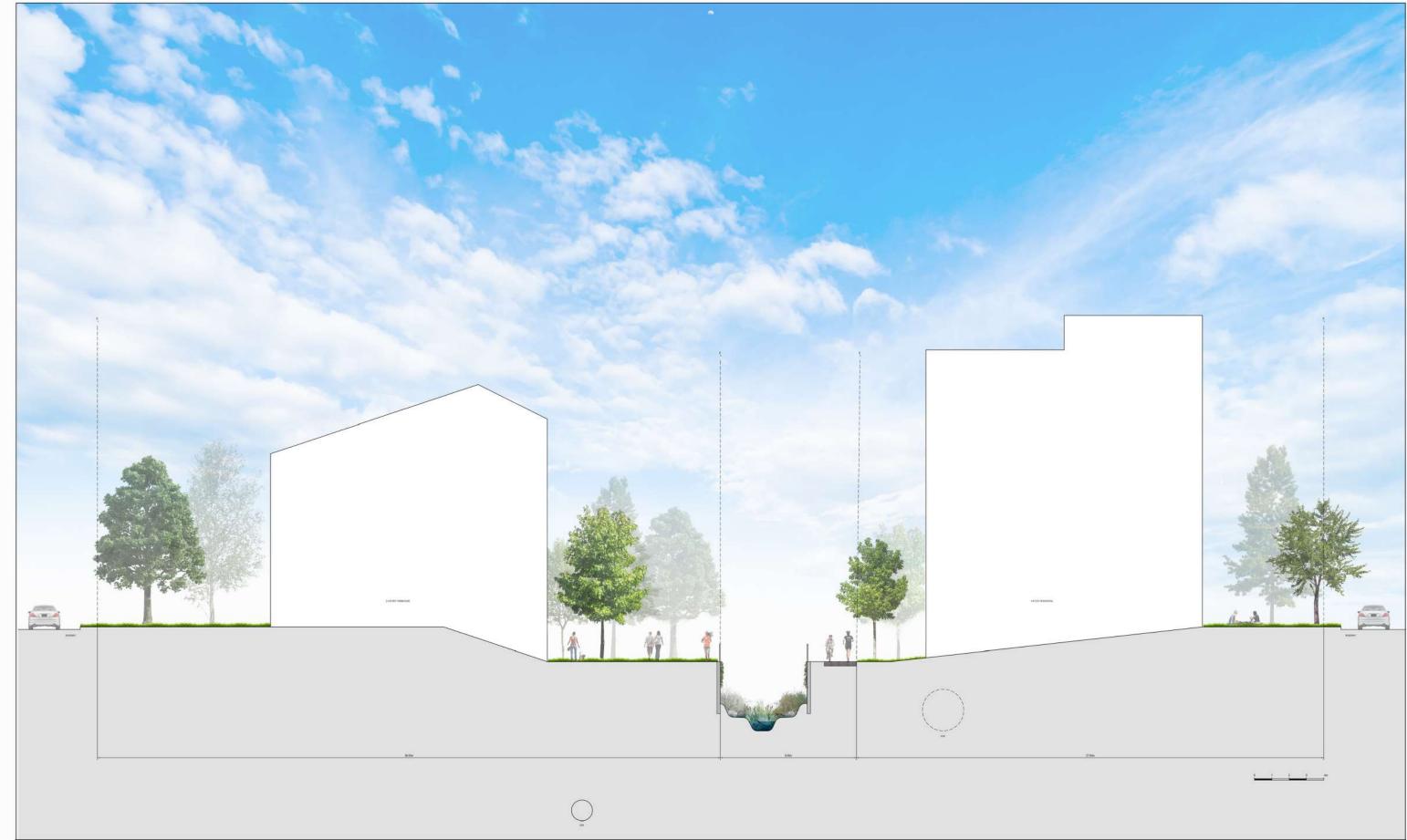




EXHIBIT 7.6







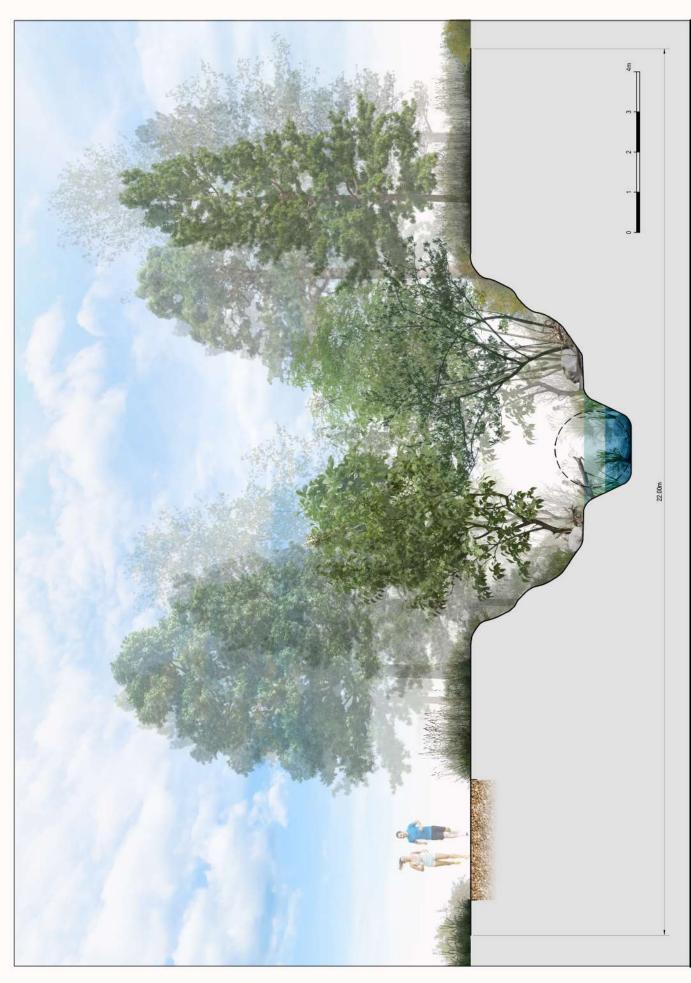


BOWKER CREEK DAYLIGHTING FEASIBILITY STUDY
ILLUSTRATED CROSS-SECTIONS
URBAN REDEVELOPMENT OF LOTS

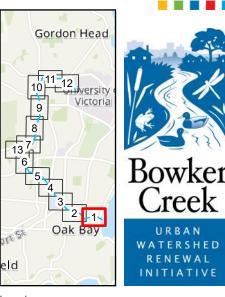
EXHIBIT 7.8 32297 2020-02-21













Bowker Creek Alignment

Underground

Open Channel
Alignment Options
- Daylighted Creek Recommended Alignment

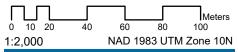
New Pipe

Green Way
Proposed

Existing

--- Contour - 1m Property
Property

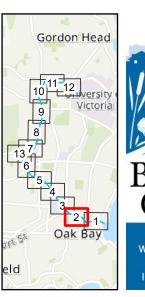
Credits: CRD, ESRI



URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
1 OF 13









Bowker Creek Alignment

Underground Open Channel

Alignment Options

- Daylighted Creek Alternate Alignment

Daylighted Creek Recommended Alignment

New Pipe

Green Way -- Proposed

Existing

Contour - 1m

1:2,000

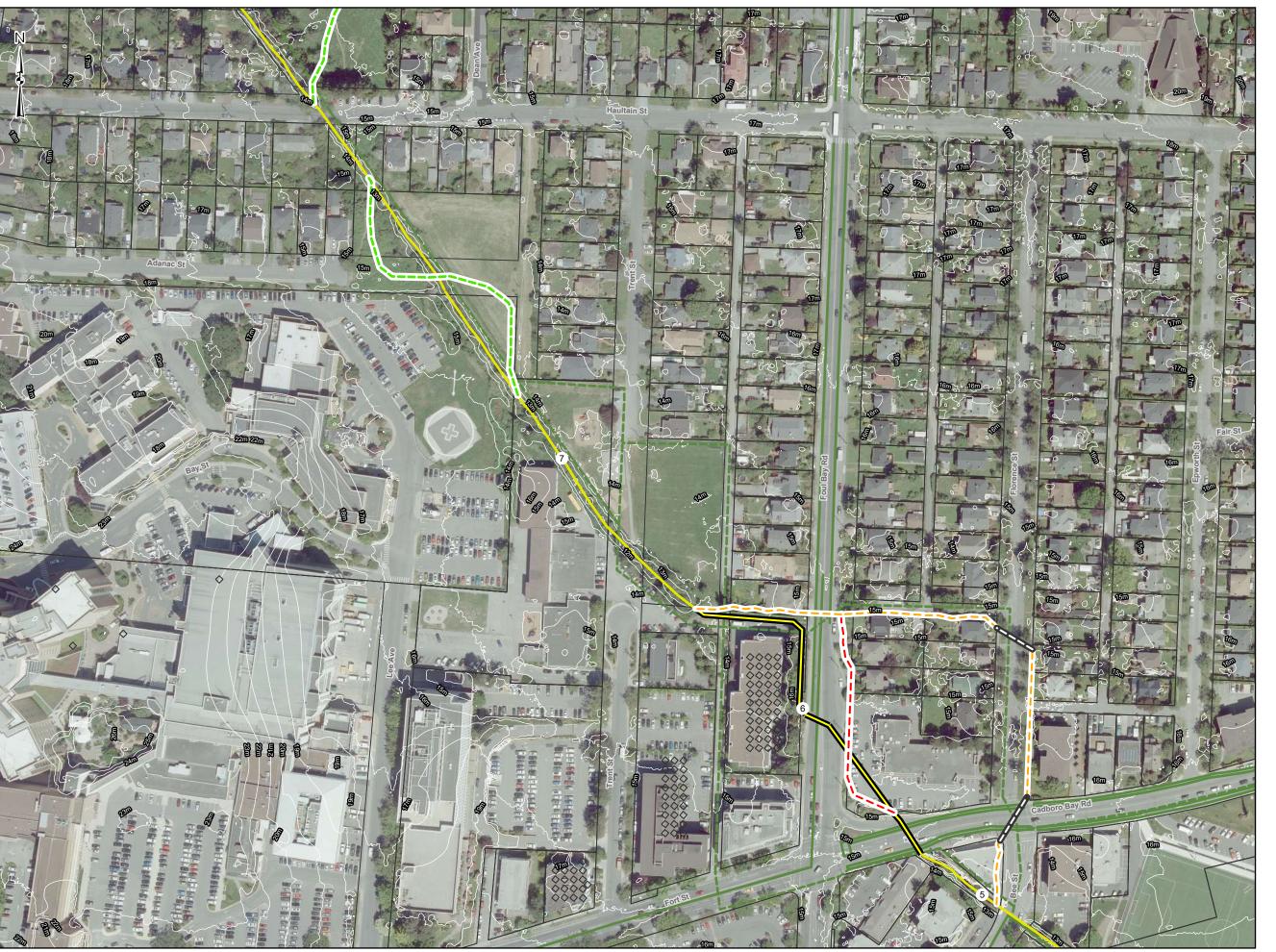
Property
Property

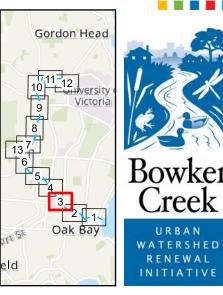
NAD 1983 UTM Zone 10N

Credits: CRD, ESRI

URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
2 OF 13







Bowker Creek Alignment

Underground Open Channel

Alignment Options

Daylighted Creek Alternate Alignment

Daylighted Creek Recommended Alignment

New Pipe

-- Realignment of Existing Creek

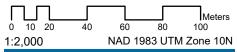
Green Way

-- Proposed Existing

Contour - 1m

Property Property

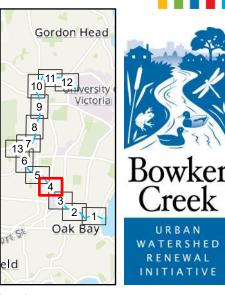
Credits: CRD, ESRI



URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
3 OF 13







Bowker Creek Alignment

Underground Open Channel

Alignment Options

- Daylighted Creek Recommended Alignment

New Pipe

-- Realignment of Existing Creek

Green Way

-- Proposed

Contour - 1m

Property
Property

Credits: CRD, ESRI

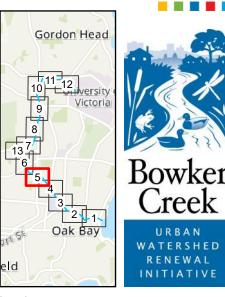
NAD 1983 UTM Zone 10N 1:2,000

URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING

MAP 7.1
ALIGNMENT RECOMMENDATIONS
4 OF 13







Bowker Creek Alignment
Underground

Open Channel
Alignment Options
- Daylighted Creek Recommended Alignment

-- Realignment of Existing Creek

Green Way
Proposed

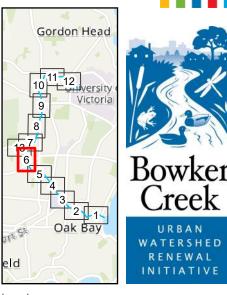
Contour - 1m

Property Property

Credits: CRD, ESRI NAD 1983 UTM Zone 10N 1:2,000 URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
5 OF 13







Bowker Creek Alignment
Underground
Alignment Options
Daylighted Creek Alternate Alignment
Daylighted Creek Recommended Alignment

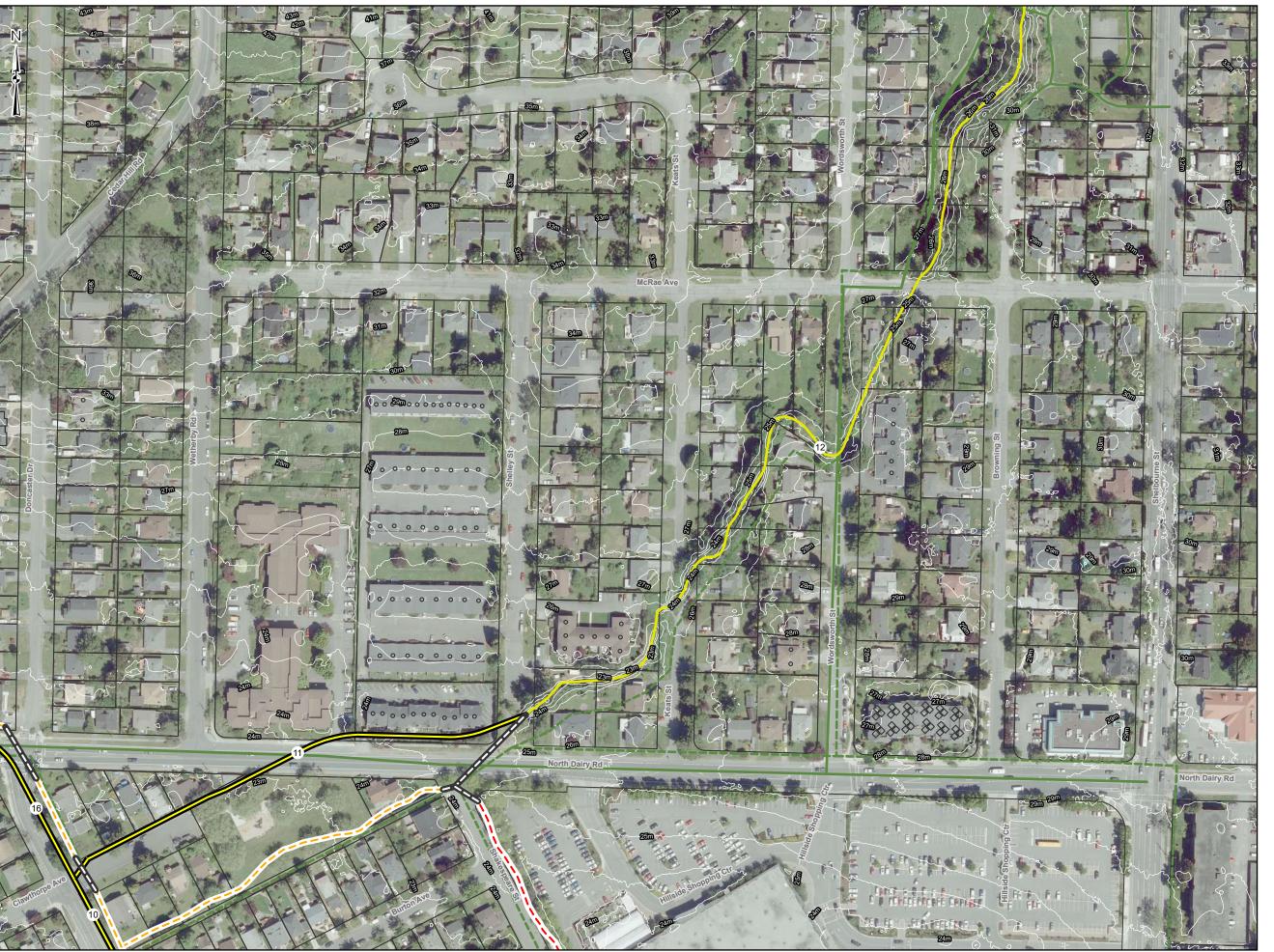
New Pipe Green Way
Proposed

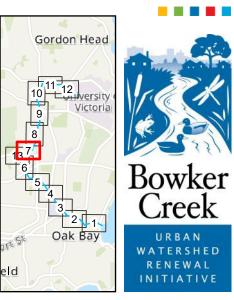
Contour - 1m

Property
Property

Credits: CRD, ESRI NAD 1983 UTM Zone 10N 1:2,000 URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
6 OF 13







Bowker Creek Alignment

Underground

Open Channel
Alignment Options
- Daylighted Creek Alternate Alignment

Daylighted Creek Recommended Alignment

New Pipe

Green Way -- Proposed

Existing

Contour - 1m

Property
Property

Credits: CRD, ESRI

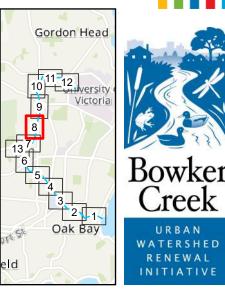
NAD 1983 UTM Zone 10N

1:2,000 URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING

MAP 7.1
ALIGNMENT RECOMMENDATIONS
7 OF 13







Bowker Creek Alignment

Underground

Open Channel
Alignment Options
- Daylighted Creek Recommended Alignment

New Pipe

Green Way
Proposed

Existing

Contour - 1m

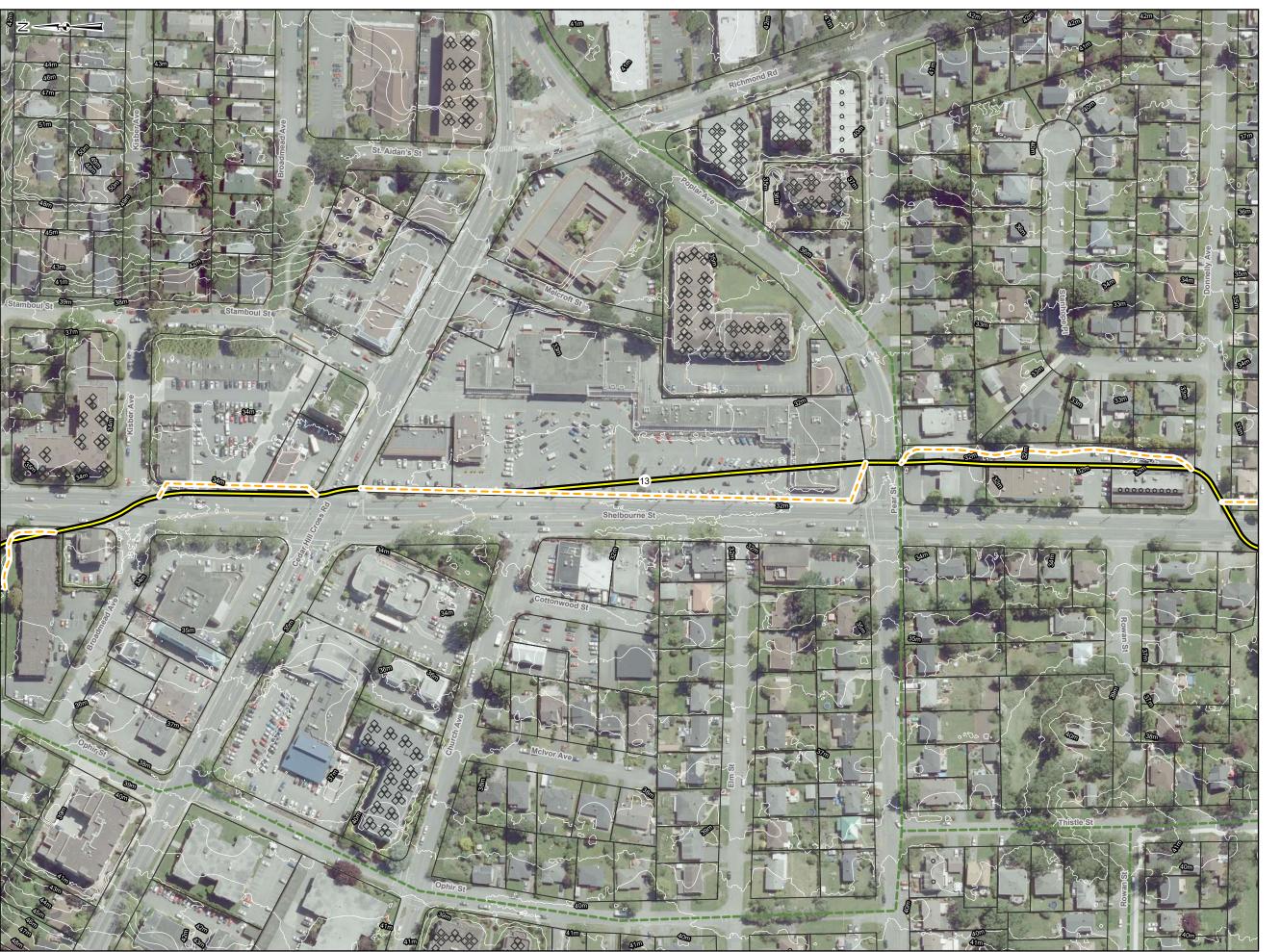
Property
Property

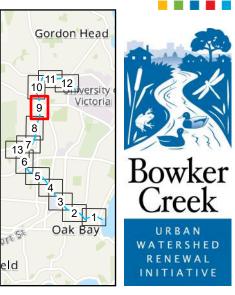
Credits: CRD, ESRI

NAD 1983 UTM Zone 10N 1:2,000

URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
8 OF 13







Bowker Creek Alignment
Underground

Alignment Options

Daylighted Creek Recommended Alignment

New Pipe Green Way

-- Proposed

Contour - 1m

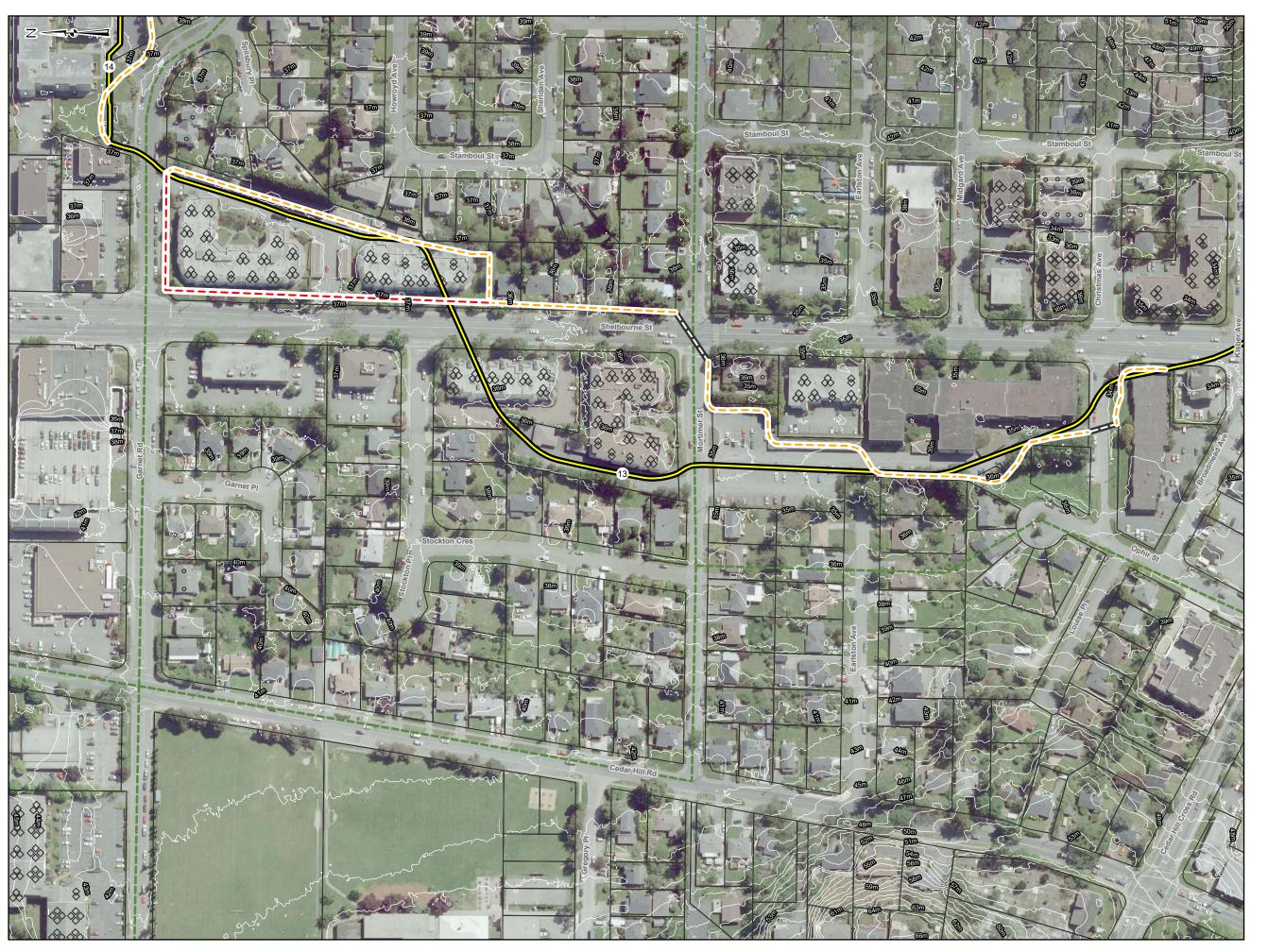
Property
Property

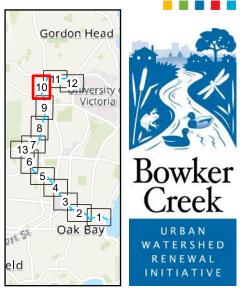
Credits: CRD, ESRI

NAD 1983 UTM Zone 10N 1:2,000

URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1 ALIGNMENT RECOMMENDATIONS 9 OF 13









Bowker Creek Alignment

Underground Alignment Options

Daylighted Creek Alternate Alignment

Daylighted Creek Recommended Alignment

URBAN

RENEWAL

New Pipe

Green Way
Proposed

Contour - 1m

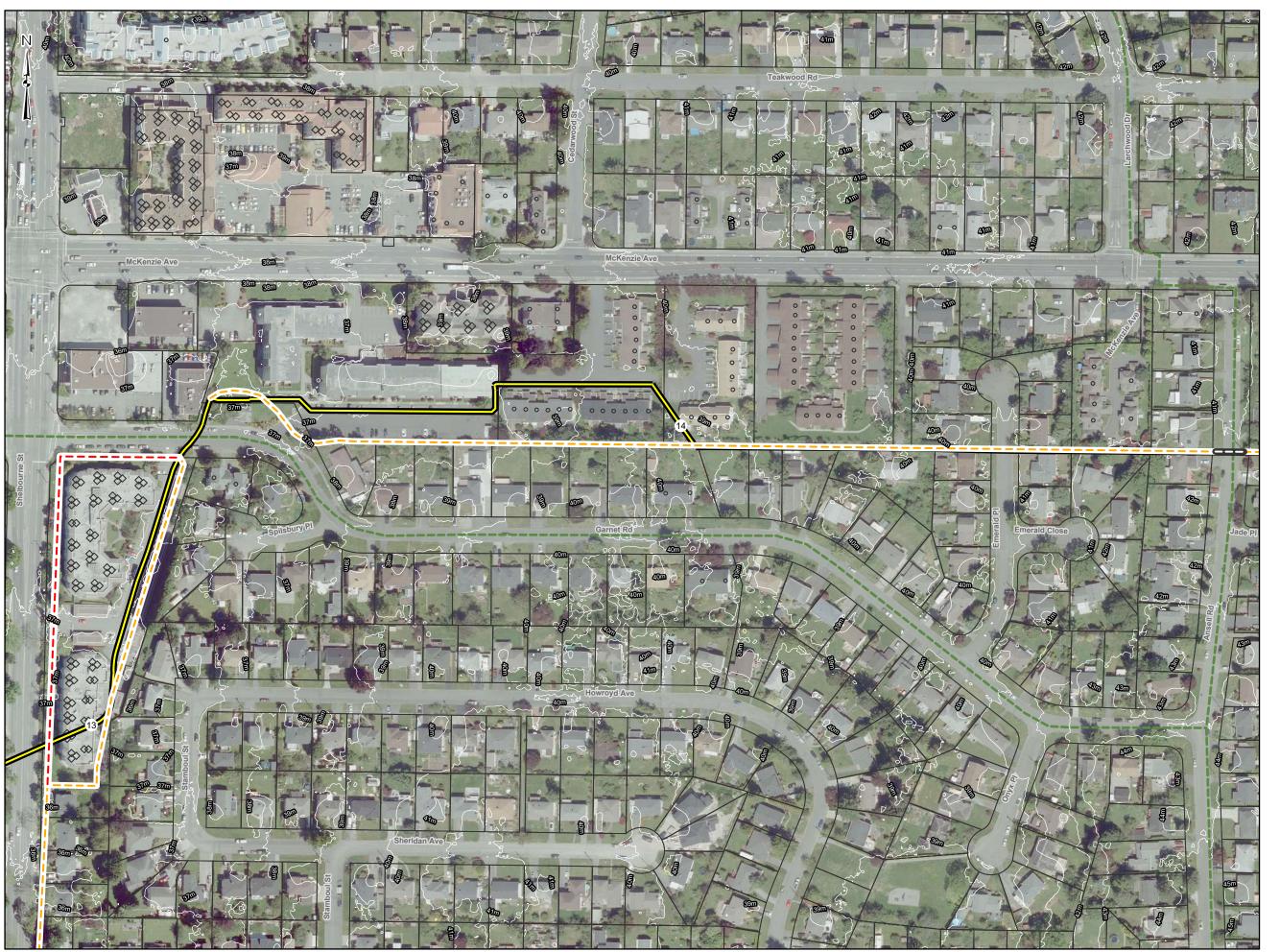
1:2,000

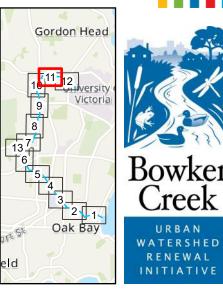
Property Property

NAD 1983 UTM Zone 10N URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
10 OF 13

Credits: CRD, ESRI







Bowker Creek Alignment

Underground Alignment Options

Daylighted Creek Alternate Alignment

- - Daylighted Creek Recommended Alignment

New Pipe Green Way

-- Proposed

Contour - 1m

Property Property

Credits: CRD, ESRI NAD 1983 UTM Zone 10N 1:2,000 URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS 11 OF 13









Bowker Creek Alignment
Underground

Open Channel
Alignment Options
Daylighted Creek Recommended Alignment
New Pipe

Green Way
Proposed

Contour - 1m

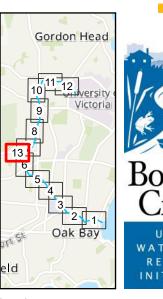
1:2,000

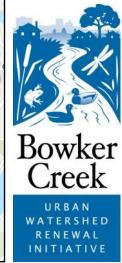
Property Property

Credits: CRD, ESRI NAD 1983 UTM Zone 10N URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1 ALIGNMENT RECOMMENDATIONS 12 OF 13









Bowker Creek Alignment
Underground

Open Channel
Alignment Options
- Daylighted Creek Alternate Alignment

Daylighted Creek Recommended Alignment

New Pipe Green Way

-- Proposed

Existing

Contour - 1m

Property
Property

Credits: CRD, ESRI

NAD 1983 UTM Zone 10N 1:2,000

URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING MAP 7.1
ALIGNMENT RECOMMENDATIONS
13 OF 13



■ 8.0 Next Steps/Recommendations

The following is a brief summary of the recommended next steps needed to continue to daylight Bowker Creek:

Land Use Planning

- Track all lots along daylighting corridor for either acquisition or for negotiating during redevelopment.
- Exchange height for daylighting ROW during redevelopment.
- Acquire additional ROW width during redevelopment through negotiating.
- Require developers to provide a nominal amount of land for daylighting (typically 2-5 m) similar to roadway dedication.
- Consider relaxing setback distances and/or put daylighting on private property (with registered easement) within typical set back distances.
- Acquire lots as they come up for sale and subdivide to create a ROW for daylighting; re-sell remnant lot (shallower or narrower) to recoup most of acquisition costs.
- Develop land use policies for lot size (narrow), building floor area ratio, etc. to facilitate development of the remnant parcels (e.g. skinny homes).
- Approach homeowners directly regarding selling a ROW or easement on their property for daylighting.
- Consider revising land use plans to allow for densification along the Bowker Creek alignment (e.g. Florence St in Oak Bay; Pearl St and Doncaster Drive in Victoria; Garnet Road in Saanich).
- Consider approaching owners of Hillside Mall about their long-term redevelopment plans and potential for daylighting on west side of the property.

Engineering

- Investigate the feasibility of partial daylighting Bowker Creek, in particular between North Dairy Road and Hillside Avenue.
- Continue to monitor rainfall and stormwater flows in Bowker Creek for future model re-calibration.
- Update and refine the stormwater model to include larger tributaries.
- If UVic is open to a SWMF in the northwest part of campus, refine the hydrologic and hydraulic model to illustrate the impacts on both the UVic campus and the downstream Bowker Creek system.
- If the GVSD is open to a dry pond on the Lansdowne Middle School site, develop a more detailed dry pond
 concept and conduct detailed hydraulic analysis to illustrate the frequency of stormwater impacting playing
 fields
- Consider developing a two-dimensional model of the Bowker Creek system, especially in the downstream reaches to understand the current flood risk and develop a range of options for flood mitigation.
- Monitor municipal assets adjacent to and above the existing Bowker Creek piped sections and look for
 opportunities to integrate daylighting into asset management plans. An example of this would be the future
 replacement of the tennis bubble at the Oak Bay Recreation Centre.

Parks

- Integrate Bowker Creek daylighting into future redevelopment plans for Fireman's Park.
- Continue to acquire parkland along the recommended Bowker Creek daylighting corridor as opportunity arises.



Stakeholder Engagement

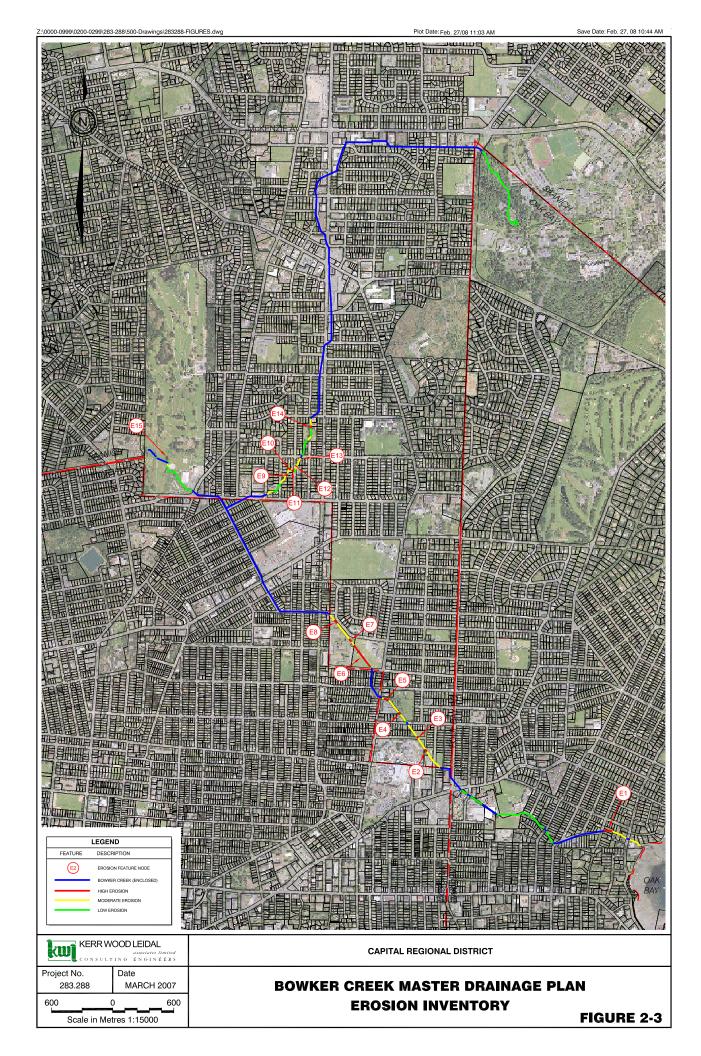
• Engage First Nations on all future daylighting opportunities.

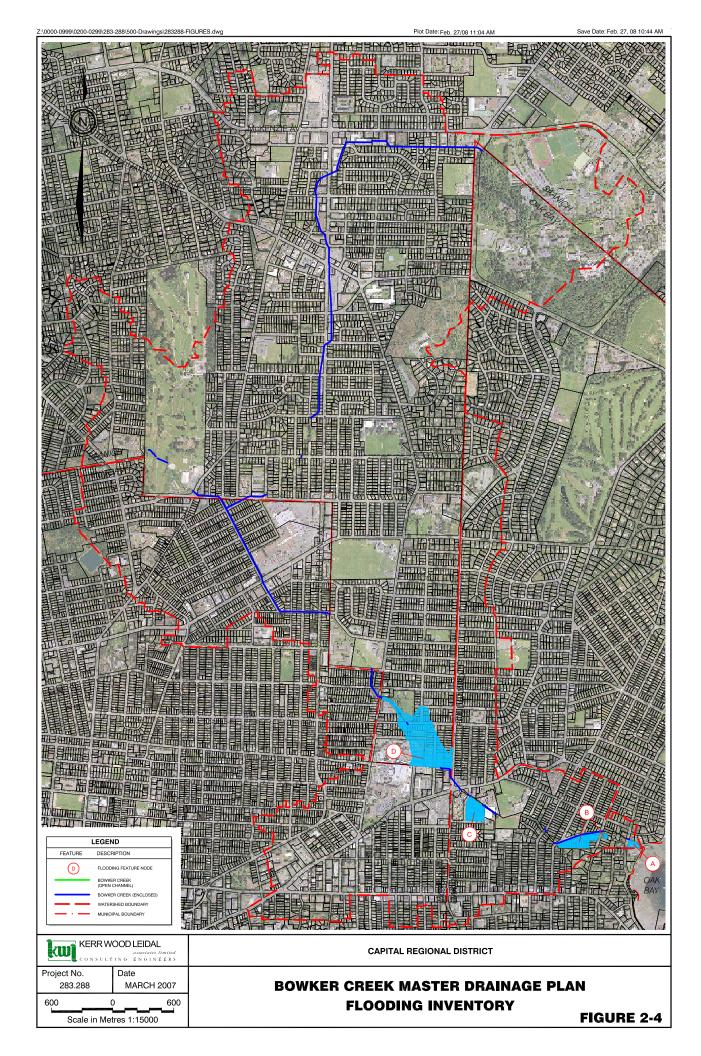
Funding

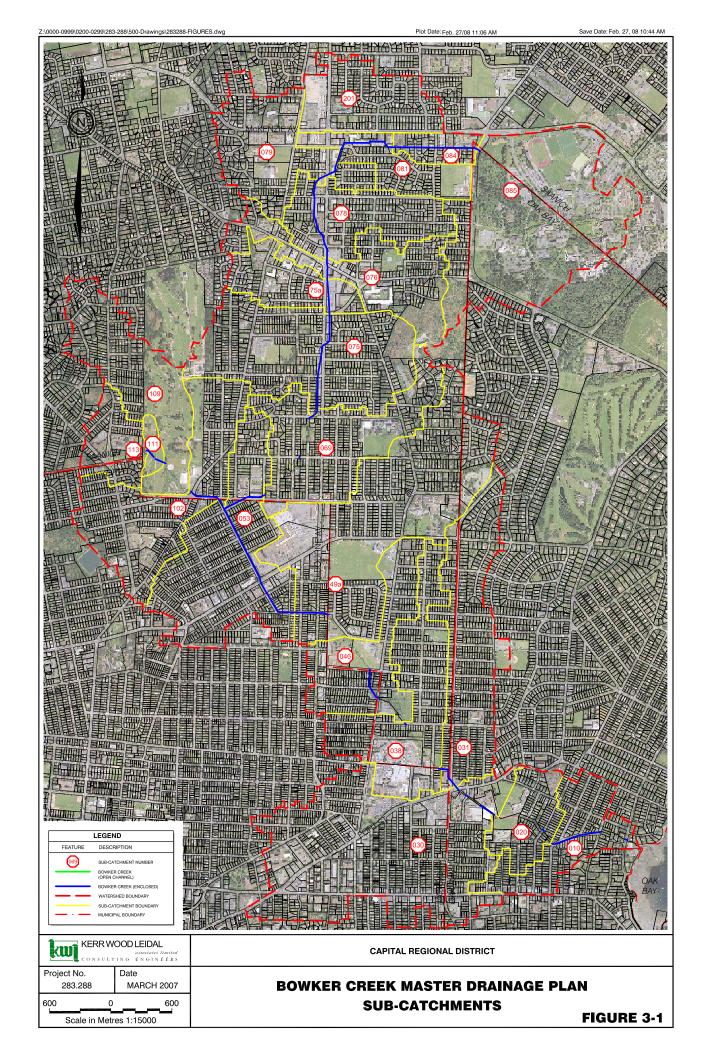
- Pursue funding opportunities to develop SWMF at Richmond School and 2661 Richmond Road.
- Victoria, Saanich and Oak Bay, with support from the CRD and BCI, should seek long term funding
 opportunities to address the existing flood risks along Bowker Creek. They should also seek funding for
 stormwater upgrading to adapt for the increase in flood risk associated with climate change.



APPENDIX MDP Excerpts





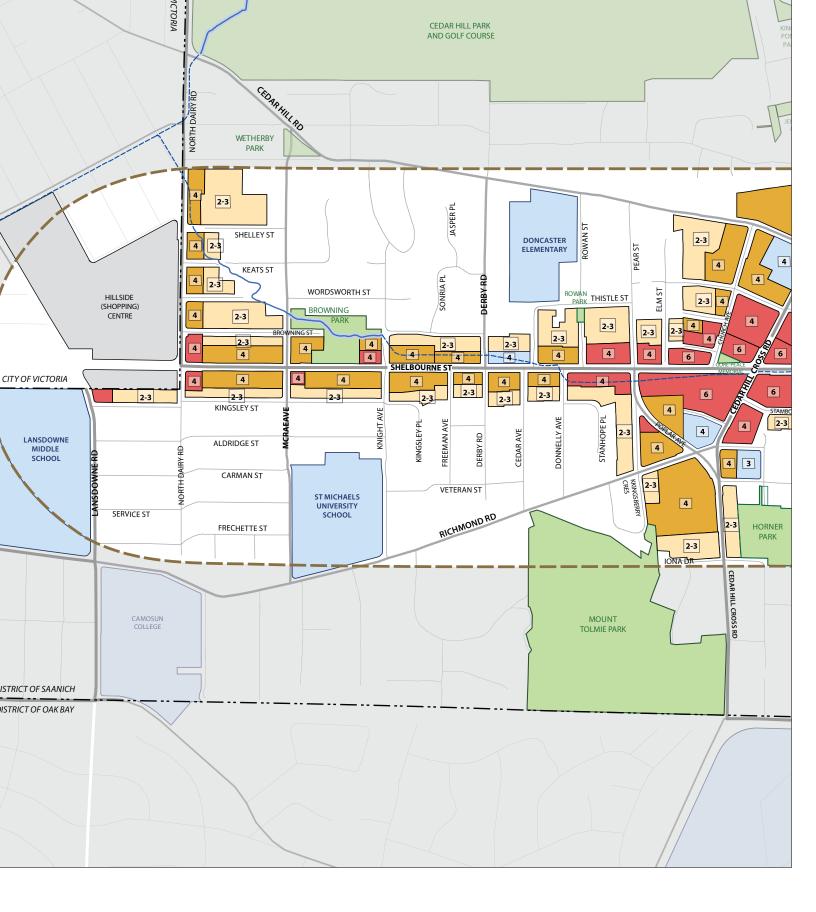




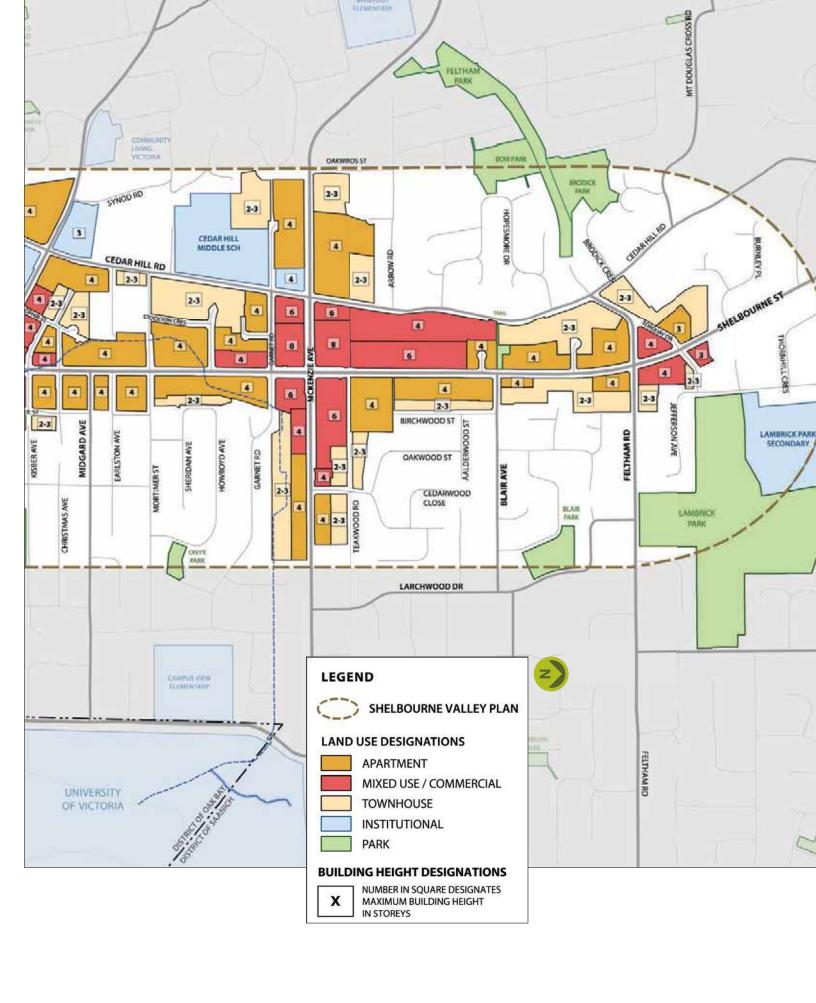


APPENDIXShelbourne Valley Exerpts

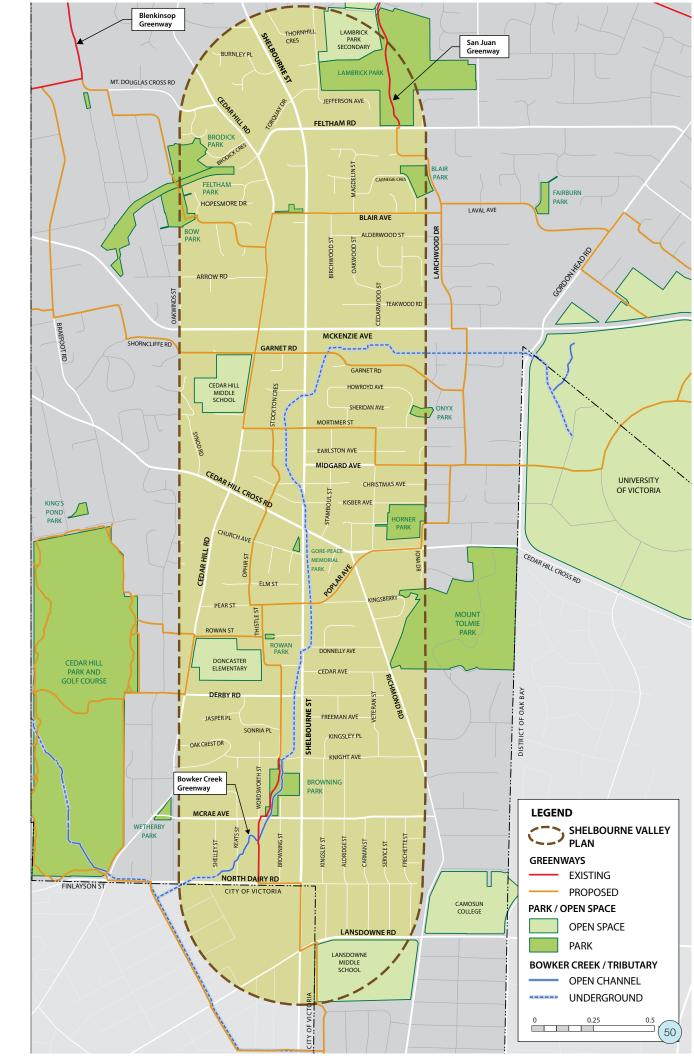
В



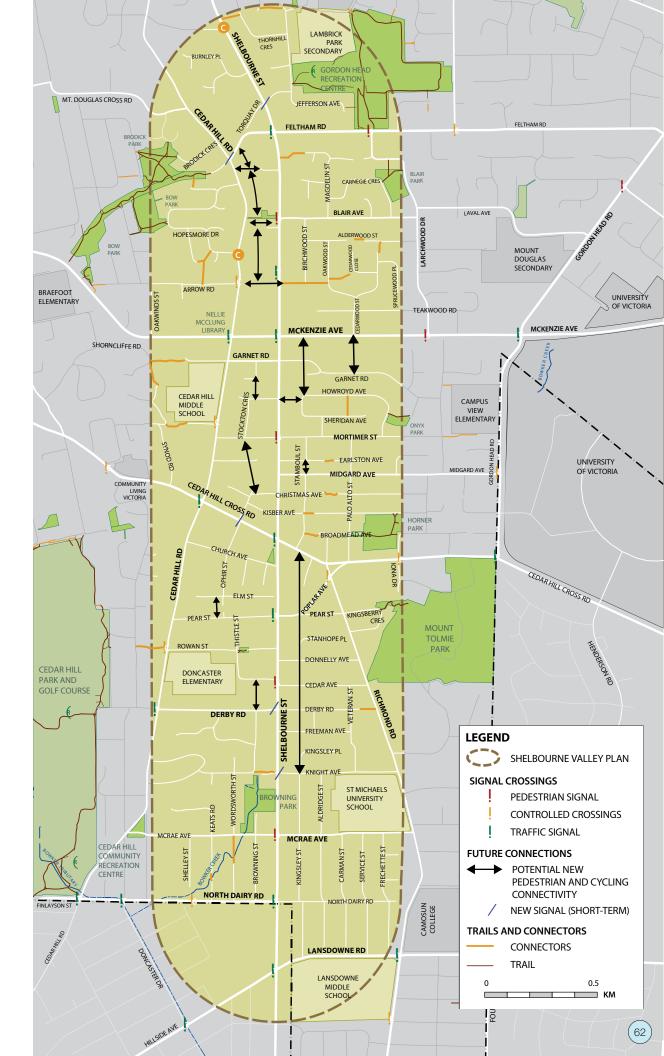
Map 5.1 | Land Use and Building Height Designations







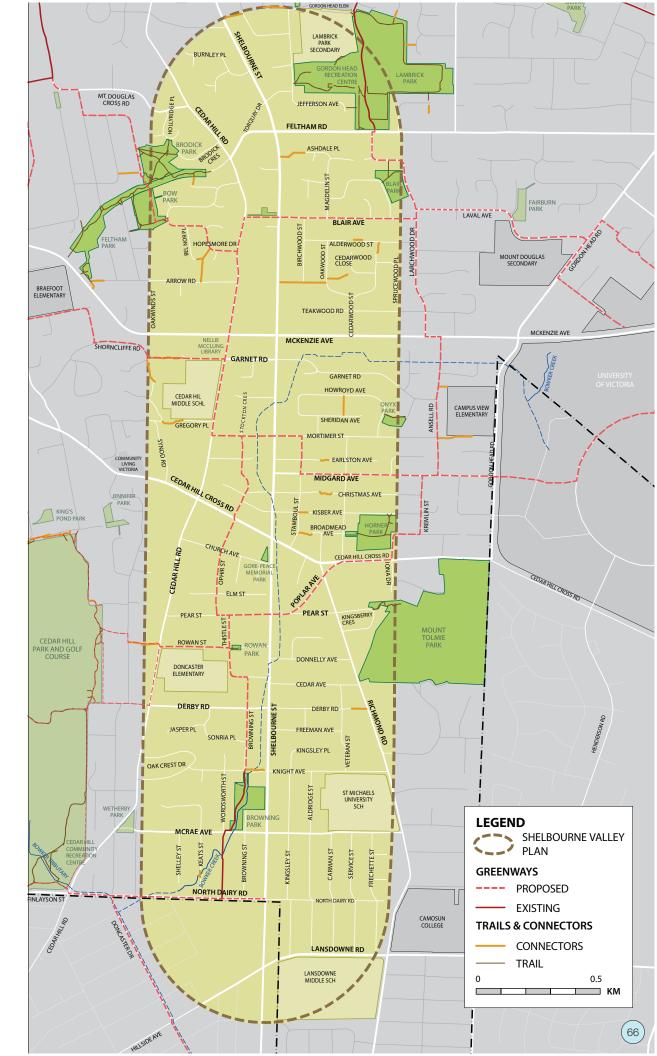












Shelbourne Street Cross Sections

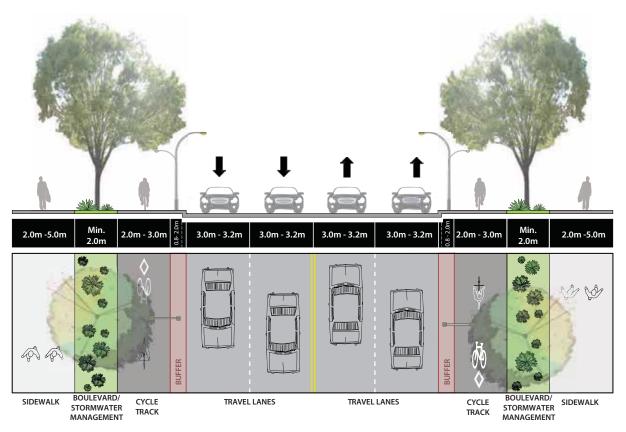


Figure 6.6 | Mid-term Shelbourne Street Cross-Section

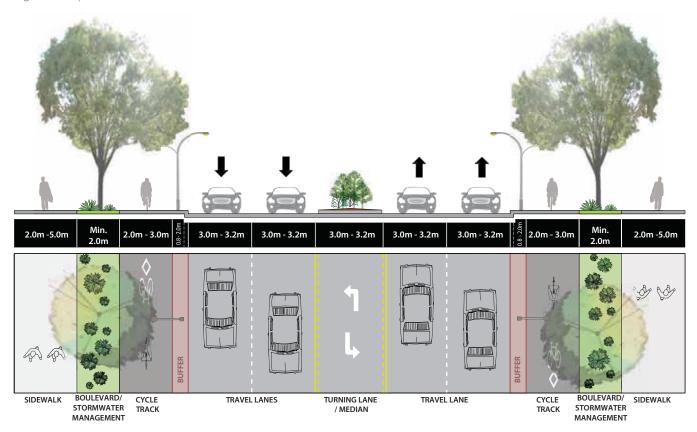


Figure 6.7 | Mid-term Shelbourne Street Cross-Section with Turn Lane / Landscaped Median

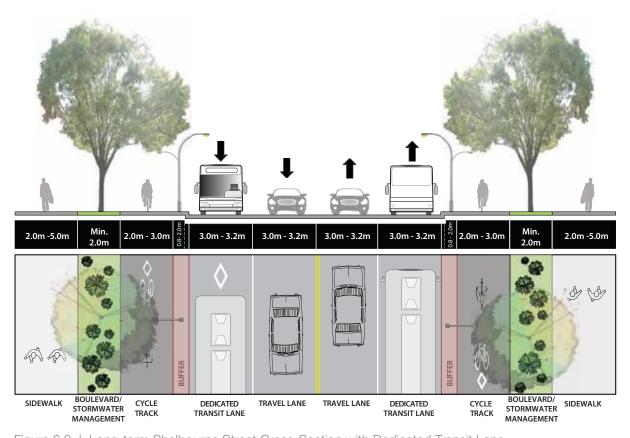


Figure 6.8 | Long-term Shelbourne Street Cross-Section with Dedicated Transit Lane



Figure 6.9 | Examples of Potential Shelbourne Street Transit Technology



Shelbourne Street

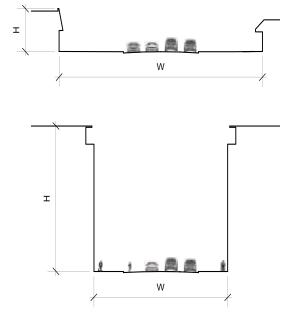
Shelbourne Street is the main connector of the Centres and Village of the Valley and is the primary street and public space that defines the character of the Valley. Improving the urban design aesthetic on Shelbourne Street is essential to the success of the Centres and Village and the realization of a main street in the Valley.

Projected land use changes will move buildings closer to the street and create a new built form identity for Shelbourne Street. A general four storey scale will provide visual consistency along the length of Shelbourne Street, with six to eight storey buildings at University Centre and Shelbourne Valley Centre, marking the prominence of these locations. These mid-rise buildings would provide a suitably scaled edge in relationship to the width of Shelbourne Street. Figure 7.3 provides an example of how new buildings and tree plantings can create a sense of enclosure to better define public spaces and the street. This defined street edge would reduce the prominence of the roadway and provide a more comfortable pedestrian environment.

A typical suburban street section in a commercial area. Buildings are far from the street edge. Width is greater than height. This optical width encourages speeding.

A typical urban street section. Buildings, and sometimes trees, line up to create a consistent street edge. Width is less than or equal to height. This optical width discourages speeding, but is perceived by some to be a "canyon".

The right -of-way strategy for Shelbourne Street. A consistent row of trees creates a visual narrowing of the right-of-way. Buildings are set back from the street edge to varying degrees based on their location. Width is less than or equal to height. This optical width discourages speeding



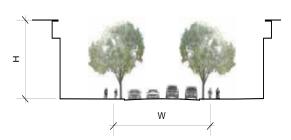


Figure 7.3 | Example of Future Shelbourne Street Enclosure Provided by Buildings and Trees

7.4 | Building Setbacks

Building setbacks provide spatial separation between adjacent buildings or between buildings and the public realm. Setbacks are typically used for fire protection, privacy, landscaping, a buffer from traffic and street noise, the preservation of natural features and viewscapes, and the creation of spaces for social interaction and temporary commercial uses, such as outdoor patios and merchandise displays. Establishing appropriate setbacks involves balancing these considerations, with the need to animate pedestrian spaces.

Setbacks will vary depending on the type of use. Active commercial uses are located closer to the street to more directly engage the public realm and invite pedestrian activity. Commercial or mixed-use buildings also typically have small or zero side yard setbacks to encourage a continuous streetscape. However, a side yard setback can allow flexibility to accommodate a driveway and/ or patios without creating excessive space between buildings. For apartments and townhouses, setbacks are generally larger to provide more privacy, while also incorporating design features, such as prominent entrances, that engage the public realm.

In general, existing setbacks as set out in the Saanich Zoning Bylaw will apply in most cases. This Plan identifies guidelines for front yard setbacks for apartments and townhouses and guidelines for pedestrian space for mixed use and commercial developments. These guidelines are intended to create developments that have a better relationship with the pedestrian environment and account for the future Shelbourne Street cross section. Figures 7.4 and 7.5 illustrate how sidewalk and building setback areas can be blended together in commercial areas to create a cohesive streetscape.



Figure 7.4 | Illustration of Pedestrian Space Measured from Building Face to Start of Sidewalk

Policies

Setback Guidelines

- 7.4.1 For mixed-use / commercial buildings, generally achieve 4-6 metres of pedestrian space through a combination of sidewalks within the public right of way and building setbacks on private land.
- 7.4.2 For apartment and townhouse developments, generally achieve a 6 m front yard setback.
- 7.4.3 Consider the same front yard setback for residential and commercial components of a mixed-use building.
- 7.4.4 Where lots designated for apartments or townhouses are of shallow depth (generally less than 30 m after road right of way dedication), consider reducing front yard setbacks to 5 m.



3m combined sidewalk and building setback



4m combined sidewalk and building setback



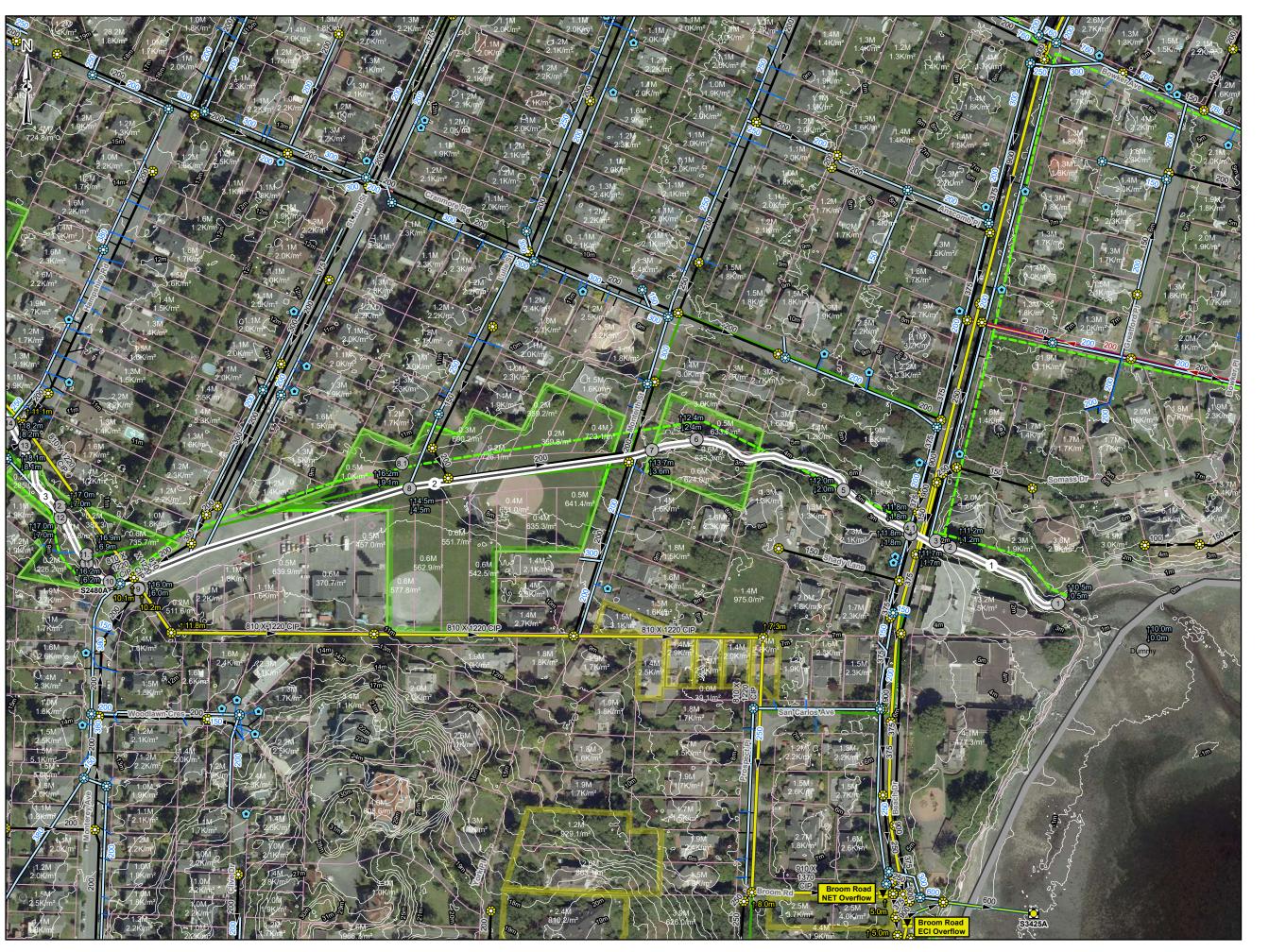
5m combined sidewalk and building setback

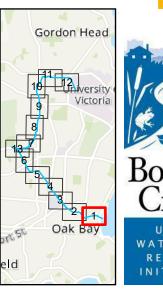
Figure 7.5 | Examples of Pedestrian Space Created by Various Sidewalk and Setback Configurations



Existing Bowker Creek Maps and Profiles

C







↑ - Elevation

Legend

Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Clean Out
Manhole

Gravity Main, Collector

Gravity Main, Culvert Lateral Line, Standard

Sanitary Infrastructure

Overflow Chamber Manhole

Discharge Point

Flow Direction Flow Direction

Collector

Overflow

Relief

Trunk swr_PressurizedMain

Force

- Lateral Line Green Way

-- Proposed Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

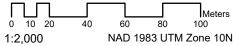
Property

Historic Environment

Sensitive Ecosystem

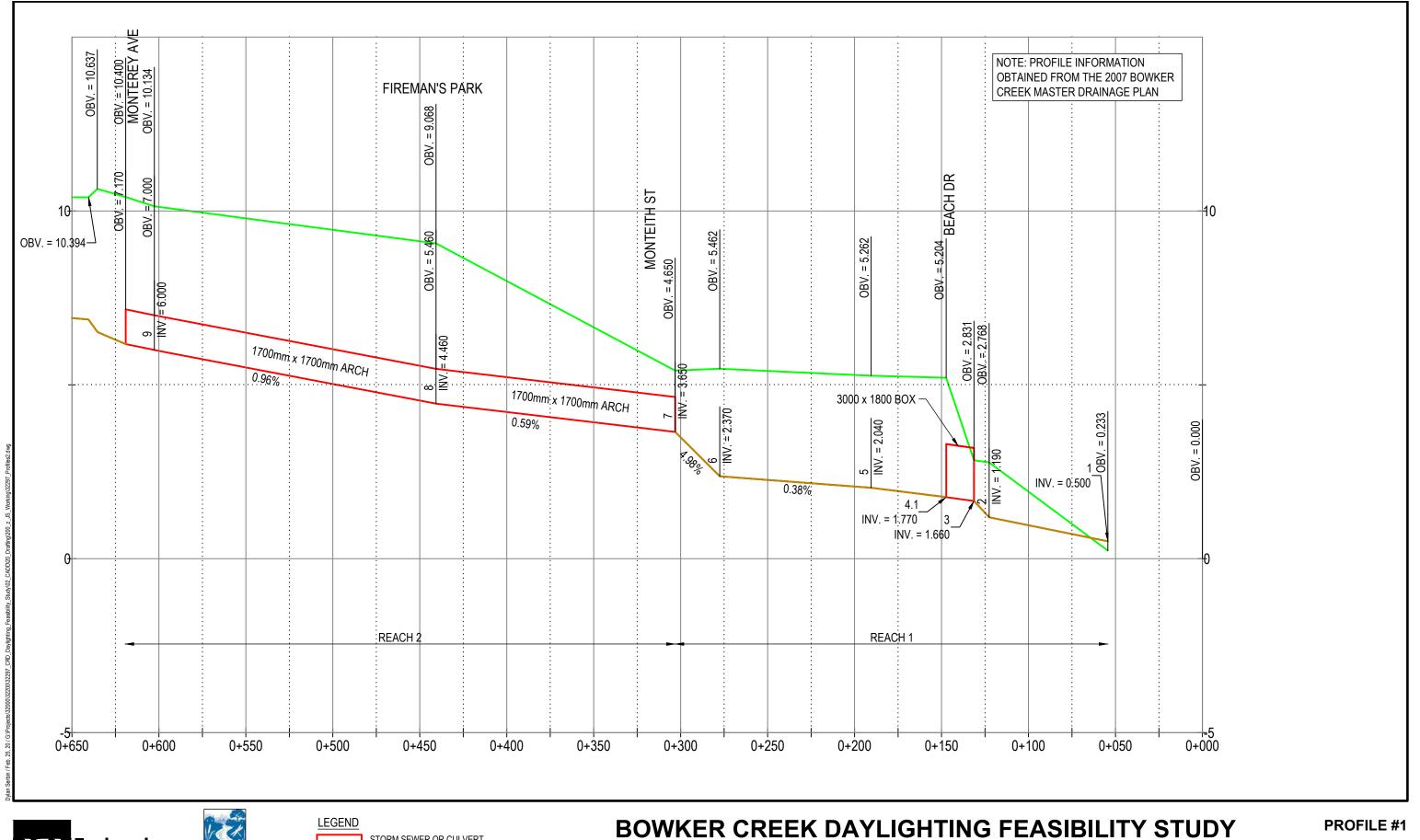
Municipal Boundary Contour - 1m

Credits: CRD, ESRI



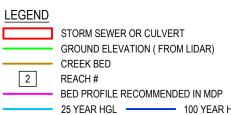
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 1 OF 13

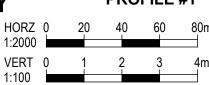




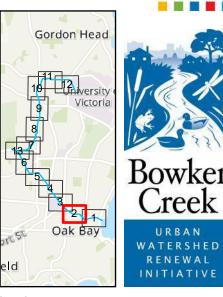












Legend

Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Clean Out
Manhole

Gravity Main, Collector

Gravity Main, Culvert Gravity Main, Overflow

Lateral Line, Standard

Manhole
Discharge Point

► Flow Direction

Collector

Overflow Trunk

- Lateral Line

Green Way

-- Proposed

Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Property
Historic Environment

Sensitive Ecosystem

Municipal Boundary

Contour - 1m

Credits: CRD, ESRI

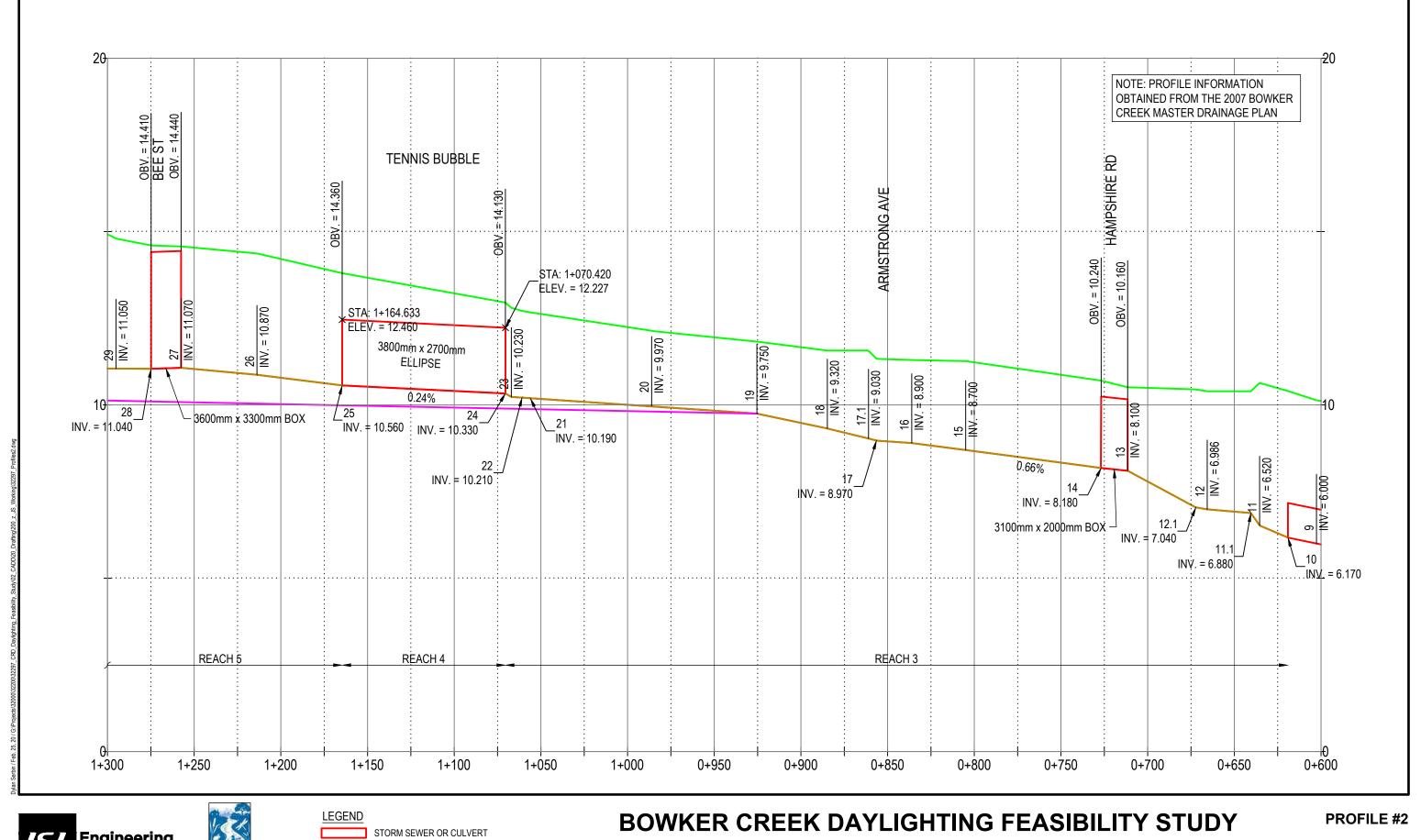
↑ - Elevation

↓ - Invert I - Obvert

NAD 1983 UTM Zone 10N 1:2,000

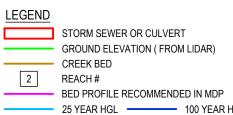
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 2 OF 13

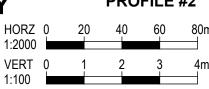


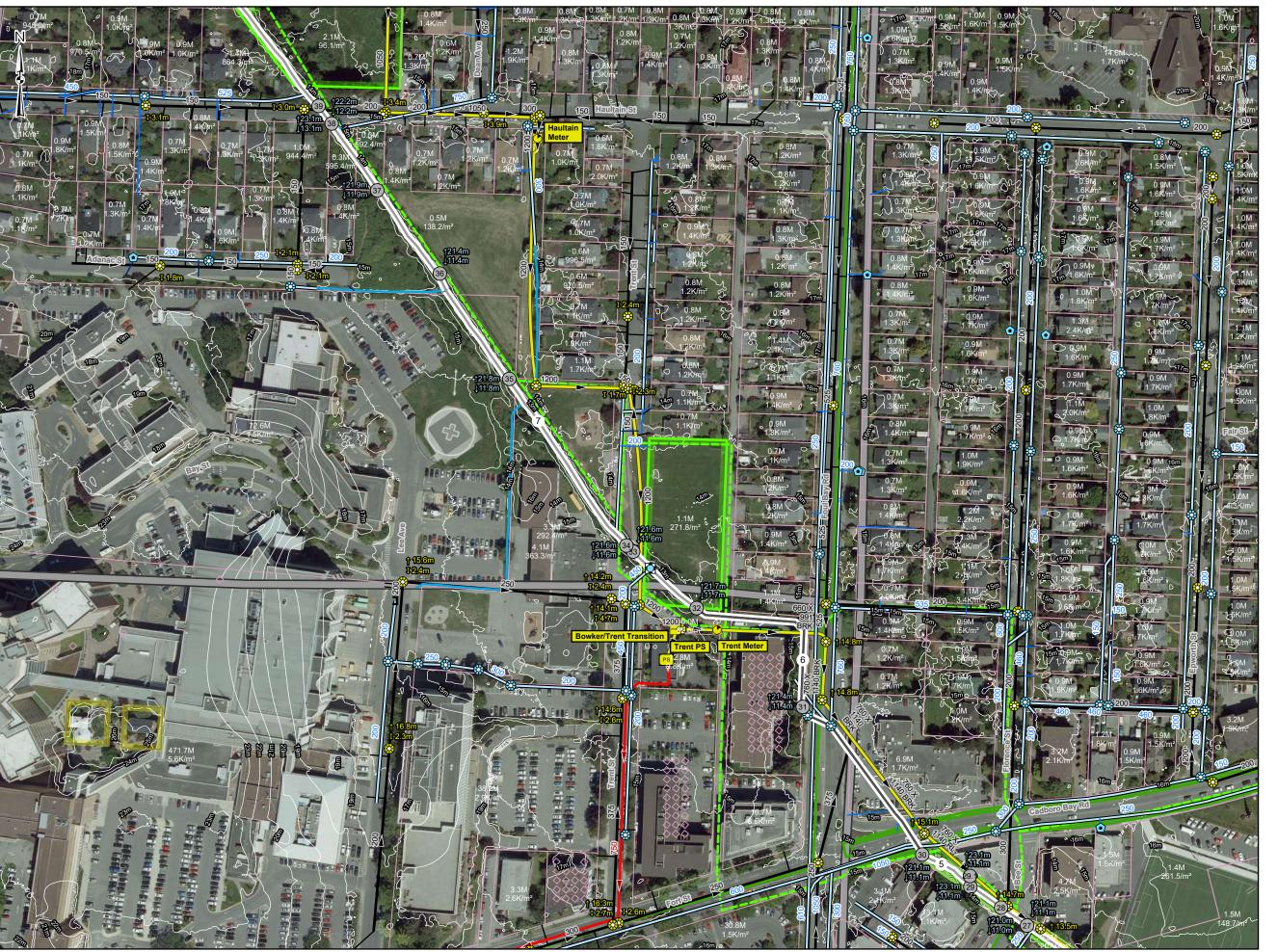


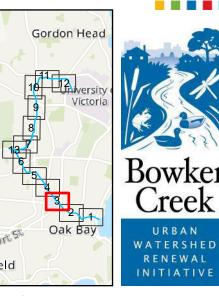












Legend

Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Cap

Clean
Manhol
Other Clean Out Manhole

Ditch

Gravity Main, Collector

Gravity Main, Culvert Lateral Line, Standard

- Lateral Line, Lead

Sanitary Infrastructure

Diversion Chamber Metering Chamber

Ps Pump Station Manhole

Flow Direction

► Flow Direction

Collector

Trunk

swr PressurizedMain

Force

Lateral Line

Green Way -- Proposed

Existing

Park / Green Space Property (Gross Value / Land value per sq. m)

Property

Historic Environment Sensitive Ecosystem

Municipal Boundary Contour - 1m

Credits: CRD. ESRI

↑ - Elevation

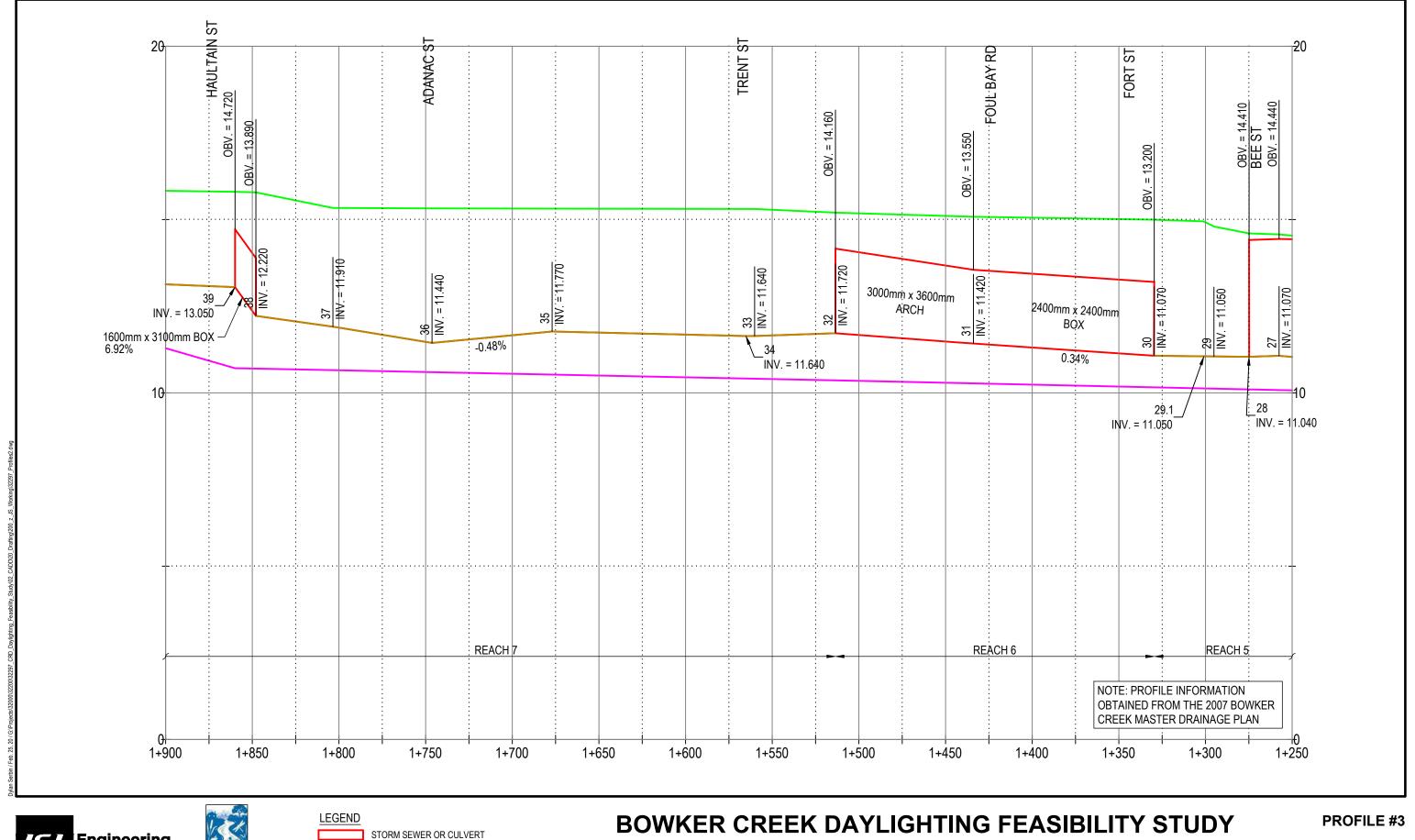
↓ - Invert

□ - Obvert

0 10 20 NAD 1983 UTM Zone 10N 1:2,000

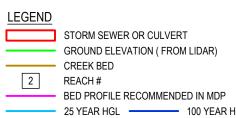
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 3 OF 13

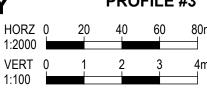


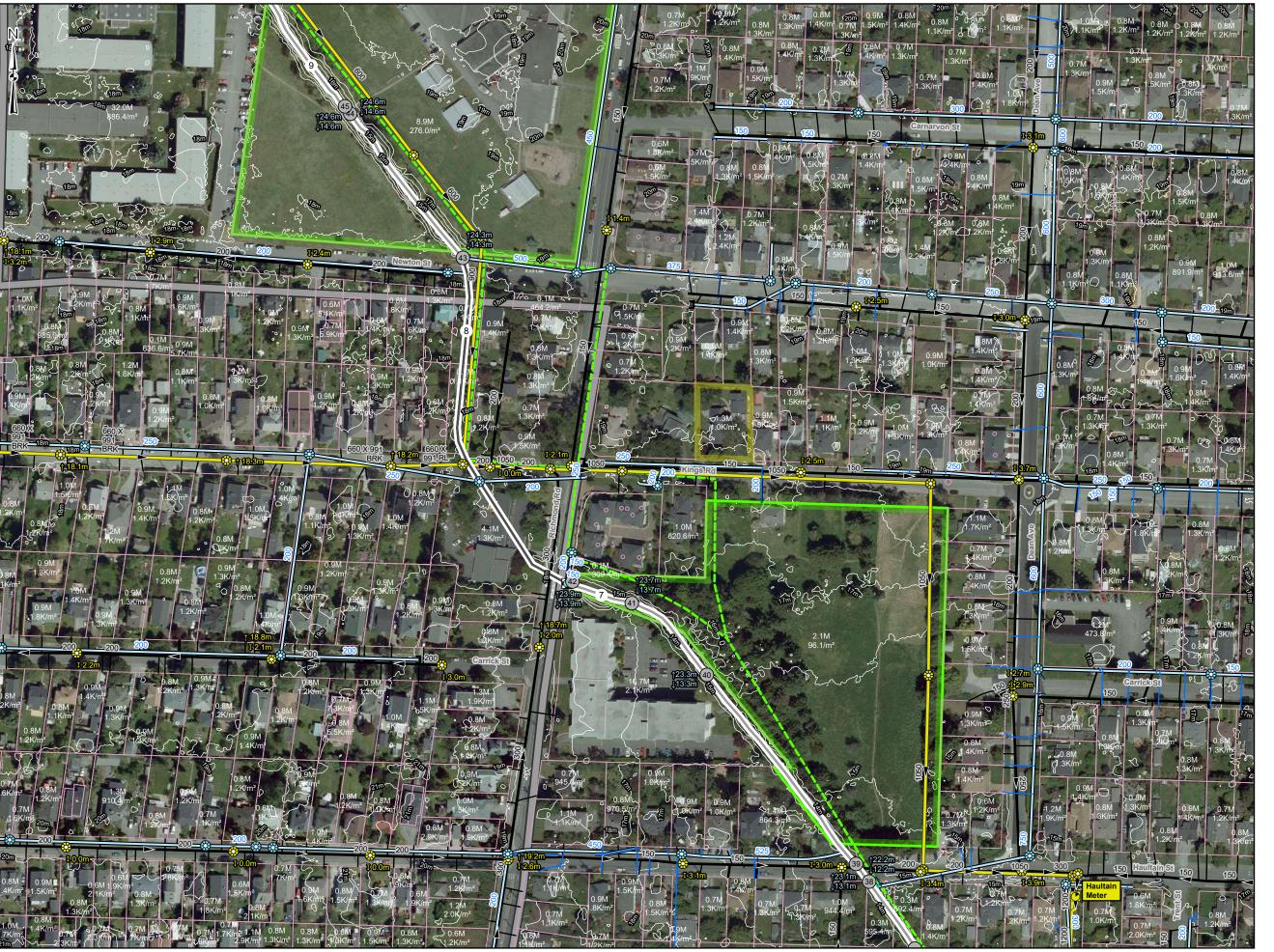


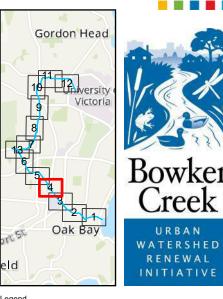












Legend

Bowker Creek Alignment

Open ChannelUnderground

Model Nodes

Contour - 1m
Storm Water Infrastructure

Cap

Manhole
Other

Stream

DitchGravity Main, Collector

Lateral Line, StandardLateral Line, Lead

Sanitary Infrastructure

Metering Chamber

Manhole

Flow Direction

Collector
Trunk

Lateral Line
Green Way

-- Proposed

Existing
Park / Green Space

Property (Gross Value / Land value per sq. m)

Property
Historic Environment

Sensitive Ecosystem
Municipal Boundary

Contour - 1m

Credits: CRD, ESRI

↑ - Elevation

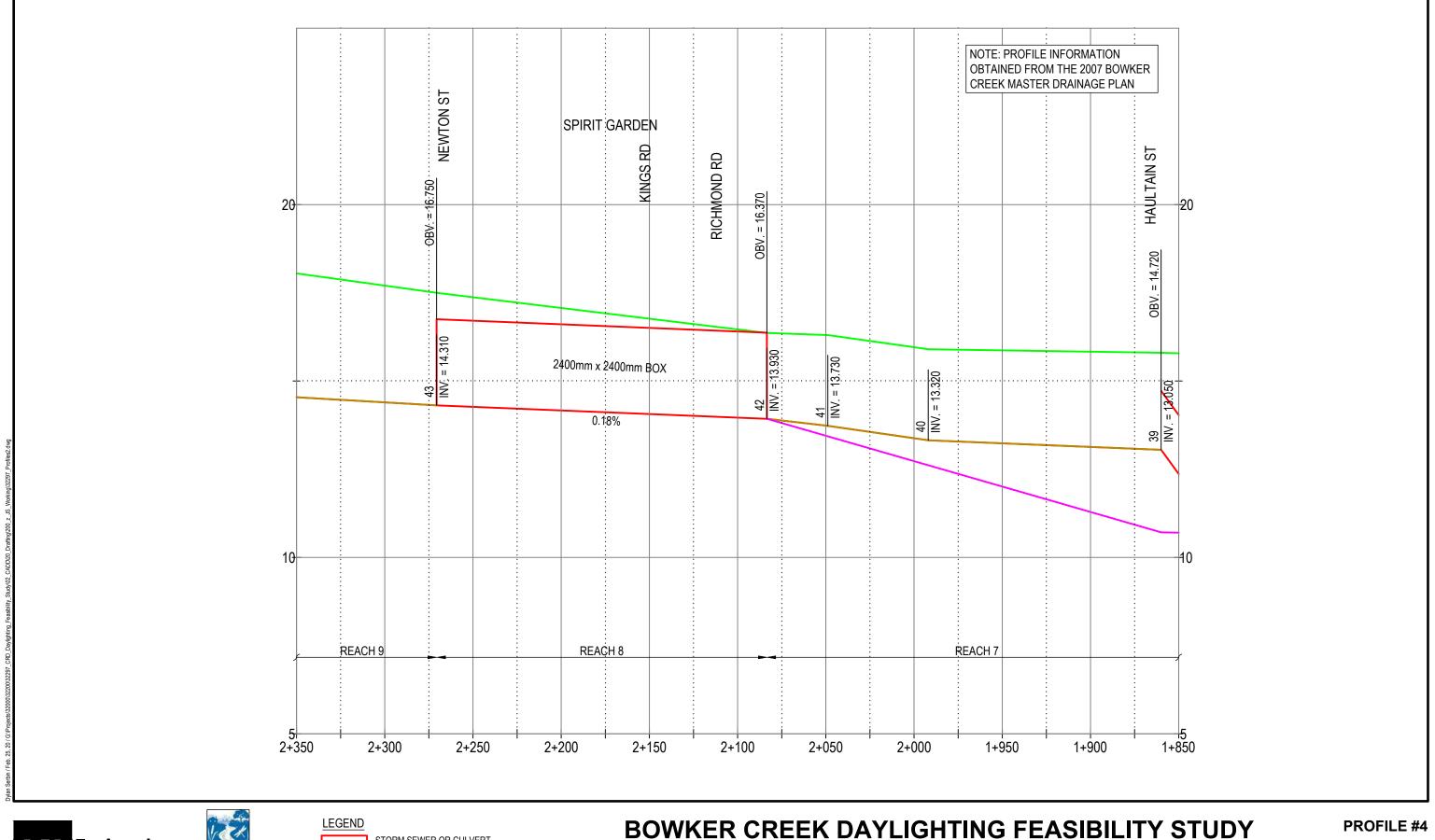
↓ - Invert

↓ - Obvert

0 10 20 40 60 80 100 1:2,000 NAD 1983 UTM Zone 10N

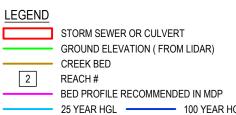
> URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 4 OF 13

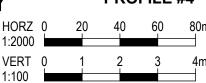




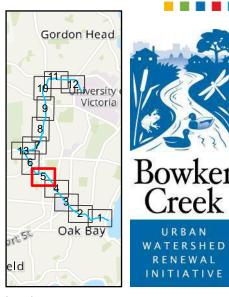












Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Cap

Manhole
Other

Stream

Ditch

— Gravity Main, Collector Gravity Main, Box Culvert

- Lateral Line, Standard - Lateral Line, Lead

Sanitary Infrastructure

Metering Chamber

Manhole

Flow Direction

Collector

Trunk

- Lateral Line Green Way

-- Proposed

Existing

Park / Green Space Property (Gross Value / Land value per sq. m)

Property

Historic Environment

Sensitive Ecosystem

Municipal Boundary Contour - 1m

Credits: CRD, ESRI

↑ - Elevation

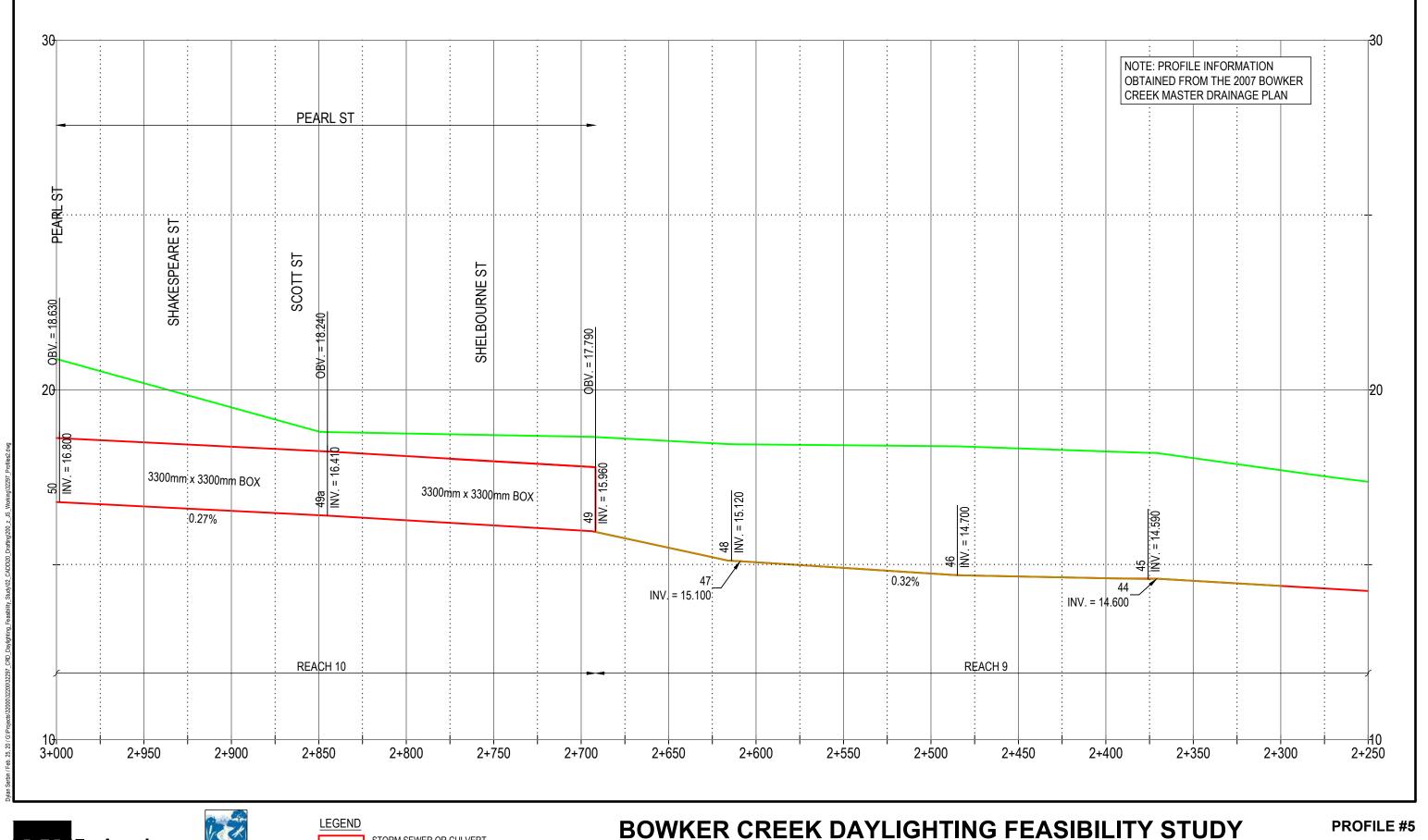
↓ - Invert

□ - Obvert

NAD 1983 UTM Zone 10N 1:2,000

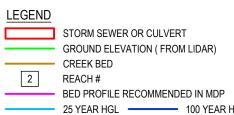
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 5 OF 13

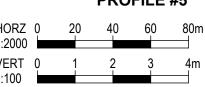




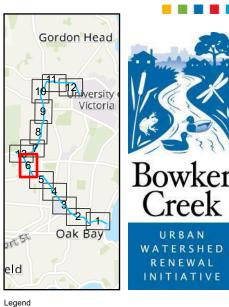














↑ - Elevation

↓ - Invert I - Obvert

Bowker Creek Alignment

Open Channel Model Nodes Contour - 1m

Storm Water Infrastructure

Cap

Manhole

Gravity Main, Collector Gravity Main, Box Culvert

Manhole Manhole

Flow Direction

Collector Trunk

Lateral Line

Green Way

-- Proposed Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment

Sensitive Ecosystem

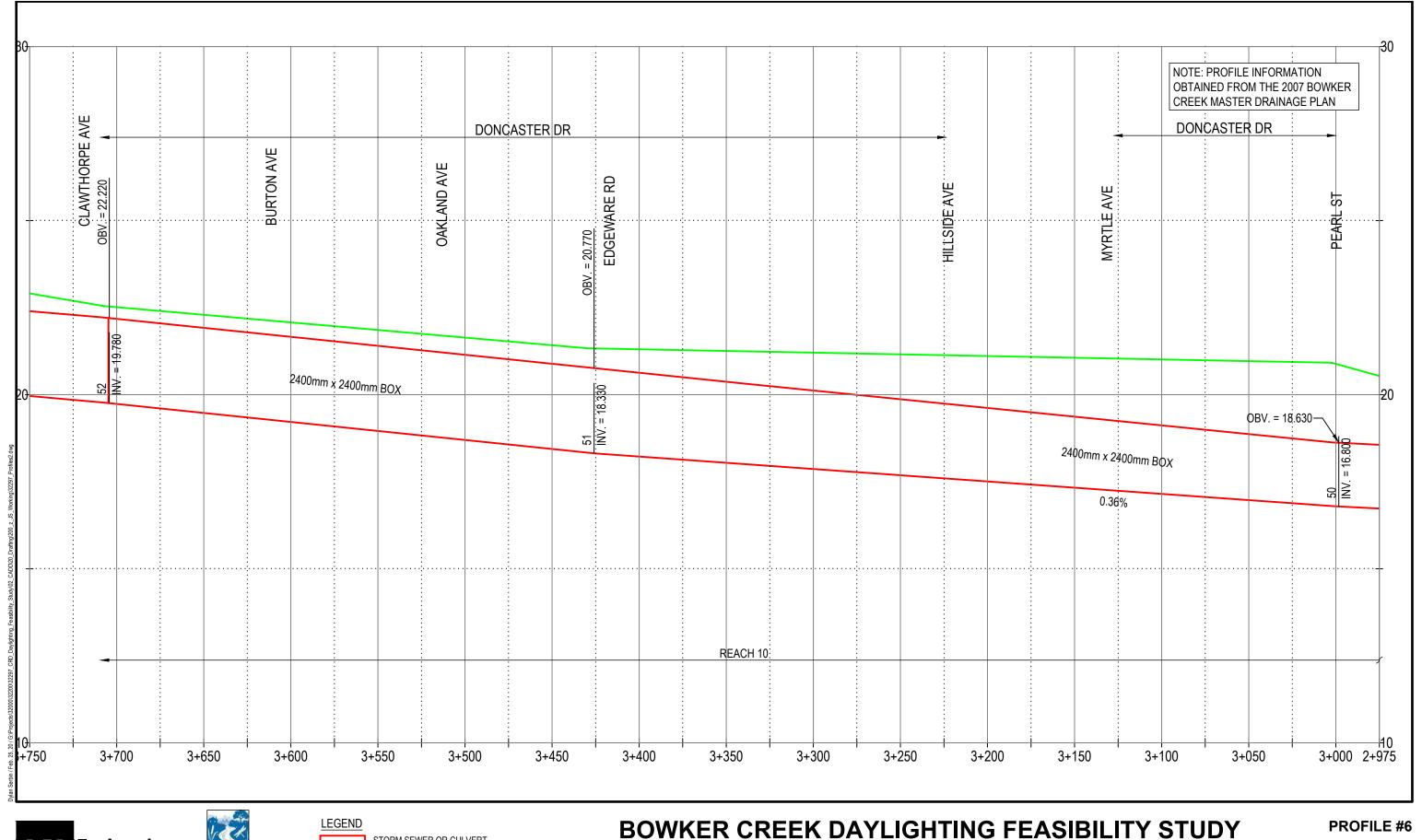
Municipal Boundary Contour - 1m

Credits: CRD, ESRI

1:2,000 NAD 1983 UTM Zone 10N

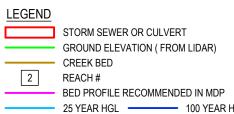
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 6 OF 13

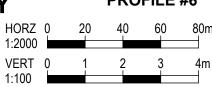


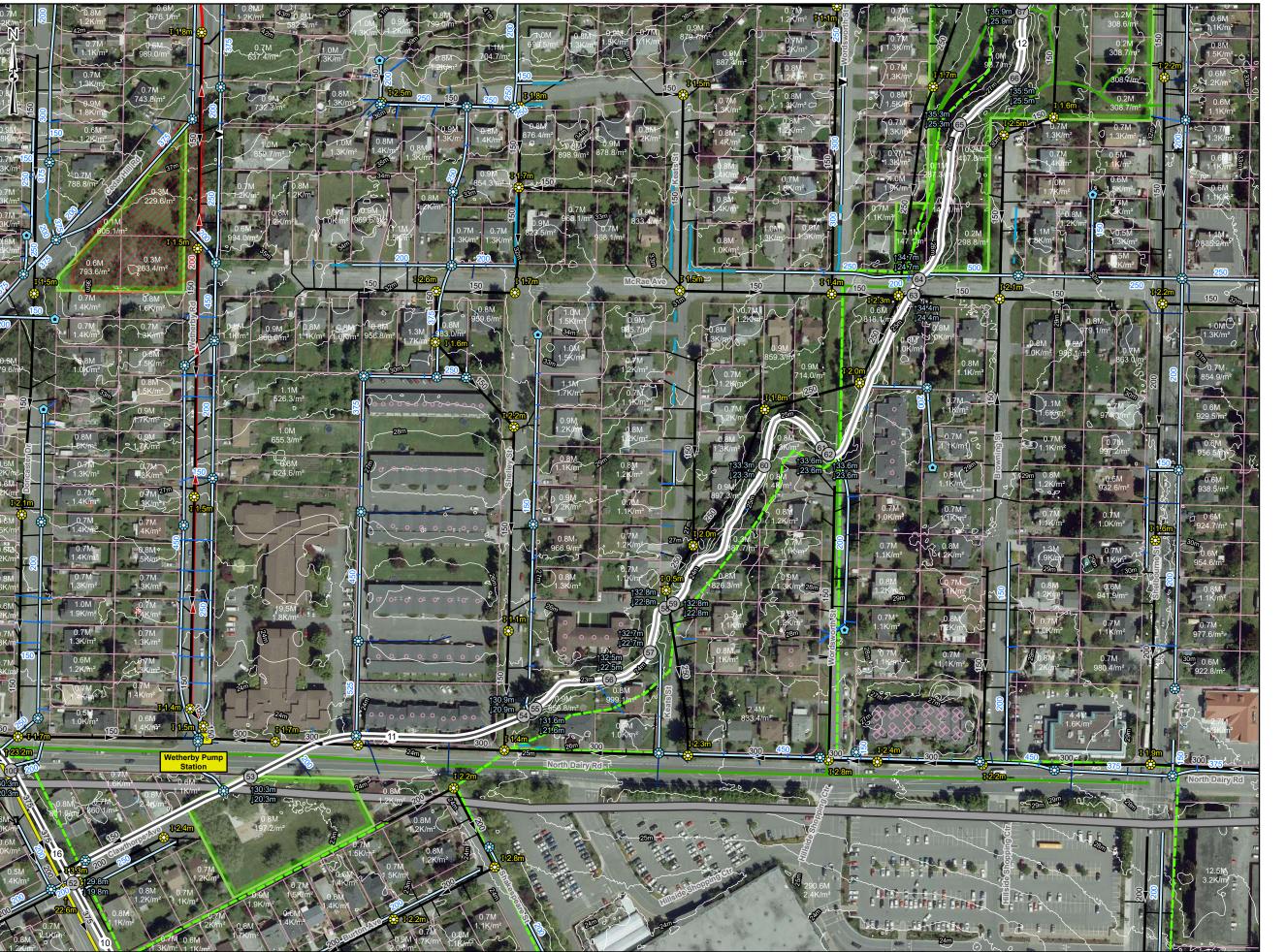


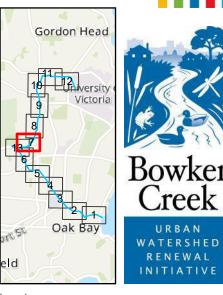












Bowker Creek Alignment

Open ChannelUnderground

Model Nodes

Contour - 1m
Storm Water Infrastructure

Cap

Clean Out
Manhole

Reducer

DitchGravity Main, Collector

Gravity Main, Culvert

Gravity Main, Box CulvertLateral Line, Standard

Lateral Line, Lead

hyd_Poly

Pond
Sanitary Infrastructure

Ps Pump Station

Manhole

Flow Direction

► Flow Direction

Collector

Trunk

swr_PressurizedMain

Force

Lateral Line
Green Way

-- Proposed

Existing
Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment

Sensitive Ecosystem

Municipal Boundary Contour - 1m

Credits: CRD, ESRI

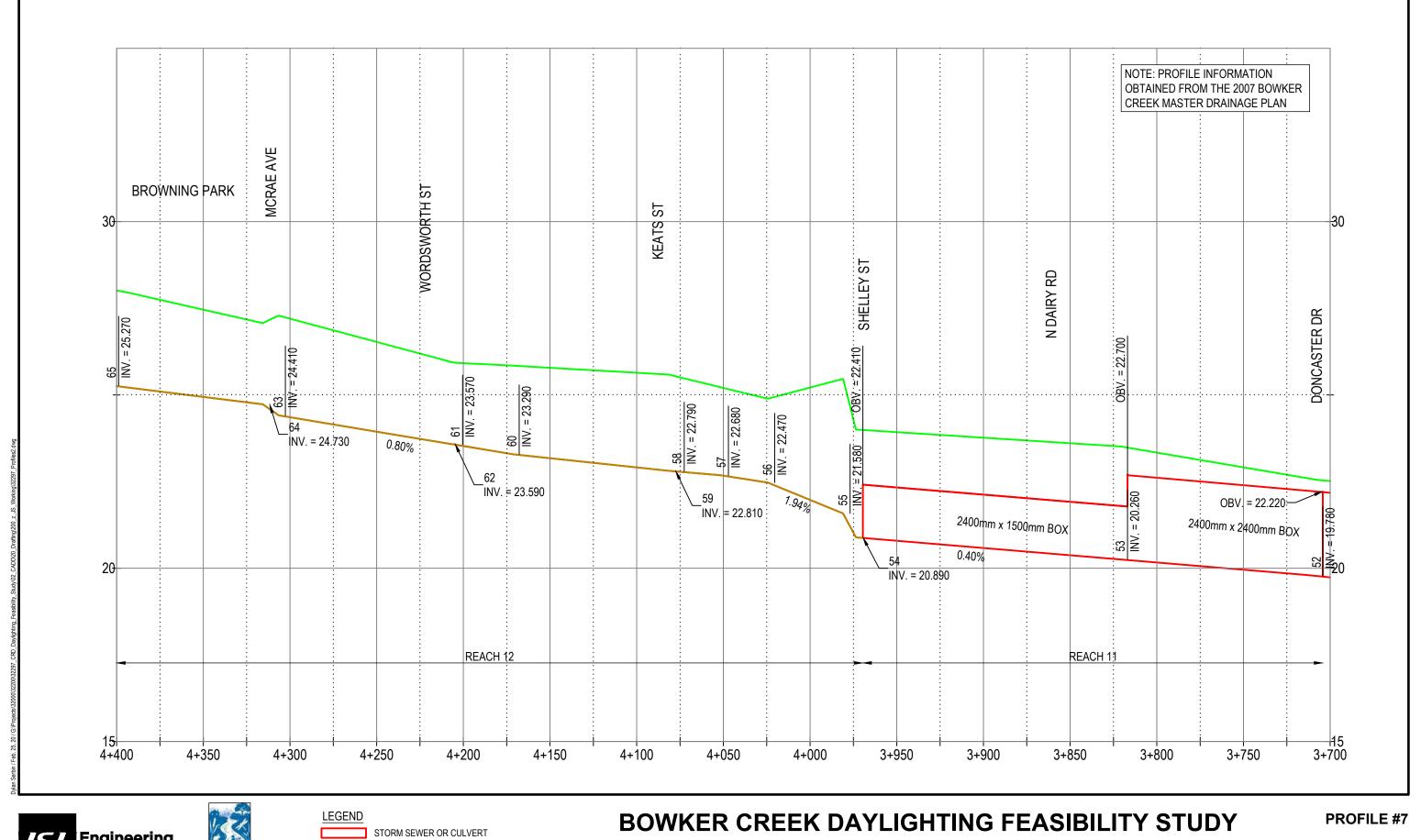
↑ - Elevation

↓ - Invert I - Obvert

0 10 20 40 60 80 100 1:2,000 NAD 1983 UTM Zone 10N

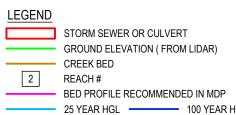
> URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 7 OF 13

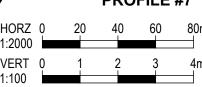


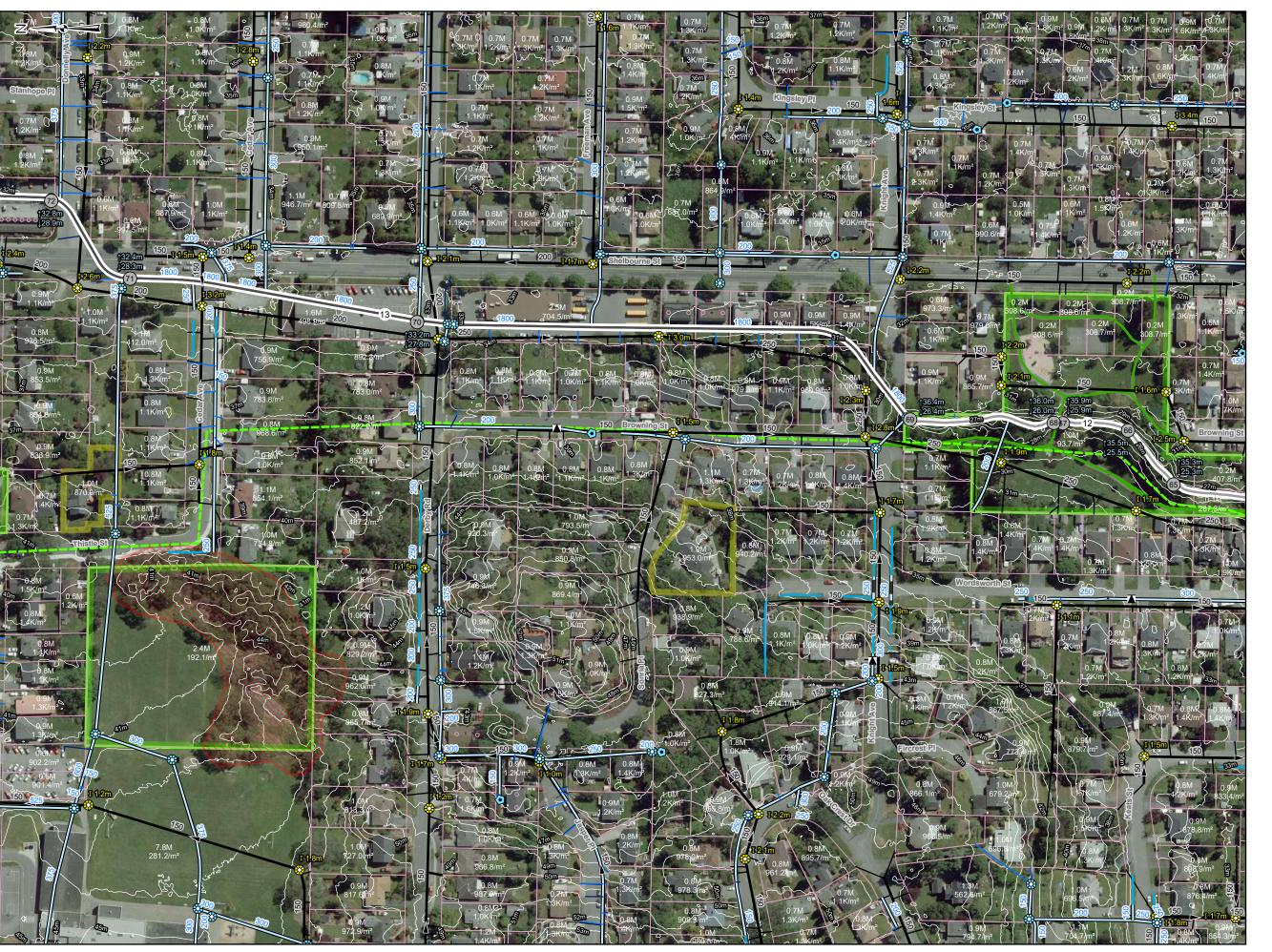


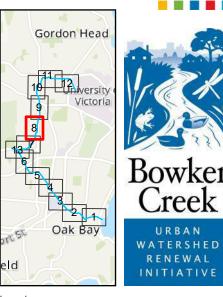














Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Cap

Clean Out
Manhole

Reducer Ditch

Gravity Main, Collector

Gravity Main, Culvert

Gravity Main, Box Culvert Lateral Line, Standard

Lateral Line, Lead

hyd_Poly

Pond

Manhole

► Flow Direction

Collector Lateral Line

Green Way

-- Proposed

Existing

Park / Green Space Property (Gross Value / Land value per sq. m)

Property

Historic Environment

Sensitive Ecosystem

Municipal Boundary Contour - 1m

Credits: CRD, ESRI

↑ - Elevation

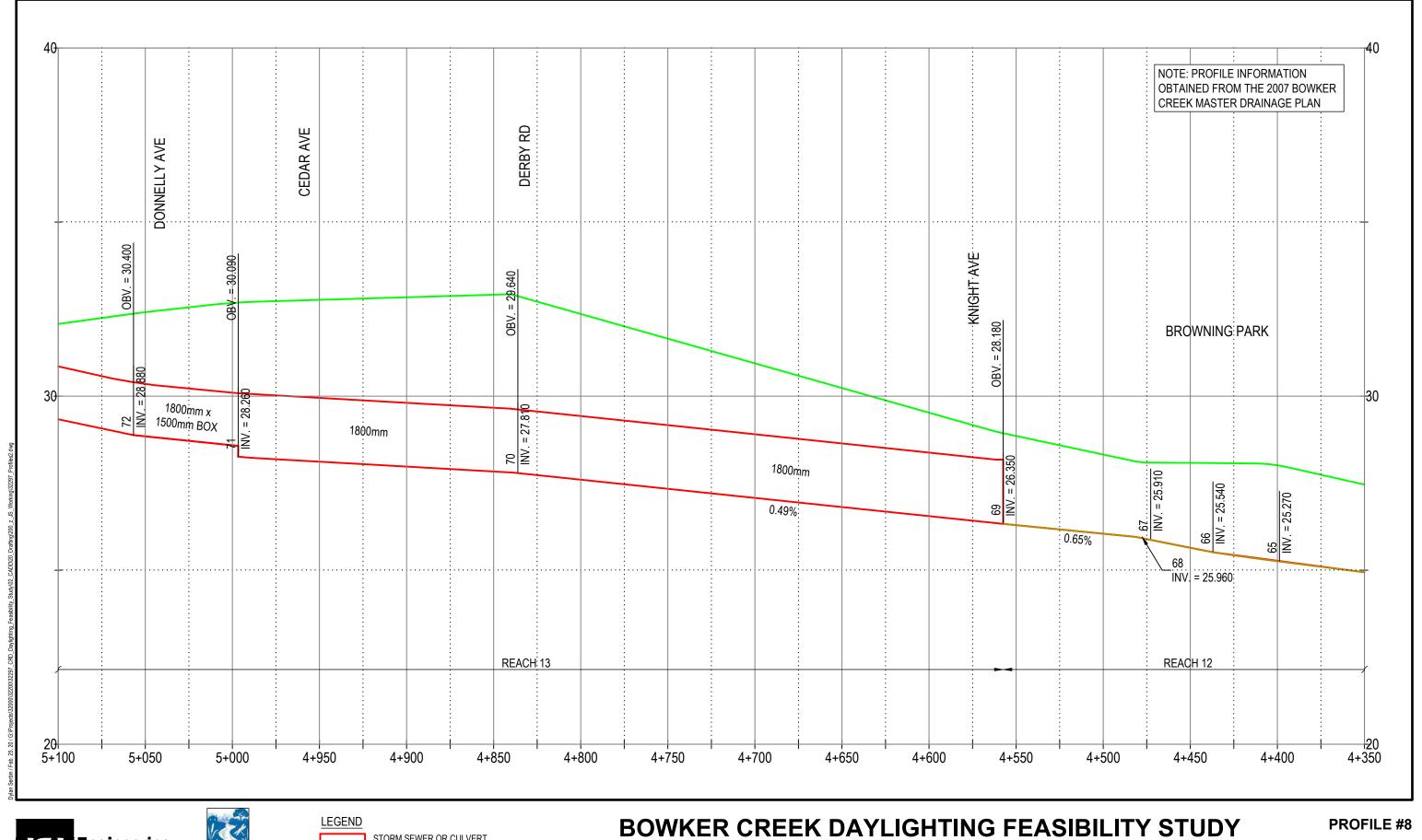
↓ - Invert

□ - Obvert

NAD 1983 UTM Zone 10N 1:2,000

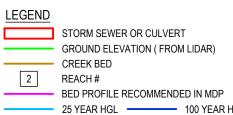


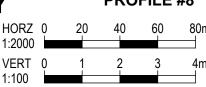
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 8 OF 13

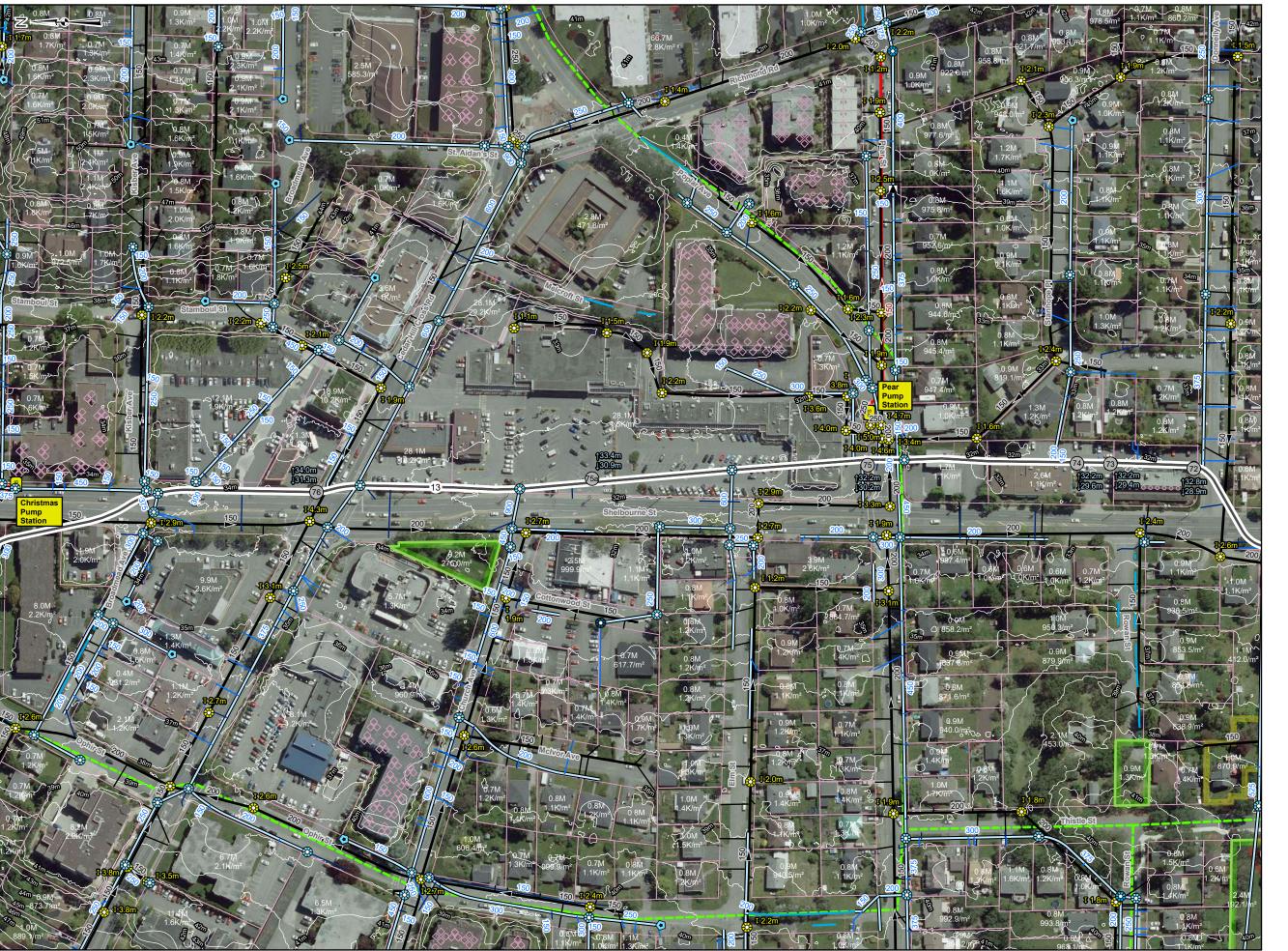


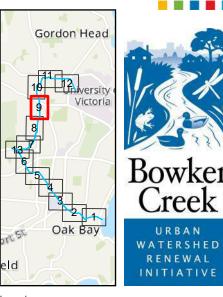














Bowker Creek Alignment

Open Channel Model Nodes Contour - 1m

Storm Water Infrastructure

Cap

Clean Out
Manhole

Manhole, Concrete Box
Manhole, Wood Box

Reducer Ditch

Gravity Main, Collector

Gravity Main, Culvert Gravity Main, Box Culvert

Lateral Line, Standard - Lateral Line, Lead

hyd_Poly

Pond

Sanitary Infrastructure

Ps Pump Station
Manhole

Flow Direction

Flow Direction

Collector

swr_PressurizedMain

Force

- Lateral Line

Green Way

-- Proposed

Existing Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment Sensitive Ecosystem

Municipal Boundary

Contour - 1m

Credits: CRD, ESRI

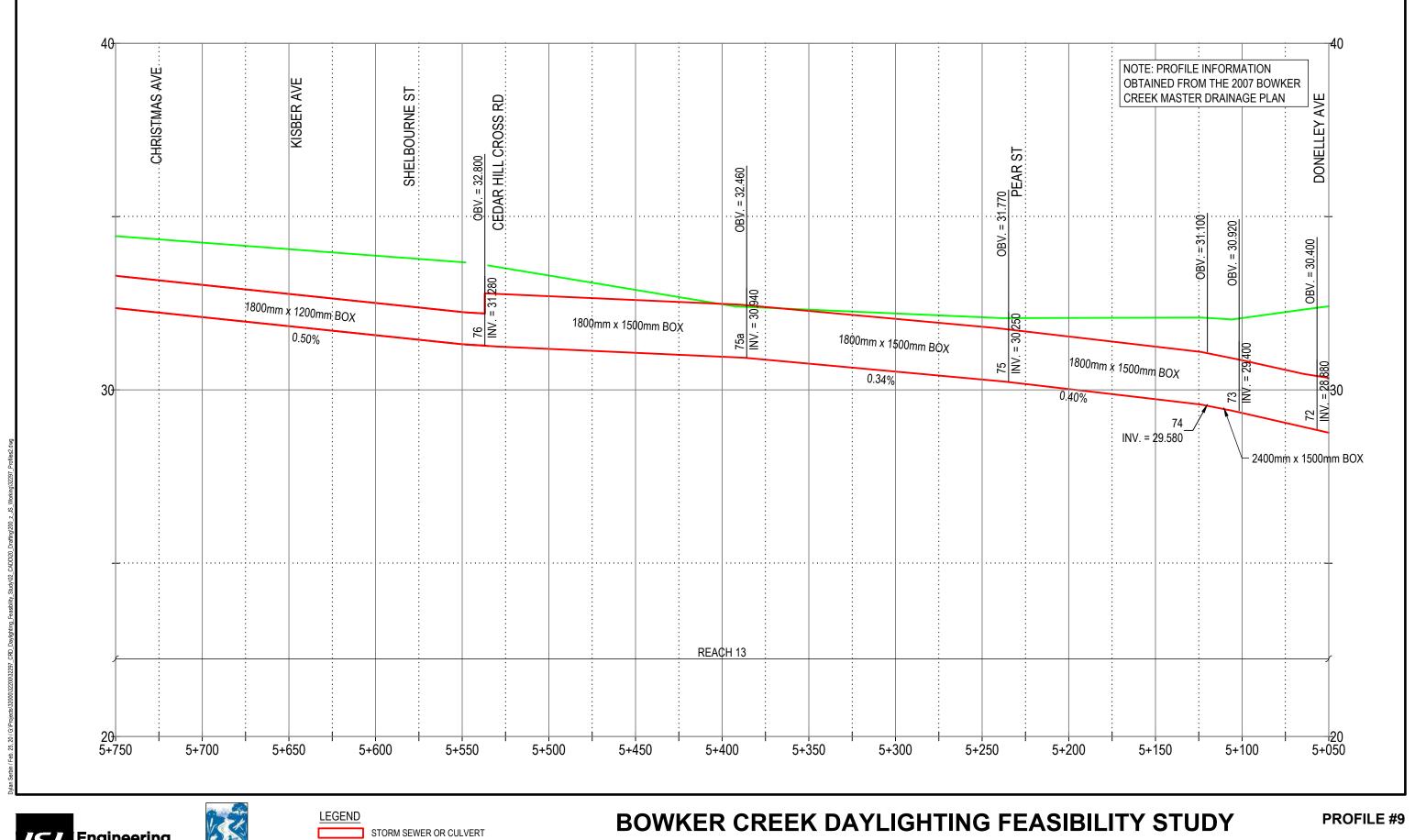
↑ - Elevation

↓ - Invert I - Obvert

NAD 1983 UTM Zone 10N 1:2,000

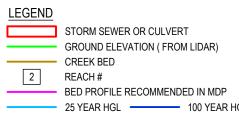
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 9 OF 13

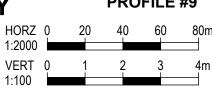


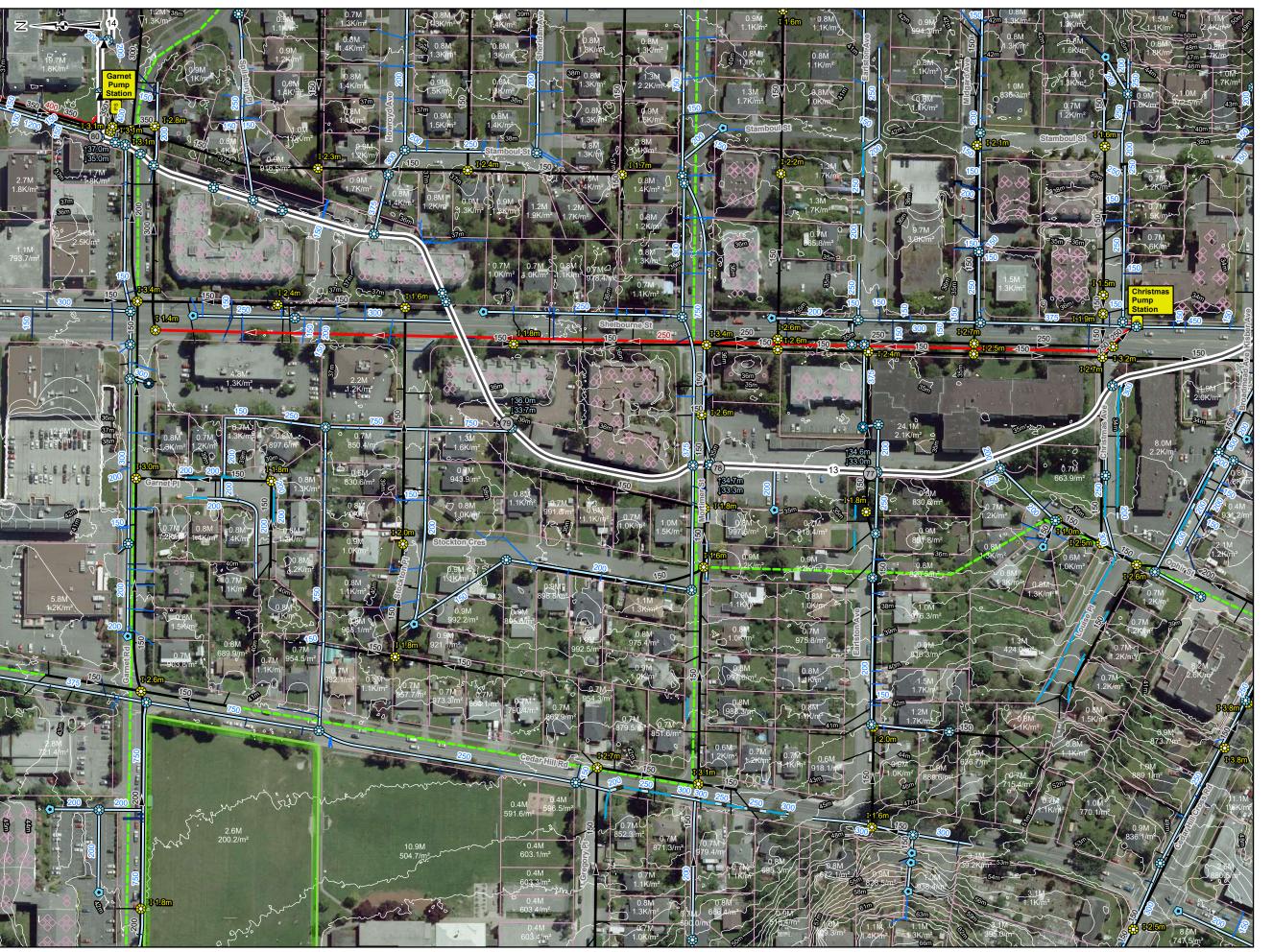


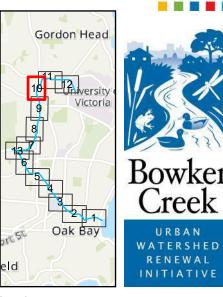












Bowker Creek Alignment

Open Channel Model Nodes

Contour - 1m

Storm Water Infrastructure Cap

Clean Out
Manhole

Manhole, Concrete Box

Manhole, Concrete B
Manhole, Wood Box

Reducer Ditch

Gravity Main, Collector

Gravity Main, Culvert

Gravity Main, Box Culvert Lateral Line, Standard

Lateral Line, Lead Sanitary Infrastructure

Ps Pump Station

Manhole

Flow Direction

➤ Flow Direction

Collector

swr_PressurizedMain

- Lateral Line

Green Way

-- Proposed Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment Sensitive Ecosystem

Municipal Boundary

Contour - 1m

Credits: CRD, ESRI

↑ - Elevation

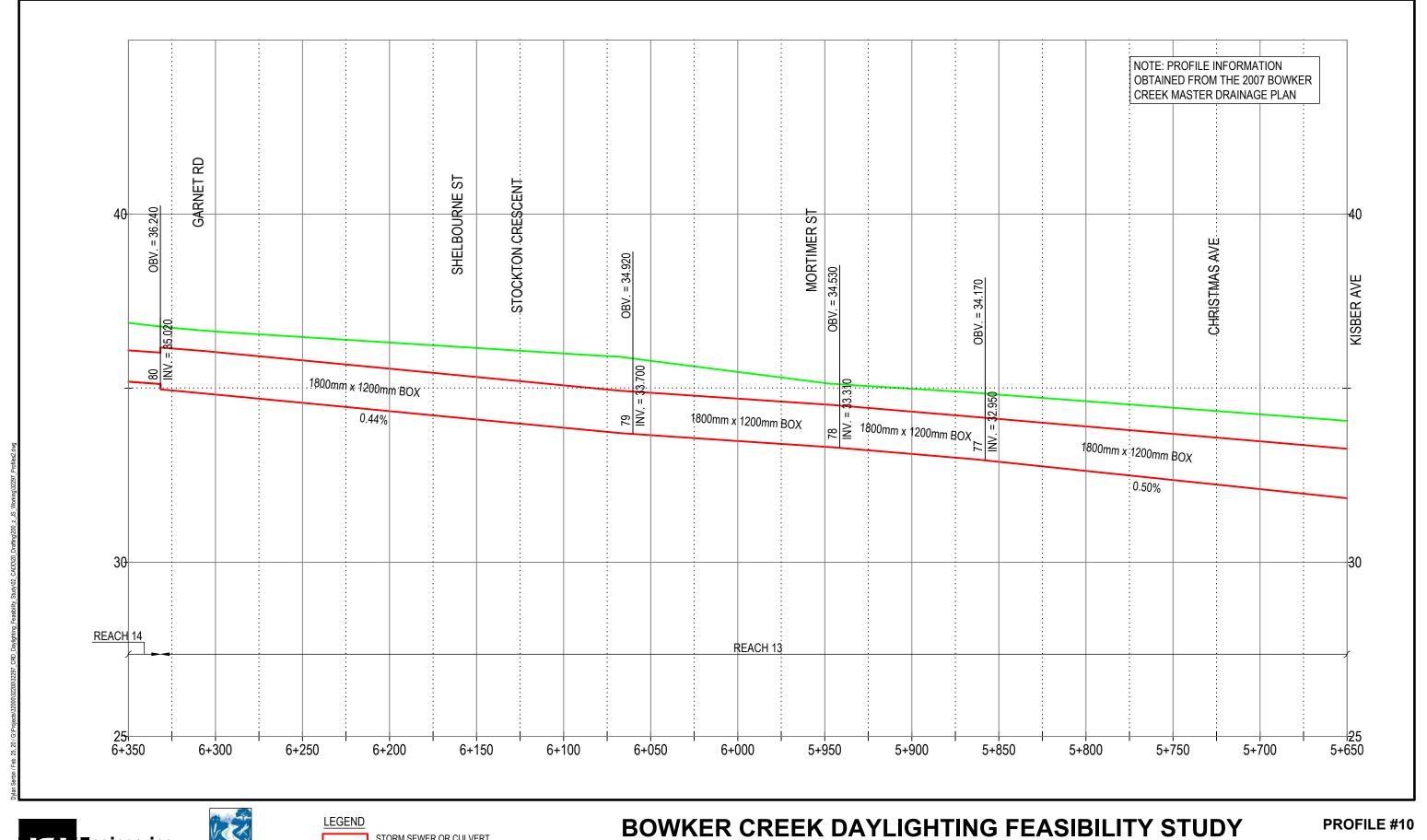
↓ - Invert

↓ - Obvert

NAD 1983 UTM Zone 10N 1:2,000

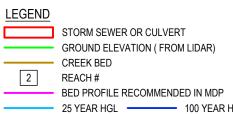
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 10 OF 13

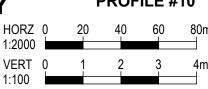


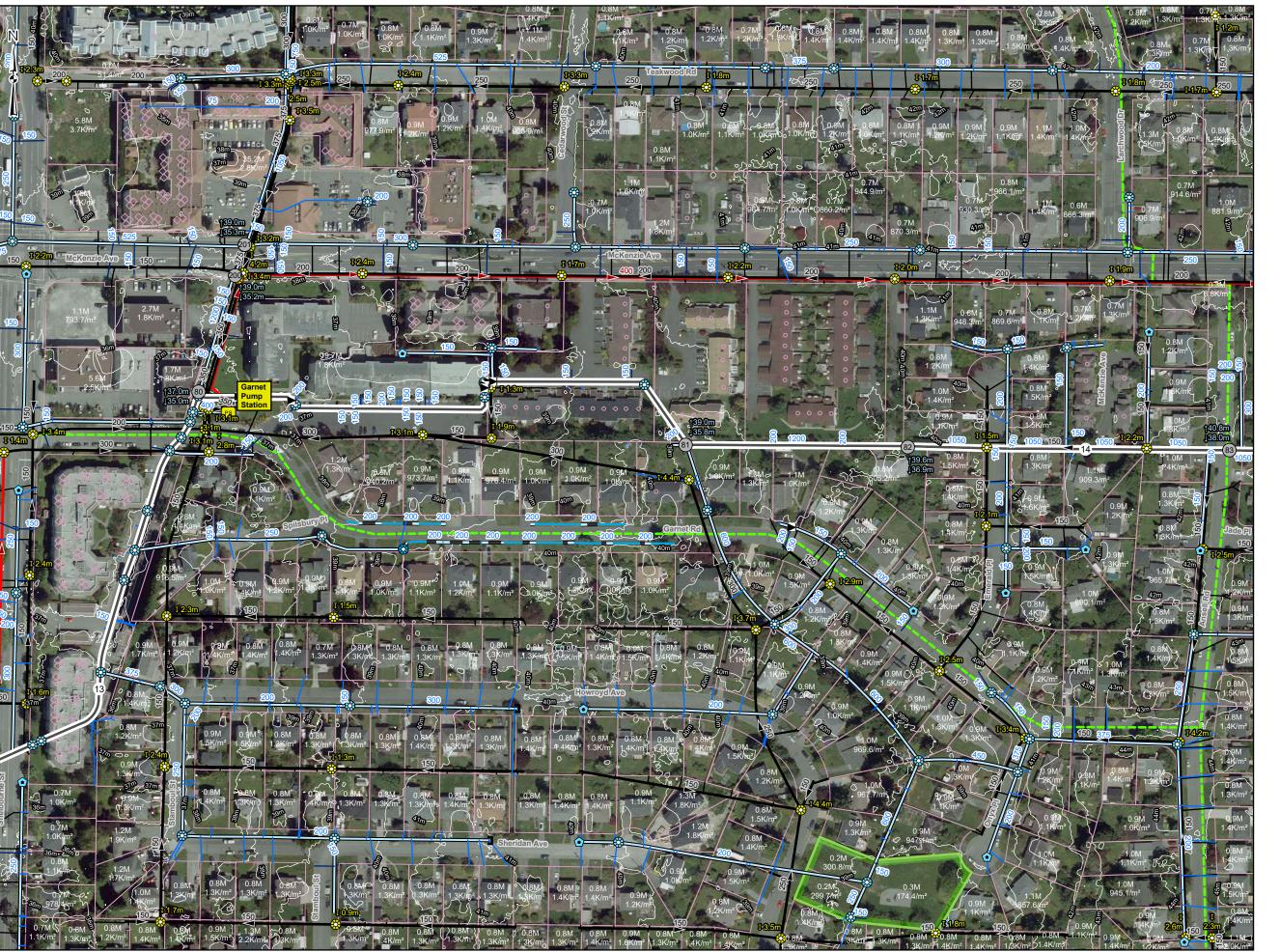


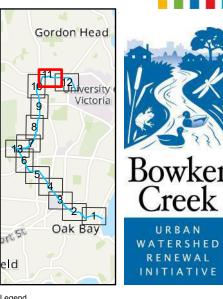












Notes: ↑ - Elevation

↓ - Invert

□ - Obvert

Legend

Bowker Creek Alignment

Open Channel Model Nodes

Contour - 1m Storm Water Infrastructure

Cap Clean Out

Clean Out

Manhole, Concrete Box

Reducer Ditch

— Gravity Main, Collector

Gravity Main, Culvert

Gravity Main, Box Culvert Lateral Line, Standard

- Lateral Line, Lead

hyd_Poly

Storage Basin or Tank Sanitary Infrastructure

Ps Pump Station Manhole

Flow Direction

Flow Direction

Collector

swr_PressurizedMain

Force

Lateral Line Green Way

-- Proposed Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment Sensitive Ecosystem

Municipal Boundary

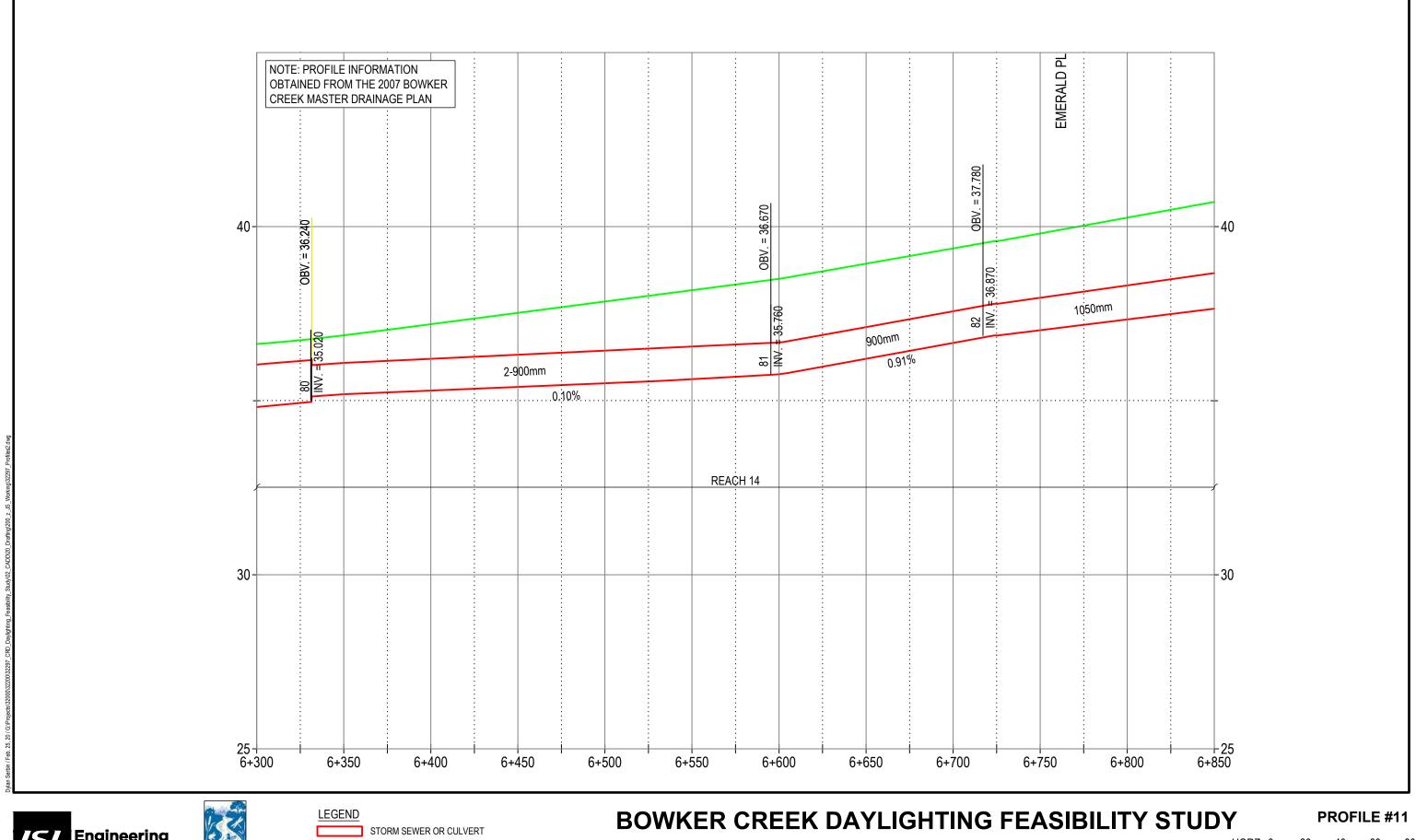
Contour - 1m

Credits: CRD, ESRI

NAD 1983 UTM Zone 10N 1:2,000

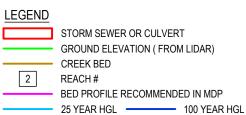
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 11 OF 13

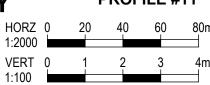




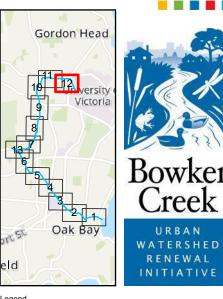












Notes: ↑ - Elevation

↓ - Invert I - Obvert

Legend

Bowker Creek Alignment

Open Channel Underground

Model Nodes

Contour - 1m Storm Water Infrastructure

Cap

Clean Out
Manhole

Manhole, Concrete Box

Manhole, Wood Box Stream

Ditch

Gravity Main, Collector

Gravity Main, Culvert Lateral Line, Standard

- Lateral Line, Lead

Manhole

Flow Direction

► Flow Direction

Collector swr_PressurizedMain

Force

- Lateral Line Green Way

-- Proposed Existing

Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment Sensitive Ecosystem

Municipal Boundary

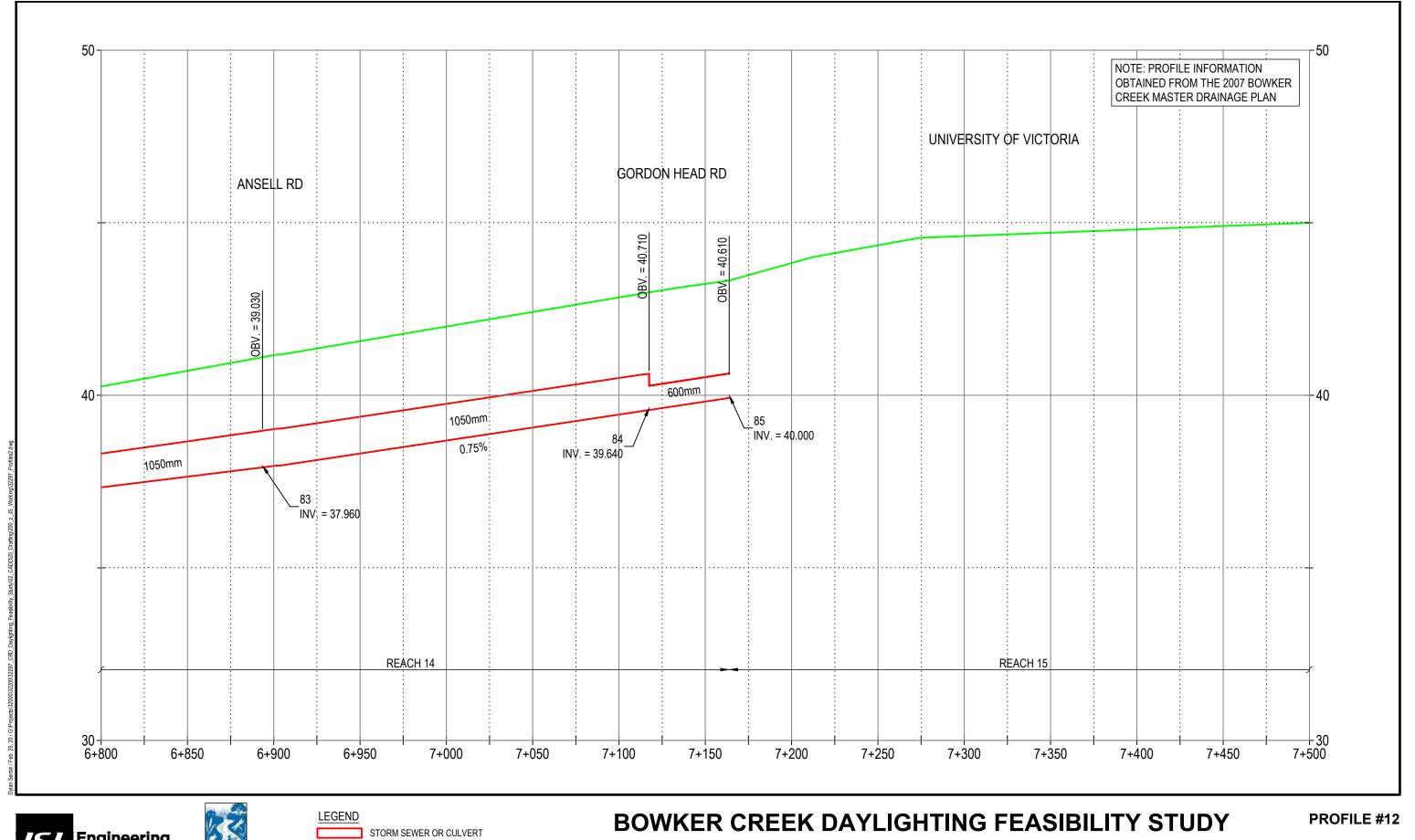
Contour - 1m

Credits: CRD, ESRI

0 10 20 NAD 1983 UTM Zone 10N 1:2,000

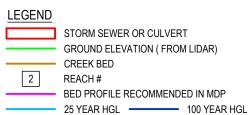
URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 12 OF 13

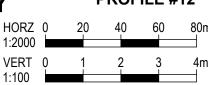


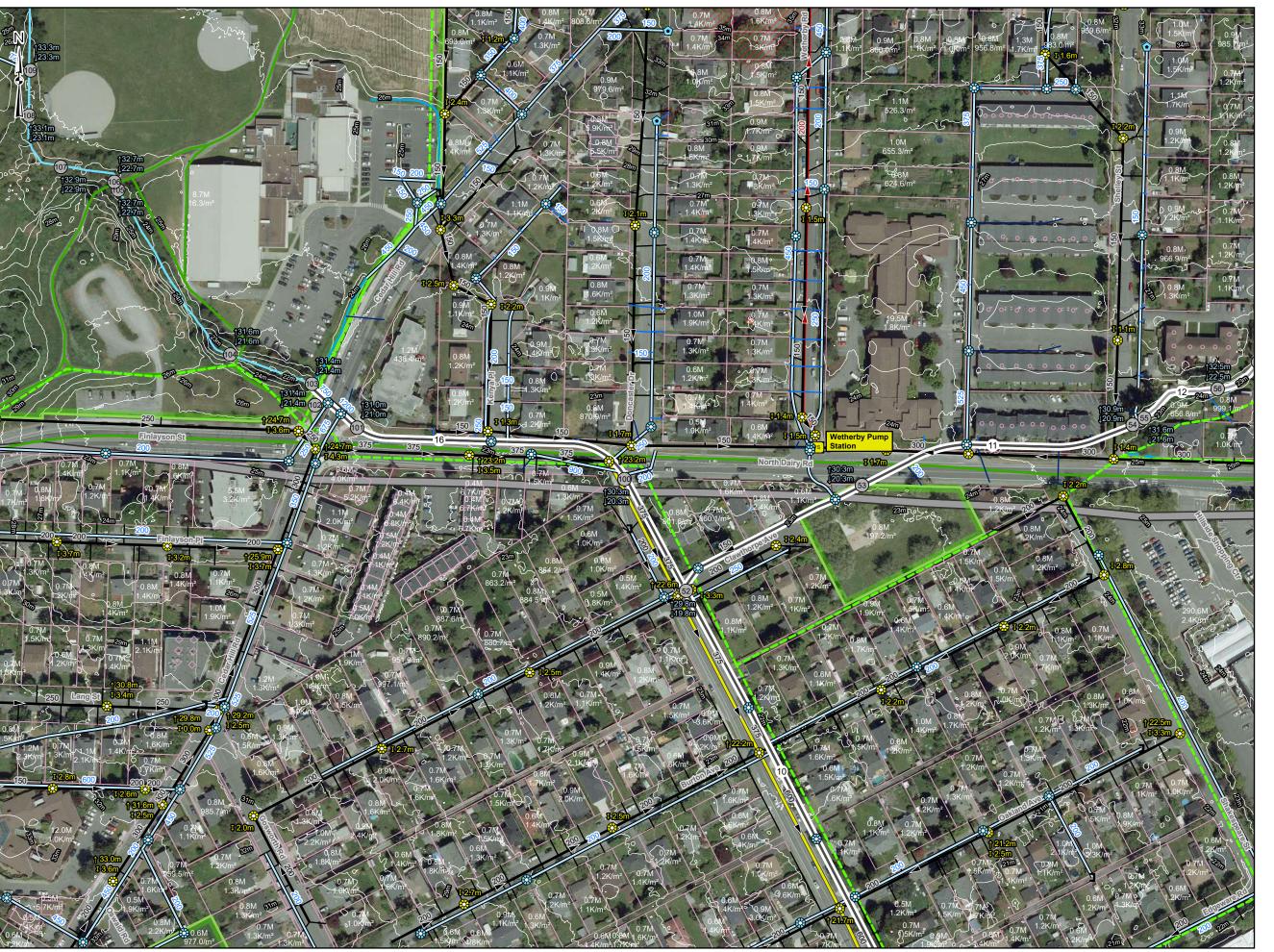


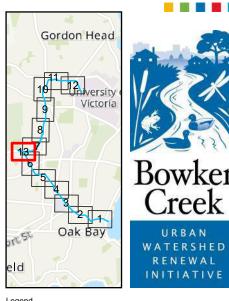












Bowker Creek Alignment

Open ChannelUnderground

Model Nodes

Contour - 1m
Storm Water Infrastructure

Cap

Clean Out
Manhole

Stream

DitchGravity Main, Collector

Gravity Main, Box Culvert

Lateral Line, StandardLateral Line, Lead

Sanitary Infrastructure

Ps Pump Station

Manhole

► Flow Direction

► Flow Direction

Collector

Trunk

swr_PressurizedMain

Force

Force

Lateral Line Green Way

en vvay

-- Proposed

Existing
Park / Green Space

Property (Gross Value / Land value per sq. m)

Property

Historic Environment

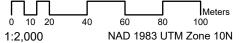
Sensitive Ecosystem

Municipal Boundary Contour - 1m

Credits: CRD, ESRI

↑ - Elevation

↓ - Invert I - Obvert



URBAN WATERSHED RENEWAL INITIATIVE BOWKER CREEK DAYLIGHTING APPENDIX C EXISTING CONDITIONS 13 OF 13



