Green Shores – Dyke Road Park Feasibility Study

PROJECT WATERSHED

Prepared for:

The Pacific Salmon Foundation
Suite 300 – 1682 West 7th Avenue
Vancouver, BC, V6J 4S6

Prepared by:

Jennifer Sutherst and Jay Baker-French
Comox Valley Project Watershed Society
2356A Rosewall Crescent
Courtenay, BC, V9N 8R9

Contents

List of Tables and Figures

Executive Summary

A feasibility study was completed by the Comox Valley Project Watershed Society (Project Watershed) to determine if Dyke Road Park, located in Courtenay, B.C., would be a good candidate site for the application of the Green Shores for Shoreline Development (GSSD) credits and ratings system - specifically a project that would achieve a gold level certification under this system while at the same time supporting salmon habitat and serving as a demonstration site for those wanting to learn about the application of the GSSD principles.

Site visits, habitat inventories and mapping were completed and background reports and studies were reviewed in order to complete the feasibility study. It was determined that the park could be redeveloped from a Green Shores approach in order to meet the series of five prerequisites (siting of permanent structures, conservation of shoreline sediment processes, conservation of critical or sensitive habitats, riparian zone protection and the development of a construction environmental management plan) outlined in the GSSD credits and ratings guide. In addition, a gold level certification, the highest achievable under the GSSD system, is possible at the site but challenging as parks have to meet a higher threshold in order to get points under the credits system, the site is hemmed in by the estuary and Comox Road providing little room for coastal retreat and it does not suffer greatly from poor coastal development practices that could be remediated with a Green Shores approach. Therefore, it is recommended that as many of the suggested strategies as possible be implemented at the site as part of the potential Green Shores project work in order to actualize a gold level rating. These suggestions include

- Rebuilding the viewing platform on piers, moving it back from the shoreline, and installing a green roof on it.
- Removing invasive and/or non-native plant species found in the park and replanting them with native ones.
- Creating one formalized public trail to the shoreline rather than multiple informal ones to reduce the amount of impact on shoreline vegetation from pedestrians.
- Eliminating the impervious paving on the site and replacing it with pervious materials.
- Undertaking a shoreline restoration that includes strategies to stabilize the shoreline against climate change associated impacts and build up the saltmarsh platform to replace areas lost to erosion.
- Working to control the impact of herbivory by resident Canada goose populations in the local area by fencing off any newly replanted saltmarsh areas.
- Excavation of a tidal channel around an existing stand of trees currently inundated at only very high tides to create more access for fish to a forested wetland with overhanging vegetation.

- Creation of an integrated stormwater management plan utilizing infiltration site treatment with bioswales.
- Installing public educational signage and conducing tours of the site with the general public and interested professionals.

In addition, it is noted that in order to support high values salmon habitat norther two undeveloped parcels in the park need to be included in any work undertaken at the site as this area has the greatest potential to be improved to support salmon rearing, refuge and foraging opportunities. The site will also make a good demonstration site for those interested in the Green Shores methodology as it is located within a park, so public access is not an issue; and has the potential to use some innovate approaches to achieve a gold level certification.

1. Introduction and Background

In 2021, the Pacific Salmon Foundation (PSF) in collaboration with the Stewardship Centre for BC (SCBC) received funding from the Climate Action and Awareness Fund (CAAF) for their "Strengthening Adoption of Nature-Based Solutions for Climate Adaptation and Shoreline Resilience in British Columbia project 2021-2026" proposal. This project, also referred to as "Resilient Coasts for Salmon", is a five-year project to work on strengthening the adoption of nature-based solutions for climate adaptation and shoreline resilience in British Columbia. The project includes at least three shoreline projects on Vancouver Island, which will serve as demonstration sites for the application of nature-based shoreline restoration solutions as outlined in the Green Shores for Shoreline Development (GSSD) guide developed by the SCBC. These projects are intended support areas of high value salmon habitat while at the same time providing real life examples to be used for volunteer and shoreline practitioner training.

The Comox Valley Project Watershed Society (Project Watershed), was contracted by PSF to undertake a feasibility study to determine the various options for undertaking a Green Shores project that would meet the GSSD prerequisites and would score a gold level rating under the associated rating criteria (projects are rated as bronze, silver or gold based on how they score using the GSSD methodology). An important partner in this process is the Comox Valley Regional District (CVRD), as one of the SCBC requirements was that the project is based within a regional park and the CVRD had had input into the original CAAF proposal submission and were on board with having a Green Shores project undertaken within one of the local parks that they administer.

Specifically, the CVRD Planning and Parks Departments recommended Dyke Road regional park as a potential location for a Green Shores project. Project Watershed met with the CVRD Parks Department in the summer of 2021 at the site and they indicated that the whole Park was on their agenda for redevelopment. Thus, the scope of the initial Green Shores work was expanded, not just to include the redevelopment of the shoreline from a Green Shores lens but to encompass the entire park including the upland infrastructure. This feasibility study will determine if the park is a good candidate for the GSSD gold level certification, and the possible options that can be undertaken to redevelop the site in order to achieve this accreditation.

1.1 Project Area and Site History

Dyke Road Park consists of four relatively flat adjoining legal lots (see Figure 1 _bookmark4) within the CVRD and is approximately 0.6 hectares in size and is located between the K'ómoks Estuary and Comox Rd. The Puntledge and Tsolum Rivers merge to form the Courtenay River which is the freshwater body that feeds the Estuary. The K'ómoks Estuary is a Class 1 estuary, second in importance only to the Fraser River estuary, and one of only eight that are ranked as Class 1 in BC[1]. It is also a federally recognized important bird area (IBA) and supports 145 bird species, 218 plant species, 29 fish species (including 5 species of Pacific salmon), and a plethora of intertidal life.

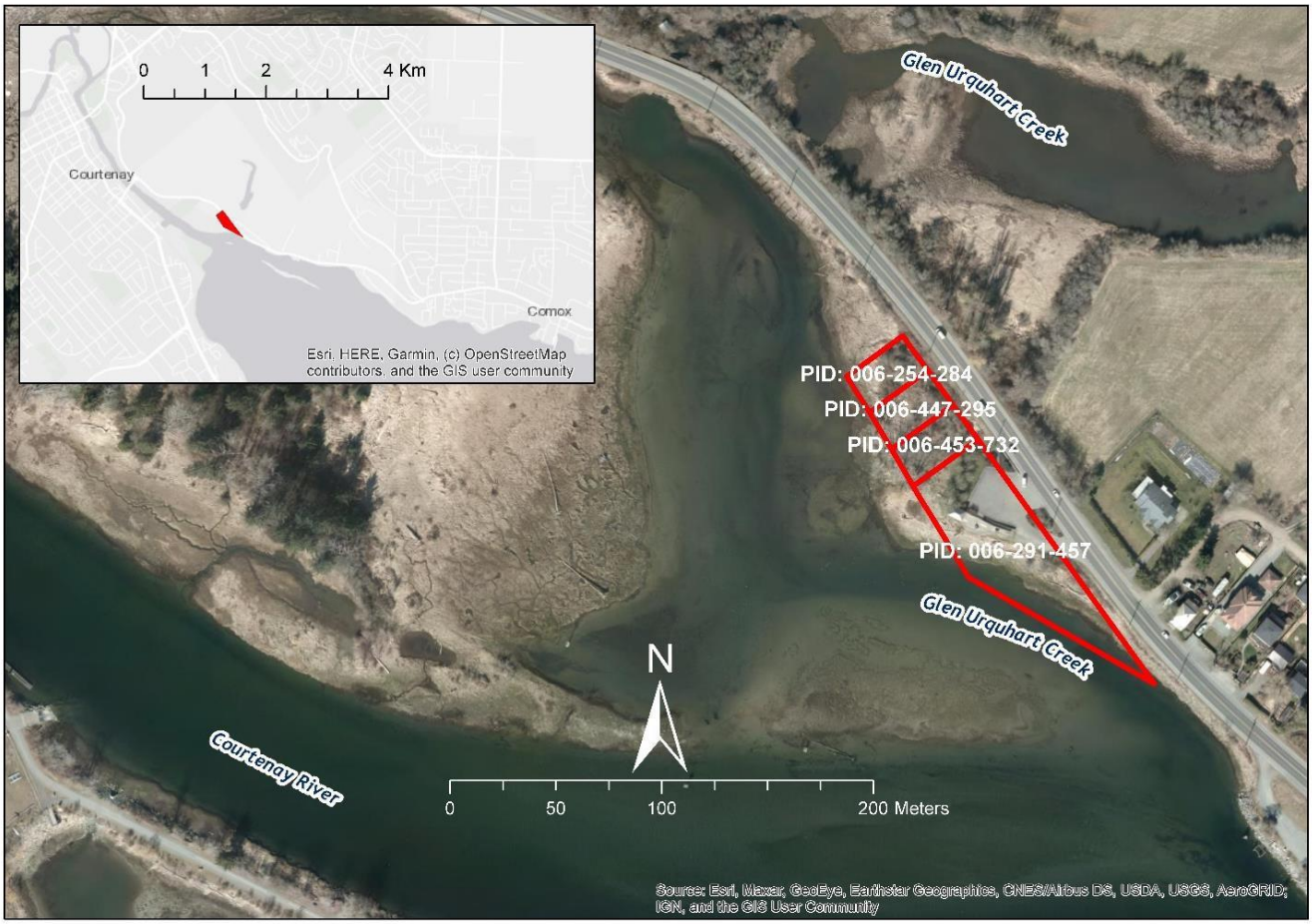

Figure 1 - Dyke Road Park parcels site outlined in red with the parcel identifier numbers (PID) shown.

Originally the site consisted of brackish shoreline saltmarsh mudflats dominated by *Carex lyngbeii*; and bisected by the drainage channel for the outlet of Glen-Urquhart Creek, which still boarders the park site to the west. Air photo analysis indicated that as early as the mid-1920s the area was being utilized for forestry related operations. The1926 air photo of the site shows a sawmill on the eastern shore of the site next to what is now Comox Road (locally often referred to as "Dyke Road"). In the 1929 air photo the sawmill operations have expanded across the Glen- Urquhart channel into the current Hollyhock Marsh Conservation area. At the same time the surrounding land was being utilized for agricultural activities and in the 1930s tide gates were installed under Comox Road to limit the amount of saltwater intrusion. This infrastructure, which is still in place today, consists of three culverts under Comox Road with flap gates that restrict access for fish (returning spawners as well as out-migrating and over-wintering juveniles) to and from the upper watersheds of Glen-Urquhart and Mallard Creeks. Subsequent air photos show the continued industrial use of the site for forestry related activities including log booming until the early 1950s.

A report by Levelton noted that anecdotal information indicated that in the late 1940's a fire at the site destroyed the majority of the on-site structures[2]. The land was purchased by the province in 1974; and the remaining structures were removed. Since 1980 the site has been

managed as a park by the CVRD under a 25-year License of Occupation granted through the provincial Ministry of Forests, Lands, Natural Resource Operations & Rural Development (FLNRO).

1.2 Current Site Conditions

The northern two lots have been left undeveloped, and support a brackish tidal wetland complex with the highest ecological values and environmentally sensitivity of any area in the park[3]. This area is mostly flat and inundated by the tides. It consists of open wetland pockets with sedges and rushes and more elevated areas that support different species of shrubs and trees. The area provides food resources for foraging and cover for rearing and refuge for a variety fish and wildlife such as waterfowl, birds, fish and small mammals. However, it has also been colonized by some invasive plant species including Himalayan blackberry and Reed canary grass, all of which outcompete many native plant species. Parks staff have been working on removing and controlling these invasive species near the picnic area, but complete eradication is difficult and some level of on-going maintenance will most likely be required to deal with these invasives.

Another invasive species of note, found within the estuary, is *Spartina patens*, or saltmarsh cordgrass, a species which outcompetes and takes over from a variety of native saltmarsh plants forming a monoculture. Although this plant was not observed within the park care should be taken to make sure it does not gain a foothold, and in particular that it doesn't colonize any newly planted saltmarsh areas that may form part of the potential Green Shores project work.

The southernmost two lots within the park are the most developed with infrastructure for public use, and the upper terrestrial section consists of a covered bird watching platform and associated decking, including a wheelchair ramp. The built structure covers 200 m^2, and is adjacent to the shoreline (Figure 2 and Figure 3). The platform is well utilized by local birders. There is also a paved parking area, 640 m^2 in size, with entrance and exiting lanes off of Comox Road, a main transportation corridor with a high volume of traffic. Surface drainage from the paved area is collected in a typical municipal storm drain system with a catch basin in the middle of the parking lot connect to an outfall pipe that discharges directly approximately 15 m away into an adjacent tidal wetland area. In addition, there is a grassy landscaped picnic area between the paved area and the wetland. The developed area also has some manicured planting beds with a mix of native and non-native plants a gravel shoulder area that extends south alongside Comox Road encompassing 80 m^2.

Figure 2 - View of the current Rotary bird viewing platform looking approximately north west.

Figure 3 - Viewing platform decking and wheelchair ramp, paved parking area.

Downslope from the Viewing platform is a marine shoreline area, which was the original focus for the Green Shores feasibility assessment prior to the scope of the project being expanded to include the entire park. This area is directly influenced by the tides and inundated with water during high tides and then drained with the outgoing tides. The substrate along this shoreline section consists of coarse pebbles to sandy and silty fines. As well some large woody debris (LWD), brought in with the high tides and storm surges, has settled along the shoreline (Figure 4 and Figure 5).

Figure 4 - Shoreline area in front of viewing platform.

Figure 5 - LWD along shoreline in front of platform.

A typical elevation profile of Dyke Road Park is shown in Figure 6. It includes the current bird viewing platform, the parking lot, Comox Road, and the vegetated zones seaward of the hard landscape features.

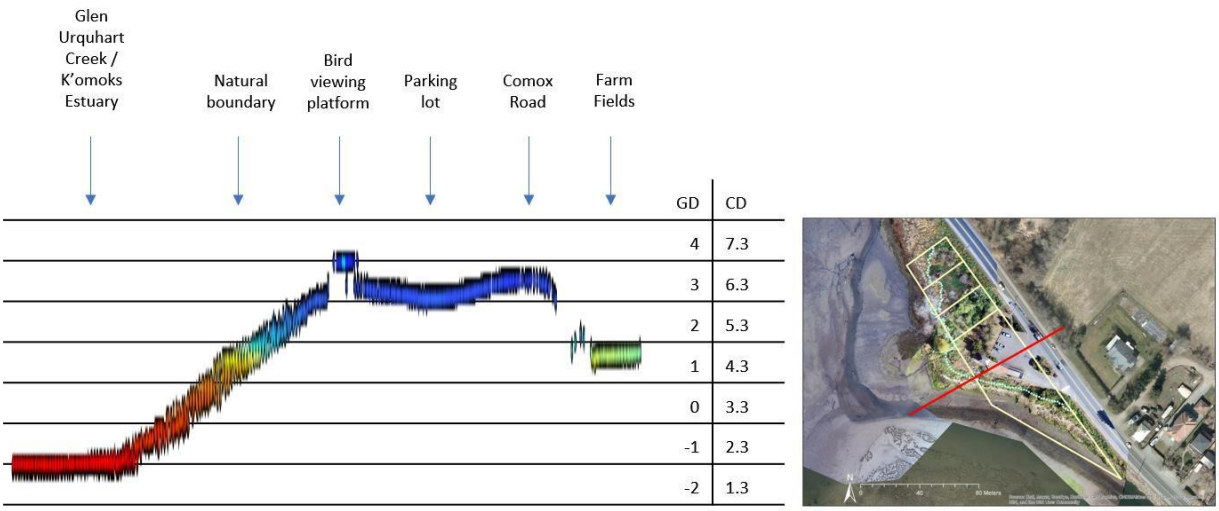

Figure 6 - Typical elevation profile of Dyke Road Park. Red line in the righthand map image shows the location of the profile across the site. The horizontal axis of the lefthand profile panel is compressed; total profile length is approximately 120 m. Elevations are approximate. Data source: City of Courtenay LiDAR (2012).

The shoreline has a moderate slope of between 2 to 7%; and recent mapping conducted by Project Watershed shows this zone to vary from about 12 to 20 m in width. In Figure 7 the orange cross-hatch areas show approximate extent of lost marsh habitat. Note imperfect alignment (a north and eastward shift of several metres) of Comox Road with the 1982 data (green outlines); if anything, this suggests a greater area of lost vegetated marsh habitat in this vicinity than depicted here.

Based on photographic evidence (Figure 8 and Figure 9), and a study completed by Current Environmental in 2010 (Appendix 1) there has been a notable decrease in the width of this zone. These changes could be due to coastal erosion due to climate change (higher sea levels and more frequent and intense storms). Another cause of coastal erosion in the area is goose herbivory.

Resident Canada geese (*Branta canadensis*) numbers are increasing along the east coast of Vancouver Island, causing habitat impacts due to herbivory of saltmarsh and eelgrass. An intense introduction program in the mid-20th century led to a well-established resident population, before which these birds were only migratory and winter visitors[4]. These geese feed on the saltmarsh vegetation and grub out the rhizomes of the plants which hold the sediments in place. Once the rhizomes are removed the sediment becomes loose and unconsolidated and is easily washed away by wave action, leaving no material for new plants to colonize. In particular, a saltmarsh platform directly across the channel from the site (shown in Figure 7) has been completely denuded of vegetation due to grazing by geese.

Figure 7 - Decrease in aerial extent of vegetated intertidal marsh adjacent to Dyke Road Park since 1982. Orange crosshatch areas represent sediment and vegetation loss; impacts to vegetation often extend landward of this fully denuded zone. Data sources: Kennedy (1982) and Project Watershed aerial imagery interpretation conducted in 2020 and 2021.

Figure 8 - View from the project site across the upper K'ómoks Estuary, summer 2010. Note extent of vegetated marsh habitat bordering denuded mudflat. Carex lyngbyei, an important marsh sedge, is already mostly absent from the area by this time due to resident Canada goose herbivory. Debris from forest industry operations are visible in the mudflat zone.

Figure 9 - Approximately the same view as the previous figure in late summer 2017. Note decrease in vegetated marsh area around the margins of the watercourse. Resident Canada geese are visible feeding in the center of the image.

In addition, there has been a change in the plant communities found in this area compared to species that were noted in a 1982 study[5] and plant inventories recently conducted by Project Watershed at the site. Early in September, 2021 shoreline plants contained in 1 x 1 m quadrats placed along transects perpendicular to the shoreline were inventoried by Project Watershed.

Concomitantly, unmanned aerial video (UAV) was obtained and this spatial imagery was processed with Pix4D software to produce shoreline vegetative polygons at the site - see Table 1 for an updated inventory of the plant species found at the site, these vegetative communities are also mapped via polygons on Figure 10. The current vegetative communities at the site were also compared with those inventoried by Current Environmental in 2010. Since that study was completed, some notable invasive species have crept into this area including Reed canary grass and white clover. However, no evidence of the invasive saltmarsh cord grass *Spartina patens* was noted, despite being found in other locations nearby the site.

Figure 10 - Results of vegetation inventory conducted in Summer 2021 at Dyke Road Park. Dotted blue line indicates the natural boundary. Note, the northern parcels were not included in this inventory effort. Jagged margins of polygons indicate the extent of the survey and/or imagery interpretation effort. Data sources: Project Watershed orthomosaics (2020 and 2021) and field surveys.

Table 1 - Plant inventory for Dyke Road Park

Riparian and terrestrial species							
Native		**Presence (P) Not Detected (ND) Not Reported (NR)**		**Exotic and/or Invasive**		**Presence (P) Not Detected (ND) Not Reported (NR)**	
Common	**Scientific**	**2010**	**2021**	**Common**	**Scientific**	**2010**	**2021**
American dunegrass	*Leymus mollis*	P	P	Alfalfa (?)	*Medicago sp.*	NR	P
Black Cottonwood	*Populus balsamifera*	P	P	Canada Thistle	*Cirsium arvense*	NR	P
Black Hawthorne	*Crataegus douglasii*	NR	P	Common Hawthorne	*Crataegus monogyna*	P	P
Common Horsetail	*Equisetum arvense*	NR	P	Common Tansy	*Tanacetum vulgare*	NR	P
Cow Parsnip	*Heracleum maximum*	P	ND*	Common Vetch	*Vicia sativa*	NR	P
Herb Robert	*Geranium robertianum*	P	ND*	Curled Dock	*Rumex crispus*	NR	P
Nootka Rose	*Rosa nutkana*	P	P	Cutleaf Blackberry	*Rubus laciniatus*	NR	P
Pacific Crapapple	*Malus fusca*	P	ND*	English Plantain	*Plantago lanceolata*	NR	P
Pacific Ninebark	*Physocarpus capitatus*	P	ND*	Hairy Cat's Ear	*Hypochaeris radicata*	P	P
Pacific Willow	*Salix lucida*	P	P	Himalayan Blackberry	*Rubus armeniacus*	P	P
Red Alder	*Alnus rubra*	P	ND*	Morning Glory	*Calystegia sepium*	P	P
Red Elderberry	*Sambucus racemosa*	P	ND*	Queen Anne's Lace	*Daucus carota*	NR	P
Red Osier Dogwood	*Cornus stolonifera*	P	P	Red Clover	*Atriplex sp.*	NR	P
Salmonberry	*Rubus spectabilis*	P	ND*	Reed Canary Grass	*Phalaris arundinacea*	P	P
Slough Sedge	*Carex obnupta*	P	P	White Sweet-clover	*Melilotus albus*	NR	P
Snowberry	Symphoricarpos albus	P	P	Broadleaf Plantain	*Plantago major*	NR	P
Stink Currant	*Ribes bracteosum*	P	ND*				
Tall Oregon Grape	*Mahonia aquifolium*	P	P				

Table 1 (concluded)

Shore zone and intertidal species							
Native		**Presence (P) Not Detected (ND) Not Reported (NR)**		**Exotic and/or Invasive**		**Presence (P) Not Detected (ND) Not Reported (NR)**	
Common	**Scientific**			**Common**	**Scientific**		P
American Dunegrass	*Leymus mollis*	P	P	English plantain	*Plantago lanceolata*	NR	P
Baltic Rush	*Juncus balticus*	NR	P	Curled Dock	*Rumex crispus*	P	P
Bentgrass	*Agrostis sp.*	NR	P	Creeping Saltbush	*Atriplex sp.*	NR	P
Broadleaf Plantain	*Plantago major*	NR	P	Reed Canary Grass	*Phalaris arundinacea*	P	P
Coastal plantain	*Plantago maritima*	NR	P				
Douglas aster	*Symphyotrichum subspicatum*	NR	P				
Henderson's checkermallow	*Sidalcea hendersonii*	P	P				
Lyngbye's sedge	*Carex lyngbyei*	P	P				
Marsh Pea	*Lathyrus palustris*	NR	P				
Sea Asparagus	*Salicornia virginica*	NR	P				
Sea Milkwort	*Glaux maritima*	NR	P				
Seaside arrowgrass	*Triglochin maritima*	NR	P				
Silver Burrweed	*Ambrosia chamissonis*	P	P				
Silverweed	*Potentilla egedii*	P	P				
Sow Thistle	*Sonchus arvensis*	NR	P				
Springbank clover	*Trifolium wormskioldii*	P	P				
Tufted Hair Grass	*Deschampsia cespitosa*	NR	P				

2. Application of Green Shores for Shoreline Development (GSSD) Principles to Dyke Road Park

2.1 How the GSSD Credits and Ratings Guide Works

The SCBC created the GSSD Credits and Ratings Guide (Appendix 3) for use by waterfront (both freshwater and marine) property owners and managers to develop or redevelop their properties using a nature-based approach that meets four key guiding principles:

1. **Preserve** or restore physical processes—the natural actions of water and sediment movement that maintain healthy shorelines.
2. **Maintain** or enhance habitat function and diversity along the shoreline.
3. **Prevent** or reduce pollutants entering the aquatic environment.
4. **Avoid** or reduce cumulative impacts—small individual effects that add up to large impacts on shoreline environments.

The GSSD rating system promotes the development of properties in a shore-friendly way while adhering to the guiding principles listed above. It aims to maintain and/or enhance shoreline ecology and ecosystem services while simultaneously reducing the impacts of shoreline development and climate change. The system is voluntary and is compatible with LEED for Homes, BuiltGreen and Sustainable Sites programs.

The GSSD rating system outlines five obligatory prerequisites, if a project can demonstrate that it meets these prerequisites, then it qualifies to be assessed using a series of ten credits for each of which it can achieve a certain number of points in order to come up with an overall score (see Table 2 below)

Table 2 - GSSD Prerequisites and Credits

GSSD Prerequisites		
Prerequisite 1	Siting of Permanent Structures	
Prerequisite 2	Conservation of Shoreline Sediment Processes	
Prerequisite 3	Conservation of Critical or Sensitive Habitats	
Prerequisite 4	Riparian Zone Protection	
Prerequisite 5	Construction Environmental Management Plan	
GSSD Credits		
Credit 1	Site Design with Conservation of Shore Zone	1 to 3 points
Credit 2	Shore-Friendly Access	1 to 3 points
Credit 3	Re-Development of Contaminated Sites	2 points
Credit 4	Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes	2 to 9 points
Credit 5	Restoration/Enhancement of Aquatic Habitats	1 to 8 points
Credit 6	Enhanced Riparian Zone Protection	1 to 9 points
Credit 7	Integrated Stormwater Planning and Design	2 to 5 points
Credit 8	Climate Change Adaptation Plan	2 to 5 points
Credit 9	Exceptional Performance and Innovation	1 to 2 points
Credit 10	Outreach and Public Education	3 to 5 points

2.2 GSSD Accreditation

The GSSD accreditation process involves the enrollment of the project, the project design and construction and then finally the project is assessed by a GSSD verifier team who undertake a site visit to make sure the project achieves its intended objectives, and the project then receives a Greens Shores rating and award. It is important to note that the GSSD credits and rating system are applied differently to park projects versus other developments, and Dyke Road Park must meet a higher standard for achieving the different rating levels. As mentioned previously the goal is to qualify the Dyke Park Green Shores project at a gold level. A project is certified bronze if it scores 10 points, silver if it scores 16 points and gold if it scores 22 points. This feasibility study outlines possible options for work at the site that will allow the project to realize the gold level rating.

Therefore, the next section of this study works through the GSSD prerequisites and credits and identifies potential redevelopment options for the site that are feasible, embody Green Shores principles, and have the best chance of meeting the gold level certification.

2.3 GSSD Prerequisites Applied to Dyke Road Park Redevelopment

Prerequisite 1: Siting of Permanent Structures

The objectives of this prerequisite are threefold:

1. To site permanent structures upland of high-risk areas subject to erosion and flooding to reduce the current and future need for shoreline protection and the potential for property damage,
2. To anticipate and adapt to impacts from sea level rise and climate change, and
3. To minimize impacts to fish and wildlife from overwater structures and excessive outdoor lighting.

The GSSD program defines permanent structures as "any building or structure lawfully constructed, placed or erected on a secure and long-lasting foundation on land that cannot practically be elevated or moved in accordance with any local government at the time of construction placement or erection". Hence the current birdwatching platform in the park qualifies as a permanent structure. The GDDS sets out guidelines for how to meet the various prerequisites. In the case of the siting of new permanent structures there are a couple of options that are available to meet this prerequisite. The first is to conform to a minimum setback distance based on the shore type and bank height. In the case of the Dyke Rd Park site, it qualifies as a low elevation shoreline made up of gravel and sand beach deposits. According to this classification the GSSD recommends a minimum horizontal setback distance of 25 m from the Natural Boundary (NB) / Ordinary High Water Mark (OHWM). However, this setback *must be equal to or greater than that which is required by local regulations*. The CVRD Floodplain Management Bylaw - No. 600 which came into effect in 2020, regulates the siting and construction of buildings and structures within the floodplain. As defined by this bylaw the site is within the floodplain for the Courtenay River, specifically the Courtenay Flats area and the any structures must be 30 m from the natural boundary of the river. The site is already setback 30 m from the Courtenay River. The bylaw also stipulates structures to be setback 15 m from the natural boundary of the sea. Thus, the GSSD guideline of a 25 m setback supersedes the CVRD setback of 15m from the NB of the ocean, and the birdwatching platform and associated decking should be relocated 25 m back horizontally from the natural boundary. Figure 11 shows the 15 and 25 m setbacks from the natural boundary of the sea in relation to the siting of the current platform. The 25 m setback confines the site to a small area, in very close proximity to Comox Rd, for relocation of the platform. Another option to meet this requirement is to take a costal retreat approach and completely unbuild the site, however the bird watching platform is a highly utilized asset by the local community, and the CVRD intends to redesign the park with consideration of Greenshores principles.

Figure 11 - Setback extents from the natural boundary (blue dotted line): yellow crosshatch = 15m, orange crosshatch = 25m.

For a project site that does not meet the minimum setback specified above, a second option outlined by the GSSD for meeting this prerequisite is to situate and build the permanent structure so as to allow for natural erosion and sea level rise to take its course over the lifetime of the structure, without the need for future shoreline protection. This option can be accommodated at the site and Project Watershed recommends the following steps in order to achieve it. First, the bird watching platform and associated decking should be moved back horizontally 15 m from the NB to comply with the floodplain setbacks outlined in Sec. 303 of the CVRD floodplain bylaw. In addition, the structure should also be elevated on piers to accommodate anticipated sea level rise. The amount of vertical elevation required the site currently lies 2-3 m above the NB (a geotechnical report by Lewkowich Engineering indicated that the area with the viewing platform and parking has been artificially raised between 1.8-2.5 m in height through the use of imported fill consisting of mostly silty sand along with debris such as cobbles and asphaltic concrete (See Appendix 2).

Section 302 of the CVRD bylaw stipulates the flood construction levels for the site must be 4.1 m above the NB of the water body, in order to conform with the 1 in 200-year flood level within the Courtenay River floodplain (Figure 13 and Figure 15). The most recent City of Courtenay floodplain mapping (Figure 13) shows the site above the 2012 floodplain boundary. The year 2100 and 2200 flood limits, which take into consideration sea level rise, are farther east of the site and the show the site completely underwater (Figure 12). The CVRD bylaw's 4.1 m

figure accommodates these flooding scenarios. However, the City of Courtenay's Integrated Floodplain Management Study (2013) indicates that the 2100 Climate Planning Flood Level for the area surrounding Dyke Road Park is 4.56 m GD, and the CVRD's Regulatory Floodplain Mapping[1] and Coastal Flooding Report (2020) indicate a suggested flood construction level of 5.7m (Figure 14). The birdwatching platform is not intended to be a habitable structure it is exempt from the Sec 302 of the Bylaw. However, to qualify for the GSSD Prerequisite #1, and adapt to anticipated sea level rise and increasing storm surges the platform infrastructure should be elevated; and the 4.56 m to 5.7 m GD figures are good reference values. Hence the platform should be built up between 1.1-3.76 metres from the current grade, depending on where it is situated on the site. A professional survey should be conducted to obtain the exact elevation of the site in relation to the NB. Furthermore, as the platform is not a habitable structure the CVRD bylaw indicates that a coastal engineering report from a professional engineer isn't required. However, is highly recommended that such a report be obtained and a site-specific coastal wave analysis be completed to inform the site Green Shores design.

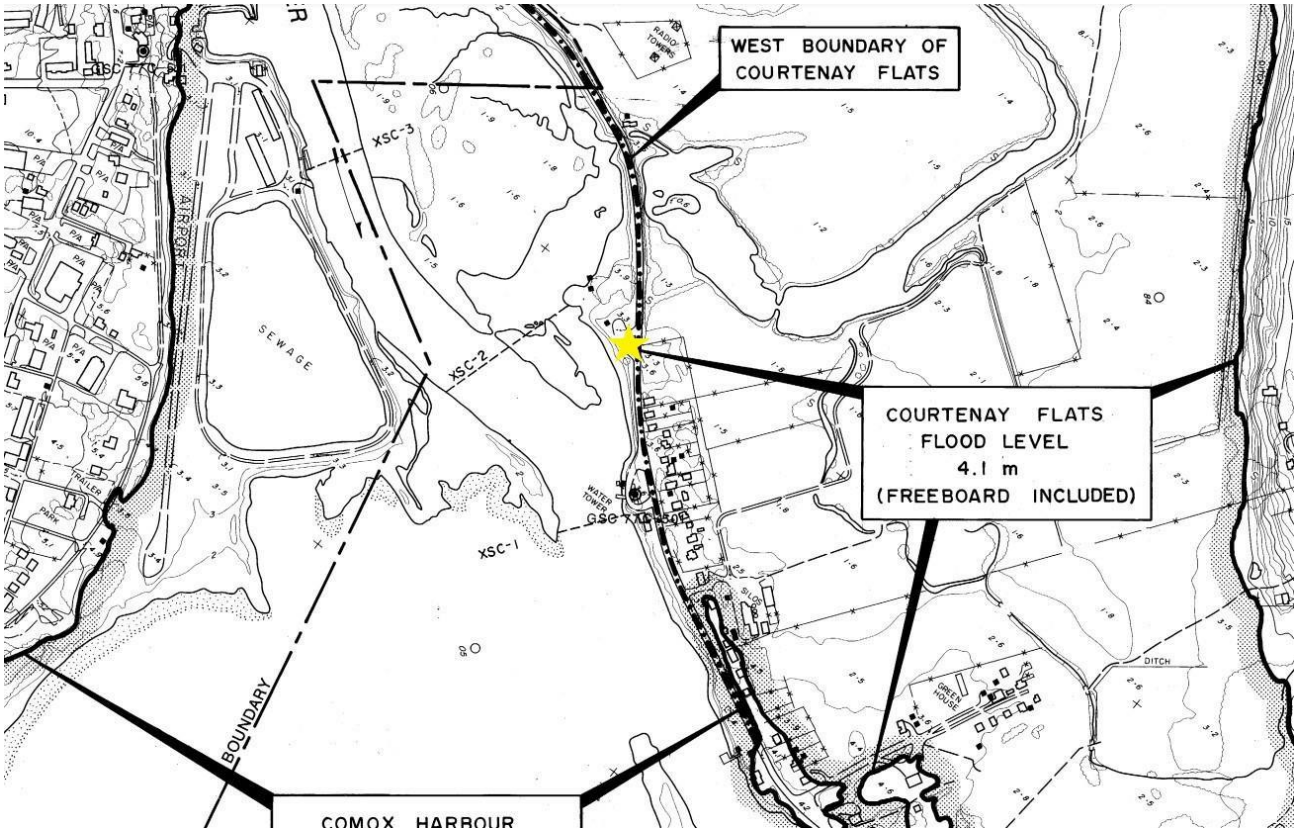

Figure 12 - Flood Construction Level map for the Dyke Road Park area. The project site is marked with a star. Source: Comox Valley Regional District Floodplain Management bylaw 600.

[1] Regulatory Coastal Floodplain Mapping (arcgis.com). Accessed March 2022.

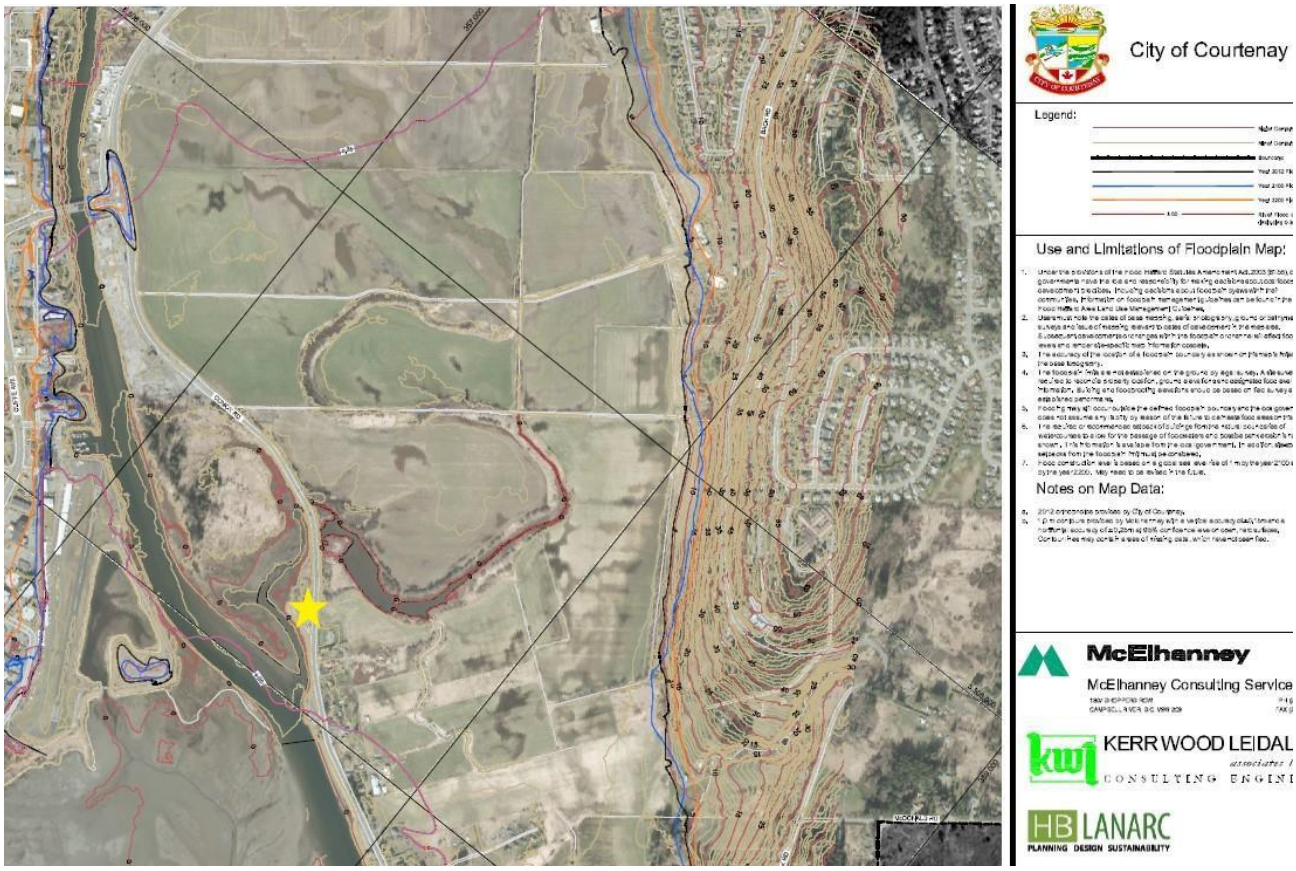

Figure 13 - City of Courtenay flood zone mapping showing the 2012 floodplain limit and the projected 2100 and 2200 floodplain limits. Source: City of Courtenay Integrated Flood Management Study (2013).

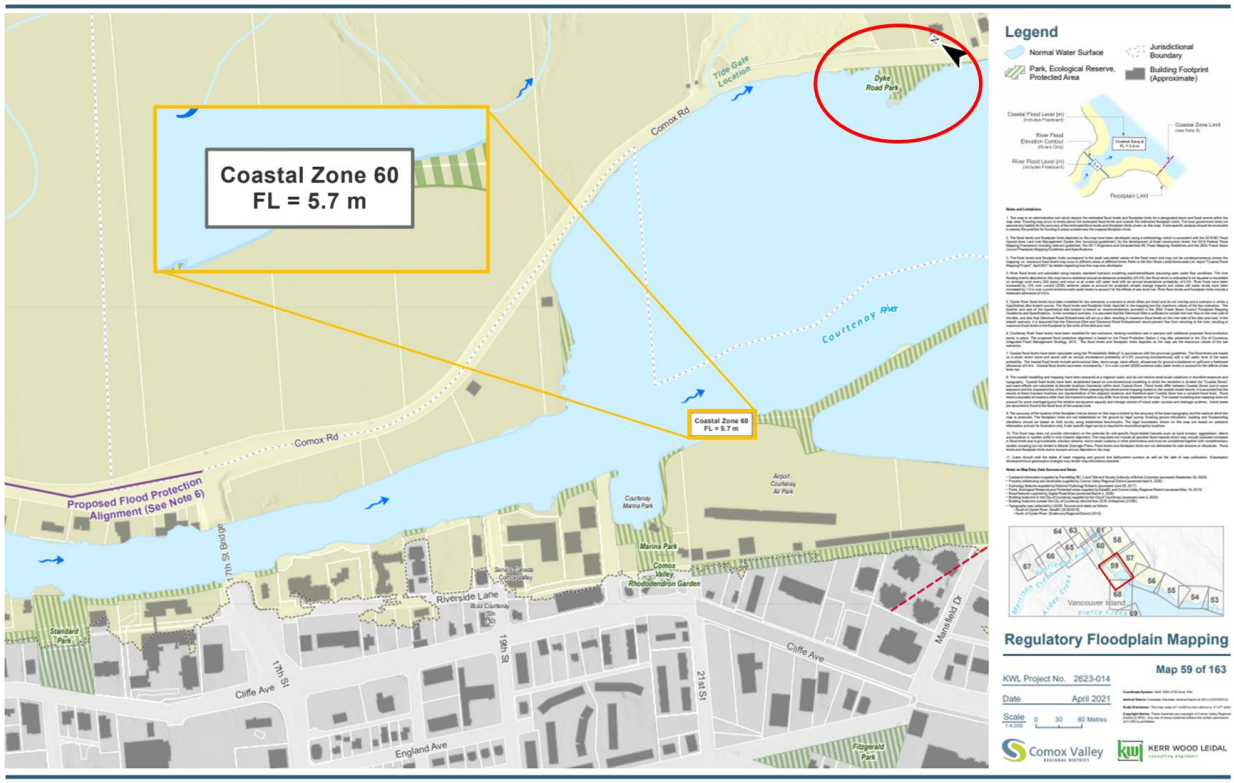

Figure 14 – Dyke Road Park (shown in red circle) has a recommended flood construction level of 5.7 m. Image modified from the CVRD Regulatory Floodplain Mapping available online (see text for link).

The platform is already elevated as it is built on a raised cement foundation. This foundation is functioning as a mini seawall and is amplifying wave energy resulting in local erosion at the site (Figure 15). It also does not allow for coastal retreat or landward migration of the vegetative communities as sea levels rise thereby contributing to coastal squeeze (see Figure 16). Having a well-designed platform elevated on non-creosote treated pilings will allow for any high tides and storm surges to move through the site and under the structure without causing damage to the structure or amplified erosion of the shoreline and will allow flood waters to recede quickly. As well, the foreshore area in front of the platform and parking lot should be enhanced with natural features that serve as wave energy dissipation structures. These could include large woody debris that is fixed in place and/or large rounded boulders that will act to protect and maintain the soil surrounding the viewing platform and parking areas. Revegetation of the shoreline should occur in step with any shoreline protection works. Suggestions for how to carry out this work are detailed in the section entitled Recommended Options for Dyke Road Park Green Shores Work.

As the site has previously been infilled the GSSD guidelines indicate the new vertical fill is allowed to meet the vertical elevation criterion in combination with a restoration effort in the upland areas of the site. This is an option for the site, however, adding additional fill to the site would potentially raise it above the current elevation of Comox Rd and create a berm along the roadway. In this case the provincial Ministry of Transportation, Infrastructure, and Highways (MOTHI) should be consulted to make sure that the road drainage is not impacted by the newly raised site. The entrance and exits from the site would also have to be designed with a gradual slope to accommodate the additional fill and if not designed properly could be a hazard for cyclists. As there is not a lot of road allowance between the site and Comox Rd adding fill to the site will create some design challenges and extra permitting will be required to import the fill. Given the extra logistical challenges associated with adding fill to the site we do not recommend that this method be pursued to achieve the required elevation.

Currently the site has neither overwater structures nor artificial lighting. We recommend that no such structures or artificial lighting be incorporated as part of any new construction to minimize impacts to fish and wildlife and align with GSSD prerequisite #1.

Figure 15 - Seaward side of bird viewing platform with eroding bank below.

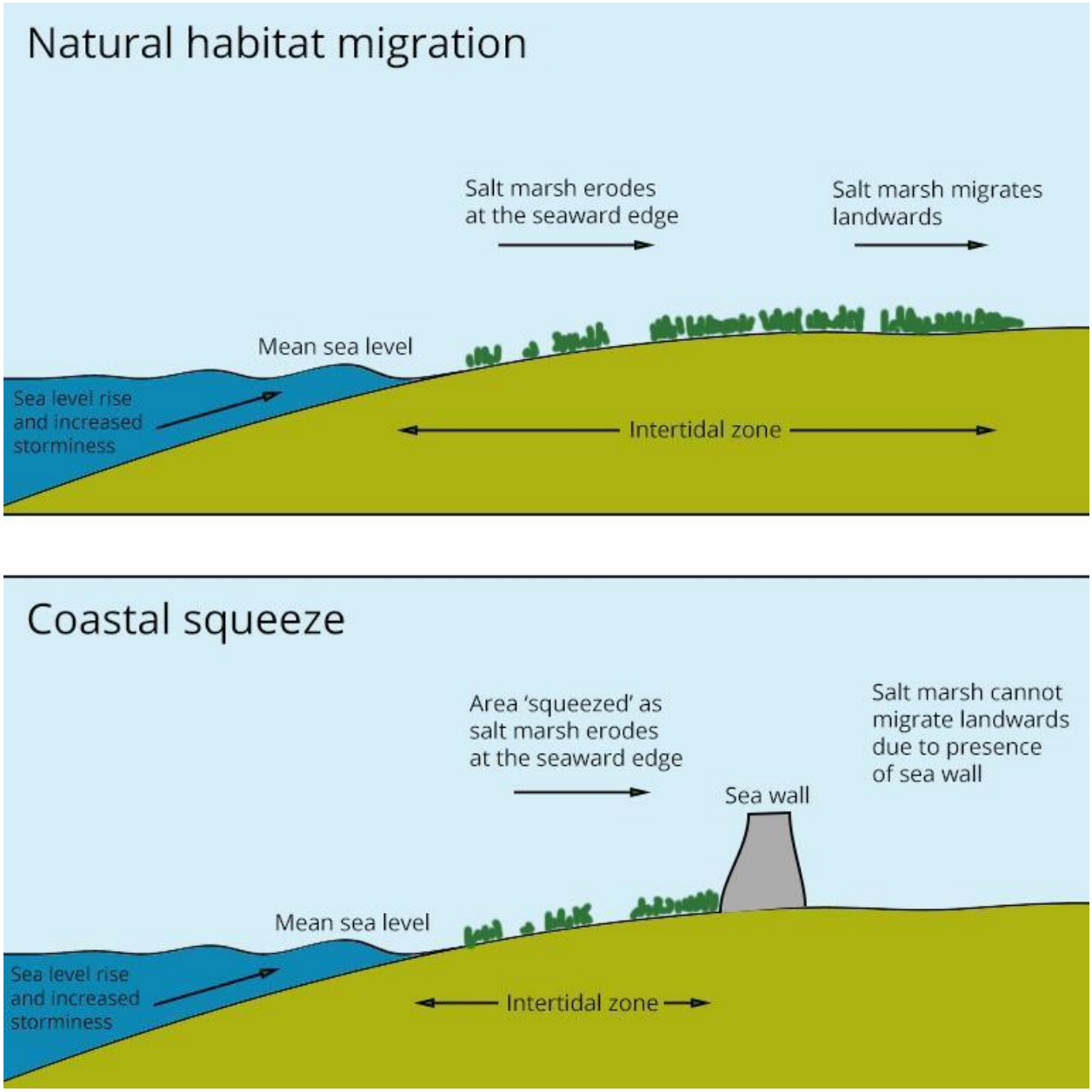

Figure 16 - When coastal squeeze occurs, the marshes become overwhelmed with salt water, yet cannot expand inland. Image source: Hampshire County Council via Coastal Wiki.

Prerequisite 2: Conservation of Shoreline Sediment Processes

This prerequisite aims to ensure that the shoreline development does not significantly reduce sediment supply or sediment transport within the coastal and lakeshore environments. In the coastal zone longshore sediment systems, or drift cells, are the primary definers of shoreline characteristics. These drift cells can be dived into three different zones:

1. Sediment source areas (usually eroding bluffs or estuarine inputs),
2. Sediment transport areas driven by prevailing wind and currents and
3. Sediment sink areas where deposition and accretion of transported sediments occurs.

Common coastal development activities that interfere with natural sediment transport and recruitment processes include dykes, seawalls, marinas, docks, groins and shoreline armouring (rip rap, gabions, wooden crib walls, steel pilings etc.).

The site is in a backwatered section of the K'ómoks Estuary and is outside of the high-energy Willemar Bluff erosion and transportation zone as well as the Goose Spit sediment sink zone (Figure 17), with minimal effects from longshore sediment transport. It is influenced by outflows and sediment inputs from the Courtenay River as well as Dyke Slough (Glen-Urquhart Creek and Mallard Creek). In its natural state, this is low-to-moderate energy, fairly stable shoreline that is subject to slow accretion with small amounts of sediment lost to wind and wave erosion.

The site is also subject to tidal, wind, and wave processes. Winter storms come predominantly from the southeast, and the portion of the site directly adjacent to the current Bird Viewing Platform shows clear evidence of localized sediment erosion and re-deposition along with accumulation of excess large woody debris during winter storms, likely exacerbated by the hard-armouring of the platform. Moving to the northwest end of the site, there is less evidence of storm energy erosion processes. The undeveloped parcels of Dyke Road Park northwest of the current Bird Viewing Platform are sheltered by the southeast portion, which bears the brunt of winter storm energy.

It is important to note the role of accelerated marsh erosion in this area caused by resident Canada geese. The feeding behaviour of these geese has led to the loss of large areas of vegetated wetland (see Figure 7). These former marsh platform areas would have further attenuated winter storm energy and their loss is likely contributing to accelerated erosion of underlying mineral sediments during winter storm events.

In order to meet Prerequisite #2, the site redesign must take into consideration shore sediment supply and longshore sediment transport ecosystem services. Specifically, for this site, according to the GSSD guidelines, the project should be designed so that:

1. There is no need for shore protection works over the life or the project or a 50-year cycle annual erosion including allowance for sea level rise.
2. If sediment nourishment is required then a post-construction monitoring plan for determining the success of the nourishment must be provided.
3. The proposed redevelopment cannot alter longshore sediment transport in such a way as to increase the risk of adverse impacts, like erosion.
4. If the site has pre-existing shore modifications, including fill, the proposed design must improve on longshore sediment transport.

Therefore, it is recommended that the new engineered design for the site utilize a Green Shores approach rather than traditional hard armoring for protection. Instead, one possible option is for the foreshore to include large woody debris (drift wood logs) dead-man anchored to the shoreline and angled to deflect prevailing winter storm energy in order to emulate small natural coastal headlands. This will allow for passive recruitment of sediments and establishment of intertidal plant species, thereby reducing need for shore protection works in

future. To expedite the plant colonize process a small amount of beach nourishment behind the anchored logs planted with suitable native plant species is a possibility. The removal of the existing bird watching platform foundation wall and replacing it with a naturally sloped shoreline area up to the new platform area should help mitigate the current erosion occurring at the site. The design for the platform should build in adaptation for more frequent and intense costal storm events as well as more intense rainfall events. The piers that the structure is built on should be made of materials and installed in such a way to last 50 years or longer as built.

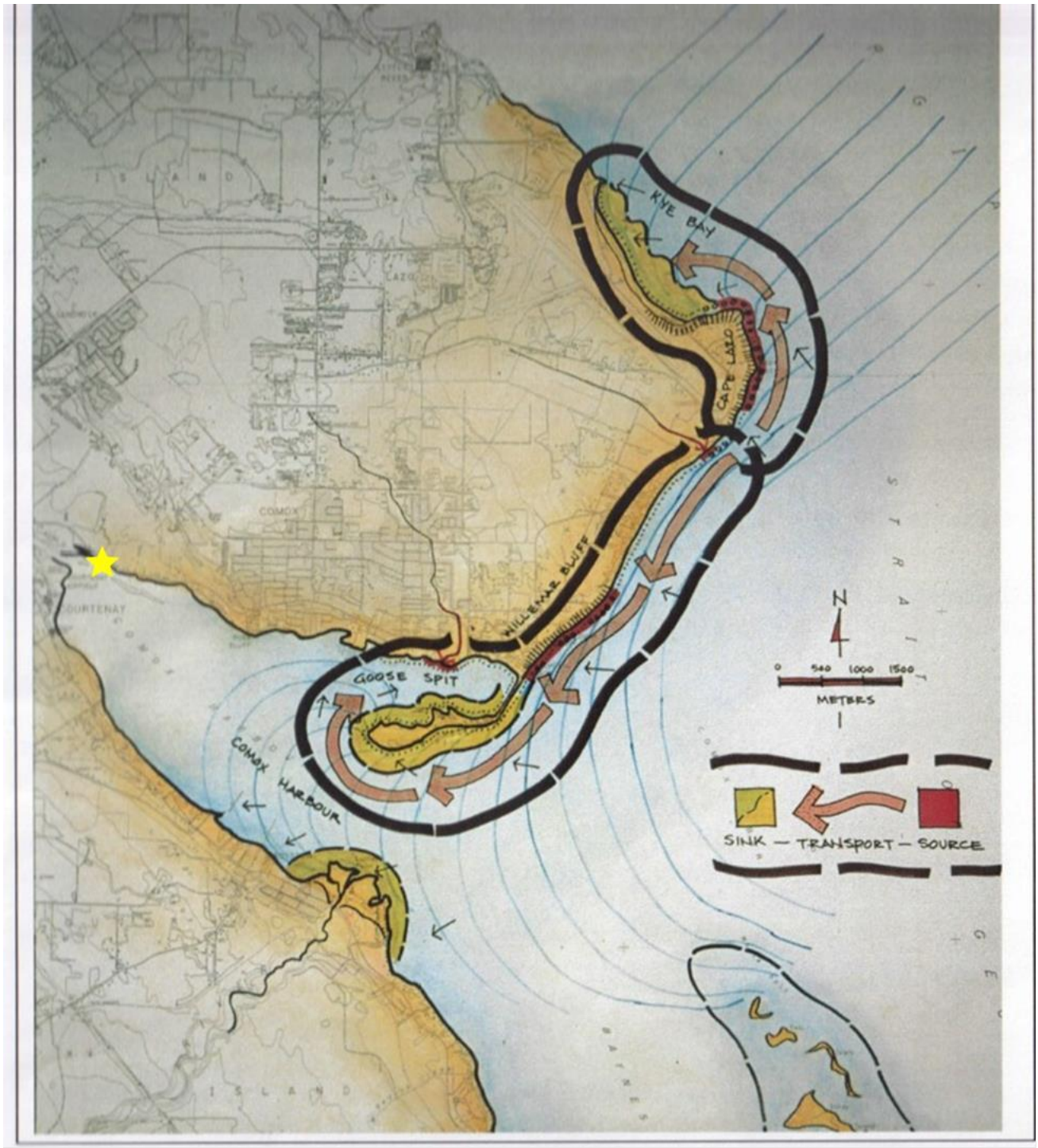

Figure 17 - Willemar Bluffs and Goose Spit sediment transport and sink zones. The star on the lefthand side of the image shows the location of Dyke Road Park. Image credit "A Framework Plan for Coastal Zone Management" produced by W. Marsh and A. Mewett for CVRD.

Prerequisite 3: Conservation of Critical or Sensitive Habitats

The third prerequisite deals with ensuring there is no net loss of critical or sensitive habitats within the site and that all the applicable regulatory conditions that govern these areas are met. To meet this requirement a copy of all the approvals or permits from the appropriate regulatory agencies will have to be obtained as part of the GSSD rating process. Work within the coastal zone is governed by multiple jurisdictions and all levels of government and First Nations have some regulatory authority and over sight. Permitting will need to be obtained from the following regulatory authorities:

Fisheries and Oceans Canada (DFO)

Under Section 35. (1) of the federal Fisheries Act, which was most recently amended in August 2019, no person shall carry on any work, undertaking or activity that results in the death of fish and/or harmful alteration, disruption or destruction of fish habitat. Thus, the project proponent will have to apply to DFO for a request for review in order to assess any potential risks that the project possess to fish and /or fish habitat. DFO may recommend best management practices to avoid these potential risks as part of their authorization process.

Province of BC

Riparian Area Protection Act (RAPA) and Regulation (RAPR)

The goal of this legislation is to identify and avoid or mitigate impacts to fish and fish habitat resulting from land use changes related to development by protecting the natural features and processes associated with streams. It applies to riparian areas within municipal jurisdictions (subject to the Local Government Act). As this site borders Glen-Urquhart Creek the upper terrestrial area can be considered to fall within the riparian zone, therefore this legislation is applicable, and the proposed works should be reviewed by a qualified environmental professional (QEP) to conduct biological and ecological assessments to identify potential impacts and develop plans to avoid or mitigate them. This box will be achieved by the production of a Construction Environmental Management Plan (CEMP) see Prerequisite #5 below.

Land Tenure Branch

The province owns most of the foreshore and administers this area through the Land Tenure Branch. To be compliant with the GSSD guidelines no permanent structures can be planned within the foreshore as part of the proposed redevelopment of the site, therefore a tenure application will not be needed.

Ministry of Forests, Lands, and Natural Resource Operations and Rural Development (FLNRORD)

The Stewardship Centre of BC and FLNRORD have collaborated to develop and expedited permitting process for Green Shores projects. Project planning should include development of all the application information requirements for this expedited process.

Additionally, a General Wildlife Permit from FLNRORD through Front Counter BC will be

required before any project work can be undertaken within the foreshore area.

Archeology Branch

Services of a professional Archeologist will be required to prepare and submit a Heritage Inspection Permit (HIP) application to the Province of BC's Archeological Branch. As well if changes are planned to the site, then a Site Alteration Permit (SAP) application outlining how to manage the expected impact(s) of the Green Shores site redevelopment on any culturally significant artifacts that may be encountered – including avoiding archeologically sensitive areas, providing guidance on archeological monitoring, etc. will also need to be submitted to the province.

K'ómoks First Nation

First Nations have authorities like provincial and local governments over upland and aquatic lands within Indian Reserves. In addition, they must be consulted on any shoreline tenure applications to ensure they do not significantly affect their aboriginal or treaty rights. The K'ómoks First Nation (KFN) has recently instituted a Cultural Heritage Investigation Permit (CHIP) permitting process requiring any work undertaken within 200 m of the shoreline to obtain a CHIP permit. They have also indicated that there is a midden site within the park, which will require further investigation, and any excavation work taken at the site will require archaeological monitoring by a qualified professional[6].

Comox Valley Regional District (CVRD)

The CVRD has the authority to plan and regulate land use within their jurisdictional boundaries, which may extend over foreshore and nearshore areas. This is done through official a variety of tools including community plans, zoning development permits, building permits and regulatory bylaws that affect land development. Listed below are the relevant CVRD regulations that pertain to the Green Shores redevelopment of the site.

Floodplain Management Bylaw No. 600

As mentioned previously, under Perquisite #1, the Floodplain Management Bylaw - No. 600 regulates the siting and construction of buildings and structures within the floodplain.

Official Community Plan (OCP) Bylaw No. 337 – Schedule 'A'

Natural environment – natural systems and biodiversity corridors policies

5. (1) Promote best management practices to protect natural systems, land forms, the marine environment and habitat.

(2) Recognize aquatic habitats and resources as environmentally sensitive sites that need to be protected and restored.

(3) Protect aquatic ecosystems, including riparian areas with tools such as the provincial riparian areas regulation, development permit area designations, guidelines, and sound rainwater management policies and practices.

(6) Use design with nature principles for new development to reduce environmental,

social and economic vulnerabilities and to build community and ecological resiliency.

(7) Encourage practices that reduce the pollution of air, soil and water and that have beneficial effects on aquatic and terrestrial ecosystems, such as the preservation and planting of trees.

(8) Encourage development proposals that include pre and post development measures in order to protect and preserve natural features that are recognized as significant including wooded areas, watercourses, groundwater recharge areas, valley lands and existing hedgerows.

(9) Encourage identification, protection and restoration of priority ecological areas and wildlife corridors to increase resilience of the natural environment such as K'ómoks Estuary, the Trent River system, coastal sand dunes and other priority ecological areas.

Natural environment – watershed management/protection policies

6. (1) Promote best management practices to protect natural systems, land forms, the marine environment and habitat.

(2) Require an applicant to hire a qualified professional, where appropriate, to assess potential water quality and quantity impacts, and submit an on-site drainage report with recommendations to ensure the pre-development or natural hydrologic regime is maintained or restored by the development, prior to development approval.

(3) Use rain water management techniques in the design and construction of new development to control quantity and quality of rain water runoff. The degree of control and techniques used will depend on the scale of development and the conditions in the downstream receiving water bodies in order to avoid adverse effects on the downstream aquatic environment and adjacent lands.

(4) Request an enhanced level of rain water quality control for development sites draining into the marine environment and the K'ómoks Estuary, in order to protect important aquaculture areas and to maintain water quality in the Strait of Georgia.

(5) Encourage water conservation through the adoption of low irrigation landscaping and discourage or prohibit the use of natural surface or ground water for nonagricultural irrigation or non-food producing irrigation.

Ensure the inclusion of rainwater management techniques in the design and construction of all new developments including retention of native vegetation, vegetates swales and pervious surfaces.

Natural environment – surface water and ground water policies

7. (3) Encourage retrofitting of existing development and infrastructure, with an aim to preserve or restore the natural hydrologic regime of the watershed.

Sensitive ecosystems – policies

9. Include provisions to protect and restore sensitive, threatened, and rare ecosystems in the approval of any development application, per the 2014 sensitive ecosystems inventory, as amended from time to time, by way of development permit conditions, and submission of development approval information in accordance with policies included within this OCP. *Dyke Rd Park is indicated as sensitive wetland habitat in the 2014 inventory.*

Parks and greenway - policies

11. (2) In any situation where the CVRD accepts and manages land for parks and greenway purposes, by way of community amenities, public land dedications, donation of private lands or other any other process, give support and consideration to the vision, goals, objectives, policies and priorities of the rural Comox Valley parks and greenways strategic plan.

(6) Keep open and map all road rights of way that provide public access to water, including lakes, streams and foreshore areas and, in collaboration with the Ministry of Highways, Transportation and Infrastructure (MOHTI), in order to improve access, in areas where it does not compromise drinking water quality or sensitive ecosystems.

(7) Work with senior government, utilities and crown corporations with respect to opportunities and appropriate agreements for trails and greenways to be developed on lands within their jurisdiction or control.

(8) Ensure that plans for trail design, development, and management protect drinking water, environmental values and minimize the potential for land use conflicts.

Climate change – policies (adaptation)

14. (1) Develop strategies to reduce the environmental, social and economic impact of sea level rise and increasing extreme storm surge events in coastal areas through development permit area designations and conditions and submission of development approval information in accordance with policies included within this OCP.

(2) Work with stakeholders to complete an assessment of risk and susceptibility of the coastal areas to increasing sea level and extreme storm surge impacts.

(3) Recognizing that increasing climate variability will result in more frequent and severe drought, consider the use of incentives such as density bonusing to promote water conservation design in new development, including when a developer proposes water conservation design measures such as: (a) composting toilets (b) xeriscaping (c) grey water reuse (i.e. purple pipe, irrigation) (d) alternative rain water management for aquifer protection and recharge.

Natural hazard - policies

16. (1) Do not permit new development in hazard areas, including mapped floodplains, steep slopes and areas of active erosion.

(2) Permit land alteration, including tree removal, in proximity to hazard areas only when it can be demonstrated by a qualified professional that the land alteration will reduce a known hazard.

(7) Explore facilitating managed retreat, as appropriate, of development in those areas prone to flooding and facing challenges due to sea level rise.

Coastal areas – policies

70. (9) Generally prohibit hardening of the coastal shoreline through the use of rip rap, concrete embankments and revetment walls, and other similar structural interventions that alter the ecological function and service of the coastal shoreline, disrupt natural coastal processes, redirect wave energy to adjacent properties, and/or destroy coastal shore habitat, including forage and spawning areas.

(10) Require preparation of a shore access plan by a qualified environmental professional for development proposal that include shore access, and require rezoning or a development permit process to protect against sensitive environmental features and processes being

disturbed.

(11) Regulate by the development permit process to reduce light trespass (i.e. light that courses property lines including the present natural boundary) and light glare (i.e. excessive illumination applied to a single area) within the coastal area to avoid disruption of natural activity patterns of coastal and marine species.

(12) Assess proposed land uses or development within the K'ómoks Estuary in accordance with a completed and finalized K'ómoks Estuary management plan that has been endorsed by all affected jurisdictions.

Aquatic and riparian habitat development permit area

80. Justification The aquatic and riparian habitat protection development permit area is designated pursuant to Section 919.1 (1)(a) of the Local Government Act for the protection of the natural environment, its ecosystems and biological diversity; and Section 919.1 (1)(b) for the protection of development from hazardous conditions. The objectives of this development permit area are to protect the natural environment, ecosystems and biological diversity and to protect development from hazardous natural conditions. More specifically, the objectives are to:

1. To work toward objective 2b of the RGS objectives of precaution, connectivity and restoration;
2. To preserve, protect, restore or enhance both terrestrial and aquatic natural features or areas associated with streams, watercourses and riparian areas;
3. To protect development from hazardous conditions associated with watercourses and riparian areas;
4. To implement the requirements of the riparian areas regulation for the protection of fish habitat; and
5. To protect non-fish habitat attributes and promote the establishment of wildlife corridors. This development permit area is indicated as a watercourse, wetland or riparian area on the sensitive habitat atlas as amended from time to time. For certainty, the areas indicated on the sensitive habitat atlas are intended to include:
   (1) all lands within 30 metres measured from the present natural boundary of a watercourse, or top of slope where a steep slope is located immediately adjacent to the watercourse, on both sides of the watercourse, including the area of the watercourse.
   (2) all lands within 30 metres measured from the present natural boundary of the sea, or top of slope where a steep slope is located immediately adjacent to the sea.

Generally speaking, these policies outlined in the OCP align well with the Green Shores approach that is outlined in the GSSD.

Prerequisite 4: Riparian Zone Protection

The purpose of this prerequisite is to maintain the integrity and ecological function of the of the marine riparian zone, and in particular the vegetation it supports. The marine riparian

zone is the nearshore environment that extends from where the intertidal zone stops to where the site transitions to upland terrestrial vegetation. Shoreline developments often clear riparian vegetation and create level sloped shores in order to improve views and/or create level lawn areas. This can result in negative impacts to site drainage, water quality, bank stability and habitats for birds, small mammals, fish and other wildlife.

In order to address this prerequisite, as the area is designated as a park, the GSSD guidelines stipulate that the project must conserve and/or restore a natural riparian zone for a minimum width of the larger of 15m or any local requirement, measured as a horizontal distance landward of the NB, over a minimum of 70% of the shore length or any vegetative buffer defined by local regulations.

Where restoration is needed it must be undertaken according to a prescription prepared by a registered professional biologist or landscape architect with experience in riparian ecosystems, and the species utilized must be native species that are endemic to the project area. Under the CVRD OCP the area within 30 m of the NB of the sea falls into an aquatic and riparian development permit area. The OCP does not specifically indicate conservation or restoration of the area within this 30 m, but a development permit will be required. The 15 m setback is shown on the map in Figure 11. Additionally, as there are invasive plant species in this area, and the project will result in the removal of these and replating with native species a post- construction monitoring plan will be required.

Prerequisite 5: Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) ensures that any construction activities undertaken follow best management practices to eliminate, avoid or reduce any negative impacts to sensitive habitats or species. This prerequisite recognizes that shorelines are extremely productive and ecologically significant areas that need to be developed sensitively.

Once a final Green Shores design is developed for the Dyke Road Park site a CEMP will need to be produced to mitigate any potential construction related impacts associated with the implementation of the design. The rough outline of a CEMP for the redevelopment of this site has already been developed by Current Environment in Section 4.2.1.1 of their report (Appendix 1).

3. Recommended Options for Dyke Road Park Green Shores Work

Although not impossible, Dyke Road Park is a challenging site in which to achieve a gold-level Green Shores certification for a variety of reasons. First, as the site has park status it is held to a higher standard in the GSSD rating process. Further, much of the natural areas at the site are relatively intact and the area has not been recently developed in a way that is strongly contrary to a Green Shores approach. Often Green Shores projects are looking to redevelop a shoreline site that has been highly modified from its natural state (for example: the site has infrastructure located within the NB; an extensive amount of shoreline armouring; etc.) and/or to apply the Green Shores principles to new residential, commercial waterfront development projects that potentially could have a large impact on the integrity of the shoreline ecosystem if

traditional development practices are employed. Such projects can more easily obtain points under the Green Shores program because the baseline is more degraded and there is much more room for improvement. Finally, the Dyke Road Park site is hemmed in by the estuary on one side and Comox Road on the other which limits the area available to work with when trying to implement the appropriate setbacks for riparian habitat and to allow for coastal retreat climate change related adaptations. Therefore, it will be important to undertake as many of the suggested options outlined below in order to maximize the potential credits to achieve the gold level accreditation. On the plus side, the park will make a good demonstration site for those interested in learning about the Green Shores methodology as it is located within a park, so public access is not an issue; and there is the potential to use some innovate approaches to achieve a gold level certification.

We have broken the Dyke Road Park site into four zones for project planning purposes (Figure 18). These delineations follow on work done by Current Environmental (2010) but further break down the landscaped portion of the site into a hard landscaping zone and a soft landscaping zone to differentiate between the parking area and bird viewing platform (hard landscape elements) and the vegetated park areas (soft landscape elements). Aerial extent of each zone is provided in the Figure 18.

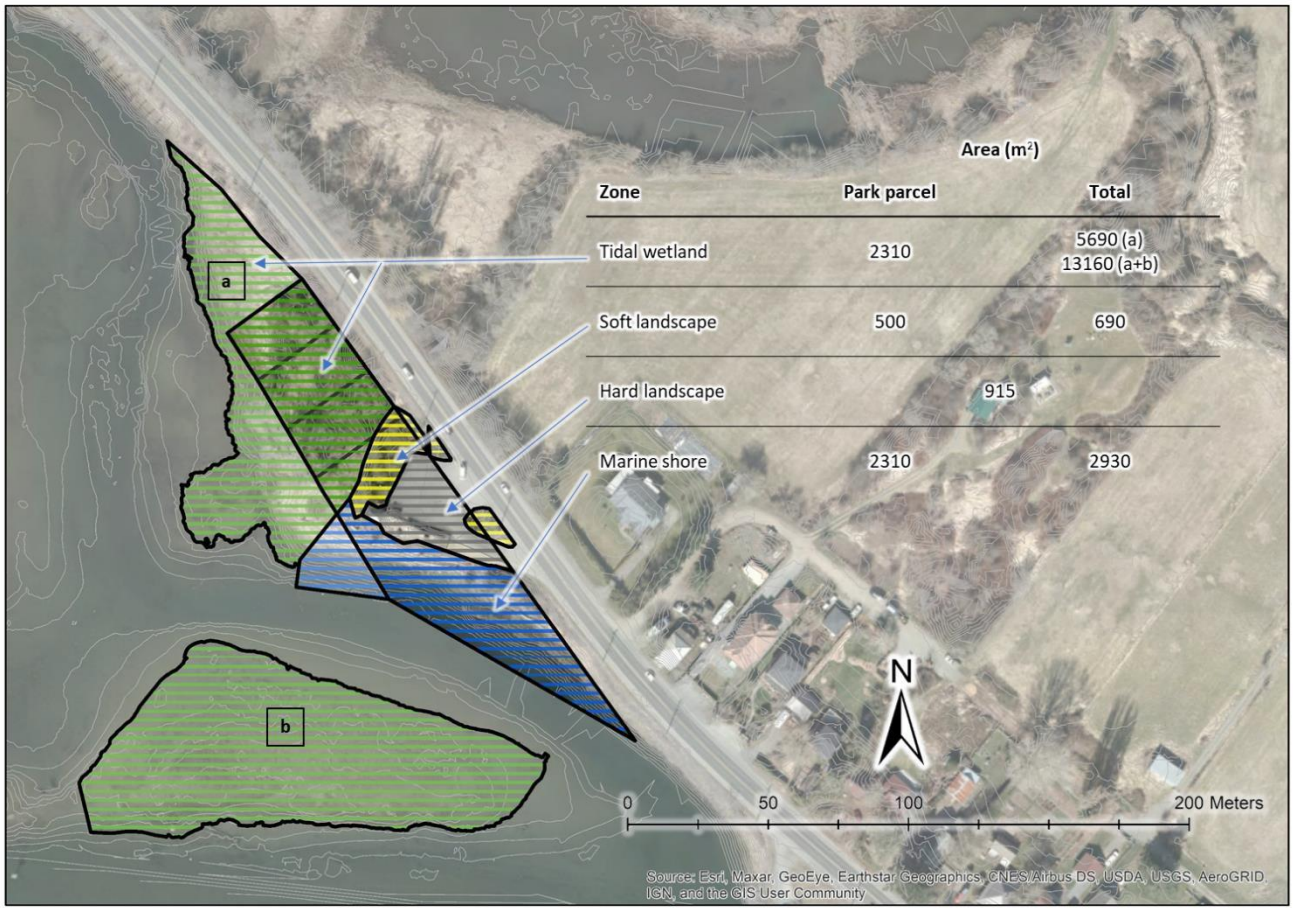

Figure 18 - Dyke Road Park Green Shores project planning zones. Note that the zones extend beyond the legal parcel boundaries as depicted in the map.

Credit 1: Site Design with Conservation of Shore Zone

Points achievable: 0 of 2

The proximity of Comox Road precludes obtaining points for this credit because the average width of the designated 'common area' would be less than 30 m.

Plan to comply with requirements: N/A

Strategy to obtain points: N/A

Credit 2: Shore-Friendly Access

Points achievable: 2 of 3 (maximum available for public park)

Plan to comply with requirements:

This credit requires the creation of a shore access plan that protects sensitive features. The landscape designer or other qualified environmental professional will have to sign off on detailed site plans including scaled design drawings showing the location of features.

Strategy to obtain points:

The park currently hosts several informal shore access trails, mostly in the vicinity of the current bird viewing platform footprint. To obtain the points for this credit, we recommend formalizing a new shoreline access trail on the site, with strategies to confine public users to this trail, in order to minimize the overall footprint of the shoreline access. Placing a trail on the landward side of the border between the upland riparian zone and the upper intertidal zone strikes a balance between access to the shore and limitation of impacts to sensitive intertidal habitats. With the new bird viewing platform moved well back from this border, there is an opportunity to set the path within the upland riparian zone to create a natural trail boundary without the use of fencing. Lower growing species could be planted on the water side of the trail and somewhat larger species planted between the trail and the new viewing platform, keeping in mind any sightline requirements. The use of thorny shrubs, such as Nootka Rose, could be used where appropriate to help confine users to the designated trail. Fencing constructed of natural materials (e.g., split rail) could also be installed between the trail and the shore to provide increased deterrence of people and domestic animals to the lower shore zone. If installed, fencing should be sited well back from the natural boundary within the upland riparian zone.

We recommend restricting access to the restored intertidal marsh zone (Figure 18) to facilitate restoration and optimal accrual of increased habitat value. This could be accomplished using fencing constructed of natural materials to encourage visitors to stay on the upland side of the site. If there is a need for more public access into the intertidal marsh zone, this should be accomplished using a raised boardwalk trail to limit impacts to the sensitive vegetation.

Though not necessarily a shore-access feature, a multi-use trail (cyclist + pedestrian) could be considered through the site, connecting to the Comox Road shoulder on either end. If CVRD wants to include a cycling path as a park feature, we recommend considering a combined multi-use trail (co-extensive with the pedestrian trail described above) to limit the footprint of non-vegetated areas.

An alternative to a multi-use trail is to leave the cycling route on the Comox Road shoulder. This would reduce the required width of the shore access trail through the site and allow for more vegetated area.

All new trails should be built of pervious material(s) such as gravel or permeable pavers.

Credit 3: Re-development of Contaminated Sites

Points achievable: 0 of 2

Plan to comply with requirements: N/A

Strategy to obtain points: N/A

Credit 4: Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes

Points achievable: 3 of 9

Plan to comply with requirements:

Detailed restoration plans including scaled maps and design drawings showing current and future desired condition. These documents will need to be signed by the appropriate qualified professional.

Strategy to obtain points:

The Dyke Road Park site was used for forest industry purposes during the first half of the 20th century, during which time fill was added to facilitate operations. The intertidal marsh zone located mostly in the northern three parcels (Figure 1, PIDs: 006-254-284, 006-447-295, and 006-453-732) presents an opportunity to restore a substantial area of intertidal wetland marsh.

Removal of fill, excavation to appropriate elevations, and revegetation will restore plant communities that are critical habitat for Chinook salmon and is an important ecosystem type for carbon sequestration[7]. The preliminary restoration concept includes the following components:

- Excavation of a tidal channel around an existing stand of trees which are inundated only at very high tides, creating a forested wetland island with overhanging vegetation
- Removal of fill to the elevation appropriate to *Carex lyngbyei* (Lyngbye's sedge, a high value species for juvenile Chinook salmon habitat),
- Removal of invasive Reed canarygrass (*Phalaris arundinacea*)
- Transplantation of *C. lyngbyei* and other species appropriate to newly excavated areas to stabilize sediments
- In the lower elevation part of the zone below the boundary between vegetated fringe marsh and denuded mudflat, we recommend that the project partners consider an innovative restoration technique known colloquially as "saltmarsh sausages"[8]. This area hosted *Carex lyngbyei* and *Juncus balticus* meadows in the decades prior to the 1990s when resident Canada goose herbivory began to erode the marsh platform (Figure 7). See Credit 5 for a detailed explanation of this habitat restoration technique. Figure 19 shows examples of this restoration technique.

Figure 19 - Examples of the "saltmarsh sausage" technique deployed on the east coast of the USA. Source, upper panel: https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/felix-neck/about/our-conservation-work/shoreline-restoration. Source, lower panel: https://www.nature.com/scitable/knowledge/library/restoration-of-estuaries- 82965822/

Figure 20 - Examples of eco-cultural Canada goose exclosure fencing in the vicinity of Dyke Road Park. Photo source: Guardians of Mid-Island Estuaries Society

A comprehensive restoration plan for the intertidal marsh zone should be prepared. Design components include mapping and quantification of current and desired future conditions, preparation of engineered construction drawings, and preparation of a revegetation and habitat complexing plan including measures to control invasive species. Field work components required to complete this plan include detailed site surveys for topography, vegetation inventory, and soils analysis. A construction logistics plan and construction environmental monitoring plan

should also be prepared tailored to the project. As outlined previously permitting of the proposed project works must be obtained from Department of Fisheries and Oceans (Fisheries Act), BC Ministry of Forests, Lands, and Natural Resource Operations and Rural Development (BC Wildlife Act, BC Heritage Conservation Act), and the K'ómoks First Nation (Cultural Heritage Policy), and CVRD.

Credit 5: Restoration/ Enhancement of Aquatic Habitats

Points achievable: 5 of 8

Plan to comply with requirements:

A detailed restoration plan and a post-construction monitoring plan signed by the appropriate qualified professionals will be required.

Strategy to obtain points:

Restoration works in all site zones (intertidal marsh, marine shore, and soft and hard landscape zones; Figure 18) should be pursued to obtain points in this credit.

The **soft landscaped zone** of the park area can be redeveloped to enhance aquatic habitat. Aside from playing an important role in shore sediment stabilization, grasses, shrubs and trees growing in the riparian transition zone are habitat for insects which enter the salmonid food web as they drop into the water. Careful selection of appropriate species that can form overhanging vegetation is an important thing to consider during the landscaping design process.

Redevelopment of the **hard landscaped zone** (pictured in Figure 3): can contribute to the enhancement of aquatic habitat by the inclusion of sand filtration and/or bioswale infiltration of road and parking lot runoff. Fine particulate tire dust poses a threat to salmonids because of a recently discovered toxic tire preservative[9]. Cleaning this material out of the runoff prior to release into the aquatic environment would be a benefit to the aquatic environment and could demonstrate best practices for road and driving infrastructure development.

The restoration of the **intertidal marsh zone** described under Credit 4 will also contribute to restoration/enhancement of aquatic habitats. The detailed restoration plan will include prescriptions for revegetating the site with appropriate intertidal and upland species. These plant communities are key to the restoration of aquatic habitat in the area because they provide foraging and refuge areas and stabilize sediments.

We recommend that the project partners consider an innovative restoration technique known colloquially as "saltmarsh sausages"[8]. The idea is to encase appropriate sediments in a fully biodegradable natural-fiber geotextile in a long tube ("sausage") which is stabilized using stakes and a course of cobble or oyster shell on the downslope side. Repeating courses of the "sausages" are installed in rows following the existing border between the vegetated and denuded areas. The sausages are planted with well-rooted nursery stock of the appropriate species, likely *Carex lyngbyei* and/or *Juncus balticus*. Reusing the sediment excavated with Reed canarygrass rhizomes to fill the "sausages" is an option that should be investigated. A simple translocation experiment during the 2022 season to assess Reed canarygrass survival at lower elevations would be helpful to decide whether to pursue this option.

Removal of upland terrestrial invasive species (largely Himalayan blackberry, *Rubus armeniacus*) and revegetation with native species is also important to optimize aquatic habitat value.

Installation of eco-cultural Canada goose exclosure fencing around all restored marine shore zone and intertidal marsh zone areas to prevent goose herbivory during plant establishment and while the resident goose populations remain unsustainably high in the region. The K'ómoks First Nation Guardian Watchmen program is expert in the installation of this type of exclosure fencing (Figure 20).

In the **marine shore zone**, restoration should focus on restoring shallow shoreline morphology and connectivity to the upland riparian zone mitigating the impacts of wind and wave energy associated with high intensity southeasterly winter storms. There is evidence of erosion in this area, likely exacerbated by the presence of the bird viewing platform just above the natural boundary and the loss of the low-elevation vegetated marsh fringe due to intense herbivory by resident Canada goose (*Branta canadensis*) over the past three decades (see Figure 7 for extent of loss of the *Carex lyngbyei* meadow and *Carex-Juncus* marsh fringe). These actions will facilitate revegetation efforts in the zone which will provide habitat benefits to fish and wildlife similar to those we are aiming for in the intertidal marsh zone. The preliminary conceptual restoration prescription includes the following elements:

- Installation of sediment sills constructed from large woody debris (i.e., tree trunk with or without root wad ballasted with buried boulders, or similar engineer-approved design to achieve stability) at an angle dictated by a coastal wave analysis to be performed by the project engineer. The sill logs will help entrain sediment (or protect placed sediment) on the upland side and facilitate establishment of native plant species. If sediment is placed on the upland side of the sill logs, it should be protected with fully biodegradable natural-fibre geotextile and/or armoured with appropriately sized cobble to improve sediment stability prior to during plant establishment. Placed sediments can likely be sourced on-site from other restoration components (e.g., excavation of tidal marsh zone); care should be taken not to transfer invasive species between sites. Revegetation with well-rooted nursery stock should occur immediately after excavation to expedite sediment stabilization.
- Removal of invasive species in the zone, largely Reed canarygrass and Himalayan blackberry. We recommend excavation of Reed canarygrass rhizomes and manual removal of Himalayan blackberry root systems. Where appropriate, Reed canarygrass excavation should be done in conjunction with excavation works required for the installation of the ballasted sill logs. Where excavation occurs as a standalone work item, and as needed in the sill log installation areas, appropriate replacement sediment should be imported to nourish the site. Sediments should be protected with fully biodegradable natural fiber geotextile and/or armoured with appropriately sized cobble to improve sediment stability during plant establishment. Revegetation with well-rooted nursery stock should occur immediately after excavation to expedite sediment stabilization.
- In the lower elevation part of the zone below the boundary between vegetated fringe

marsh and denuded mudflat, we recommend that the project partners consider an innovative restoration technique known colloquially as "saltmarsh sausages". This area hosted *Carex lyngbyei* and *Juncus balticus* meadows in the decades prior to the 1990s when resident Canada goose herbivory began to erode the marsh platform (Figure 7, Figure 9). The idea is to encase appropriate sediments in a fully biodegradable natural-fiber geotextile in a long tube ("sausage") which is stabilized using stakes and a course of cobble or oyster shell on the downslope side. Repeating courses of the "sausages" are installed in rows following the existing border between the vegetated and denuded areas. The sausages are planted with well-rooted nursery stock of the appropriate species, likely *Carex lyngbyei* and/*or Juncus balticus*. In areas with high exposure to southeasterly winter storms, the sausages should be installed in tandem with ballasted sill logs to achieve maximum sediment stability during plant establishment. Reusing the sediment excavated with Reed canarygrass rhizomes to fill the "sausages" is an option that should be investigated. A simple translocation experiment during the 2022 season to assess Reed canarygrass survival at lower elevations would be helpful to decide whether to pursue this option.

- Installation of eco-cultural Canada goose exclosure fencing around all restored marine shore zone and intertidal marsh zone areas to prevent goose herbivory during plant establishment and while the resident goose populations remain unsustainably high in the region. The K'ómoks First Nation Guardian Watchmen program is expert in the installation of this type of exclosure fencing.

Credit 6: Enhanced Riparian Zone Protection

Points achievable: 4 of 9

Unfortunately, the number of points attainable are low in the Credit because the proximity of Comox Road precludes sufficient widening of the riparian area along 50% of the length of the natural boundary.

Plan to comply with requirements:

1. The current bird viewing platform will be removed from the riparian zone and relocated outside of the legally required setback as per the requirements for this credit. The footprint of the current bird viewing platform will be restored to appropriate riparian plant species composition.

2. New plantings in the riparian zone will be comprised of at least 75% native species.

Strategy to obtain points:

We believe that a strong case can be made that more than 66% of the length of the natural boundary will be dedicated to riparian zone protection, to gain 2 points. As depicted in Figure 21, the natural boundary is 222 m in length. The area enclosed by a 15 m buffer landward of this line and bounded by the park parcel boundaries is 2500 m2. To account for the sinuosity of the natural boundary, this buffer area divided by the natural boundary length is 11.26 m, giving a sinuosity ratio of 1.33. Applying this ratio to the requirement for over 66% of the natural boundary length to be protected with 15m width, we get 110 m (222 / 1.33 * .66) as the required

length. The landward boundary of the riparian zone is 128 m in length, satisfying the length requirement.

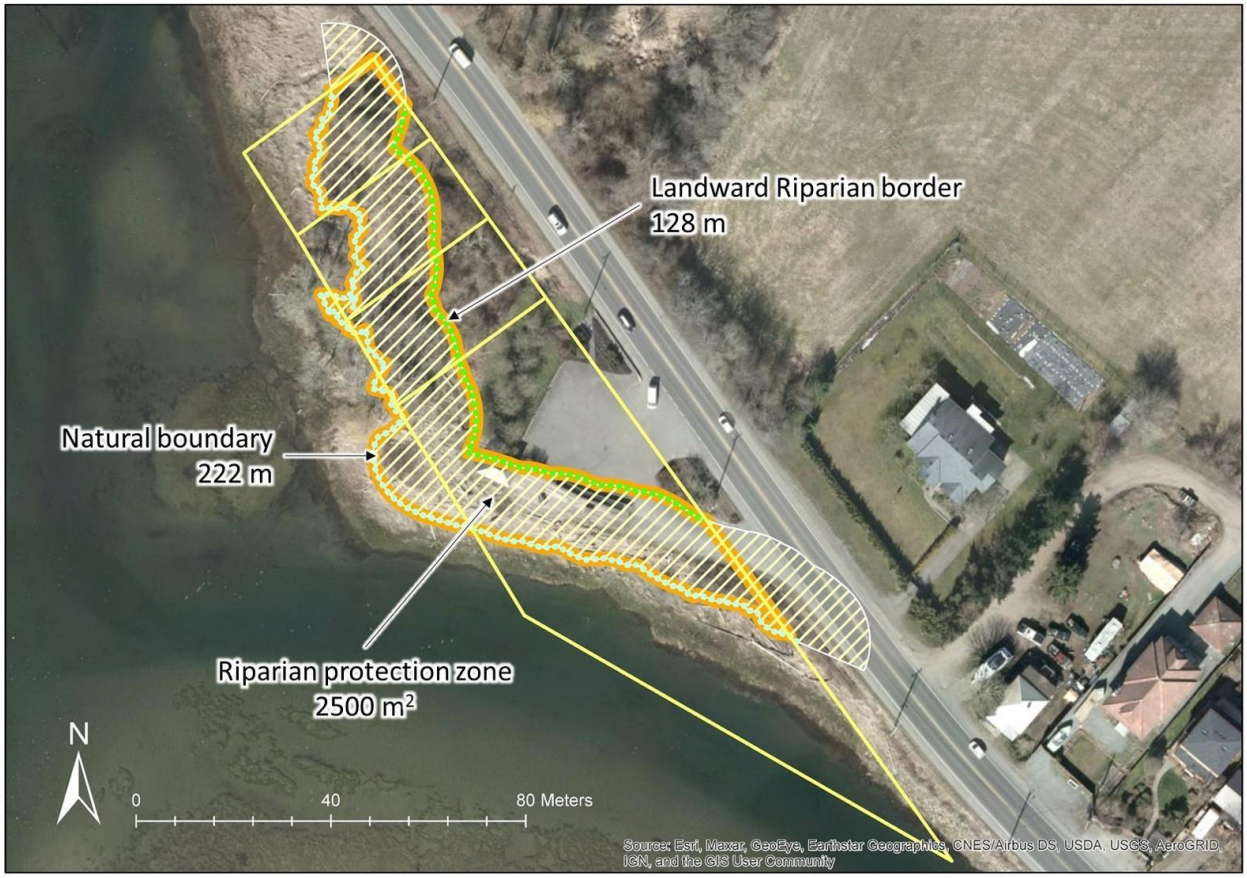

Figure 21 - Natural boundary, 15 m coastal flood setback (crosshatch), and landward riparian border.

The current bird viewing platform should be moved outside the legally required 15-meter coastal flooding setback and the footprint restored to a slope that will facilitate establishment of appropriate riparian species, allow for landward migration of plant communities with future sea level rise, and accommodate natural erosion and sedimentation processes.

Another 2 points are available by way of restoring the function of existing riparian habitat. Removal of invasive species across the site is a key deliverable here together with replanting and ongoing management to ensure successful establishment of native species and suppression of re-invasion by invasive species. Care should be taken in the planting prescription to emphasize measures that will reduce the level of ongoing management required, e.g., thorough removal of root systems of invasive species, application of heavy mulch where appropriate, and installation of fencing to protect plants during establishment.

Credit 7: Integrated Stormwater Management and Design

Points achievable: (4 of 5)

Plan to comply with requirements:

A stormwater management plan must be developed and signed by a qualified professional. The plan must bring the park's effective impervious area (EIA) below 20% and protect existing

natural features including vegetation.

Strategy to obtain points:

For parks and natural area such as Dyke Road Park, four points are available if the EIA can be reduced to less than 1%. We believe this goal is achievable through the use of the following:

- Permeable pavement technology in the parking area and all public access trails
- Installation of a green roof on the new bird viewing platform. The roof should support a substantial depth (at least 10 cm) of soil media to have a beneficial effect on stormwater runoff dynamics and be planted with drought-tolerant grass and shrub species.
- The design for the new bird viewing platform could be designed to permit light and rainfall penetration, allowing for a planted area beneath the deck itself. This would increase the total vegetated area.
- If the parking area includes a stormwater filtration system, such as a bioswale, to remove tire particles from runoff prior to discharge into the estuary, this facility should be fully vegetated with appropriate native species so that it also contributes to the riparian function of the upland area.

Credit 8: Climate Change Adaptation Plan

Points achievable: 3 of 5

Plan to comply with requirements:

1. The projected extreme water level in 2100 has been documented by the City of Courtenay and the Comox Valley Regional District. See the introductory section of this report for a discussion of its position. All analyses show Dyke Road Park to be within even the lowest- elevation flood projections even without considering sea level rise.
2. The proposed project works will use a combination of approaches to adapt to sea level rise including Retreat, Accommodate, and Protect as required.

Strategy to obtain points:

Actions to adapt to climate change in accordance with GSSD principles come under three broad strategies: Retreat, Accommodate, and Adapt. Each of these strategies can be applied to this Dyke Road Park project and we provide recommendations for each below.

Retreat:

- Move the bird viewing platform structure away from the natural boundary into the upland terrestrial / riparian zone. This will widen the upper intertidal and riparian plant communities and provide space for landward migration of these communities with projected sea level rise.
- Regrade the site to a lower slope landward of the current bird viewing platform and consider creation of a shallow dune swale in its footprint. These areas should be replanted to appropriate high intertidal and upland riparian species to stabilize

sediments and provide habitat value.

Accommodate:

- Elevate the new bird viewing platform structure on low-footprint piers to allow storm surge to dissipate below. Creating a structure on piers that is well elevated above ground level allows for better sightlines for bird viewing and planting of larger species on the seaward side than would be possible with a ground level structure, which improves the riparian habitat value.

Protect:

- Install ballasted sill logs as outlined in Credit 5
- Restore the lower intertidal marsh fringe as outlined in Credit 4 and Credit 5. The marsh island across from the bird viewing platform as well as large areas of marsh bordering Dyke Road Park have been heavily degraded by both resident Canada goose herbivory and winter storm energy. If restored, these areas will provide storm energy attenuation to the shoreline and provide habitat value.

Credit 9: Exceptional Performance and Innovation

Points achievable: 2 of 2

Plan to comply with requirements:

We believe this project can obtain points under this credit for the following innovative approaches:

- The marsh "sausage" restoration technique, since this approach to marsh restoration has not been attempted in British Columbia to our knowledge.
- The eco-cultural Canada goose exclosure fencing, which is a recent innovation that originated in our region and can be further developed in collaboration with the K'ómoks First Nation Guardian Watchmen Program and Guardians of Mid-Island Estuaries Society to adapt to changing Canada goose behaviour.

Credit 10: Outreach and Public Education

Points achievable: 5 of 5 points

Plan to comply with requirements:

- A case study document using the Green Shores template that showcases the design process, pre- and post- construction conditions including imagery, and documentation of the application of Green Shores principles.

Strategy to obtain points:

Up to four more points are available under this credit. We suggest the following in order of feasibility:

- We suggest that the CVRD develop public signage highlighting the Green Shores

design with a focus on habitat and climate adaptation benefits.

- Facilitation of interpretive walks for the general public. Project Watershed can deliver this given adequate funding to cover staff time.
- Facilitation of site tours for interested professionals. Project Watershed can deliver this given adequate funding to cover staff time.
- Facilitation of ongoing stewardship of the site by members of the community. This would be particularly useful for ongoing invasive species control, especially for Reed canarygrass, Himalayan blackberry, and White sweet-clover. Project Watershed can deliver this given adequate funding to cover staff time.

3.1 Summary

The restoration and design options outlined in this document should result in a project that can obtain a gold-level certification (22 points or more) under the GSSD credit system. Furthermore, there is room to reduce scope and still achieve the gold-level certification.

Table 3 - Summary of GSSD Credits and points achievable as outlined in this report

GSSD Credits and Achievable Points		
	Description	*Achievable Points*
Credit 1	Site Design with Conservation of Shore Zone	0 of 2
Credit 2	Shore-Friendly Access	2 of 3
Credit 3	Re-Development of Contaminated Sites	0 of 2
Credit 4	Restoration/Enhancement of Shoreline Sediment and Tidal Flow Processes	3 of 9
Credit 5	Restoration/Enhancement of Aquatic Habitats	5 of 8
Credit 6	Enhanced Riparian Zone Protection	4 of 9
Credit 7	Integrated Stormwater Planning and Design	4 of 5
Credit 8	Climate Change Adaptation Plan	3 of 5
Credit 9	Exceptional Performance and Innovation	2 of 2
Credit 10	Outreach and Public Education	5 of 5
	Points Total	**28 / 50**

4. Next Steps

This report will serve as a foundation for the next phases of the project which include more detailed scoping, integration of the ecosystem restoration and park redevelopment components of the project, and development of project construction phasing. A design charrette workshop is scheduled for March 8, 2022 to bring project stakeholders together to advance the design and planning of this project.

Project Watershed can contribute to the implementation of a Green Shores for Shoreline Development (GSSD) demonstration project for Dyke Road Park that will receive a gold level accreditation in several ways including, but not limited to:

- Restoration plan development and implementation.
- Preparation of planting prescriptions for restored areas, sourcing of plants and installation of plants.
- Coordination of construction permitting (archaeological and environmental).
- Production of restoration plan maps.
- Preparation of construction logistics plans.
- Coordination and supervision of project implementation including construction supervision and contracting of required monitoring services (environmental and archaeological).
- Education and outreach as needed to showcase how the GSSD approach has been applied to the project.

5. References

1. World Wildlife Fund Canada. 2013. Marine Factsheet – Estuaries of British Columbia. http://awsassets.wwf.ca/downloads/estuary_fact_sheet.pdf
2. Levelton Consultants Ltd. 2011. Stage 1 Preliminary Site Investigation Dyke Road Park, Courtenay, British Columbia. Prepared for Comox Valley Regional District.
3. Fleenor, W. Current Environmental Ltd. 2010. Environmental Impact Assessment – Dyke Road Park – Courtenay, B.C. Prepared for Comox Valley Regional District.
4. Dawe, N. K. and A. C. Stewart. 2010. The Canada Goose (*Branta canadensis*) on Vancouver Island, British Columbia. *British Columbia Birds* 20:24–40.
5. Kennedy, K.A. 1982. Plant communities and their standing crops on estuaries of the east coast of Vancouver Island. Thesis (Mater's of Science). The University of British Columbia.
6. C. Newman, personal communication, Dec 01, 2021.
7. Arias-Ortiz, A., Oikawa, P. Y., Carlin, J., Masqué, P., Shahan, J., Kanneg, S., et al. 2021. Tidal and nontidal marsh restoration: A trade-off between carbon sequestration, methane emissions, and soil accretion. Journal of Geophysical Research: Biogeosciences, 126.
8. Kennish, M. J. 2012. Restoration of Estuaries. Nature Education Knowledge 3(11):5. Saltmarsh restoration project | Essex Wildlife Trust (essexwt.org.uk)
9. Tian, Z. et al. 2020. A ubiquitous tire rubber-derived chemical induces acute mortality in Coho salmon. Science 10.1126/science.abd6951.

6. Appendices (attached separately)

1. Current Environmental Ltd. Environmental Impact Assessment – Dyke Road Park – Courtenay,
2. B.C. Prepared for Comox Valley Regional District.
3. Lewkowich Engineering Associates Ltd. - Geotechnical Site Report.
4. BC Stewardship Centre - Green Shores for Shoreline Development Credits and Ratings Guide.